MACHEnergy

Mount Pleasant Operation

A JOINT VENTURE WITH JCDA Japan Coal Development Australia

Appendix O

Economic Assessment

AnalytEcon

Mount Pleasant Optimisation Project

Economic Assessment prepared for
MACH Energy Australia Pty Ltd

January 2021

ACN 140 021 450

Table of contents

List of figures

List of tables

Abbreviations

ABS	Australian Bureau of Statistics
BAM	Biodiversity Assessment Method
BSAL	Biophysical strategic agricultural land
CBA	Cost benefit analysis
CHPP	Coal Handling and Preparation Plant
CIC	Critical industry cluster
EA	Economic Assessment
EA Guidelines	Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals (2015)
EA Technical Notes	Technical Notes supporting the EA Guidelines
EEX	European Energy Exchange
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EUA	European emission allowance
FTE	Full-time equivalent
GDP	Gross domestic product
GE	General equilibrium
GHG	Greenhouse gas
GOS	Gross operating surplus
GMI	Gross mixed income
GSP	Gross state product
GVA	Gross value added
ha	Hectare
kcal/kg	Kilocalorie per kilogram
km	Kilometre
LEA	Local effects analysis
LGA	Local government area

LQ	Location quotient
MACH	MACH Mount Pleasant Operations Pty Ltd or the unincorporated Mount Pleasant Joint Venture
MFP	Multifactor productivity
ML	Mining Lease
ML	Megalitre
MLA	Mining Lease Application
MSC	Muswellbrook Shire Council
Mt	Million tonnes
Mtpa	Million tonnes per annum
NPfI	Noise Policy for Industry
NPV	Net Present Value
NSW	New South Wales
NSW Treasury Guide	NSW Government Guide to Cost-Benefit Analysis (2017)
PM10	Particulate matter less than 10 microns
PM2.5	Particulate matter less than 2.5 microns
RBA	Reserve Bank of Australia
ROM	Run-of-mine
SA3 Region	Statistical Area Level 3
SEARs	Secretary's Environmental Assessment Requirements
VLAMP	Voluntary Land Acquisition and Mitigation Policy
VPA	Voluntary Planning Agreement

EXECUTIVE SUMMARY

The Mount Pleasant Operation is an open cut coal mine and associated infrastructure, located approximately 3 kilometres (km) north-west of Muswellbrook in the Muswellbrook Local Government Area (LGA) of New South Wales (NSW).

MACH Mount Pleasant Operations Pty Ltd (MACH) manages the Mount Pleasant Operation as agent for and on behalf of the unincorporated Mount Pleasant Joint Venture between MACH Energy Australia Pty Ltd (95% owner) and J.C.D. Australia Pty Ltd (JCDA) (5% owner). MACH is seeking a new State Significant Development consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Mount Pleasant Optimisation Project (the Project).

This Economic Assessment (EA) forms part of the Environmental Impact Statement, which has been prepared to accompany the development application for the Project, with reference to the economic components of the Secretary's Environmental Assessment Requirements (SEARs). The EA has been prepared in accordance with the NSW Government's *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government, 2015a) (the EA Guidelines) and the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2018) (the EA Technical Notes). The EA Guidelines require the following analyses to be undertaken:

- a cost-benefit analysis (CBA) to assess the net benefit that the Project would deliver to the NSW community; and
- a local effects analysis (LEA) to assess the net benefit that the Project would deliver to the local region.

NET BENEFITS OF THE PROJECT FOR NSW

In this report, the net benefits to NSW are derived by comparing outcomes in the 'Project Scenario' (whereby the Project is approved) with outcomes in the 'Reference Case', whereby the Project is not approved, and mining of the Mount Pleasant Operation continues as approved.

Table ES-1 summarises the estimated incremental net benefits of the Project for NSW: the additional net benefits that would be generated by the Project relative to the Reference Case. The incremental net benefit of the Project for NSW is estimated at $855 million in net present value (NPV) terms, consisting of royalties of $684 million in NPV terms, and the NSW share of company income tax of $172 million in NPV terms. Overall, the Project's net contribution to NSW Gross State Product is estimated at $1.4 billion in NPV terms.

Table ES-1. Incremental net benefits of the Project for the NSW community (2023 to 2053, $2020)

Incremental costs	(NPV $million)	Incremental benefits	(NPV $million)
External effects	$0.7	Royalties	$684
		NSW share of company income tax	$172
Total direct and indirect costs	$0.7	Total direct and indirect benefits	$856
Net benefits to NSW			$855

Note: Totals may not sum precisely due to rounding.
Source: AnalytEcon.

The Project is likely to result in significant economic benefits to suppliers. Based on current expenditure patterns, MACH would be expected to direct an additional $2.7 billion in NPV terms in operating expenditures to NSW suppliers between 2023 and 2053 if the Project is approved.

The EA Guidelines set out a prescriptive methodology for the CBA that generally does not account for economic benefits to workers: the additional wages and salary payments that would accrue to the Project workforce. These benefits are potentially substantial. Overall, the Project is estimated to employ an annual average of 525 full-time equivalent (FTE) workers that are based in NSW between 2023 and 2053, or 462 NSW FTE workers more than in the Reference Case over the same timeframe. The aggregate disposable income accruing to the NSW workforce over that timeframe is estimated at $604 million in NPV terms, or $467 million more in NPV terms than in the Reference Case.

The Project would potentially give rise to external effects that would impact third parties. However, with the exception of greenhouse gas (GHG) emissions, MACH would mitigate these, including by implementing various management and compensation measures, by purchasing the requisite water licences, and by implementing a biodiversity offset strategy. The costs of these external effects would therefore be internalised by MACH, so that no net cost is attributable to the NSW community. The NSW share of incremental GHG emissions attributable to the Project is estimated at around $0.7 million in NPV terms; these costs represent an incremental cost to the NSW community.

The results of sensitivities undertaken to establish the robustness of the net benefit estimates to the underlying assumptions suggest that the Project would generate significant net benefits to NSW in a broad range of circumstances. The net benefits attributable to the Project are also higher than in an alternative Reference Case considered, whereby the Mount Pleasant Operation would continue operations within the parameters of current approvals until all approved open cut

coal reserves are depleted in 2038. In this scenario, the incremental net benefit accruing to the NSW community if the Project is approved would amount to $491 million in NPV terms.

FLOW-ON EFFECTS OF THE PROJECT

In addition to the immediate net benefits attributable to the Project, the Project would generate 'second round' or 'flow-on' effects. Flow-on effects are the result of the additional expenditures from a development. The additional demand for goods and services sets the economy in motion as businesses buy and sell goods and services from one another, and households earn and spend additional income. These linkages cause the total effects on the economy to exceed the initial change in demand as a result of the Project.

The incremental flow-on benefits for NSW have been derived using the same assumptions as those used for the CBA. The flow-on benefits for NSW are estimated as:

- on average an additional 444 FTE jobs per annum over the life of the Project; and
- additional disposable income benefits accruing to NSW of $276 million in NPV terms, or $20 million per annum.

LOCAL EFFECTS ANALYSIS OF THE PROJECT

Local region

For the purpose of undertaking the LEA, the EA Guidelines require proponents to adopt a study area that should match a Statistical Area Level 3 (SA3) geographic definition. In the case of the Project, the relevant SA3 area is the 'Upper Hunter SA3 Region' (the SA3 Region). The SA3 Region includes the town of Muswellbrook and the Muswellbrook Region, as well as the town of Scone and the Scone Region (which together broadly align with Muswellbrook LGA and Upper Hunter LGA, respectively).

At present, 49 per cent of the operational workforce lives in the SA3 Region, and an additional 21 per cent of the current workforce reside in Singleton Shire. An LEA prepared for the SA3 Region would therefore capture only about half of the local economic impacts of the Project.

The approach adopted in this EA is therefore to also consider the local impacts of the Project for a second region that better aligns with the places of residence of the Project local workforce:

- consistent with the EA Guidelines, the SA3 Region, which encompasses the place of residence of 49 per cent of the operational workforce; and
- the 'Project Region', consisting of Muswellbrook Shire, Upper Hunter Shire, and Singleton Shire, which captures the places of residence of 70 per cent of the operational workforce.

Net benefits of the Project for the local region

Table ES-2 summarises the net effects of the Project for the local region in the format required by the EA Guidelines.

Employment-related benefits (rows (1) through (3)) refer to the additional employment and the additional disposable income that the Project would bring to the local region.

- The Project would require an average operational workforce of 602 FTE workers between 2023 and 2048. In the Project Scenario, 422 (294) FTEs workers of the operational workforce are expected to live in the Project Region (the SA3 Region). In incremental terms, i.e., considering the Project Scenario relative to the Reference Case, 376 (261) FTE workers are expected to live in in the Project Region (the SA3 Region). If broader employment flow-on effects are taken into account, the total employment effects are estimated at 643 FTE jobs and 447 FTE jobs for the Project Region and the SA3 Region, respectively.
- In aggregate terms, the disposable income accruing to the NSW operational workforce of the Project between 2023 and 2048 is estimated at $558 million in NPV terms. The disposable income accruing to the 422 (294) operational workers expected to live in the Project Region (SA3 Region) is estimated at $409 ($284) million in NPV terms. Taking the difference between the Project Scenario and the Reference Case and considering the difference between mining wages and the average local wage, the net incremental income accruing to the Project operational workforce is estimated at $132 million for the Project Region and $98 million for the SA3 Region. If broader disposable income flow-on effects are taken into account, the total local income effects are estimated at $189 million and $140 million in NPV terms for the Project Region and the SA3 Region, respectively.

Row (4) summarises the information on non-labour related local expenditures. Operating expenditures for the Project between 2023 and 2053 are estimated to amount to $6,024 million in NPV terms, excluding private royalty payments. If current expenditure patterns are maintained, an additional $176 million ($147 million) in NPV terms in expenditures would be directed at suppliers in the Project Region (the SA3 Region) if the Project is approved.

Row (5) focuses on local government rate payments. In the Project Scenario, MACH would pay around $16 million in rate payments to Muswellbrook Shire Council, or $8.3 million in NPV terms more than in the Reference Case.

Row (6) relates to external effects that are relevant at the level of the local region. No uncompensated external effects are predicted to occur at the local level. While the Project is a source of additional GHG emissions, the share of GHG emissions that is attributable to the local region is zero for all practical purposes.

Table ES-2. LEA Summary ($2020)

(A)			(B)	(C)		(D)		(E)	
			Project direct: Total	Project direct: Local		Net effect: Local		Total Local Effects	
				Project Region	SA3 Region	Project Region	SA3 Region	Project Region	SA3 Region
(1)	Employment related								
(2)	Operational jobs created	Annual average FTE jobs	602	422	294	376	261	442	311
(3)	Disposable income operational workforce	NPV $m	$558	$409	$284	$132	$98	$189	$140
(4)	Other, non-labour expenditure (excluding private royalty payments)	NPV $m	$6,024	$224	$186	$176	$147	$176	$147
(5)	Local government rates	NPV $m	$15.8	$15.8	$15.8	$8.3	$8.3	$8.3	$8.3
(6)	Externality benefit/cost	NPV $m	$0	$0	$0	$0	$0	$0	$0

Source: AnalytEcon.

1. INTRODUCTION

The Mount Pleasant Operation is an open cut coal mine and associated infrastructure, located approximately 3 kilometres (km) north-west of Muswellbrook in the Muswellbrook Local Government Area (LGA) of New South Wales (NSW).

MACH Energy Australia Pty Ltd (MACH Energy) acquired the Mount Pleasant Operation from Coal and Allied Operations Pty Ltd on 4 August 2016, and commenced mining operations in October 2017.

MACH Mount Pleasant Operations Pty Ltd (MACH) manages the Mount Pleasant Operation as agent for and on behalf of the unincorporated Mount Pleasant Joint Venture between MACH Energy (95 per cent (%) owner) and J.C.D. Australia Pty Ltd (5% owner).[1]

MACH is seeking a new State Significant Development consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Mount Pleasant Optimisation Project (the Project). This Economic Assessment (EA) forms part of an Environmental Impact Statement (EIS), which has been prepared to accompany the development application for the Project.

1.1. PURPOSE AND SCOPE OF THE ECONOMIC ASSESSMENT

This EA has been prepared to address the economic components of the Secretary's Environmental Assessment Requirements (SEARs):

- *Economic – including a detailed assessment of the likely economic impacts of the development, in accordance with the Guidelines for the economic assessment of mining and coal seam gas proposals 2015, paying particular attention to:*
    - *the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; ...*

This EA has also considered the general requirements of the SEARs:

- *the reasons why the development should be approved, having regard to:..*
    - *the biophysical, economic and social impacts of the development, including the principles of ecologically sustainable development;*

[1] Throughout this assessment, MACH Mount Pleasant Operations Pty Ltd and the unincorporated Mount Pleasant Joint Venture will be referred to as MACH.

- *Cumulative Impacts – including a detailed assessment of the cumulative impacts of the development, in combination with other existing and approved mining projects in the locality, with a particular focus on air quality, noise, traffic and social impacts, as well as impacts on water resources.*

This EA of the Project has been prepared in accordance with the Guidelines for the economic assessment of mining and coal seam gas proposals (NSW Government, 2015a) (the EA Guidelines) and the Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals (NSW Government, 2018) (the EA Technical Notes). The EA Guidelines require the following analyses to be undertaken:

- a cost-benefit analysis (CBA) to assess the net benefit that the Project would deliver to the NSW community; and
- a local effects analysis (LEA) to assess the net benefit that the Project would deliver to the local region.

1.2. ABOUT THIS REPORT

This report is structured as follows:

- Section 2 describes the Mount Pleasant Operation and the Project, and the local region;
- Section 3 describes the CBA methodology, the derivation of the CBA components, and various sensitivities;
- Section 4 describes the analysis of flow-on effects;
- Section 5 describes the LEA that has been prepared for the local region; and
- Section 6 comments on the significance of the resource.

Supporting documentation is presented in the following appendices:

- Appendix A describes the net producer surplus calculation;
- Appendix B comments on wage differentials in the mining sector;
- Appendix C outlines the Project's contribution to NSW gross state product (GSP);
- Appendix D describes the 'Approved Resource Scenario' sensitivity in which the closure date of the existing/approved Mount Pleasant Operation is varied; and
- Appendix E describes the methodology for deriving the flow-on effects of the Project.

2. MOUNT PLEASANT OPERATION AND PROJECT CONTEXT

This section describes the Mount Pleasant Operation, the Project, and other relevant regional developments.

2.1. OVERVIEW OF THE MOUNT PLEASANT OPERATION

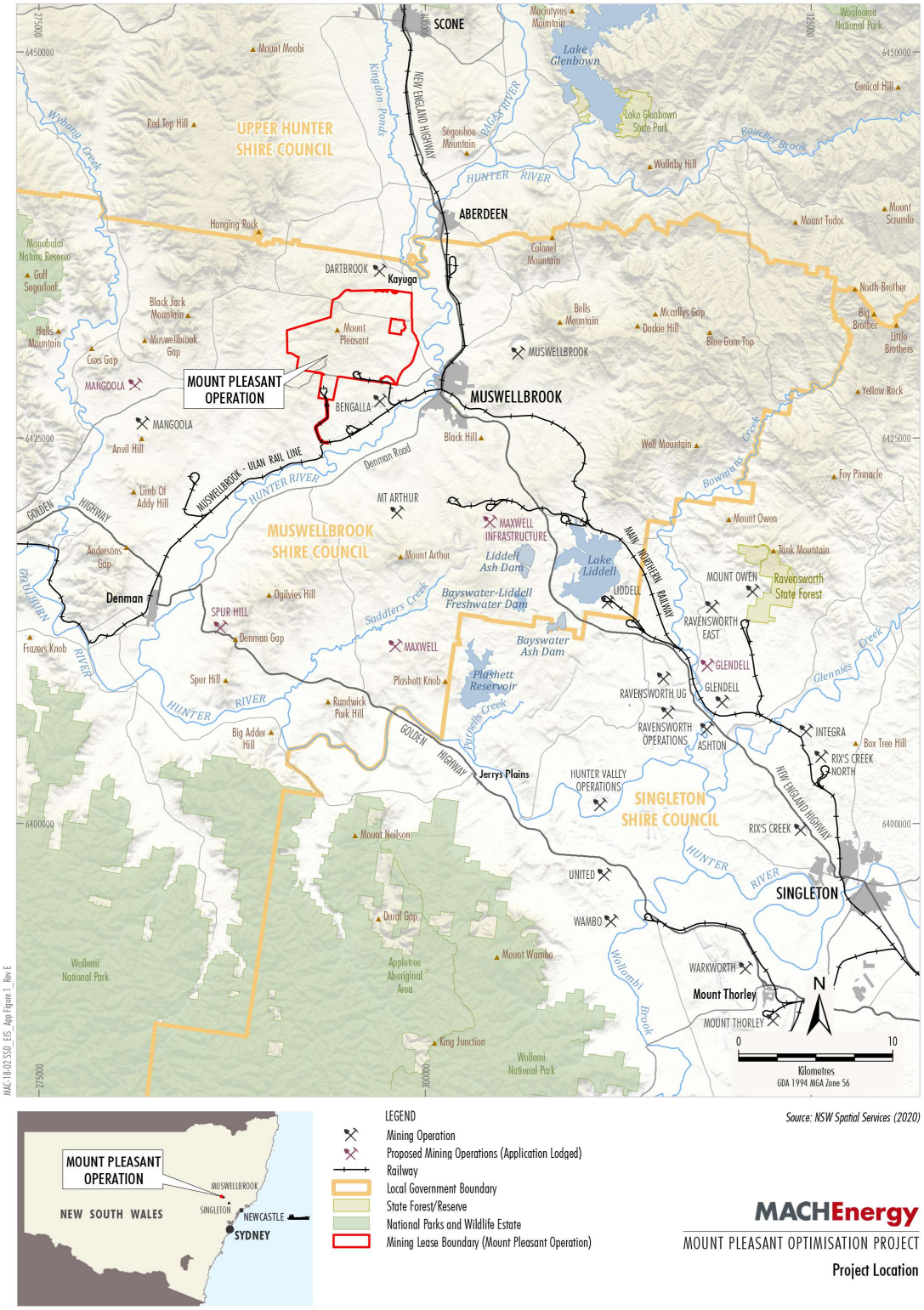
The Mount Pleasant Operation Development Consent DA 92/97 was granted on 22 December 1999. The Mount Pleasant Operation was also approved under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2012 (EPBC 2011/5795).

The approved Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated rail spur and product coal loading infrastructure located approximately 3 km north-west of Muswellbrook in the Upper Hunter Valley of NSW (Figure 2-1). The mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Up to approximately 9 trains per day of thermal coal products from the Mount Pleasant Operation are transported by rail to the Port of Newcastle for export, or to domestic customers for use in electricity generation.

Construction activities commenced at the Mount Pleasant Operation in November 2016 and mining operations commenced in October 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795. Development Consent DA 92/97 allows for the mining operations to continue until 2026. Based on a ROM coal mining rate of 10.5 Mtpa post-2026, mining operations would need to continue through to 2038 (i.e., beyond the approved mine life) to allow for all of the originally approved coal resource (i.e., 197 Mt) to be mined.

A detailed description of the Mount Pleasant Operation is provided in Section 2 in the main text of the EIS.

Figure 2-1. Location of the Project



Source: MACH.

2.2. OVERVIEW OF THE PROJECT

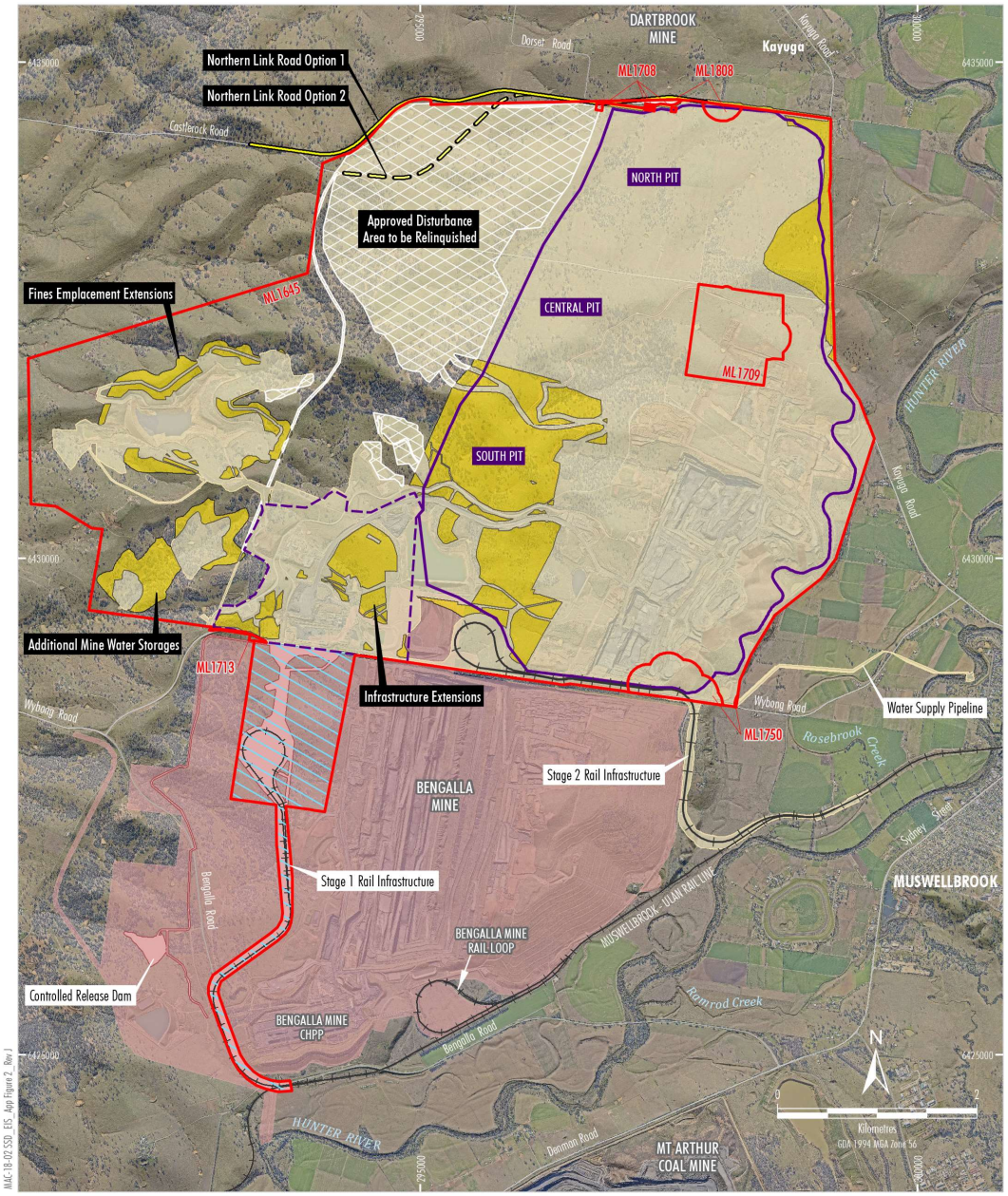
The Project would include the following developments:

- increased open cut coal extraction within the Mount Pleasant Operation Mining Leases by mining of additional coal reserves, including lower coal seams in North Pit;
- staged increase in extraction, handling and processing of ROM coal up to 21 Mtpa (i.e., progressive increase in ROM coal mining rate from 10.5 Mtpa over the Project life);
- staged upgrades to the existing Coal Handling and Preparation Plant (CHPP) and coal handling infrastructure to facilitate the handling and processing of additional coal;
- rail transport of up to approximately 17 Mtpa of product coal to domestic and export customers;
- upgrades to workshops, electricity distribution and other ancillary infrastructure;
- existing infrastructure relocations to facilitate mining extensions (e.g., local roads, powerlines and water pipelines);
- the construction and operation of new water management and water storage infrastructure in support of the mine;
- additional reject dewatering facilities to allow co-disposal of fine rejects with waste rock as part of ROM waste rock operations;
- the development of an integrated waste rock emplacement landform that incorporates geomorphic drainage design principles for hydrological stability, and varying topographic relief to be more natural in exterior appearance;
- the construction and operation of new ancillary infrastructure in support of mining;
- an extension to the time limit on mining operations to 22 December 2048;
- an average operational workforce of approximately 600 people, with a peak of approximately 830 people;
- ongoing exploration activities; and
- other associated infrastructure, plant, equipment and activities.

The general arrangement of the Project is shown on Figure 2-2.

A detailed description of the Project is provided in Section 3 in the main text of the EIS.

Figure 2-2. Project general arrangement



Source: MACH.

2.3. KEY PROJECT PARAMETERS

The following sections present key economic parameters for the Mount Pleasant Operation and the Project.

