SIMEC

SECOND PROJECT AMENDMENT REPORT

Prepared for Tahmoor Coal Pty Ltd
August 2020

MEMBER OF GFG ALLIANCE

T: (02) 4640 0100 **E:** tahmoreenquiries@simecgfg.com **W:** www.tahmoorcoal.com.au
SIMEC Mining Site Address: 2975 Rememberance Drive, Bargo | Postal Address: PO Box 100, Tahmoor NSW 2573, Australia

Tahmoor South Project

Second Amendment Report and Response to Submissions

Report Number

H180201 RP#1

Client

Tahmoor Coal Pty Ltd

Date

3 August 2020

Version

v1 Final

Prepared by

Nicole Armit
Associate Director
3 August 2020

Approved by

Brett McLennan
Director
3 August 2020

Executive summary

ES1 Introduction

Introduction Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates the Tahmoor Mine, an existing coal mine approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW) and within the Wollondilly local government area (LGA). The mine has been operating continuously since 1979 when coal was first mined.

The location of Tahmoor Mine in a regional context can be seen in Figure ES1.

Tahmoor Mine predominantly produces high quality coking coal which is used to make steel. From 2017, Tahmoor Mine has produced, on average, 97.5 per cent coking coal. The remainder is thermal coal which is used for power generation.

Tahmoor Coal is seeking approval for the Tahmoor South Project, being an extension of underground coal mining at Tahmoor Mine, to the south of Tahmoor Coal's existing surface facilities area (the Project).

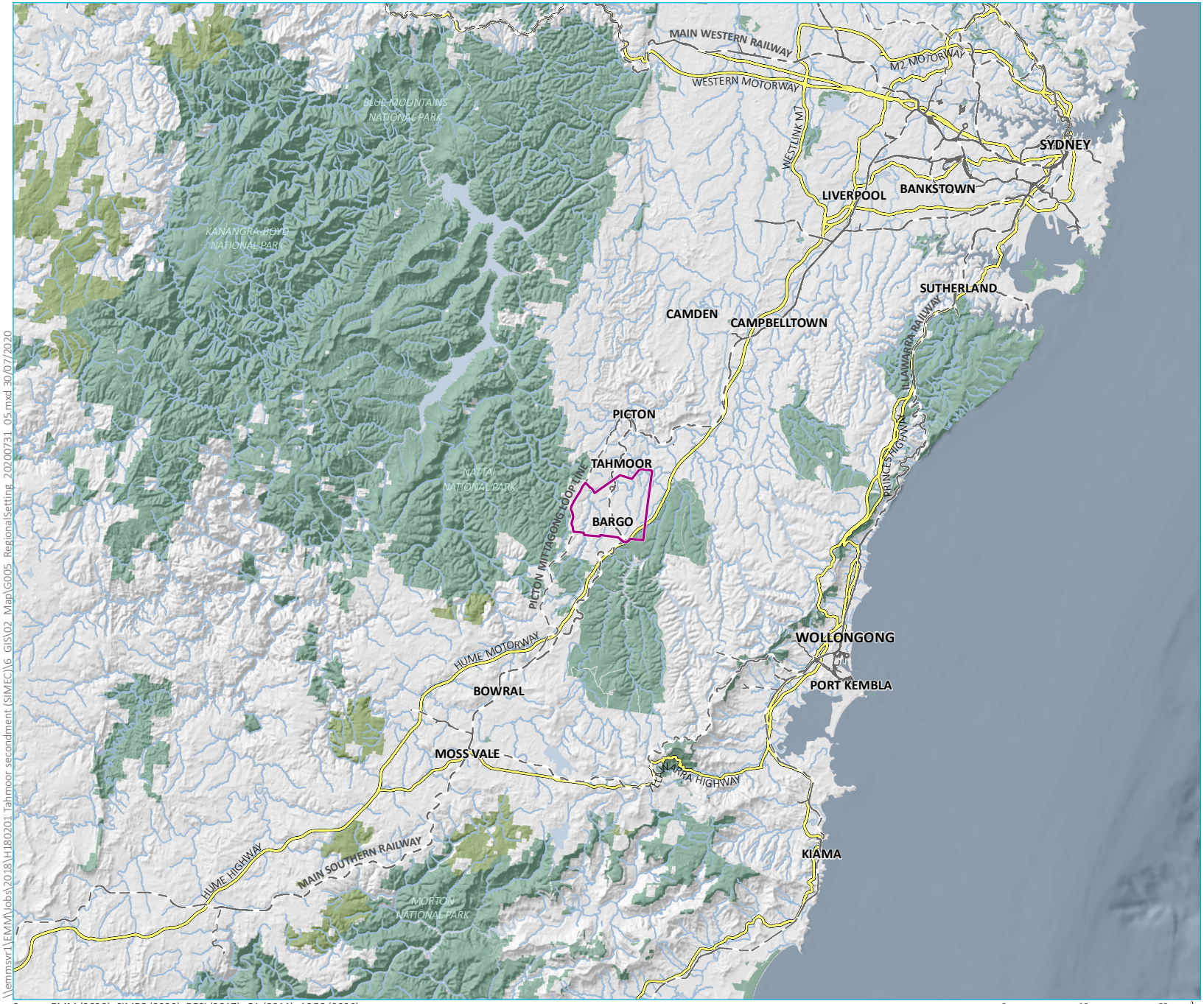
ES2 The Project

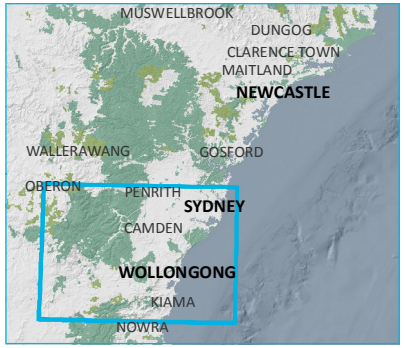
Coal extraction of up to 4 million tonnes (Mt) of run of mine (ROM) coal per annum is proposed with up to 33 Mt of ROM coal proposed over the life of the Project. Longwall mining would be used to extract from the Bulli seam within the bounds of Consolidated Coal Lease (CCL) 716 and CCL 747. This technique for coal extraction has been used by Tahmoor Mine for over 30 years. Once the coal has been extracted and brought to the surface, it would be processed at Tahmoor Mine's existing coal handling and preparation plant (CHPP) and coal clearance facilities, before being transported via the existing rail loop, the Main Southern Railway and the Moss Vale to Unanderra Railway to Port Kembla, and from time to time, Newcastle for Australian and international markets. Up to 0.2 Mt per annum of either product coal or reject material is proposed to be transported to customers via road.

The Project seeks to extend the life of underground mining at the Tahmoor Mine until approximately 2032. The Project would enable mining to be undertaken within the southern portion of Tahmoor Coal's (and its wholly owned subsidiary Bargo Collieries Pty Ltd) existing mining lease areas, and operations and will continue the employment of close to 400 people for approximately a further 10 years.

ES3 State significant development

Given its significance to the State, the Project is deemed to be State significant development (SSD) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Under these provisions, the NSW Minister for Planning and Public Spaces, or delegate, is the consent authority for the Project. Approval for the Project is also required from the Commonwealth Minister for the Environment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).





KEY

- Project area
- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Source: EMM (2020); SIMEC (2020); DFSI (2017); GA (2011); ASGC (2006)

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6 GIS\02 Map\G005 RegionalSetting 20200731 05.mxd 30/07/2020

Regional context

Tahmoor South Project
Second amendment report
Figure ES1

SIMEC

EMM creating opportunities

ES4 Environmental impact statement

Following the receipt of revised Secretary's Environmental Assessment Requirements (SEARs) in June 2018, a comprehensive *environmental impact statement* (EIS) was prepared for the Project. The EIS was publicly exhibited between 23 January and 5 March 2019 by the NSW Department of Planning, Industry and Environment (DPIE).

In total, 83 individual community submissions were received. Of these, 73 submissions (or 88 per cent) indicated support for the Project, and ten submissions (or 12 per cent) raised objections to it. Of those that objected, the predominant issue of concern related to subsidence and subsidence-related impacts. Concerns were also raised in relation to greenhouse gas emissions (GHG) and the extent of vegetation clearing required for the extension of the rejects emplacement area (REA).

ES5 Submissions report and project amendment report

On 20 February 2020, a *submissions report* was lodged with DPIE which responded to all submissions made during exhibition of the EIS. At the same time (ie 20 February 2020), a *project amendment report* (PAR) was lodged with DPIE to document amendments made to the Project in response to the submissions and to reduce its potential environmental impacts.

The amendments to the Project documented in the PAR included, among other things, changes to the mine plan and the coal reject emplacement area (REA).

The changes to the mine plan included the removal of a longwall in the northern part of the mine (LW109), reconfiguration of the longwall layouts to comprise two series of shorter longwall panels, the reduction of the width of the longwalls, and a reduction in the height of extraction within the longwalls. The changes to the REA included a reduction in the proposed extension area by increasing the height of the REA by 5 metres (m).

The submissions report and PAR were placed on DPIE's website but were not publicly exhibited.

In response to the submissions report and PAR, DPIE received advice from several government agencies and WSC. On 1 April 2020, DPIE wrote to Tahmoor Coal requesting that it responds to the advice from the agencies and WSC.

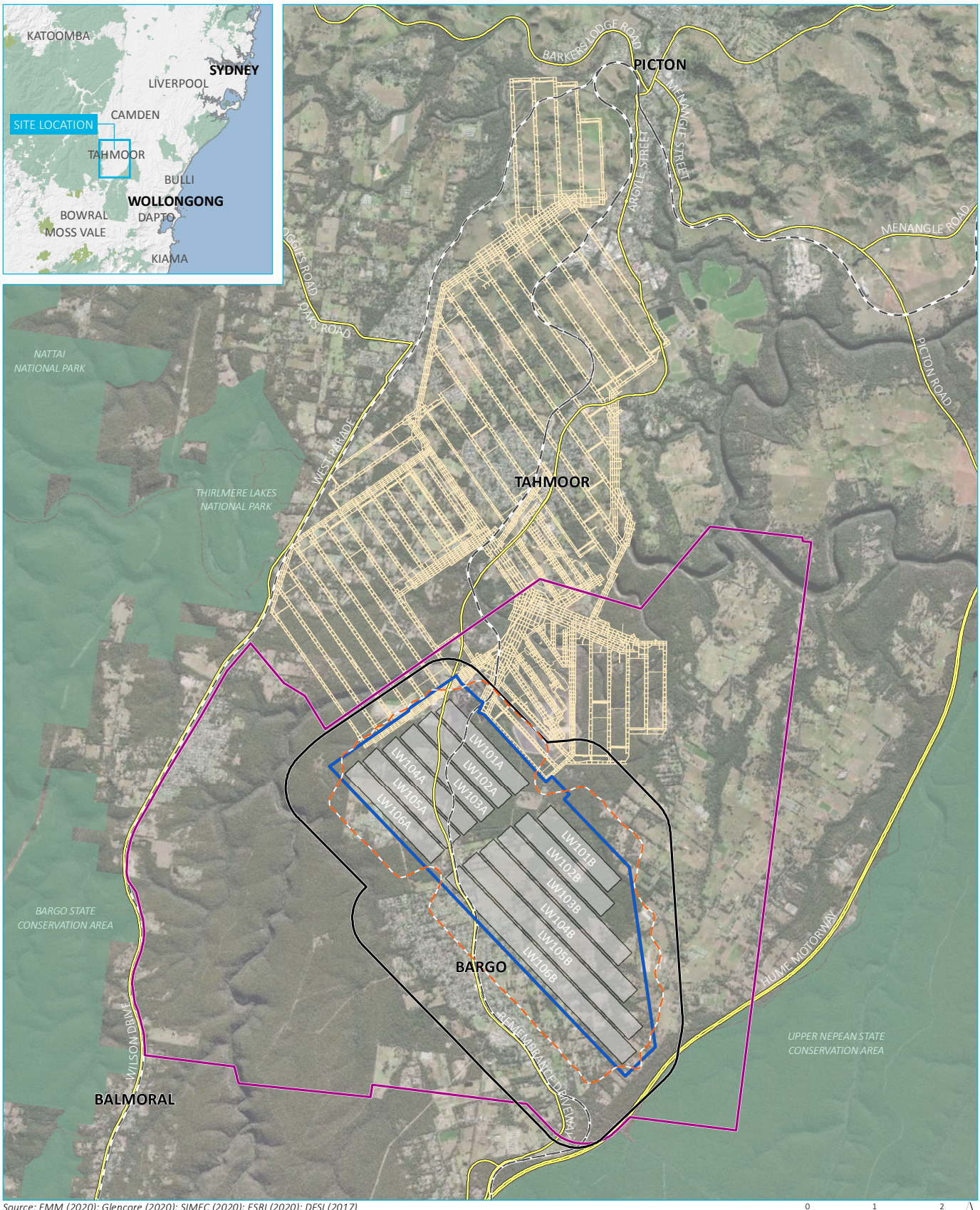
From late 2019, DPIE has received a number of representations from the community on the Project which fell outside the public exhibition period of the EIS. Predominantly these representations raise concerns or state opposition to the Project based on concerns regarding subsidence related impacts, particularly on properties in the township of Bargo.

ES6 Second amendment report

Tahmoor Coal has made the decision to make further changes to the Project to further reduce potential environmental impacts, particularly potential subsidence and biodiversity impacts. These amendments include:

- the removal of an additional two longwalls, LW107B and LW108B, to reduce subsidence impacts at the township of Bargo;
- containment of the REA on its approved disturbance footprint to reduce impacts to biodiversity; and
- amendments to the construction layout of the ventilation shafts (TSC1 and TSC2) and associated transmission lines to also reduce impacts to biodiversity.

The amended mine plan can be seen in Figure ES2. The footprint and layout of the REA can be seen in Figure ES3. And the amendments to the construction layout of TSC1 and TSC2 can be seen in Figure ES4.



Source: EMM (2020); Glencore (2020); SIMEC (2020); ESRI (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G001_AmendedMinePlan_20200728_08.mxd 30/07/2020

KEY

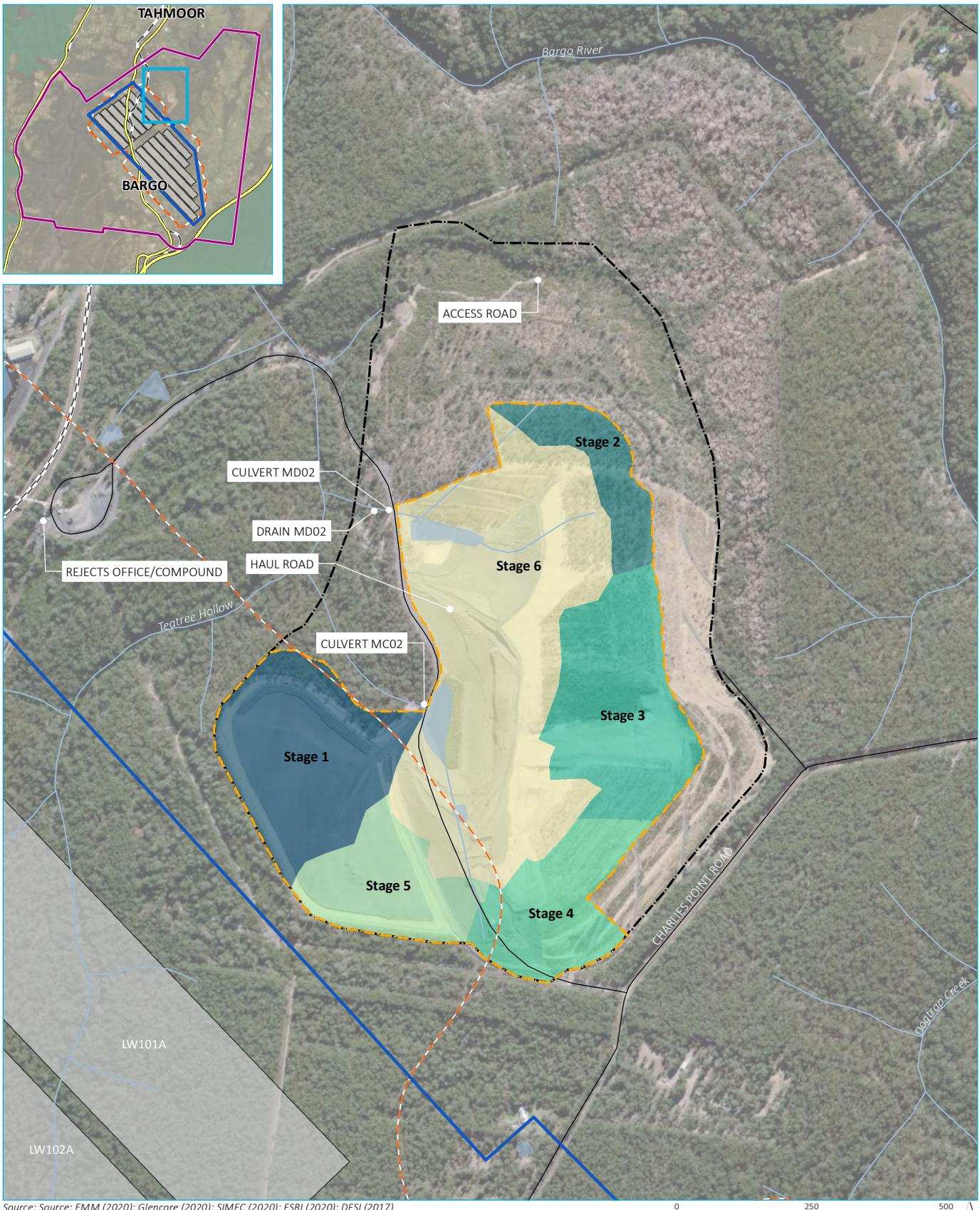
- Project area
- Extent of longwalls
- Longwall panel
- Subsidence study area
- Predicted 20 mm subsidence contour
- Approved Tahmoor North underground working
- Rail line
- Major road
- NPWS reserve
- State forest

Amended mine plan

Tahmoor South Project
Second amendment report
Figure ES2

SIMEC

EMM creating opportunities



Source: Source: EMM (2020); Glencore (2020); SIMEC (2020); ESRI (2020); DFSI (2017)

0 250 500 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G002_AmendedRejectEmplacementAreaLayout_20200728_04.mxd 30/07/2020

KEY

- Project area (refer to inset)
- Approved reject emplacement area footprint
- Amended reject emplacement extension area
- Predicted 20 mm subsidence contour
- Extent of longwalls
- Longwall panel

Amended reject emplacement extension staging area

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5
- Stage 6

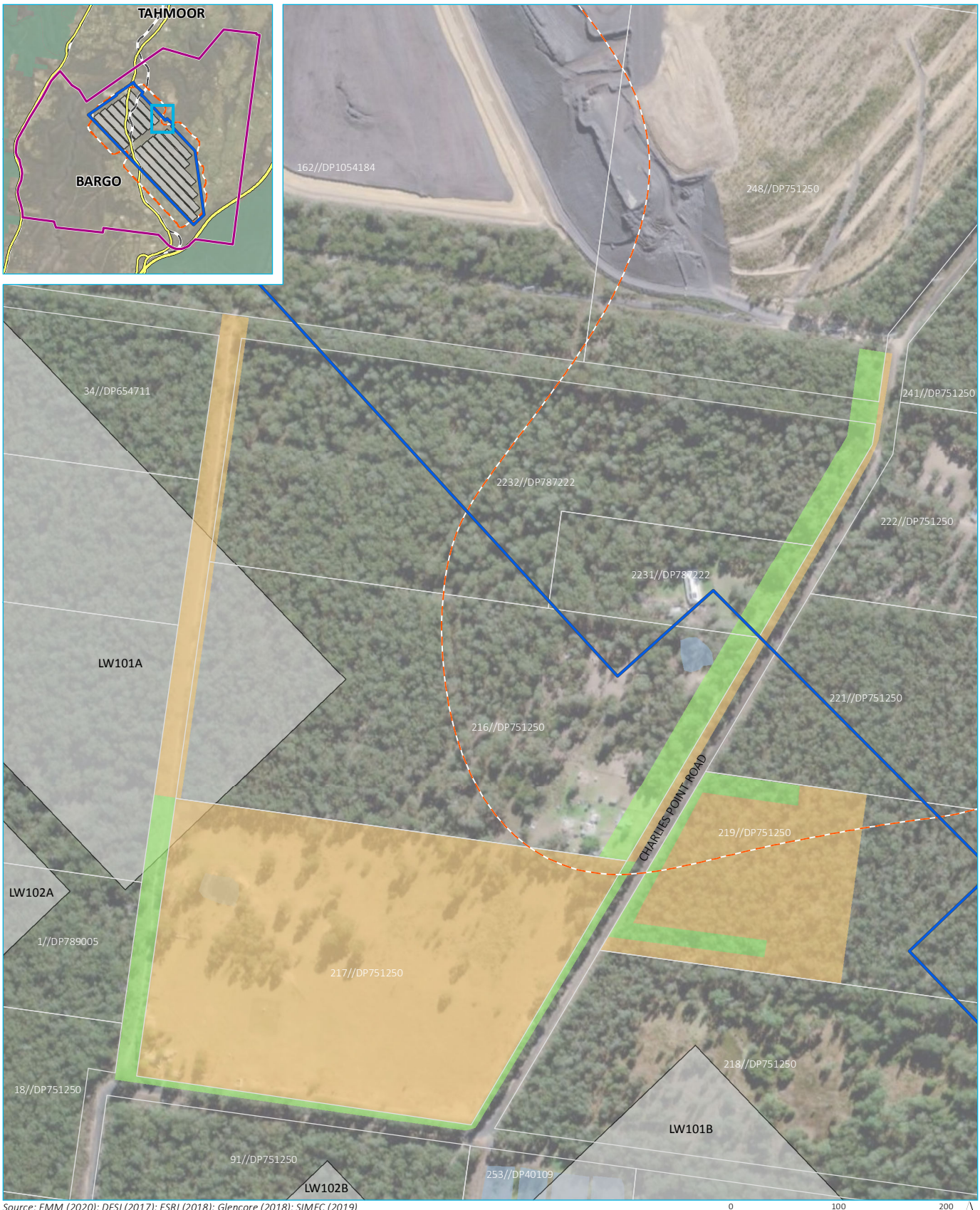
- Rail line
- Major road
- Minor road
- Watercourse / drainage line
- Waterbody
- NPWS reserve (refer to inset)

Amended reject emplacement area layout

Tahmoor South Project
Second amendment report
Figure ES3

SIMEC

EMM creating opportunities



Source: EMM (2020); DFSI (2017); ESRI (2018); Glencore (2018); SIMEC (2019)

0 100 200 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G004_VegetationClearance_20200728_05.mxd 29/07/2020

KEY

- Project area (refer to inset)
- Extent of longwalls
- Longwall panel
- Predicted 20 mm subsidence contour
- Vegetation to be cleared
- Vegetation to be retained
- Rail line (refer to inset)
- Major road (refer to inset)
- Cadastral boundary
- Waterbody
- NPWS reserve (refer to inset)

Vegetation clearing for ventilation shafts and associated transmission lines

Tahmoor South Project
Second amendment report
Figure ES4

SIMEC

EMM creating opportunities

The removal of the two longwalls will lead to a subsequent reduction in the life of the Project by about three years from 2035 to 2032. The containment of the REA on its approved disturbance footprint will necessitate an increase in its height by 10 m.

All other aspects of the Project remain the same as those documented in the PAR.

This *second amendment report* supports the amendment to the development application by Tahmoor Coal for the Project. It describes the amended Project for which approval is now sought, providing a summary of the impacts associated with the amended Project compared to those presented in the EIS and the PAR, and presents an updated evaluation of the merits of the Project.

This report also provides a response to advice from government agencies and WSC on the *submissions report* and PAR.

ES7 Consideration of impacts

ES7.1 Subsidence

The Bargo Mine Subsidence District was declared in 1975. This information is included on the title deed of each property, and applications to construct buildings in this area must be approved by Subsidence Advisory NSW (SA-NSW – formerly the Mine Subsidence Board).

Bargo has expanded steadily over time, such that 83 per cent of houses in the SSA have been built since the declaration in 1975. These houses have been designed in accordance with guidelines to reduce the potential for subsidence impacts, as required by SA-NSW (formerly the Mine Subsidence Board). The houses were constructed in the understanding that they may be subsided by underground mining in the future.

Tahmoor Coal made the decision to make additional changes to the Project to further reduce potential environmental impacts, particularly potential subsidence impacts. The changes include the removal of two longwalls, LW107B and LW108B.

The changes will substantially reduce the number of houses and associated civil infrastructure that were predicted to be adversely affected by mine subsidence due to the extraction of the Project. A total of 143 houses are located directly above the proposed longwalls compared to 571 houses that were located directly above the longwalls considered in the PAR.

Tahmoor Coal will continue to engage with the community through its existing community consultative committee meetings and other processes to address community concerns on subsidence and other matters. Consultation processes that are currently implemented in relation to subsidence management would continue to be applied for the Project.

Tahmoor Coal will compensate homeowners for mining-induced damage to houses in accordance with the NSW *Coal Mine Subsidence Compensation Act 2017*. Any claim for mine subsidence damage is lodged with SA-NSW who arrange for the damage to be assessed by an independent specialist assessor. If the damage is attributable to mine subsidence, a scope is prepared, and the compensation determined. If property owners are not satisfied with the outcome, the Act provides clear and simple mechanism to request an independent review by the Secretary of the NSW Department of Customer Service. In addition to the requirements under the Act, Tahmoor Coal will provide additional safeguards to homeowners, to address concerns raised by SA-NSW.

The overall findings of the assessments undertaken by MSEC are that the levels of impact and damage to all identified natural features and built infrastructure are manageable and can be controlled by the preparation and implementation of subsidence management plans (or extraction plans), many of which have already been developed and are being successfully implemented during mining at Tahmoor Mine.

ES7.2 Ground and surface water

The removal of LW107B and LW108B as part of the Project is likely to result in a reduced impact to the environmental features directly adjacent to or overlying these longwall panels.

The mining-related baseflow losses predicted to occur in Hornes Creek and Cow Creek would be reduced with the removal of LW107B and LW108B. The upper reaches of Dog Trap Creek and tributaries will not be subject to subsidence and surface cracking, and there would be less groundwater drawdown in the local area as a result of the removal of the two longwall panels. Overall, there will be a lower reduction in catchment yield as a result of the amendments.

Cumulative mine inflow to the Tahmoor South workings is predicted to be reduced by 4,100-6,400 megalitres (ML) over the life of the Project due to the expected completion of amended mine plan occurring approximately three years earlier.

The further amendments to the mine plan are not anticipated to reduce the predicted peak inflow into the mine workings. As such, changes to licensing would require a shorter duration licence to be acquired, but entitlement would be required to cover the same peak 'take'.

In addition, the risk of 'make good' being required for registered groundwater bores has been re-assessed. At one bore previously classified as 'high-risk', the risk is expected to be reduced as it is positioned directly above LW107B. There is still a 'moderate' risk to yield at this bore due to the amendment Project. Eight previously 'low risk' bores to the south of LW107B and LW108B are expected to have drawdown below 2 m (ie below the AIP 'minimal harm' criteria).

The amendments to the Project will lead to a removal of changes to potential flooding extents within Dog Trap Creek. It will also eliminate 11 of the 17 potential impact areas of overland flowpaths in and near the township of Bargo. It will also reduce potential water quality impacts, including a reduction in the extent of discharges from the mine's licenced discharge point.

ES7.3 Ecology

The amended Project has significantly reduced impacts on terrestrial ecology, particularly threatened communities and species. It has also reduced impacts to aquatic ecology.

The Project will now only impact 24.32 hectares (ha) of native vegetation, of which 14.20 ha is mine rehabilitation. This is a reduction of 13.45 ha compared to previous impacts, all of which relates to the Shale Sandstone Transition Forest (SSTF) where now only 10.10 ha will be impacted. Previously it was proposed to clear 23.57 ha of this community. In addition, of the 10.10 ha of SSTF to be disturbed, 1.42 ha already has approval to be disturbed under existing approvals at Tahmoor Mine.

The Project has also significantly reduced impacts on threatened flora. The amended Project will result in an impact to 55 *Grevillea parviflora* subsp. *parviflora* plants, and one *Persoonia bargoensis*. Previously, it was proposed to impact 491 *Grevillea parviflora* subsp. *parviflora* plants, and eight *Persoonia bargoensis*. The Project has now also avoided any impacts to *Pomaderris brunnea*.

The Project also reduces impacts to potential fauna habitat. This compares to 17.26 ha previously proposed.

Minor residual impacts to terrestrial ecology will be offset in accordance with the NSW biodiversity offset scheme.

A reduction in mining-related baseflow losses, catchment yield and water quality impacts have also resulted in a reduction in risk of potential impacts to aquatic ecology and habitat in the Project area.

ES7.4 Noise

Amendments to the Project, particularly the increase in the height of the REA have led to a negligible (up to 2 dB) change to the noise impacts presented in the PAR. Notwithstanding this, consistent with findings presented in the PAR, the Project, inclusive of the amendments, is expected to reduce noise emissions at all assessment locations compared to existing levels by at least 2 dB and by up to 11 dB at assessment locations during the more sensitive night-time period.

ES7.5 Air quality and greenhouse gas

The amendments to the Project will reduce dust emissions at the REA. It is therefore anticipated that the Project is not likely to result in any increases in particulate emissions or ground level concentrations compared to those presented in the PAR.

A reduction in total years of operation of the Project will result in GHG emissions, including approximately 22 per cent for scope 1, 23 per cent for scope 2 and 25 per cent for scope 3 emissions from those presented in the PAR.

ES7.6 Visual

Despite an increase in height of the REA, a visual assessment found that it would unlikely result in a level of visual effect or visual significance over and above the low impact determined in the visual assessment in the PAR. This is principally due to the distance between the REA and surrounding view locations and the extent of existing tree cover surrounding and between the REA and surrounding view locations.

ES7.7 Social

Overall, the predicted level of social impact of the Project has reduced because of the amendments made to reduce subsidence and subsidence-related impacts. Of all the social aspects considered, impacts in only one aspect has increased. This is the social benefits derived from a reduction in economic benefits of the Project due a net reduction in coal volume mined by the Project. However, the reduction in the predicted level of social impacts of the Project is also directly related to the removal of these longwalls and the resultant improvement in subsidence and subsidence-related impacts.

As documented in the EIS and PAR, residual social impacts from the Project can be managed by Tahmoor Coal through the implementation of mitigation measures which have been informed by over 40 years of mining in the Southern Coalfields and through significant experience gained in managing social impacts in consultation with the community and other stakeholders.

ES7.8 Economic

An *economic assessment* was undertaken for the Project, inclusive of the amendments which would see a reduction in the amount of coal mined and the time in which its mined. The assessment includes a cost-benefit analysis (CBA), a local effects analysis (LEA) and computable general equilibrium (CGE) modelling.

The CBA indicates that the Project will have a net benefit of $664.9 million in net present value (NPV). This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively and an incremental cost of the Project is $0.1 million. The LEA shows an estimated net benefit of $137.5 million to the Wollondilly region in NPV terms. This is driven largely by:

- benefits to local workers of $100.3 million in NPV terms based on the assumption that 45 per cent of the mine's direct employees continue to be drawn from Wollondilly;

- benefits to local suppliers of $32.5 million in NPV terms which assumes that 12.9 per cent of the inputs to production are from the region; and
- the payment of local Council rates totalling $4.7million in NPV terms.

The LEA also showed that total employment in the Wollondilly region is projected to increase by 245.4 full time equivalent (FTE) workers on average as a result of the Project.

Similarly, the results of the CGE modelling shows significant benefits to the Wollondilly region. It indicates that the Project is expected to increase gross regional product and gross regional income (GRI) by $1,624.5 million and $1,189.0 million, respectively, in NPV terms.

The projected increase in GRI is significant to the relatively small Wollondilly region. In total, the Project is expected to increase welfare for each person in the region by $19,681.7 in NPV terms.

ES8 Potential impacts

As previously stated, a number of amendments have been made to the Project to address concerns raised by the community and government agencies, particularly around subsidence and subsidence related impacts and impacts associated with the clearing of native vegetation.

The Project is expected to have a range of impacts, both positive and negative.

To enable a balanced comparison of the overall merits of the Project as currently proposed, an economic assessment was prepared which includes a CBA. This CBA uses the net production benefits of the project in NPV terms that accrue to NSW. These benefits would be distributed to numerous stakeholders including the NSW Government via royalties and tax and, WSC via rates and the local community through wages and local expenditure.

For the Project to be questionable from an economic efficiency perspective, all residual environmental impacts would need to be valued by the community at greater than the total net production benefits that will accrue to NSW.

The economic assessment the Project clearly indicates that it will provide a net benefit to NSW. This net benefit is estimated to be $664.9 million in NPV terms. This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively. The incremental indirect costs of the Project are $0.1 million. Other costs, like subsidence and biodiversity impacts are being borne by Tahmoor Coal and are included in the financial costs of the Project.

ES9 Conclusion

Tahmoor Coal has sought to address and resolve matters raised during and after the public exhibition period of the EIS and to deliver a balanced outcome.

The Project is strongly justified. There is a need for the Project, driven by the need for high quality coking coal to produce steel. The need is underpinned by State strategic planning policies and consistent with the *Strategic Statement on Coal Exploration and Mining in NSW*.

The Project continues the orderly and logical use of natural, physical and human resources that exist in the local area, and enhanced outcomes will result from ongoing investment and employment in the area. A range of physical, economic and environmental attributes combine to make the Project area suitable for the development, particularly its proximity to existing Tahmoor Coal physical and human infrastructure.

While the Project has the potential to cause adverse impacts, including subsidence and water impacts, mitigation or compensation measures have been developed to address these. When all relevant factors are considered, the benefits of the Project sufficiently outweigh its costs.

Table of Contents

Appendices

Tables

Figures

1 Introduction

1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates the Tahmoor Mine, an existing underground coal mine approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW). The mine has been operating continuously since 1979 when coal was first mined.

Currently, up to three million tonnes (Mt) of run-of-mine (ROM) coal is extracted annually from the mine. Product coal is primarily transported via rail to Port Kembla Coal Terminal, or to the Port of Newcastle from time to time, for shipment to both Australian and international markets. Currently, about 97.5 per cent of the coal produced at Tahmoor Mine is coking coal which is used in the production of steel. The remainder is thermal coal and used to produce electricity.

The location of Tahmoor Mine in a regional context can be seen in Figure 1.1.

Tahmoor Mine employs close to 400 people.

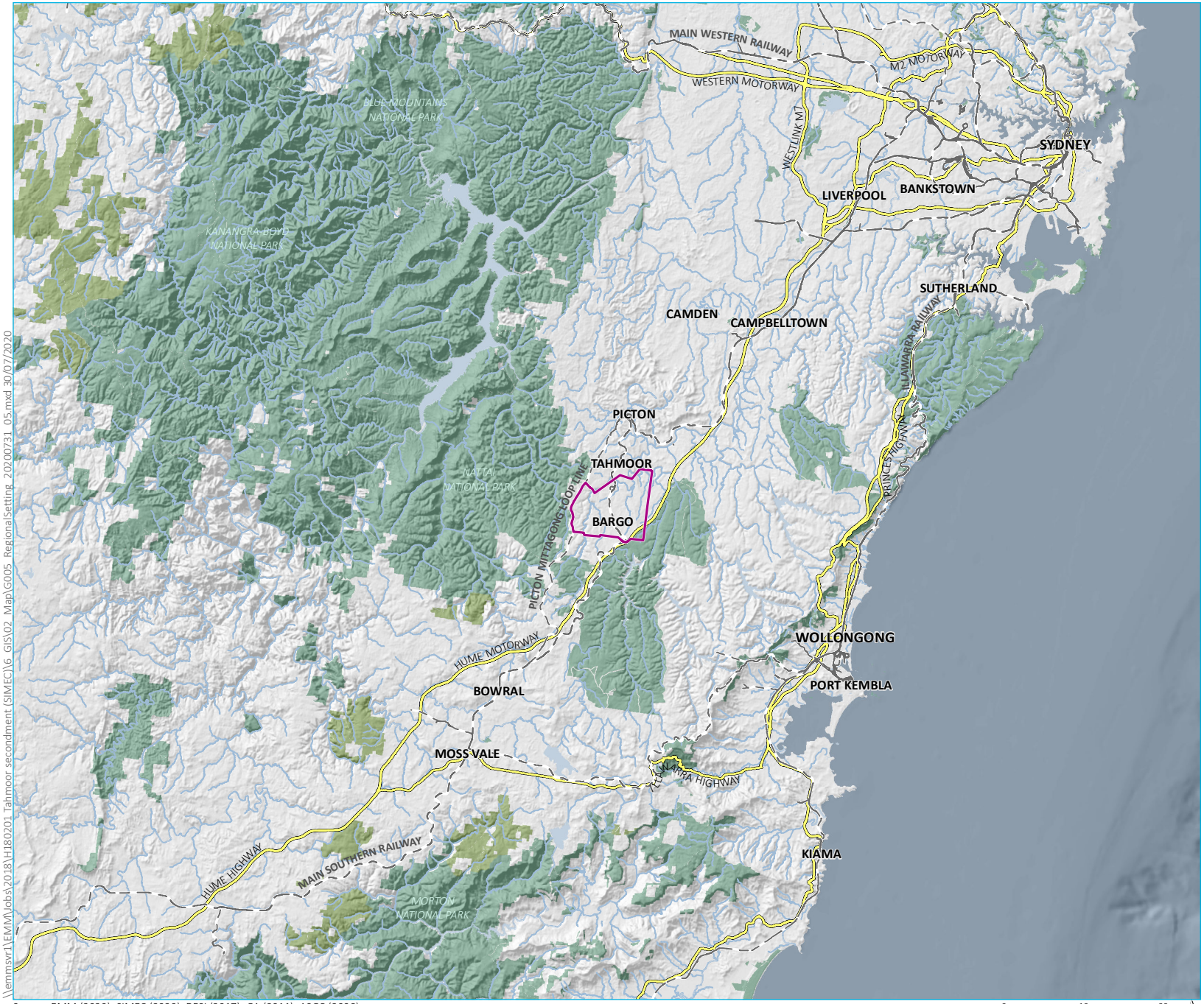
Mining within the existing Tahmoor North mining area is scheduled for completion by approximately 2022, depending on geological and mining conditions. Without access to a new extraction area by this time, Tahmoor Mine would commence closure of the mine resulting in cessation of the extraction of the coking coal resource. Accordingly, Tahmoor Coal is seeking approval for the Tahmoor South Project, being an extension of underground coal mining at Tahmoor Mine, to the south of Tahmoor Coal's existing mining area (the Project).