2.3.1. Product coal

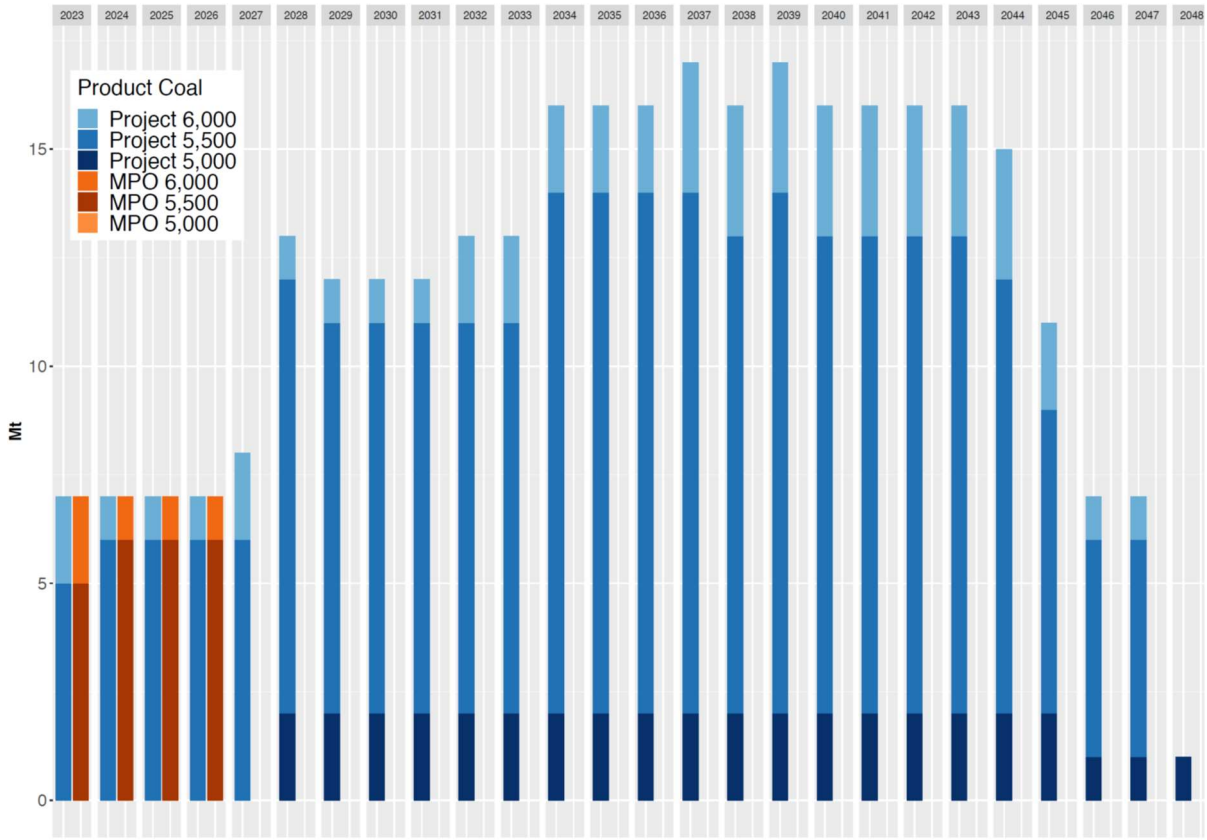
PRODUCT COAL PRODUCTION

Figure 2-3 shows product coal production profiles for the Mount Pleasant Operation and the Project, respectively:

- For the Mount Pleasant Operation, average product coal production between 2023 and 2026 would amount to around 7.7 Mtpa.
- If approved, Project product coal production would remain at current levels from 2023 (Year 1 of the Project) until 2027, increase to around 12.6 Mtpa between 2028 and 2033 (Intermediate Phase), and then increase further to around 16.6 Mtpa from 2034 to 2043 (Peak Production Phase). Production would ramp down thereafter and end in 2048 (Year 26 of the Project).

The Project is expected to produce up to three thermal coal product types (5,000 kilocalories per kilogram [kcal/kg], 5,500 kcal/kg and 6,000 kcal/kg specifications). In the absence of the Project, Mount Pleasant Operation is expected to predominantly produce 5,500 kcal/kg and 6,000 kcal/kg product coal types and minor amounts of the 5,000 kcal/kg product coal type.

Figure 2-3. Product coal production profile – Mount Pleasant Operation and Project



Notes: 6,000, 5,500, and 5,000 refer to thermal product coal specifications of 6,000 kcal/kg, 5,500 kcal/kg and 5,000 kcal/kg, respectively.

MPO = Mount Pleasant Operation.

Minor amounts of 5,000 kcal/kg product coal (approximately 0.2 Mtpa) would be produced at the MPO during 2023 to 2026.

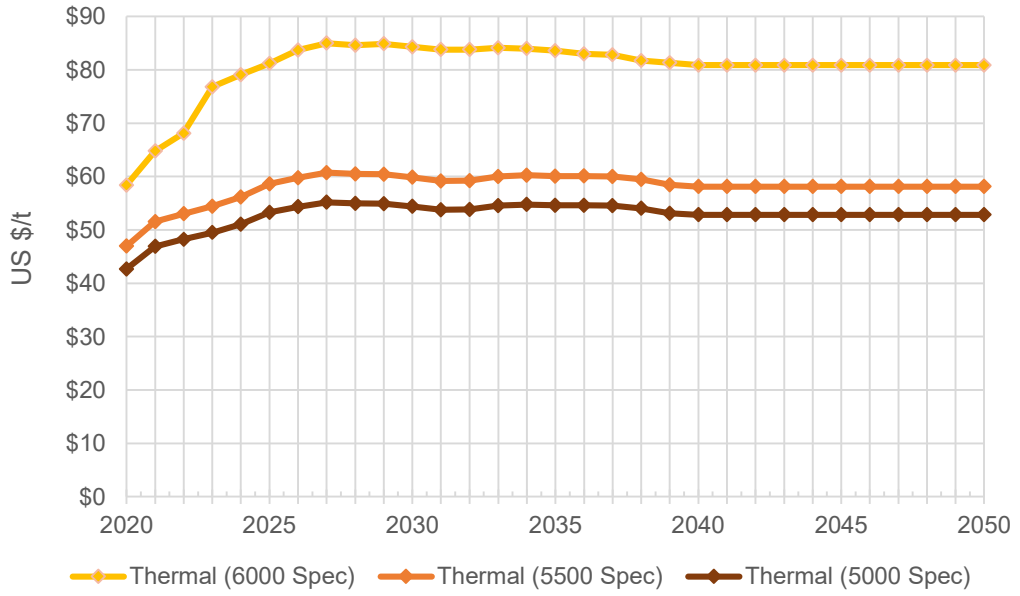
Source: MACH.

PRODUCT COAL PRICES

Figure 2-4 below shows the benchmark thermal coal price projections sourced from Wood Mackenzie that have been applied in this EA. In the short term – through to 2023 – thermal coal prices are projected to slowly recover from the effects of the COVID-19 pandemic. Prices are then expected to increase through to about 2027, particularly for higher quality (energy content) product coal specifications, reflecting higher demand for high energy bituminous coal at the expense of lower ranked coals. In the longer term, prices for higher quality (energy content) product coal are expected to flatten but remain at around the US$80 per tonne level (Figure 2-4), underpinned by increased electricity demand and higher levels of electrification in India and South East Asia.

Wood Mackenzie's AU$/US$ exchange rate forecast broadly matches coal price projections, with the US$/AU$ exchange rate projected to gradually increase from 0.64 in 2020 to 0.71 in 2024, remaining at 0.71 thereafter.

Figure 2-4. Benchmark thermal product coal price projections (US$/tonne)



Source: MACH/Wood Mackenzie.

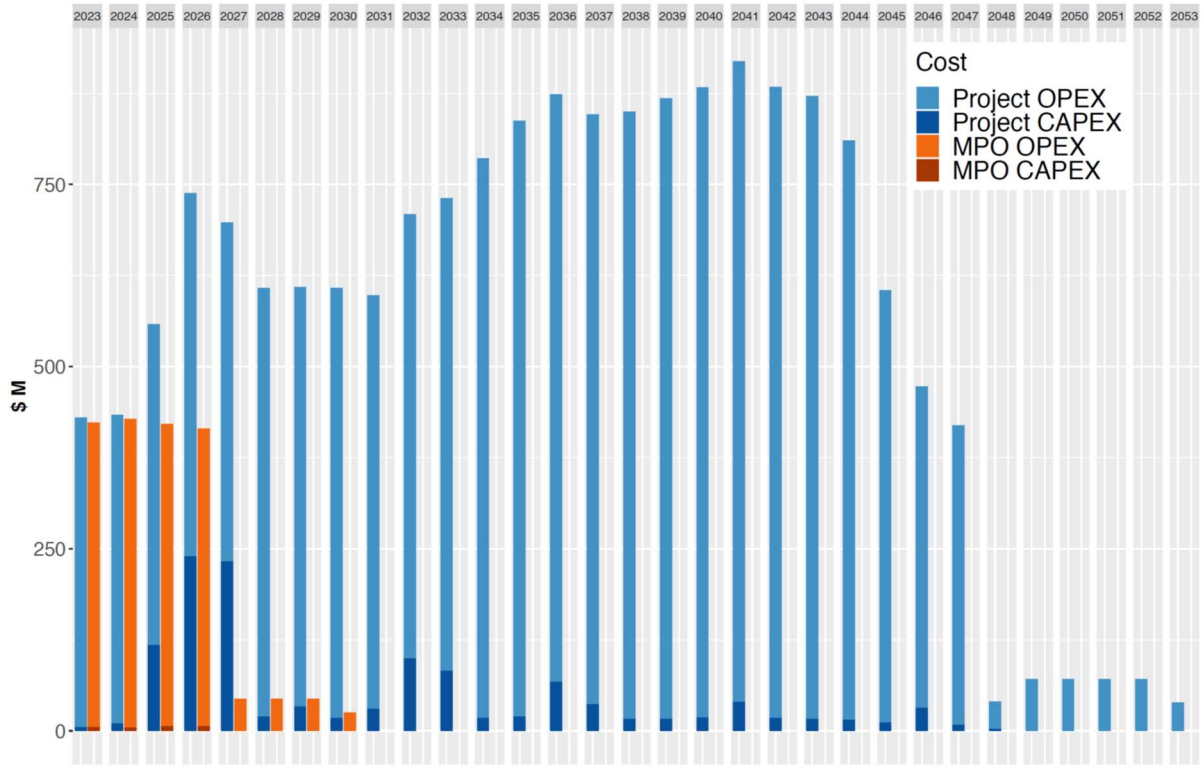
2.3.2. Capital and operating expenditures

Figure 2-5 compares projected operating and capital expenditures for the Project and the Mount Pleasant Operation. Here, capital expenditures include outlays on Project and sustaining capital, but exclude land purchases and residual land and capital values. Operating expenditures (excluding labour costs) include the costs of all ongoing mining-related activities, rail and port charges, other selling expenses, private royalty charges, as well as environmental management, rehabilitation and closure costs.

Operating expenditures for the Mount Pleasant Operation are expected to amount to around $1.8 billion ($1.3 billion in net present value or NPV terms) between 2023 and 2030, including around $156 million ($89 million in NPV terms) in closure costs that would be incurred from 2027 onwards. Operating costs for the Project between 2023 and 2053 are projected to amount to around $16.8 billion, ($6.2 billion in NPV terms), of which around $324 million ($40 million in NPV terms) would be expended in closure costs from 2049 onwards.

Capital expenditures (excluding land purchases and residual values) for the Mount Pleasant Operation are projected to be around $26 million ($19 million in NPV terms) from 2023 through to 2026, compared to $1.2 billion ($630 million in NPV terms) for the Project between 2023 and 2048.

Figure 2-5. Capital and operating expenditure – Project and Mount Pleasant Operation ($2020)



Notes: CAPEX refers to capital expenditures including project and sustaining capital expenditures but excludes land purchases and residual capital and land values. OPEX refers to freight-on-board (FOB) operating expenditure, private royalty charges, rehabilitation and closure costs, and environmental management costs, but excludes salaries and wages.

MPO = Mount Pleasant Operation.

Source: MACH.

2.3.3. Workforce profile

Figure 2-6 shows the respective workforce profiles for the Mount Pleasant Operation and the Project.

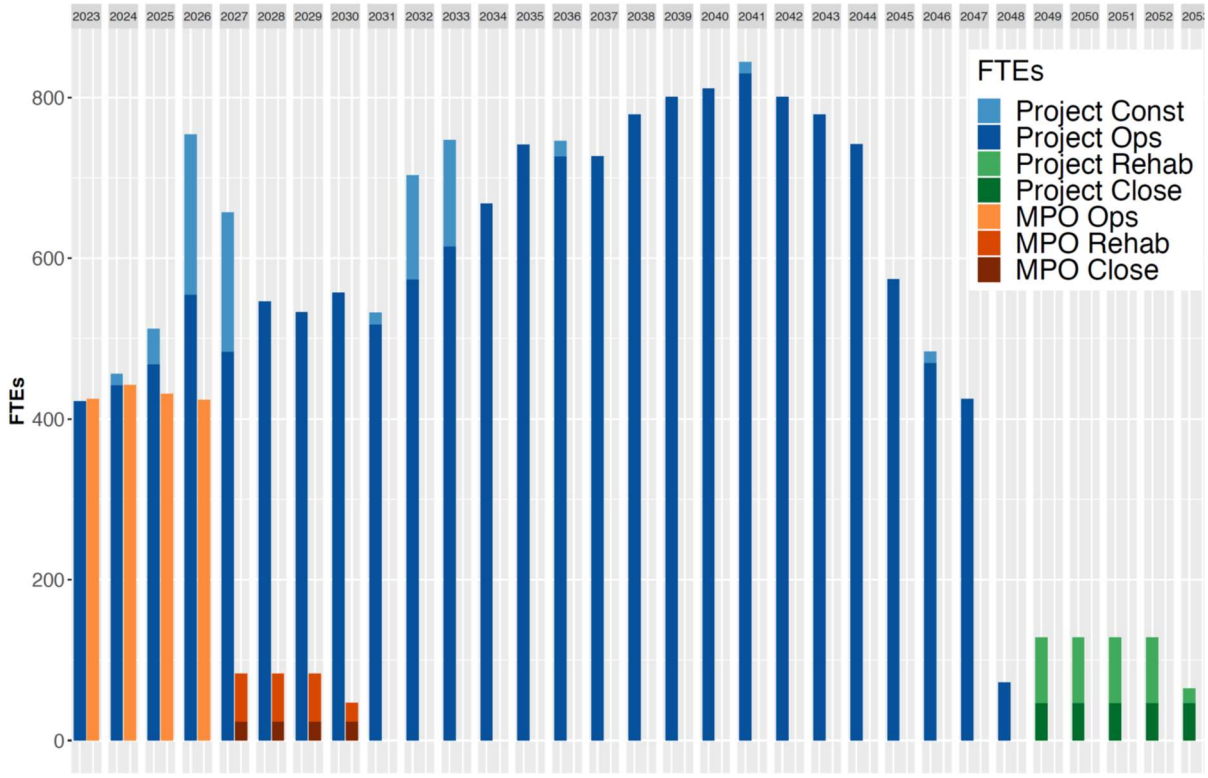
Operational employment at the Mount Pleasant Operation would continue through to 2026 and reach a peak operational workforce of 442 full-time equivalent (FTE) workers in 2024. From 2027 through to 2030 a final rehabilitation and closure workforce of around 83, declining to 46, would be required.

If the Project is approved, the operational workforce would slowly increase to a peak of 615 FTE workers during the Intermediate Phase of the Project (Years 6 through 11) and increase to a peak of 830 FTE workers in 2041 during the Peak Production Phase of the Project (Years 12 through 21). Post-mining, from 2049 to 2053, a final rehabilitation and closure workforce of 128 FTE workers, declining to 62 in 2053, would be required.

Construction activities would be undertaken at various times over the life of the Project. A temporary construction workforce would be required from 2024 through 2027 and 2031 through to 2033, and in individual years thereafter. The construction workforce is anticipated to peak at approximately:

- 44 FTEs in 2025 (e.g., for development of Northern Link Road);
- 199 FTEs and 173 FTEs in 2026 and 2027 (e.g., construction of the Stage 2a CHPP infrastructure components); and
- 129 FTEs and 132 FTEs in 2032 and 2033 (e.g., for construction of the Stage 2b CHPP infrastructure components).

Figure 2-6. Workforce profile – Project and Mount Pleasant Operation (FTEs)



Notes: 'Const' refers to the construction workforce. 'Ops' refers to the operational workforce. 'Rehab' refers to the rehabilitation workforce. 'Close' refers to the closure workforce.
MPO = Mount Pleasant Operation.

Source: MACH.

2.4. LOCAL REGION

The Mount Pleasant Operation is located within the boundaries of the Muswellbrook LGA, in the Hunter Valley region of NSW. For the purpose of undertaking the LEA, the EA Guidelines require proponents to adopt a study area that should match a Statistical Area Level 3 (SA3) geographic definition – that SA3 Region should contain the proposed development. In the case of the Project, the relevant SA3 area is the Upper Hunter SA3 Region (the SA3 Region). The SA3 Region includes the town of Muswellbrook and the Muswellbrook Region, as well as the town of Scone and the Scone Region (which together broadly align with Muswellbrook LGA and Upper Hunter LGA, respectively).

The LEA is intended to capture the effects of a development on the local economy, including via the additional employment and income that accrues to the local workforce. From this perspective, the SA3 Region does not represent a good approximation of the geographical area where the Project would lead to increased local economic activity, since a significant share of the workforce lives outside of the SA3 Region.

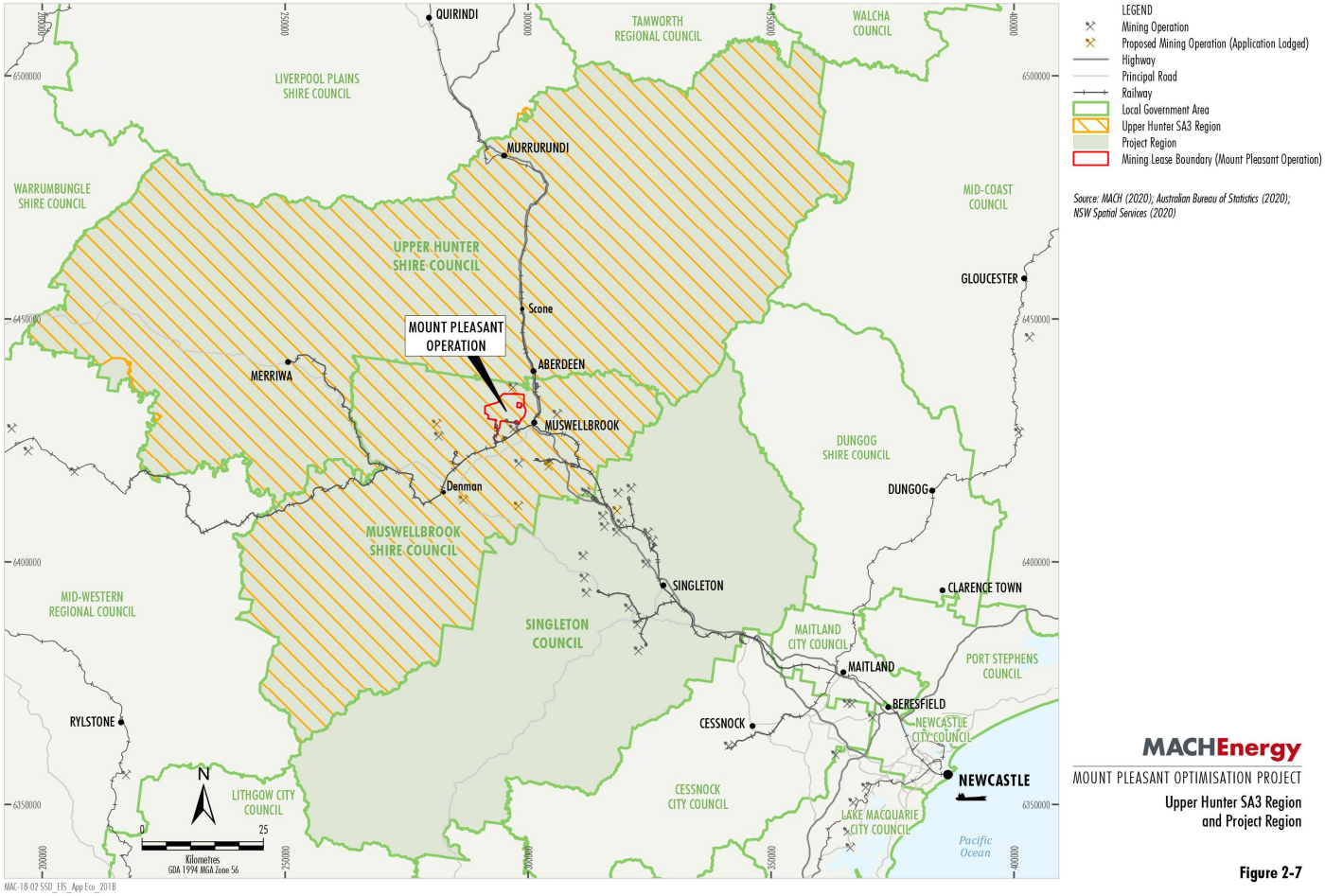
Table 2-1 below shows the places of residence of the Mount Pleasant Operation operational workforce as of March 2020. Table 2-1indicates that 33 per cent of the workforce live in Muswellbrook Shire, and 16 per cent in Upper Hunter Shire, so that a combined 49 per cent of the operational workforce lives in the SA3 Region. While smaller percentages of the workforce live in Cessnock Shire, Maitland Shire and other adjacent LGAs, an additional 21 per cent of the current workforce reside in Singleton Shire.

Table 2-1. Place of residence of the Mount Pleasant Operation operational workforce (March 2020)

Place of residence	Percentage share of total
Muswellbrook Shire LGA	33%
Upper Hunter Shire LGA	16%
Singleton Shire LGA	21%
Cessnock Shire LGA	7%
Maitland Shire LGA	5%
Other NSW	13%
Other Australia	4%
Total	100%

Source: MACH.

Figure 2-7. SA3 Region and Project Region



Source: MACH (2020).

Given that the SA3 Region includes the places of residence of only about half of the operational workforce, the approach adopted in this EA is also to consider the local impacts of the Project for a second region that would better capture the local economic impacts of the Project (Figure 2-7):

- the 'SA3 Region', consistent with the EA Guidelines, which captures the places of residence of around 49 per cent of the operational workforce; and
- the 'Project Region', consisting of Muswellbrook Shire, Upper Hunter Shire, and Singleton Shire, which captures the places of residence of around 70 per cent of the operational workforce.

2.5. OTHER RESOURCES PROJECTS IN THE REGION

The potential for interactions between other resources projects in the region and the Project is relevant for assessing the cumulative 'external effects' associated with the Project (described in Section 3.9). Table 2-2 provides an overview of other existing and proposed projects located in the vicinity of the Mount Pleasant Operation. Where relevant, the potential cumulative environmental impacts have been considered in the specialist studies undertaken for the Project.

Table 2-2. Resources projects located in the vicinity of the Mount Pleasant Operation

Project	Description	Location	Project life	Max ROM Mtpa
Operational projects				
Bengalla Mine	Open cut coal mine	Immediately south of the Mount Pleasant Operation	2039	15
Mt Arthur Coal Mine	Open cut coal mine	8 km south of the Mount Pleasant Operation	2026	32
Mangoola Coal	Open cut coal mine	8 km west of the Mount Pleasant Operation	2029	13.5
Muswellbrook Coal Mine	Open cut and underground coal mine	North-west of Muswellbrook	2022	2
Projects in care and maintenance				
Dartbrook Mine	Underground coal mine	Immediately north of the Mount Pleasant Operation	2022	6

Source: Development Consent, Section 89E of the EP&A Act: Bengalla Continuation Project, SSD-5170, 19 December 2018. Project Approval, Section 75J of the EP&A Act: Mt Arthur Coal Mine – Open Cut Consolidation Project, 09_0062, 26 September 2014; Mangoola Coal Project, 06_0014. 14 June 2017. Development Application No. 205/2002 – Section 96(2) Modification to Mining Operations in Open Cut No.1 & 2, Muswellbrook Coal, 27 October 2016. NSW Government Independent Planning Commission, Dartbrook Mine – Modification 7 (DA 231-7-2000 MOD7), Statement of reasons, August 2019.

A number of other mines are located in the Hunter region. Potential interactions with these mines are typically limited to shared use of the Main Northern Railway, shared use of supporting contractors, contributions to regional background air quality and traffic movements and socio-economic effects on the area (e.g., support industries based in Muswellbrook and other centres in the Hunter Valley).

3. COST-BENEFIT ANALYSIS OF THE PROJECT

The EA Guidelines require a CBA to be prepared to evaluate the economic impacts of a coal mining proposal on the NSW community. This section describes the methodology for deriving the components of the CBA, as set out in the EA Guidelines, the results of the analysis, and the results of various sensitivities to test the robustness of the assumptions.

3.1. NSW CBA REQUIREMENTS

CBA is a technique for assessing the economic merits of an initiative or development (such as undertaking a mining investment) from the perspective of society; in this case, from the perspective of the NSW community. A CBA compares all costs and benefits attributable to the initiative, discounted to a common point in time, to arrive at an overall assessment of whether the initiative is 'net beneficial'; that is, whether society will benefit from its implementation. A development is net beneficial if the NPV of the sum of benefits minus the sum of costs is greater than zero.

In the analysis presented in this EA, both the CBA and the LEA draw on the same data set. The central assumptions that underpin the analyses are common to both:

- the application of a central discount rate of 7 per cent per annum to discount all costs and benefits back to a common point in time, the year 2020;
- the use of internally consistent prices, expressed in 2020 Australian dollars ($2020); and
- the use of a common timeframe, beginning in 2023 and ending in 2053, to enable all incremental costs and benefits attributable to the Project to be captured, including any residual values that may be relevant beyond the life of the mine.

Preparing a CBA requires that the economic merits of a proposal are compared to a meaningful counterfactual. The CBA examines the incremental (net) benefits that would arise if the Project is approved, referred to as the 'Project Scenario', relative to those that would arise in the counterfactual 'Reference Case', whereby mining operations at the Mount Pleasant Operation would continue as approved (i.e., mining operations would cease in 2026). Table 3-1 summarises the key aspects of these scenarios.

Table 3-1. Reference Case and Project Scenario

	Reference Case Scenario		Project Scenario	
Production timeline	2023 to 2026		2023 to 2048	
Product coal production				
Annual average (Mtpa)	7.7		11.9	
Peak (Mtpa)	7.8		16.9	
Total (Mt)	30.8		345.4	
Outlays (NPV $2020 millions)				
Capital expenditures	$19		$630	
Operating expenditures, (excluding private royalty payments) plus costs associated with mitigation of external effects	$1,281		$6,032	
Average workforce (FTEs)				
Operations	2023 to 2026	431	2023 to 2048	602
Construction	2023 to 2026	0	Construction years	75
Final Rehabilitation	2027 to 2030	50	2049 to 2053	68
Closure	2027 to 2030	24	2049 to 2053	47

Notes: Construction years in the Project Scenario are 2024 to 2027, 2031 to 2033, as well as the years 2036, 2041, and 2046. The average construction workforce in the Project scenario is based on the average construction workforce over these 10 construction years. The construction workforce peaks in 2026, with approximately 200 FTE personnel on an annual basis (and approximately 400 FTE personnel in the peak month). Operating expenditures exclude private royalty payments.