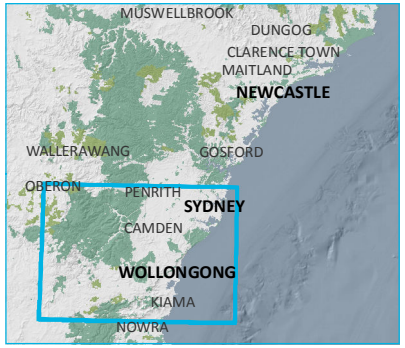
Given its significance to the State, the Project is deemed to be State significant development (SSD) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Under these provisions, the NSW Minister for Planning and Public Spaces, or delegate, is the consent authority for the Project. Approval for the Project is also required from the Commonwealth Minister for the Environment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Following the receipt of revised Secretary's Environmental Assessment Requirements (SEARs) in June 2018, a comprehensive *environmental impact statement* (EIS) was prepared for the Project by AECOM Australia Pty Limited (AECOM 2018). The EIS was publicly exhibited between 23 January and 5 March 2019 by the NSW Department of Planning, Industry and Environment (DPIE). In response, 91 submissions were received from the community and community organisations, and 15 responses were received from government agencies and councils.

In total, 83 individual community submissions were received. Of these, 73 submissions (or 88 per cent) indicated support for the Project, and ten submissions (or 12 per cent) raised objections to it. Most submitters were from the Wollondilly or Wollongong local government areas (LGAs). In these two LGAs, there were 46 individual submissions. Thirty-nine submissions (or 85 per cent) indicated support for the Project, and seven submissions (or 15 per cent) raised objections to it. There were five individual submissions from the Wingecarribee LGA, where the southern part of the Project area lies. Of these, four submissions (or 80 per cent) indicated support for the Project, and one submission (or 20 per cent) raised objections to it.

On 15 January 2019, the NSW Minister for Planning and Public Spaces requested that the NSW Independent Planning Commission (IPC) undertake a review of the Project and prepare a report which identifies the key issues requiring detailed consideration by DPIE in preparing its assessment report.





KEY

- Project area
- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Regional context

Tahmoor South Project
Second amendment report
Figure 1.1

Source: EMM (2020); SIMEC (2020); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km
GDA 1994 MGA Zone 56

N

SIMEC

EMM creating opportunities

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6 GIS\02 Map\G005 RegionalSetting 20200731 05.mxd 30/07/2020

In June 2019, DPIE prepared a *preliminary issues report* (PIR) to assist the IPC in conducting the public hearing. The report was prepared following a preliminary review of the EIS and submissions, and considered the advice received from government agencies and an independent groundwater expert. It is noted that within this PIR, DPIE stated that 86 community submissions (78 individuals and eight organisations) were received in response to the exhibition of the EIS. This is due to the number of community submissions being reduced by five after the 91 had previously been issued to Tahmoor Coal.

In July 2019, the IPC deferred the public hearing and its review of the Project following advice from Tahmoor Coal that the Project would be amended in response to submissions on the EIS. Also, in July 2019, DPIE formally requested that Tahmoor Coal respond to the submissions.

On 20 February 2020, a *submissions report* (AECOM 2020a) was lodged with DPIE which responded to all submissions made during exhibition of the EIS. At the same time (ie 20 February 2020), a *project amendment report* (PAR) (AECOM 2020b) was lodged with DPIE to document amendments made to the Project in response to the submissions and to reduce its potential environmental impacts.

The amendments to the Project documented in the PAR included, among other things, changes to the mine plan and the coal reject emplacement area (REA). The changes to the mine plan included the removal of a longwall in the northern part of the mine (LW109), reconfiguration of the longwall layouts to comprise two series of shorter longwall panels, the reduction of the width of the longwalls, and a reduction in the height of extraction within the longwalls. The changes to the REA included a reduction in the proposed extension area by increasing the height of the REA by 5 metres (m).

The *submissions report* and PAR took into consideration, and addressed, the issues raised by DPIE in its PIR prepared in June 2019. The submissions report and PAR were placed on DPIE's website but were not publicly exhibited. They were also provided to government agencies and Wollondilly Shire Council (WSC) for comment.

In response to the submissions report and PAR, DPIE received advice from several government agencies and WSC. On 1 April 2020, DPIE wrote to Tahmoor Coal requesting that it responds to the advice from the agencies and WSC. From late 2019, DPIE has received a number of representations from the community on the Project which fell outside the public exhibition period of the EIS. Predominantly these representations raise concerns or state opposition to the Project based on concerns regarding subsidence related impacts, particularly on properties in the township of Bargo.

1.2 Policy changes

In August 2014, the NSW Government released the *Strategic Statement of NSW Coal*. The statement recognised the significant value of coal to the NSW economy and set out clear objectives for the growth and performance of the coal sector in NSW. Since the preparation of the EIS (AECOM 2018), the *submissions report* (AECOM 2020a) and PAR (AECOM 2020b), the NSW Government updated the strategic statement through the release of the *Strategic Statement on Coal Exploration and Mining in NSW* (DRNSW 2020) in June 2020.

The objective of the current strategic statement is to "provide greater certainty to explorers, investors, industry stakeholders and communities about the future of coal mining in the state" and set out "how the NSW Government is taking a responsible approach to the global transition to a low carbon future."

The strategic statement provides a balanced consideration of the ongoing global demand for coal, and therefore the need for ongoing support of coal industry to meet this demand. Significantly, in relation to the Project, the strategic statement states that "the global demand for thermal coal [could be] sustained for the next two decades or more" and that "The use of coal in the manufacture of steel (coking coal) is likely to be sustained longer as there are currently limited practical substitutes available." In addition, it states that "the NSW Government will … recognise existing industry investment by continuing to consider responsible applications to extend the life of current coal mines".

1.3 Further amendments to the Project

Tahmoor Coal has made the decision to make further changes to the Project to further reduce potential environmental impacts, particularly potential subsidence and biodiversity impacts. These amendments include:

- the removal of an additional two longwalls, LW107B and LW108B, to reduce subsidence impacts at the township of Bargo;
- containment of the REA on its approved disturbance footprint to reduce impacts to biodiversity; and
- amendments to the construction layout of the ventilation shafts (TSC1 and TSC2) and associated transmission lines to also reduce impacts to biodiversity.

The removal of the two longwalls will lead to a subsequent reduction in the life of the Project by about three years from 2035 to 2032. The containment of the REA on its approved disturbance footprint will necessitate an increase in its height by 10 m.

All other aspects of the Project remain the same as those documented in the PAR (AECOM 2020b).

Further details on the proposed amendments to the Project are described in Chapter 3. An updated detailed description of the Project is provided in Appendix A.

1.4 Purpose and structure of this report

Clause 55 of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) states that:

> (1) A development application may be amended or varied by the applicant (but only with the agreement of the consent authority) at any time before the application is determined.
>
> (2) If an amendment or variation results in a change to the proposed development, the application to amend or vary the development application must have annexed to it written particulars sufficient to indicate the nature of the changed development.

An application to amend SSD-8445 pursuant to clause 55 of the EP&A Act Regulation was lodged on 24 February 2020. This was in respect of the amendments to the development outlined in the PAR (AECOM 2020b).

A further application to amend SSD-8445 pursuant to clause 55 of the EP&A Act Regulation was lodged on 3 August 2020 with this *second amendment report*. This was in respect of the further amendments to the development outlined in this report.

This *second amendment report* supports the amendment to the development application by Tahmoor Coal for the Project. It describes the amended Project for which approval is now sought, providing a summary of the impacts associated with the amended Project compared to those presented in the EIS and the PAR (AECOM 2020b) submitted, and presents an updated evaluation of the merits of the Project.

For clarity, this amendment report is entitled the '*second amendment report*'. The first amendment report is referenced in this document as the 'PAR' or 'PAR (AECOM 2020b)'.

This report also provides a response to advice from government agencies and WSC on the *submissions report* (AECOM 2020a) and PAR.

This *second amendment report* is structured as follows:

- Chapter 2 provides a background to the Project.
- Chapter 3 provides details on the amendments on the Project.
- Chapter 4 provides some context on the strategic and statutory context of the Project.
- Chapter 5 provides an overview of the engagement Tahmoor Coal has had with various stakeholders since the submissions report and PAR were prepared.
- Chapter 6 provides a summary of the relevant environmental impacts of the amendments to the Project, particularly compared to those impacts described in the EIS and PAR.
- Chapter 7 provides a response to the advice from government agencies and WSC on the *submissions report* and PAR.
- Chapter 8 provides an evaluation of the merits of the Project and conclusion.

This report also contains various appendices. A detailed description of the Project which includes all project amendments contained in the PAR and this *second amendment report* is provided in Appendix A. Appendix B to Appendix O includes all the technical specialists' assessments of the amendments to the Project, as well as additional material to support the response to government advice. These include:

- Appendix B – Subsidence assessment;
- Appendix C – Groundwater assessment;
- Appendix D – Surface water assessment;
- Appendix E – Biodiversity assessment;
- Appendix F – Aquatic ecology assessment;
- Appendix G – Noise assessment;
- Appendix H – Air quality and greenhouse gas assessment;
- Appendix I – Visual assessment;
- Appendix J – Rehabilitation strategy;
- Appendix K – Economics assessment;
- Appendix L – AHIMS site card;
- Appendix M – Groundwater modelling plan;
- Appendix N – Response to DPIE-Water; and
- Appendix O – Statement of heritage impact – Wirrimbirra Sanctuary.

2 Background

2.1 Tahmoor Mine

The Tahmoor Mine consists of two holdings:

- Tahmoor Colliery Holding – covering an area of 6,735 hectares (ha) with surface rights over 231.7 ha and consisting of Consolidated Coal Lease (CCL) 716 and Mining Leases (ML) 1308, 1376 and 1539; and
- Bargo Colliery Holding – consisting of CCL747 and covering 4,769 ha with surface rights over 921 ha.

Coal exploration operations commenced at the Tahmoor Mine during the 1960s by the NSW Government.

Both the Tahmoor and Bargo Mines were granted approvals to commence operations in the mid to late 1970s. The current Tahmoor Mine operation consists of:

- the Tahmoor Mine, which commenced mining operations in 1979 and has undertaken coal production until the present day; and
- the Bargo Mine, where limited development was undertaken between 1979 and 1981.

The Tahmoor Mine initially operated using bord and pillar mining methods. These early methods were replaced by longwall mining methods in 1987 when a gas extraction facility and longwall mining unit were commissioned and installed.

Current operations at the Tahmoor Mine are undertaken within the Tahmoor North mining area under several approvals. Coal is currently mined from the Bulli seam, producing predominantly hard coking coal for steel production. From 2017, Tahmoor Mine has produced, on average, 97.5 per cent coking coal. The remainder is thermal coal which is used for power generation (see Table 2.1).

Table 2.1 Coal production at Tahmoor Mine – per cent

Year	Coking coal	Thermal coal
2017	94.54	5.46
2018	97.73	2.27
2019	99.16	0.84
2020 (to date)	98.58	1.42
Average	**97.5**	**2.5**

Coal products from the mine are primarily transported via rail to Port Kembla or the Port of Newcastle from time to time for delivery to both Australian and international markets. Tahmoor Mine also has approval to transport up to 0.05 million tonnes per annum (Mtpa) of coal by road within the Wollondilly LGA or in circumstances where rail transport is unavailable.

Mining within the Tahmoor North mining area is scheduled for completion by approximately 2022, depending upon geological and mining conditions.

Tahmoor Mine is divided into three distinct mining areas: Tahmoor Central (LW1-21), Tahmoor North (LW22-37) and Tahmoor South (the Project). Tahmoor South comprises a single mining domain: The Central Domain. Two additional domains, the Eastern and Southern domains, were identified during project planning and pre-feasibility studies. Mining in these domains are now not proposed as part of the Project.

2.2 Tahmoor South Project

2.2.1 Environmental impact statement

A *preliminary environmental assessment* (AECOM 2012) for the Project was submitted to DPIE in September 2012 to identify key environmental planning issues to inform the development of Director-General's Requirements (DGRs), which are now known as SEARs, for the preparation of an EIS. In 2012 DGRs were issued and an EIS completed in 2014.

The Project was placed on hold and subsequently withdrawn in late 2015. In May 2017, the PEA was resubmitted to DPIE requesting SEARs in order to recommence the Project and update the EIS. The SEARs were issued in June 2017 and revised in February 2018 to account for the Commonwealth's requirements (see below) and June 2018 to address social impact assessment requirements.

The Project was deemed to be a controlled action under the EPBC Act by the Commonwealth Department of Agriculture, Water and Environment (DAWE) in January 2018 and revised SEARs were issued in February 2018 to include the Commonwealth's environmental assessment requirements. The Commonwealth has accredited the NSW environmental assessment process under the EP&A Act under a bilateral agreement between the two governments. As such, the Project will be assessed under the provisions of the EP&A Act in accordance with the bilateral agreement.

Following the receipt of the revised SEARs in June 2018, a comprehensive EIS (AECOM 2018) was prepared for the Project. The EIS was publicly exhibited between 23 January and 5 March 2019 by DPIE. In response, 91 submissions were received from the community and community organisations and companies, and 15 responses were received from government agencies and councils.

Of the community submissions, 73 submissions were in support of the Project and 10 raised objections to it. Of the community organisations and company submissions, one was in support of the Project, five raised objections to it and two provided comments.

On 15 January 2019, the NSW Minister for Planning and Public Spaces requested that the IPC undertake a review of the Project and prepare a report which identifies the key issues requiring detailed consideration by DPIE in preparing its assessment report. In doing so, the Minister requested that the IPC conduct a public hearing into the carrying out of the Project as soon as practicable after the public exhibition of the EIS, and consider the EIS, submission report, relevant expert advice, and any other relevant information when preparing its report.

In June 2019, DPIE issued a PIR to assist the IPC in conducting the public hearing. The report was prepared following a preliminary review of the EIS and submissions, and considered the advice received from government agencies and an independent groundwater expert. DPIE noted that the key issues resulting from its preliminary review of the Project included:

- subsidence – including its impacts on homes and other built features and on groundwater and surface water resources;
- water resources – including further clarification and details of the groundwater modelling, groundwater sensitivity assessment, exchange between surface water and groundwater, and the management of impacts to groundwater bore users;

- amenity impacts – including application of current noise policy and technical inputs;
- biodiversity impacts – including clearing of a critically endangered ecological community (CEEC) and other threatened species, further clarification on biodiversity offset availability and consideration of other reject emplacement methods;
- social impacts – including impacts on the owners of subsidence affected properties, the local Aboriginal community and people with a connection to Thirlmere Lakes; and
- economic – including assumptions used to calculate employment benefits and the Project's local environmental, social and transport impacts.

DPIE also noted that there were additional concerns raised in public submissions, along with strong support for the Project from the majority of submitters, identifying the positive social, employment and economic benefits of mining to the broader regional economy.

In July 2019, the IPC deferred the public hearing and its review of the Project following advice from Tahmoor Coal that the Project would be amended in response to submissions on the EIS. Also, in July 2019, DPIE formally requested that Tahmoor Coal respond to the submissions.

2.2.2 Submissions and project amendment report

On 20 February 2020, a *submissions report* (AECOM 2020a) was lodged with DPIE which responded to all submissions made during exhibition of the EIS. At the same time (ie 20 February 2020) a PAR (AECOM 2020b) was lodged with DPIE to document amendments made to the Project in response to the submissions and to reduce potential environmental impacts of the Project.

As previously stated, the amendments documented in the PAR included, among other things:

- a reduction in the extent of longwall mining (mine plan) and magnitude of subsidence impacts;
- a reduction in the extent of vegetation clearing required for the extension of the REA; and
- a reduction in the operating hours of the REA to reduce night-time noise impacts.

As previously stated, the *submissions report* and PAR took into consideration, and addressed, the issues raised by DPIE in its PIR prepared in June 2019.

i Mine plan

The following amendments were made to the mine plan to reduce the extent and magnitude of anticipated surface subsidence:

- removal of LW109, which was directly beneath Dog Trap Creek;
- reconfiguration of the longwall layout to comprise two series of shorter longwall panels;
- reduction in the proposed longwall width, from approximately 305 m to approximately 285 m; and
- reduction in the height of extraction within longwall panels from up to 2.85 m to up to 2.6 m.

The revised mine plan also allowed the longwalls to move north.

The changes meant that the estimated production volume of the Project would be reduced from about:

- 48 Mt of ROM coal considered in the EIS to 43 Mt;
- 35 Mt of coking coal considered in the EIS to 30 Mt; and
- 3.5 Mt of thermal coal considered in the EIS to 2 Mt.

ii Reject emplacement area

As part of the EIS (AECOM 2018), the REA was proposed to be extended by 43 ha, which would have required the clearing of a total of 39.7 ha of native vegetation, comprising 34 ha of the Shale Sandstone Transition Forest (SSTF) CEEC. The design of the REA was subsequently amended to reduce the extension footprint from 43 ha to 11.06 ha, resulting in a reduced extension area of approximately 74%.

Changes to the mine plan also led to a reduction on the rejects generated by the Project from approximately 14.3 Mt to 11.6 Mt.

In addition, it was proposed that the height of the REA be increased by 5 m from reduced level (RL) 305 m to RL 310 m to further minimise the REA footprint.

The operation of the REA was also amended to what was proposed in the EIS. Rather than a 24-hour operation as proposed in the EIS, the haulage of rejects at the REA were amended to occur during daytime and evening hours only (7 am to 10 pm).

iii Power line

The construction and operation of the powerline for ventilation shaft site TSC1 was contained in the PAR. Previously it was not considered in the EIS.

iv Mine ventilation

Following preparation of the EIS, a review of the ventilation strategy for the Project was undertaken and concluded that the Project would require continued use of the existing upcast shaft (T2) used for Tahmoor North operations. However, the operation of T2 would only require one fan compared to the existing two fans once the new ventilation shafts and fans (TSC1 and TSC2) are in operation in Tahmoor South.

v Government advice

Given the changes to Project to reduce impacts, the submissions report and PAR were placed on DPIE's website but were not publicly exhibited. They were also provided to government agencies and WSC for advice.

In response, DPIE received advice from 12 government agencies and WSC. On 1 April 2020, DPIE wrote to Tahmoor Coal requesting that it provide a response to the matters raised in the advice.

vi Community representations

From late 2019, DPIE received a number of representations from the community on the Project. These representations fall outside the public exhibition period of the EIS. Predominantly, these representations raise concerns or state oppose the Project on the basis of subsidence and subsidence related impacts, particularly on properties in the township of Bargo.

3 Description of amendments

3.1 Overview

Further changes to those documented in the PAR (AECOM 2020b) are proposed to the Project to further reduce potential environmental impacts, particularly potential subsidence and biodiversity impacts. These amendments include:

- the removal of two longwalls in the southern part of the mine near the township of Bargo (LW107B and LW108B) and reduction in magnitude of subsidence impacts;
- the containment of the REA within the bounds of the currently approved disturbance footprint to eliminate the need for any further vegetation clearing at that site; and
- changes to the layout of the ventilation shafts and associated transmission line easements to reduce the extent of vegetation clearing during construction.

In addition, the removal of the two longwalls will reduce the estimated production volumes and schedule (or timeframe) of the Project.

The amendments to the Project are described below.

All other aspects of the Project remain the same as those documented in the PAR and EIS.

A table is provided at the end of this chapter which compares the Project as proposed now compared to the Project described in the PAR and EIS (AECOM 2018).

A full description of the Project including all project amendments is provided in Appendix A.

3.2 Mine plan

The Project has been amended to remove LW107B and LW108B from the mine plan, which were predominantly below the township of Bargo. The amendments made to the configuration of the longwalls in the PAR remain the same, including:

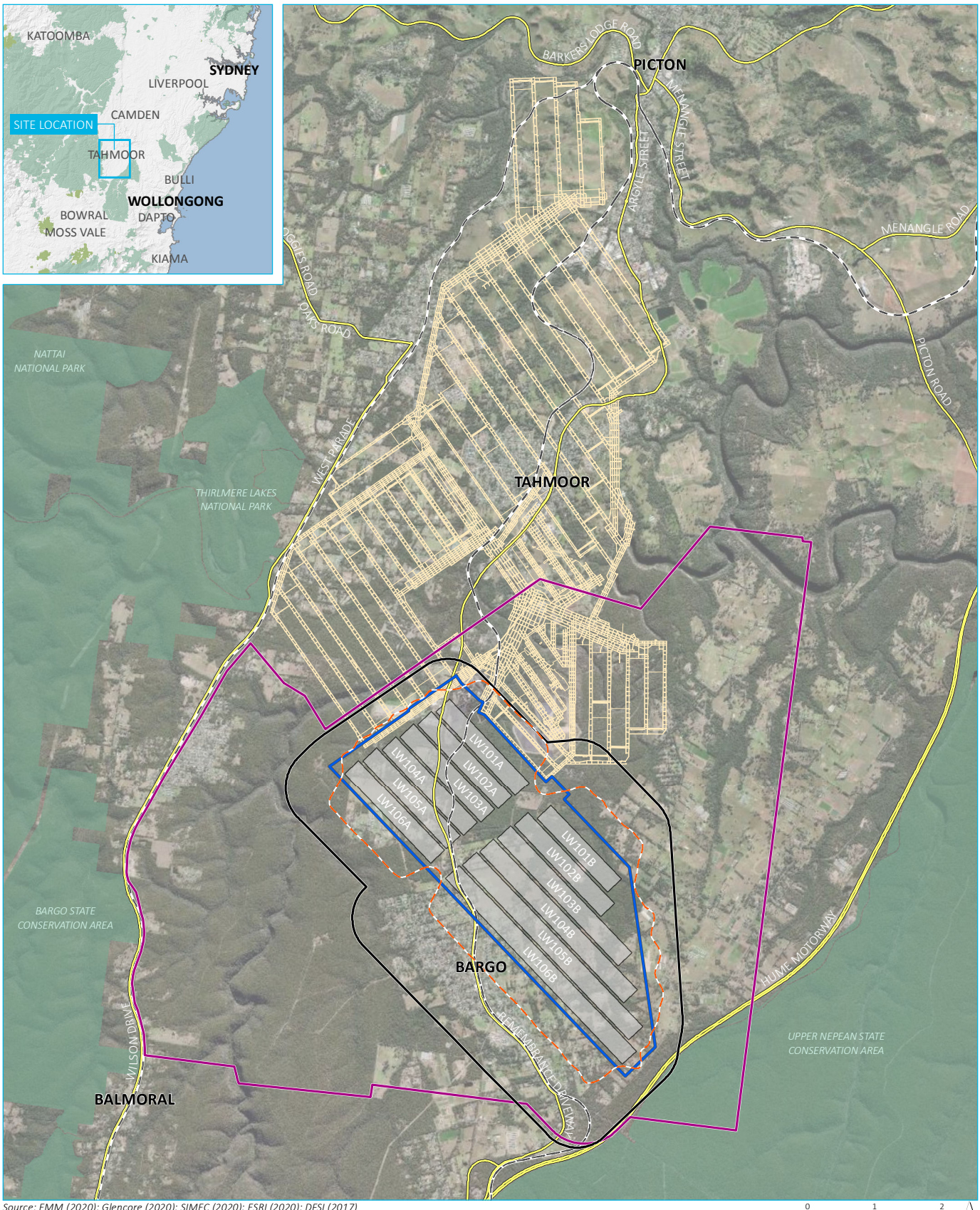
- layout comprising two shorter longwall panels;
- reduction in the proposed longwall width, from approximately 305 m to approximately 285 m; and
- reduction in the height of extraction within longwall panels from up to 2.85 m to up to 2.6 m.

The proposed mine plan can be seen in Figure 3.1.

3.3 Production schedule

The removal of LW107B and LW108B will reduce the estimated production volume of the Project from about:

- 43 Mt of ROM coal considered in the PAR to 33 Mt;
- 30 Mt of coking coal considered in the PAR to 23 Mt; and
- 2 Mt of thermal coal considered in the PAR to 1.4 Mt.



Source: EMM (2020); Glencore (2020); SIMEC (2020); ESRI (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G001_AmendedMinePlan_20200728_08.mxd 30/07/2020

KEY

- Project area
- Extent of longwalls
- Longwall panel
- Subsidence study area
- Predicted 20 mm subsidence contour
- Approved Tahmoor North underground working
- Rail line
- Major road
- NPWS reserve
- State forest

Amended mine plan

Tahmoor South Project
Second amendment report
Figure 3.1

SIMEC

EMM creating opportunities

The removal will also reduce the life of the Project by about three years compared to the schedule presented in the PAR.

The estimated production volumes for the Project can be seen in Table 3.1.

Table 3.1 Estimated production volumes

Year	ROM coal (t)	Coking coal (t)	Thermal (t)	Total product (t)	Reject (t)
2021	389,055	178,442	13,397	191,839	210,042
2022	1,696,732	997,407	52,026	1,049,433	703,236
2023	2,768,309	1,658,229	106,801	1,765,030	1,094,542
2024	3,474,754	2,292,053	119,296	2,411,350	1,177,956
2025	3,117,111	2,250,027	105,102	2,355,129	864,744
2026	3,492,968	2,679,597	150,346	2,829,943	778,178
2027	3,502,524	2,646,827	176,103	2,822,930	795,062
2028	3,892,768	2,888,684	200,711	3,089,395	931,706
2029	3,144,623	2,360,688	173,522	2,534,211	714,082
2030	3,411,150	2,231,724	145,549	2,377,273	1,146,332
2031	2,979,672	1,919,002	91,484	2,010,486	1,067,417
2032	788,650	544,761	25,179	569,940	244,709
Total	**32,658,317**	**22,647,442**	**1,359,516**	**24,006,958**	**9,728,007**

To enable the continuation of mining to occur sequentially with the current mining operations in Tahmoor North, which are scheduled for completion during 2022, pre-development works in anticipation of mining in the Tahmoor South project area commenced in the Tahmoor North mine area in 2019 under existing development consents. These pre-development activities include such as the recovery of existing underground development roadways, redevelopment of the underground pit bottom, and longwall development including establishment of gate roads. Accordingly, production volumes in 2021 and partly in 2022 shown in Table 3.1 include coal recovered from pre-development works.

The anticipated mining schedule of the longwall panels can be seen in Table 3.2. Following completion of the pre-development works, mining of the first longwall for the Project, LW101A, is anticipated to commence in the third quarter of 2022. Mining of the final longwall, LW106A is anticipated to be completed in the second quarter of 2032.

Table 3.2 Anticipated mining schedule

Longwall panel	Start	Finish
LW101A	August 2022	March 2023
LW102A	April 2023	November 2023
LW103A	December 2023	July 2024
LW101B	August 2024	February 2025
LW102B	March 2025	October 2025

Table 3.2 Anticipated mining schedule

Longwall panel	Start	Finish
LW103B	November 2025	October 2026
LW104B	November 2026	October 2027
LW105B	November 2027	January 2029
LW106B	February 2029	May 2030
LW104A	June 2030	January 2031
LW105A	February 2031	August 2031
LW106A	September 2031	April 2032

The anticipated mining schedule and estimated production volumes in Table 3.1 and Table 3.2 are estimates only based on mine planning activities. The actual volumes and schedule will vary based on a range of conditions both internal and external to the mine.

3.4 Reject emplacement area

The footprint of the REA will now be contained within its approved disturbance footprint (about 87.4 ha). Therefore, there is no extension of the REA outside of the footprint of the existing REA.

The containment of the REA within the currently approved disturbance footprint will ensure that no native vegetation, particularly the SSTF, will be required to be cleared for the REA.

To accommodate the reduced footprint, the height of the REA will be increased by 10 m from a top of RL 310 m that was proposed in the PAR to a top of RL 320 m.

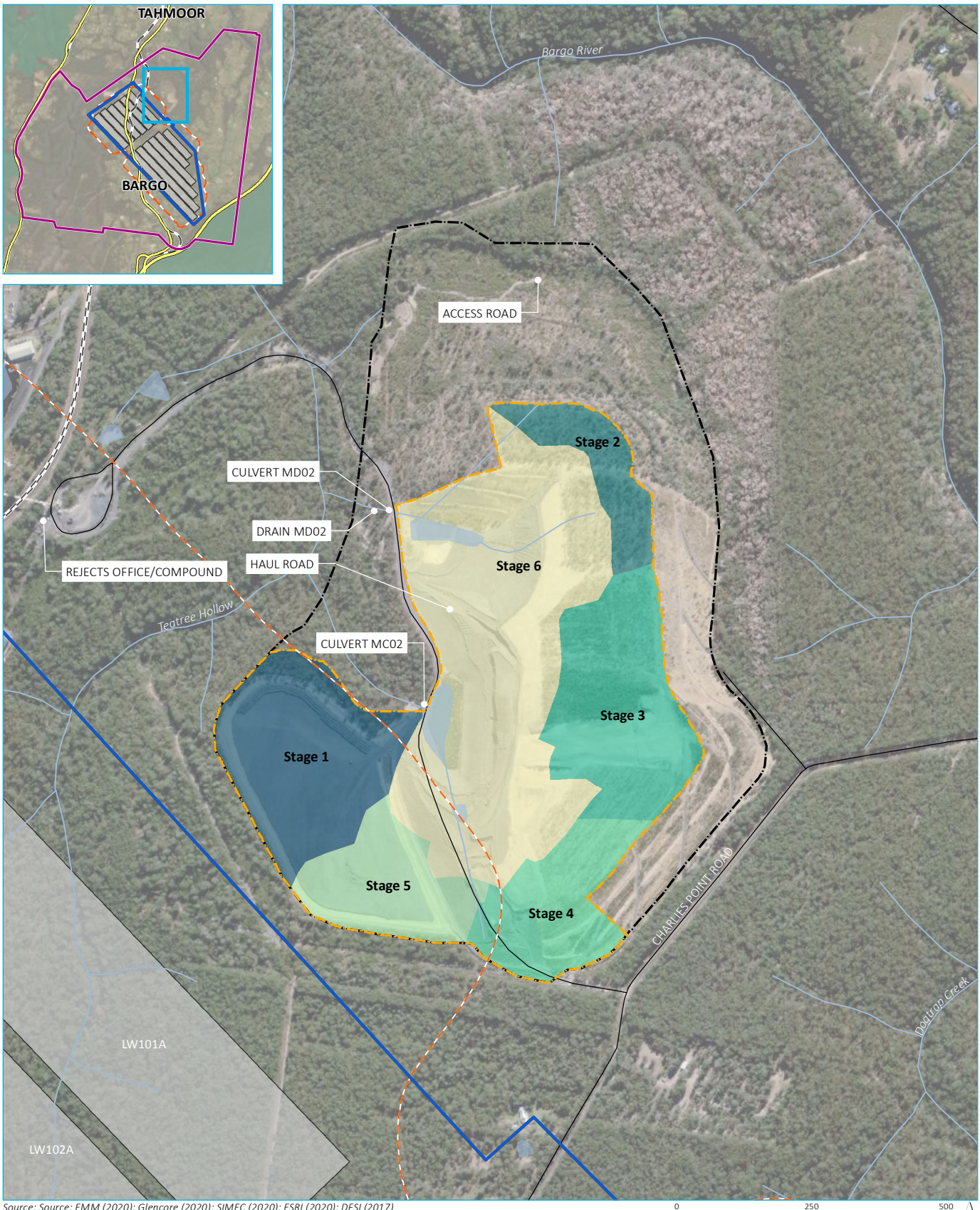
A plan showing the proposed REA can be seen in Figure 3.2. This figure also shows how filling of the REA will be staged.

3.5 Ventilation shafts

Tahmoor Coal have reviewed the design of, and construction methodology for, the two ventilation shafts required for the Project; TSC1, which will be an upcast ventilation shaft, and TSC2, which will be a downcast ventilation shaft. This has led to a decrease in SSTF required to be cleared during the construction of the shafts.

In addition, the review has led to a decrease in SSTF required to be cleared for the construction of powerlines required for the ventilation shafts. As part of the PAR it was proposed to clear 12.51 ha of SSTF. This has now been reduced to 10.1 ha. This reduction in clearing has also led to a significant reduction in the impact on threatened flora species and habitat for threatened fauna.

A plan showing the SSTF to be cleared and retained for the construction of the ventilation shafts and associated transmission lines can be seen in Figure 3.3.



Source: Source: EMM (2020); Glencore (2020); SIMEC (2020); ESRI (2020); DFSI (2017)

0 250 500 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G002_AmendedRejectEmplacementAreaLayout_20200728_04.mxd 30/07/2020

KEY

- Project area (refer to inset)
- Approved reject emplacement area footprint
- Amended reject emplacement extension area
- Predicted 20 mm subsidence contour
- Extent of longwalls
- Longwall panel

Amended reject emplacement extension staging area

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5
- Stage 6

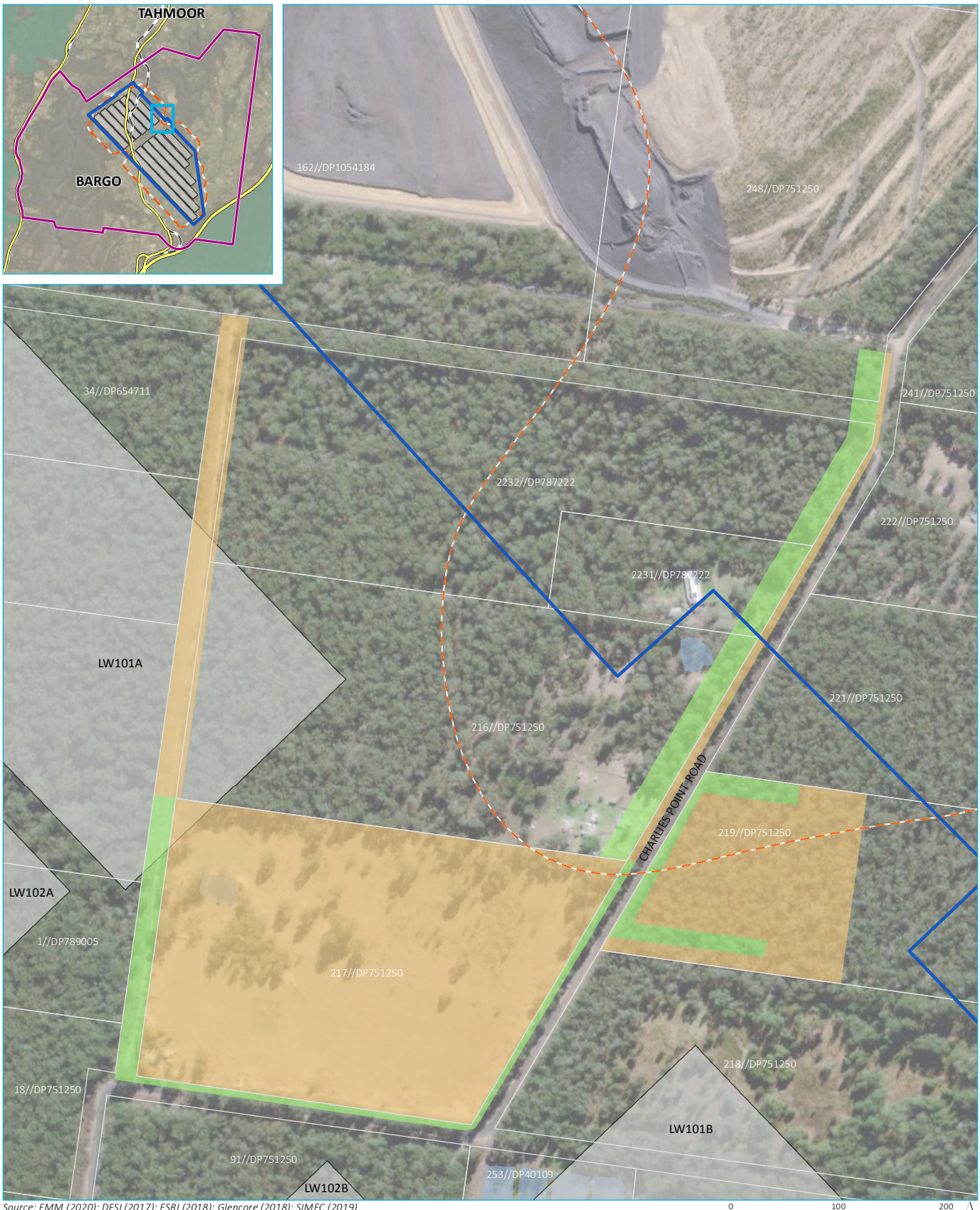
- Rail line
- Major road
- Minor road
- Watercourse / drainage line
- Waterbody
- NPWS reserve (refer to inset)

Amended reject emplacement area layout

Tahmoor South Project
Second amendment report
Figure 3.2

SIMEC

EMM creating opportunities



Source: EMM (2020); DFSI (2017); ESRI (2018); Glencore (2018); SIMEC (2019)

0 100 200 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2018\H180201 Tahmoor secondment (SIMEC)\6_GIS\02_Map\G004_VegetationClearance_20200728_05.mxd 29/07/2020

KEY

- Project area (refer to inset)
- Extent of longwalls
- Longwall panel
- Predicted 20 mm subsidence contour
- Vegetation to be cleared
- Vegetation to be retained
- Rail line (refer to inset)
- Major road (refer to inset)
- Cadastral boundary
- Waterbody
- NPWS reserve (refer to inset)

Vegetation clearing for ventilation shafts and associated transmission lines

Tahmoor South Project
Second amendment report
Figure 3.3

SIMEC EMM creating opportunities

3.6 Summary of Project amendments

A summary of the amendments to the Project proposed in this *second amendment report* compared to the Project described in the EIS and the PAR is provided in Table 3.3.