Source: MACH.

A CBA requires a full accounting calculation whereby the costs and benefits of a project are compared in monetary terms, and therefore requires that costs and benefits should, as far as possible, be valued. Table 3.1 in the EA Guidelines contains a list of the potential costs and benefits of a proposal that are attributable to NSW in the CBA, which are derived in the following subsections.

As a general matter, a CBA relies on the 'opportunity cost' principle to value goods and services (NSW Government 2017). For 'conventional', market-based transactions, such as the sale of coal outputs or the purchase of labour and other inputs, the relevant value is determined with reference to market prices. For so-called 'external effects' or 'externalities' – environmental costs and other impacts on third parties for which there are no obvious prices – alternative valuation methods need to be used. These valuation methods are prescribed in the EA Technical Notes and are described in Section 3.9.

3.2. COAL ROYALTIES

The incremental coal royalty payments attributable to the Project were derived as shown in Table 3-2. Gross royalty payments accruing to NSW were calculated by multiplying gross mining revenues, net of allowable deductions for coal beneficiation, and net of estimated levies, with the ad valorem royalty rate of 8.2 per cent applied to the net disposal value.

Table 3-2. Incremental royalty calculation (2023 to 2053, $2020)

	Project (NPV $million)	Mount Pleasant Operation (NPV $million)	Difference (NPV $million)	Notes
Assessable revenues	$10,620	$1,998	$8,621	Product coal production × AU$ coal prices
Allowable deductions				
Beneficiation	$333	$77	$256	Beneficiation deduction of $0.50 per tonne (bypass product coal) $3.50 per tonne (full cycle of washing)
Levies	$31	$7	$24	Coal Research Levy, Mines Rescue Levy, Long Service Leave Levy
Net disposal value	$10,256	$1,914	$8,341	Assessable revenue net of allowable deductions
NSW royalty	$841	$157	$684	8.2 per cent (open-cut coal royalty rate) × net disposal value

Note: Totals may not sum precisely due to rounding.
Source: MACH, AnalytEcon analysis.

Table 3-2 shows that the Project would result in royalty payments to NSW of $841 million in NPV terms, an increase of $684 million in NPV terms relative to the Mount Pleasant Operation. This would correspond to total (undiscounted) royalty payments of around $2.2 billion, or around $2 billion more than in the Reference Case.

3.3. COMPANY INCOME AND OTHER TAXES

3.3.1. Company income taxes

The EA Guidelines require an estimate of the total annual company income tax payable for each year of the evaluation period of the Project, of which a share corresponding to the proportion of Australia's population based in NSW (31.9 per cent) should be attributed to NSW.

Aggregate Commonwealth company income tax payments were derived by deducting operating costs, wages and salaries, the costs of mitigating externalities, royalty and tax payments, and depreciation of capital assets from gross revenues to derive taxable income, as shown in Table 3-3. Tax depreciation was calculated using the diminishing value method,[2] assuming an average effective tax life of 20 years.

An inflation adjustment is necessary to account for the fact that depreciation is determined on the basis of nominal asset values. Real ($2020) company tax payments were derived by adjusting for inflation, assumed to be 2.5 per cent per annum over the forecasting timeframe in line with the Reserve Bank of Australia's (RBA's) 2 to 3 per cent inflation target, on average, for its monetary policy.

[2] The diminishing value method assumes the decline in value each year is a constant proportion of the amount not yet written-off and produces a progressively smaller decline in value over time. Assuming that all assets are held for a full year, the formula for the decline in value is: base value × (200% ÷ asset's effective life). https://www.ato.gov.au/Forms/Guide-to-depreciating-assets-2019/?page=7; accessed on 30 June 2020.

Table 3-3. Incremental company income tax calculation (2023 to 2053, $2020)

	Project (NPV $million)	Mount Pleasant Operation (NPV $million)	Difference (NPV $million)	Notes
Coal revenues	$10,620	$1,998	$8,621	Product coal production × AU$ coal prices
Less:				
Operating costs	$6,237	$1,319	$4,918	Operating expenditures, mitigation of external effects
Labour costs	$1,027	$231	$796	Wages & salaries for operational, construction, rehabilitation and closure workforces
Royalties	$841	$157	$684	NSW royalty payments
All other taxes	$106	$28	$78	Payroll, land taxes, shire rates
Tax depreciation	$364	$17	$347	Depreciation of capital assets
Total assessable income	$2,044	$246	$1,799	Coal revenues minus all costs
Company tax	$613	$74	$540	30% of total assessable income
Share of company tax attributable to NSW	$196	$24	$172	31.9% of company tax (NSW share of Australian population)

Note: Totals may not sum precisely due to rounding.
Source: MACH, AnalytEcon analysis.

3.3.2. Personal income taxes

The EA Guidelines note that a new mine will also generate other taxes, such as personal income tax. However, whether an economic initiative such as the Project can be deemed a source of additional personal income taxes (a share of which can be attributed to NSW) depends on whether the additional wages and salaries paid to the workforce in the Project Scenario are deemed 'additional'. We discuss this issue in Section 3.6.

3.3.3. Payroll taxes

The EA Guidelines similarly allow for the inclusion of payroll taxes, provided that these taxes are shown to be 'additional'. Payroll taxes accrue directly to the State of NSW and therefore constitute a direct benefit to the NSW community. Whether the Project is deemed to generate additional payroll tax revenues also hinges on whether the additional wages and salaries paid to the Project workforce are deemed additional (discussed in Section 3.6).

3.3.4. Local government rates

Local government rates are levied on individuals and businesses located within an LGA and are collected by the local council, to the benefit of the local NSW community. The EA Guidelines do not comment on the treatment of local government rates.

In this EA, the local government rates paid by MACH have been incorporated in the costings for the Mount Pleasant Operation and the Project, respectively, but have conservatively not been counted as a benefit for NSW. MACH is assumed to pay rates of $1,443,000 per annum in either the Reference Case or the Project Scenario over the operating life of the mine and through to the end of the process of rehabilitation and closure.

3.3.5. Land taxes

Land taxes are levied on the value of NSW land owned by individuals and businesses. Land taxes accrue to the State of NSW and benefit the NSW community. The EA Guidelines also do not comment on the treatment of land taxes.

In this EA we have assumed that MACH would pay land taxes of around $250,000 per annum in either the Reference Case or the Project Scenario. Land taxes have been included in the costings for either scenario but have also conservatively not been counted as a benefit for NSW.

3.4. NET PRODUCER SURPLUS

Table 3.5 in the EA Guidelines sets out the approach to be applied to determine the net producer surplus, in effect an approximation of cash profits. The total direct net benefit to the producer is the difference between the value of the output (including any residual value of land and capital at the end of the mine life), and expenditures on inputs, i.e., the costs of production.

The EA Guidelines set out that the net producer surplus attributable to NSW is the economic rent attributable to NSW owners of capital, which depends on the Australian share of the Project's ownership. The Mount Pleasant Operation is owned by the unincorporated Mount Pleasant Joint Venture between MACH (95 per cent ownership share), and J.C.D. Australia Pty Ltd (5 per cent ownership share). MACH is, in turn, owned by Droxford International, a subsidiary of Indonesia's Salim Group, while J.C.D. Australia Pty Ltd is Japanese owned.

Neither of these companies have an Australian ownership share, and no share of the net producer surplus would therefore accrue to NSW. The details of the net producer surplus calculation are reported in Appendix A.

3.5. ECONOMIC BENEFITS TO EXISTING LANDHOLDERS

The EA Guidelines note that a mining proponent may purchase or lease land from existing landholders at a price which exceeds the opportunity cost of the land, for instance when a premium above market prices for land acquisitions or leases is paid. The corresponding surplus is an economic benefit that accrues to existing landholders and should be attributed to NSW.

In the case of the Project, any future acquisitions, such as properties provided with voluntary acquisition rights may include a premium to market value. However, the resulting net benefit accruing to landholders is insignificant relative to the overall net benefit to NSW generated by the Project, and these premia often include a component of compensation to account for the costs of relocation. Therefore, any economic benefits accruing to local landholders are unlikely to be material and have not been estimated.

3.6. ECONOMIC BENEFITS TO NSW WORKERS

3.6.1. EA Guidelines approach

The mining industry is a significant employer of skilled workers such as machinery operators, truck drivers, technicians and trades workers, as well as labourers, managers, professionals and support workers. Average wages in the Australian mining sector are also significantly higher than in other industries that require similarly skilled workers, such as the construction, transport, utilities and manufacturing sectors. Wages and salaries paid to the Mount Pleasant Operation workforce in the Reference Case are correspondingly higher than the average or median NSW wage, and the same applies in the Project Scenario.

The EA Guidelines discount any higher than average wages that might accrue to the workforce of a mining project, noting that the starting point of any analysis should be that workers will not earn a 'wage premium' even if they earn more working in the mining sector. The rationale for this approach is that:

- A mine that employs workers who are already working locally (but not in the mining sector), may need to offer higher wages to compensate for more physically demanding work or tougher conditions. Hence it is claimed that the benefit to workers from higher pay will be offset by the (personal opportunity) costs associated with greater hardship.
- A mine that attracts workers from other parts of NSW may need to offer higher wages to compensate for a worker relocating. Again, it is claimed that the added monetary benefit to workers is not a valid wage premium but compensation for a personal opportunity cost.

3.6.2. Consideration of EA Guidelines

The EA Guidelines place strict limitations on the extent to which higher than average salaries paid to the workforce of a mining project can be considered as a benefit in the CBA (although not in the LEA). This approach does not accord with standard economic thinking about the nature of such 'wage premia', and is also inconsistent with the approach set out in the *NSW Government Guide to Cost-Benefit Analysis* ('the NSW Treasury Guide', NSW Government, 2017).[3] This section provides a justification for this position.

WAGES AND PRODUCTIVITY

The EA Guidelines assume that higher wages paid to workers simply reflect the 'disutility' of working a particular job, such as physically demanding or otherwise difficult work, or poor working conditions. However, while labour markets are complex, there is near universal agreement that over a longer timeframe, the fundamental determinant of wages is labour productivity: the amount of output produced by a worker over a unit of time, say an hour.

Labour productivity does not evolve in a vacuum but depends on the amount or quality of capital and other factors of production that are available to workers. For instance, workers mining coal will be far more productive if they can access heavy, specialised equipment as opposed to using a pick and shovel. Hence growth in labour productivity (or the increase in output per hour worked) depends on the quantity of capital inputs available and the efficiency with which capital and labour are combined in the course of the production process.

Recent empirical research from the Australian Treasury (Australian Government, 2017) confirms the importance of this central economic relationship between wages and productivity. The analysis of Australian businesses across all industry sectors, for all sizes, and other characteristics confirmed that:

- businesses with higher labour productivity pay higher real wages; and
- the relationship between real wages and labour productivity holds across all business characteristics examined, including size and export exposure.

[3] Background and supporting information on this section is presented in Appendix B.

The broad conclusions highlighted by the Australian Treasury (2017) analysis directly apply to the Australian mining sector:

- average earnings in the mining sector exceed those in sectors that require similar skills;
- relatively high earnings in the mining sector are matched by the underlying labour productivity which, in absolute terms, is higher in the mining industry than in any other Australian industry; and
- high labour productivity and high wages in the mining sector in turn reflects substantial investment in capital assets.

COMPENSATING WAGE DIFFERENTIALS

It is possible that the claim in the EA Guidelines that differences in wages between the mining and other sectors of the economy merely compensate workers for greater hardship refers to the theory of 'compensating wage differentials' originally articulated by Adam Smith. That theory postulates that wages in some industries are high because workers want to be compensated for job attributes that are dangerous or unpleasant or otherwise undesirable.

In practice, however, empirical support for the theory of compensating differentials is weak. Those studies that identify a compensating effect find large variations in how work-reward trade-offs are valued by workers, including as a function of income levels, job risk, age, immigrant status, race, gender, and other characteristics. The results of empirical research into the theory of compensating differentials in Australia are inconclusive. The most recent Australian study on this subject by Cai and Waddoups (2012) using Household, Income and Labour Dynamics in Australia (HILDA) survey data to estimate the role of negative job characteristics (job stress, employment security, complexity and difficulty, control of the work process, commute times) found that these job characteristics have a negligible effect on wages.

NSW TREASURY GUIDE

Standard economic analysis which draws on considerable empirical evidence in Australia and overseas suggest that the fact that there are wage differentials for otherwise similar jobs reflects productivity differences of individuals employed in different industries. Wage differentials do not reflect some form of personal opportunity cost or disutility, that effectively negates a wage premium.

This conclusion is also reflected in the approach towards wage differentials set out in the NSW Treasury Guide, which explicitly recognises wage increases as a benefit accruing to workers (Table 2.2, p. 13):

> *Labour surplus is the difference between a worker's actual wages and what they are willing to accept (their reservation wage). If an initiative increased hourly wage rates, the incremental increase would be a benefit.*

3.6.3. Potential economic benefits for the Project workforce

The EA Guidelines do not recognise the benefits that would accrue to NSW workers – in terms of additional employment and higher wages and salaries – as a result of a new mining development, and none have been included in this EA for the Project.

However, the benefits of the Project for the NSW workforce are potentially substantial. The Mount Pleasant Operation will employ, on average, 431 FTE operational workers per year from 2023, but employment at the mine is projected to end in 2026. If the Project is approved, it would offer continuous employment to the existing workforce and to local residents by employing, on average, 602 FTE operational workers from 2023 to 2048. Almost all of these operational workers (see Table 2-1) are expected to be NSW residents.

Between 2023 and 2053, the Project's NSW workforce (including the construction, operational, final rehabilitation and closure workforce) would earn an aggregate gross income of $2,593 million ($983 million in NPV terms), corresponding to an aggregate disposable income of $1,590 million ($604 million in NPV terms). Relative to a counterfactual whereby employment at the Mount Pleasant Operation ceases in 2026, the NSW workforce would earn an additional $2,284 million ($762 million in NPV terms) more in gross income or $1,400 million ($467 million in NPV terms) in disposable income if the Project is approved.

There are different approaches for further refining the above difference calculation, so as to limit the aggregate income that can be deemed 'additional' and attributable to the Project. For instance, it could be assumed that a share of the future workforce may transfer to the Project from the Mount Pleasant Operation or from another mining sector employer, so that the incremental income attributable to the Project would be less. Alternatively, or additionally, it may be assumed that a share of the workforce may have been previously employed at a lower wage in a different (non-mining) industry). Either way, however, the above (indicative) calculations suggest that the economic benefits accruing to NSW workers (and the additional payroll and other taxation revenues attributable to NSW) are potentially large.

Notwithstanding the above, consistent with the EA Guidelines, no economic benefits to workers have been include in the CBA.

3.7. ECONOMIC BENEFITS TO SUPPLIERS

The EA Guidelines note that NSW suppliers may receive an economic benefit in the form of higher surpluses if they supply a new mining development. The value of that economic benefit should be incorporated in the CBA.

Quantifying such a benefit to suppliers poses practical difficulties. There are no published statistics as to which businesses in NSW are also NSW-owned. The fact that a business may have a local or NSW presence is not indicative of the ownership of the business. Even if NSW-owned businesses could be identified, it is generally not known whether the goods and services supplied by these businesses are produced in NSW or whether they are 'imported' from elsewhere in Australia (or from overseas). Depending on the situation, the additional 'surplus' that these businesses might then earn from supplying the Project may consist of a pure wholesale or retail margin, or of additional income that may be paid to workers and for services.[4] These data limitations imply that economic benefits to NSW suppliers cannot be measured with any precision.

However, an illustrative calculation suggest that these impacts are likely to be significant. In the Project Scenario MACH would incur operating expenditures between 2023 and 2053 of around $6 billion in NPV terms (excluding private royalty payments), as opposed to around $1.3 billion in NPV terms in the Reference Case, a difference of around $4.7 billion in NPV terms. An analysis of the Mount Pleasant Operation's operating expenditures suggests that almost 58 per cent are currently directed towards NSW suppliers (Table 5-3). If that share of NSW expenditures remains the same going forward, expenditures in the order of an additional $2.7 billion in NPV terms would be directed towards NSW suppliers between 2023 and 2053. If it is assumed, for illustrative purposes, that 10 per cent of these additional NSW expenditures represent some form of margin to wholesalers or retailers, the additional surplus accruing to NSW suppliers in the Project Scenario would be around $270 million in NPV terms.

[4] Data on wholesale margins (likely to be more appropriate for a large purchaser such as MACH) is difficult to access in the public domain. The petroleum industry, which is monitored by the Australian Competition and Consumer Commission (ACCC), reportedly earned wholesale margins (earnings before interest and tax relative to sales revenue) between 2.0 and 3.4 per cent over the last 10 years to 2017-18 (ACCC 2020). The most recent research published by the RBA for retail goods indicates that in 2012-13, wholesalers' gross margins (including expenditure on staff, rent, freight and the cost of holding inventory) on average comprised 15 per cent of final sales prices, with just over 2 per cent representing wholesalers' net margins (Ballantyne and Langcake, 2016).

3.8. NET PUBLIC INFRASTRUCTURE COSTS

As noted in the EA Guidelines, the incremental cost of public infrastructure (such as utilities and communications expenditures) and transport infrastructure required due to a proposal should be included in the CBA.

No public infrastructure costs are expected to be incurred for the Project, and none have therefore been included in the CBA.

3.9. NET ENVIRONMENTAL, SOCIAL AND TRANSPORT-RELATED COSTS

This section reviews the predicted net environmental, social and transport-related costs of the Project, referred to as 'externalities' or 'external effects', as summarised in Table 3-4. The following subsections focus on each of the identified external effects.

Table 3-4. Overview of external effects in the Reference Case and Project Scenario

Externality	Reference Case	Project Scenario
Noise	Noise mitigation and management costs included in capital/operational costs to 2026.	Noise mitigation and management costs included in capital/operational costs to 2048. Acquisition and compensation costs included in capital costs. Immaterial residual noise impacts.
Air Quality*	Air quality management costs up to 2026 included in capital/operational costs.	Air quality management costs up to 2048 included in capital/operational costs. Acquisition and compensation costs included in capital costs.
Greenhouse Gas	Market-based and social cost of Scope 1 and 2 GHG emissions to 2026 have been estimated.	Market-based and social cost of Scope 1 and 2 GHG emissions to 2048 have been estimated.
Surface Water	Surface water management costs up to 2026 included in capital/operational costs.	Surface water management costs up to 2048 included in capital/operational costs.
Groundwater	Groundwater management costs up to 2026 included in capital/operational costs.	Groundwater management costs up to 2048 included in capital/operational costs. Costs associated with impacted bores included in operating costs. Costs of purchasing additional licenses in 2023 included in environmental mitigation costs.

Externality	Reference Case	Project Scenario
Biodiversity	Biodiversity management costs up to 2026 included in capital/operational costs. Biodiversity offset already established.	Biodiversity management costs up to 2048 included in capital/operational costs. No additional biodiversity offset requirements are anticipated, however, conservative additional biodiversity offset cost allowance included in capital/operating costs in 2023.
Land Resources	Agricultural production forgone to 2026 (opportunity cost to MACH).	Agricultural production forgone to 2048 (opportunity cost to MACH).
Aboriginal Heritage	Aboriginal heritage management costs up to 2026 included in capital/operational costs.	Aboriginal heritage management costs up to 2048 included in capital/operational costs.
Historic Heritage	Historic heritage management costs up to 2026 included in capital/operational costs.	Historic heritage management costs up to 2048 included in capital/operational costs.
Road Transport	Road transport management costs up to 2026 included in capital/operational costs.	Voluntary Planning Agreement road maintenance contributions included in operational costs.
Visual	Visual management costs up to 2026 included in capital/operational costs.	Visual management costs up to 2048 included in capital/operational costs.
Social	Voluntary Planning Agreement community contributions included in operational costs.	Voluntary Planning Agreement community contributions included in operational costs.

Notes: * For the reasons set out in Section 3.9.2, no air quality damage estimate has been included in the CBA.

Source: MACH (2020).

3.9.1. Noise

Appendix A of the EIS contains the Noise and Blasting Assessment (Wilkinson Murray, 2020) for the Project.

PREDICTED NOISE AND BLASTING IMPACTS

The Noise and Blasting Assessment considered representative scenarios to evaluate operational noise, the noise from construction activities, and blasting, as well as road and rail transportation noise. The Noise and Blasting Assessment found that (Wilkinson Murray, 2020):

- With noise mitigation measures, of the 670 privately-owned residential receptors modelled, 14 receptors would be in the Noise Affectation Zone (greater than 5 A-weighted decibels [dB{A}] above the relevant Project Noise Trigger Levels), 14 would be in the Noise Management Zone (3 to 5 dB[A] above the relevant Project Noise Trigger Levels) as defined in the *Noise Policy for Industry* (NPfI).

- A number of privately owned receptors outside of the township of Muswellbrook and village of Aberdeen are predicted to experience 'negligible' exceedances of the relevant Project Noise Trigger Levels, and therefore receiver-based mitigation measures would not be warranted, as defined in the NPfI.
- The Project would comply with relevant criteria in relation to construction noise, blasting overpressure and ground vibration levels.
- Five privately-owned receptors are predicted to experience 'negligible' exceedances of the relevant traffic noise criteria due to Project traffic.
- Two privately-owned receptors are predicted to experience 'negligible' exceedances of the relevant rail transportation noise criteria.
- Cumulative noise levels with other nearby mining operations would exceed the relevant cumulative (amenity) noise criteria at some privately-owned receptors to the south of the Mount Pleasant Operation, though these exceedances would generally occur with or without the Project. Some privately-owned receptors to the north are predicted to exceed the criteria due to the Project alone (these receivers are a subset of those in the Noise Affectation Zone).

MITIGATION AND MANAGEMENT MEASURES

Wilkinson Murray (2020) undertook several iterative noise modelling investigations designed to determine feasible and reasonable noise mitigation measures for the Project. A key mitigation measure adopted for the Project is the staged increase in production (i.e., progressive increase in ROM coal mining rate from 10.5 Mtpa up to 21 Mtpa over the Project life) combined with mine progression in the western direction away from receivers in and around the Muswellbrook township and village of Aberdeen. The intent of this staged increase in production rate is to allow for enough distance separating the populated noise-sensitive areas to the east and the Project's active disturbance area.

In addition, the following specific noise mitigation measures would be implemented for the Project:

- noise controls on mobile plant during fleet procurement (e.g. extra quiet mobile plant models) to reduce emitted noise levels;
- enclosure/acoustic shrouding of selected infrastructure items in the mine infrastructure area;
- acoustic design incorporated into mine planning, including optimising shielding of selected haul roads, truck numbers assigned to haul roads (with more trucks using haul roads further away from receivers), and alignment of haul roads away from receivers where possible; and

- real-time monitoring and forecasting systems, incorporating noise and meteorological monitoring, with the purpose of anticipating upcoming periods of very noise-enhancing meteorological conditions that may generate noise exceedances at receivers surrounding the mine. Such a system would allow the mine operator to prepare to modify operations to reduce noise levels as far as reasonably and feasibly practical in the event that predicted adverse weather conditions are experienced.

Details of the noise mitigation measures (including real-time monitoring and forecasting system) would be provided in a Noise Management Plan.

The Noise and Blasting Assessment (Wilkinson Murray, 2020) notes the outcomes described in the Predicted Noise and Blasting subsection above generally represent a reduction in impact in comparison to the approved Mount Pleasant Operation, and the Project's staged increases to ROM coal extraction would be effective in minimising potential noise impacts to the majority of privately-owned receptors surrounding the Mount Pleasant Operation.

VALUATION APPROACH

The EA Technical Notes require that the current and future cost of any noise mitigation measures, negotiated agreements or land acquisition to mitigate noise impacts in accordance with the NPfI and the NSW *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) should be included in the proponent's operating and capital costs.

The costs associated with the proposed noise mitigation measures (e.g., equipment modifications, preparing and implementing a Noise Management Plan) have been incorporated in MACH's operating and capital expenditure costings. In addition, conservative estimates of the relevant property acquisitions costs have been allocated and included in MACH's capital costings for the Project.

No material residual noise impacts are predicted after the implementation of the noise mitigation measures in accordance with the NPfI and the VLAMP.

3.9.2. Air Quality

Appendix B of the EIS contains the Air Quality Impact Assessment (Todoroski Air Sciences, 2020) for the Project.

PREDICTED AIR QUALITY IMPACTS

The Project's air quality impacts were assessed with reference to the NSW Environment Protection Authority's (NSW EPA's) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2016). The assessment predicted the following impacts as a result of the Project (Todoroski Air Sciences, 2020):

- Nine privately owned receptors are predicted to exceed the Project-only 24-hour average particulate matter less than 10 microns (PM_{10}) assessment criterion.
- No privately owned receptors are predicted to exceed the Project-only 24-hour average particulate matter less than 2.5 microns ($PM_{2.5}$) criterion.
- Cumulative 24-hour average $PM_{2.5}$ and PM_{10} levels exceeding the NSW EPA impact assessment criteria were predicted to occur in the surrounding environment in the absence of the implementation of reactive measures. With the application of a reactive dust mitigation strategy and incorporation of real-time/predicted management systems, no privately owned receivers are predicted to exceed the cumulative 24-hour average PM_{10} criterion (in addition to those predicted to experience Project-only impacts) and five privately owned receptors are predicted to experience exceedances of the cumulative 24-hour average $PM_{2.5}$ criterion.
- Four privately owned receptors are predicted to experience exceedances of the relevant cumulative annual average $PM_{2.5}$, PM_{10}, TSP and dust deposition criteria, with the Project estimated to contribute approximately 1 to 2 per cent to the predicted cumulative levels at these receptors. Given that the predicted exceedances would occur with or without the Project at each receptor, it is considered the Project would not contribute to an exceedance of the relevant cumulative criteria at any of the receptors.
- One parcel of vacant land to the north of the Mount Pleasant Operation is predicted to exceed the relevant VLAMP criteria for vacant land.

A Human Health Assessment (Environmental Risk Sciences (EnRisks), 2020) was prepared for the Project to also consider potential air quality impacts on community health (Appendix R of the EIS). EnRisks (2020) identified three additional receptors in close proximity to the Mount Pleasant Operation that may be exposed to health risks due to Project-only annual average $PM_{2.5}$ levels. No health risk issues of concern were identified for the township of Muswellbrook or village of Aberdeen.

MITIGATION AND MANAGEMENT MEASURES

MACH would implement dust management measures in accordance with an Air Quality Management Plan. Key dust mitigation measures that would be implemented for the Project include:

- the use of water (i.e., wet suppression) during drilling;
- minimising the fall height of overburden materials where practicable;
- the application of water and regular maintenance of unsealed haulage surfaces;
- the application of water on dozer travel routes and work areas;
- three-sided enclosure and activation of fogging sprays during ROM coal unloading;
- enclosures for conveyors and transfer points with application of water sprays at transfer points;
- the use of a luffing stacker to reduce fall height of coal at stockpiles; and
- water application to stabilise surface of stockpile and vegetative wind breaks to reduce wind speed over surface of stockpile.

In addition to the physical mitigation measures described above, reactive operational dust mitigation strategies and management measures would be implemented to minimise the potential for dust impacts during mining operations on the surrounding environment.

VALUATION APPROACH

As noted above, the assessment by Todoroski Air Sciences (2020) found that the Project would either not breach the NSW EPA air quality criteria, or that, where breaches might occur, these could be mitigated by MACH purchasing the affected land.

The EA Technical Notes require that the cost of any management and mitigation measures, negotiated agreements or land acquisition in accordance with the VLAMP to mitigate air quality impacts should be included in the proponent's costs. The costs of ongoing air quality management and mitigation measures, which would continue to be implemented if the Project is approved, have therefore been included as part of MACH's costings in the Reference Case and the Project Scenario. Conservative estimates of the costs associated with negotiated agreements or land acquisition as per the VLAMP have also been included in the costings.

The EA Technical Notes also state that (p. 25):

Mitigating and controlling air pollution, as described above, may reduce but not fully ameliorate economic impacts to the NSW community.

In these circumstances – that is, if air pollution impacts are not fully ameliorated – various social damage valuation methodologies are said to be available, including the 'Impact Pathway Approach', and others.

The meaning of the term 'fully ameliorate' in the EA Technical Notes is unclear. One interpretation is that if the air quality effects fall within NSW EPA air quality criteria, no additional social damage calculation is necessary.

It has also been suggested (e.g., Cadence, 2019) that the EA Technical Notes require air quality impacts to be valued and incorporated in the CBA, irrespective of whether NSW EPA criteria have been breached. While this may be an interpretation of the EA Technical Notes, the logic is flawed and appears to conflict with other aspects of the EA Technical Notes.

The NSW EPA air quality criteria are ambient standards that require a mandated level of performance that is enforced in law. The NSW EPA air quality and other standards implicitly incorporate trade-offs between the (health) damages that are thought to result from a deterioration of air quality, potential abatement costs, and the benefits of development that apply broadly across developments within the State.[5] They are not intended to single out and disadvantage any particular development.

It is a central feature of standards that breaches attract a regulatory penalty (Field and Field, 2016). Activities that breach a standard can then be presumed to constitute some cost to society that is to be prevented. Activities that do not breach a standard are 'allowed' and not penalised. Such activities may be deemed to have no negative impact, or a negative impact that is deemed to be low and (in the judgement of regulators) tolerable. Either way, it would then be incongruous to attribute 'damages' to activities that are permissible and legal.

This view is also reflected elsewhere in the EA Technical Notes in the context of noise externalities, which are similarly regulated by the NSW EPA under the NPfI (2017, previously the NSW Industrial Noise Policy [2000]). Here, the EA Technical Notes set out that the valuation of noise impacts would only be necessary for 'residual noise impacts': *material* noise levels that cannot be managed through the NSW Industrial Noise Policy (NSW EPA, 2017) and the VLAMP.

[5] The NSW EPA's 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales' does not clarify the basis for the standards set in respect of particulate matter, but references national standards set by the National Environment Protection Council (NEPC). In the impact statement for the Variation to the National Environment Protection (Ambient Air Quality) Measure 2015, the most recent variation of the numerical values and form of particulate matter standards, the NEPC notes (p. 1):

> *The standards and goals of the AAQ NEPM aim to guide policy formulation that allows for the adequate protection of health and wellbeing.*

There is also a wider concern that relates to the reliability of commonly used techniques to value externalities, specifically adverse air quality impacts, as applied in Cadence Economics (2019). Attempts to put a dollar benefit on health improvements involve two key components, namely estimates of the value of a 'statistical life' and a concentration-response function that relates pollution exposure to mortality risk (Currie and Walker, 2019). Deriving either of these relationships for a specific pollutant is fraught with ethical, practical, and theoretical problems.[6]

The 'Impact Pathway Approach' described in PAEHolmes (2013), as cited in the EA Technical Notes, for instance, assumes that the marginal damage cost per tonne of $PM_{2.5}$ is linear; that is, the impacts on human health would be the same for the first or the 100th tonne of $PM_{2.5}$. In fact, environmental research suggests that for many pollutants, marginal damages increase in a non-linear way with the level or concentration of pollutants. PAEHolmes (2013) also derive damage cost estimates as a function only of population density. Other crucial aspects of morbidity and mortality related to air quality – in particular, the age of the relevant population – are not accounted for.[7]

While we have therefore derived an estimate of the incremental air quality damage impacts (Table 3-5) as set out in PAEHolmes (2013), for the reasons set out above they have not been incorporated in the results of the CBA.

Table 3-5. $PM_{2.5}$ damage cost calculation ($2020)

	Estimated damages from $PM_{2.5}$ emissions NPV $million	Difference relative to Project NPV $million	Time horizon
Project	$53	N/a	2023-2048
Mount Pleasant Operation	$9	$44	2023-2026
Approved Resource Scenario	$34	$19	2023-2038

Source: $PM_{2.5}$ emissions damages calculated as described in PAEHolmes (2013). $2011 figures were restated to $2020 using the ABS 6401.0 Consumer Price Index, Australia, Table 1 (ABS, 2020a). Population adjustments were made with reference to 2011 ABS Census data and using NSW Government population projections (https://www.planning.nsw.gov.au/Research-and-Demography/Population-projections/Projections; accessed on 5 October 2020).

[6] For instance, estimating the causal effect of pollution on health raises several statistical challenges, including omitted variable bias, measurement error, and separately identifying the effects of different pollutants.

[7] The 'Summary of PM damage cost values from Australian studies' (PAEHolmes 2013, Table 2-3) also gives an indication of the extent of uncertainty around these estimates. Expressed in 2010 Australian dollars, and excluding pre-2000 studies, the estimated AU$ cost per tonne of $PM_{2.5}$ damages varies between $23,659 (2000) and $427,155 (2002).

3.9.3. Greenhouse gas emissions

Appendix S of the EIS contains the Greenhouse Gas Assessment (MACH, 2021) for the Project.

PREDICTED GREENHOUSE GAS IMPACTS

Between 2023 and 2053, the Project (including decommissioning activities) is predicted to give rise to around 14.2 million tonnes of carbon dioxide equivalent (Mt CO2-e) in Scope 1 and 2 GHG emissions, compared to around 1.9 Mt CO2-e attributable to the Mount Pleasant Operation (including decommissioning activities) between 2023 and 2031.

MITIGATION MEASURES

Existing greenhouse gas mitigation and management measures implemented at the Mount Pleasant Operation would continue for the Project. These measures are generally focused on reducing fuel usage, through optimisation of haul roads, minimising rehandling and maintaining fleet in good operating order.

VALUATION APPROACH

The costs associated with various mitigation measures to minimise the overall generation of GHG emissions have been incorporated in MACH's costings.

Where the valuation of GHG emissions is concerned, the EA Technical Notes clarify that the focus should be on Scope 1 and 2 emissions, and state that market prices should be referenced to value GHG emissions. The EA Technical Notes refer to the forecast price of European emission allowances (EUAs) as reflected in futures prices published by the European Energy Exchange (EEX). This approach has been adopted here.

Table 3-6 summarises total estimated (Scope 1 and 2) GHG emissions for the Project and the Mount Pleasant Operation, respectively, and the valuation of these emissions at 'central', 'high' and 'low' carbon prices, as recommended in the EA Technical Notes:

- the central forecast relies on the prices of EUA futures, as published by European Energy Exchange (EEX) (2020);
- the high price forecast refers to the carbon prices derived in the Australian Treasury Clean Energy Future Policy Scenario, as published in the NSW Government's *Greenhouse Gas Emissions Valuation Workbook* (NSW Government, 2015b); and
- the low-price forecast refers to the carbon prices derived from the US EPA Social Cost of Carbon (NSW Government, 2015c).

The EA Technical Notes require that the economic impact of GHG emission should be estimated for NSW only. In Table 3-6, the NSW share of costs associated with increased GHG emissions has therefore been calculated with reference to NSW GSP as a percentage of world gross domestic product (GDP), which is around 0.31 per cent. On that basis, the incremental social costs of the GHG emissions associated with the Project using EUA futures prices amount to $0.7 million in NPV terms.

Table 3-6. Project emissions valuation ($2020)

		Central price scenario	High price scenario	Low price scenario
	Total scope 1 & 2 emissions	EUAs - Futures prices	Clean Energy Future Policy Scenario	US EPA Social Cost of Carbon
	(Mt CO_{2-e})	(NPV $million)	(NPV $million)	(NPV $million)
Total emissions / valuation				
Project	14.2	$289	$418	$154
Mount Pleasant Operation	1.9	$61	$64	$31
Difference	12.3	$227	$354	$124
NSW share of emissions / valuation				
Project	0.04	$0.9	$1.3	$0.5
Mount Pleasant Operation	0.01	$0.2	$0.2	$0.1
Difference	0.04	$0.7	$1.1	$0.4

Notes: NSW share of emissions has been calculated with reference to relative GDP/GSP. The Australian share of world GDP as of 2019 was 0.95%, and the NSW GSP share of Australian GDP as of 2018-19 was 32.6%. The €/AU$ exchange rate was assumed to be 1.6.

Totals may not sum precisely due to rounding.

Source: MACH; World Bank, 2020; https://www.eex.com/en/market-data/environmental-markets/derivatives-market, accessed on 2 October 2020; ABS, 2020b; 5220.0 Australian National Accounts: National Income, Expenditure and Product; Table 1 & Table 26.

3.9.4. Groundwater

Appendix C of the EIS contains the Groundwater Assessment (AGE, 2020) for the Project.

PREDICTED GROUNDWATER IMPACTS

Numerical modelling conducted as part of the Groundwater Assessment predicted the following (AGE, 2020):

- The predicted reduction in baseflow to the Hunter River, Sandy Creek and Dart Brook would be negligible.
- A total of six bores on private property were predicted to experience drawdown exceeding 2 m due to cumulative impacts from the Project and neighbouring mines. Of these bores, only one bore is actively used and is not dry.
- The Project is anticipated to have a negligible impact on groundwater quality.
- The Project is anticipated to have negligible impacts to groundwater dependent ecosystems or stygofauna populations.

Table 3-7 shows the predicted water licence requirements for the Project and the licences currently held by MACH. Based on peak predicted licensing requirements, MACH holds sufficient licences to account for the take from each water source, with the exception of 13 megalitres per year (ML/year) of predicted take from the Dart Brook Water Source, which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009*.

VALUATION APPROACH

The EA Technical Notes say that the economic significance of potential impacts on water resources should primarily be measured with reference to the market price of the relevant water resource(s) and, if relevant, other factors potentially not captured by market prices (such as specific locational or seasonal effects that may affect third parties).

A review of the prices paid for unit shares for the Dart Brook Water Source since 2010 (permanent transfer and trades at prices greater than zero only) held at the NSW Water Register for the groundwater sources suggests that prices have remained steady. Unit shares generally traded between $750 to, at most $1,250, but generally at $1,000 per unit.[8] We have therefore assumed that the licences required by MACH would be purchased at a price of $1,000 per unit, and that these entitlements would be purchased in Year 1 of the Project (2023). The cost of purchasing these groundwater licences is a cost to MACH and has been included in the costs of the Project.

The EA Technical Notes set out options for estimating the water-related costs borne by third parties, including the owners of potentially impacted bores. These include the costs of water treatment, providing an alternative water source, or compensating for lost income, among others. The costs associated with impacted bores has been included in the Project costings.

In addition, the costs associated with the proposed groundwater management measures (e.g., preparing and implementing a Groundwater Management Plan) have been incorporated in MACH's operating and capital expenditure costings.

[8] The weighted average $2020 price of these trades is $966 per unit.

Table 3-7. Groundwater licensing summary for the Project

Water sharing plan	Water source/ management zone	Existing licensed volume (Units)	Peak volume requiring licensing during mining (ML/year)	Peak volume requiring licensing – post-mining (ML/year)	Additional Licences Required?	Amount Required (ML/year)
Hunter Regulated River Water Source, 2016	Hunter Regulated River (Management Zone 1A)	961 (High) 2,937 (General)	27	32	No	0
Hunter Unregulated and Alluvial Water Sources, 2009	Hunter Regulated River Alluvial	285	27	34	No	0
	Muswellbrook	41	2	6	No	0
	Dart Brook	Nil	6	13	Yes	13
North Coast Fractured and Porous Rock Groundwater Sources, 2016	Sydney Basin	730	247	44	No	0

Note: ML = Megalitres.
Source: AGE (2020).

3.9.5. Surface Water

The Surface Water Assessment (HEC, 2020) for the Project is described in Appendix D of the EIS.

PREDICTED SURFACE WATER IMPACTS

The Surface Water Assessment indicates that the Project is not expected to materially impact the environmental values of the receiving surface waters (HEC, 2020):

- there would be a small and likely indiscernible impact to flows in the Hunter River during the Project and post-closure;
- the potential impacts of predicted overflows from sediment dams and ED3 on downstream water quality would be negligible; and
- the potential impacts of controlled releases on downstream water quality is expected to be negligible.

MITIGATION MEASURES

MACH would conduct surface water management in accordance with updated versions of the existing Water Management Plan (including the Erosion and Sediment Control Plan, Surface Water Management Plan and Surface and Ground Water Response Plan).

VALUATION APPROACH

The EA Technical Notes recommend that surface water impacts primarily be measured with reference to the market price of water, subject to ensuring that any remaining third-party effects are properly accounted for.

The water balance modelling undertaken as part of the Surface Water Assessment indicates that external water demands associated with the Project would be met by existing surface and groundwater entitlements already held by MACH (HEC, 2020).

There is additionally no indication that the water requirements for the Project would impact third parties in a manner that is not already captured by market prices.

No additional surface water-related costs would therefore be incurred in the Project Scenario relative to the Reference Case, and none have been included in the CBA.

3.9.6. Biodiversity

Appendix E of the EIS contains the Biodiversity Development Assessment Report (Hunter Eco, 2021) for the Project.

PREDICTED BIODIVERSITY IMPACTS

The Project would require the progressive clearance of woodland and derived native grassland over the Project life. MACH would satisfy any residual biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e., impact avoidance, retirement of biodiversity credits, ecological mine rehabilitation and/or contribution to the Biodiversity Conservation Fund). The Biodiversity Development Assessment Report (Hunter Eco, 2021) includes an estimate of ecosystem credits and species credits required for the Project in accordance with the NSW Biodiversity Assessment Method (BAM) Credit Calculator.

MITIGATION AND MANAGEMENT MEASURES

The development of the Project is an optimisation of the approved Mount Pleasant Operation without significantly increasing the approved surface development area. MACH is foregoing the development of some areas of approved surface development area to minimise the additional development required for the Project (i.e., the relinquishment areas on Figure 2-2).

MACH would satisfy any residual biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e., retirement of biodiversity credits, ecological mine site rehabilitation and/or contribution to the Biodiversity Conservation Fund).

In addition, MACH has a number of existing measures available to mitigate and manage impacts on biodiversity, such as a vegetation clearance protocol, weed and pest animal control, monitoring programmes and a rehabilitation plan that would be implemented for the Project.

VALUATION APPROACH

The EA Technical Notes set out the requirement to assess and quantify impacts that are then reflected in a biodiversity offset requirement (or biodiversity credit) so that impacts on biodiversity have a direct and quantifiable economic cost. The biodiversity impacts associated with the Project have therefore been valued using MACH's estimated cost to establish a residual land-based biodiversity offset required to generate sufficient credits to meet the biodiversity offset requirement. MACH has estimated the total cost of establishing a residual land-based biodiversity offset for the Project and this is included in the Project costings in 2023.

3.9.7. Aboriginal Heritage

Appendix G of the EIS contains the Aboriginal Cultural Heritage Assessment (South East Archaeology, 2020) for the Project.

PREDICTED IMPACTS

The Aboriginal Cultural Heritage Assessment identified approximately 1,750 known Aboriginal cultural heritage sites within the area investigated for the Project, predominantly open artefact scatters and isolated artefacts (South East Archaeology, 2020). The majority of these sites are located within the existing Aboriginal Heritage Impact Permit (AHIP) areas (AHIPs #C0002053, #C0002092 and #C0004783) associated with the approved Mount Pleasant Operation.

South East Archaeology (2020) concluded that the additional impacts associated with the Project would be relatively low within a local context and very low within a regional context.

MITIGATION AND MANAGEMENT MEASURES

The Aboriginal Cultural Heritage Assessment recommended the implementation of a range of mitigation and management measures that would be documented in an Aboriginal Heritage Management Plan for the Project.

VALUATION APPROACH

Consistent with the EA Technical Notes, the costs of compliance with the recommendations in the Aboriginal Cultural Heritage Assessment, the ongoing application of the Aboriginal Heritage Management Plan and all related processes have been included in the Project costings.

3.9.8. Historic Heritage

Appendix H of the EIS contains the Historic Heritage Assessment (Extent Heritage Pty Ltd, 2020) for the Project.

PREDICTED IMPACTS

The Historic Heritage Assessment identified 14 historical heritage places of local heritage significance located within or in the vicinity of the Project study area. Two places of State heritage significance were also identified within the broader Muswellbrook area (Extent Heritage Pty Ltd, 2020).

Seven of the identified historical heritage places of local heritage significance would be directly impacted by the Project (MP20 Kayuga Coal Mine; MP21 Kayuga School; MP22 Smith's Clear Farm; MP27 Thorndale; MP29 Lynch's; MP42 Fibbins; and MP45 (a-b) Casey: Clenmore and Edgeway). These places are located within the approved Mount Pleasant Operation surface development area. Extent Heritage Pty Ltd (2020) concluded that these direct impacts would be appropriately mitigated by implementing recommended management measures.

Potential indirect impacts associated with blasting were also considered. Extent Heritage Pty Ltd (2020) concluded that the Project would have no adverse impact associated with blasting, given that all blasting activities would be carried out to meet the prescribed blasting criteria in the approved Mount Pleasant Operation Blast Management Plan.

Other potential indirect impacts relating to air quality, acoustic, visual amenity and altered 'use' of the site have also been assessed. Any potential indirect impacts would be avoided or mitigated by implementing management measures recommended by Extent Heritage Pty Ltd (2020).

MITIGATION AND MANAGEMENT MEASURES

Management of the historic heritage sites would be conducted in accordance with a Heritage Management Plan prepared for the Project.

VALUATION APPROACH

Consistent with the EA Technical Notes, the costs associated with the development and implementation of the Heritage Management Plan have been included in the Project operating costs.

3.9.9. Road Transport

Appendix J of the EIS contains the Road Transport Assessment (TTPP, 2020) for the Project.

PREDICTED IMPACTS

The Road Transport Assessment concluded that no specific measures or upgrades are required to mitigate the impacts of the Project on the capacity, safety, and efficiency of the road network as a result of the changed road traffic conditions associated with the Project.

MITIGATION AND MANAGEMENT MEASURES

The existing Site Access Management Plan for the Mount Pleasant Operation provides guidance to manage the traffic aspects of the Mount Pleasant Operation, to facilitate traffic management in and around operations during the construction commissioning and day to day activities. For the Project, the Site Access Management Plan would continue to be reviewed and more appropriate procedures implemented if the existing practices are proven not to be efficient.

Given that Project-generated traffic would have a negligible impact on the operation of the road network and its intersections, and that no specific safety concerns have been identified, no additional specific road or intersection upgrade measures are required to address potential adverse impacts of the Project.

VALUATION APPROACH

The costs associated with the development and implementation of the Site Access Management Plan have been included in the Project operating costs.

In addition, MACH makes road maintenance contributions to the Muswellbrook Shire Council (MSC) in accordance with the Voluntary Planning Agreement. The costs associated with the Voluntary Planning Agreement have also been included in the Project operating costs.

Based on the conclusions of TTPP (2020), it is considered that any residual road transport impacts would be immaterial.

3.9.10. Visual amenity

Appendix M of the EIS contains the Visual and Landscape Assessment (Van Pelt Allen Visual Planning and Assessment, 2020) for the Project.

PREDICTED IMPACTS

Potential visual impacts of the Project would be associated with the expansion in vertical and horizontal scale of the waste rock emplacement landform and associated construction activity and lighting effects and the extension to duration of operations for an additional 22 years (Van Pelt Allen Visual Planning and Assessment, 2020).

The expanded landform would generally result in similar visual effects to the approved Mount Pleasant Operation, with high visual impacts during the construction period of the extension over and above approved levels and area of disturbance. The ongoing early rehabilitation would progressively minimise the extent and duration of high visual impacts at Muswellbrook and other viewpoints around the view catchment. As the ground cover crops and vegetation replanting is established, the visual effects would be lowered; there would be moderate impacts over broader areas for longer duration until the rehabilitation is well established. In the long term, visual impact would reduce (Van Pelt Allen Visual Planning and Assessment, 2020).

MITIGATION AND MANAGEMENT MEASURES

The Project rehabilitation strategy would emulate the vegetation patterns, landforms, lines and colours of the existing landscape (consistent with the approved Project strategy) to reduce the contrast with surrounding landscape setting to lower visual impacts. The final landform has been modified to achieve an upper profile and micro-topographic contouring that emulates natural landscape topography and is an example of best practice mine geomorphic rehabilitation. In the long term, this design feature of the Project improves visual integration within a rural landscape setting, particularly the surrounding rolling foothills to the north and west of the mine lease boundary.

The following mitigation strategies would further ameliorate visual impacts at the Project:

- progressive rehabilitation of the integrated waste rock emplacement landform;
- lighting mitigation strategies;
- planting of tree screens consistent with the approved Visual Impact Management Plan (MACH 2019) and additional site-specific tree screens at the most proximal privately owned residences (i.e., within 1 km) of the Project (e.g., residences along Wybong Road, Kayuga Road and Collins Lane).

VALUATION APPROACH

Consistent with the EA Technical Notes, the costs associated with the development and implementation of the Project rehabilitation strategy and visual mitigation measures have been included in the Project operating costs.

Based on the conclusions of Van Pelt Allen Visual Planning and Assessment (2020), it is considered that any residual visual impacts would be immaterial.

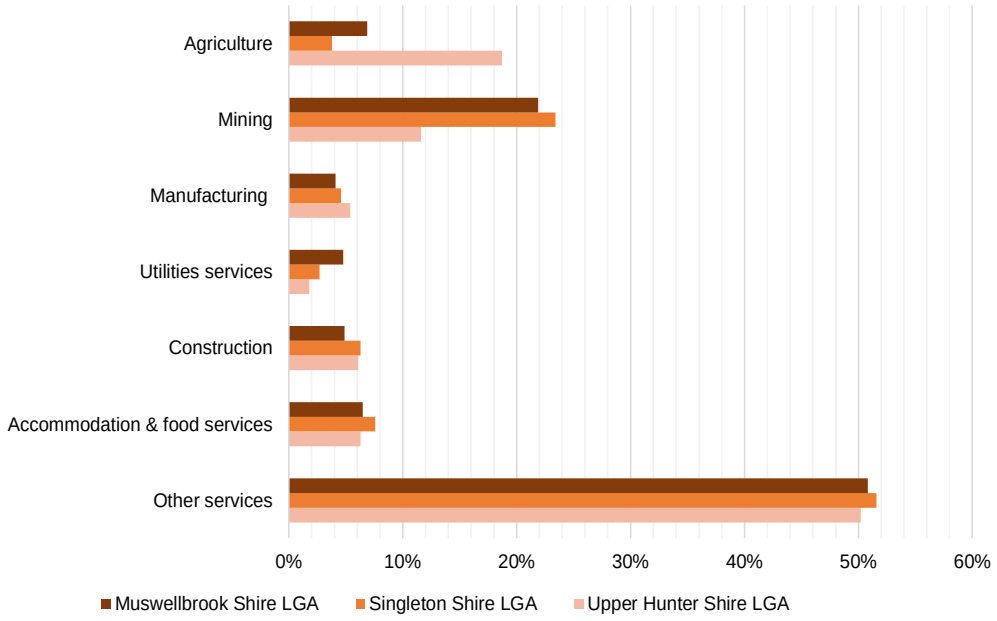
3.10. LOSS OF SURPLUS TO OTHER INDUSTRIES

The approved Mount Pleasant Operation is located in the Muswellbrook mining precinct in the Upper Hunter Valley (Figure 2-1). The Mount Pleasant Operation abuts the Hunter River floodplain and the town of Muswellbrook to the East, with the Bengalla Mine located directly to the south and the Dartbrook Mine to the north. Other mines within a 20 km radius of the Mount Pleasant Operation include the Mt Arthur Coal Mine, Mangoola Coal, and the Muswellbrook Coal Mine. Looking further towards the south-east, there are open-cut and underground coal mines located towards the way to the town of Singleton in Singleton LGA. Both the town of Muswellbrook and the town of Singleton are considered mining towns (Just Add Lime, 2020).

The EA Guidelines specify that the CBA should incorporate changes in economic surplus arising in other NSW industries such as the tourism or equine industries. The Upper Hunter Valley, where the approved Mount Pleasant Operation is located, is a very diverse part of NSW where heavy industry such as mining coexists with agriculture, viticulture, and the equine industry, as well as a range of tourism activities centred on the natural and man-made attractions of the region.