Table 3.3 Summary of Project amendments

Element	EIS	PAR	*Second amendment report*
Mine plan	• Establish nine longwalls to the south of Tahmoor Mine • Dimensions of the longwalls: – About 305 m wide and up to 2.85 m high – Gate roads about 5.2 m wide and up to 3 m high • Extraction of up to 48 Mt of ROM coal	• Removal of one longwall (LW109) beneath Dog Trap Creek • Reconfiguration of longwall layout to comprise two series of shorter longwall panels • Reduction in longwall width, from about 305 m to 285 m • Reduction in the height of longwall panels from 2.85 m to 2.6 m • Extraction of up to 43 Mt of ROM coal	• Removal of two longwalls (LW107B and LW108B) beneath township of Bargo • No change to longwall dimensions • Extraction of up to 33 Mt of ROM coal
REA	• Volume of rejects about 14.3 Mt • Increase in height from RL 300 m to RL 305 m • Extension area of 43 ha	• Volume of rejects about 11.6 Mt • Increase in height from RL 305 m to RL 310 m • Reduction in extension area to 11.06 ha	• Volume of rejects about 9.7 Mt • Increase in height from RL 310 m to RL 320 m • No extension to approved footprint
Mine ventilation	• Partial use of the existing mine upcast ventilation shaft (T2) in emergency situations only • New upcast (TSC1) and downcast (TSC2) ventilation shafts • Clearance of 9.52 ha	• Continued use of existing upcast ventilation shaft (T2) with reduction in usage from two fans to one fan • No change to new upcast (TSC1) and downcast (TSC2) ventilation shafts • Clearance of 9.52 ha	• No change to use of existing upcast ventilation shaft (T2) • Reduction in clearing required for construction of new upcast (TSC1) and downcast (TSC2) ventilation shafts • Clearance of 8.84 ha
Transmission lines	• Easement for 66 kV overhead transmission line from the REA to ventilation shafts (TSC1 and TSC2) not included • Clearance of 2.99 ha	• Inclusion of easement for 66-kV overhead transmission line from pit top to the ventilation shafts • Clearance of 2.99 ha	• No change to inclusion of easement for 66-kV overhead transmission line • Reduction in clearing required for construction of transmission lines • Clearance of 1.26 ha

Note: Shaded text represents current Project description

4 Strategic and statutory context

4.1 Strategic context

4.1.1 Introduction

Tahmoor Mine is a key supplier of coking coal (also known as metallurgical coal) which is an important resource to the State. The value in the continuation of the Project is highlighted through the importance in producing coking coal for steel production, the premium quality of the coking coal and the continuation of an established mine site.

The Project is also consistent with the NSW Government's *Strategic Statement on Coal Exploration and Mining in NSW* (DRNSW 2020) released in June 2020 which favours responsible applications to extend the life of current coal mines.

4.1.2 Production of coking coal

Coking coal is used to create coke, which is one of the key inputs for the primary production of steel. Global steel production is dependent on coal, with approximately 70 per cent of steel produced using coking coal. This steel is used to deliver products that are needed in society including healthcare, telecommunications, transport infrastructure, construction and agricultural equipment.

Coking coal has high economic importance compared to thermal coal due to its use in the steel sector and few options for substitution available. Apart from the electric arc furnace (EAF) method which relies solely on scrap steel there are currently no commercially viable alternatives to the use of coking coal to produce steel. The carbon in coking coal is a key element in the process of extracting iron from iron ore. Despite the global increase in demand for steel and coking coal there is a limited global market for scrap steel and there is a corresponding limit to the use of EAF for steel making. As a result, there is still a growing global demand for coking coal, particularly the high-quality coking coal from Tahmoor Mine. Coking coal will continue to be the principal component of steel making worldwide in the foreseeable future.

4.1.3 Premium quality coking coal

Tahmoor Mine is recognised in the steel production industry for its premium quality coking coal. Since mining first commenced in 1979, coal produced at Tahmoor Mine has been used for steel production at Port Kembla, Whyalla and overseas. The Project would allow for the continued supply of this valuable product to existing domestic and international markets.

Globally, Australia is the second largest coking coal supplier. The production of coking coal is dependent of specific environments factors including a higher carbon energy content and lower ash and moisture. These are environmental influences have been identified from Australian exported coal that are of high-quality blended mix, ensuring an optimum level of performance of the blast furnace and associated steel production.

4.1.4 Continuation of an established mine site

The continuation of mining into the Tahmoor South area would facilitate the supply of premium grade coal through utilising existing facilities rather than to establish a separate, new mine to access this resource. The use of an operating mine is considered preferable to the construction of a new mine from an environmental, economic and social perspective to maximise production and supply product coal into established export markets.

The Project seeks to continue the life of underground mining at the Tahmoor Mine until approximately 2032. Without approval, completion of mining in the Tahmoor North mining area would result in closure of Tahmoor Mine

by approximately 2022 effectively ceasing the extraction of a coking coal resource via existing infrastructure. The Project would enable mining to be undertaken within the southern portion of Tahmoor Coal's (and its wholly owned subsidiary Bargo Collieries Pty Ltd) existing mining lease areas, and operations and employment to continue for approximately a further 12 years.

4.1.5 Policy update

As stated in Section 1.2, since the preparation of the EIS (AECOM 2018), the *submissions report* (AECOM 2020a) and PAR (AECOM 2020b), the NSW Government has updated its strategic statement through the release of its *Strategic Statement on Coal Exploration and Mining in NSW* (DRNSW 2020) in June 2020.

The objective of the strategic statement is to "provide greater certainty to explorers, investors, industry stakeholders and communities about the future of coal mining in the state" and set out "how the NSW Government is taking a responsible approach to the global transition to a low carbon future." The strategic statement primarily focuses on thermal coal, but is also relevant to coking coal. As previously stated, 97.5 per cent of product at Tahmoor Mine is coking coal, while 2.5 per cent is thermal coal.

The strategic statement states that "Coal is a significant industry in NSW and globally. Coal mining generates jobs in the regions and provides royalties that help pay for important social infrastructure such as schools and hospitals." In NSW, the industry provides over 22,000 direct jobs and around 89,000 indirect jobs. In 2018−2019, royalties from coal brought in around $2 billion in government revenue.

The strategic statement states that "Many countries around the world have begun a transition away from fossil fuels to low carbon sources of energy to meet commitments under the Paris Agreement. This will ultimately lead to the global phasing out of coal in electricity generation (thermal coal), but will take some decades to complete. Coal currently remains a critical energy source globally, supplying over a third of all electricity." Accordingly, the strategic statement states that "In the short to medium term, coal mining for export will continue to have an important role to play in NSW" and that "… in the medium term, demand is likely to remain relatively stable. Some developing countries in South East Asia and elsewhere are likely to increase their demand for thermal coal as they seek to provide access to electricity for their citizens. Under some scenarios, this could see the global demand for thermal coal sustained for the next two decades or more. The use of coal in the manufacture of steel (coking coal) is likely to be sustained longer as there are currently limited practical substitutes available."

The strategic statement provides a balanced consideration of the ongoing global demand for coal, and therefore the need for ongoing support of coal industry to meet this demand. Significantly, in relation to the Project, the strategic statement states that "the NSW Government will … recognise existing industry investment by continuing to consider responsible applications to extend the life of current coal mines …".

4.2 Statutory context

4.2.1 State

i General

The EP&A Act and EP&A Regulation form the statutory framework for environmental assessment and planning approval in NSW. Implementation of the EP&A Act is the responsibility of the NSW Minister for Planning and Public Spaces, DPIE, other State government agencies and local councils.

This EP&A Act is supported by environmental planning instruments (EPIs) including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

ii Planning approval requirements

The EP&A Act contains two parts that regulate 'development' (Part 4) and 'activities' (Part 5).

Part 4 provides for the control of development that cannot be carried out except with the approval of the relevant consent authority. In most cases the relevant consent authority is the local council, however, for development defined to be SSD, under Division 4.7 of Part 4 of the EP&A Act, section 4.6 of the EPA Act states that the consent authority is:

> … in the case of State significant development—the Independent Planning Commission (if the development is of a kind for which the Commission is declared the consent authority by an environmental planning instrument) or the Minister (if the development is not of that kind).

Development applications under Part 4 of the EP&A Act are required to be accompanied by a statement of environmental effects (SEE), or an EIS when the development is generally more complex.

iii State significant development

The Project is classified as SSD under Division 4.7 of the EP&A Act as it is development for the purpose of coal mining and mining related works, which are specified in clause 5 of Schedule 1 to *State Environmental Planning Policy (State and Regional Development) 2011* (the SRD SEPP). Section 4.6 of the EPA Act states that the consent authority is:

> … in the case of State significant development—the Independent Planning Commission (if the development is of a kind for which the Commission is declared the consent authority by an environmental planning instrument) or the Minister (if the development is not of that kind).

Currently, the NSW Minister for Planning and Public Spaces is the consent authority for the Project. However, under the Minister's delegation of 11 October 2017, the Executive Director, Resource Assessments and Compliance, may determine the development application as neither WSC nor Wingecarribee Shire Council objected, there were less than 25 objections from the general public and a political donations disclosure statement has not been made.

iv Permissibility

The Project area is located within the Wollondilly and Wingecarribee LGAs. Actual development would be located within the Wollondilly LGA only, on land subject to the *Wollondilly Local Environmental Plan 2011* (Wollondilly LEP).

The surface facilities area and REA and the mining area straddle various land use zones under the Wollondilly LEP. Under the LEP the Project is permissible with consent in some land zones and prohibited in other zones. However, due to the provisions of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP) the Project is permissible with consent. Under the Mining SEPP, development for the purposes of underground mining is permissible anywhere in the State.

v Environmental planning instruments

Under section 4.15 of the EP&A Act the consent authority is required to consider, amongst other things, the provisions of relevant EPIs, including any exhibited draft EPIs, development control plans (DCPs) or planning agreements. The EIS (AECOM 2018) included consideration of several relevant instruments, including:

- *State Environmental Planning Policy No.33 – Hazardous and Offensive Development*;
- *State Environmental Planning Policy No.44 – Koala Habitat Protection*;
- *State Environmental Planning Policy No.55 – Remediation of Land*;

- *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*;
- Mining SEPP;
- *Sydney Regional Environmental Plan No.20 – Hawkesbury-Nepean River (No 2-1997)*;
- Wollondilly LEP; and
- *Wingecarribee Local Environmental Plan 2010*.

The assessment of the Project against the relevant provisions in the above EPIs undertaken in the EIS concluded that the Project is able to be undertaken in a manner that is generally consistent with these instruments.

In its PIR, DPIE also considered the Project against the provisions of the above EPIs. It also considered the provisions of the SRD SEPP and *State Environmental Planning Policy (Infrastructure) 2007*. The Department formed a preliminary view that the Project is generally consistent with the aims and objectives of these EPIs.

vi Other approvals

Under section 4.41 of the EP&A Act, several approvals are integrated into the SSD assessment process and consequently are not required to be separately obtained for the proposal. These include various approvals relating to heritage required under the NSW *National Parks and Wildlife Act 1974* and the NSW *Heritage Act 1977* and certain water approvals under the NSW *Water Management Act 2000*.

Under section 4.42 of the EP&A Act, several other approvals are required, but must be substantially consistent with any development consent granted for the Project. These include a mining lease under the NSW *Mining Act 1992* and an environment protection licence (EPL) under the NSW *Protection of the Environment Operations Act 1997* (POEO Act).

Tahmoor Coal would also require several other approvals for the Project which are not integrated into the SSD assessment process. These approvals were listed in EIS.

vii Amendments to development applications

As previously stated, clause 55 of the EP&A Regulation states that:

> (1) A development application may be amended or varied by the applicant (but only with the agreement of the consent authority) at any time before the application is determined.
>
> (2) If an amendment or variation results in a change to the proposed development, the application to amend or vary the development application must have annexed to it written particulars sufficient to indicate the nature of the changed development.

These amendments may be necessary to improve the design of the project, respond to issues raised in submissions or further community engagement, and/or reduce the impacts of the project.

As stated in Section 1.1, on 20 February 2020, Tahmoor Coal amended the DA for the Project to respond to issues raised in submissions by government agencies on the EIS (AECOM 2018), and to reduce the impacts of the Project. These amendments were documented in the PAR (AECOM 2020b). At the same time, Tahmoor Coal responded to all submissions on the EIS via the *submissions report* (EACOM 2020a).

Following advice from government agencies and WSC on the PAR, and representations made by the community outside of the EIS exhibition period, Tahmoor Coal has amended the DA again to further reduce impacts of the Project. These amendments are considered in the *second amendment report*.

4.2.2 Commonwealth

The EPBC Act provides a legal framework to protect and manage, among other things, nationally and internationally important flora, fauna, ecological communities and heritage places which are defined as matters of national environmental significance (MNES). It is administered by the Commonwealth Minister for the Environment, DAWE and other Commonwealth government agencies.

MNES defined under the EPBC Act include:

- world heritage properties;
- national heritage places;
- Ramsar wetlands of international importance;
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

If an action will, or is likely to, have a significant impact on any MNES, it is deemed to be a 'controlled action' and requires approval from the Commonwealth Minister for the Environment or the Minister's delegate. To determine whether a proposed action will or is likely to be a controlled action, a referral of proposed action is submitted to DAWE for assessment.

On 12 January 2018, DAWE declared the Project to be a controlled action as it may potentially impact the following MNES:

- nationally threatened species and ecological communities; and
- a water resource, in relation to coal seam gas development and large coal mining development.

DAWE also notified Tahmoor Coal that the Project will be assessed using an accredited process under section 87(4) of the EPBC Act, where the Commonwealth accredits the assessment process under Division 4.7 of Part 4 of the EP&A Act.

The use of an accredited assessment process does not alleviate the approval requirements of the Commonwealth Minister for the Environment under the EPBC Act. While the NSW Minister for Planning and Public Spaces (or delegate) is the consent authority for the project under the EP&A Act, the Commonwealth Minister for the Environment remains the person who must decide whether or not to approve the controlled action under the EPBC Act.

5 Engagement

5.1 Government

Since the PAR (AECOM 2020b) were prepared, Tahmoor Coal has held several meetings with government agencies and WSC to provide them with updates on the Project, to discuss the amendments aimed at reducing environmental impacts and discuss the process for addressing these amendments under the approval processes for both the EP&A Act and EPBC Act.

Meetings have included:

- meeting with WSC on 3 April 2020 to provide an update on the project and overview of the amendments to the Project;
- meeting with DPIE on 3 July 2020 to provide an overview of the amendments to the Project in this *second amendment report*;
- meeting with DAWE on 14 July 2020 to discuss amendments to the Project in this *second amendment report* and the process for amending the action under the EPBC Act; and
- meeting with DPIE on 21 July 2020 to provide details on the amendments to the Project in this *second amendment report* and provide an overview of the anticipated impacts of the amendments compared to the impacts described in the EIS and PAR.

At the time of the preparation of this report, additional meetings were being scheduled with WSC, DPIE – Biodiversity and Conservation Division (DPIE-BCD), DPIE – Resources Regulator (DPIE-RR), Subsidence Advisory NSW (SA-NSW) and DPIE – Water (DPI-W) to provide them with details on the amendments to the Project in this *second amendment report*.

5.2 Community

A number of community engagement activities on the Project have occurred since the PAR was prepared. These activities have included:

- letterbox distribution of an information flyer within the local community in February 2020;
- media release to local papers and radio following lodgement of the PAR on 25 February 2020;
- letters to stakeholders advising PAR submitted and update on key aspects of PAR in February 2020;
- Updates to the Tahmoor South Project website including https://www.tahmoorsouth.com.au/media-release-revised-tahmoor-mine-continuation-project-reduces-key-impacts-and-retains-economic-benefits/;
- ABC Radio interview on 27 February 2020;
- door knock, letter box drop and meetings with residents above longwalls in 'A' series (then ceased due to Covid-19 restrictions), March 2020
- Regular updates at the Tahmoor Colliery Community Consultative Committee (CCC) meeting held quarterly on 5 March and 4 June 2020;

- WIN News interview on 10 March 2020;
- Meetings with stakeholders (eg local school, Progress Association) March 2020;
- Letterbox and email distribution of Community Newsletter to local community in April 2020;
- Live question and answer session with Tahmoor Coal General Manager, Peter Vale, on 28 April 2020; and
- Distribution of Project Information booklet in May 2020.

The community will continue to be engaged as the approval process of the Project progresses.

6 Assessment of impacts

6.1 Introduction

This chapter provides a summary of the impacts of the project amendments documented in Chapter 3 of this report, particularly the impacts compared to those documented in the EIS (AECOM 2018) and PAR (AECOM 2020b).

6.2 Subsidence

Mine Subsidence Engineering Consultants Pty Ltd (MSEC) has undertaken an assessment of the subsidence impacts of the proposed amendments of the Project. A copy of this *subsidence assessment* can be found in Appendix B. The assessment:

- identifies the natural features and items of surface infrastructure that are in the vicinity of the proposed longwalls;
- provides subsidence predictions at each of these natural features and items of surface infrastructure;
- provides an impact assessment, in conjunction with other technical specialists, for each of these natural features and items of surface infrastructure; and
- provides information on the measures that can be implemented to manage potential impacts.

A significant benefit of the amendments to the Project is that the removal of LW108B and LW107B will result in a significant reduction in the number of houses and associated civil infrastructure that are directly above the proposed mine plan.

There were 751 houses directly above the longwalls within the mine plan presented in the EIS (AECOM 2018). This has now been reduced to 143 houses above the amended longwalls. Most of these houses are located within the urban areas of Bargo township.

SA-NSW has recommended that additional safeguards be offered to homeowners whose houses experience significant damage as a result of mine subsidence movements. The recommended criteria are based on the severity of the damage and the period of time between when the damage occurs and when the house will no longer experience active subsidence movements from future mining.

The safeguards would allow affected homeowners to be offered property acquisition as an option for compensation, rather than repair.

Tahmoor Coal supports the recommendation in principle and has provided commitments within this *second amendment report.* A decision on whether to request property acquisition is, however, a personal decision for affected landowners. Tahmoor Coal's experience is that a very small proportion of landowners are likely to select the option of compensation. Out of the total 1,890 residential homes and commercial premises that experienced subsidence due to the extraction of Tahmoor North LW22 to LW29, only eight homeowners requested acquisition.

The amended mine plan will result in a significant reduction in the number of houses that are likely to meet the criteria for offering acquisition as an option for compensation, noting that the majority of the houses that may meet the criteria are likely to be located directly above the longwalls.

Landowners should have confidence that they will be compensated for damage sustained due to mine subsidence. Compensation will be provided in accordance with the NSW *Coal Mine Subsidence Compensation Act 2017*, as administered by SA-NSW, with additional commitments provided by Tahmoor Coal as documented in this *second amendment report*.

Tahmoor Coal has extensive experience in successfully managing potential subsidence impacts on houses during the extraction of longwalls in the Tahmoor North lease. This includes longwall extraction directly beneath the township of Tahmoor. Tahmoor Coal is committed to ensuring that houses remain safe and serviceable during and after the extraction of the proposed mine plan.

6.2.1 Maximum predicted subsidence parameters

Maximum predicted subsidence parameters resulting from the extraction of the proposed amended layout for Longwalls 101A to 106B were calculated using the calibrated incremental profile method (IPM) model which was calibrated for local conditions including an extensive analysis of the strains measured during the previous extraction of longwalls at Tahmoor Mine, as well as at other nearby collieries. Given the ability to use local data to calibrate the model it is expected that that the model will be extremely robust.

The *subsidence assessment* predicts lower maximum subsidence levels than those associated with the mine plan in the EIS (AECOM 2018) and the PAR (AECOM 2020b). There is a reduction in maximum predicted subsidence of approximately 50 millimetres (mm) as well as predicted maximum tilts and curvatures.

The main purpose of the latest amendments to the Project is to substantially reduce the number of houses and associated civil infrastructure that will be adversely affected by mine subsidence due to the extraction of the proposed development. The majority of houses and associated civil infrastructure are located directly above LW107B and LW108B which have been removed from the mine plan. Doing this removes or significantly reduces the likelihood of impact to them.

Maximum subsidence predictions comparing the mine plans in the EIS, the PAR and this *second amendment report* are summarised in Table 6.1 below.

Table 6.1 Comparison of maximum subsidence predictions - longwalls

Mine plan	Longwalls	Maximum predicted total conventional subsidence (mm)	Maximum predicted total conventional tilt (mm/m)	Maximum predicted total conventional hogging curvature (km^{-1})	Maximum predicted total conventional sagging curvature (km^{-1})
EIS	LW101 to LW108	1,900	13.0	0.19	0.33
	LW09	1,000	8.0	0.09	0.24
PAR	LW101A to LW106A	1,350	8.7	0.16	0.23
	LW101B to LW108B	1,650	10.5	0.18	0.28
Current (*second amendment report*)	LW101A to LW106A	1,350	8.7	0.16	0.23
	LW101B to LW106B	1,600	10.5	0.18	0.28

Source: MSEC
Notes: Shaded cells relate to maximum subsidence predictions for the current mine plan

6.2.2 Watercourses

A summary of the comparison between maximum predicted subsidence, upsidence and closure along the streams between the mine plans in the EIS, the PAR and this *second amendment report* are summarised in Table 6.2 below.

The predicted maximum total conventional subsidence, upsidence and closure movements due to the extraction of the amended mine plan are less than the predicted maxima from the EIS mine plan, but similar to those for the PAR mine plan. Notwithstanding this, the maximum predicted total subsidence for Tributary 1 and Tributary 2 to Dog Trap Creek reduce as a result of the removal of LW107B and LW108B.

Table 6.2 Comparison of maximum subsidence predictions - watercourses

Mine plan	Location	Maximum predicted total subsidence (mm)	Maximum predicted total upsidence (mm)	Maximum predicted total closure (mm)
EIS	Dog Trap Creek	1,850*	550*	425*
	Hornes Creek	50	30	50
	Tea Tree Hollow	1,400*	400*	275*
	Tributary 1 to Dog Trap Creek	1,850	750	725
	Tributary 2 to Dog Trap Creek	1,800	525	450
	Tributary 3 to Dog Trap Creek	1,700	475	400
PAR	Dog Trap Creek	1,550	575	425
	Hornes Creek	20	20	20
	Tea Tree Hollow	1,350	375	250
	Tributary 1 to Dog Trap Creek	1,600	750	750
	Tributary 2 to Dog Trap Creek	1,575	525	450
	Tributary 3 to Dog Trap Creek	1,250	400	350
Current (*second amendment report*)	Dog Trap Creek	1,550*	575*	425*
	Hornes Creek	<20	20	<20
	Tea Tree Hollow	1,350*	375*	275*
	Tributary 1 to Dog Trap Creek	1,500	750	750
	Tributary 2 to Dog Trap Creek	1,550	525	450
	Tributary 3 to Dog Trap Creek	1,250	400	350

Source: MSEC
Notes: Shaded cells relate to maximum subsidence predictions for the current mine plan
* = downstream sections of Dog Trap Creek and Teatree Hollow have been previously mined beneath by LW12 and LW13 and by LW1 and LW2, respectively, at Tahmoor Mine. The maximum predicted parameters provided in the above table include those resulting from the extraction of these earlier longwalls.

6.2.3 Houses

The removal of LW108B and LW107B has resulted in a significant reduction in the number of houses that are directly above the proposed mine plan. There were 751 houses directly above the longwalls within the mine plan presented in the EIS (AECOM 2018). That was reduced to 571 houses (a reduction of 180 houses) within the mine plan presented in the PAR (AECOM 2020b). This has now been reduced to 143 houses above longwalls which is a reduction of 608 houses compared to the mine plan in the EIS and 428 houses in the mine plan in the PAR. Most of these houses are located within the urban areas of Bargo township.

A summary comparison between maximum predicted conventional subsidence, tilt and curvature at houses between the mine plans in the EIS, the PAR and this *second amendment report* are summarised in Table 6.3 below.

Table 6.3 Comparison of maximum subsidence predictions - houses

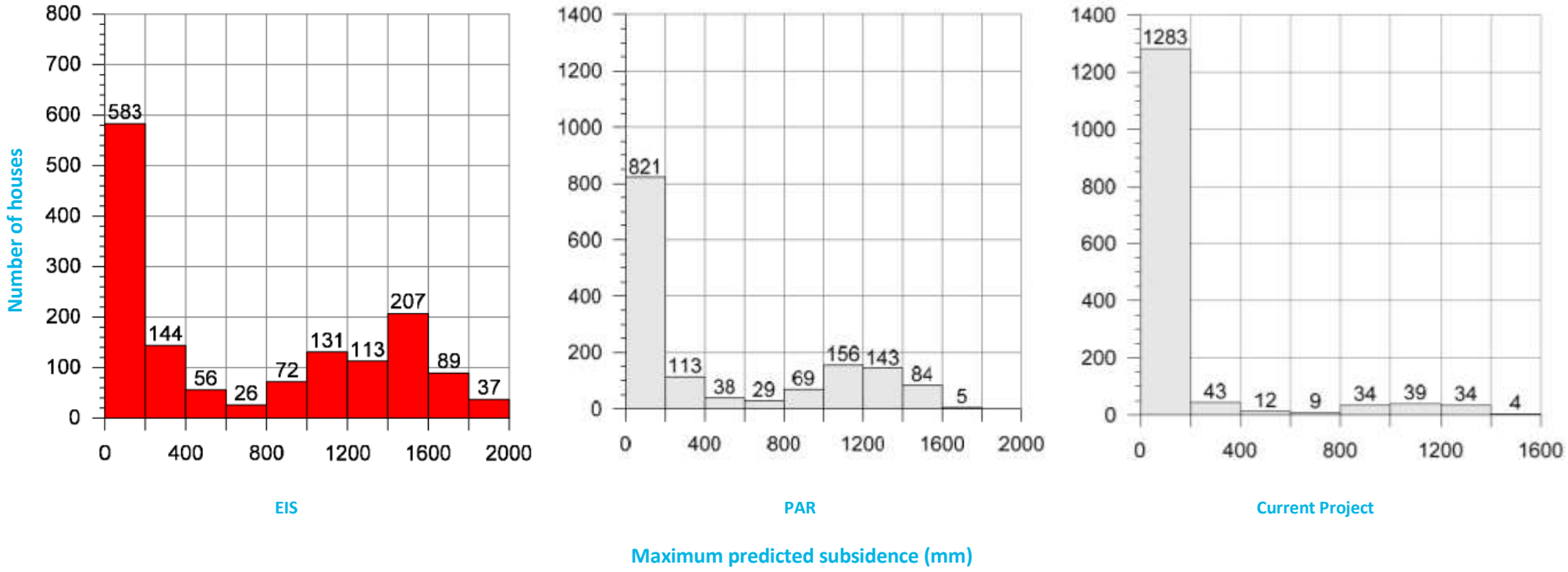
Mine plan	Maximum predicted total conventional subsidence (mm)	Maximum predicted total conventional tilt (mm/m)	Maximum predicted total conventional hogging curvature (km^{-1})	Maximum predicted total conventional sagging curvature (km^{-1})
EIS	1,900	13.0	0.17	0.33
PAR	1,650	10.0	0.13	0.28
Current (*second amendment report*)	1,450	10.0	0.13	0.28

Source: MSEC
Notes: Shaded cells relate to maximum subsidence predictions for the current mine plan

A comparison of the distribution of the predicted conventional subsidence for all houses within the subsidence study area (SSA) between the mine plans in the EIS, the PAR and this *second amendment report* is illustrated in Figure 6.1 below.

A summary comparison between the overall distribution of the assessed impacts at houses between the mine plan in the EIS, the PAR and this *second amendment report* is shown in Table 6.4. It demonstrates that the amended mine plans (presented in the PAR and this report) will result in lower (about 15 per cent) predicted total subsidence, tilt and curvature at points on the surface directly above the longwalls when compared to original mine plan contained in the EIS. This reduction is due to both the proposed reduction in panel width and proposed reduction in extraction heights proposed in amended mine plans.

As the houses are generally predicted to experience less subsidence, tilt and curvature due to the amended mine plan compared to the EIS mine plan, it is expected that the overall frequency and severity of impacts would reduce. Whilst the predicted subsidence movements and assessed distribution of impacts are reduced for the amended mine plan, the recommendations for managing potential impacts to residential structures are unchanged from the EIS and PAR and impacts would be managed via an extraction plan process.



Source: MSEC

Figure 6.1 Distribution of maximum predicted conventional subsidence for houses in subsidence study area

Table 6.4 Comparison of impacts to houses

Mine plan	Group	Repair category			
		No claim or R0	R1 or R2	R3 or R4	R5
EIS	All houses (1,458)	1,109 (70%)	296 (20%)	115 (8%)	28 (2%)
	Directly above longwalls (751)	391 (52%)	234 (31%)	100 (13%)	26 (3%)
	Directly above solid coal (707)	628 (89%)	62 (9%)	15 (2%)	2 (<0.5%)
PAR	All houses (1,458)	1,118 (77%)	234 (16%)	86 (6%)	20 (1%)
	Directly above longwalls (571)	308 (54%)	172 (30%)	73 (13%)	18 (3%)
	Directly above solid coal (887)	810 (91%)	62 (7%)	13 (1%)	2 (<0.5%)
Current (*second amendment report*)	All houses (1,458)	1,316 (90%)	108 (7%)	28 (2%)	7 (<0.5%)
	Directly above longwalls (143)	76 (53%)	43 (30%)	19 (13%)	5 (4%)
	Directly above solid coal (1,315)	1,240 (94%)	64 (5%)	9 (1%)	2 (<0.5%)

Source: MSEC
Notes: Shaded cells relate to maximum subsidence predictions for the current mine plan

As illustrated in Table 6.4 above, the total number of houses predicted to be impacted by repair categories R3–R5 has reduced from 143 in the EIS to 35, with the removal of LW107B and LW108B from the Project. This is an extensive reduction of 108 houses (ie a 76 per cent reduction compared to the EIS).

The repair category described in Table 6.5 is described in Appendix C of the *subsidence assessment*. In summary, it includes:

Table 6.5 Repair categories

Repair category	Description	Extent of repairs
No claim	-	No repairs required
R0	Adjustment	Where the damage does not require the removal or replacement of any external or internal claddings or linings
R1	Very minor repair	Where the damage can be repaired by filling, patching or painting without the removal or replacement of any external or internal brickwork, claddings or linings
R2	Minor repair	Where the damage affects a small proportion of external or internal claddings or linings, but does not affect the integrity of external brickwork or structural elements
R3	Substantial repair	Where the damage requires the removal or replacement of a large proportion of external brickwork, or affects the stability of isolated structural elements
R4	Extensive repair	Where the damage requires the removal or replacement of a large proportion of external brickwork, or the replacement or repair of several structural elements
R5	Rebuild	Extensive damage to house where SA NSW and the owner have agreed to rebuild as the cost of repair is greater than the cost of replacement

Source: MSEC

6.2.4 Conclusion

Tahmoor Coal's existing operations have mined beneath a total of 1,890 residential homes and commercial premises. The houses remained safe and serviceable during and after mining. Claims for damage were managed through the NSW *Mine Subsidence Compensation Act 1961* and subsequently the NSW *Coal Mine Subsidence Compensation Act 2017* and approved procedures.

Conditions 18 to 26 of development consent number DA67/98 for the Tahmoor North operations detail the process by which a landowner may seek for their property to be acquired. Out of the total 1,890 residential homes and commercial premises that experienced mine subsidence movements only eight properties requested they be acquired (one by Tahmoor Coal and seven by SA-NSW) and only 19 required to be rebuilt (all by SA-NSW). That is only 0.4 per cent of houses that were acquired and 1.4 per cent if the 19 rebuilt houses are included in the total.

The Bargo Mine Subsidence District was declared in 1975. This information is included on the title deed of each property, and applications to construct buildings in this area must be approved by SA-NSW (formerly the Mine Subsidence Board).

Bargo has expanded steadily over time, such that 83 per cent of houses in the SSA have been built since the declaration in 1975. These houses have been designed in accordance with guidelines to reduce the potential for subsidence impacts, as required by SA-NSW (formerly the Mine Subsidence Board). The houses were constructed in the understanding that they may be subsided by underground mining in the future.

Tahmoor Coal made the decision to make additional changes to the Project to further reduce potential environmental impacts, particularly potential subsidence impacts. The changes include the removal of two longwalls, LW107B and LW108B.

The changes will substantially reduce the number of houses and associated civil infrastructure that were predicted to be adversely affected by mine subsidence due to the extraction of the Project. A total of 143 houses are located directly above the proposed longwalls compared to 571 houses that were located directly above the longwalls considered in the PAR.

Tahmoor Coal will continue to engage with the community through its existing CCC meetings and other processes to address community concerns on subsidence and other matters. Consultation processes that are currently implemented in relation to subsidence management would continue to be applied for the Project.

Tahmoor Coal will compensate homeowners for mining-induced damage to houses in accordance with the NSW *Coal Mine Subsidence Compensation Act 2017*. Any claim for mine subsidence damage is lodged with SA-NSW who arrange for the damage to be assessed by an independent specialist assessor. If the damage is attributable to mine subsidence, a scope is prepared, and compensation determined. If property owners are not satisfied with the outcome, the Act provides clear and simple mechanism to request an independent review by the Secretary of the NSW Department of Customer Service.

In addition to the requirements under the Act, Tahmoor Coal will provide additional safeguards to homeowners, to address concerns raised by SA-NSW.

The overall findings of the assessments undertaken by MSEC are that the levels of impact and damage to all identified natural features and built infrastructure are manageable and can be controlled by the preparation and implementation of subsidence management plans (or extraction plans), many of which have already been developed and are being successfully implemented during mining at Tahmoor Mine.

6.3 Groundwater

HydroSimulations[1] has undertaken an assessment of the groundwater impacts of the proposed amendments of the Project. A copy of this assessment can be found in Appendix C. The *groundwater assessment* is conducted against the predicted impacts outlined in the *Groundwater Assessment* prepared by HydroSimulations (2020) that accompanied the PAR (AECOM 2020b).

It is worth noting that the previous groundwater assessment (HydroSimulations 2020) was reviewed by DPIE's independent expert and determined to be "fit for the purpose of mine dewatering environmental impact assessment (including cumulative impacts) and informing management strategies and licensing" (HydroGeoLogic, 2020).

The groundwater assessment is primarily qualitative, considering the spatial extent of the changes to longwall areas and the changed longwall scheduling and project duration.

A 'semi-quantitative' assessment was undertaken for the estimation of groundwater take and for identifying bores (water supply works) that are at risk of experiencing drawdown >2 m, as per the NSW *Aquifer Interference Policy* (AIP) criteria. Semi-quantitative in this context means that the numerical model has not been re-run to consider changes to longwall layout and timing, but existing model results from HydroSimulations (2020) have been examined in detail to provide Tahmoor Coal and agencies with relevant quantitative information.