Figure 3-1 shows employment by industry in Muswellbrook Shire, Singleton Shire and the Upper Hunter Shire from the most recent ABS Census (2016). In all three LGAs, more than 50 per cent of people are employed in the services sector. Particularly in Muswellbrook and Singleton LGAs, the mining sector is an important employer, employing 22 per cent and 23 per cent of the workforce, respectively. Employment in agriculture, forestry and fishing (which also includes horse breeding and horse studs) plays less of a role in these two LGAs (7 per cent in Muswellbrook and 4 per cent in Singleton) but is important in the Upper Hunter LGA where 19 per cent of people were employed in agriculture in 2016. Employment in accommodation and food services – services typically associated with tourism – accounted for around 7 per cent in Muswellbrook LGA, 8 per cent in Singleton LGA, and 6 per cent in the Upper Hunter LGA.

Figure 3-1. Employment by industry in the local region (2016)



Source: ABS, 2019. 1410.0 - Data by Region, 2013-18, 17 May.

3.10.1. Agriculture

The Project is located within the Muswellbrook LGA of the Upper Hunter region, one of the State's most fertile and productive agricultural areas. The Project site is situated in and adjacent to the existing open cut mining disturbance of the Mount Pleasant Operation with cattle and sheep grazing undisturbed areas to the north (MACH, 2020).

A Soil Resource Assessment has been completed by GT Environmental (GTE, 2020) to support the Project Agricultural and Land Resources Assessment (MACH, 2020).

PREDICTED IMPACTS

The key findings of the Project Agricultural Land and Resources Assessment can be summarised as follows:

- The Project open cut extent would remain wholly within the existing Mount Pleasant Operation Mining Leases.
- The majority of the Project area is of Agricultural Suitability Class 3 (limited suitability), with a small portion of Class 4 (unsuitable). The existing approved disturbance area for the Mount Pleasant Operation also contains some Agricultural Suitability Class 2 (capable) land associated with the adjacent Hunter River floodplain (which aligns with biophysical strategic agricultural land (BSAL) mapping).
- The Project would result in no significant increase in total disturbance area compared to the existing approved Mount Pleasant Operation, due to the relinquishment of an approved disturbance area in the north-west.
- There is no additional NSW Government-mapped BSAL or critical industry cluster (CIC) land within the revised open cut extent of the Project, in comparison to the existing approved extent of the Mount Pleasant Operation.

MITIGATION MEASURES

MACH currently leases non-mining MACH-owned agricultural land to original landowners or other local farmers for ongoing productive use, and this practice would continue for the Project.

The existing Commonwealth approval under the EPBC Act for the Mount Pleasant Operation requires the establishment of native woodland ecosystems over much of the rehabilitated final landform, characteristic of vegetation communities found in the local area. Establishment of native woodland rehabilitation would also improve final landform stability and ameliorate potential visual impacts. Smaller areas associated with existing infrastructure and associated potentially useful infrastructure (e.g., an existing approved rail loop and rail spur) may be available for intensive agricultural use post-mining, subject to final land use planning.

MACH would manage blasting, air quality and noise emissions to achieve ongoing compliance with applicable Development Consent criteria, which would limit potential indirect impacts on surrounding land uses, including adjoining agricultural uses.

VALUATION APPROACH

The Project is located on MACH-owned land consisting of previously cleared agricultural areas used for cattle grazing. The most recent disaggregated data published by the ABS (2017) similarly indicates that as of 2015-16, livestock (cattle and calves) accounted for around 60 per cent of gross value (agricultural output valued at market prices) in the Statistical Area Level 2 regions of Muswellbrook and the Muswellbrook Region.

The agricultural impacts of the Project relate to the temporary displacement of agriculture over the Project life. These losses refer to:

- the forgone *gross* value of agricultural production (GVA); that is, the forgone revenue from the sale of primary agricultural products due to the disruption of agricultural land use; and
- the forgone *net* value of agricultural production; that is, the forgone gross revenue less the costs of production due to the disruption of agricultural land use.

The GVA is not a cost per se but may reduce demand for inputs from upstream domestic industries and cause a loss of throughput to downstream domestic industries. These flow-on effects may result in a reduction in value added by these industries. However, the most recent information about agricultural land use in the Hunter Valley suggests that 122,000 hectares (ha) were used for farming in Muswellbrook LGA in 2006 (ABS, 2010), and that 850,457 ha were used for farming in the Project Region (NSW Department of Primary Industries, 2013). Given that, at most, 4,100 ha of agricultural land would potentially be affected in either the Reference Case or the Project Scenario, any potential (negative) flow-on effects arising from a small reduction in agricultural activity as a result of the Project are likely to be immaterial, and they have not been considered further in this EA.

The direct agricultural impacts of the Project relate to the forgone net value of agricultural production, and represent an opportunity cost for MACH. That is, while the Project generates significant value added as a result of coal mining activities, that value added has an opportunity cost in the form of the value added from agricultural activities that is forgone.

To estimate the forgone net value of agricultural production, an estimate of 4,100 ha of land that would be displaced from agricultural production has been adopted for both the Mount Pleasant Operation and the Project (corresponding to the area of the mining leases). This estimate assumes that the entire mining lease areas would be unavailable for agricultural use over the life of the Mount Pleasant Operation and the Project, respectively. This is considered to be a conservative approach; in reality, only discrete portions of the mining lease areas would be unavailable at a time as these areas are progressively developed. These same areas are then progressively restored (primarily to woodland) as this infrastructure is decommissioned and these areas are rehabilitated.

Gross margins per hectare for typical agricultural enterprises were taken from budgets compiled by the NSW Department of Primary Industries (2019). As noted above, most of the Project area is of Agricultural Suitability Class 3 (limited suitability), with small portions of Class 4 (unsuitable) and Class 2 (capable) land. The highest gross margin on native or unimproved pasture corresponding to Meat Standards Australia beef ($194.12 per ha) was therefore used to conservatively estimate forgone gross margins. Agricultural gross margins refer to revenues less variable costs but exclude capital costs and a return to owner-operator labour, and hence tend to overstate the opportunity cost of the forgone agricultural production.

Table 3-8 shows the estimated incremental forgone value added of agriculture production – the land removed from production multiplied by the corresponding gross margins and discounted over the life of the Project and the Mount Pleasant Operation, respectively. The total incremental forgone gross margin associated with the Project is around $5.5 million in NPV terms. The incremental forgone gross margin associated with the Project is an opportunity cost for MACH and is not relevant to the CBA.

Table 3-8. Foregone net value of agricultural production – Mount Pleasant Operation and Project (2020, $million)

	Project	Mount Pleasant Operation	Difference
Land Type	2023-2048	2023-2026	
Class 3 (NPV $million)	$22.8	$17.3	$5.5

Note: NPVs calculated using a discount rate of 7 per cent.
Source: AnalytEcon.

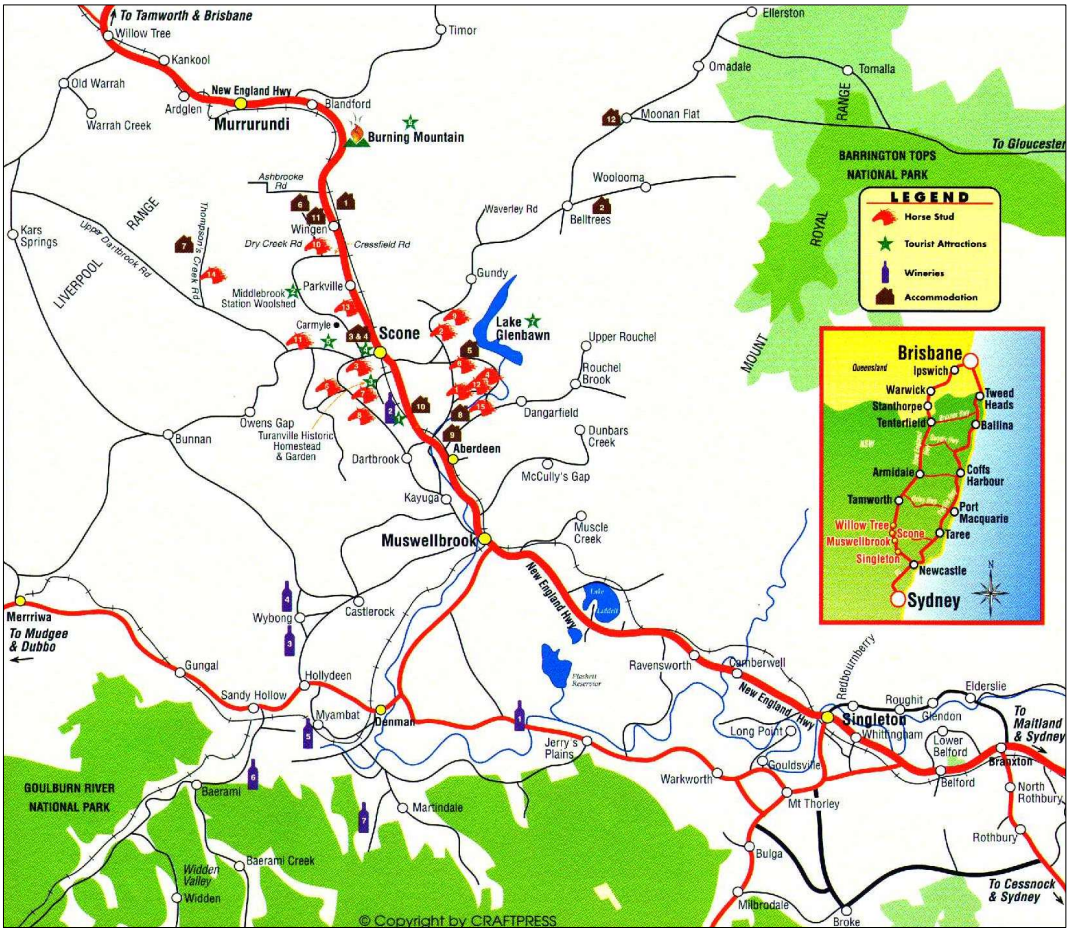
It is noted that any agricultural land associated with the Project biodiversity offset area would be permanently displaced. The existing biodiversity offset for the Mount Pleasant Operation is some 12,785 ha on a number of properties with a combined area of 15,590 ha. Although the Project would essentially occupy the same footprint as the Mount Pleasant Operation, as noted in Section 3.9.6, the CBA conservatively includes an additional biodiversity offset cost. The forgone value of agricultural production from the biodiversity offset area has not, however, been estimated. This forgone agricultural production is not expected to be significant as the biodiversity offset area site would be selected for its biodiversity values and is therefore expected to have marginal agricultural value.

3.10.2. Viticultural, equine and tourism industries

CONTEXT

Figure 3-2 provides an overview of the location of tourism and related activities in the Upper Hunter Valley. Sites of interest for tourism include wineries, horse studs, and scenic attractions, all of which tend to be located some distance from the town of Muswellbrook and the Mount Pleasant Operation.

Figure 3-2. Tourism map of the Upper Hunter Valley



Source: http://www.mappery.com/map-of/Upper-Hunter-Valley-Tourist-Map; accessed 2 October 2020.

The Hunter Valley has many outstanding vineyards and wineries, which tend to be located to the west and south-west of the town of Muswellbrook and to the north-west of the town of Singleton. The Upper Hunter Wine Region includes the area from Singleton to Murrurundi, including the towns of Muswellbrook, Denman, Gundal, Sandy Hollow, Scone and Stroud.[9] The closest winery to Muswellbrook and the Mount Pleasant Operation appears to be the Pukara Estate, located some 16 km from the town of Muswellbrook.

The equine industry in the Hunter Valley is centred around Denman and Scone and no equine or viticulture enterprises are located in the immediate vicinity of the Project site, with the exception of a horse stud on MACH-owned land that produces stock horses (MACH, 2020).

The range of scenic attractions in the Upper Hunter Valley includes national parks, nature reserves, wilderness areas and state forests, including Barington Tops National Park, Burning Mountain Nature Reserve, Goulburn River National Park, Towarri National Park, Wingen Maid Nature Reserve, Wollemi National Park, and Yengo National Park. However, all of these natural attractions are located at least 50 km away from the Mount Pleasant Operation and the Muswellbrook mining precinct.

PREDICTED IMPACTS

The Agricultural and Land Resources Assessment (MACH 2020) concluded that the Project is likely to have insignificant impacts on production in the agricultural, viticultural and equine industries. The assessment further concluded that the Project would have negligible outcomes for the regional agricultural, viticultural and equine industries and related services and employment (MACH, 2020).

VALUATION APPROACH

Given that there are no expected significant impacts of the Project on the viticulture and equine industries, no additional cost has been included in the CBA.

[9] https://www.findawinery.com/414prg.html; accessed 1 June 2020.

3.11. NET BENEFITS OF THE PROJECT

This section summarises the results of the CBA, which compares the benefits accruing to NSW in the Project Scenario relative to the Reference Case.

3.11.1. Attribution of benefits to NSW

Table 3-9 summarises how the net benefits of the Project have been attributed to NSW, as described in previous subsections.

Table 3-9. Attribution of Project net benefits to NSW (2023 to 2053, $2020)

Benefit	Total value	Proportion attributed to New South Wales (Per cent)	Value for NSW CBA (NPV $million)
NSW royalties	$684	100%	$684
Company income tax	$540	31.9%	$172
Net producer surplus	$913	0%	$0

Source: AnalytEcon analysis.

3.11.2. Net benefits of the Project for NSW

Table 3-10 summarises the estimated net benefits of the Project for NSW. The NPV of the net benefits are estimated at $855 million NPV terms, consisting of royalties of $684 million in NPV terms, and the NSW share of company income tax of $172 million in NPV terms.

Table 3-10. Incremental net benefits of the Project for the NSW community (2023 to 2053, $2020)

Incremental costs	(NPV $million)	Incremental benefits	(NPV $million)
External effects – GHG emissions	$0.7	Royalties	$684
		NSW share of company income tax	$172
Total direct and indirect costs	$0.7	Total direct and indirect benefits	$856
Net benefits to NSW			**$855**

Note: Totals may not sum precisely due to rounding.
Source: AnalytEcon.

The Project would potentially give rise to some additional external effects that would impact third parties. However, MACH would mitigate the great majority of these, including through the deployment of state-of-the-art equipment, the purchase of the requisite water licences, and via compensation provisions that would address affected private landowners or other third parties. These external effects therefore do not impose a cost on the NSW community. The NSW share of incremental GHG emissions attributable to the Project is estimated at around $600,000 in NPV terms and constitutes a cost to the NSW community.

Overall, the Project's incremental contribution to NSW GSP is estimated at $1.4 billion in NPV terms. As set out in Appendix C, the change in GSP as a result of the Project being approved captures the incremental benefits accruing to NSW from:

- the additional disposable income paid to the NSW workforce, including the NSW share of income tax and Medicare payments;
- the share of the Project's 'gross operating surplus' (GOS) that can be attributed to NSW, including coal royalty payments to NSW, and Commonwealth income taxes that can be attributed to NSW residents; and
- the additional payroll taxes, land taxes and local government rates paid.

3.12. SENSITIVITY ANALYSIS

The EA Guidelines require a proponent to undertake sensitivity analyses of a range of variables as part of the CBA.

3.12.1. Variations in the discount rate

In accordance with the EA Guidelines, a discount rate of 7 per cent per annum has been assumed for the analysis, and the sensitivity of the results of the CBA has been tested by applying a discount rate of 4 per cent and 10 per cent, respectively (Table 3-11).

Table 3-11. Incremental net benefit to NSW – Discount rate sensitivity (2023 to 2053, $2020)

Discount rate assumption	Incremental net benefits to NSW (NPV $million)
7 per cent	$855
4 per cent	$1,318
10 per cent	$573

Source: AnalytEcon.

3.12.2. Variations in coal prices and exchange rates

Most of the Project's coal production would be exported and priced in US dollars. Different combinations of coal prices and US$/A$ exchange rates would affect company revenues, and therefore royalty and income tax payments. Table 3-12 shows the net benefits accruing to NSW as a function of various combinations of coal prices and exchange rates.

Table 3-12. Incremental net benefit to NSW and royalties – Coal price and exchange rate sensitivity (2023 to 2053, NPV $2020)

	Incremental net benefits to NSW (NPV $million)		
	Coal price assumptions		
Exchange rates (US$/A$)	All coal prices reduced by 30%	Central coal price assumptions	All coal prices increased by 20%
All US$/A$ exchange rates decreased by 20%	$247	$521	$796
Central US$/A$ exchange rate assumption	$499	$855	$1,212
All US$/A$ exchange rates increased by 30%	$771	$1,217	$1,663

Notes: NPVs have been derived using an annual discount rate of 7 per cent.
Source: AnalytEcon.

The EA Guidelines require proponents, where practicable, to undertake a sensitivity analysis of how much output prices would need to fall for a project to have a zero NPV. The analysis suggests that all coal prices over the life of the Project would need to fall by 48 per cent from 2023 to 2048 to result in a net benefit to NSW of $0.

It should be noted, however, that the CBA model framework is not well suited to capture the impacts of material external shocks. In such circumstances, management would be expected to respond, for instance, by changing production or cutting expenses. In contrast, the CBA model takes the production profile, as well as operating, capital, and labour costs as fixed, so that royalty payments to the NSW Government would continue to be made while the producer surplus would turn negative.

3.12.3. Variations in royalty payments

The EA Guidelines require an assessment of the royalties derived from the Project if mining revenues are 25 per cent lower or higher than in the central case (Table 3-13).

Table 3-13. Incremental net benefits to NSW and royalties – Mining revenues sensitivity (2023 to 2053, $2020)

	Incremental net benefits to NSW (NPV $million)	Net royalty receipts (NPV $million)
Central case mining revenues	$855	$684
25% increase in mining revenues	$1,303	$902
25% decrease in mining revenues	$411	$466

Notes: NPVs have been derived using an annual discount rate of 7 per cent.
Source: AnalytEcon.

3.12.4. Variations in company income tax payments

The EA Guidelines require an assessment of a variation in company income tax by +/- 50 per cent. Table 3-14 summarises the results of the analysis, and also includes a scenario where no income tax would be payable.

Table 3-14. NSW share of company income tax payments – Income tax sensitivity (2023 to 2053, NPV $2020)

	Incremental net benefits to NSW (NPV $million)	Net company income tax payments (NPV $million)
50 per cent increase in company income tax	$855	$172
Central case company income tax	$941	$258
50 per cent decrease in company income tax	$769	$86
No company income tax attributable to the Project	$684	$0

Notes: NPVs have been derived using an annual discount rate of 7 per cent.
Source: AnalytEcon.

3.12.5. Mount Pleasant Operation Approved Resource

The Mount Pleasant Operation Modification 3 (dated 24 August 2018) permits mining operations at the Mount Pleasant Operation until 22 December 2026 at a maximum rate of 10.5 Mt of ROM coal per calendar year. Within the operational parameters approved under Modification 3, significant approved open cut coal reserves would remain available for mining post-2026. Based on a ROM coal mining rate of 10.5 Mtpa post-2026, mining operations would need to continue through to 2038 to allow for all of the originally approved coal resource (i.e. 197 Mt) to be mined.

An 'Approved Resource' scenario whereby the Mount Pleasant Operation would continue operating until 2038 has therefore been considered as an alternative Reference Case as part of the CBA sensitivity analysis.[10] Table 3-15 suggests that the Project would generate a net benefit to NSW of $491 million in NPV terms relative to the Approved Resource Scenario, as opposed to a net benefit of $855 million in NPV terms relative to the Reference Case.

Table 3-15. Incremental net benefits to NSW – Mount Pleasant Operation closure sensitivity (2023 to 2053, $2020)

Incremental net benefits to NSW (NPV $million)	
Project Scenario Relative to Reference Case	**Project Scenario Relative to Approved Resource Scenario**
$855	$490

Source: AnalytEcon.

3.13. DISTRIBUTIONAL IMPACTS

The EA Guidelines suggest that the distributional impacts of a proposal should be considered in the EA.

As described in previous sections of this report, the Project would deliver significant net benefits to the NSW community as a whole, estimated at $855 million in NPV terms. These net benefits consist of royalties flowing to the NSW Government, as well as the NSW share of company income taxes that may accrue to the NSW Government in an indirect manner. Either way, these are funds that are available to the NSW Government to be expended to benefit all people living in NSW.

[10] Further detail on this sensitivity is provided in Appendix D.

The Project would benefit the NSW workforce. Between 2023 and 2053, the Project would employ an average of 525 FTE NSW workers or 462 FTE NSW workers more than in the Reference Case over the same timeframe. In NPV terms, the incremental disposable income accruing to the Project's NSW workforce is estimated at $488 million.

Given the significant operating costs that would be incurred over the life of the Project, local and NSW suppliers can be expected to benefit from additional sales. As noted in Section 3.7, on the basis of current expenditure patterns, an additional $2.7 billion in NPV terms would be directed towards NSW suppliers between 2023 and 2053 if the Project is approved.

The assessments of the likely external effects associated with the Project suggest that no significant adverse effects on other local industries, such as the equine, viticulture or tourism industries would be expected. As described in Section 3.9, the additional (negative) environmental and other impacts of the Project on third parties are predicted to be limited.

4. FLOW-ON EFFECTS OF THE PROJECT

This section describes the incremental 'second-round' or 'flow-on' effects that the Project would generate for the NSW community. The choice of an input-output approach for deriving these flow-on effects, the necessary caveats, and the derivation of multipliers is detailed in Appendix E.

4.1. CHOICE OF INPUT-OUTPUT ANALYSIS

Second-round or 'flow-on' effects refer to the adjustments in the economy that follow on from an initial change in the demand for goods, services and labour arising from a significant development such as the Project. Such a change in demand for a range of inputs sets the economy in motion as the productive sectors buy and sell goods and services from one another, and households earn additional incomes. These relationships cause the total effects on the regional or state economy to exceed the initial change in demand so that an entire jurisdiction benefits from the increased economic activity that arises from a significant investment.

4.1.1. Determining flow-on effects

Two main methods are generally used to calculate the flow-on effects for resources projects: input-output analysis and general equilibrium (GE) analysis. These methods differ in terms of their complexity, but they also face some common issues.

First, the degree of difficulty in estimating flow-on effects increases when moving from the national to the state and the regional economy (Coughlin and Mandelbaum 1991). This reflects a general lack of information about the specific composition and source of intermediate inputs used by local and state industry, as well as about trade at a state and regional level. At the same time, state and local impact analysis depends, in large part, on adjusting the flows of production and expenditure, as represented in national input-output tables, to represent a state or local economy.[11] Industries at a local or state level have differing compositions of inputs and outputs than is the case for the national average. Hence, a consistent set of ancillary information that is specific to the state or regional economy is required to apportion national aggregates. The most commonly used information for this purpose (which is also recommended by the ABS and has been used in this EA) is industry employment.

[11] Input-output tables capture the flows of intermediate inputs between producers and form the basis for deriving multipliers. These tables are generally prepared at a national level. Thus, the Australian input-output tables reflect a snapshot in time of the entire Australian economy and the inter-relationships between producers, households, governments, and the outside world. Similar information about the relationships between economic agents within a region and flows into and out of a region ('imports' and 'exports') is not available.

Second, all methodologies used to estimate flow-on effects are underpinned by various strong assumptions, which result in the impacts of a proposal being overstated if these assumptions are breached (Bess and Ambargis, 2011). These assumptions and limitations include that:

- inputs are used in fixed proportions to one another;
- all firms within an industry are characterised by a common production process;
- for input-output analysis, prices are fixed; and
- there are no supply constraints.

The implication is that the regional or state flow-on impact estimates should be interpreted as an upper bound of the likely effects.

The approach for estimating flow-on effects in this EA is to rely on input-output analysis to derive various 'multipliers'. The primary reasons for selecting this methodology are the simplicity and clarity with which the underlying assumptions can be set out and appropriate caveats made. Further, when compared to more complex methods such a GE analysis, given the lack of information about industry structure and trade at a regional and state level, there is no reason to think that one method would be materially more accurate than another. Finally, the value of the Project is small relative to the size of the NSW economy. While GE analysis takes into account the price impacts of a proposal on inputs and outputs, given the relative size of the Project, material price impacts would not be expected and the difference between the results of a GE and an input-output analysis should also be small.

4.1.2. Input-output multipliers

Economic flow-on impacts can be measured in terms of the effects on income, employment and value added. Input-output analysis is then used to generate income, employment and value added multipliers, which are applied to the expected changes in activity as a result of a proposal.

Multipliers are further classified into 'types':

- 'Type IA' multipliers refer to the 'initial' and 'first-round' effects arising from an increase in demand generated by a proposal. Type IA multipliers capture the immediate subsequent impacts on income, employment or value added from all industries whose output is required to produce the additional output from the Project.
- Type IB and Type IIA multipliers capture the initial and 'production induced' effects, and additionally the effects on households, respectively. These are compound multipliers that effectively trace the entire chain of interactions from an initial increase in employment or income through to all affected industries and households.

- Type IIA multipliers take into account all adjustments in an economy and are therefore the best choice for calculating flow-on effects from a theoretical perspective. However, these multipliers are calculated in a way that compounds any measurement errors and breaches in the assumptions that underpin the analysis. A more conservative approach is therefore to rely only on multipliers that capture only first-round effects (Type IA multipliers), and this is the approach adopted in this EA.

4.2. INCREMENTAL FLOW-ON BENEFITS OF THE PROJECT FOR NSW

Table 4-1 shows the estimated flow-on effects of the Project for NSW. The assumptions made for the input-output analysis are consistent with those made in the CBA; that is, the flow-on effects arise from the incremental employment, disposable income, and value added generated in the Project Scenario relative to the Reference Case.

The flow-on benefits shown in Table 4-1 are additional to the direct (employment and income) impacts of the Project; that is, they represent the employment and income generated elsewhere in the NSW economy as a result of the economic impetus provided by the Project. The incremental flow-on benefits amount to:

- $276 million in NPV terms in terms of additional disposable income generated in NSW, or $20 million annually;
- additional employment of 444 FTE workers annually; and
- additional value added of $346 million in NPV terms, or $25 million per annum.

Table 4-1. Incremental initial flow-on effects (Type IA) of the Project – NSW (2023 to 2053, $2020)

	Units	Total	Annual
Disposable income	NPV $million	$276	$20
Employment	Average FTEs	N/a	444
Value added	NPV $million	$346	$25

Notes: NPVs have been derived using a discount rate of 7 per cent.
Source: AnalytEcon analysis.