6.3.1 Mine Inflow/groundwater take

The modelled inflows from the modelling in HydroSimulations (2020) have been analysed and manually edited to remove the effects of LW107B and LW108B. Panels that were later in the sequence have been moved forward in time. These results are displayed in Figure 6.2.

i Cumulative groundwater take/inflow

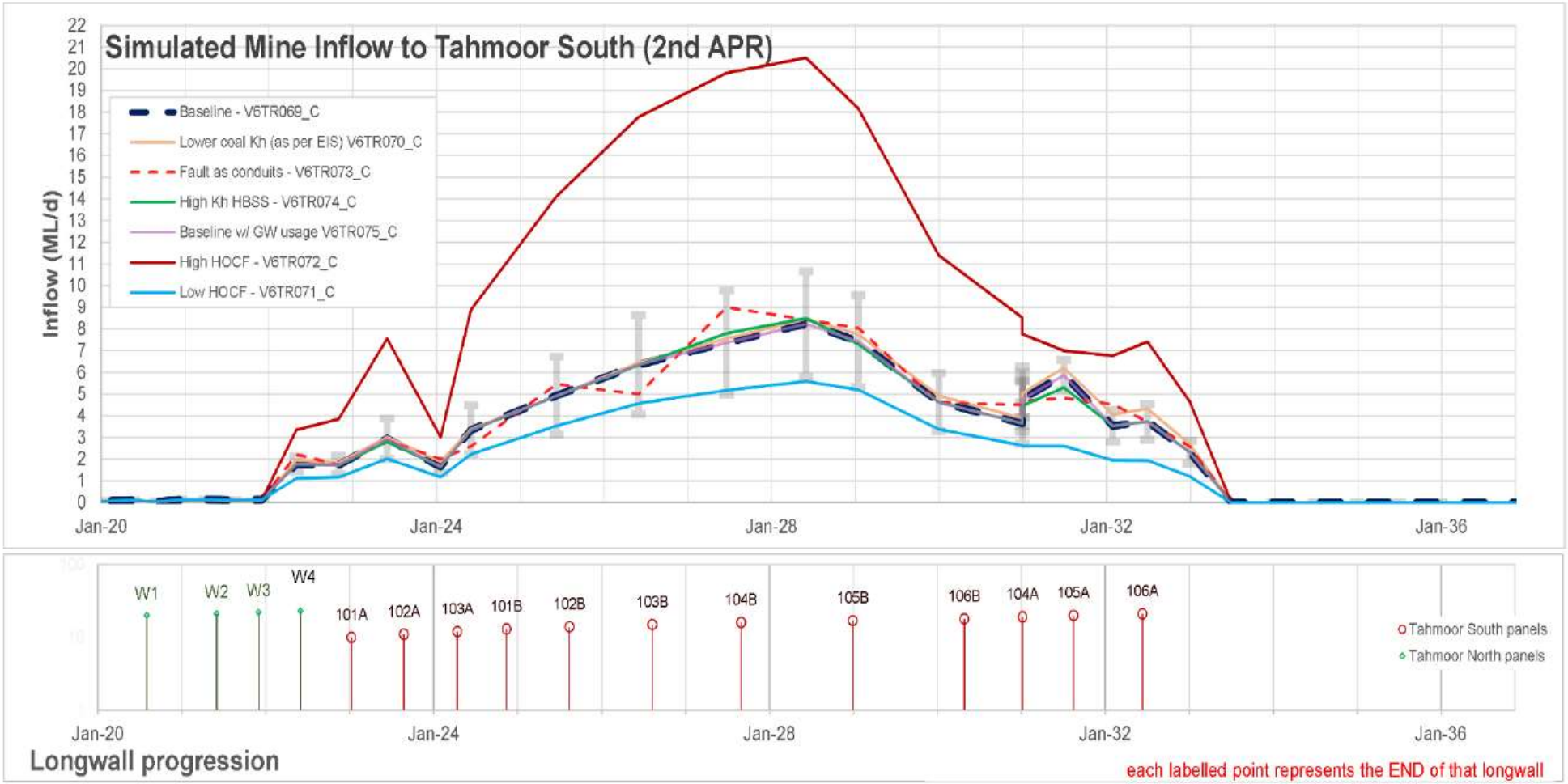
Amendments to the Project, including the removal of LW107B and LW108B will reduce the duration of active groundwater take by about three years ceasing in approximately 2032, not 2035. This will result in a reduction of total inflow over the active mine life by 1,800 megalitres (ML) per year (ML/yr) (range 1,650-2,500 ML/yr). Over the period that LW107B and LW108B were proposed to be extracted, this would mean a reduction in cumulative inflow (groundwater take) of 4,100 to 6,400 ML over the life of the Project. Overall, this will result in a reduced impact on the Sydney Basin Nepean Sandstone Groundwater Source, a groundwater source in the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*.

ii Peak inflow and licensing requirements

The peak inflow is unlikely to significantly change as a result of the amendments to the Project. As no change to the peak inflow is likely, no change to the licensing entitlements is required to cover this peak take.

Due to the reduction in the duration of mining, the licence will not be required to be held for as long.

[1] HydroSimulations is a trading name of SLR Consulting Australia Pty Ltd



Source: HydroSimulations

Figure 6.2 Predicted groundwater inflow

6.3.2 Surface water take (via baseflow reductions and induced leakage)

i Watercourses

It is likely that due to the amendments to the Project, the baseflow reduction in Hornes Creek will be smaller than outlined in the PAR (AECOM 2020b). Similarly, the predicted reduction in surface water flow in Cow Creek (and the associated WaterNSW Special Area) is likely to be smaller than outlined in the PAR. This represents a reduction in impact for both areas.

It is likely that the baseflow losses and surface cracking in the headwaters of Dog Trap Creek will be reduced due to the removal of underlying LW107B and LW108B. While there is a reduction in impact in this area, it would be localised. As a result, given that the lower parts of Dog Trap Creek will still be undermined by other panels, it effectively means no change to the downstream flow in Dog Trap Creek due to the amendments to the Project. It is likely that the amendments to the Project will result in no changes to surface water take at other watercourses in the vicinity of the Project.

It is likely that the amendments to the Project will result in no changes to predicted surface water loss along Tea Tree Hollow where it flows through the property of Wirrimbirra Sanctuary.

ii Surface water licensing requirements

The amendments to the Project will likely result in a reduction in total surface water take, but effectively represents 'no change' to the surface water licensing requirements.

iii Losses from reservoirs

The amendments to the Project include the removal of the two longwall panels closest to the Nepean Reservoir. This would likely result in a small benefit compared to the PAR, although it could effectively be considered 'no change' to the small predicted losses in HydroSimulations (2020).

6.3.3 Groundwater drawdown

i General

The amendments to the Project could potentially result in a very small reduction in the amount of groundwater drawdown in the vicinity of Thirlmere Lakes. However, any reduction is unlikely to be discernible or significant. This effectively represents no change in predicted groundwater drawdown or inferred impacts at Thirlmere Lakes.

For context, the findings so far from the NSW Government's Thirlmere Lakes Research Program (TLRP) are that historical longwall mining at Tahmoor has had little effect on the hydrology of the lakes (eg WRL 2020), which is consistent with the findings of the previous assessments for this Project.

There is also unlikely to be any change in previously predicted groundwater drawdown at Wirrimbirra Sanctuary as a result of the Project amendments. This is because this property is located above LW101A to LW104A and relatively distant from LW107B and LW108B.

ii Bore user effects

The model results from the previous groundwater assessment (HydroSimulations 2020) were reviewed and due to the further amendments and based on the proximity of bores to the removed LW107B and LW108B it is expected that, a number of bores would be at a lower risk of being affected by the Project.

The AIP includes criteria where more than minimal harm to water supply works (bores) is deemed to be >=2 m drawdown. It is noted that 2 m drawdown is only a small fraction of the drawdown typically available to bores in this area.

For context, during the approximately 30 years of longwall mining (not including bord and pillar mining) at Tahmoor Mine (Tahmoor North), only two private bores have needed to have 'make good', including:

- a bore within 250 m of LW21, affected by poor water quality; and
- a bore above a chain pillar adjacent to LW27, affected by shearing and drawdown.

Groundwater modelling predicted that 75 bores would be affected by Tahmoor North >2 m drawdown (and 17 with drawdown in excess of 10 m). Considering just two bores required 'make good' provisions, this highlights the conservatism in the combination of the modelling and in the AIP (ie the 2 m threshold is very low in an environment where available drawdowns are typically 30–90 m). A 2 m variation in water levels is of similar magnitude to seasonal fluctuation, and 2 m or even 10 m drawdown will only be a fraction of the available drawdown, and therefore will not affect yield for local users to a notice degree, the majority of whom are domestic users and do not require high groundwater yields (such as might be required for municipal water supply). The effects that have required attention and 'make good' at Tahmoor Mine in the past have been associated with strata deformation processes that affect bore water quality or bore integrity.

As a result, the 'risk' of requiring 'make good' has been classified based on the operational history and the record of 'make good' at Tahmoor North (see Table 6.6).

Table 6.6 Risk of bore requiring 'make good'

Risk rating	Criteria	Justification
High	Above longwalls and pillars	Groundwater drawdown plus the likelihood of subsidence (strata deformation) likely to affect bore integrity. Historical effects on a bore above a pillar at Tahmoor North have required 'make' good
Moderate	Model predicts a maximum drawdown greater than 10 m and within 1 km of a panel	A drawdown of greater than 10 m is probably approx. 10–30 per cent of available drawdown, but potentially more Historical effects on a bore 250 m from panels at Tahmoor North have required 'make' good. The distance selected (1 km) is deliberately conservative
Moderate-low	Model predicts a maximum drawdown greater than 10 m and beyond 1 km from a panel	Drawdown due to mining of this magnitude at this distance is only predicted in deeper bores, and so would be a fraction of the expected available drawdown
Low	Model predicts a maximum drawdown between 2–10 m	Drawdown of this magnitude is a fraction of available drawdown expected in this environment and is approaching seasonal variation
Negligible	Model predicts a maximum drawdown of less than 2 m	Below AIP 'minimal harm' threshold

Source: HydroSimulations

There was a total of 52 bores predicted to be impacted by >2 m by the Project, with 46 of these bores impacted solely by Tahmoor South, and six bores already impacted by historical mining effects.

Considering the modelled drawdown contours in Section 5 of HydroSimulations (2020) and based on the proximity of bores to the removed LW107B and LW108B, there is one bore (GW100433) above LW107B will no longer be categorised as 'high risk'. It is close to Longwall 106B and will still be at a 'moderate' risk of requiring 'make good'.

In addition, drawdown would be reduced at a cluster of eight bores to the south of the LW107B and LW108B, which previously had predicted drawdown in the range 2−4 m. It is likely that these bores would no longer experience drawdowns greater than 2 m (therefore, below the AIP threshold and with a 'negligible' risk of requiring 'make good').

The above points are summarised in Table 6.7 illustrating that there is a reduction from a total of 52 bores to 44 bores predicted to be impacted, and the location and risk classification of all registered bores around Tahmoor South is shown on Figure 6.3. Furthermore, as a result of the amendments to the project, the groundwater model predicts that the Project alone will impact 38 bores by >2 m, and a six bores that are already impacted by historical mining effects beyond the 2 m drawdown.

Based on the HydroSimulations (2020) assessment, there are 10 bores that are 'at risk' of requiring 'make good' provisions as a result of the current proposal. Taking into account the experience from Tahmoor North and the available drawdown, it is likely that the vast majority of these bores will not observe an effect on performance. Furthermore, of the ten 'high risk' bores, five are used for domestic purposes, and at two, the purpose is unknown with only three bores understood to be used for business purposes. Tahmoor Coal has committed to implementing 'make-good' provisions for affected groundwater users.

The 'make-good' plan will be finalised in consultation with the Natural Resources Access Regulator (NRAR). Relevant measures include lowering pumps within groundwater bores or providing an improved pump, deepening a bore or drilling a new bore, or providing an alternative water supply. Pre-longwall mining bore census surveys would be undertaken to establish baseline conditions of bores predicted to be affected, so that 'make-good' measures can be implemented in the event that the bores are impacted (determined by monitoring pre, during and post longwall mining).

The overall level of impact to neighbouring users is similar, if slightly lower, compared to impacts due to the 30 years of historical longwall mining at Tahmoor. That is, of the approximately 70 or more bores estimated to be affected by >2 m drawdown due existing Tahmoor Mine operations, only two users have required 'make good' arrangements to replace or improve water supply.

The timing of impact or risk to neighbouring users would be based on longwall scheduling (see Figure 6.3). Based on historical experience, significant or noticeable impacts to neighbouring users are likely to be most associated with the underlaying panel, but could also be due to extraction of any panel within approximately 250 m.

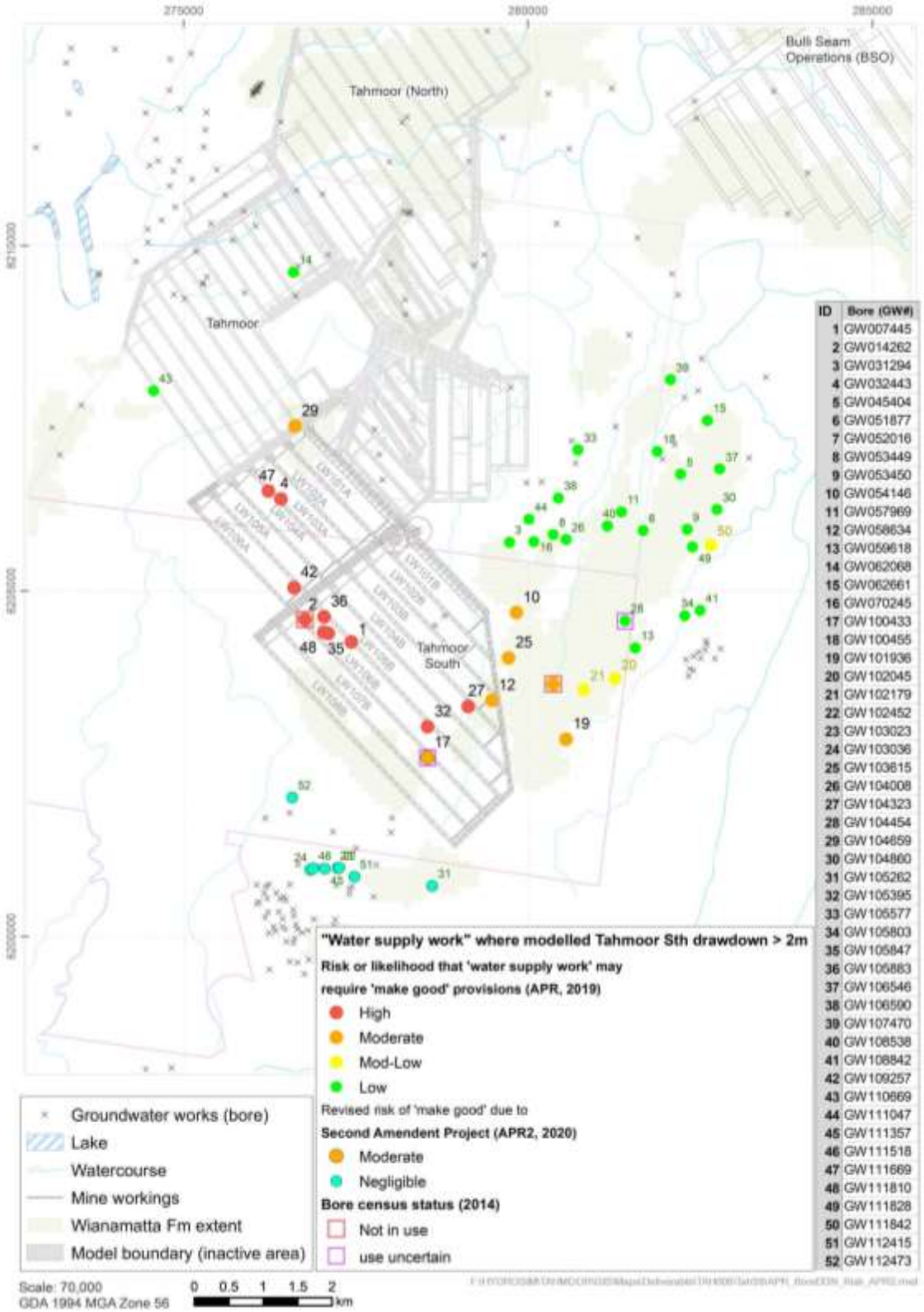


Figure 6.3 Predicted drawdown effects at water supply bores

Table 6.7 Bores likely to require make good

Risk rating	Number of bores, PAR (AECOM 2020b)	Number of bores, *second amendment report*
High	11	10
Moderate	6	7
Moderate-low	3	3
Low	32	24
Negligible	-	+8

Source: HydroSimulations
Notes: Shaded cells relate to predictions for the current mine plan

6.3.4 Conclusion

The proposed removal of LW107B and LW108B as part of the Project plan is likely to result in a reduced impact to the environmental features directly adjacent to or overlying these longwall panels.

The mining-related baseflow losses predicted to occur in Hornes Creek and Cow Creek would be reduced with the removal of LW107B and LW108B. The upper reaches of Dog Trap Creek and tributaries will not be subject to subsidence and surface cracking, and there would be less groundwater drawdown in the local area as a result of the removal of the two longwall panels.

Under the second amended mine plan the predicted impact to most environmental features are expected to be the same as those presented in the HydroSimulations (2020). These features where no change to predicted effects are expected include:

- Thirlmere Lakes;
- Wirrimbirra Sanctuary;
- regional watercourses (with the exception of Hornes Creek, Cow Creek and the upper reaches of Dog Trap Creek); and
- Lake Nepean and other water supply reservoirs.

Cumulative mine inflow to the Tahmoor South workings is predicted to be reduced by 4,100-6,400 ML over the life of the Project due to the expected completion of amended mine plan occurring approximately three years earlier.

The further amendments to the mine plan are not anticipated to reduce the predicted peak inflow into the mine workings. As such, changes to licensing would require a shorter duration licence to be acquired, but entitlement would be required to cover the same peak 'take'.

No changes to surface water licensing requirements are expected to occur due to the second amended mine plan.

In addition, the risk of 'make good' being required for registered groundwater bores has been re-assessed. At one bore previously classified as 'high-risk', the risk is expected to be reduced as it is positioned directly above LW107B. There is still a 'moderate' risk to yield at this bore due to the amendment Project. Eight previously 'low risk' bores to the south of LW107B and LW108B are expected to have drawdown below 2 m (ie below the AIP 'minimal harm' criteria).

6.4 Surface water

Hydro Engineering & Consulting Pty Ltd (HEC) has undertaken an assessment of surface water impacts of the amendments to the Project. A copy of this *surface water assessment* can be found in Appendix D. The *surface water assessment* compares impacts of the amended Project to the impacts assessed in the *Surface Water Impact Assessment* (SWIA) (HEC 2020a) contained in the PAR (AECOM 2020b).

6.4.1 Reduced downstream streamflows

i Reject emplacement area

Catchment runoff intercepted within the pit top water management system would reduce catchment yield to downstream watercourses.

The total catchment of the REA reporting to the site water management system is estimated to be approximately 45 ha compared to 56 ha for the system in the SWIA (HEC 2020a) that accompanied the PAR (AECOM 2020b). Therefore, there is a decrease in the catchment area reporting to the site water management system for the Project which would result is a lesser reduction in catchment yield when compared with HEC (2020a).

ii Licensed discharge volumes

Volumes of licensed discharges from the mine water management system are related to groundwater inflows to underground mining operations, with mine inflows returned to the surface, treated and in part recycled for mine use, with a portion discharged to Tea Tree Hollow via EPL 1389 Licensed Discharge Point 1 (LDP1).

As stated in Section 6.3.1:

- peak groundwater inflow rates are unlikely to change significantly; and
- the duration of groundwater inflow would be reduced by approximately three years due to the reduction in mine life, thereby reducing the total inflow over the active mine life by approximately 1,800 ML.

These effects are expected to directly affect the mine water balance and forecast LDP1 outflows. Previously it was expected that peak forecast outflows occur from LDP1 in 2033/34, two to three years from the end of mine life (HEC 2020a). With the Project now ending in about 2032 the higher discharge periods from 2033 will no longer occur. Predicted discharges in earlier years are unlikely to change significantly, although there may be some reduction on average due to the reduced REA catchment area.

6.4.2 Reduced flows in watercourse

i Underflow

The impacts of localised diversion of surface flow in upsidence induced subsurface fracture networks include loss of water holding capacity of pools, reduced frequency of pools overflowing and periodic loss of interconnection between pools within the affected reach during dry weather conditions. Potentially such impacts could occur in Tea Tree Hollow and Dog Trap Creek as a result of the Project.

LW107B and LW108B underlie the upstream reaches of Dog Trap Creek and its tributaries, therefore Tea Tree Hollow would be unaffected by the proposed removal of these two longwalls. The upstream reaches of Dog Trap Creek and its tributaries have been mapped as first order streams by MSEC in the *subsidence assessment* in Appendix B. Mapped pools on these streams are located further north and do not overlie LW107B and LW108B. Therefore, the potential impact on the upper reaches of Dog Trap Creek and its tributaries of subsidence induced fracturing associated with LW107B and LW108B would have been low.

It is considered unlikely that there would be any change to the potential for underflow occurring in the lower reaches of Dog Trap Creek and its tributaries, from LW106B northwards. Qualitative risks to mapped pools are documented in the SWIA (HEC, 2020a) and remain valid for the amended Project.

ii Baseflow

Changes to forecast baseflows for the amended Project have been discussed in Section 6.3.1i:

- Hornes Creek – smaller baseflow reduction;
- Cow Creek – smaller baseflow reduction;
- Dog Trap Creek – smaller baseflow reduction at headwaters of creek (in vicinity of LW107B and LW108B), otherwise unchanged further downstream; and
- other watercourses – no change to baseflow reduction.

The potential impacts of baseflow reduction to flow and to pools in Hornes, Dog Trap and Cow creeks would therefore be less than documented in SWIA (HEC 2020a), with no change to other watercourses.

A tributary of Tea Tree Hollow and a small portion of Tea Tree Hollow flow through the Wirrimbirra Sanctuary. A change to the low flow regime in the tributary of Tea Tree Hollow was quantified in the SWIA (HEC 2020a). This area is remote from LW107B and LW108B and therefore no change to subsidence-related effects are likely. No changes to baseflow reductions are also likely for these streams. Therefore, predicted impacts documented in the SWIA (HEC 2020a) would be unchanged.

iii Trapping in runoff

The SWIA (HEC 2020a) identified only one location in which subsidence induced depressions may occur - upstream of the tailgate of LW103B. This is remote from LW107B and LW108B which are to be removed from the proposed amended Project and therefore this predicted impact would be unchanged.

6.4.3 Thirlmere Lakes

There were no surface impacts associated with potential impacts to the Thirlmere Lakes associated with the Project (eg due to subsidence) documented in the SWIA (HEC 2020a). Potential impacts were related to groundwater drawdown. These groundwater related impacts are discussed in Section 6.3.2iii.

6.4.4 Subsidence

i Streamflow velocity and bed shear stress

Subsidence can result in changes to the vertical and horizontal alignment of overlying watercourses, which in turn can result in changes to the hydraulic characteristics of the watercourses and has the potential to change erosion and sediment deposition patterns. The hydraulic characteristics of Tea Tree Hollow and Dog Trap Creek were assessed using a hydraulic (flood) model, as reported in the SWIA (HEC 2020a) and the *Flood Study* (FS) report (HEC 2020c). Tea Tree Hollow is remote from LW107B and LW108B and therefore no change to subsidence-related effects (including changes to streamflow velocity and bed shear) are likely.

For Dog Trap Creek, the SWIA (HEC 2020a) indicated that changes are predicted from LW107B downstream (ie to the north-east). The removal of LW108B (located south-west of LW107B) as part of the amended Project would therefore have no effect on these predictions. The removal of LW107B would eliminate the changes in flow velocity and bed shear predicted within the stream reaches directly overlying LW107B. With the removal of LW107B, there

is potential for increased flow velocity in Dog Trap Creek and its tributaries at the south-western margin of LW106B (ie where the creeks flow over the south-western edge of LW106B).

Any effect is likely to be localised to these areas, with no additional effects further downstream. These areas could potentially experience localised increased erosion, depending on the specific nature of the bed materials. Suggested management and mitigation measures are given in Section 8.1.3 of the SWIA (HEC 2020a).

ii Flood levels

a Creek flood levels

Flood modelling of Dog Trap Creek and Tea Tree Hollow was reported in the FS report (HEC 2020c). No changes are likely to the predicted flood levels and extents resulting from subsidence-related effects in Tea Tree Hollow, because LW107B and LW108B are located in the headwaters of Dog Trap Creek.

In Dog Trap Creek in the reaches overlying LW107B, only small changes were predicted to flooding extents and these would not occur for the amended Project, with the removal of LW107B. The small changes predicted to flood extents downstream of LW107B would likely remain for the amended Project.

b Overland flow paths in and near Bargo

LW106B, LW107B and LW108B were planned to be mined under the township of Bargo. These areas drain to the headwaters of Tea Tree Hollow and Dog Trap Creek. With the removal of LW107B and LW108B, eleven of seventeen potential impact areas would be eliminated – 5, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17. The remaining overland flow paths should remain unchanged in terms of potential effects. Notwithstanding this, based on HEC (2020c), based on subsidence predictions, the predicted subsidence induced tilts are small relative to the natural gradients along potential overland flow paths and any changes to flow along these features is likely to be imperceptible.

6.4.5 Water quality

i Water releases

The SWIA (HEC 2020a) concluded that the Project would not result in adverse water quality impacts due to LDP1 releases and overflows from the site water management system.

A key driver of LDP1 releases is underground mine inflow from groundwater. As previously stated, the higher discharge periods from 2033 will no longer occur as a result of the amended Project. This further reduces the risk of adverse impacts of releases on downstream water quality.

ii Liberation of contaminants

Liberation of contaminants can occur from subsidence induced fracturing in watercourses, causing localised and transient increases in iron concentrations and other constituents due to flushing of freshly exposed fractures in the sandstone rocks which contain iron and other mineralisation. As previously stated, the potential impact on the upper reaches of Dog Trap Creek and its tributaries of subsidence induced fracturing associated with LW107B and LW108B, which are proposed to be removed as part of the amended Project, would have been low. It is therefore considered that the risk of liberation of contaminants would be unchanged for the amended Project.

iii Chemical characteristics of surface flow

One of the effects of longwall subsidence on watercourses commonly reported is the emergence of ferruginous springs, as described in the SWIA (HEC 2020a). The removal of LW107B and LW108B would reduce the risk of such an impact.

iv Gas drainage

Drainage of strata gas and expression to the surface through surface water has occurred to varying degrees in the Southern Coalfields. Studies of the phenomena have shown that the gas flow does not affect the quality of surface waters that it drains through. The removal of LW107B and LW108B would reduce the risk of the occurrence of gas drainage.

6.4.6 Conclusion

The removal of LW107B and LW108B from the mine plan will reduce potential surface water impacts of the Project. These reductions include a lower reduction in catchment yield, reduction in extent of discharges from LDP1, smaller reduction in baseflows and changes in flow velocities of Hornes Creek, Cow Creek and the headwaters of Dog Trap Creek, and removal of changes to potential flooding extents within Dog Trap Creek. It will also eliminate 11 of the 17 potential impact areas of overland flowpaths in and near the township of Bargo, and reduce potential water quality impacts.

6.5 Terrestrial ecology

Niche Environment and Heritage Pty Ltd (Niche) has undertaken an assessment of the terrestrial ecology impacts of the amendments to the Project. A copy of the *biodiversity assessment* can be found in Appendix E.

6.5.1 Assessment

i Avoidance of impacts

The amendments to the Project have resulted in an overall reduction in direct and indirect impacts to biodiversity previously assessed in the *Biodiversity Assessment Report* (BAR) by Niche (2020a) that accompanied the PAR (AECOM 2020b). The key reductions in biodiversity impacts include:

- REA – the area proposed for the REA has been significantly reduced to only be within the bounds of the currently approved disturbance footprint. As a result, 11.06 ha of SSTF previously proposed to be directly impacted for the REA, has been avoided.

- Transmission lines - the proposed transmission lines has been revised to maximise the existing cleared land, road, and existing easement as much as practical. Clearing is therefore only required where vegetation encroaches on the proposed transmission line easement. The installation of the transmission line has also been designed to avoid direct impact to threatened flora by:

    - Engaging a suitability qualified ecologist to be present during clearing associated with the transmission line easement to:

        - clearly mark the threatened plants to ensure that the contractors avoid impacts during clearing event; and

        - be present during the installation of the power poles to safeguard against direct impacts to the threatened plants.

    - The transmission line will require on-going maintenance, such as slashing of vegetation within the easement to a height of 2 m. Given the plants will not grow above 2 m in height, the long-term maintenance slashing is unlikely to impact the threatened plants.

- Ventilation shaft site TSC2 – the area of direct impact to native vegetation has been reduced by 0.67 ha. The re-design of ventilation shaft TSC2 has retained a portion of SSTF and avoided direct impacts to threatened flora, including *Persoonia bargoensis* and *Grevillea parviflora* subsp. *parviflora* which occur along Charlies Point Road.

- Mine plan – the extent of subsidence has reduced a result of the removal of LW107B and LW108B. The revised mine plan will not result in the potential for greater subsidence impacts compared to that already assessed in the BAR (Niche 2020a).

ii Direct and indirect impacts

The amended Project would result in an overall reduction in direct impacts and associated indirect impacts to native vegetation and associated habitat.

The unavoidable direct impacts to native vegetation associated with the proposed surface infrastructure are provided in Table 6.8. In total, the native vegetation to be impacted by the amended Project is 24.32 ha (including 14.22 ha of native rehabilitation), which is a 13.45 ha reduction compared to Niche (2020a).

Table 6.8 Direct impacts

Project element	Native vegetation disturbance (ha)	Native rehabilitated Vegetation (ha)	Total native vegetation impacted
Disturbance in Niche 2020a			
REA	11.06	14.20	25.26
TSC 1 Ventilation shaft site	6.05	0.00	6.05
TSC 2 Ventilation shaft site	3.47	0.00	3.47
Powerline	2.99	0.00	2.99
Total	**23.57**	**14.20**	**37.77**
Disturbance for *second amendment report*			
REA	1.42[2]	14.22	14.22
TSC 1 Ventilation shaft site	6.04	0.00	6.04
TSC 2 Ventilation shaft site	2.80	0.00	2.80
Powerline	1.26	0.00	1.26
Total	**10.10**	**14.22**	**24.32**

Source: Niche
Notes: Shaded cells relate to impacts associated with amended Project

iii Vegetation disturbance

The BAR (Niche 2020a) has detailed the process for vegetation mapping and stratification, which is consistent with the methodology proposed in the OEH (2014) *Framework for Biodiversity Assessment* (FBA).

[2] Located within an area associated with existing approval. Therefore, the 1.42 ha associated with existing approval is not considered in impact calculations and offset requirement for the Project.

The amended Project would impact on two Plant Community Types (PCTs):

- Approximately 10.10 ha of PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556), which has been attributed to two vegetation classes which is reflective of historic disturbance. Up to 1.42 ha of this area is already approved to be disturbed under existing approvals at Tahmoor Mine.

- Approximately 14.22 ha of mine site rehabilitation located on the former REA, which has been assigned as a 'best fit PCT - PCT 1081 Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin (HN564).

In comparison to PAR, the amended Project would:

- Reduce the direct disturbance associated with PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556) by 13.47 ha.

- The area of direct disturbance to mine rehabilitation (PCT 1081 Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin (HN564)) has very slightly increased by 0.02 ha.

iv Threatened ecological community

PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556) aligns to SSTF, a CEEC under both the NSW *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act.

Based on the revised footprint, two condition classes of SSTF would be impacted by the Project, as shown in Table 6.9. This is a reduction of 13.47 ha compared to the original amount proposed to be directly impacted in the BAR (Niche 2020a).

Table 6.9 Impact on Shale Sandstone Transition Forest

SSTF condition class	Area impacted in Niche 2020a (ha)	Revised impact area (ha)	Reduction (ha)
PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556) Derived	6.31	5.98	0.33
PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556) Good	17.26	4.12	13.14
Total	**23.57**	**10.10***	**13.47**

Source: Niche
Notes: * 1.42 ha of the 10.10 ha is already approved to be disturbed by existing approvals at Tahmoor Mine
Shaded cells relate to impacts associated with amended Project

v Threatened flora

The BAR (Niche 2020a) determined that three threatened flora would be impacted by the Project: *Persoonia bargoensis, Grevillea parviflora* subsp. *Parviflora* and *Pomaderris brunnea.* All three species were attributed a credit offset liability.

The amended Project would result in an overall reduction in the number of plants proposed to be directly impacted in the BAR. The reduced amount compared to that assessed in the BAR is shown in Table 6.10. The reduced impact to threatened flora has been largely attributed to the following:

- Most of the threatened flora occur along the existing Charlie Point Road easement, and the existing easement to the west of ventilation shaft TSC1. Threatened flora that occur within the vicinity of the proposed transmission line easement would no longer need to be cleared as originally proposed in the BAR. Given the relatively small footprint required to install the power poles, the threatened flora can be avoided from direct impacts. Furthermore, given the height of the threatened flora (less than 2 m), the threatened flora will not need to be slashed or cleared during routine maintenance of the transmission line.

- The native vegetation proposed to be cleared for ventilation shaft site TSC2 has been reduced. As such, the threatened flora which predominately occur towards Charlies Point Road would be retained.

- The REA disturbance footprint has been significantly reduced, thus no longer impacting upon threatened flora.

The mitigation measures proposed to avoid/minimise indirect impacts have been detailed in the BAR (Niche 2020a).

Table 6.10 Threatened flora

Species	Number of plants impacted	
	BAR (Niche 2020a)	Revised impact
Persoonia bargoensis	8	1
Grevillea parviflora subsp. *parviflora*	491	55
Pomaderris brunnea	1	0

Source: Niche
Notes: Shaded cells relate to impacts associated with amended Project

vi Threatened fauna

The BAR determined that five 'species credit' threatened fauna would be impacted by the Project: Large-footed Myotis, Koala, Large-eared Pied Bat, Eastern Cave Bat and Eastern Pygmy Possum. A total of 17.26 ha of habitat (referred to as the species polygon) was assigned to each of the five threatened fauna species. The species polygon coincided with the removal of PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556) Good.

Given the reduction in impact to PCT 1395, the associated species polygon for each of the five threatened fauna species has subsequently been reduced. The area of impact (species polygon) for each of the threatened fauna is therefore 4.12 ha.

vii Commonwealth listed communities and species

Given the reduced impact associated with the Project, the Commonwealth assessments of significance that were completed as part of the BAR (Niche 2020a) have been amended and included in Annex 1 of the *biodiversity assessment* in Appendix E.

Based on the updated assessments, it was concluded that, despite the reduction in disturbance associated with Project, the removal of 10.10 ha of SSTF, a CEEC under the EPBC Act, is likely to have a significant impact on the CEEC.

No other threatened species listed on the EPBC Act are likely to be significantly impacted by the Project.

6.5.2 Biodiversity offsets

Due to the reduced impacts to biodiversity associated with the amended Project, the BioBanking Credit Calculator has been updated. The Landscape Scoring and plot data has not been edited or changed since the BAR was submitted. As such, the key changes to the BioBanking Credit Calculator are attributed to the change to vegetation impacts and habitat/species counts.

The BioBanking credits required for the amended Project are provided in Table 6.11 and the credit report has been attached to the *biodiversity assessment* contained in Appendix E.

Note that the area of SSTF within Table 6.11 includes the 1.42 ha of this CEEC already approved for disturbance under existing approvals at Tahmoor Mine.

A comparison has also been provided in Table 6.11 against the original credits required for the Project. The key reduction in credits are in relation to:

- SSTF – reduction of 629 credits;
- *Grevillea parviflora* subsp. *parviflora* – reduction of 6,104 credits;
- *Persoonia bargoensis* – reduction of 539 credits;
- *Pomaderris brunnea* – reduction of 15 credits; and
- threatened fauna – reduction of credits due to decrease in habitat impact.

Table 6.11 Biodiversity offsets

Threatened biodiversity	BAR		Revised offset liability		Reduction in credits required
	Area (ha)/ No. impacted	Credits required	Area (ha)/ No. impacted	Credits required	
Shale Sandstone Transition Forest/PCT1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556)	23.57 ha	1,084	10.10 ha	455	629
Native mine rehabilitation/PCT1081 Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin (HN564)	14.20 ha	398	14.22 ha	399	+1
Persoonia bargoensis	8	616	1	77	539
Grevillea parviflora subsp. *parviflora*	491	6,874	55	770	6,104
Pomaderris brunnea	1	15	0	0	15
Large-footed Myotis	17.26 ha	380	4.12	91	289
Koala	17.26 ha	449	4.12	107	342
Large-eared Pied Bat	17.26 ha	224	4.12	54	170
Eastern Cave Bat	17.26 ha	224	4.12	54	170
Eastern Pygmy Possum	17.26 ha	345	4.12	82	263

Source: Niche
Notes: Shaded cells relate to impacts associated with amended Project

6.5.3 Conclusion

The amended Project has significantly reduced impacts on terrestrial ecology, particularly threatened communities and species.

The Project will now only impact 24.32 ha of native vegetation, of which 14.20 ha is mine rehabilitation. This is a reduction of 13.45 ha compared to previous impacts, all of which relates to SSTF where now only 10.10 ha will be impacted. Previously it was proposed to clear 23.57 ha of this CEEC. In addition, of the 10.10 ha of SSTF to be disturbed, 1.42 ha already has approval to be disturbed under existing approvals at Tahmoor Mine.

The Project has also significantly reduced impacts on threatened flora. The amended Project will result in an impact to 55 *Grevillea parviflora* subsp. *parviflora* plants, and one *Persoonia bargoensis*. Previously, it was proposed to impact 491 *Grevillea parviflora* subsp. *parviflora* plants, and eight *Persoonia bargoensis*. The Project has now also avoided any impacts to *Pomaderris brunnea*.

The Project also reduces impacts to potential fauna habitat. A total of 4.12 ha of potential habitat for the following 'species credit' fauna may be impacted: Large-footed Myotis, Koala, Large-eared Pied Bat, Eastern Cave Bat and Eastern Pygmy Possum. This compares to 17.26 ha previously proposed.

Minor residual impacts to terrestrial ecology will be offset in accordance with the NSW biodiversity offset scheme.

6.6 Aquatic ecology

Niche has undertaken an assessment of the aquatic ecology impacts of the amendments to the Project. A copy of this *aquatic ecology assessment* can be found in Appendix F. The *aquatic ecology assessment* compares the impacts of the amended Project to impacts documented in the *Tahmoor South Project Aquatic Ecology Impact Assessment of the Amended Project* (Niche 2020b) that accompanied the PAR (AECOM 2020b).

6.6.1 Assessment

Niche 2019b identified two mechanisms that had the potential to impact aquatic biodiversity:

- subsidence; and
- mine water discharge.

The removal of the two longwalls (LW107B and LW108B) from the Project will reduce the mine life by three years and therefore reduce the duration of the groundwater take and induced surface water take by the same amount of time. This will lead to a reduction in the quantity of mine water required to be discharged and also reduce the risk of subsidence related impacts near waterways that would have been associated with the construction and operation of the longwalls. This will result in reduced ecological risk to the aquatic environment from mine water discharge into the Bargo River as well as reduced risk of subsidence impacts to Hornes Creek and Dog Trap Creek tributaries.

Details regarding changes to the Project and its potential impact on aquatic ecology are provided in the *aquatic ecology assessment* in Appendix F.

Table 6.12 Risk of subsidence impact of the Project in comparison to previous longwall layout

Location	Strahler Stream Order	Previous longwall layout (2019)	Amended Project	Discussion of impact
Dog Trap Creek and tributaries	1st Order	Sections of 1st Order Dog Trap Creek and tributaries are the only waterways located directly above LW107B and LW108B	LW107B and LW108B will not directly mine beneath sections of Dog Trap Creek and tributaries	LW107B and LW108B will not directly mine beneath 1st order sections of Dog Trap Creek or its tributaries and therefore there will be a reduced risk of subsidence related impacts in these areas. There is also likely to be a reduction in cumulative impacts associated with longwalls adjacent to LW107B. The *surface water assessment* (Appendix D) Appendix C concluded that the removal of LW107B and LW108B is unlikely to lead to changes in subsidence related subsurface flow and pool holding capacity, as there are no mapped pools in the area. The aquatic habitat provided by these sections of stream are limited (consisting of small drainage lines/swales) and any potential change in risk is minimal. However, given the removal of the longwalls and the potential source of impact, it is considered likely that the risk to any aquatic habitat present within these sections of waterways (whether marginal or temporary) will be reduced. The *groundwater assessment* (Appendix C) concluded it likely that the baseflow losses and surface cracking in the headwaters of Dog Trap Creek will be reduced due to the removal of underlying LW107B and LW108B however this reduction in impact in this area would be localised. As a result, given that the lower parts of Dog Trap Creek will still be undermined by other panels, it was concluded that there will be no change to the downstream flow in Dog Trap Creek due to the amendments to the Project (see Appendix C). Therefore, while the amendments may result in a localised reduced risk of impacts to aquatic ecology, there is no change to potential aquatic ecological impact due to groundwater losses on downstream flow as a result of the amendments.
Hornes Creek	4th Order	Not directly mined beneath, located 540 m south-west of LW108B at its closest point to mining	Not directly mined beneath, located 1,180 m west of LW106B at its closest mining point	Previous assessment on subsidence related impacts in this creek (MSEC 2019) found that the risk of impacts is likely to be low based on the distance from the creek to the longwalls. This risk is reduced further with the removal of LW107B and LW108B. Thus, loss of water in pools and changes to water quality associated with subsidence related impacts are unlikely to impact the aquatic habitat in Hornes Creek. Baseflow losses in Hornes Creek were predicted to be very minor in HydroSimulations 2020. These are now predicted to be negligible in the *groundwater assessment* (Appendix C) with the further amendments removing LW107B and LW108B, of which LW108B was to be the closest of all the proposed longwalls. As such the risk of potential impacts to aquatic ecology (albeit minor) will also be reduced.
Cow Creek	3rd Order	Not directly mine beneath -outside of 20 mm subsidence contour	Not directly mine beneath outside of 20 mm subsidence contour	The *groundwater assessment* (Appendix C) stated that 'the predicted reduction in surface water flow in Cow Creek (and the associated WaterNSW Special Area) is likely to be smaller than outlined in the Amended Project Report'. This represents a further reduction in potential impact to Cow Creek. Niche (2020b) concluded that the small changes in baseflow will have negligible effect on aquatic ecology. This assessment is still applicable to the Project.

i Subsidence

The type of subsidence impacts that may occur will not change as a result of the proposed amendments. However, the removal of the two longwalls from the Project will result in a reduction in the extent of potential subsidence-related impacts associated with construction and operation of the longwalls; and as such the risk of impact to streams located above or near LW107B and LW108B will be reduced accordingly. Areas above these longwalls include reaches of 1st order tributaries of Dog Trap Creek. The removal of longwalls from these areas will reduce the risk of subsidence impacting these sections of streams. Also, with the removal of the longwalls, cumulative impacts associated LW107B and LW108B with previously mined longwalls adjacent (eg LW105B and LW106B) are also likely to be reduced.

Hornes Creek was not previously proposed to be directly mined beneath as part of the Project, and as such the previous assessment (Niche 2020b) found that there was a low risk of subsidence related impacts occurring to Hornes Creek. The removal of the longwalls from the Project will further reduce this risk as the stream is more than double the distance away from the closest longwall compared to the previous longwall layout.

ii Mine water discharge

The mine water discharge is likely to differ to Niche (2020b) with the removal of LW107B and LW108B. The removal of these longwalls will result in less water required to be discharged over the life of the mine. However, the management of the mine water will not change.

The previous assessment (Niche 2020b) concluded:

- It is expected that no further impacts to aquatic ecology will occur as a result of mine water discharge from the Tahmoor South Project, as hydrology is not expected to differ significantly from the current regime, and water quality is expected to improve with the implementation of the waste water treatment plant (WWTP) (Pollution Reduction Program 22- Stage 3).

- It is expected that reductions in salinity concentrations will improve aquatic ecology downstream of the mine water discharge as a result of the implementation of the WWTP.

- The results of predictive modelling of the water management system over the remaining mine life indicate that release to LDP1 is unlikely to increase above the EPL 1389 volume limits. On this basis, it is expected that the amended Project would not result in adverse water quality impacts due to releases and overflows from the site water management system (HEC 2019).

As the management of mine water will not change as a result of the Project amendments, the assessment and conclusion reached in the previous assessment (Niche 2020b) still stand and are relevant to the proposed amendments.

6.6.2 Conclusion

The amended Project will reduce the risk of potential impacts to aquatic ecology.

The removal of LW107B and LW108B will reduce the risk of impact to 1st order tributaries that are located directly above the longwalls as well as the cumulative impacts associated with previously mined adjacent longwalls. This will reduce this risk of impact to some 1st order sections of Dog Trap Creek and its tributaries. The risk of impacts to Hornes Creek, which previously had a low risk of being impacted by mining, will be reduced even further as it will be located even further from the nearest longwall (1,180 m). Similarly, the minor risk of impact to Cow Creek will also be reduced as a result of these additional amendments.

The quantity of mine water discharge will likely be reduced over the life of the mine due to the amended Project. Management of the mine water discharge will be the same as discussed in the previous assessment (Niche 2020b) where it was determined that impacts to aquatic ecology as a result of potential changes to water quality and quantity as a result of the Project would be unlikely.

The amended Project is considered to have resulted in a reduction in risk of potential impacts to aquatic ecology and habitat in the Project area.

6.7 Noise

EMM has undertaken an assessment of the noise impacts of the amendments to the Project. A copy of this *noise assessment* can be found in Appendix G.

6.7.1 Assessment

The *Noise and Vibration Impact Assessment* (NVIA) (EMM 2020a) that accompanied the PAR (AECOM 2020b) considered three stages representative of the life of the Project; Stage 2, Stage 4 and Stage 5. Equipment was modelled within the REA representative of each of these stages at the original proposed maximum REA height of RL 310 m. The REA height increase is proposed to occur in the areas previously considered as Stages 2 and 4 however the elevation increase will occur during Stage 6 of the project. The noise model has been updated in terms of the equipment locations assumed for Stages 2 and 4.

It is noted that purchase of the residence at 185 Charlies Point Road, Bargo is currently under negotiation between Tahmoor Coal and the landowner.

Noise modelling considered the proposed additional amendments to the Project including the increased height of the REA and slight relocation of ventilation shaft TSC1. All other modelling assumptions, including the incorporation of all feasible and reasonable noise mitigation measures, are the same as those utilised for the NIVA. In addition, the modelling considered noise-enhancing meteorological conditions only.

Noise emissions as a result of the amendments to the Project are predicted to result in negligible changes at all assessment locations compared to those presented in the NVIA (EMM 2020a).

Table 6.13 provides a summary of the number of assessment locations for each operational scenario (existing mine and each of the Stages considered) where predicted noise emissions are in the following categories:

- no more than 2 dB above the Project noise trigger level (PNTL);
- 3-5 dB above PNTL; and
- more than 5 dB above PNTL.

In addition, a comparison has been made to the outcomes of the NVIA for each of the stages considered.

Predicted noise impacts from all considered stages of the Project have been categorised as per Table 1 of the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) with reference to noise predictions under noise-enhancing weather conditions.

Table 6.13 Noise assessment

	Number of assessment locations within each category														
	Existing Tahmoor mine[1]			Stage 2 mitigated[1]			Stage 2 mitigated including Stage 6 REA height			Stage 4 mitigated[1]			Stage 4 mitigated including Stage 6 REA height		
Noise-enhancing	**Day**	**Eve**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
No more than 2 dB above PNTL	2,753	2,715	2,650	2,753	2,723	2,734	2,751	2,720	2,733	2,757	2,725	2,734	2,754	2,726	2,732
3-5 dB above PNTL	5	24	73	6	29	19	7	30	19	2	27	19	4	26	20
More than 5 dB above PNTL	1	19	33	0	6	3	0	7	3	0	6	3	0	5	3

Notes 1 - as presented in the NVIA (EMM 2020a)

Key points from the noise assessment are summarised as follows:

- Consistent with findings presented in the NVIA (EMM 2020a), the Project, inclusive of the second amendments, is expected to reduce noise emissions at all assessment locations compared to existing levels by at least 2 dB and by up to 11 dB at assessment locations during the more sensitive night-time period.

- Predicted noise levels show (consistent with those presented in the NVIA) a significant reduction in the number of privately-owned dwellings affected by mine noise emissions more than 5 dB above the relevant PNTL compared to existing mine noise.

- Categorising residual noise impacts in accordance with the VLAMP noise impact categories results in three residential properties classified as significantly affected (refer to Appendix C of the noise assessment in Appendix G). This is the same outcome as that presented in the NVIA. In some cases, locations categorised as significant are relatively further from the mine than those with a moderate or marginal impact category. This is due to several factors including rounding of noise predictions, local topographical features and the relative PNTLs for these locations (intrusive and amenity). This outcome is consistent with the NVIA.

Table 6.7 of the NVIA provided a summary of the predicted noise levels at ten locations around the mine which are representative of the potentially most exposed to mine noise and likely to form the basis of a future noise compliance monitoring program. Achievable noise emissions inclusive of the amendments to the Project are provided in Table 6.14.These are mostly unchanged from the NVIA with the following exceptions:

- day and evening noise levels at location C5 have increased by 1 dB;

- day and evening noise levels at location C7 have increased by 1 dB; and

- day and evening noise levels at location C8 have increased by 2 dB.

The Project noise levels presented in Table 6.14 are highest of all stages considered (including Stage 5 from the NVIA).

Table 6.14 Predicted 'achievable' noise levels (noise enhancing)

Location				PNTL			Existing			Project		
Ref.	X	Y	Description	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
C1	276653	6207152	Wollondilly Anglican Church	53	53	n/a	57	60	60	51	53	51
C2	276472.9	6207650	Western end of Olive Lane	47	47	43	52	55	55	47	49	46
C3	276741	6207616	Eastern end of Olive Lane	51	48	43	54	57	57	52	52	49
C4	276936.3	6208105	2900 Remembrance Drive	51	48	43	46	46	46	46	46	43
C5	278017.5	6208249	Southern end of Stratford Road	41	41	41	43	43	43	45	45	38
C6	278663.1	6208711	Eastern end of Hodgson Grove	40	40	35	39	39	39	40	40	32
C7	279273	6207883	Rockford Road	40	35	35	38	38	38	41	41	34
C8	279711.4	6207784	Kammer Place	40	35	35	33	33	33	37	37	<30
C9	277768	6205158	80 Charlies Point Road	40	39	35	37	37	37	38	38	32
C10	276577.5	6206476	3076 Remembrance Drive	49	42	35	43	43	43	43	43	41

Notes: Noise level predictions presented in this table considers the NPfI LFN modifying factor
Notes: Shaded cells relate to impacts associated with amended Project

6.7.2 Conclusion

EMM has undertaken an assessment of the potential noise impacts associated with the amendments to the Project. They result in negligible (up to 2 dB) change to the noise impacts presented in the NVIA (EMM 2020a).

Notwithstanding this, consistent with findings presented in the NVIA, the Project, inclusive of the amendments, is expected to reduce noise emissions at all assessment locations compared to existing levels by at least 2 dB and by up to 11 dB at assessment locations during the more sensitive night-time period.

6.8 Air quality and greenhouse gas

ERM Australia Pacific Pty Ltd (ERM) has undertaken an assessment of the air quality impacts of the amendments to the Project, including an assessment of the greenhouse gas (GHG) emissions generated by the Project. A copy of this *air quality and GHG assessment* can be found in Appendix H.

6.8.1 Air quality

The *Air Quality Impact Assessment* (AQIA) (ERM 2020a) completed by ERM that accompanied the PAR (AECOM 2020b) included dispersion modelling for a maximum ROM throughput of 4 Mtpa. The Project is not proposed to exceed this production rate and would therefore not result in any changes to particulate emissions associated with these activities.

One of the main sources of dust emissions for the Project is wind erosion from the REA, accounting for approximately 10 per cent of the total emissions from the site. As this footprint will reduce in size this will result in a reduction in dust emissions at the REA. In addition, the increased height of the REA will not increase the dust emissions.

It is therefore anticipated that the Project is not likely to result in any increases in particulate emissions or ground level concentrations compared to those presented in ERM (2020a).

6.8.2 Greenhouse gas

The *Greenhouse Gas Assessment* (GHGA) (ERM 202b) completed by ERM that accompanied the PAR included a comprehensive assessment of scope 1, 2 and 3 emissions resulting from the Project. Scope 1 emissions are the emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level Scope 2 emissions are the emissions released to the atmosphere from the indirect consumption of an energy commodity. And scope 3 emissions are indirect greenhouse gas emissions other than scope 2 emissions that are generated in the wider economy.

A reduction in total years of operation and therefore subsequent ROM production over the life of the mine, will result in a reduction in GHG emissions. Using the same assumptions as those presented in ERM (2020b), the following tables present a summary of the re-calculated scope 1, 2 and 3 emission estimates.

Table 6.15 Summary of estimated CO_2-e (tonnes) – all scopes

	Scope 1 emissions (t CO_2-e) (based on the power plant operating)						Scope 2 emissions (t CO_2-e)	Scope 3 emissions (t CO_2-e)
Year	**Diesel**	**Unleaded petrol**	**Methane**	**SF_6**	**Post-mining activities**	**Total**	**Electricity**	**Energy production**
2021	465	7	89,971	0.4	6,614	97,058	11,929	525,244
2022	2,029	30	157,843	1.9	28,844	188,749	52,024	2,880,188
2023	3,311	50	508,623	3.1	47,061	559,048	84,879	4,837,896
2024	4,156	62	626,743	3.8	59,071	690,036	106,540	6,618,074
2025	3,728	56	652,197	3.4	52,991	708,976	95,574	6,467,475
2026	4,178	63	701,435	3.9	59,380	765,059	107,098	7,763,571
2027	4,189	63	835,956	3.9	59,543	899,755	107,391	7,735,856
2028	4,656	70	1,455,162	4.3	66,177	1,526,069	119,356	8,463,474
2029	3,761	56	1,305,609	3.5	53,459	1,362,888	96,417	6,939,653
2030	4,080	61	1,294,164	3.8	57,990	1,356,299	104,589	6,515,485
2031	3,564	54	910,576	3.3	50,654	964,851	91,360	5,520,472
2032	943	14	264,345	0.9	13,407	278,711	24,181	1,565,209
Total	**39,060**	**587**	**8,802,624**	**36**	**55,191**	**9,397,498**	**1,001,338**	**65,832,595**
Annual average						**783,125**	**83,445**	**5,486,050**

Source: ERM 2020
Notes: Total values may not always equate to the sum of the numbers shown due to rounding

These values represent a reduction over the life of the mine of approximately 22 per cent for scope 1, 23 per cent for scope 2 and 25 per cent for scope 3 emissions from those presented in ERM (2020b).

6.8.3 Conclusion

The amendments to the Project will reduce dust emissions at the REA. It is therefore anticipated that the Project is not likely to result in any increases in particulate emissions or ground level concentrations compared to those presented in ERM (2020a).

A reduction in total years of operation of the Project will result in GHG emissions, including approximately 22 per cent for scope 1, 23 per cent for scope 2 and 25 per cent for scope 3 emissions from those presented in ERM (2020b).

6.9 Visual

Green Bean Design Ltd (GBD) has prepared a *visual assessment* of the amendments to the Project. A copy of this assessment can be found in Appendix I. The assessment focuses on the changes to the REA presented in this *second amendment report*.

6.9.1 Assessment

The approach for the visual assessment is consistent with the *Visual Assessment* (GBD 2020) prepared for the EIS (AECOM 2018) and PAR (AECOM 2020b). It is proposed to increase the height of the REA, from RL 310 m proposed in the REA to RL 320 m. This increase in height is to accommodate a reduction in the surface footprint of the REA to within its approved footprint.

GBD (2020) noted that the REA would have some limited visual exposure to visual receptors and locations due to:

- the distance between the REA and surrounding view locations;
- the extent of existing tree cover surrounding and between the REA and surrounding view locations; and
- visually consistent and contiguous gently undulating landforms extending beyond the REA.

GBD (2020) also indicated that progressive and ongoing planting during the rehabilitation and vegetation of the REA would provide further screening potential.

Accordingly, it was determined that the extensions to REA proposed in the EIS and PAR would result in low visual effect and low visual significance.

The *visual assessment* for the amended Project (Appendix I) has assessed the changes proposed to the REA. It confirms that the increase in the height of the REA would be restricted by existing landscape characteristics surrounding it and would not result in additional visual impacts over and above the low impact determined in the EIS and PAR.

6.9.2 Conclusion

The amended REA would unlikely result in a level of visual effect or visual significance over and above the low impact determined in the visual assessment in the EIS and PAR.

6.10 Rehabilitation

SLR Consulting Pty Ltd (SLR) has prepared a *rehabilitation strategy* for the proposed amendments of the Project. A copy of this strategy can be found in Appendix J.

The *rehabilitation strategy* focuses on the rehabilitation required as a result of changes to the REA.

6.10.1 Topsoil mass balance

i Landscape units

The majority (145.95 ha) of the approved disturbance area of the REA has been disturbed by reject emplacement and consists of both reject emplacement and areas of rehabilitation. There is a small area (6.83 ha) on the western side that has yet to be disturbed. This undisturbed area contains two soil landscape units, Lucas Heights and Gymea.

The Lucas Heights soil landscape unit covers gently undulating crests, ridges and plateau surfaces, with slopes less than 10 per cent and local relief of 10–50 m. Within the approved disturbance area of the REA, the Lucas Heights soil landscape covers 6.17 ha. The Gymea soil landscape unit covers undulating to rolling rises and low hills, with slopes between 10–25 per cent and local relief of 10–80 m. Within the approved disturbance area of the REA, the Gymea soil landscape covers 0.66 ha.

ii Soils

Soils within the approved disturbance area of the REA consists predominantly of mine disturbance and Anthroposols with a small area of Lithosols situated on the on the western boundary.

Anthroposols are soils resulting from human activities which have led to a profound modification, truncation or burial of the original soil horizons, or the creation of new soil parent materials by a variety of mechanical means. Anthroposols within the REA consist of rehabilitated areas where topsoil has been placed over the reject material.

Lithosols in the REA occur on crests and sideslopes and are characterised by shallow (less than 0.3 m), loamy sand to sandy loam. Structure is typically apedal and the profile is strongly to slightly acidic (pH 4.0–6.0). Limitations include low fertility, acidity and presence of sandstone gravel and rock outcrop, particularly on steeper slopes.

a Mine disturbance

Mine disturbance within the REA consist of currently disturbed areas where reject placement and rehabilitation have not yet taken place or are currently in the process of being undertaken.

6.10.2 Topsoil stripping assessment and balance

Topsoil for existing approved REA rehabilitation works is stripped from natural, vegetated sections being utilised for rejects emplacement within the approved REA disturbance area. Where further reject emplacement is to take place on current rehabilitation, topsoil will be recovered prior to placement. Stripping occurs following clearing and prior to emplacement of the reject material. The depth of topsoil stripped is generally sufficient to provide for the depth of topsoil to be re-spread across the rehabilitated REA sections to the specified depth. Where there is insufficient topsoil, topsoil is imported to make up the deficit.

Up to 6.83 ha of existing natural, vegetated area is yet to be stripped from within the approved REA disturbance area. This area consists of Lithosols which are generally marginally suitable for reuse due to coarse topsoil texture and poor soil structure with limitations consisting of acidity and sandstone fragments, stones and rock outcrops characteristic of the Gymea soil landscape unit. Material may be stripped and reused in rehabilitation provided appropriate erosion and sediment controls are in place. They will need organic ameliorants to improve their structure.

The recommended topsoil stripping depths for soils within the REA is shown in Table 6.16. Recommended topsoil stripping depth for areas to be de-habilitated will be determined via soil survey prior to removal as stripping depths will be dependent on the depth of capping across the existing REA. The total maximum remaining topsoil that can be sourced from areas of natural vegetation within the existing REA is 6.82 ha, potentially providing an additional 20,476 cubic metres (m^3) of topsoil.

Table 6.16 Soil Stripping Recommendations

Soil unit	Topsoil depth (m)	Stripping depth (m)	Area (ha)	Volume (m^3)
Lithosols (slope greater than 10%)	0.30	0.30	6.83	20,476
Anthroposols	*	*	58.29	*
Mine disturbance	N/A	N/A	87.65	N/A
Total			**152.77**	**20,476**

Source: SLR
Notes: * Depth to be determined via soil survey

6.10.3 Final land use

The final land use of the REA post-rehabilitation is native tree, shrubs and grassland.

6.10.4 Conclusion

Changes to the rehabilitation and mine closure strategy because of amendments to the Project are primarily related to the amended REA landform design. This includes considerations for disturbance areas and variations to topsoil resources required for rehabilitation.

The amended REA reduces potential impacts that resulted from the additional topsoil stripping of the previously proposed REA expansion and contains all disturbance to the existing approved REA area. As a result, the existing REA will be required to be an additional 10 m above the previously specified top landform height.

Topsoil for rehabilitation within the REA will be sourced from previously stripped and stockpiled areas of the existing REA and de-habilitated areas with the potential to source additional topsoil from the remaining native vegetation area within the approved REA boundary.

6.11 Social

A *Social Impact Assessment* (SIA) was prepared and submitted in support of the EIS (AECOM 2018) for the Project. An *SIA Addendum* (AECOM 2020c) was prepared to update the original SIA following the project amendments presented in the PAR (AECOM 2020b). AECOM (2020c) considered the differences in impacts compared to the Project in the EIS and further addressed social impacts associated with the Project in relation to issues raised in submissions and representations. It also considered comments made by DPIE in it PIR.

Issues addressed included:

- subsidence, including:
    - the psychological and other indirect impacts of subsidence including stress, anxiety, uncertainty, disturbance and hardship;
    - the timeframe of subsidence impacts, from when a property owner begins to experience subsidence impacts to when those subsidence impacts conclude; and
    - the assessment of those impacts, the subsequent claims process and possible appeals;
- impacts on the Aboriginal community;
- impacts to groundwater bore users; and
- impacts on those with ties to surrounding natural features (especially Thirlmere Lakes).

This section provides an update on AECOM (2020c) with consideration to the second Project amendments, which, like the first Project amendments, have been designed to further ameliorate the issues identified in the submissions and representations.

6.11.1 Assessment

A summary of the changes in social impacts, resulting from the Project amendments, is provided in Table 6.17. This table compares changes from the EIS and PAR.

Table 6.17 Summary of social impacts

Aspect	Change from EIS to PAR (AECOM 2020c)	*Change from PAR to project amendment report*	Change in impact
Surroundings - natural features			
Surface water	• Improvements in streamflow for Dog Trap Creek, Eliza Creek and Bargo River • Increased groundwater inflow to the underground mine • Increased discharge via LDP1 • Increased discharge via the licensed overflow points (LOPs) to Tea Tree Hollow • Reduced predicted peak of simulated annual release to Bargo River from dam S11 based on the 95th percentile results • The underground stored water volume is predicted to increase from 2025 and is likely to near the storage capacity by 2032, based on 95th percentile model results	• Catchment runoff intercepted within the pit top water management system would reduce catchment yield to downstream watercourses • Improvements in streamflow for Hornes Creek, Cow Creek and headwaters of Dog Trap Creek • No change to streamflows of other creeks • Decreased duration of groundwater inflow to the underground mine via reduction in mine life • Decreased discharge via LDP1 via reduction in mine life • Increased discharge via the licensed overflow points (LOPs) to Tea Tree Hollow	Reduced impacts
Groundwater	• Not reported in table	• Decreased duration of groundwater inflow to the underground mine via reduction in mine life • Small decrease in already small losses from Nepean Reservoir • A very small reduction in the amount of groundwater drawdown in the vicinity of Thirlmere Lakes (the findings so far from the NSW Government's *Thirlmere Lakes Research Program* (TLRP) are that historical longwall mining at Tahmoor has had little effect on the hydrology of the lakes) • Reduction in impacts to private bores from 52 to 44 bores: – One bore (GW100433) above LW107B will no longer be categorised as 'high risk' and categorised as 'moderate' risk of requiring 'make good' – Cluster of eight bores to the south of the LW107B and LW108B, which previously had predicted drawdown in the range 2-4 m, would likely no longer experience drawdowns greater than 2 m (therefore, below the AIP threshold and with a 'negligible' risk of requiring 'make good') – 10 bores that are 'at risk' of requiring 'make good' – Taking into account the experience from Tahmoor North and the available drawdown, the vast majority of these bores will not observe an effect on performance	Reduced impacts

Table 6.17 Summary of social impacts

Aspect	Change from EIS to PAR (AECOM 2020c)	*Change from PAR to project amendment report*	Change in impact
Surroundings - amenity			
Subsidence	• Reduction in the maximum predicted subsidence, tilt and curvature by approximately 15% • Reduction of the maximum total conventional subsidence, upsidence and closure movements to waterways	• Reduction in maximum predicted subsidence of approximately 50 mm as well as predicted maximum tilts and curvatures • No change to total conventional subsidence, upsidence and closure movements to waterways • Significant reduction in the number of houses that are directly above the proposed mine plan: – Reduction of 428 houses above longwalls (143 houses compared to 571 houses) – Total number of houses predicted to be impacted by repair categories R3-R5 reduced by 71 houses (35 houses compared to 106 houses)	Reduced impacts
Noise and vibration	• A reduction in night noise emissions compared to existing noise levels from the mine by at least 2 dB and up to 18 dB • Reduction in the number of privately-owned dwellings affected by operational noise emissions more than 5 dB above the relevant project noise trigger level • Operational noise at the nearby Anglican Church and School is predicted to be reduced by at least 3 dB, compared to existing noise levels.	• No significant change from predicated noise levels	No change
Air quality and odour	• Reduction in odour levels when one fan is used when compared with two fans at Vent Shaft T2	• Reduction in dust emissions at the REA • No change to odour levels	Reduced impacts
Greenhouse gas	• Not reported in table	• A reduction over the life of the mine of approximately 22% for scope 1, 23% for scope 2 and 25% for scope 3	Reduced impacts
Visual aesthetics impacts	• The amended REA is unlikely to result in a significant visual impact	• No change despite increase in height of the REA	No change
Traffic	• The Project amendments would not influence the traffic impacts associated with the Project	• No change	No change
Land use, agriculture and resource	• Rehabilitation of previously pre-REA Class 6 agricultural land to REA Class 7	• No change	No change
Way of life	• Construction and operation workforce numbers would not be substantially altered by the Project amendments • Impacts to employment and housing would remain unchanged from that presented in the original SIA	• No change	No change

Table 6.17 Summary of social impacts

Aspect	Change from EIS to PAR (AECOM 2020c)	*Change from PAR to project amendment report*	Change in impact
Community identity and cohesion	• There would be little, if any, change in impacts as a result of the Project amendments for: – Use of Existing Mine Facilities – Access – New Infrastructure – Employment and Demographics – Wollondilly Community Strategic Plan (local strategic community direction) – Community Contributions • In terms of natural features – the potential for the project to affect local natural features, resulting in impacts upon the community's sense of place – the Project amendments would result in the following reductions in impacts: – SSTS: reduced clearing from 43.4 ha to 23.57 ha (approximate 46% reduction) – *Persoonia bargoensis*: avoided removal of 96 individuals, leaving eight individuals that would be impacted by the Amended Project – *Grevillea parviflora* subsp. Parviflora: avoided removal of 2,324 individuals, leaving 491 individuals that would be impacted by the Amended Project – *Pomaderris brunnea*: avoided removal of approximately 40 individuals, leaving one individual that would be impacted by the Amended Project	• No change in impacts: – Use of Existing Mine Facilities – Access – New Infrastructure – Employment and Demographics – Wollondilly Community Strategic Plan (local strategic community direction) – Community Contributions • In terms of natural features – the potential for the project to affect local natural features, resulting in impacts upon the community's sense of place – the Project amendments would result in the following reductions in impacts: – SSTS: reduced clearing from 23.57 ha to 10.10 ha (approximate 57% reduction) of which, 1.42 ha already has approval to be disturbed under existing approvals – *Persoonia bargoensis*: avoids impacts to all but one individual – *Grevillea parviflora* subsp. Parviflora: avoids removal of a further 436 individuals, leaving 55individuals that would be impacted by – *Pomaderris brunnea*: avoids impacts to all indivisuals	Reduced impacts
Access to, and use of, infrastructure, services and facilities	• There would be little, if any, change in impacts as a result of the Project amendments for – Subsidence impacts – Construction damage – Resources Workforce – Royalties	• There would be the following changes to impacts on – Subsidence impacts – significant reduction – Construction damage – significant reduction – Resources Workforce – no change – Royalties – reduction in royalties	Subsidence and construction damage – reduced impact Workforce resources – no change Royalties – reduction in royalties

Table 6.17 Summary of social impacts

Aspect	Change from EIS to PAR (AECOM 2020c)	*Change from PAR to project amendment report*	Change in impact
Culture	• There are three Aboriginal cultural heritage sites (comprising stone artefacts) that are now outside of the limit of subsidence • An addendum to the ACHA been prepared to address the additional archaeological test excavation and assessment, which identified one ironbark tree with scarring within the Project area, however specialist assessment concluded the scar was relatively modern and of European origin	• No material changes to impacts	No change
Health and wellbeing	• There would be little, if any, change in impacts as a result of the Project amendments for: – Anxiety relating to subsidence impacts – Anxiety relating to impacts to natural systems, including greenhouse gases • Noise impacts would reduce as a result of the Project amendments	• Likely to be reduction in the anxiety of the community as a result of significant reduction in subsidence impacts • Unlikely to be any change in the anxiety of the community as a result of impacts to natural systems despite reduced impacts to surface and groundwaters and reduced GHG emissions	Anxiety related to subsidence – reduced impacts Anxiety related to natural systems – no change
Other impacts	• Personal and property rights • Decision making systems • Fears and aspirations	• Likely to be a reduction in impacts associated with other matters as a result of a reduction in the number of houses and private bores impacted	Reduced impacts
Cumulative social impacts			
Direct cumulative social impacts	• Workforce for the Project, and extent of other mining operations are largely unchanged by the Project amendments	• No change	No change
Indirect cumulative social impacts	• Reduction in impacts on terrestrial ecology may reduce concerns in the community regarding the overall environmental impact of the Project • Additional commitments made by Tahmoor Coal to reduce the GHG impacts of the Project (ie a parent company target to achieve zero carbon emissions by 2030) may reduce concerns in the community regarding the overall environmental impact of the Project	• Significant reduction in biodiversity impacts • Reduction in GHG emissions	Reduced impacts
Economic	• Increase in net benefit from $699.5 million to $783.8 million	• Decrease in net benefit from $783.8 million in net present value (NPV) to $664.9 million NPV	Increased due to decreased economic benefit

As the table demonstrates, in most aspects, the predicted level of social impact has reduced because of the amendments to the Project, particularly in relation to subsidence and subsidence-related impacts. In all of aspects, bar one, the predicted level of social impact has stayed the same.

The only aspect where the level of social impact has increased relates to the social benefits derived from the economic impacts of the Project. That is because the overall net benefit of the Project has reduced from $783.8 million NPV to $664.9 million NPV, a reduction of $118.9 million NPV. This is due to the removal of LW107B and LW108B from the mine plan which results in a net reduction in coal volume from 43 Mt ROM in the PAR to 33 Mt ROM. These reductions have resulted in an overall decrease in ROM and resource recovery by 31 per cent. However, the reduction in the predicted level of social impacts is also directly related to the removal of these longwalls and the resultant improvement in subsidence and subsidence-related impacts. However, as demonstrated in the following section (Section 6.12), the economic benefits of the Project on NSW and the local area are still significant.

Of the community submissions that raised concerns or objected to the Project during the exhibition of the EIS, and the community representations that raised concerns or objected to the Project following the exhibition period, the main issue was subsidence and subsidence-related impacts. This has been addressed in Section 6.2, however, as demonstrated in that section and in Table 6.17, these impacts have been substantially reduced as a result of the amendments to the Project.

6.11.2 Conclusion

Overall, the predicted level of social impact has reduced because of the amendments to the Project, particularly in relation to subsidence and subsidence-related impacts. Of all the social aspects considered, impacts in only one aspect has increased. This is the social benefits derived from the economic impacts of the Project which is due to the removal of LW107B and LW108B from the mine plan which results in a net reduction in coal volume mined by the Project. However, the reduction in the predicted level of social impacts of the Project is also directly related to the removal of these longwalls and the resultant improvement in subsidence and subsidence-related impacts.

As documented in the EIS and PAR, residual social impacts from the Project can be managed by Tahmoor Coal through the implementation of mitigation measures which have been informed by over 40 years of mining in the Southern Coalfields and through significant experience gained in managing social impacts in consultation with the community and other stakeholders.

6.12 Economic

Ernst & Young (EY) has undertaken an assessment of the economic impacts of the proposed amendments of the Project. A copy of this *economic assessment* can be found in Appendix K.

The *economic assessment* was prepared in accordance with the economic assessment framework set out in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines) released by the NSW Government in December 2015. The analysis is also consistent with the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (the Technical Notes) published in April 2018.

Consistent with the Guidelines, the assessment includes a cost-benefit analysis (CBA) and a local effects analysis (LEA). The CBA provides an estimate of the net benefits of the Project to NSW, while the LEA is based on analysis for the Wollondilly local region (as defined by the Australian Bureau of Statistics SA3 (12303) region). In addition to the CBA and LEA, an assessment of the economic impacts of the amended Project on the Wollondilly region of NSW based on computable general equilibrium (CGE) modelling has also been undertaken. The CGE modelling considers the coal output, the payment of royalties from Wollondilly into the rest of NSW, the repatriation of profits overseas and that workers from the NSW would be drawn into the Wollondilly LGA.

6.12.1 Cost benefit analysis

The net benefit of the Project is estimated to be $664.9 million in NPV. This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively and an incremental cost of the Project is $0.1 million. This represents a decrease in economic benefit when compared to the CBA undertaken in the EIS and PAR which was $699.5 million and $783.8 million in NPV terms, respectively.

The Project would generate the following direct benefits:

- an overall net producer surplus (NPS) of $119.6 million in NPV terms, of which zero is attributed to NSW as Tahmoor Coal is 100 per cent foreign owned;
- total corporate taxes of $178.7 million in NPV terms for Australia, of which $57.2 million is attributed to NSW; and
- $157.8 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $131.5 million with council rates and payroll taxes contributing $4.7 million and $21.5 million, respectively.

The indirect benefits of the Project are related to the linkages that the Project has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $450.0 million in estimated indirect benefits:

- worker benefits are $216.9 million in NPV terms; and
- supplier benefits are $233.2 in NPV terms based on NSW-based operational expenditure over the life of the development of $1,155.5 million in NPV terms.

The incremental indirect costs of the Project are $0.1 million, attributed entirely to GHG emissions. Other indirect costs, like subsidence, noise air quality and biodiversity impacts are being borne by the proponent and are included in the financial costs of the Project.

Consistent with the guidelines, systematic sensitivity analysis of the estimated net benefits is undertaken in this report. This sensitivity analysis shows that the estimated net benefits are robust in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis.

In isolation, the estimated net benefit of the Project is most sensitive to the coal price assumptions underpinning the analysis. For example, assuming coal prices are 25 per cent lower than the central case assumptions, the net benefits to NSW are estimated to be $570.8 million in NPV terms (a 14.2 per cent reduction in net benefit).