4.3. FLOW-ON BENEFITS FOR THE LOCAL REGION

As set out in Section 2.4, the local effects of the Project have been analysed for two regional definitions: the SA3 Region and the Project Region.

Table 4-2 shows the estimated incremental flow-on effects from the project for the Project Region and the SA3 Region, respectively.[12] In order to ensure that these results are consistent and can be incorporated into the LEA, local flow-on effects have been calculated for the operational workforce only (i.e. excluding the construction, rehabilitation and closure workforce):

- total disposable income benefits of $57 million in NPV terms for the Project Region ($4 million annually), or of $42 million in NPV terms for the SA3 Region ($3 million annually); and
- annual average employment benefits of 267 FTE jobs for the Project Region, or 186 FTE jobs for the SA3 Region.

As is the case for the flow-on effects calculated for the NSW economy as a whole (Section 4.2), the flow-on effects summarised in Table 4-2 should be understood as incremental; that is, these effects are additional to the direct disposable income and employment effects that would occur as a result of the Project.[13]

Table 4-2. Incremental flow-on effects (Type IA) for the Project operational workforce (2023 to 2053, $2020)

		Project Region		SA3 Region	
	Units	Total	Annual	Total	Annual
Disposable income	NPV $m	$57	$4	$42	$3
Employment	Annual average FTE jobs	N/a	267	N/a	186

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: AnalytEcon.

[12] Table 4-2 does not incorporate and estimate for value added flow-on effects. One component of value added are profits, which are distributed on the basis of the ownership of capital. Distributing profits in this way becomes increasingly uncertain as the analysis becomes more granular. There are no regional or state statistics on the local and imported content of goods and services, or the stock and ownership of capital. The calculation of value added flow-on effects at a local level is therefore not meaningful.

[13] As discussed in Section 3.10.1, the incremental agricultural income and employment flow-on effects for the local region are unlikely to be material and have not been incorporated in the calculation in Table 4-2. The flow-on calculation also excludes effects associated with any residual Project biodiversity offset area.

5. LOCAL EFFECTS ANALYSIS

This section describes the LEA that has been prepared for the Project. The LEA is intended to complement the CBA by translating the effects estimated at the State level into impacts on the local region.

5.1. LOCAL EMPLOYMENT AND INCOME EFFECTS

This section derives the incremental local employment and income effects attributable to the Project. Given that the LEA is concerned with the effects on the local economy, the focus is on the operational workforce, a large share of which can be expected to live locally.

5.1.1. Local workforce

As noted in Section 2.3.3, the Mount Pleasant Operation would cease operations in 2026, and would employ, on average, 431 operational FTE workers between 2023 and 2026. In contrast, the Project operational workforce would be deployed from 2023 through to 2048 and consist of an average of 602 FTE worker over that same timeframe.

For the LEA it is necessary to compare various employment and disposable income aggregates for the Reference Case and the Project Scenario. To ensure that these are consistent and comparable, it is necessary to calculate employment averages over a common timeframe, namely the operational timeframe of the Project from 2023 (Year 1) to 2048 (Year 26). Over that timeframe:

- the operational workforce in the Project Scenario is projected to consist of 602 FTE operational workers on average; while
- the operational workforce in the Reference Case would consist of 66 FTE operational workers on average.[14]

[14] That is, this average covers the years 2023 through 2026 when the Mount Pleasant Operation would employ well over 400 operational workers, but also the years 2027 through 2048 when the Mount Pleasant Operation would have ceased operating and would employ no operational workers.

Table 5-1 summarises the respective shares of the operational workforce assumed to live in the Project Region and the SA3 Region between 2023 and 2048. These shares have been derived from the places of residence of the current Mount Pleasant Operation workforce (Table 2-1).

Table 5-1. Operational workforce – Project scenario and Reference Case (FTE averages, 2023 to 2048)

	Project Region			SA3 Region		
	Project Scenario	Reference Case	Difference	Project Scenario	Reference Case	Difference
Ordinarily resident in region	422	46	376	294	32	261
Not ordinarily resident in region	180	20	160	309	34	275
Total operational workforce	602	66	536	602	66	536

Note: Totals may not sum exactly due to rounding.
Source: AnalytEcon.

5.1.2. Incremental disposable income

Table 5-2 derives the incremental disposable income accruing to the local operational workforce, consistent with Table 4.2 in the EA Guidelines. Table 5-2 focuses on the difference between the Project Scenario and the Reference Case, respectively, for each of the Project Region and the SA3 Region. The incremental disposable income benefit attributable to the Project operational workforce is calculated by comparing, for each of the Project Scenario and the Reference Case, the additional disposable income that the respective workforce would earn if they were paid the average local wage and taking the difference.

Table 5-2 should be read as follows:

- Row (1) contains the numbers of operational workers assumed to live in the Project Region and the SA3 Region in each scenario, consistent with Table 5-1.
- Rows (2) through (4) derive the difference in disposable incomes for workers earning a mining sector wage (the average wage earned by the Mount Pleasant operational workforce) relative to the disposable income corresponding to the average wage in the Project Region and the SA3 Region, respectively.
- Row (5) translates the increased disposable income per person into a per annum aggregate by multiplying it with the number of local FTE jobs for the Project and the Mount Pleasant Operation, respectively. For instance, looking at the SA3 Region, multiplying the per worker annual incremental disposable income for the Project of $42,521 with the number of local workers (294) gives a per annum total of $12 million. For the Mount Pleasant Operation, the corresponding per annum total is $1 million. The difference of $11 million is the incremental annual disposable income benefit attributable to the Project for the SA3 Region.
- Row (6) converts the additional disposable income attributable to the Project and the Mount Pleasant Operation, respectively, into FTE jobs by dividing by the gross mining wage (the average wage earned by the Mount Pleasant operational workforce).
- Row (7) determines the aggregate incremental disposable income benefit from 2023 to 2048 in NPV terms for the Project Region and the SA3 Region, respectively.

In summary, Table 5-2 suggests that in the Project Scenario (relative to the Reference Case) the local operational workforce would benefit from:

- an increase in disposable income of $132 million in NPV terms in the Project Region; and
- an increase in disposable income of $98 million in NPV terms in the SA3 Region.

Table 5-2. Incremental increase in disposable income – Operational workforce (2023 to 2048)

		Units	Project Region			SA3 Region		
			Project	Mount Pleasant Operation	Difference	Project	Mount Pleasant Operation	Difference
(1)	Average direct employment during operations phase (2023 to 2048)	FTE jobs	422	46	376	294	32	261
(2)	Average disposable income Mount Pleasant Operation/Project	$ per year	$97,729	$97,729	$0	$97,729	$97,729	$0
(3)	Average local disposable income	$ per year	$57,861	$57,861	$0	$55,208	$55,208	$0
(4)	Average increase in net income per employee (2) – (3)	$ per year	$39,867	$39,867	$0	$42,521	$42,521	$0
(5)	Increase in net income per year due to direct employment (4) x (1)	$m per year	$17	$2	$15	$12	$1	$11
(6)	FTE job equivalent (5) / (Average disposable income Mount Pleasant Operation/Project)	FTE jobs	106	12	94	78	9	70
(7)	Increase over the operational mine life (2023-2048)	NPV $m	$173	$41	$132	$128	$30	$98

Note: The NPV estimate of the incremental increase in disposable income over the life of the mine (row 7) takes account of the year-on-year variability of the operational employment profile.

Source: AnalytEcon.

5.2. EFFECTS RELATED TO NON-LABOUR PROJECT EXPENDITURE

The EA Guidelines require proponents to quantify (non-labour) construction and operating expenditures and to attribute those expenditures to the relevant local region. MACH has prepared an analysis of the local operating expenditures, summarised in Table 5-3 below. Table 5-3 suggests that almost 58 per cent of MACH's operating expenditures are directed at NSW suppliers, 3.7 per cent of operating expenditures are directed at suppliers in the Project Region (Muswellbrook, Singleton, and Upper Hunter LGAs), and that 3.1 per cent of operating expenditures are directed at suppliers in the SA3 Region (Muswellbrook and Upper Hunter LGAs).

Table 5-3. Analysis of direct operating expenditures in NSW (excluding labour, 2019)

Expenditure by geography	Percentage of operating expenditures by geography
Muswellbrook	2.7%
Singleton	0.6%
Upper Hunter Shire	0.4%
Project Region	3.7%
SA3 Region	3.1%
NSW	57.8%

Source: MACH.

Using the ratios derived in Table 5-3 it is possible to estimate the share of local and NSW expenditures going forward in the Project Scenario and the Reference Case, assuming that these shares remain the same over time (Table 5-4). Table 5-4 suggests that of the $6,024 million in NPV terms of operating expenditures in the Project Scenario (excluding private royalty payments), around $3,484 million in NPV terms would be expended in NSW (compared to $741 million in NPV terms for the Mount Pleasant Operation). Overall, the Project would result in additional operating expenditures relative to the Reference Case of:

- $2,743 million in NPV terms in NSW;
- $176 million in NPV terms in the Project Region; and
- $147 million in NPV terms in the SA3 Region.

Table 5-4. Estimated future NSW and local operating expenditures (2023 to 2053, $2020)

	Project	Mount Pleasant Operation	Difference
	NPV $million	NPV $million	NPV $million
Operating expenditures (excluding private royalty payments)	$6,024	$1,281	$4,743
NSW suppliers	$3,484	$741	$2,743
Project Region suppliers	$224	$48	$176
SA3 Region suppliers	$186	$40	$147

Source: AnalytEcon.

5.3. OTHER NET BENEFITS ATTRIBUTABLE TO THE LOCAL REGION

In addition to the incremental income benefits discussed above, net rate payments accruing to MSC represent a direct benefit to the local region. MACH is assumed to pay $1.443 million per annum in either scenario until all mine closure activities have been completed (Section 3.3.4), corresponding to around $16 million in NPV terms in the Project Scenario and $8 million in NPV terms in the Reference Case.

MACH has also provided a number of contributions in accordance with the Voluntary Planning Agreement (VPA) negotiated between Coal & Allied Operation Pty Ltd and MSC. The VPA was novated to MACH Energy Australia Pty Ltd, and then novated again to MACH Mount Pleasant Operations Pty Ltd (as operator of the joint venture between MACH and JCDA). The agreed contributions include the following:

- $500,000 per annum as Mount Pleasant Community Contribution (indexed annually according to Consumer Price Index [CPI]);
- up to a maximum annual payment of $220,000 per annum (indexed annually according to CPI) to contribute to the MSC's road maintenance cost;
- up to a maximum of $20,000 per annum (indexed annually according to CPI) as a contribution to an Environmental Officer; and
- using best endeavours to engage four apprentices per year for the life of the mine sourced from residents within the Muswellbrook Shire and Aberdeen.

The allocation of the Mount Pleasant Community Contribution is at the discretion of MSC, and has been allocated as follows between 2018 and 2021:

- $345,000 covering works to the new Muswellbrook outdoor swimming pool and the Muswellbrook Tertiary Education Centre;
- $250,000 for the establishment of the Hunter 2050 Foundation;

- $605,000 to the Denman Business Precinct Masterplan; and
- $1,455,000 to the following initiatives:
  - the Muswellbrook Entertainment Centre
  - the Denman Business Precinct Masterplan
  - the Muswellbrook Animal Shelter
  - the Aquatic Centre.

To date, MACH has provided donations, sponsorship or support to a number of local community organisations, events and initiatives including (but not limited to) the following:

- the Aboriginal Community Development Fund;
- the Muswellbrook NAIDOC Week;
- the Muswellbrook Cultural Spectacular;
- the Wybong Rural Fire Brigade;
- the Westpac Rescue Helicopter;
- the Muswellbrook Chamber of Commerce;
- the Muswellbrook Men's Shed;
- the NSW Women in Mining; and
- the Merriwa Race Club.

5.4. EFFECTS ON OTHER LOCAL INDUSTRIES

The EA Guidelines require a qualitative discussion of the effects of a proposal on other local industries, including whether a project would displace specific land uses, affect tourism, or whether short-run market adjustments, for instance in housing markets, might be expected.

As set out in Section 3.10, the Project is unlikely to adversely affect other local industries, in particular the agricultural, viticultural, equine and tourism industries:

- The Project would extend the length of time that land in the mining lease areas would be unavailable for agricultural use. The corresponding forgone net value of agricultural production represents an opportunity cost for MACH, but does not represent a cost to the local region. A reduction in agricultural production may also result in (negative) flow-on impacts on upstream and downstream industries through a loss of throughput to these industries. However, in the case of the Project these effects are considered to be immaterial.

- The Agricultural and Land Resources Assessment (MACH, 2020) concluded that the Project is likely to have insignificant impacts on production in the agricultural, viticultural and equine industries. The assessment further concluded that the Project would have negligible outcomes for the regional agricultural, viticultural and equine industries and related services and employment.

5.5. ENVIRONMENTAL IMPACTS ON THE LOCAL COMMUNITY

The approved Mount Pleasant Operation is located in the Muswellbrook mining precinct in the Upper Hunter Valley (Figure 2-1), close to the town of Muswellbrook and the Bengalla Mine and Dartbrook Mine. As described in Section 3.9, mine planning activities for the Project have proceeded in an iterative manner in order to minimise or eliminate adverse environmental impacts as a result of the Project on the local community. Where such impacts are predicted to occur, affected third parties would be 'made whole' by MACH, so that no additional cost should be included in the LEA:

- The Noise and Blasting Assessment (Wilkinson Murray, 2020) found that the likely outcomes from the Project generally represent a reduction in impact in comparison to the approved Mount Pleasant Operation, and that the staged increases to ROM coal extraction would minimise potential noise impacts to the majority of privately owned receptors surrounding the Mount Pleasant Operation. No material residual noise impacts are predicted after the implementation of the noise mitigation measures in accordance with the NPfI and the VLAMP.
- The Air Quality Impact Assessment (Todoroski Air Sciences, 2020) for the Project concluded that the Project would either not breach the NSW EPA air quality criteria, or that, where breaches might occur, these could be mitigated by MACH purchasing the affected land. The Human Health Assessment (EnRisks, 2020) identified no health risk issues of concern for the township of Muswellbrook or village of Aberdeen.
- The Groundwater Impact Assessment (AGE, 2020) for the Project concluded that the Project would have a negligible effect on groundwater quality or groundwater dependent ecosystems, and that one actively used bore of a total of six bores would experience a greater than 2 m drawdown. MACH would make whole the affected landowners, and purchase the required water licences.
- The Surface Water Assessment (HEC, 2020) for the Project concluded that the potential impacts of the Project would likely be negligible, and that no third parties would be affected.

No other potential material impacts of the Project on third parties or the local community were identified. In particular, both the Aboriginal Cultural Heritage Assessment (South East Archaeology, 2020) and the Historic Heritage Assessment (Extent Heritage Pty Ltd 2020) concluded that the majority of affected sites would be located within the areas associated with the current Mount Pleasant Operation.

5.6. NET BENEFITS OF THE PROJECT FOR THE LOCAL REGION

Table 5-5 summarises the net effects of the Project for the local region, as derived in the previous sections of the LEA, and consistent with Table 4.5 in the EA Guidelines.

Employment-related benefits (rows (1) through (3)) refer to the additional employment and the additional disposable income that the Project would bring to the local region:

- The Project would require an average operational workforce of 602 FTE workers between 2023 and 2048. In the Project Scenario, 422 (294) FTEs workers of the operational workforce are expected to live in the Project Region (the SA3 Region). In incremental terms, i.e. considering the Project Scenario relative to the Reference Case, 376 (261) FTE workers are expected to live in in the Project Region (the SA3 Region). If local employment flow-on effects are taken into account (Section 4.3), the total employment effects are estimated at 643 FTE jobs and 447 FTE jobs for the Project Region and the SA3 Region, respectively.
- In aggregate terms, the disposable income accruing to the NSW operational workforce of the Project between 2023 and 2048 is estimated at $558 million in NPV terms. The disposable income accruing to the 422 (294) operational workers expected to live in the Project Region (SA3 Region) is estimated at $409 ($284) million in NPV terms. Taking the difference between the Project Scenario and the Reference Case and considering the difference between mining wages and the average local wage (Section 5.1), the net incremental income accruing to the Project operational workforce is estimated at $132 million for the Project Region and $98 million for the SA3 Region. If broader disposable income flow-on effects are taken into account (Section 4.3), the total local income effects are estimated at $189 million and $140 million in NPV terms for the Project Region and the SA3 Region, respectively.

Row (4) summarises the information on non-labour related local expenditures. Total operating expenditures (excluding the private royalty) for the Project between 2023 and 2053 are estimated at $6,024 million in NPV terms. The Project would be expected to direct an additional $176 million in NPV terms in operating expenditures in the Project Region ($147 million in NPV terms in the SA3 Region) relative to the Reference Case.

Row (5) focuses on local government rate payments. In the Project Scenario MACH would pay around $8 million more in NPV terms to MSC than in the Reference Case.

Row (6) is concerned with potential external effects. No uncompensated external effects are predicted to occur locally (Section 5.5). The Project is a source of additional GHG emissions, with the NSW share of the associated societal costs estimated at $0.7 million in NPV terms. The share of GHG emissions costs attributable to the local region is zero for all practical purposes.

Table 5-5. LEA Summary ($2020)

(A)			(B)	(C)		(D)		(E)	
			Project direct: Total	Project direct: Local		Incremental Project direct: Local		Incremental Project direct and Flow-on: Local Effects	
				Project Region	SA3 Region	Project Region	SA3 Region	Project Region	SA3 Region
(1)	Employment related								
(2)	Operational jobs created	Annual average FTE jobs	602	422	294	376	261	442	311
(3)	Disposable income operational workforce	NPV $m	$558	$409	$284	$132	$98	$189	$140
(4)	Operating expenditures (excluding private royalty payments)	NPV $m	$6,024	$224	$186	$176	$147	$176	$147
(5)	Local government rates	NPV $m	$15.8	$15.8	$15.8	$8.3	$8.3	$8.3	$8.3
(6)	Externality benefit/cost	NPV $m	$0	$0	$0	$0	$0	$0	$0

Source: AnalytEcon.

6. SIGNIFICANCE OF THE RESOURCE

The net benefits that are attributable to the Project as described in this EA indicate the significance of the resource, in terms of the generation of taxation revenues, including NSW royalties, and additional employment and payments to the workforce. These net benefits would accrue at both the State and local levels.

The incremental economic benefits of the Project for NSW are estimated at $855 million in NPV terms, consisting of:

- $684 million in NPV terms of incremental royalty payments; and
- a NSW share of incremental company income tax payments of $172 million in NPV terms.

The Project would create 602 operational FTE jobs per annum on average between 2023 and 2048, of which 577 would be filled by NSW workers if current trends continue. The disposable income accruing to the NSW operational workforce is estimated at $558 million in NPV terms. Overall, the Project's net contribution to NSW GSP is estimated at $1.4 billion in NPV terms.

The wider economic flow-on effects for the State of NSW are estimated at an additional 444 FTE jobs per annum over the life of the Project.

If approved, the Project would give rise to operating expenditures of $6,024 million in NPV terms between 2023 and 2053, compared to $1,281 million in NPV terms for the Mount Pleasant Operation (excluding private royalty payments). On current trends, around 58 per cent of those operating expenditures would be expected to be directed at NSW suppliers.

The Project would deliver significant net benefits to the local region. For the Project Region, consisting of Muswellbrook, Upper Hunter and Singleton LGAs where 70 per cent of the current operational workforce live, these incremental benefits are estimated at:

- an additional 376 FTE operational jobs; and
- additional disposable income accruing to the local workforce of $132 million in NPV terms.

REFERENCES

Australian Bureau of Statistics, 2020a. 6401.0 Consumer Price Index, Australia; Tables 1 and 2. CPI: All Groups, Index Numbers and Percentage Changes; June.

—, 2020b. 5220.0 Australian National Accounts: National Income, Expenditure and Product; Table 1 & Table 26.

—, 2019a. 1410.0 - Data by Region, 2013-18, 17 May.

—, 2019b. 5206.0 Australian National Accounts; Table 45. Gross Value Added by Industry, Current prices.

—, 2016 – 2017. 5209.055.001 – Australian National Accounts: Input – Output Tables.

—, 2016. 2011 and 2016 ABS Census; at: https://www.abs.gov.au/census; accessed 5 October 2020.

—, 2010. National Regional Profile: Muswellbrook (A) (Statistical Local Area), Archived Issue, April.

Australian Competition and Consumer Commission, 2020. Financial performance of the Australian downstream petroleum industry 2002 to 2018, April.

Australian Government, 2017a. Analysis of wage growth, November.

Australasian Groundwater and Environmental Consultants Pty Ltd (2020) Mount Pleasant Optimisation Project – Groundwater Impact Assessment

Ballantyne, A. and Langcake, S., 2016. Why Has Retail Inflation Been So Low?, RBA Bulletin, June, pp. 9-17.

Bess, Rebecca, and Zoë O. Ambargis, 2011, Input-Output Models for Impact Analysis: Suggestions for Practitioners Using RIMS II Multipliers; in: 50th Southern Regional Science Association Conference, New Orleans, Louisiana.

Cadence Economics, 2019. Economic Impact Assessment of the Dendrobium Mine – Plan for the Future: Coal for Steelmaking.

Cai and Waddoups, 2012 - Household, Income and Labour Dynamics in Australia.

Coughlin, Cletus, and Thomas B. Mandelbaum, 1991. A consumer's guide to regional economic multipliers, Federal Reserve Bank of St. Louis Review, January/February, 73(1).

Currie, J. and Walker, R., 2019. What Do Economists Have to Say about the Clean Air Act 50 Years after the Establishment of the Environmental Protection Agency? Journal of Economic Perspectives, 33(4).

Department of Primary Industries, 2019. Summary of gross margins for NSW beef enterprises, April.

—, 2013. Upper Hunter Region Agricultural Profile, Factsheet No. 1, June.

Duncan, Greg J. & Holmlund, Bertil, 1983. 'Was Adam Smith Right after All? Another Test of the Theory of Compensating Wage Differentials', Journal of Labor Economics, 1(4), pp. 366-79.

Environmental Protection Authority, 2017. Noise Policy for Industry; at: https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017); accessed on 2 October 2020.

—, 2016, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

—, 2015. Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, December.

Environmental Risk Sciences (2020) Mount Pleasant Optimisation Project - Human Health Assessment.

European Energy Exchange, 2020. https://www.eex.com/en/market-data/environmental-markets/derivatives-market; accessed on 2 October 2020.

Extent Heritage Pty Ltd (2020) Mount Pleasant Optimisation Project NSW Historic Heritage Assessment and Statement of Heritage Impact.

Field, Barry C. and Field, Martha K., 2016. Environmental economics: an introduction; Seventh Edition., McGraw-Hill Education.

GT Environmental (2020) Soil Resource Assessment for Mount Pleasant Optimisation Project.

Hunter Eco, 2021. Mount Pleasant Optimisation Project Biodiversity Assessment Report.

Hydro Engineering and Consulting Pty Ltd (2020) Mount Pleasant Optimisation Project Surface Water Assessment.

Just Add Lime, 2020. Mount Pleasant Optimisation Project, Social Impact Assessment Report, September.

Lane, J.I., Salmon, L.A. and Spletzer, J. R., 2007. Establishment wage differentials. Monthly Lab. Rev., 130, p.3.

Lavetti, K., 2018. The estimation of compensating wage differentials: Lessons from the Deadliest Catch. Journal of Business & Economic Statistics, 1-18.

MACH Energy Australia Pry Ltd, 2019, Mount Pleasant Operation Visual Impact Management Plan.

—, 2020, Mount Pleasant Optimisation Project Agricultural and Land Resource Assessment.

—, 2021, Mount Pleasant Optimisation Project Greenhouse Gas Assessment.

National Environment Protection Council, 2015. Draft Variation to the National Environment protection (Ambient Air Quality) Measure, Impact Statement, July.

NSW Government, 2018. Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, April.

—, 2017. Guide to Cost-Benefit Analysis.

—, 2015a. Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, December.

—, 2015b. Greenhouse Gas Emissions Valuation Workbook.xlsm; http://planspolicies.planning.nsw.gov.au/index.pl?action=view_job&job_id=7312; accessed on 2 October 2020.

—, 2015c. US EPA Social Cost of Carbon.

PAE Holmes, 2013. Methodology for Valuing the Health Impacts of Changes in Particle Emissions – Final Report, February.

Preston, A. and Yu, S., 2015. Is there a part-time/full-time pay differential in Australia? Journal of Industrial Relations, 57(1), pp. 24-47.

Productivity Commission, 2019, PC Productivity Bulletin, May.

South East Archaeology Pty Ltd, 2020. Mount Pleasant Optimisation Project, Hunter Valley, New South Wales: State Significant Development Application – Aboriginal Cultural Heritage Assessment.

Sullivan, P. and To, T., 2014. Job dispersion and compensating wage differentials. Available at SSRN 2506693.

The Transport Planning Partnership, 2020. Mount Pleasant Optimisation Project Road Transport Assessment.

Todoroski Air Sciences Pty Ltd, 2020. Mount Pleasant Optimisation Project Air Quality Impact Assessment, 20 May.

Van Pelt Allen Visual Planning and Assessment, 2020. Mount Pleasant Optimisation Project Landscape and Visual Assessment.

Viscusi, W.K. and Gentry, E.P. 2015.'The value of a statistical life for transportation regulations: A test of the benefits transfer methodology'. Journal of Risk and Uncertainty. 51(1), pp. 53-77.

Wilkinson Murray Pty Ltd, 2020. Mount Pleasant Optimisation Project Noise and Blasting Assessment.

Wood Mackenzie, 2020. Thermal Coal Outlook Report, pp. 13.

World Bank, 2020. GDP ranking, PPP based; https://datacatalog.worldbank.org/dataset/gdp-ranking-ppp-based; accessed on 2 October 2020.

APPENDIX A NET PRODUCER SURPLUS

A.1. NET PRODUCER SURPLUS OF THE PROJECT

Table A-1 shows the net producer surplus calculation for the Project. The net producer surplus calculation is an incremental calculation; that is, the net producer surplus is the difference between the producer surplus in the Project Scenario and the producer surplus in the Reference Case. The producer surplus in the Project Scenario and the Reference Case, respectively, has been calculated by deducting costs from benefits, and is estimated at $1,110 million in NPV terms for the Project and $197 million in NPV terms for the Mount Pleasant Operation. The incremental producer surplus attributable to the Project is therefore $913 million in NPV terms. Given that MACH is owned by overseas entities, none of that producer surplus would accrue to the NSW community.