The lower bound estimate of net benefits, which takes the most pessimistic assumptions around coal prices, capital expenditure, operational expenditure, worker and supplier benefits as well as indirect costs, yields an estimated net benefit to NSW of $526.3 million in NPV terms. The upper bound estimate, based on the most optimistic assumptions, is $811.5 million in NPV terms.

The results are relatively sensitive to the choice of discount rate chosen due to the long timeframe of the Project. The NPV of the estimated net benefits to NSW range from between $555.4 million and $805.4 million under real discount rates of 10 and 4 per cent respectively.

6.12.2 Local effects analysis

The LEA considers the costs and benefits of the Project on residents of the Wollondilly region of NSW. The analysis shows an estimated net benefit of $137.5 million to the Wollondilly region in NPV terms. This is driven largely by:

- benefits to local workers of $100.3 million in NPV terms based on the assumption that 45 per cent of the mine's direct employees continue to be drawn from Wollondilly;
- benefits to local suppliers of $32.5 million in NPV terms which assumes that 12.9 per cent of the inputs to production are from the region; and
- the payment of local Council rates totalling $4.7million in NPV terms.

The *economic assessment* found that the estimated local effects are robust under the sensitivity analysis conducted with a lower bound estimate of net benefits to the Wollondilly region of $129.8 million and upper bound estimate of $146.2 million in NPV terms.

6.12.3 Economy-wide modelling

Overall, the Project is expected to provide positive economy-wide impacts to both Wollondilly SA3 region and to NSW. The net economic impacts of the Project are shown in Table 6.18. In the Wollondilly region, the Project is expected to increase real gross regional product (GRP) by $1,624.5 million in NPV terms. Real gross regional income (GRI), a proxy for regional welfare, is projected to increase by $1,189.0 million in NPV terms. The projected increase in real GRI is significant to the relatively small Wollondilly region. In total, the Project is expected to increase welfare for each person in the region by $19,681.7 in NPV terms.

For NSW, the projected increase in real gross state product (GSP) is $1,844.6 million in NPV terms. Real gross state income (GSI) is projected to increase by $2,347.4 million.

Table 6.18 Economy wide impacts

Variable	Description	Wollondilly	NSW
Real GRP	NPV - $m	1,624.5	1,844.6
Real GRI	NPV - $m	1,189.0	2,347.4
Employment	Average FTE	245.4	138.0
Real wages	Average	4.11	0.02
Real GRI per person	NPV - $	19,681.7	193.9

Source: EY

Total employment in the Wollondilly region is projected to increase by 245.4 full time equivalent (FTE) workers on average, and across NSW employment is projected to increase by 138.0 FTE.

6.12.4 Computable general equilibrium modelling

In total, the Project is expected to provide positive economy-wide impacts to both Wollondilly SA3 region and to NSW. In the Wollondilly region, the Project is expected to increase GRP by $1,624.5 million in NPV terms. GRI or regional welfare, is projected to increase by $1,189.0 million in NPV terms. The projected increase in GRI is significant to the relatively small Wollondilly region. In total, the Project is expected to increase welfare for each person in the region by $19,681.7 in NPV terms.

For NSW, the projected increase in GSP is $1,844.6 million in NPV terms. GSI is projected to increase by $2,347.4 million.

Total employment in the Wollondilly region is projected to increase by 245.4 FTE workers on average, and across NSW employment is projected to increase by 138.0 FTE.

6.12.5 Conclusion

The *economic assessment* demonstrates that the Project would generate significant economic benefits to the local and State economy, with a net benefit of $664.9 million in NPV.

7 Response to advice

7.1 Introduction

DPIE received advice from the following government agencies in relation to the *submissions report* (AECOM 2020a) and PAR (AECOM 2020b) submitted in February 2020:

- SA-NSW;
- DPIE – Crown Lands (DPIE-CL);
- DPIE-BCD;
- Heritage Council of NSW (HC-NSW);
- WaterNSW;
- Environment Protection Authority (EPA);
- DPIE-RR;
- NSW Health, South Western Sydney Local Health District;
- Transport for NSW (TfNSW);
- Roads and Maritime Services (RMS);
- DPIE – Division of Resources and Geoscience (DPIE-DRG); and
- DPIE-W.

Advice was also received from WSC.

On 1 April 202, DPIE wrote to Tahmoor Coal requesting that it respond to the matters raised in the advice from the government agencies and WSC.

Most government agencies responded to DPIE stating that the issues or concerns raised in their submission on the EIS had been adequately addressed by the submissions report and PAR. This included responses from DPIE-CL, WaterNSW, EPA, DPIE-RR, NSW Health, TfNSW, RMS and DPIE-DRG. Accordingly, no further response is therefore required to these government agencies.

Responses to issues raised by SA-NSW, DPIE-BCD, HC-NSW, DPIE-W and WSC are provided in the following sections.

7.1.1 DPIE - Biodiversity and Conservation Division

DPIE-BCD provided advice relating to potential impacts on biodiversity, particularly with reference to the avoidance principle and impacts to threatened species and SSTF, Aboriginal heritage, and creeks.

The advice provided in DPIE-BCD's advice is provided in the boxes below, along with Tahmoor Coal's response.

i Avoidance of impacts

EIS submission: The proponent did not thoroughly demonstrate how the "avoid" principle of biodiversity assessment policy, guidelines and the SEARs were met with regard to the site's biodiversity constraints. This is particularly critical given the quantum of critically endangered native vegetation and threatened species proposed to be cleared.

RTS advice: We acknowledge the detail provided in the Amended Biodiversity Assessment Report (BAR) relating to this key concern, particularly the substantial reductions in the quantum of clearing and impacts to threatened plants. However, further detail is required. We recommend avoidance be addressed for TSC2 where large numbers of *Grevillea parviflora* and Shale Sandstone Transition Forest occur (see detail below). Several individuals of *Persoonia bargoensis* also occur in this area and we query whether any of these individuals will be avoided and protected. We also query whether Grevillea parviflora will be avoided along the power easements. Figures 3.3 and 3.4 of the Project Amendment Report provide a conceptual location for works at the ventilation shafts, however it is not clear how much vegetation will be removed. If total loss is assumed in TSC 1 and 2, we question whether some of the construction phase infrastructure required for TSC2 could be co-located with TSC1. This would reduce impacts on vegetation, given that TSC1 occurs in a more disturbed area and is reasonably close by.

Figures 3.3. and 3.4 of the Project Amendment Report should be included in the BAR with detail provided on how important biodiversity values were avoided.

Polygon boundaries showing infrastructure in Figure 3 of the BAR are not consistent with polygon boundaries in Figure 2.2 of the Project Amendment Report.

The BAR should include a spatial comparison of clearing areas as originally proposed, and under the current design. Shapefiles showing original (EA) and current (RTS) clearing areas must be provided to EES for verification prior to approval.

Further refinement of the Project design has resulted in an overall reduction of direct and indirect impacts to threatened flora and the SSTF.

As detailed in the *biodiversity assessment* contained in Appendix E, impacts to threatened biodiversity has been reduced for the construction and operation of ventilation shaft TSC 2, and associated transmission line.

Ventilation shaft TSC2 has been modified to retain SSTF and threatened flora towards Charlies Point Road. This has resulted in an avoidance of 0.67 ha of SSTF, and avoidance of impacts on a large population of *Grevillea parviflora* subsp*. parviflora* and *Persoonia bargoensis*.

The transmission line has been revised to maximise the existing cleared land, road, and existing easement as much as practical. Clearing is therefore only required where vegetation encroaches on the proposed transmission line easement. Threatened flora occurring within the transmission line easement would be retained.

The *biodiversity assessment* has provided a spatial comparison of clearing areas as originally proposed, and under the current design, including a Figure showing the avoidance of biodiversity values.

Shapefiles showing clearing areas as proposed in the PAR (AECOM 2020b) and this *second amendment report* will be provided with the *biodiversity assessment*.

ii Impacts to Shale Sandstone Transition Forest

We acknowledge the significant reduction in clearing of native vegetation. However, as vegetation to be cleared still includes a substantial area of CEEC (Shale Sandstone Transition Forest) we request further detail on avoidance of this community as detailed above.

Furthermore, the MNES assessment of Shale Sandstone Transition Forest found a significant impact on this TEC is likely, despite the reduced quantum of clearing.

Further refinement of the Project design has resulted in an overall reduction in direct and indirect impacts to SSTF. This has been detailed in the *biodiversity assessment* contained in Appendix E. The refinement of the surface infrastructure footprint has resulted in a 13.47 ha reduction in the amount of clearing compared to that proposed in the PAR (AECOM 2020b) – refer to Table 7.1.

The key reduction in impact to SSTF because of Project refinement, is attributed to the following:

- REA – the area proposed for the REA has been significantly reduced to only be within the bounds of the currently approved disturbance footprint. As a result, 11.06 ha of SSTF previously proposed to be directly impacted, has been avoided.
- Transmission line - the proposed transmission line has been revised to maximise the existing cleared land, road, and existing easement as much as practical. Clearing is therefore only required where vegetation encroaches on the proposed transmission line easement.
- TSC2 – the area of direct impact to native vegetation for TSC2 has been reduced by 0.67 ha. The retention of a portion of SSTF along Charlies Point Road has avoided direct impacts to threatened flora, including *Persoonia bargoensis* and *Grevillea parviflora* subsp. *Parviflora*.

The unavoidable impact to SSTF is 10.10 ha. Details regarding the biodiversity credits associated with the unavoidable impacted are provided in the *biodiversity assessment report*.

Table 7.1 Impact to Shale Sandstone Transition Forest

SSTF condition class	Area impacted in PAR (ha)	Revised impact (in *second amendment report*) (ha)	Reduction (ha)
Derived	6.31	5.98	0.33
Good	17.26	4.12	13.14
Total	**23.57**	**10.10**	**13.47**

Source: Niche

An update of the MNES assessment for SSTF is provided in the *biodiversity assessment* in Appendix E. The assessment concluded that a significant impact to SSTF was likely. Subsequent biodiversity offsetting is therefore proposed.

iii Hollow bearing trees

Hollow bearing trees are shown on Figure 17 in the Amended BAR. It is not clear which trees can be retained, and which will be cleared, particularly in the vent shaft areas.

A total of seven hollow-bearing trees would be removed for the Project. The location of the hollow-bearing trees in respect to the area of direct impact, are shown on Figure 7.1.

Figure 7.1 Hollow-bearing tree locations

iv Impacts for further consideration

EIS submission: Impacts for Further Consideration (IFFC) for *Persoonia Bargoensis* in accordance with the s9.2 of the NSW Framework for Biodiversity Assessment (FBA) needs to further demonstrate that the local population will not be put at risk of extinction or have its viability significantly reduced as a result of this development.

RTS advice: The reduced impact on this IFFC species is noted. However, further detail on avoidance, particularly in ventilation shaft sites, is still recommended as detailed above.

Impacts to *Persoonia bargoensis* have largely been avoided through the re-design of the REA, transmission line and TSC2. Only one individual will be impacted for the construction of ventilation shaft TSC2. The remaining population would be retained, therefore the local population will not be placed at risk of extinction. Further details are provided in the *biodiversity assessment* contained Appendix E.

The justification for the design of the ventilation shaft sites has been provided in the PAR (AECOM 2020b). The re-design of the infrastructure has significantly avoided impacts to threatened biodiversity as detailed in the *biodiversity assessment*.

v Biodiversity offsets

Conditions of consent will need to address staging, timing of establishment of Biodiversity Stewardship Agreements (BSAs) and credit retirement as well as payment to the fund. We support in principle the site selection of offsets presented to date. We note that full field assessment under the BAM has not occurred as yet. Preliminary surveys have been done to determine if required PCTs and threatened biodiversity are present.

However, the proponent will need to consider if the 2019-20 bushfires have impacted the proposed stewardship sites, particularly for entities that are vulnerable to fire (eg. *Persoonia bargoensis*).

a Offset strategy

The biodiversity offset liability and offset strategy have been updated in the *biodiversity assessment*. Tahmoor Coal have proposed offsetting options, including payment into the Biodiversity Conservation Fund (BCF), as part of the biodiversity offset strategy. Tahmoor Coal may consider the proposed biodiversity stewardship sites (BSS) identified in Table 7.2.

Table 7.2 Potential biodiversity stewardship sites

BSS	Property description	Address	Lot and DP	Total native vegetation (ha)
1	Bargo Colliery land	Ashby Close and 76 Gwynn Hughes Street, Bargo	Lot 170 DP751250 and Lot 35 DP751250	275.0
2	185 Charlies Point Road	185 Charlies Point Road	Lot 2232 DP787222 and Lot 216 DP751250	13.9
3	220 Charlies Point Road	220 Charlies Point Road	Lot 222 DP751250	8.5
4	Pit top	2975 Remembrance Driveway, Bargo	Lot 162 DP1054184	57.9
5	Rockford Road	260 and 270 Rockford Road, Tahmoor	Lot 1 and Lot 2 DP1037712	25.8

Source: Niche

Each of the BSSs are shown on Figure 7.2 and Figure 7.3 in relation to the 2019/2020 bushfire event.

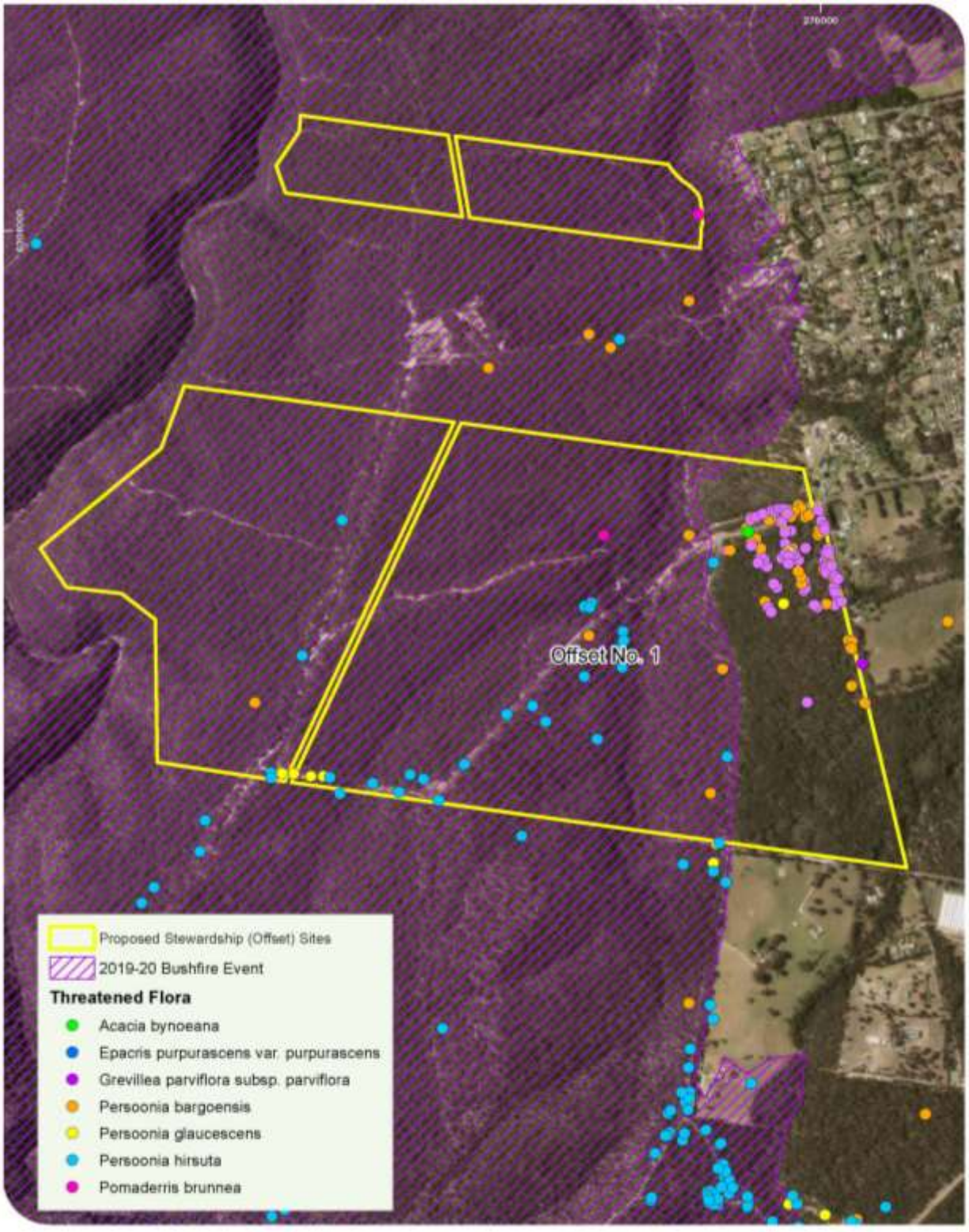


Figure 7.2 Potential biodiversity stewardship sites – Site 1

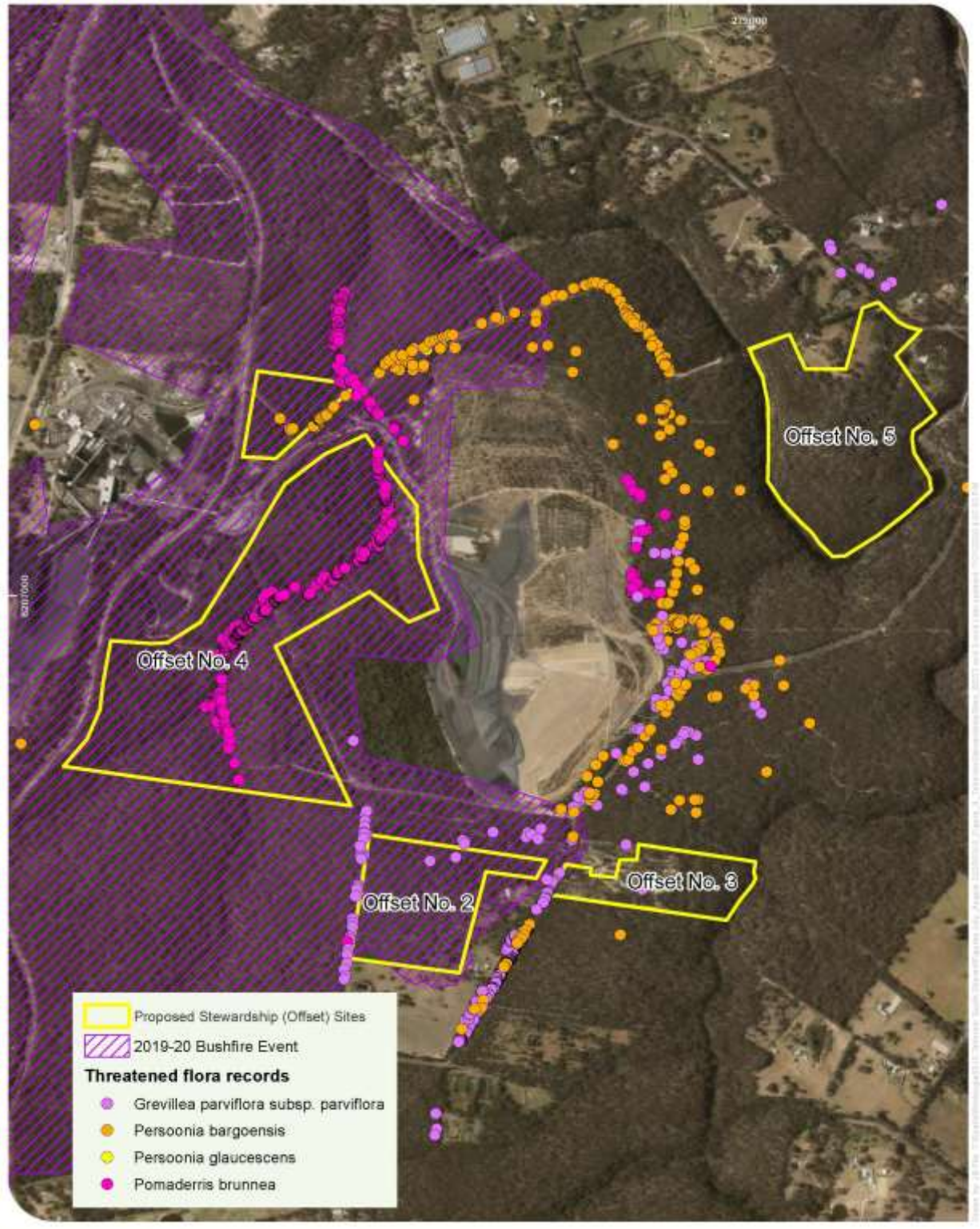


Figure 7.3 **Potential biodiversity stewardship sites – Sites 2 to 5**

b Bushfire impacts

BSS 1

The population of *Persoonia bargoensis* and the core population of *Grevillea parviflora* subsp. *Parviflora* that occur on the eastern edge of BSS 1 were not impacted by the recent bushfire event. The location of the threatened flora is provided in Figure 7.2.

Most of the vegetation to the west of the site was impacted by the bushfire, which in turn has impacted threatened fauna habitat. Niche have requested assistance from the Biodiversity Conservation Trust (BCT) in order to determine the most suitable method for determining fauna survey effort and subsequent species polygons.

BSS 2 and 4

The recent bushfire event has impacted most of the vegetation and associated habitat within BSS 2 and 4 including the extensive population of *Pomaderris brunnea* which occurred along Teatree Hollow Creek. Niche completed the vegetation validation and flora counts prior to the bushfire event. However, we have requested assistance from the BCT to inform the assessment.

BSS 3 and 5

The recent fire event has not impacted BSS 3 and 5.

Further detail on obtaining credits for HN556 (PCT 1395) is also required.

Detail on individual species is discussed below:

- Koala: Addressed in 5.7.6 of the RTS and amended BAR. Area of impacted habitat reduced from 43.5 ha to 17.26 ha.
- Eastern pygmy possum: Addressed in 5.7.6 of the RTS and amended BAR. EPP to be assumed present and offset.
- Large-eared pied bat: Addressed in 5.7.6 of the RTS and amended BAR. Eastern cave bat to be offset as well.
- Red-crowned toadlet: offsets no longer required as the 20 mm subsidence impact area has changed as a result of amendments to mine plan. The 20 mm subsidence impact area now mostly avoids Hornes Creek where the toadlet was originally recorded and impacts are therefore considered unlikely.
- Cumberland land snail: None recorded, therefore no offsets required.
- *Pomaderris brunnea:* Table 5.6. EIS stated 40 *P. brunnea* were to be cleared. This has been reduced to 1 in the amended project.

Tahmoor Coal can pay into the BCF to satisfy the Project's offset liability in-lieu of establishing BSSs or purchasing credits on the market. As such, there is confidence that the offset for HN556 (PCT 1395) can easily be secured.

Impacts associated with threatened species have been reduced due to the changes in vegetation disturbance associated with the Project. The updated impacts associated with threatened biodiversity are provided in the *biodiversity assessment* contained Appendix E.

There were minor issues with credit calculations and updates requested at EIS stage. The credit calculator was re-run to reflect the amended footprint and the proponent must submit the case for EES to review prior to approval. The proponent noted that offset site surveys were carried out in accordance with the BAM.

The BioBanking credit calculator has been updated to reflect the changes in the amended design.

The biodiversity credit obligation has been detailed in the *biodiversity assessment*.

The BioBanking calculator case has been submitted.

The need for a Biodiversity Management Plan was highlighted at EIS stage. This has been incorporated into the Revised Management Measures for the Amended Project. A requirement to develop the Plan in consultation with EES should be imposed as a condition of consent.

This comment is noted.

vi Aboriginal cultural heritage

We note the predicted low likelihood of harm to Dog Trap Creek site complex but acknowledge that a level of risk remains. We maintain our recommendation that reducing the length of Longwalls 101 and 103 would provide further protection to the Dog Trap Creek site complex. We note that dust and vibration impacts will continue to be monitored during operation of the project. The impact of changed hydrological patterns in Dog Trap Creek on Aboriginal cultural heritage values should be considered in the HMP.

Tahmoor Coal has made significant modifications to it mine plan, and as a result, coal volume has decreased from 48 Mt ROM in the EIS (AECOM 2018), to 43 Mt ROM in the PAR (AECOM 2020b), to now 33 Mt ROM as documented in this *second amendment report*. These reductions have resulted in an overall decrease in ROM and resource recovery by 31 per cent.

It is now considered that the Project provides the best balanced outcome for the Wollondilly LGA, the region and NSW, taking into account and balancing the benefits and impacts of the Project. Reducing the length of LW101B and LW103B would further reduce ROM volumes by around 1 Mt impacting resource recovery and benefits to local, regional and NSW economies.

Adaptive management techniques will be applied to monitor the ground movements during the extraction of the longwalls in the vicinity, and if required, the commencing position of LW103B could be shortened.

Results of test excavations must be provided to the AHIMS Register as a site recording form as per Requirement 16a(13) of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*. This must occur as soon as possible. We note that Glenda Chalker of Cubbitch Barta Native Title Claimants provided comments on the proposed test excavation methodology (EMM 2020). Ms Chalker reiterated the high Aboriginal cultural heritage significance of Dog Trap Creek and commented on the scarred tree and test excavation assessment processes. EMM (2020) addressed these comments.

The results of the text excavations undertaken for TSC2 were provided in a report entitled *Tahmoor South Project Addendum to the Aboriginal Cultural Heritage Assessment* (EMM 2020b). The report was contained in Appendix 9 of the *Aboriginal Cultural Heritage Assessment* (Niche 2020c) that accompanied the PAR (AECOM 2020b).

The test excavations were undertaken by EMM over three days – 1 to 3 October 2019. The methodology included:

- A series of linear transects (TR) were set out across the TSC2 ventilation shaft location.
- 50 cm x 50 cm test pits were spaced at 20 m intervals along each transect.
- The first test pit at each site was dug manually with hand tools in 5 cm spits to identify the nature of the soils and to identify if a stratigraphic sequence existed. The remaining pits were dug in 10 cm spits as no stratigraphic sequence was identified.
- Each pit was excavated until basal clay or impenetrable parent rock (ie ironstone and/or shale) was reached.
- All excavated soil was sieved on-site using a dry sieving technique. The soil was sieved through 5 mm aperture mesh sieves.

- All test pits were backfilled by the excavation team after each pit was recorded.

A total of 38 test pits (50 cm x 50 cm) were excavated amounting to 9.5 square meters (m^2) total excavation area. No artefacts were recovered from excavation.

Section 2.6 of EMM (2020b) states:

> Archaeological potential is expressed as being low, moderate, high or no potential. These terms refer to the likelihood of recovering subsurface Aboriginal objects and are defined as follows:
>
> - low potential: it is against expectation for Aboriginal objects to occur;
> - moderate potential: Aboriginal objects could occur but in an uneven or highly clustered manner;
> - high potential: Aboriginal objects almost certainly occur throughout the identified area; and
> - no potential: Aboriginal objects cannot occur unless artificially imported– typically because of the artificial landform.
>
> Based on the predictive model and results as outlined in the ACHA, archaeological resources of the area are more likely to be concentrated in closer proximity to water sources (ie within 200 m) and in association with rock outcrops (ie shelter sites). The location of the disturbance footprint of TSC 2 and Aboriginal site Charlies Point Road OCS-1 is 500 m from the nearest water source (Dogtrap Creek) and is situated on a featureless, plain landform within which focal points for past activity cannot be readily defined.
>
> The archaeological potential of the TSC 2 area has been assessed as low to moderate. Surface artefacts identified as Charlies Point Road OCS-1 demonstrate that artefacts have the potential to occur, however the results of the test excavation in identifying no archaeological material support the assessment that Aboriginal objects are likely to be in very low density.

As a result, an Aboriginal Site Impact Recording form is not a requirement post-excavation; however, if, in future, the artefacts are moved or harmed, one will be prepared and submitted to AHIMS.

The applicant has not addressed the impact of landscape and hydrological changes on the Dreaming site. This could include changes to watercourses, hydrological characteristics of the area and intangible cultural heritage values, notwithstanding the site's location outside the 20 m contour. This matter should be updated.

The potential Aboriginal dreaming site Bandibong (AHIMS ID#52-2-1599) will not be impacted by the Project as it has no physical location. The site was registered by W.T. Bluff in 1991 based on his diary entry. The AHIMS site card describes the site below:

> My information from Pheasants Nest tells me that "Coombes Sugarloaf" was known to the local Koorie's at Bindiblong or Bindibiong and the area around the knob was known as Wollamulk. Bindi [undetermined] point: Bindibong Hill Wollamulk plenty kangaroo's.
>
> Governor Macquarie was given this information by his native guide when they climbed the knob in 1815.

The AHIMS site card can be found in Appendix L. No further information about this potential Aboriginal dreaming site or dreaming story was gleened through the consultation process for the Project.

We note that the HMP will be prepared prior to ground disturbance occurring. DPIE require the HMP to be prepared in consultation with the Registered Aboriginal Parties and request the opportunity to provide comment on the draft HMP. We recommend the HMP include:

- risk of impact to artefact scatters and single stone artefacts from subsidence, mining operations and future remediation works;
- Aboriginal cultural heritage survey of land that has not yet been surveyed if future ground;
- disturbance works are proposed in those areas;
- impact assessment of changed hydrological patterns in Dog Trap Creek on Aboriginal cultural heritage values;
- impact to the cultural landscape of the Dreaming site and how these will be avoided;
- whether there are specific management actions required to address the information provided by Historical Indigenous Research regarding 'men's business sites' (Niche 2018, p.71);
- risk of impact to artefact scatters and single stone artefacts from subsidence, mining operations and future remediation works; and
- detailed processes for avoiding and limiting harm to grinding groove sites.

Site cards must be submitted as soon as possible to comply with section 89A of the *National Parks and Wildlife Act 1974*. We also note that the site recorded by EES has been incorporated into the assessment.

This comment is noted.

vii Water and subsidence

We acknowledge the proposed amended layout and reduced impact through changes to longwall geometry. However, there remains insufficient avoidance of 3rd order and above streams or cumulative impact assessment for loss of water/flow to the Upper Nepean River catchment. It is acknowledged that all 3rd order sections of these streams above longwalls will likely be fractured and drained by the proposed longwall mining.

Tahmoor Coal has designed a mine layout that avoids mining directly beneath significant streams in the region. Every stream was assessed for significance on a case by case basis. The stream order was considered as one of many factors when assessing significance. For example, one 3rd order section of Dog Trap Creek was identified as significant due to its archaeological significance, and the longwalls were setback from this section.

If the mine plan was adjusted to avoid mining beneath all 3rd order streams, regardless of their significance, the proposal would not be economically viable. Tahmoor Coal is committed to remediate 3rd order streams, particularly where permanent pools are observed to be drained more frequently than they currently lose water due to non-mining reasons.

The likelihood of fracturing and drainage of pools above longwalls has been addressed in the *subsidence assessment* by MSEC (Appendix F of the EIS (AECOM 2018)) and the SWIA by HEC (Appendix J of the EIS).

In particular, it was predicted that less than 10 per cent of pools on Tea Tree Hollow would be impacted by subsidence, while on Dog Trap Creek less than 30 per cent of pools, on average, were predicted to be impacted. Therefore, not all 3rd order sections of these streams will be impacted by the Project.

Regarding the loss of flow to the Upper Nepean River catchment, although there may be fracturing and drainage in some portions of streams overlying longwalls, this would be as a result of localised near-surface fracturing and flow diversion. Partial or complete diversion of surface water and loss of water from directly undermined streams and pools may occur at locations and times where the rate of flow diversion is greater than the rate of incoming surface water and where substantial fracturing occurs. However, it is unlikely that there would be any resulting net loss of

flow from the catchment, because any redirected flow would not be diverted into deeper strata or the mine (no connective or surface to seam cracking is predicted), rather flow would reappear in the surface water system further downstream. This behaviour has been observed and is evident in the recorded streamflow data from Redbank Creek – refer Section 5.2 of the SWIA (Appendix J of the EIS). Such behaviour has also been noted at other longwall mining operations in the Southern Coalfield, eg at the Dendrobium Mine[3].

Some localised reduction in streamflow in the streams in the vicinity of the Project may occur due to reduction in baseflow as described in Section 6.3 of the SWIA (Appendix J of the EIS) and Section 5.7 of the *groundwater assessment* by HydroSimulations (Appendix I of the EIS). The predicted maximum baseflow reduction because of the Project totals 0.59 megalitres per day (ML/d). The mean and median daily flow rate in the Nepean River (at Maldon Weir), based on recorded data from 1973 to 2020 is 618 and 20.3 ML/d, respectively. A maximum reduction of 0.59 ML/d represents 2.9 per cent of the median daily flow in the Nepean River at Maldon and less than 0.1 per cent of the mean daily flow. The maximum predicted baseflow reduction in the Nepean River at Maldon Weir because of cumulative mining is 1.3 ML/d, which represents 6.4 per cent and 0.2 per cent of the median and mean river flows, respectively.

The above small decreases in flow reporting to the Nepean River would be more than offset by increases in licensed discharge from the Project. Licensed discharge of treated water occurs and is proposed to continue to occur for the Project to Tea Tree Hollow, a tributary of the Bargo River which in turn flows into the Nepean River. Licensed discharge totalled 1,568 ML in 2019, with just over 1,400 ML discharged in 2018[4]. Water balance modelling for the Project (Appendix J of the EIS) forecasts that median licensed discharge would be maintained at approximately 1,500 ML until 2024 before rising to a peak of 2,595 ML in 2033. These rates equate to a daily discharge of between 4.1 ML and 7.1 ML, which is significantly more than the maximum predicted Nepean River baseflow reduction.

Issues also remain with the hydrological and groundwater models presented in the RTS, as follows:

1. Models are poorly calibrated and not validated
2. Modelling provides no error bounds around baseflow losses (likely to be at least as large as the figures provided)
3. Only baseflow loss and not pool fracturing and drainage when modelling flows/water loss are considered
4. The flow assessment does not conform to a BACI design (which would help further demonstrate the inadequacies in conclusions based on the modelling)
5. Most of the modelling and conclusions for Redbank Creek are based on data collected after the stream had already been impacted by earlier longwalls, invalidating conclusions suggesting lack of impact
6. Conclusions of baseflow return in Redbank Ck are made without adequate scientific evidence (or peer review of such evidence) - there appears to be both datum and rating curve changes that affect assumptions and conclusions in the modelling
7. Modelling does not consider nearby reference gauge behaviour (eg Stonequarry Creek; Redbank Ck is a tributary of Stonequarry Creek).

[3] South32 – Illawarra Metallurgical Coal (2020). "End of Panel Surface Water and Shallow Groundwater Assessment: Longwall 15 (Area 3B)". Report D20358 prepared by HGEO Pty Ltd, May.

[4] Tahmoor Coal Pty Ltd (2020). "2019 Annual Review and AEMR". SIMEC Mining, Rev 1 March,

a Issue 1 – Model calibration/validation

Hydrology model

Catchment yield (daily streamflow) models have been developed for the following streamflow monitoring stations as documented in the *surface water baseline study* (SWBS) and SWIA (both in Appendix J of the EIS (AECOM 2018)):

- Dog Trap Creek downstream (GS 300063);
- Eliza Creek (GS 300073);
- Bargo River Upstream (GS 300010A); and
- Redbank Creek (Site R11).

Model calibration is described in Appendix J of the EIS, with goodness-of-fit metrics for the first three streams presented in Section 5.4 of the SWBS. These are described as varying between very good, satisfactory and acceptable, with coefficients of determination on monthly flows of between 0.72 and 0.77. For Redbank Creek the coefficient of determination was 0.94. These metrics do not support the assertion that the models are poorly calibrated.

The veracity of the models is further demonstrated by undertaking sensitivity analyses - where key model parameters (surface store capacities and baseflow index) have been varied by +/-20 per cent. The corresponding effect on the flow duration curves for the four stations for their respective periods of calibration are shown in Figure 7.4 to Figure 7.7.