Table A-1. Incremental net producer surplus calculation (2023 to 2053, $2020)

Project				Mount Pleasant Operation			
Revenues ($m)		**Costs ($m)**		**Revenues ($m)**		**Costs ($m)**	
Gross mining revenue	$10,620	Wages & salaries	$1,027	Gross mining revenue	$1,998	Wages & salaries	$231
Residual value of land	$2	Operating costs, mitigation of external effects	$6,237	Residual value of land	$7	Operating costs, mitigation of external effects	$1,319
Residual value of capital	$15	Capital costs, net of rehabilitation expenditures, net of land acquisition costs	$630	Residual value of capital	$115	Capital costs, net of rehabilitation expenditures, net of land acquisition costs	$19
		Rehabilitation/closure costs	$40			Rehabilitation/closure costs	$89
		Purchase costs for land	$32			Purchase costs for land	$7
		All taxes	$1,560			All taxes	$259
Total	$10,637		$9,526	Total	$2,121		$1,924
Producer surplus			$1,110				$197
Net producer surplus (Project Scenario – Reference Case)							$913
NSW share of the net producer surplus							$0

Note: Totals may not sum exactly due to rounding.

Source: MACH, AnalytEcon.

APPENDIX B BENEFITS TO WORKERS

B.1. MINING SECTOR – SKILLS OVERLAP AND WAGE DIFFERENTIALS

The construction, transport, utilities and manufacturing sectors employ workers with many of the same skills as the mining sector. Table B-1 below shows the percentage of employees in the top 10 occupations in the mining sector, on the one hand, and the construction, transport, utilities, and manufacturing sectors, on the other. There is a significant degree of overlap in terms of the skills required. For instance, 9 per cent of employees in the mining sector are metal fitters and machinists, compared to 4 per cent in manufacturing. Truck drivers make up 6 per cent of employees in mining, compared to 18 per cent in the transport sector and 8 per cent in the utilities sector. Four per cent of mining employees are electricians, compared to 8 per cent in construction and 5 per cent in the utilities sector.

Table B-1. Skills overlap – Mining and other sectors

Top employing occupations	Mining	Constr.	Transport	Utilities	Manuf.
Drillers, Miners and Shot Firers	18%				
Metal Fitters and Machinists	9%				4%
Truck Drivers	6%		18%	8%	
Other Building and Engineering Technicians	5%				
Electricians	4%	8%		5%	
Production Managers	3%				3%
Structural Steel and Welding Trades Workers	3%				5%
Mining Engineers	2%				
Other Stationary Plant Operators	2%			3%	
Earthmoving Plant Operators	2%	3%			
Accountants, Accounting Clerks	2%	2%	1%	4%	2%
Geologists, Geophysicists and Hydrogeologists	2%				
Contract, Program and Project Administrators	2%			2%	

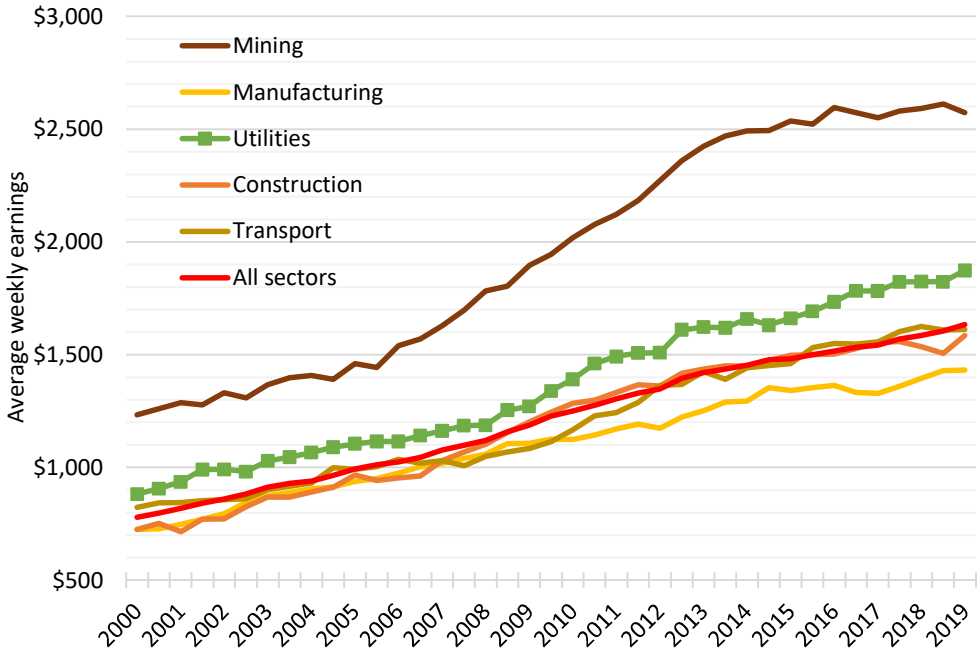
Top employing occupations	Mining	Constr.	Transport	Utilities	Manuf.
Other Construction and Mining Labourers	2%				
Purchasing and Supply Logistics Clerks	1%		2%		2%
Store Persons	1%		4%		3%
Structural Steel Construction Workers	1%	2%			
Motor Mechanics	1%				
Human Resource Managers	1%			1%	
Occupational and Environmental Health Professionals	1%				

Notes: Transport refers to 'transport, postal and warehousing'. Utilities refers to 'electricity, gas, water and waste services'. The top 20 occupations cover 69 per cent of employees in the mining sector, 72 per cent in the construction sector, 73 per cent in the transport sector, 52 per cent in the utilities sector, and 47 per cent in the manufacturing sector.

Source: https://australianjobs.employment.gov.au/jobs-industry/mining; accessed 20 January 2020.

As shown in Figure B-1, average remuneration in the mining sector is significantly higher than in the utilities, construction, transport and manufacturing sectors.

Figure B-1. Average weekly earnings by industry sector ($ nominal, 2000 to 2020)



Source: ABS, 6302.0 Average Weekly Earnings, Australia; August 2020.

B.2. WAGES AND PRODUCTIVITY

Labour markets are complex, and many supply and demand factors play a role in determining how wages evolve in different industries in the short run.[15] However, over a longer timeframe, the fundamental determinant of wages is labour productivity. Labour productivity is the amount of output produced by a worker over a unit of time, say an hour. Labour productivity depends on the amount or quality of capital and other factors of production that are available to workers. Growth in labour productivity (or the increase in output per hour worked) depends on (Productivity Commission 2019, Treasury 2017):

- The capital-labour ratio: the quantity of capital inputs used per unit of labour input, also referred to as the contribution from 'capital deepening'. Increased capital deepening means that, on average, each unit of labour has more capital to work with to produce output, and so is an indicator of a firm's ability to augment labour.
- The contribution from 'multifactor productivity' (MFP) growth: the efficiency with which labour and capital are combined in the production process. MFP growth may reflect many factors, including innovation and technological improvements, efficiency improvements arising from economies of scale and scope, improvements in management practices, and others.

B.2.1. Australian Treasury research

Recent research from the Australian Treasury (Australian Government 2017) confirms the importance of the central economic relationship between wages and productivity. The analysis of wage growth prepared by the Australian Treasury considered, among other things, the key drivers of wage growth, and the relationship between wage growth and the characteristics of employing businesses using firm-level tax data from the Business Longitudinal Analysis Data Environment (BLADE).

The analysis showed that (p. 53):

> *.. businesses with higher labour productivity pay higher real wages. The relationship between real wages and labour productivity holds across all business characteristics examined: business size (measured in terms of turnover), export participation and foreign ownership status.*

[15] For instance, wages are 'sticky' and adjust only slowly to changes in economic conditions. Also, there are a number of circumstances when workers' pay may be higher than the minimum that economic theory would predict, for instance because firms want to minimise staff turnover by paying their employees a higher wage, or in unionised industries.

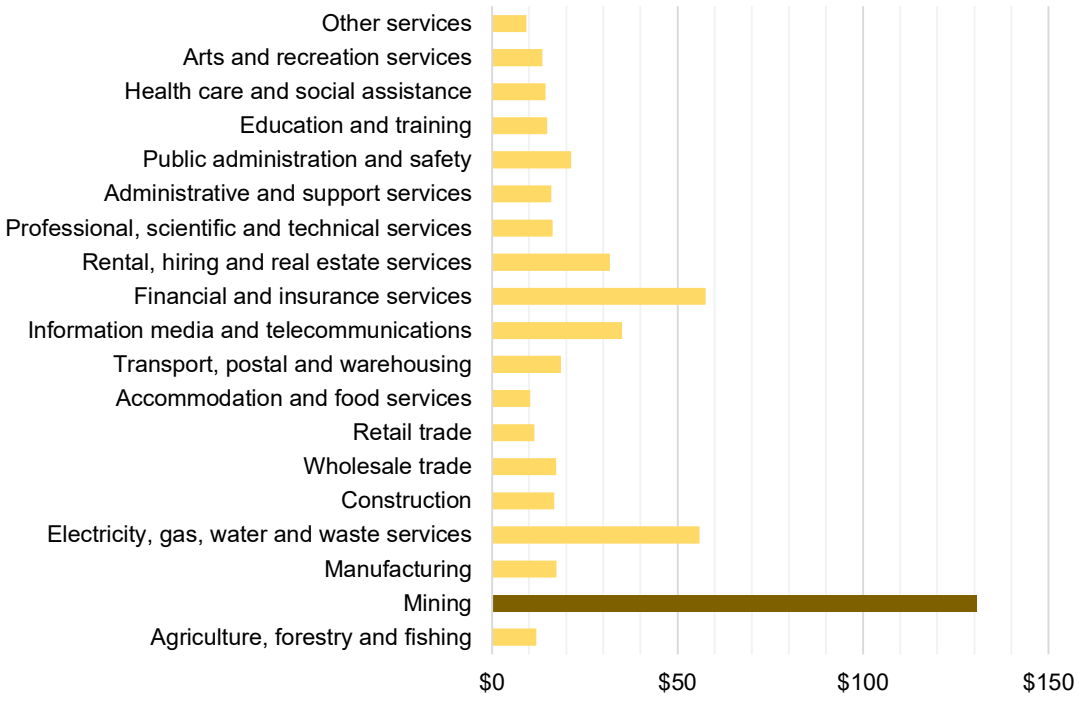
Specifically:

- High labour productivity businesses — and the most productive 10 per cent of businesses in particular — pay markedly higher average real wages (in *level* terms). On average over 2001-02 to 2013-14, the high productivity category paid average real wages 1.4 times as high as the low productivity category and 1.3 times as high as the mid-productivity category.
- Larger businesses paid higher average real wages and had higher real wage growth. On average over 2001-02 to 2013-14, businesses with more than $50 million turnover paid average real wages 1.5, 1.2 and 1.1 times as much as the $0-$2 million, $2-$10 million and $10-$50 million categories, respectively.
- Exporting businesses paid higher average real wages than non-exporting businesses. Exporters paid their employees, on average, 1.3 times as much as non-exporters over 2001-02 to 2013-14.

B.2.2. Labour productivity in the mining sector

As shown in Figure B-2, average earnings in the mining sector far exceed those in sectors that require similar skills.

Figure B-2. Labour productivity by sector (2019)



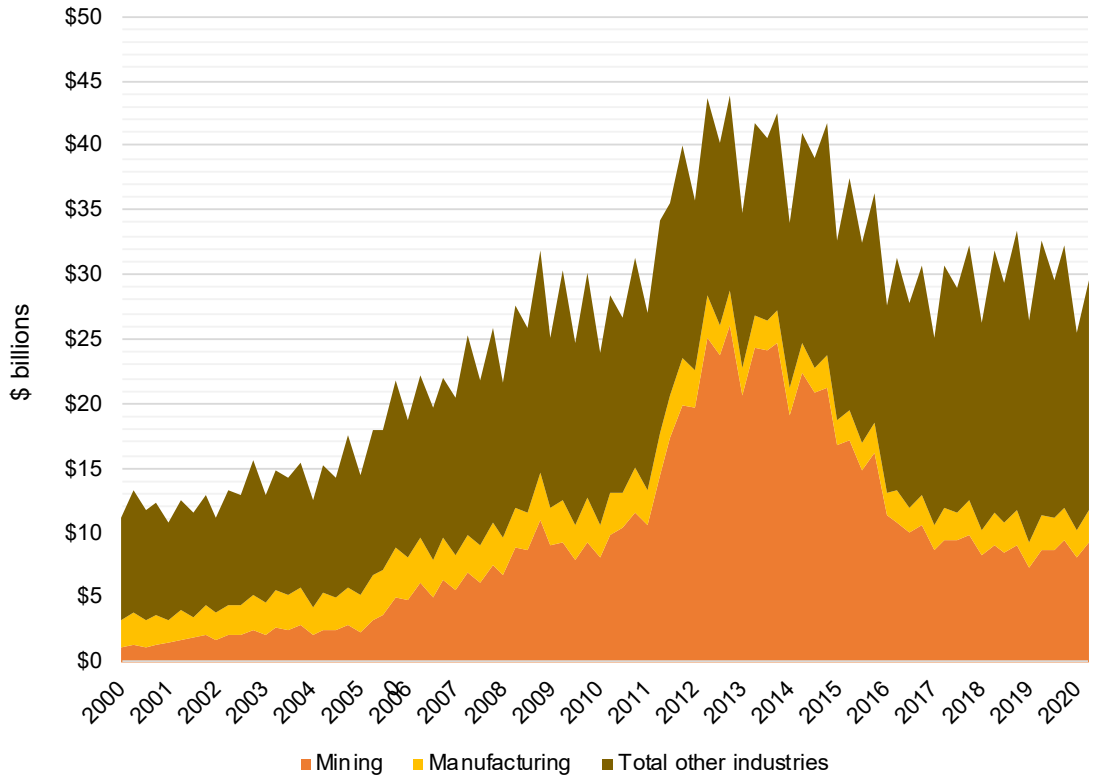
Notes: Labour productivity is estimated as gross value added (GVA) by sector per hour worked.

Source: ABS 2019, 5206.0 Australian National Accounts; Table 45. Gross Value Added by Industry, Current prices, June; Labour Account 2019, hours actually worked in all jobs.

High earnings in that sector are matched by the underlying labour productivity which, in absolute terms, is higher in the mining industry than any other Australian industry (Figure B-2).[16]

High labour productivity (and wages) in the mining sector are a reflection of substantial investment in capital assets. Figure B-3 shows new capital expenditures by the mining sector, the manufacturing sector, and other selected industries since June 2000. Together, these sectors account for virtually all private capital investment. As a share of market sector investment expenditure, mining increased from around 10 per cent in 2000 to 59 per cent in 2013, to around 30 per cent as of June 2020. As noted above, capital deepening is one of the key factors that raises labour productivity.

Figure B-3. Private new capital expenditure (2000 to 2020)



Notes: New capital expenditure refers to actual expenditure on buildings and structures; and equipment, plant and machinery. Other selected industry Other selected industries include Electricity, Gas, Water and Waste Services, Construction, Wholesale Trade, Retail Trade, Transport, Postal and Warehousing, Information Media and Telecommunications, Finance and Insurance, Rental, Hiring and Real Estate Services, Professional, Scientific and Technical Services.

Source: ABS 2020. 5625.0 Private New Capital Expenditure and Expected Expenditure, June.

[16] While mining labour productivity is high in absolute terms, it has varied over time. The mining sector responded to the mining boom by installing productive capacity, which required substantial inputs of capital and labour ahead of actual production (PC 2019). For these and other reasons, labour productivity for the mining industry fell by over 40 per cent between 2003-04 and 2011-12, but then subsequently rose by more than 60 per cent between 2011-12 and 2017-18.

B.3. COMPENSATING WAGE DIFFERENTIALS

The theory of 'compensating wage differentials' was originally articulated by Adam Smith: workers will want to be compensated for job attributes that are dangerous or unpleasant or otherwise undesirable (Duncan and Holmlund 1983).

In practice, however, empirical support for the theory of compensating differentials is weak, at best (Sullivan and To 2014; Lavetti 2018). Workers vary in their preferences as to how they assess risk-reward trade-offs, as well as in terms of other factors that cannot easily be observed or measured, such as worker ability. Furthermore, the risk of injury is occupation-specific, and does not necessarily apply to all workers in an establishment or industry (Lane et al. 2007). Those studies that identify a compensating effect then suggest large variations in how risk-reward trade-offs are valued, including as a function of income levels, levels of job risk, age, immigrant status, race, gender, and other characteristics (Viscusi & Gentry 2015).

The results of empirical research into the theory of compensating differentials in Australia are inconclusive. Cai and Waddoups (2012) use Household, Income and Labour Dynamics in Australia (HILDA) survey data to estimate the role of negative job characteristics (such as job stress, employment security, complexity and difficulty, control of the work process and commute times) as a determinant of wages. They found that controlling for job characteristics has a negligible effect on wages. Many studies have been done to identify a 'penalty' effect associated with casual or part-time work, but here the results have been contradictory (Preston and Yu 2015).

APPENDIX C PROJECT CONTRIBUTION TO NSW GSP

C.1. VALUE ADDED AND GROSS STATE PRODUCT

From an economic perspective, the extent to which a commercial development contributes to the welfare of a country or state differs from a private benefit calculation, which focuses on profits. The public benefit of a project is measured with reference to value added. Value added is the additional value of goods and services that are newly created in an economy, and that are available for domestic consumption or for export.

Value added is a central concept in the Australian System of National Accounts, where it is referred to as 'gross value added' to emphasise that this measure is gross of the consumption of fixed capital (that is, depreciation). Gross value added is the difference between output and intermediate inputs (the value created by production), and equals the contribution of labour and capital to the production process (ABS 2013). Subject to adjustments that need to be made to ensure that valuations are internally consistent by accounting for various taxes and subsidies, the sum of gross value added across all industries in a country or state equals GDP or gross state product GSP, respectively.

Formally, GSP at market prices derived using the income approach (GSP(I)) measures the sum of income flows accruing to the factors of production, plus taxes less subsidies on production and imports (ABS 2013):

$$\begin{aligned} GSP(I) = {} & \text{Compensation of employees and contractors} \\ & + \text{Gross operating surplus} \\ & + \text{Gross mixed income} \\ & + \text{Taxes} - \text{Subsidies on production and imports} \end{aligned}$$

Where:

- The gross operating surplus (GOS) is a measure of the surplus accruing to the owners of incorporated enterprises, and is the difference between gross output, on the one hand, and intermediate consumption, the compensation of employees and long-term contractors, and taxes less subsidies on production and imports. GOS is calculated before deduction of consumption of fixed capital, dividends, interest, royalties and land rent, and direct taxes payable.
- Gross mixed income (GMI) is a similar concept as GOS and refers to the share of income from production that can be attributed to unincorporated businesses (for instance, self-employed people), and is not relevant here.

- Taxes (subsidies) on production include taxes on products, such as GST and import duties, and other taxes (subsidies) on production, such as payroll taxes or subsidies, land taxes, stamp duties and taxes on pollution.

The change in GSP as a result of the Project being approved therefore captures the incremental benefits accruing to NSW from:

- the additional salaries and wages paid to the NSW workforce;
- the share of the Project's GOS that can be attributed to NSW, including coal royalty payments to NSW and Commonwealth income taxes that can be attributed to NSW residents; and
- the additional payroll taxes, land taxes and local government rates paid to NSW and to local government.

C.2. INCREMENTAL COMPENSATION OF THE NSW WORKFORCE

In order to correctly apportion wage and salary benefits to NSW, gross wages and salaries have been decomposed into disposable income, income taxes, superannuation contributions, and Medicare levies. Only incremental disposable income is assumed to constitute a full benefit to NSW (Table C-1).

Table C-1. Disposable income accruing to the NSW workforce – Project and Mount Pleasant Operation ($2020)

	Project	Mount Pleasant Operation	Difference
Gross income (NPV $m)	$983	$221	$762
Superannuation (NPV $m)	$116	$25	$91
Personal income taxes (NPV $m)	$244	$55	$188
Medicare (NPV $m)	$20	$4	$15
Disposable income (NPV $m)	$604	$136	$467

Source: AnalytEcon analysis.

Some share of income taxes and Medicare levies paid by the Project workforce to the Commonwealth Government can be deemed to benefit the residents of NSW. That share of income taxes and other imposts has been determined on the basis of population share (31.9 per cent).

C.3. INCREMENTAL VALUE ADDED

Table C-2 shows the estimated incremental contribution of the Project to NSW GSP.

Table C-2. Value added – Project and Mount Pleasant Operation ($2020)

Components of value added	Project (NPV $m)	Mount Pleasant Operation (NPV $m)	Difference (NPV $m)
Compensation of employees and long-term contractors:			
Disposable income	$604	$136	$467
NSW share of net personal income tax & other receipts:			
Net income tax	$78	$18	$60
Net Medicare	$6	$1	$5
NSW share of Project GOS:			
Producer surplus	$0	$0	$0
Royalties	$841	$157	$684
Company tax	$196	$24	$172
Other taxes on production less subsidies on production:			
Payroll	$56	$13	$43
Land taxes	$3	$1	$1
Local government rates	$16	$8	$8
Externalities:			
GHG emissions	$0.9	$0.2	$0.7
Net change in GSP			$1,441

Source: AnalytEcon analysis.

APPENDIX D VARIATION IN THE CLOSURE DATE OF THE EXISTING/APPROVED MOUNT PLEASANT OPERATION

D.1. BACKGROUND

Construction activities commenced at the Mount Pleasant Operation in November 2016 and mining operations commenced in October 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795.

Mount Pleasant Operation Modification 3, dated 24 August 2018, permits mining operations at the Mount Pleasant Operation until 22 December 2026 at a maximum rate of 10.5 Mt of ROM coal per calendar year. Within the operational parameters approved under Modification 3, significant approved open cut coal reserves would remain available for mining post-2026. Based on a ROM coal mining rate of 10.5 Mtpa post-2026, mining operations would need to continue through to 2038 to allow for all of the originally approved coal resource (i.e. 197 Mt) to be mined.

The Mount Pleasant Operation 'Approved Resource Scenario' described above has been considered as an alternative Reference Case as part of the cost-benefit analysis sensitivity analysis (Section 3.12).

D.2. APPROVED RESOURCE SCENARIO – KEY PARAMETERS

Table D-1 below compares key parameters for the Approved Resource Scenario and the Project Scenario. To model the Approved Resource Scenario, it has been assumed that production of ROM coal would continue at the Mount Pleasant Operation at the rate of 10.5 Mt per annum, and assuming the same product coal split as for the Mount Pleasant Operation. At this rate, the remaining coal reserves would be mined by 2038.

Given that this is a hypothetical scenario that has not been fully costed, it was further assumed that relevant expenditure items, such as project and sustaining capital expenditures, operating and labour costs would continue to be incurred in line with current ROM coal production. Closure costs and labour costs associated with the closure and the final rehabilitation of the Mount Pleasant Operation were assumed to be incurred post-production, as is currently the case. All other costs, including average wages and salaries, and residual land and capital values are assumed to remain unchanged.

Table D-1. Approved Resource Scenario and Project Scenario

	Approved Resource Scenario		Project Scenario	
Production timeline	2023 to 2038		2023 to 2048	
Product coal production				
Annual average (Mtpa)	7.4		11.9	
Peak (Mtpa)	7.8		16.9	
Total (Mt)	118.1		345.4	
Outlays (NPV $2020 millions)				
Capital expenditures	$56		$630	
Operating expenditures, (excluding private royalty payments) plus costs associated with mitigation of external effects	$3,332		$6,032	
Average workforce (FTEs)				
Operations	2023 to 2038	405	2023 to 2048	602
Construction	2023 to 2038	0	Construction years	75
Final Rehabilitation	2039 to 2042	50	2049 to 2053	68
Closure	2039 to 2042	24	2049 to 2053	47

Notes: Construction years in the Project Scenario are 2024 to 2027, 2031 to 2033, as well as the years 2036, 2041, and 2046. The average construction workforce in the Project scenario is based on the average construction workforce over these 10 construction years. The construction workforce peaks in 2026, with approximately 200 FTE personnel on an annual basis (and approximately 400 FTE personnel in the peak month). Operating expenditures exclude private royalty payments.

Source: MACH; AnalytEcon.

D.3. NET ENVIRONMENTAL SOCIAL AND TRANSPORT-RELATED COSTS

The predicted net environmental, social and transport-related costs in the Approved Resource Scenario are summarised in Table D-2.

Table D-2. Predicted net environmental, social and transport-related costs – Approved Resource Scenario

Environmental Aspect	Predicted net environmental, social and transport-related costs	Valuation
Noise	Extension of approved noise impacts to 2038	Noise mitigation and management costs included in capital/operational costs to 2038
Air quality	Extension of approved air quality impacts to 2038	Air quality mitigation and management costs included in capital/operational costs to 2038
Greenhouse gas	Total GHG emissions at 10.5 Mtpa ROM coal production to 2038 estimated at 6.9 Mt	Market-based and social GHG emissions valuations as described in Section 3.9.3 Central (EUA futures) damage cost estimate of $183 million in NPV terms, corresponding to a NSW share of damages of $0.6 million in NPV terms
Surface water	Extension of the approved surface water impacts to 2038	Surface water management costs included in capital/operational costs to 2038
Groundwater	Extension of the approved groundwater impacts to 2038	Groundwater management costs included in capital/operational costs to 2038
Biodiversity	No change to the approved surface development area Biodiversity offset already established for approved surface development area	Biodiversity management costs included in capital/operational costs to 2038
Land resources	No change to the approved surface development area	Agricultural production forgone to 2038 (opportunity cost to MACH)
Aboriginal heritage	No change to the approved surface development area	Aboriginal heritage management costs up to 2038 included in capital/operational costs
Historic heritage	No change to the approved surface development area	Historic heritage management costs up to 2038 included in capital/operational costs
Road transport	Extension of approved road transport impacts to 2038	Voluntary Planning Agreement road maintenance contributions included in operational costs
Visual	Extension of approved visual impacts to 2038	Visual management costs up to 2038 included in capital/operational costs
Social	Extension of approved social benefits and impacts to 2038	Voluntary Planning Agreement community contributions included in operational costs

Source: MACH (2020).