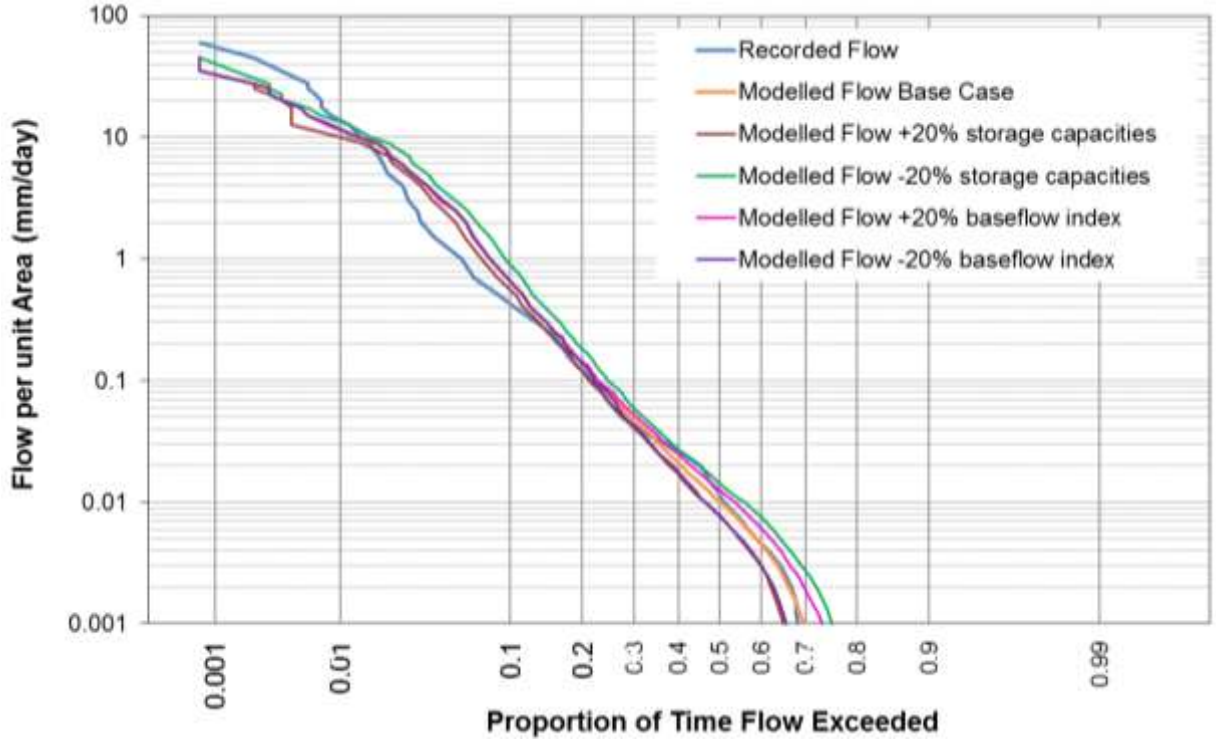


Figure 7.4 Modelled and Recorded Flow Duration Curves - Dog Trap Creek Downstream (GS 300063)

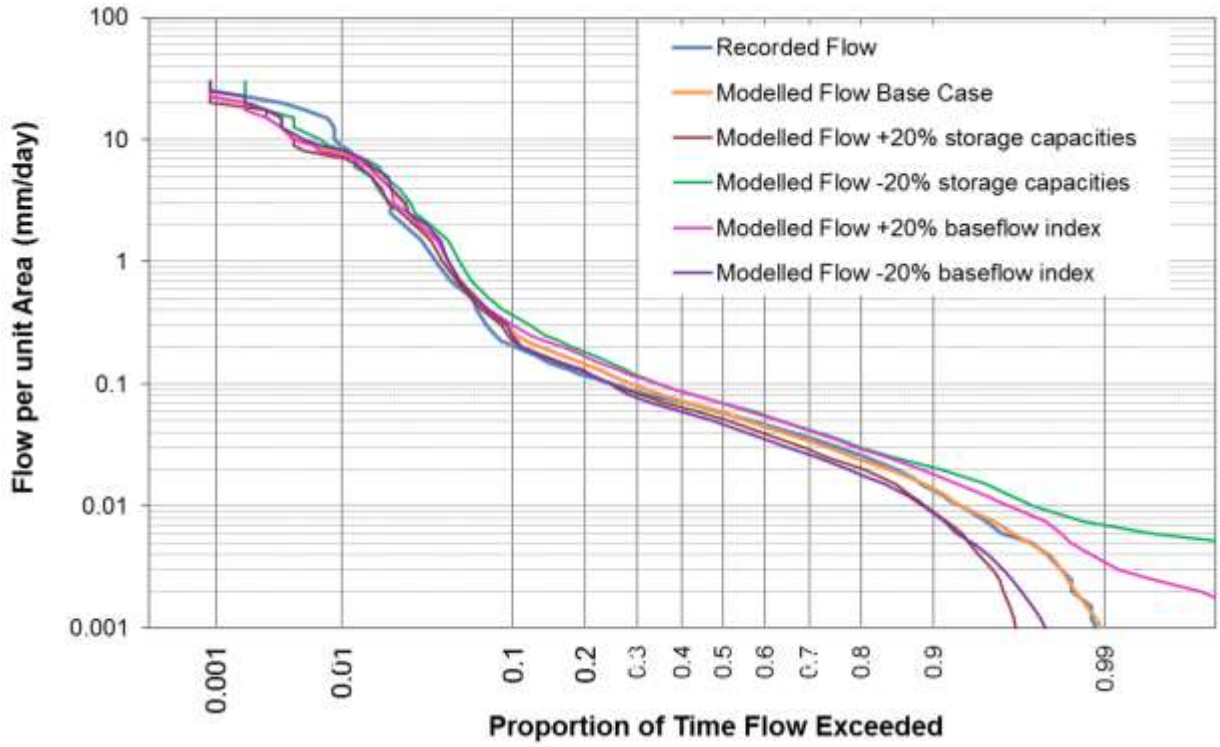


Figure 7.5 Modelled and Recorded Flow Duration Curves - Eliza Creek (GS 300073)

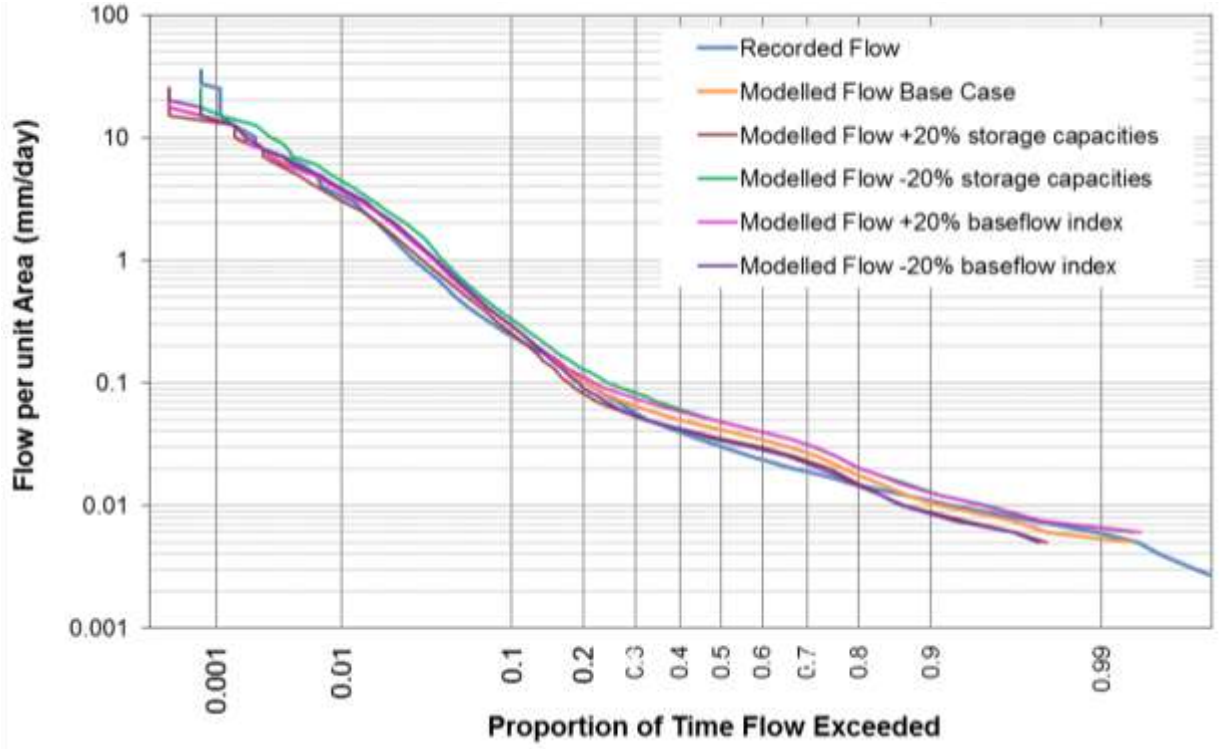


Figure 7.6 Modelled and Recorded Flow Duration Curves - Bargo River Upstream (GS 300010a)

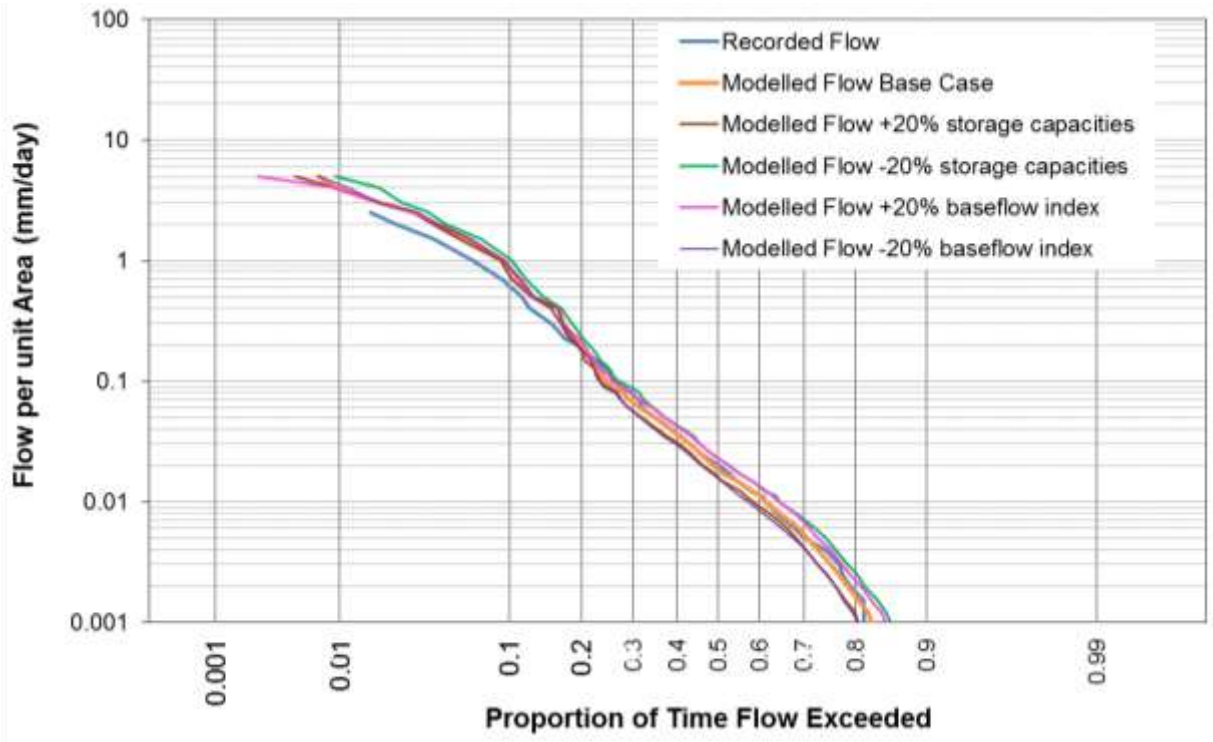


Figure 7.7 Modelled and Recorded Flow Duration Curves - Redbank Creek (Site R11)

The above flow duration curves indicate that model results are not highly sensitive to significant changes in the key model parameters. This illustrates the robustness of the AWBM and further supports the results reached from the use of these catchment yield models.

For the Redbank Creek and the Bargo River monitoring stations, the full period of available data was used for model calibration. For Dog Trap and Eliza creeks, the periods of calibration ended in 2015 when the stations were temporarily decommissioned – these stations have since been recommissioned, however only a limited period of data was available prior to EIS reporting. Data collected since recommissioning will be used to validate the models prior to Project commencement (in order to maximise the period of data for validation).

Groundwater model

Groundwater model development and calibration is described in HydroSimulations (2020). A number of metrics of calibration are presented for the model as a whole as well as layer-by-layer statistics. A discussion of structural errors and other sources of mismatch between modelled and observed behaviours is provided.

The groundwater model has been calibrated against groundwater levels, mine inflow and baseflow fluxes, while being constrained by independent estimates of recharge and a large dataset of hydraulic conductivity field test results. The model calibration presented meets the requirements of the *Australian Groundwater Modelling Guidelines* (Barnett et al 2012).

DPIE-W's submission on the PAR (AECOM 2020b) stated [*our emphasis*]:

> DPIE Water notes that *the revised groundwater model (and report) have already addressed many of the previous issues raised by DPIE-Water* (and other submitters). The model revision has lowered the mean absolute error from c. 21 m to c. 11 m and the Scaled Root Mean Square (SRMS) from 3.7% to 2.8%, and *includes additional improvements to the model* and report. As such, *DPIE-Water has a higher level of confidence in the provided analysis and results*, but there are still issues that must be addressed in future editions of the model.

DPIE-W do not state that there is a significant deficiency in calibration that means that the modelling cannot be relied on. A plan for future revision of the modelling has been prepared and is attached in Appendix M.

In relation to the groundwater model calibration, it should be noted that DPIE's independent groundwater expert, (HydroGeoLogic 2019), has stated:

> Model calibration performance is acceptable statistically in terms of the 2.8% weighted scaled RMS value, well within the AGMG criterion of 5%. The performance is sound in terms of the multiple criteria applied (groundwater levels, mine inflow fluxes, dewatering discharge salinity, height of fracturing, aquifer properties, baseflow flux estimates and hydrological variability). The methodology applied is well-executed to reduce potential non-uniqueness, with conservative assumptions applied where warranted (e.g. transmissive faults), consistent with best practice and confirming the model as a fit for purpose predictive tool.

b Issue 2 – Baseflow loss error bounds

The aim of the groundwater modelling is to provide conservative estimates, in line with the recommendations of IEPMC (2019), which highlighted the difficulties in accurately predicting such losses from groundwater models due to the differences in spatial and temporal scale. Further, actual future losses will be dependent on weather conditions (smaller ML/d losses but with more visible effects during dry periods, higher losses but less visible consequences during wet periods). A further limitation is that groundwater pumping by third party bores is uncertain. WaterNSW have not been able to provide reliable estimates of historical pumping from registered bores for this area. Thus, the effects on surface water from pumping from the Hawkesbury Sandstone aquifer (which is the source of most groundwater abstraction), over and above the effects of mining, cannot be confidently quantified.

Predictions of surface water losses by the groundwater model are based on simulated drawdown from mine dewatering and associated subsidence/deformation processes including simulated surface cracking effects, and the use of specified head boundary conditions (MODFLOW Rivers) to simulate watercourses leaking to the subsurface (or with reduced baseflow to the watercourse). This method has been used because it typically produces conservative estimates of flow reductions (based on experience at Dendrobium, where model results are now compared against analysis of field data).

The *Groundwater Modelling Plan* in Appendix M (includes a recommendation regarding the potential to calibrate an updated groundwater model to estimated historical surface water losses around Tahmoor.

c Issue 3 – Baseflow loss and not pool fracturing and drainage are considered when modelling flows/water loss

That is correct because, as outlined above in the response to Issue 1, localised fracturing (that could contribute to reduced water levels in pools) causes flow diversion locally and should not affect catchment yield/water loss. Further, the recorded total flow at Redbank Creek site R11 for the period from station commencement to 10 September 2019 (just prior to the end of LW32) totals 6,612 ML, compared with a volume of 6,828 ML from the calibrated catchment yield model – this is within approximately 3 per cent and indicates no loss of flow.

d Issue 4 - The flow assessment does not conform to a BACI design

A before-after-control-impact (BACI) approach is a method used to detect changes in systems due to an activity – in this case mining. For the Project area, this approach will be adopted as part of the water management plan for the Project. This will include the establishment of trigger action response plans (TARPs) which use baseline (before) data and data from sites in other catchments (controls) to assess if impacts have occurred post mining (after). TARPs are described in Section 12.2 of the SWIA (Appendix J of the EIS (AECOM 2018)).

It is unclear how the flow assessment presented in the EIS for the Project area streams (eg Dog Trap Creek) can conform to BACI design prior to the impact (ie the Project) occurring. For the Redbank Creek flow analysis presented

in Section 5.2.1 of the SWIA (Appendix J of the EIS), it is recognised that, in the strictest sense, there is no 'before' data available, with flow data available only from the period of mining of LW25. However, LW25 resulted in undermining of less than 5 per cent of the catchment area of site R11. Furthermore, LW25 is located approximately 3 km upstream of site R11, which is the focus of the streamflow analysis reported in the SWIA. Therefore, the effect on streamflow of LW25 recorded at R11 is likely to have been low during this period (the period used for model calibration) - this is supported by the monitoring data. The analysis is aimed at illustrating the effect on streamflow magnitude and the flow regime of progressive longwall mining. The analysis demonstrates a change in the flow regime during and after mining. Further analysis of flow data from Redbank Creek site R11 against a 'control' site is presented in response to Issue 7 below.

e Issue 5 - Modelling and conclusions for Redbank Creek are based on data collected after the stream had already been impacted

The aim of the analysis was to demonstrate the change in flow regime at monitoring site R11 during mining – hence it is agreed that most of the data analysed has been collected for the period after subsidence-induced effects have occurred in the upstream catchment. However, as indicated above in response to Issue 4, the effect of mining during the period of data used for model calibration is likely to have been low.

f Issue 6 – Lack of scientific evidence of Redbank Ck baseflow return - datum and rating curve changes

It is unclear from DPIE-BCD's advice what 'scientific evidence' is requested. The analysis undertaken illustrates a clear change in the flow regime in Redbank Creek, based on a well-established, reviewed and accepted catchment yield model that has been well calibrated. The analysis has been internally reviewed by HEC.

HEC are not aware of any datum or rating changes that would affect recorded data. The hydrographic consultants[5] that manage the gauging stations have indicated that the only datum changes would have involved a change from a local datum to Australian Height Datum (AHD) – this would not affect the stage/discharge relationships (ratings).

g Issue 7 –Modelling does not consider nearby reference gauge behaviour (eg Stonequarry Creek)

Flow duration curves for Redbank Creek at Site R11 (downstream of longwall mining effects) for the period of mining of LW25 and LW26 respectively are shown below in Figure 7.8 and Figure 7.9 reproduced from Figure 14 and Figure 16 of the SWIA (Appendix J of the EIS (AECOM 2018)). The flow record during the mining of these two longwalls corresponds to a period of low impact to flow at Site R11. Also plotted are concurrent flow duration curves for the Stonequarry Creek at Picton gauging station – showing both recorded flow and flow modelled using a calibrated AWBM for this gauging station. Flow data is plotted on a per unit catchment area basis which obviates the significant difference in the catchment areas of the two gauging stations.

[5] Hydrometric Consulting Services Pty Ltd

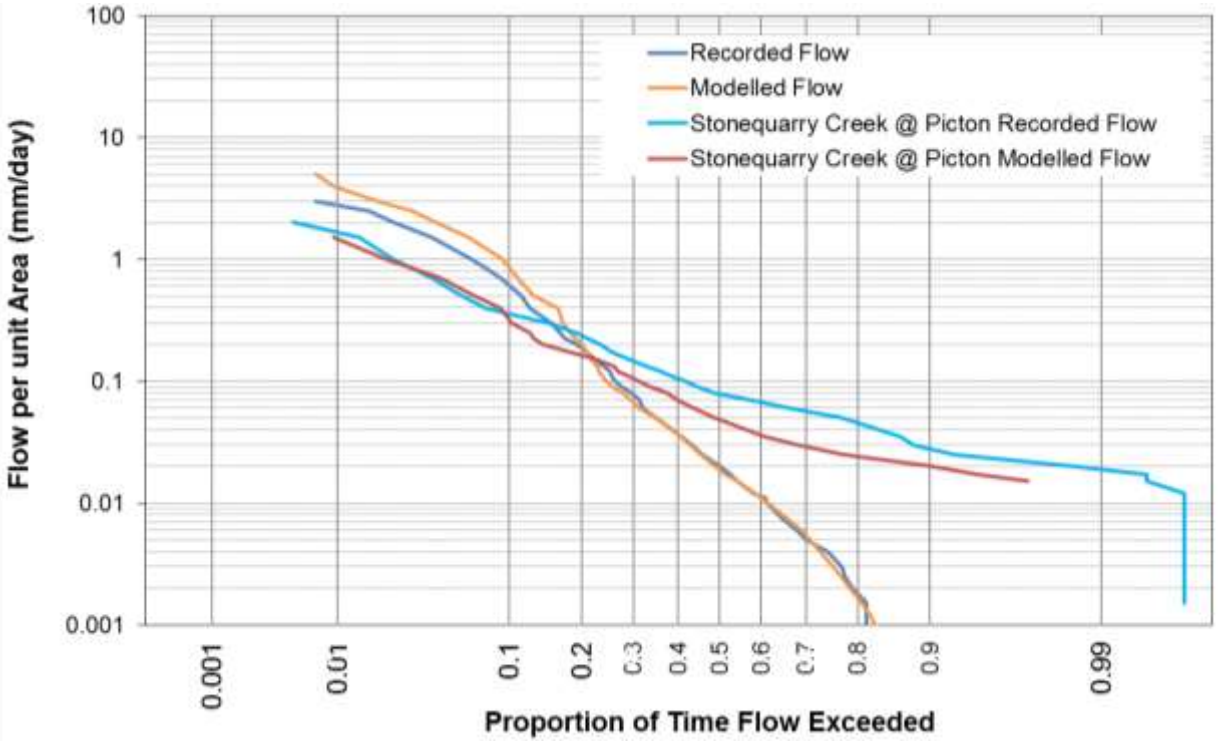


Figure 7.8 Modelled and Recorded Flow Duration Curves - Redbank Creek (Site R11) and Stonequarry Creek at Picton during Mining of LW25

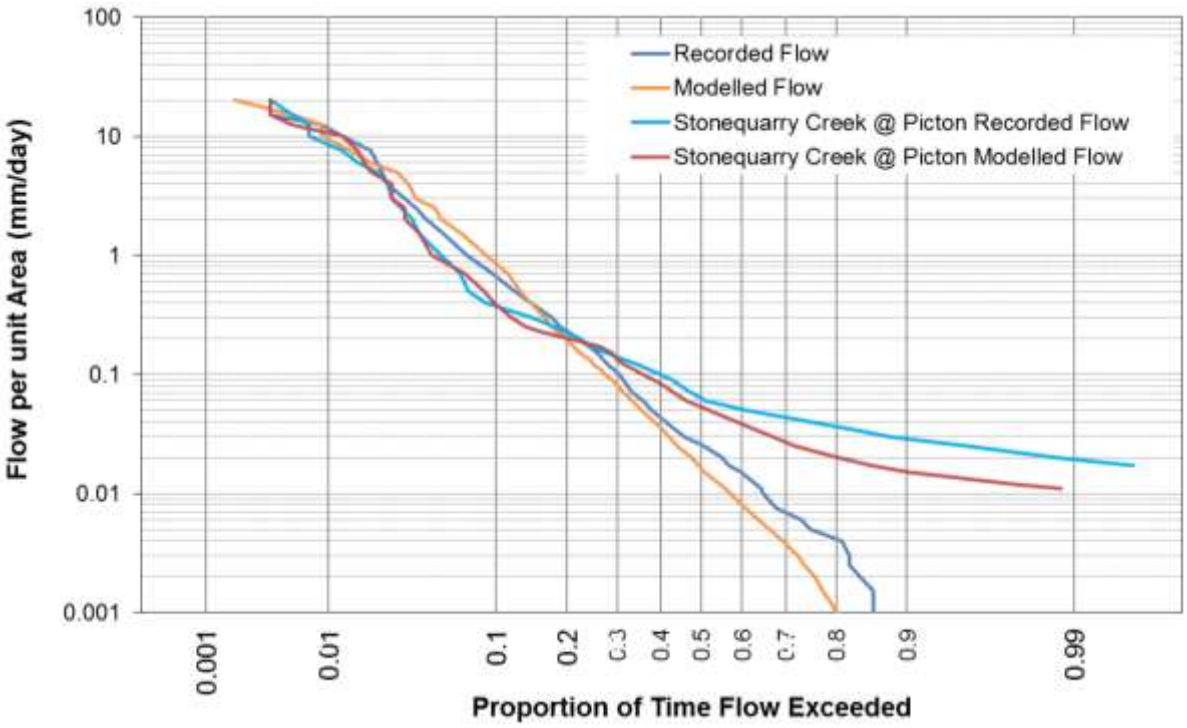


Figure 7.9 Modelled and Recorded Flow Duration Curves - Redbank Creek (Site R11) and Stonequarry Creek @ Picton during Mining of LW26

From the plotted flow duration curves, it can be seen that the flow characteristics of Stonequarry Creek vary markedly from those of Redbank Creek. The Stonequarry Creek flow duration curves exhibit a much longer 'tail', indicative of a much slower recession, with baseflow sustained for longer periods after rainfall. The flow behaviour of Stonequarry Creek is therefore not considered useful for comparison with the flow characteristics of Redbank Creek.

We recommend considering further amendments to the layout to reduce the fracture, drainage and permanent impacts to 3rd order streams. These are impacts that have been seen in similar situations with earlier Tahmoor Coal mining, such as impacts to Bargo River, Myrtle Creek, Redbank Creek, and the southern coalfield more generally.

For example, avoidance of direct undermining of 3rd order stream sections in Dog Trap Creek could be achieved with relatively minor reductions in longwall extraction at LW101B, LW103B and 104B, as outlined at Attachment B. Reductions at LW101B and 103B would also provide significant benefits for sites of Aboriginal cultural heritage significance, as discussed previously.

As previously stated, as a result of changes to the mine plan, coal volume has decreased from 48 Mt ROM in the EIS (AECOM 2018), to 43 Mt ROM in the PAR (AECOM 2020b), to now 33 Mt ROM as documented in this *second amendment report*. These reductions have resulted in an overall decrease in ROM and resource recovery by 31 per cent.

As previously stated, it is now considered that the Project provides the most balanced outcome for the Wollondilly LGA, the region and NSW, taking into account and balancing the benefits and impacts of the Project. Reducing the length of LW101B and LW103B would further reduce ROM volumes by around 1 Mt impacting resource recovery and benefits to local, regional and NSW economies.

Adaptive management techniques will be applied to monitor the ground movements during the extraction of the longwalls in the vicinity, and if required, the commencing position of LW103B could be shortened. These adaptive management measures were outlined in Niche (2020c) for the Project through the following recommendation:

> In addition to this monitoring program it is recommended that adaptive management techniques be applied. In the case of 52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529 it will be possible to monitor the ground movements and the conditions of the sites during the extraction of longwalls in the vicinity. If monitoring detects the early development of potentially severe differential movements at the archaeological sites, the commencing position of Longwall 103B could be shortened (MSEC 2020:175).

We note that further information has been supplied regarding the proposed remediation plans, now adopted, for Redbank and Myrtle Creeks. It has not been demonstrated to date that these areas can be successfully remediated. Impacts are therefore likely to be irreversible and remain in perpetuity.

The RTS proposed layout will detract considerably from the ecological function of the streams and severely reduce future recreational and cultural experiences in the Crown Land corridor (particularly Charlies Pt walking trails). It will also reduce flows to the Upper Nepean River system.

An aquatic monitoring report for Myrtle Creek (Niche 2020c) has been prepared has been prepared which describes the outcomes of monitoring surveys of stream health post mining beneath Myrtle Creek and before and after creek remediation.

Monitoring was conducted using standard Australian River Assessment System (AUSRIVAS) methods and quantitative macroinvertebrate survey undertaken in autumn and spring 2019, before remediation commenced, and autumn 2020, after remediation was completed.

Mining related subsidence in Myrtle Creek had resulted in reduced pool holding capacity. Water flow in affected pools is diverted through the subsurface via cracks and fissures in the bedrock. This led to a pool, Pool 23, in Myrtle Creek being unable to retain water and aquatic habitat. Prior to remediation, Pool 23 had been effectively dry post mining.

Remediation works at Pool 23 consisted of a Polyurethane Injection Resin (PUR) grout curtain wall, which involved drilling holes to 7 m deep and infilling fractures with PUR. Works were completed on 5 February 2020. Autumn 2020 monitoring was undertaken in March 2020, approximately one month after remediation was completed.

After being dry during autumn and spring 2019 monitoring, Pool 23 was holding water in autumn 2020 and was able to be sampled. Autumn 2020 was considerably wetter than previous years with one high rainfall event and one moderate rainfall event occurring in the month before sampling. There was evidence of high flows with reduction in aquatic macrophytes and benthic organic matter and flood debris at all monitoring sites in Myrtle Creek.

The previous monitoring report (Niche 2019), which considered autumn 2019 and spring 2019 (ie prior to remediation of Pool 23), identified several targets that may indicate improved stream health in Myrtle Creek, including increases in EPT (Ephemeroptera, Plecoptera and Tricoptera) taxa and AUSRIVAS scores.

Monitoring results indicate that Myrtle Creek has improved in stream health. The improvement in stream health occurred in part due to overall wetter conditions in February 2020, however remediation of Pool 23 has enabled the pool to store water. This has resulted in a rapid response from aquatic macroinvertebrates (approximately one month) that have colonised this habitat. The report notes that while it is difficult to determine what recovery of Pool 23 should look like with no pre-mining macroinvertebrate surveys, the AUSRIVAS and benthic quantitative data suggests that Pool 23 is close to reference condition and has ecology reflective of good stream health.

7.1.2 DPIE – Water

DPIE-W provided advice relating to water access licences and potential groundwater and surface water impacts.

The advice provided in DPIE-W's response to the submissions report (AECOM 2020a) is provided in the boxes below, along with Tahmoor Coal's response.

i Water licensing

1.1 Water Access Licences

The following recommendations are required as conditions of consent.

The project must:

- Obtain adequate Water Access Licences to account for both Surface and Groundwater take, prior to the take of any additional unlicensed water.
- Provide evidence of the additional Water Access Licence shares obtained (in accordance with the predicted water) to the Natural Resources Access Regulator.

a Surface Water

HEC (2020a) identified that the combined maximum baseflow reduction for the Bargo River, Tea Tree Hollow, Dog Trap Creek, Eliza Creek, Carters Creek and Cow Creek would be approximately 73.1 ML/a. As stated in Section 6.3.1, the removal of LW107B and LW108B from the Project is likely to lead to a decrease in that baseflow reduction.

The Project area falls within the Upper Nepean and Upstream Warragamba Water Source of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources*. The combined effects of the Project, consumptive groundwater extraction and the effects of other existing mining projects may result in a reduction in baseflow in three management zones in the Upper Nepean and Upstream Warragamba Water Source, namely Pheasants Nest Weir, Stonequarry Creek at Picton and Maldon Weir.

HEC (2020a) includes the following estimates of the maximum reductions in mean daily flow at the three management zones:

- Pheasants Nest Weir - 0.01% (due to the Project) to 0.012% (cumulative effect);
- Stonequarry Creek at Picton – 0.05% (due to the project) to 0.56% (cumulative effects); and
- Maldon Weir – 0.10% (due to project) to 0.27% (cumulative effects).

The revised assessment identified that this would represent a small and likely indiscernible impact to flows with likely negligible observable impact on mean daily flows at these locations. Notwithstanding, Tahmoor Coal will obtain necessary water entitlements to cover the incidental flow reduction in consultation with NRAR.

b Groundwater

The groundwater water sharing plan covering the Project area is the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*. Under this plan, the groundwater source relevant to the Project is the Sydney Basin Nepean Sandstone Groundwater Source. The groundwater assessment that accompanied the PAR predicted maximum annual inflow volumes of 2,850 ML/a (with average annual inflows of between 500-1,900 ML/a). As stated in Section 6.2.3, the maximum annual inflow volume of the amended Project is unlikely to change as a result of the removal of LW107B and LW108B.

Tahmoor Coal holds an existing groundwater licence entitlement of 1,642 ML/a; meaning a shortfall of a maximum of 1,208 ML/a (based on the maximum predicted inflow of 2,850 ML in 2029).

Additional groundwater licence(s) would be secured to account for the increased groundwater inflows for the Project in consultation with DPI-W and in accordance with the requirements of the AIP prior to the commencement of longwall mining for the Project.

Licences are available for purchase to cover the shortfall. The Sydney Basin Nepean Sandstone Groundwater Source has an annualised limit on entitlement (LTAAEL) of 99,568 ML (NOW, 2011), while the current entitlement is 28,841 ML (based on the WaterNSW Water Register). The volume of 'Unassigned Water' is not publicly available and requires confirmation with the NRAR, however it is expected based on current entitlements that allocations would be available to cover the Project's requirements.

ii Groundwater

a Prior to determination

2.1 Groundwater drawdown / water user impacts – bore census, make good provisions, mitigation strategy and Trigger Action Response Plan.

As the project presents high impacts and risks to existing water users and groundwater dependent ecosystems in the area, approval requires: a very rigorous bore census; make good provisions; and Trigger Action Response Plan (TARP), as follows:

- Bore census: the proponent should clarify the proposed scope of its bore census, specifically whether this is to include bores outside the predicted direct impact of the proposal that are affected cumulatively. Please note that post determination Recommendation 2.3 covers development of the detailed design of the bore census.
- Make good provisions: DPIE – Planning & Assessment (P&A) should ensure make good provisions are in place, well understood, feasible and equitably address the potential impacted users.

- Development of a strategy to mitigate or offset impacts to the high priority groundwater dependent ecosystem Thirlmere Lakes.

- A TARP in relation to groundwater impacts must be further developed in consultation with DPIE – Water, and DPIE – P&A should ensure that the conditions of consent have an appropriate approval pathway for the TARP.

DPIE – Water recommends that the proponent be held to the make good and TARP commitments through the conditions of consent.

Bore census

HydroSimulations has updated the analysis of registered bores likely to require 'make good' provisions. This is documented in the *groundwater assessment* contained in Appendix C, and summarised in Section 6.2.3. This identifies the bores at 'high' through to 'low' risk of requiring 'make good' provisions to be enacted. This information has been provided to Tahmoor Coal for the purpose of informing the on-going bore census. The bore census is being completed by Geoterra.

Make good

This will be accompanied by a management plan to outline the process for Tahmoor Coal and local bore operators to obtain baseline data, make a claim, and a pathway regarding assessment of effects and potential 'make good' actions.

Thirlmere Lakes

Conservative predictions of groundwater drawdown at Thirlmere Lakes were made in the *groundwater assessment* HydroSimulations (2020) that accompanied the PAR (AECOM 202b). Effects on the lake themselves were described in the surface water assessment (HEC, 2020) as "negligible increase in… leakage" from the lakes to groundwater, and the consequent effect on lake levels "would be imperceptible and unmeasurable in the field and very small compared to natural variability".

This finding is supported by the key finding from the NSW government's TLRP regarding the historical effects of mining at Tahmoor Mine, which is much closer to the lakes than Tahmoor South: This states "Current evidence does not show that the lake water levels are influenced by changes in the deep groundwater table (or nearby longwall mines)" (WRL 2020).

Taken together, these conclusions indicate that there is no need to mitigate or offset impacts at Thirlmere Lakes due to historical Tahmoor operations or due to the Project.

The final TLRP report is due in early 2021. In case that final report will reaches different conclusions, there may be a need to consider mitigation options, however any effects are highly unlikely to be due to the more distant Project.

Water management plan/Trigger action response plans

Tahmoor Coal commit to the need for a water management plan including TARPs, similar to that recently approved for Tahmoor Western Domain longwalls. This plan should, however, be developed as a post-determination action following on from the water monitoring Plan.

2.2 Groundwater Assessment report and model plan

The proponent should:

- Update the Groundwater Assessment report (Appendix C of the Amended Report).
- Provide a clear plan for a groundwater model re-build and calibration.

Note: DPIE – Water's model rebuild recommendation in Recommendation 2.4 (below), with specific details provided in Attachment B. These recommendations should be developed in consultation with DPIE – Water.

A response to comments made in 'Attachment B' in DPIE-W's submission is provided in Appendix N of this report. With respect to those comments and recommendations:

- the *groundwater assessment* has been revised (see Appendix C), incorporating a response to relevant suggestions and comments made by DPIE-W in their submission; and
- a *groundwater modelling plan* has been produced (see Appendix M), including a description of future analysis and modelling that would occur should the Tahmoor South Project be approved.

b Post- determination recommendations

2.3 Groundwater drawdown/water user impacts – bore census development

The detailed design of the bores census is to be developed in consultation with DPIE – Water and to the satisfaction of the DPIE Secretary.

This comment is noted.

Notwithstanding the above, HydroSimulations has updated the analysis of registered bores likely to require 'make good' provisions. This is documented in the revised *groundwater assessment* (Appendix C). This identifies the bores at 'high' through to 'low' risk of requiring 'make good' provisions to be enacted. This information has been provided to Tahmoor Coal for the purpose of informing the on-going bore census. The bore census is being completed by GeoTerra.

2.4 Groundwater model

The proponent should rebuild the model within two years of project determination. This should be in accordance with the model rebuild plan (required prior to determination –see Recommendation 2.2 above). Attachment B provides further detailed recommendations regarding the model rebuild.

The comment is noted.

As outlined earlier, a *groundwater modelling plan* has been prepared, including a description of future analysis and modelling that would occur should the Project be approved. This plan is contained in Appendix M.

Appendix N of this report presents the comments made in 'Attachment B' in DPIE-W's submission and includes a summary of HydroSimulations's response to each.

2.5 Water Monitoring Plan

The proponent should develop its Water Monitoring Plan in consultation with DPIE - Water and to the satisfaction of the DPIE Secretary.

This comment is noted.

Tahmoor Coal acknowledge that a water monitoring plan is required. Pending approval, Tahmoor Coal would initiate a monitoring plan, and following a confirmation of monitoring, develop a set of TARPs associated with groundwater and surface water effects.

iii Surface water

a Post- determination recommendations

3.1 Geomorphology Survey

The proponent should undertake a geomorphology survey (baseline and post mining) of waterways overlying and within the 20mm line of subsidence for each longwall to complement monitoring of subsidence at each longwall, in consultation with DPIE – Water.

This comment is noted.

3.2 Trigger Action Response Plans

Trigger Action Response Plans (TARPS) are to be developed in consultation with DPIE – Water:

- to develop risk assessments and appropriate management responses, including any necessary remediation and rehabilitation of impacts to overlying or adjacent watercourses or floodplain pockets;
- for unexpected flow loss based on analysis of baseline (i.e. pre-subsidence) streamflow data, post-subsidence streamflow data and contemporaneous data from control sites. This is to apply catchment flow modelling to form baseline and variability in flow stage from rainfall events during and following mining subsidence; and
- for unexpected loss of pool water holding capacity based on analysis of baseline (ie pre-subsidence) pool water level data, post-subsidence pool water level data and contemporaneous data from control pool sites. Pool water balance modelling should be developed in the analysis particularly during unusual climatic/hydrological conditions.

This comment is noted.

3.3 Monitoring

Monitoring of streamflow, pool water levels and water quality should continue for a minimum two years following cessation of longwall subsidence related movement in a watercourse or following completion of any stream/pool remediation. Monitoring data would be reviewed at regular periods over this period. Reviews would involve assessment against long term performance objectives which would be based on the pre-mine baseline conditions or an approved departure from these objectives.

This comment is noted.

7.1.3 Heritage Council of NSW

HC-NSW provided advice relating to potential heritage impacts on the Wirrimbirra Sanctuary (now known as the Australian Wildlife Sanctuary) in response to the submissions report (AECOM 2020a). HC-NSW's advice provided in the box below, along with Tahmoor Coal's response.

The following documentation must be prepared and submitted to the Department of Planning, Industry and Environment for assessment prior to issue of any approval:

- detailed assessment of the condition, significance and associations of all historic heritage items within the Wirrimbirra Sanctuary (including post-1960s structures) and preparation of a detailed site-specific Heritage Management Plan;
- consideration and refinement of mitigative measures to ensure adverse subsidence or other impacts on Wirrimbirra Sanctuary are avoided or minimised; and
- preparation of a site-specific Statement of Heritage Impact (SoHI) report for Wirrimbirra Sanctuary in consultation with landowners and the NSW Heritage Council.

To address comments from HC-NSW, EMM has prepared a Statement of Heritage Impact (SoHI) for the Wirrimbirra Sanctuary. A copy of the SoHI can be found in Appendix O.

The SoHI was prepared in consultation with Brad Wilson from the Australian Wildlife Sanctuary and Gerry Hayes from National Trust NSW. In addition, a copy of the SoHI will be provided to HC-NSW for comment.

The SoHI:

- investigates the potential for items of historic heritage value, including relics, to exist within the property boundary of the sanctuary;
- assesses the significance of these historic heritage items;
- assesses the potential impacts of the Project on items of historic heritage in the property boundary; and
- formulates management measures for the protection of historic heritage items in the development footprint.

7.1.4 Subsidence Advisory NSW

SA-NSW provided advice relating to potential subsidence impacts of the Project in response to the submissions report (AECOM 2020a). SA-NSW's advice is provided in the boxes below, along with Tahmoor Coal's response.

i Predicted impacts to residential houses

The EIS identified that 571 houses will be mined directly beneath under the proposal. Tahmoor Coal has confirmed that, in addition to the houses mined directly beneath, an additional 762 houses will experience ground movements greater than 20 mm. In total there are 1333 houses predicted to be impacted by subsidence.

The number of houses influenced by subsidence increases substantially as mining progresses with Longwalls 105b, 106b, 107b and 108b toward the township of Bargo.

The exclusion of certain longwalls would likely have a significant reduction on the number of houses predicted to be impacted. For example, excluding Longwall 108b from the proposal will reduce the number of houses with damage classifications of R3-4 and R5 by 46 houses or 43%. Excluding both Longwalls 107b and 108b will reduce the number by 75 houses or 71 per cent.

The mine plan presented in this *second amendment report* has removed LW107B and LW108B from the Project. The changes substantially reduce the number of houses predicted to be adversely affected by mine subsidence due to the extraction of the proposed development. The *subsidence assessment* has been revised to reflect the change (refer to Appendix B).

Under the current proposal, approximately 159 houses will experience final tilt of 7mm/m or greater. The EIS notes 'tilts greater than 7 mm/m can result in greater serviceability impacts which may require more substantial remediation measures, including the relevelling of wet areas or, in some cases, the relevelling of the building'. 'Relevelling of a building' is included as one of the repair elements included under Damage Classification R4 Extensive Repair in the EIS.

The number of houses impacted by tilts of 7 mm/m or greater is reduced by 76 houses or 48 per cent with the exclusion of Longwall 108b. The exclusion of both Longwalls 107b and 108b further reduces the number of houses impacted by 124 houses or 78 per cent when compared to the current proposal.

The EIS notes Tahmoor Coal has considered the subsidence impacts of mining, including anomalous movements, at Tahmoor North when predicting the impacts for Tahmoor South. The EIS further notes it is not possible to predict the locations and magnitudes of non-conventional anomalous movements.

The mine plan presented in this *second amendment report* has removed LW107B and LW108B from the Project. The changes substantially reduce the number of houses predicted to be adversely affected by mine subsidence due to the extraction of the proposed development. The *subsidence assessment* has been revised to reflect the change (refer to Appendix B).

ii Proposed mining sequence and claim timeframes

The EIS notes Tahmoor Coal has considered the subsidence impacts of mining, including anomalous movements, at Tahmoor North when predicting the impacts for Tahmoor South. The EIS further notes it is not possible to predict the locations and magnitudes of non-conventional anomalous movements.

Under the proposed mining layout, there are houses that will be impacted by five different longwalls. This will result in active subsidence periods of approximately five years. Therefore, it is likely several homeowners will be living in damaged properties for a number of years. Others may require relocation where their properties require extensive repairs or rebuilding. Tahmoor Coal has acknowledged the stress and anxiety these impacts have on the community.

SA NSW notes there are properties that will be impacted by both Longwalls 103A and 104A. Due to the significant period of time between the extraction of these longwalls, SA NSW would anticipate progressing claims for subsidence damage resulting from Longwall 103A at the completion of this longwall. The owners of properties impacted by subsidence from subsequent longwalls would then be eligible to lodge further claims under the *Coal Mine Subsidence Compensation Act 2017.*

Tahmoor Coal support that affected homeowners should not have to wait for completion of mining before being compensated when there is a significant delay in time between the extraction of one longwall and the next longwall. Tahmoor Coal commits to interim progress claims in such situations, which may result in some landowners being compensated twice if damage reoccurs during later longwalls.

iii Management of subsidence claims

Under the *Coal Mine Subsidence Compensation Act 2017*, Tahmoor is required to pay compensation to affected property owners for subsidence impacts as part of recent changes to the coal mine subsidence compensation framework.

SA NSW manages the claim process, including coordinating independent assessment of claims, to ensure mine proprietors determine claims and pay compensation in accordance with the Act and associated procedures. The SA NSW claims process is designed to ensure property owners are fairly compensated when subsidence damage occurs.

This comment is noted.

iv Recommended additional protections for homeowners

Subsidence damage may cause considerable stress and anxiety for homeowners who may be required to live in damaged houses for a number of years before their claims can be resolved. In situations where a house has sustained significant damage, these effects on homeowners are exacerbated. SA NSW recommends consideration be given to including provisions in the Development Consent, similar to those for Tahmoor North, for Tahmoor South to:

1. offer property acquisition when the house reaches damage category R4 or R5; and/or
2. offer property acquisition when the house is in tilt of greater than 10mm/m; and/or
3. offer property acquisition when the house reaches damage category R3 or more and has/will be impacted by more than two longwalls.

Property acquisition should occur in accordance with the provisions of the *Coal Mine Subsidence Compensation Act 2017*.

This comment is noted. Notwithstanding this, Tahmoor Coal supports the option for property acquisition as a reasonable safeguard for the affected homeowners. A decision on whether to request property acquisition is, however, a personal decision for affected landowners. Tahmoor Coal's experience is that a very small proportion of landowners are likely to pursue this avenue of compensation.

v Subsidence impacts to infrastructure

Tahmoor Coal undermined several pieces of infrastructure during the Tahmoor North Project, including local roads, utility infrastructure and services and the Main Southern Railway. During this project, performance measures were applied ensuring infrastructure was safe and that serviceable or serviceability was maintained wherever practicable. SA NSW recommends the application of these conditions is continued, including maintaining the relevant management groups that have proven successful in the mitigation, identification and responses to mining impacts.

This comment is noted.

vi Impacts on future surface development

The EIS acknowledges the increased impact the proposal will have on the community, should additional houses be constructed within the proposed mining area. It is not possible to mitigate the predicted subsidence impacts through practical engineering design. As a result, and to prevent further impact on the community, applications to rezone and subdivide land for urban development within the proposed mining area are likely to be refused, should the Tahmoor Coal project be approved.

SA NSW requests the opportunity to review of the draft development consent conditions prior to finalisation and granting of any development consent.

This comment is noted.

7.1.5 Wollondilly Shire Council

WSC provided advice relating to potential surface and groundwater impacts, potential impacts to the Bargo Waste Management Centre, the disposal of coal wash waste, and the expansion of the REA in response to the *submissions report* (AECOM 2020a). WSC's advice is provided in the boxes below, along with Tahmoor Coal's response.

i Surface and groundwater impacts

Potential impacts on the condition of both surface and groundwaters as a result of longwall operations is a major concern to Council and the local community. The key identified shortcomings of the Application detailed in Council's submission are:

- Key aspects of the EIS and associated specialist reports have not been updated to reflect scientific research and studies, in particular in regard to the impacts associated with subsidence on water sources.
- The groundwater assessment is not considered to include a detailed geological analysis and modelling that would identify the likely interaction of mining induced fracturing with both surface and groundwaters at the Application Stage (based on received specialist advice).

a Surface water

With respect to the comment on scientific research, WSC does not make it clear which research is missing or what elements are deficient.

With reference to the original submission on the EIS (AECOM 2018) by WSC, reference is made to the research project by Dr Ian Wright, which, in Attachment 1 of the submission, refers to Morrison et al (2019). Attachment 1 also noted that data presented in the original EIS was out of date – this has been addressed in the SWIA contained in the PAR (AECOM 2020b). In addition, water quality data for LDP1 has been included in the SWBS (Appendix J of the EIS). It is further noted that the recorded maximum values for cadmium given in Table 24 to Table 35 of the SWBS are in error. Corrected data is given in Table 7.3 below.

Table 7.3 Corrected baseline water quality data - cadmium

Site	Maximum recorded (mg/L)	Site specific trigger value (20%ile)	Number exceeding	
			ANZECC aquatic ecosystems guideline value	ANZECC recreational use guideline value
Bargo River at SW-1	0.0001	0.0001	0	0
Hornes Creek at SW-9	0.0003	0.0001	1	0
SW-13 Bargo River at Upstream Bargo	0.0001	0.0001	0	0
SW-14 Bargo River Downstream Rockford Road Bridge	0.0001	0.0001	0	0
SW-15 Dog Trap Creek (Downstream)	0.0001	0.0001	0	0
SW-16 Dog Trap Creek (Upstream)	0.0001	0.0001	0	0
SW-18 Eliza Creek	0.0001	0.0001	0	0
SW-20A Dry Creek	0.0001	0.0001	0	0
SW-21 Nepean River at Maldon Weir	0.0003	0.0001	1	0
SW-22 Tea Tree Hollow	0.0003	0.0001	1	0
SW-23 Carters Creek	0.0001	0.0001	0	0
SW-24 Cow Creek	0.0001	0.0001	0	0

Source: HEC

The paper by Morrison et al (2019) reports investigations on Redbank Creek, reportedly "…impacted by upwelling groundwater due to recent geological strata fracturing caused by subsidence activity from longwall coal mining". This infers that discharge to Redbank Creek is from groundwater. As discussed at length in the SWIA (Appendix J of the EIS) near-surface subsidence induced cracking has resulted in diversion of surface flows through these fractures and re-emergence downstream – the "upwelling" therefore predominantly results from diversion of surface flow from upstream to downstream rather than from groundwater associated with "upwelling" from an aquifer.

The analysis by Morrison et al (2019) appears to have been based on only five sets of water quality samples from four locations on Redbank Creek – collected in November 2016 and September/October 2017. That is only a total of twenty samples. By contrast, the SWIA reported on the analysis results from between approximately 100 to 200 samples collected at sites located on upstream, mid and downstream Redbank Creek. Moreover, these samples spanned a period from early 2005 (before mining, with LW25 commencing in late 2008) to 2019 rather than (as reported in Morrison et al (2019) two isolated periods which coincided with the mining of LW30 and LW31. With reference to the time series plots shown in figures 29 to 35 of the SWIA (Appendix J of the EIS), it may be seen that:

- recorded electrical conductivity (EC) was elevated at the mid-stream site (RC2) prior to mining with values of up to 1,960 microsiemens per centimetre (µS/cm) recorded;
- recorded EC values at RC2 and the downstream site (RC5) rose during the period of longwall mining, reaching a peak in early 2014, before falling to pre-mining levels or lower in 2019 (during mining of LW32);
- recorded pH values appeared similar in 2019 to values recorded before mining;

- recorded iron concentrations at RC2 and RC3 increased during the period of longwall mining, generally reaching a peak in 2014/15, before falling to pre-mining levels in 2016 (during mining of LW30);

- recorded manganese concentrations at RC2 and RC3 similarly rose during the period of longwall mining, with values at RC2 falling by 2019 to near or below values recorded before mining, while values at RC5 have also fallen but remained somewhat above values recorded before mining (0.62 milligrams per litre (mg/L) average total manganese in 2019);

- recorded dissolved nickel concentrations at RC2 and RC3 similarly rose during the period of longwall mining, generally reaching a peak in 2015/16, before falling to pre-mining levels or lower in 2017 (during mining of LW31);

- somewhat elevated dissolved zinc concentrations were recorded at RC2 prior to mining (up to 0.079 mg/L);

- dissolved zinc concentrations at RC2 and RC3 rose during the period of longwall mining, reaching a peak in 2014 before falling to near or below values recorded before mining by 2019; and

- recorded sulphate concentrations remained fairly consistent for the period of monitoring with some increases at all three sites (including the upstream site) during the period of longwall mining, while recorded values in 2019 were similar to those recorded before mining.

The extensive water quality dataset illustrates that the majority of water quality effects in Redbank Creek, that are likely associated with mining-induced subsidence, have been temporary and have diminished with time, even while mining is on-going. It is also evident that the water quality data reported in Morrison et al (2019) is out of date, with the last recorded data (October 2017) coinciding with elevated EC and manganese recorded at downstream RC5 – subsequent sampling and analysis has indicated lower values of these water quality parameters.

b Groundwater

Again, with respect to the comment on scientific research, WSC does not make it clear which research is missing or what elements are deficient.

However, we note that the *groundwater assessment* (HydroSimulations 2020) contained in the PAR (AECOM 2020b) considers:

- The outputs of recent research and consideration of fracturing effects above longwalls from IEPMC (2019a), PSM (2017) and its associated reviews, as well as site-specific investigation for Tahmoor (SCT, 2014).

- Surface cracking effects from recent investigations at Dendrobium and Tahmoor (eg SCT, 2018).

- Water quality effects due to surface cracking in the bed and sub-surface around watercourses (eg Morrison, Reynolds and Wright, 2019).

- Preliminary findings (from 2019) from the NSW government's TRLP. With respect to the TRLP, further findings were released in early 2020 which was after the PAR was issued. Tahmoor Coal acknowledges the need to share and incorporate these findings in future work, noting that a final report from the TRLP is not due until early 2021.

c Geological analysis

As noted in the groundwater assessment, more detailed mapping and assessment of geological structures will need to be carried out following project approval and as development occurs. This is standard practice; as discussed with IESC/DAWE regarding geological structures, mine operators can commit more resources and carry out further

investigations from seam level to improve the understanding of geological conditions, both with regard to mine safety and environmental effects.

Further detailed mapping and analysis of geological structures round Tahmoor South workings will be required for future extraction management plan approvals, and any necessary simulation of these should be included in groundwater modelling at that time.

With reference to potential environmental effects and structures, recent findings from the TRLP include a finding "*It appears unlikely that any identified geological structures are directly connected to mine workings from the subsurface below the lakes*" (UNSW 2020). In any case, connection between mine workings and Thirlmere Lakes via a hypothetical pathway matching mapping structures was tested in the modelling presented in HydroSimulations (2020).

d Groundwater and surface water connectivity

With respect to the likely interaction of mining-induced fracturing with groundwaters and surface waters, HydroSimulations presented data analysis, conceptualisation and numerical modelling of the connected fracturing (extending up from the goaf/longwall panel) and surface cracking (extending down from ground surface). In terms of connected fracturing, the representation used was based on site-specific data, geotechnical modelling, and model representation reliant on the Tammetta (2012) model and calibrated to mine inflow. This approach, and each element within that, is consistent with the advice from the Independent Expert Panel for Mining in the Catchment (IEPMC).

The simulation of surface cracking effects was added to the groundwater model (HydroSimulations 2020) in response to recommendations by DPIE-W and DPIE's independent groundwater expert. The representation of this in the numerical model was based on recently acquired geotechnical and groundwater data for sites on Redbank Creek as well as being based on experience at other sites in the Southern Coalfield.

The analysis and simulation of these deformation or fracturing processes was reviewed by DPIE's independent groundwater expert, who made a number of comments around interaction and connectivity:

> IESC advice then extended the false premise of the 'underestimation' of the height of fracturing …
>
> … lack of evidence to support the IESC hypothesis of 'connectivity'

And most significantly:

> There is evidence presented in the geotechnical report and groundwater assessment (EIS Appendix G and I) on the intervening constrained zone that shows a clear separation between the potential shallow surface cracking horizon and the fractured zone above the longwalls. A shallow surface cracking horizon (<30 m deep) has been included in the Amended Project Report modelling (HydroSimulations, 2020), but the separation distance between the top of the HoF and the surface cracking still exceeds 130 m, which greatly limits the potential for connectivity from shallow to deep horizons, consistent with longwall 10A data.

ii Bargo Waste Management Centre

Council's submission expressed concern over the Bargo Waste Management Centre experiencing full subsidence and requested consultation and greater analysis. Council officers from the Waste Management Section have expressed satisfaction at the response by SIMEC to these expressed concerns. Clarification is however requested over whether the rehabilitation of any impacts to the facility identified as being attributable to mine subsidence will be funded in accordance with the *Coal Mine Subsidence Compensation Act 2017.*

Any mine subsidence impacts to the Bargo Waste Management Centre will be rehabilitated in accordance with the NSW *Coal Mine Subsidence Compensation Act 2017*. Any damage found attributable to mine subsidence will be eligible for compensation (ie the cost of rehabilitation) in accordance with this act. Specifically, a detailed Property Subsidence Management Plan will be developed to understand and document pre-mining status.

iii Disposal of coal wash waste

A key issue raised in Council's submission was the need for investigation of options to reduce the volume of coal wash waste generated.

A *Rejects Management Options Gap Analysis* was prepared and documented in Appendix A of the PAR (AECOM 2018). This was available to WSC at the time its advice was prepared.

Additionally, as previously stated, the Project now reduces coal waste from about 11.6 Mt to 9.7 Mt, and as result, no expansion is proposed to the current approved footprint of the REA.

iv Expansion of REA

A further key related issue was the (considered) high area of vegetation clearance for the expansion of the current Emplacement Area and associated impact on threatened species in total. The EES are noted to have raised similar issues regarding biodiversity impacts in its submission.

The modification of the proposal to achieve a reduction in vegetation clearance and impact on threatened species is viewed as positive. The intended 23.57 ha of clearance and removal in total of 500 threatened species plants is however continued to be viewed with concern. Further investigations to reduce the required area of clearance for the expansion of the Emplacement Area facility is consequently requested.

This issue has been addressed in sections 7.1.1i and 7.1.1ii.

8 Conclusion

8.1 Introduction

Tahmoor Mine is an established underground coal mine which has operated since 1979. As a result of historical and current operations, Tahmoor Coal has a strong understanding of mine design principles and requirements for the protection of surface features, including the natural and built environment, and is experienced in the management of potential environmental impacts particularly relating to subsidence.

Mining within the existing Tahmoor North mining area is scheduled for completion by approximately 2022, depending on geological and mining conditions. Without access to a new extraction area by this time, Tahmoor Mine would commence closure of the mine resulting in cessation of the extraction of the coking coal resource. This would result in the loss of close to 400 employees.

Accordingly, Tahmoor Coal is seeking approval for the Tahmoor South Project, being an extension of underground coal mining at Tahmoor Mine, to the south of Tahmoor Coal's existing mining area.

The Project would enable mining to be undertaken within the southern portion of Tahmoor Coal's (and its wholly owned subsidiary Bargo Collieries Pty Ltd) existing mining lease areas, and operations and employment to continue for approximately a further 10 years.

Given its significance to the State, the Project is deemed to be SSD under the provisions of EP&A Act. Under these provisions, the NSW Minister for Planning and Public Spaces, or delegate, is the consent authority for the Project. Approval for the Project is also required from the Commonwealth Minister for the Environment under the provisions of the EPBC Act.

In response to the public exhibition of the EIS for the Project (AECOM 2018), 91 submissions were received from the community and community organisations, and 15 responses were received from government agencies and councils. Most community submissions were in support of the Project.

Subsequently a *submissions report* (AECOM 2020a) and PAR (AECOM 2020b) were lodged with DPIE which responded to all submissions made during exhibition of the EIS and document amendments made to the Project in response to the submissions and to reduce its potential environmental impacts. These amendments included, among other things, changes to the mine plan to reduce subsidence impacts, and changes to the REA to reduce biodiversity impacts.

In response to the *submissions report* and PAR, DPIE received advice from several government agencies and WSC. In addition, from late 2019 DPIE has received a number of representations from the community on the Project which fell outside the public exhibition period of the EIS. Predominantly these representations raise concerns or state opposition to the Project based on concerns regarding subsidence related impacts, particularly on properties in the township of Bargo.

Tahmoor Coal has made the decision to make further changes to the Project to further reduce potential environmental impacts. These amendments include the removal of LW107B and LW108B to reduce subsidence impacts at the township of Bargo, the containment of the REA on its approved disturbance footprint to reduce impacts to biodiversity, and amendments to the construction layout of the ventilation shafts (TSC1 and TSC2) and associated transmission lines to also reduce impacts to biodiversity.

8.2 Key attributes

The Project has the following key attributes:

- extraction of premium quality coking coal;
- utilisation of existing pit top infrastructure (brownfield site);
- continuation of employment at an established mine site;
- a strong relationship with the local community and demonstrated support for the Project;
- amendments to key matters raised in government advice and community representations;
- consistency with government policies and plans; and
- the careful evaluation of environmental and community impacts in designing and amending the Project.

These features are discussed in detail below.

8.2.1 Premium quality coking coal

Coking coal is used to create coke, which is one of the key inputs for the primary production of steel. The quality of the resultant coke is determined by the qualities of the coking coals used, as well as the coke plant operating conditions.

Tahmoor Mine is recognised in the steel production industry as an Australian mine that produces high fluidity coking coal, making it of optimum quality and suitability for steel production.

This is a valued resource that is important to the State, given the increased demand for higher quality coal since the early 2000s. This follows reforms in the international steel production industry, including the closure of inefficient steel mills and stricter environmental standards.

Steel is an important part of society, used in healthcare, telecommunications, transport, infrastructure, construction and agricultural equipment.

8.2.2 Continuation of established mine site

Australian coal mines operate to some of the highest environmental standards in the world. The continuation of mining into the Tahmoor South area would utilise a brownfield development, facilitating demand through existing facilities rather than to establish a separate, new mine to access the coal resource. The use of an existing site is considered preferable to a new mine (as supported by the *Strategic Statement on Coal Exploration and Mining in NSW,* June 2020) from an environmental, economic and social perspective to maximise production and supply of product coal to established domestic customers and export markets.

8.2.3 Economic support and benefits

Tahmoor Coal has been a major employer in Wollondilly for over 40 years, employing approximately 400 people with around half being local residents. Further, Tahmoor Coal has a long history of successful engagement with the local community in which it operates. This was reiterated through the overall strong support expressed in the majority of submissions during the exhibition period of the EIS.

Key benefits to local, Regional and State economies include continued provision of employment for Tahmoor Mine's workforce until 2032, as well as additional employment through the construction phase of the Project. The CBA predicts that the Project would generate a net benefit of up to $664.9 million in NPV over its life, while the LEA predicts that the Project would generate benefits to local suppliers and employees of $32.5 million and $100.3 million respectively in NPV terms.

8.2.4 Design considerations and amendments

i Initial considerations

The Project has been carefully developed by Tahmoor Coal through collaboration with a variety of specialists including mining engineers, ecologists, heritage specialists, hydrologists and hydrogeologists which included consideration of predicted subsidence impacts on built and natural features. Prior to lodging the EIS, Tahmoor Coal made a number of revisions to the original mine plan, including shortening LW105 to LW108 from the commencing ends of the longwalls such that they do not encroach into the Metropolitan Special Area.

ii First amendments

While submissions on the EIS indicated a majority of support for the Project, concerns were also raised in submissions regarding the proposed extent of longwall mining, the associated subsidence impacts, GHG emissions and the extent of vegetation clearing required for the extension of the REA. In response to these and other issues raised in submissions, and as a result of ongoing mine planning, several amendments were made to reduce the predicted environmental impacts of the Project. These amendments included:

- a reduction in the extent of longwall mining (mine plan) and magnitude of subsidence impacts;
- a reduction in the extent of vegetation clearing required for the extension of the REA; and
- a reduction in the operating hours of the REA to reduce night-time noise impacts.

A reduction in the extent of longwall mining also resulted in the reduction of Scope 1, 2 and 3 GHG emissions.

iii Second amendments

In response to advice from government agencies and representations made by the community since the EIS was publicly exhibited, Tahmoor Coal has made the decision to make further changes to the Project to further reduce potential environmental impacts. These amendments include:

- further reductions in the extent of longwall mining (mine plan) and magnitude of subsidence impacts;
- eliminating the need for any vegetation clearing required for the extension footprint of the REA by maintaining it within its approved disturbance footprint; and
- amendments to the construction layout of the ventilation shafts and associated transmission lines to also reduce impacts to biodiversity.

As a result of the amendments to the Project, coal volume has decreased from 48 Mt ROM in the EIS (AECOM 2018), to 43 Mt ROM in the PAR (AECOM 2020b), to now 33 Mt ROM as documented in this second amendment report. These reductions have resulted in an overall decrease in ROM and resource recovery by 31 per cent.

The amendments will substantially reduce the number of houses and associated civil infrastructure that was predicted to be adversely affected by mine subsidence due to the extraction of the Project. A total of 143 houses are located directly above the proposed longwalls compared to 571 houses that were located directly above the

proposed longwalls considered in the PAR. Further, the total number of houses predicted to be impacted by repair categories R3–R5 reduced from 143 in the EIS to 35, with the removal of LW107B and LW108B from the Project. This is an extensive reduction of 108 houses (ie a 76% reduction compared to the EIS).

The overall findings of the subsidence assessment are that the levels of impact and damage to all identified natural features and built infrastructure are manageable and can be controlled by the preparation and implementation of detailed management plans, many of which have already been developed and are being successfully implemented during mining at Tahmoor Mine.

The changes to the mine plan will also have benefits on subsidence-related impacts, particularly surface and groundwater impacts. This includes a lower reduction in catchment yield, lower reduction in baseflows and changes in flow velocities of Hornes Creek, Cow Creek and the headwaters of Dog Trap Creek.

The changes will also mean that a number of landholder bores would be at a lower risk of being affected by the Project. The groundwater assessment indicates that there will be a reduction in the number of bores impacted by >2 m, from 52 bores identified in the PAR, to 44 bores. Based on the groundwater assessment, there are 10 bores that are 'at risk' of requiring 'make good' provisions as a result of the current proposal. Based on experience from Tahmoor North (where only two bores required 'make good' out of a total of 75 bores predicted to be impacted by >2 m), it is considered that the vast majority of these bores will not observe any effect on performance.

The changes to the REA and construction footprint of the ventilation shafts and associated transmission lines have significantly reduced impacts on terrestrial ecology, particularly threatened communities and species.

The Project will now only impact 24.32 ha of native vegetation, of which 14.20 ha is mine rehabilitation. This is a reduction of 13.45 ha compared to previous impacts, all of which relates to SSTF where now only 10.10 ha will be impacted. Previously it was proposed to clear 23.57 ha of this CEEC. In addition, of the 10.10 ha of SSTF to be disturbed, 1.42 ha already has approval to be disturbed under existing approvals at Tahmoor Mine.

The Project has also significantly reduced impacts on threatened flora. The amended Project will result in an impact to 55 *Grevillea parviflora* subsp. *parviflora* plants, and one *Persoonia bargoensis*. Previously, it was proposed to impact 491 *Grevillea parviflora* subsp. *parviflora* plants, and eight *Persoonia bargoensis*. The Project has now also avoided any impacts to *Pomaderris brunnea*. The Project also reduces impacts to potential fauna habitat. Only a total of 4.12 ha of potential habitat for threatened fauna will be impacted. This compares to 17.26 ha previously proposed.

Minor residual impacts to terrestrial ecology will be offset in accordance with the NSW biodiversity offset scheme.

It is considered that the Project provides the best balanced outcome for the Wollondilly LGA, the region and NSW, taking into account and balancing the benefits and impacts of the Project. The Project is critical to maintaining the continued operations of Tahmoor Mine, ensuring the ongoing generation of employment and increased economic activity locally and within the wider NSW community.

8.2.5 Consistency with government policies and plans

The Project is generally consistent with all relevant government policies and plans. As described in Chapter 4, the Project is permissible with development consent due to the provisions of the Mining SEPP. Under this EPI, development for the purposes of underground mining is permissible anywhere in the State.

An assessment of the Project against the relevant provisions in all relevant EPIs was undertaken in the EIS which concluded that the Project is able to be undertaken in a manner that is generally consistent with these instruments. This assessment was also reiterated in the PAR.

In its PIR, DPIE also considered the Project against the provisions of all relevant EPIs. The Department formed a preliminary view that the Project is generally consistent with the aims and objectives of these EPIs.

Since the EIS, PAR and PIR were prepared, the NSW Government released the *Strategic Statement on Coal Exploration and Mining in NSW* in June 2020. In relation to the Project, the strategic statement states that "the global demand for thermal coal [could be] sustained for the next two decades or more" and that "The use of coal in the manufacture of steel (coking coal) is likely to be sustained longer as there are currently limited practical substitutes available." In addition, it states that "the NSW Government will … recognise existing industry investment by continuing to consider responsible applications to extend the life of current coal mines".

8.3 Potential impacts

As previously stated, a number of amendments have been made to the Project to address concerns raised by the community and government agencies, particularly around subsidence and subsidence related impacts and impacts associated with the clearing of native vegetation.

The Project is expected to have a range of impacts, both positive and negative.

To enable a balanced comparison of the overall merits of the Project as currently proposed, an economic assessment was prepared which includes a CBA. This CBA uses the net production benefits of the project in NPV terms that accrue to NSW. These benefits would be distributed to numerous stakeholders including the NSW Government via royalties and tax and, WSC via rates and the local community through wages and local expenditure.

For the Project to be questionable from an economic efficiency perspective, all residual environmental impacts would need to be valued by the community at greater than the total net production benefits that will accrue to NSW.

The economic assessment the Project clearly indicates that it will provide a net benefit to NSW. This net benefit is estimated to be $664.9 million in NPV terms. This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively. The incremental indirect costs of the Project are $0.11 million. Other costs, like subsidence and biodiversity impacts are being borne by Tahmoor Coal and are included in the financial costs of the Project.

8.4 Conclusion

Tahmoor Coal has sought to address and resolve matters raised during and after the public exhibition period of the EIS and to deliver a balanced outcome.

The Project is strongly justified. There is a need for the Project, driven by the need for high quality coking coal to produce steel. The need is underpinned by State strategic planning policies and consistent with the *Strategic Statement on Coal Exploration and Mining in NSW*.

The Project continues the orderly and logical use of natural, physical and human resources that exist in the local area, and enhanced outcomes will result from ongoing investment and employment in the area. A range of physical, economic and environmental attributes combine to make the Project area suitable for the development, particularly its proximity to existing Tahmoor Coal physical and human infrastructure.

While the Project has the potential to cause adverse impacts, including subsidence and water impacts, mitigation or compensation measures have been developed to address these. When all relevant factors are considered, the benefits of the Project sufficiently outweigh its costs.

9 References

AECOM 2012, *Tahmoor South Project – Preliminary Environmental Assessment*, prepared for Tahmoor Coal Pty Ltd by AECOM Australia Pty Ltd.

AECOM 2018, *Tahmoor South Project - Environmental Impact Statement*, prepared for Tahmoor Coal Pty Ltd by AECOM Australia Pty Ltd.

AECOM 2020a, *Tahmoor South Project - Response to Submissions*, prepared for Tahmoor Coal Pty Ltd by AECOM Australia Pty Ltd.

AECOM 2020b, *Tahmoor South Project - Project Amendment Report*, prepared for Tahmoor Coal Pty Ltd by AECOM Australia Pty Ltd.

AECOM 2020c, *Tahmoor South Project – Addendum to Social Impact Statement*, prepared for Tahmoor Coal Pty Ltd by AECOM Australia Pty Ltd.

Barnett et al, 2012, *Australian groundwater modelling guidelines, Waterlines report*, prepared for National Water Commission, Canberra.

DRNSW 2020, *Strategic Statement on Coal Exploration and Mining in NSW*, Department of Regional NSW.

EMM 2020a, *Tahmoor South Project Noise and Vibration Impact Assessment,* prepared for Tahmoor Coal Pty Ltd by EMM Consulting Pty Ltd.

EMM 2020b, *Tahmoor South Project Addendum to the Aboriginal Cultural Heritage Assessment*, prepared for Tahmoor Coal Pty Ltd by EMM Consulting Pty Ltd.

ERM 2020a, *Tahmoor South Project – Air Quality Impact Assessment*, prepared for Tahmoor Coal Pty Ltd by ERM Australia Pacific Pty Ltd.

ERM 2020b, *Tahmoor South Project – Greenhouse Gas Assessment*, prepared for Tahmoor Coal Pty Ltd by ERM Australia Pacific Pty Ltd.

GBD 2020, *Reject Emplacement Area design amendment (Visual Assessment)*, prepared for Tahmoor Coal Pty Ltd by Green Bean Design Pty Ltd.

HEC 2020a, Tahmoor South Amended Project Surface Water Impact Assessment, prepared for Tahmoor Coal Pty Ltd by Hydro Engineering & Consulting Pty Ltd.

HEC 2020b, *Tahmoor South Amended Project Water Management System and Site Water Balance*, prepared for Tahmoor Coal Pty Ltd by Hydro Engineering & Consulting Pty Ltd.

HEC 2020c *Tahmoor South Amended Project Flood Study*, prepared for Tahmoor Coal Pty Ltd by Hydro Engineering & Consulting Pty Ltd.

HydroGeoLogic 2019, Tahmoor South Coal Project Groundwater Assessment Independent Review (Stage 1), prepared for NSW Department of Planning and Environment.

HydroSimulations 2020, *Tahmoor South Amended Project Report: Groundwater Assessment*, prepared for Tahmoor Coal Pty Ltd by Hydrosimulations/SLR NPM Technical Pty Ltd trading as Hydrosimulations.

IEPMC 2019, *Independent Expert Panel for Mining in the Catchment Report: Part 1. Review of specific mining activities at the Metropolitan and Dendrobium coal mines*, Prepared for the NSW Department of Planning, Industry and Environment.

Morrison et al 2019, *Subsidence Fracturing of Stream Channel from Longwall Coal Mining Causing Upwelling Saline Groundwater and Metal-Enriched Contamination of Surface Waterway*", Water Air Soil Pollut 230: 37.

MSEC 2019, *Tahmoor South Project Subsidence Constraints Assessment: Assessment of potential constraints on the proposed Tahmoor South Project due to surface subsidence impacts resulting from the proposed longwall mining*, prepared for Tahmoor Coal Pty Ltd by Mine Subsidence Engineering Consultants Pty Ltd.

Niche 2019, *Myrtle Creek Aquatic Monitoring Report – Tahmoor North*, prepared for Tahmoor Coal Pty Ltd by Niche Environment and Heritage Pty Ltd.

Niche 2020a, *Biodiversity Assessment Report of the amended project*, prepared for Tahmoor Coal Pty Ltd by Niche Environment and Heritage Pty Ltd.

Niche 2020b, *Aquatic Ecology Impact Assessment of the Amended Project*, prepared for Tahmoor Coal Pty Ltd by Niche Environment and Heritage Pty Ltd.

Niche 2020c, *Aboriginal Cultural Heritage Assessment of the Amended Project*, prepared for Tahmoor Coal Pty Ltd by Niche Environment and Heritage Pty Ltd.

Niche 2020c, *Myrtle Creek Aquatic Monitoring Report – Tahmoor North*, prepared for Tahmoor Coal Pty Ltd by Niche Environment and Heritage Pty Ltd.

WRL 2020, *Understanding Thirlmere Lakes Water Balance*, presentation to Thirlmere Lakes Science Day, Water Research Laboratory.

EMM
creating opportunities

Address
Ground floor, 20 Chandos Street
St Leondards NSW 2065

Postal Address
PO Box 21
St Leonards NSW 1590

Telephone 02 9493 9500
www.emmconsulting.com.au