D.4. COST BENEFIT ANALYSIS

D.4.1. Coal royalties

The coal royalty payments attributable to the Approved Resource Scenario were derived as outlined in Section 3.2 and are summarised in Table D-3.

Table D-3. Incremental royalty calculation (2023 to 2053, $2020)

	Project Scenario (NPV $m)	Approved Resource Scenario (NPV $m)	Difference (NPV $m)	Notes
Assessable revenues	$10,620	$5,566	$5,054	Product coal production × AU$ coal prices
Allowable deductions				
Beneficiation	$333	$215	$118	Beneficiation deduction of $0.50 per tonne (bypass product coal) $3.50 per tonne (full cycle of washing)
Levies	$31	$18	$13	Coal Research Levy, Mines Rescue Levy, Long Service Leave Levy
Net disposal value	$10,256	$5,332	$4,923	Assessable revenue net of allowable deductions
NSW royalty	$841	$437	$404	8.2 per cent (open-cut coal royalty rate) × net disposal value

Note: Totals may not sum precisely due to rounding.
Source: MACH, AnalytEcon analysis.

D.4.2. Company income taxes

The company income taxes attributable to the Approved Resource Scenario were derived as outlined in Section 3.3 and are summarised in Table D-4.

Table D-4. Incremental company income tax calculation (2023 to 2053, $2020)

	Project (NPV $m)	Approved Resource Scenario (NPV $m)	Difference (NPV $m)	Notes
Coal revenues	$10,620	$5,566	$5,054	Product coal production × AU$ coal prices
Less:				
Operating costs	$6,237	$3,332	$2,905	Operating expenditure, private royalty charges, and closure costs, costs related to mitigating external effects
Labour costs	$1,027	$559	$468	Wages & salaries for operational, construction, rehabilitation and closure workforces
Royalties	$841	$437	$404	NSW royalty payments
All other taxes	$106	$64	$41	Payroll, land taxes, shire rates
Tax depreciation	$364	$37	$327	Depreciation of capital assets
Total assessable income	$2,044	$1,135	$910	Coal revenues minus all costs
Company tax	$613	$340	$273	30% of total assessable income
Share of company tax attributable to NSW	$196	$109	$87	31.9% of company tax (NSW share of Australian population)

Note: Totals may not sum precisely due to rounding.
Source: MACH, AnalytEcon analysis.

D.4.3. Other taxes

Other taxes have been incorporated in the costings for the Approved Resource Scenario as described in Section 3.3. In the Approved Resource Scenario, MACH is assumed to pay local government rates of $1,443,000 per annum over the operating life of the mine and through to the end of the process of rehabilitation and closure (2042). MACH would similarly pay land taxes of around $250,000 per annum through to 2042. Neither land taxes nor local government rates have been included as a benefit for NSW in the CBA.

D.4.4. Net producer surplus

Table D-5 summarises the net producer surplus calculation for the Approved Resource Scenario. The methodology outlined in Section 3.4 of the Main Report was adopted.

Table D-5. Incremental net producer surplus calculation (2023 to 2053, $2020)

Revenues ($m)		Costs ($m)	
Gross mining revenue	$5,566	Wages & salaries	$559
Residual value of land at end of the evaluation period	$3	Operating cost incl. cost of mitigating external effects, incl. private royalty payments	$3,332
Residual value of capital at end of the evaluation period	$51	Capital costs, net of rehabilitation expenditures, net of land acquisition costs	$56
		Rehabilitation/closure costs	$89
		Purchase costs for land	$7
		All taxes	$842
Total	$5,620		$4,846
Producer surplus			$734
Incremental producer surplus relative to Project			$376
NSW share of the net producer surplus			$0

Note: Totals may not sum exactly due to rounding.
Source: MACH, AnalytEcon.

D.4.5. Net benefits of the Approved Resource Scenario

Table D-6 summarises how the net benefits in the Approved Resource Scenario have been attributed to NSW, consistent with the approach in Section 3.4.

Table D-6. Attribution of Mount Pleasant Operation approved resource scenario net benefits to NSW (2023 to 2053, $2020)

Benefit	Total value (NPV $m)	Proportion attributed to New South Wales (Per cent)	Value for NSW CBA (NPV $m)
NSW royalties	$404	100%	$404
Company income tax	$273	31.9%	$87
Net producer surplus	$376	0%	$0

Source: AnalytEcon analysis.

Table D-7 summarises the estimated incremental net benefits of the Project for NSW relative to the Approved Resource Scenario. The NPV of the net benefits are estimated at $491 million in NPV terms, consisting of royalties of $404 million in NPV terms, and the NSW share of company income tax of $87 million in NPV terms.

Table D-7. Incremental net benefits of the Approved Resource Scenario for the NSW community (2023 to 2053, $2020)

Incremental costs	(NPV $m)	Incremental benefits	(NPV $m)
External effects – GHG emissions	$0.4	Royalties	$404
		NSW share of company income tax	$87
Total direct and indirect costs	$0.4	Total direct and indirect benefits	$491
Net benefits to NSW			**$490**

Note: Totals may not sum precisely due to rounding.
Source: AnalytEcon.

APPENDIX E INPUT-OUTPUT ANALYSIS AND DERIVATION OF FLOW-ON EFFECTS

This appendix describes the interpretation of input-output multipliers, the limitations of input-output analysis, and the methods used to calculate flow-on effects.

E.1. INPUT-OUTPUT MULTIPLIERS

Economic impacts can be measured in terms of income, value added and employment, which in turn gives rise to income, value added and employment multipliers. Multipliers are classified into 'types'. Type I multipliers refer only to flow-on effects in the production sectors, while Type II multipliers incorporate subsequent impacts on households:

- Type IA multipliers refer to the 'initial' and 'first-round' effects arising from an increase in demand from a proposal. The first-round effect captures the immediate subsequent impacts on income, employment or value added from all industries whose output is required to produce the additional output from the proposal.
- Type IB multipliers refer to the initial and 'production induced' effects, which encompass first-round effects and additionally 'industrial support' effects. Industrial support effects capture subsequently induced effects that occur after the first-round effects (since the initial output effect from a proposal will induce additional output in other industries, which will in turn lead to further rounds of effects and so on).
- Type IIA multipliers incorporate the effects of the initial increase in output from a proposal on households and refer to the sum of production induced, and consumption induced effects. Consumption induced effects capture the fact that, as a result of the additional output from a proposal and subsequent production induced effects in other industries, wage and salary earners will earn extra income, which they spend on goods and services produced by all industries in the state or region.

E.2. LIMITATIONS OF INPUT-OUTPUT ANALYSIS

The principal advantage of the impact multiplier method is the simplicity with which levels of mining investment, employment and output can be translated into measures of changes in regional income and employment. However, the accounting conventions that form the basis of input-output models and hence how multipliers are derived impose several restrictive assumptions. Some of these assumptions pertain to input-output analysis generally while others relate to the use and interpretation of input-output analysis at a regional or state level, as opposed to a national level.

The key assumptions used for the input-output analysis of flow-on effects are summarised in the following. Many of these assumptions can lead to an overstatement of the impacts of a proposal (Bess and Ambargis 2011, Coughlin et al. 1991). The implication is that the resulting regional impact estimates should be interpreted as an upper bound of the likely effects. There are additionally specific issues that arise in deriving local value added multipliers. Value added includes profits that are distributed on the basis of ownership of capital assets, which becomes increasingly uncertain as the analysis becomes more granular. The calculation of value added multipliers at a local level is therefore not meaningful.

E.2.1. Fixed capital stocks

The National Accounts, on which input-output analysis is based, do not explicitly account for fixed capital stocks. This is an issue with input-output analysis generally, as fixed capital has a significant impact on how an industry adjusts over time. A corollary to this is that input-output analysis is static in the sense that it takes no account of the time required for the composition of inputs and outputs of production to shift to a changed level in output. Industries that require large amounts of fixed capital and labour adjust slowly, particularly when they are near full employment or when the supply of skilled labour is tight. These dynamics are hard to predict, but the implication over the short to medium term is that input-output effects will be overstated to varying degrees across industries.

The fixed nature of the capital stock is a critical issue in local impact assessments. In moving from the national to a state or local level, the location of fixed assets becomes increasingly important in establishing the goods and services that are supplied locally and those which are imported. Moreover, there is no information as to whether fixed assets are owned locally or whether the owners are located outside the region or state. Consequently, determining the valued added by local industry becomes increasingly problematic.

E.2.2. Supply constraints

Relatedly, when the initial impact considered is an increase in production, the assumption of fixed production patterns requires that there is a sufficient endowment of resources that is either available in (or able to migrate to) a local region to meet the increase in demand for inputs whose supply is fixed. These inputs include resources such as land and water, as well as labour with adequate skills.

E.2.3. Homogenous and fixed production patterns

The input coefficients that measure inter-industry flows between sectors are 'fixed' in input-output models; at any level of output, an industry's relative pattern of purchases from other sectors is unchanged. These assumptions are likely to be inconsistent with production patterns in the local economy, since the local economy may not have on offer the range of inputs required for a given industry. Therefore, the impact of the change in output on the local economy will differ from that implied by a national multiplier.

E.2.4. Fixed prices

Input-output analysis assumes that prices in the economy in question are held constant, so that the additional material and labour inputs are available at existing prices and wage rates. In reality, prices of inputs may change with substantive changes in their demand. To the extent that there is an impact on prices, imputed output effects will be overstated. However, this is only a problem in input-output analysis for projects of a sufficient scale to materially shift the demand for production inputs and the total supply of industry output.

E.3. DERIVATION OF MULTIPLIERS

The following describes the various steps required to derive state and local input-output multipliers.

E.3.1. Concordance of the national accounts with census employment data

The Australian National Accounts input-output tables set out the flows of industry inputs (columns) and outputs (rows) for 114 industry classifications. The input output tables are for the year 2016-17, which were released in July 2019. The ABS census records employment at an aggregated level with 19 industry classifications. The employment data was drawn from the most recent, 2016, census. The concordance between the census and the accounts is set out in Table E-1.

Table E-1. Industry concordance between the industries in the National Accounts and industry level employment data in the 2016 Census

2016 ABS census Aggregate Industry	ABS National Accounts industry codes	
	Starting from	Ending with
Agriculture, forestry and fishing	101	501
Mining	601	1001
Manufacturing	1101	2502
Electricity, gas, water and waste services	2601	2901
Construction	3001	3201
Wholesale trade	3301	3301
Retail trade	3901	3901
Accommodation and food services	4401	4501
Transport, postal and warehousing	4601	5201
Information media and telecommunications	5401	6001
Financial and insurance services	6201	6401
Rental, hiring and real estate services	6601	6702
Professional, scientific and technical services	6901	7001
Administrative and support services	7210	7310
Public administration and safety	7501	7701
Education and training	8010	8210
Health care and social assistance	8401	8601
Arts and recreation services	8901	9201
Other services	9401	9502

Source: 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2016-17. 2016 ABS Census.

To construct the flows of industry inputs and outputs at the same level of the census, the rows and columns are summed. For example, there are seven industries classified as being part of the broader agriculture classification. Summing the seven rows aggregates the outputs of agriculture as a whole into each of the 114 industries. Summing the resulting new rows across the seven individual agricultural industries give the total input requirements for agriculture as a whole from each of the 114 regions. The final result is a balanced flow table with 19 industry classifications.

The balancing items include rows and columns that are important for the regional impact analysis:

- there are rows for wages and salaries, imports and value added, respectively; and
- there are columns for household consumption, as well as for other final demands.

E.3.2. Requirements matrix and first-round (Type IA) output multipliers

The initial requirement for an extra dollar's worth of output of a given industry is called the initial output effect. It equals one in total for all industries since an additional dollar's worth of output from any industry will require the initial one dollar's worth of output from that industry plus any induced extra output. The first-round effect is the amount of output required from all industries of the economy to produce the initial output effect.

First-round effects can be measured by deriving the 'direct requirements matrix'. In this matrix, the coefficients in a given industry's column show the amount of extra output required from each industry to produce an extra dollar's worth of output from that industry. The requirements matrix has been constructed from the Australian input-output (flows) table by standardising the inputs into each industry to produce one unit of output in each industry. This is achieved by dividing each row of the table by the total output on an industry-by-industry basis.

The first-round impact multiplier is then the sum of the standardised inputs for a given industry. For example, each element of the column for agriculture is divided by total agricultural output and then summed to obtain the total input requirement for one additional unit of output. The initial multiplier can be interpreted as the direct costs of an additional unit of production at current prices. Given these inputs are supplied domestically, the costs are other industry outputs and therefore contribute to total economic output. The sum of the initial output effect (which equals one) and the first-round effect is the Type IA output multiplier. This is simply the total first-round contribution of a project to the economy. For a project that is small when compared to the size of the industry, the first-round and Type IA impact multipliers are valid given the requirements are representative of those used in the project.

E.3.3. Simple output or Type IB multiplier

The simple Type IB multiplier takes into account the inputs required for the increased agricultural output (for example) that must also be produced, which requires the expansion of these industries and those that support them. These may be seen as series of flow-on effects that continue until the overall industry flows are again balanced.

Calculation of the simple multipliers requires solving a matrix equation. Let A be the 19 by 19 matrix of industry requirements (as discussed above), x a vector of inputs used in each of the industries and y a vector of net outputs from the economy. Net output can be standardised to 1 for each industry, giving rise to the simple linear input-output equation:

$$Ax - x = 1$$

Solving for the overall input requirement for one additional unit of output from each industry:

$$x = (I - A)^{-1}$$

where I is an identity matrix with ones along the main diagonal and zeros elsewhere, and the superscript -1 denotes the matrix inverse.

Summing the columns of $(1 - A)^{-1}$ gives the simple multipliers. For example, summing the agricultural column gives the total inputs from all industries needed to sustain the production of one additional unit of net agricultural output at the national level.

The simple multiplier represents a shift in the composition of industry output, as well as the total level of industry output assuming constant prices. This may be reasonably valid for a small increase in, for example, agricultural output. However, for large changes, such as those that have occurred in the Australian mining industry, output prices for most industries will adjust in an offsetting manner. That is, the relative prices for the outputs that are used more extensively in mining will rise, while prices for those that are less extensively used will fall. The implication is that the simple multiplier will, for a given increase in mining output, overstate the flow-on effects in industries where relative prices rise and understate flow-on effects where relative prices fall.

For a project that is small relative to the size of industry the price effects will be small and the bias in the simple multiplier may be ignored. However, the composition of flow-on effects will vary if the input requirements for the project differ from those of the industry. A comparison can lead to useful caveats regarding the simple multiplier effects on other industries.

E.3.4. The total or Type IIA output multiplier

The total multiplier takes into account the relationship between wages and household demand, that is, the increase (decline) in household demand that results from a rise (fall) in household income. This is derived by adding the wages row and the household expenditure column to the A matrix from the requirements table. Let the expanded matrix be denoted B. The total multipliers are analogous to the simple multiplier and given by the column sums of the matrix $(I - B)^{-1}$.

The key issue with the total multiplier is that wage rates and output price changes will tend to offset the effect. In a limiting case, an increase in wage rates will result in an increase in output prices and leave total output and real household expenditure unchanged. However, if the project is small relative to the size of the economy the effects on household income and wages can be ignored.

E.4. EMPLOYMENT, INCOME AND VALUE ADDED MULTIPLIERS

First-round, simple and total employment, income and value add multipliers can be calculated in much the same way as the output multipliers. The caveat noted for wage rates and employment in the previous section applies.

E.4.1. Employment multipliers

To calculate employment multipliers requires information about employment by industry that is provided in the ABS National Accounts (Table 20). For each industry, the FTE level of employment is divided by total industry output. This creates a vector of employment requirements per unit of output (denoted h) that can be used to convert the physical input requirements per additional unit of industry output into requirements for labour. The sum of these labour requirements constitutes the employment multipliers, written in matrix notation as:

Type IA: hA;

Type IB: $h(I-A)^{-1}$

Type IIA: $h(I-B)^{-1}$

These multipliers give the FTEs of employment needed to support an additional unit of output. These multipliers can be adjusted to Type IA, Type IIA multipliers by expressing the multiplier as the total employment needed per person directly employed on the project. This is done by dividing each of the multipliers above by the number of workers required per unit of output. They are not the number of jobs created as this will be impacted by the number of part-time workers that are converted to full-time workers or vice versa.

E.4.2. Income multipliers

The calculation of the income multiplier is done in the same way. The wage and salary requirement per unit are given in the requirements table. Designating these as a vector w the income multipliers written in matrix notation are:

Type IA: wA;

Type IB: $w(I-A)^{-1}$

Type IIA: $w(I-B)^{-1}$

These multipliers can be adjusted to Type IA, Type IIA multipliers by expressing the multiplier as the total income per dollar of salaries and wages expended directly on the project. This is done by dividing each of the multipliers above by the salaries and wages required per unit of output.

E.4.3. Value added multipliers

Value added is the value of industry output less the costs of inputs, whether produced domestically or imported (the contribution to regional GDP). This can again be calculated, as a vector, v, from the requirements table as value added per unit of industry output. The multipliers are then calculated in an identical way to employment and income:

Type IA: vA;

Type IB: $v(I-A)^{-1}$

Type IIA: $v(I-B)^{-1}$

These multipliers can be adjusted to Type IA, Type IIA multipliers by expressing the multiplier as the total income per dollar of value added by the project. This is done by dividing each of the multipliers above by the valued added per unit of output.

E.5. REGIONAL IMPACTS

It is not possible to maintain the level of consistency that exists in national input output tables at a regional level. Comprehensive data on industry composition, household consumption and the flow of goods and services to and from regions is not available.

E.5.1. Location quotients

A standard approach that can be reproduced across different regional definitions in a consistent manner is to use employment by industry data to form what are known as location quotients (LQs). Employment-based LQs are ratios that indicate the percentage of people employed in a particular industry at a state or regional level, relative to the percentage of people employed in that industry in the national economy. Employment-based LQs are then used to proportionally adjust the contribution of an industry to the use of intermediate inputs in a state or region. The consequent shortfall in intermediate inputs is made up by increasing 'imports' from outside the state or region across all industries.

LQs are used to translate economy-wide input-output relationships into state or regional relationships. Hence the national input-output tables need to be adjusted to better reflect the characteristics of the local economy (Table E-2).

Table E-2. NSW and local FTE employment by industry as a percentage of total employment (2016 Census)

Industry	NSW	SA3	Project Region
Agriculture, forestry and fishing	2.1%	13.2%	11.1%
Mining	0.9%	17.5%	19.3%
Manufacturing	5.8%	5.0%	4.7%
Electricity, gas, water and waste services	0.9%	3.4%	4.0%
Construction	8.4%	5.7%	5.5%
Wholesale trade	3.1%	2.5%	2.6%
Retail trade	9.7%	8.4%	8.7%
Accommodation and food services	7.1%	6.6%	6.7%
Transport, postal and warehousing	4.7%	3.3%	3.3%
Information media and telecommunications	2.2%	0.6%	0.7%
Financial and insurance services	4.9%	1.0%	1.0%
Rental, hiring and real estate services	1.8%	1.0%	1.0%
Professional, scientific and technical services	8.1%	3.3%	3.2%
Administrative and support services	3.5%	3.4%	3.7%
Public administration and safety	6.0%	4.7%	4.7%
Education and training	8.4%	7.0%	6.6%
Health care and social assistance	12.5%	8.2%	8.3%
Arts and recreation services	1.5%	1.2%	1.1%
Other services	3.7%	3.8%	3.8%
Inadequately described or not stated	4.7%	0.2%	0.0%
Total	100.0%	100.0%	100.0%

The use of employment LQs has a critical limitation. Input-output tables do not explicitly account for fixed capital, human or physical, although the returns to these assets are implicitly reflected in wages and operating surpluses (profits). As the impact analysis becomes more granular, the geographic location of these assets becomes increasingly important. A local region may simply not have the fixed capital needed to cost-effectively produce the input required by a local industry. The input will be then be 'imported' from other regions, states, or from overseas.

E.5.2. Adjusting regional/state industry composition and trade

A raw LQ is simply the percentage of FTE employment in a given industry and region, divided by the percentage of FTE employment in a given industry at the national level. This may be written for the i^{th} industry and the j^{th} region as:

$$LQ_{i,j} = \frac{\text{employment}_{i,j}}{\frac{\sum_i \text{employment}_{i,j}}{\sum_j \text{employment}_{i,j}}}{\sum_i \sum_j \text{employment}_{i,j}}$$

The LQ has a natural interpretation for an industry within a region:

- if the LQ is less than one, the goods and services from that industry will tend to be imported into the region to meet demand; while
- if the LQ is greater than one, the goods and services from that industry will tend to be exported into the region to meet demand elsewhere.

Given that goods and services and labour requirements are the same in all regions, the relationship will tend to be proportional so long as the actual size of the labour force does not represent a constraint. These are standard assumptions in an input output analysis. However, at the regional level, the violation of these assumptions can often be more apparent. For example, specialised goods or services demanded for a project may simply not be produced domestically and may have to imported, with a consequent reduction in regional flow-on effects. However, this can be addressed within the context of the requirements table if project information on where purchases are made is available.

Total employment may not be a constraint for a large region, such as a state. However, while a large proportion of people may be employed in an industry in a small region, the overall workforce in that industry may not be sufficient to meet labour requirements. While this may in part be offset by migration, it can simply be more efficient to import goods and services into the region.

It is recommended practice (Bess and Ambargis 2011) to adjust the raw LQs in small regions by the following formula:

$$LQ_{i,j} = \begin{cases} LQ_{i,j} & if \;\; LQ_{i,j} < 1 \\ 1 & if \;\; LQ_{i,j} >= 1 \end{cases}$$

LQs consist of the ratio of an industry's share of regional earnings to the industry's share of national earnings. This adjustment has the effect of holding constant or reducing regional flow-on effects. The basic idea is that industries in the region are not likely to produce all of the intermediate inputs required to produce the change in final demand. In these cases, local industries must purchase intermediate goods and services from producers outside the region, thereby creating leakages from the local economy.

E.5.3. Regional multipliers

Given that LQ is a vector of location quotients, the regionally adjusted Type IA and Type IB input multipliers are calculated by multiplying the industry requirements by the quotients. The output multipliers are the column sums of:

Type IA: $LQ \times A$;

Type IB: $\left(I - LQ \times A\right)^{-1}$

Type IIA: $\left(I - LQ \times B\right)^{-1}$

Where × denotes element-by-element multiplication of each column of A by LQ.

The income, employment and value added multipliers are calculated in the same manner as the national multipliers.

E.5.4. Adjusted mining industry expenditures

The LQ adjusts for locally sourced intermediate inputs. Therefore, the expenditure column of the input-output matrix, which includes wages, gross operating surplus, taxes and imports needs to be rebalanced to sum to total industry output. The balancing item is imports. The adjusted state and regional mine expenditures are shown in Table E-3.

Table E-3. NSW and local regions – Regional adjusted mining expenditures

Expenditures	NSW	SA3	Project Region
Agriculture, forestry and fishing	0.1%	0.1%	0.1%
Mining	3.7%	6.4%	6.4%
Manufacturing	3.2%	2.2%	2.5%
Electricity, gas, water and waste services	1.9%	2.1%	2.2%
Construction	5.2%	3.5%	3.3%
Wholesale trade	1.6%	1.4%	1.4%
Retail trade	0.5%	0.4%	0.4%
Accommodation and food services	0.4%	0.4%	0.4%
Transport, postal and warehousing	2.3%	2.3%	1.5%
Information media and telecommunications	0.2%	0.1%	0.1%
Financial and insurance services	4.0%	1.2%	1.1%
Rental, hiring and real estate services	1.8%	1.0%	1.0%
Professional, scientific and technical Services	3.6%	1.8%	1.5%
Administrative and support services	0.7%	0.5%	0.7%
Public administration and safety	0.7%	0.5%	0.5%
Education and training	0.1%	0.1%	0.1%
Health care and social assistance	0.0%	0.0%	0.0%
Arts and recreation services	0.1%	0.0%	0.1%
Other services	1.5%	1.5%	1.5%
Total Domestic Inputs	31.5%	24.9%	24.6%
Wages and Salaries	11.7%	11.7%	11.7%
Gross Operating Surplus	53.8%	53.8%	53.8%
Taxes	0.7%	0.7%	0.7%
Imports	2.3%	8.9%	9.2%
Total	100.0%	100.0%	100.0%

Note: Totals may not sum precisely due to rounding.

E.6. ESTIMATES OF MULTIPLIERS

The multipliers reported in the following were derived from national level multipliers in accordance with guidelines provided by the ABS. State and regional multipliers were derived using employment LQs to translate economy-wide input-output relationships into regional relationships.

Table E-4 shows NSW multipliers derived from the 2010 National Accounts tables and employment data for:

- income;
- employment (FTE equivalent); and
- value added (contribution to GDP).

Table E-4. NSW input-output multipliers - Mining

Multiplier	Type IA: Direct + Type IA effects	Type IB: Direct + Type IA + industry support effects	Type IIA: Direct + Type IA + industry support + consumption induced effects
Income	1.59	3.08	4.14
Employment	1.96	3.75	5.82
Value Added	1.24	2.43	2.87

Source: AnalytEcon.

Table E-5 shows the corresponding mining multipliers for the SA3 Region and the Project Region, respectively.

Table E-5. Local region input-output multipliers – Mining

	SA3 Region			Project Region		
Multiplier	IA	IB	IIA	IA	IB	IIA
Income	1.43	2.65	3.28	1.43	2.64	3.27
Employment	1.71	3.07	4.38	1.71	3.05	4.35
Value Added	1.19	2.28	2.54	1.19	2.28	2.54

Source: AnalytEcon.

For completeness, Table E-6 shows the agricultural input-output multipliers for the local region.

Table E-6. Local region input-output multipliers – Agriculture

	SA3 Region			Project Region		
Multiplier	**IA**	**IB**	**IIA**	**IA**	**IB**	**IIA**
Income	1.70	3.07	3.95	1.70	3.12	3.94
Employment	1.36	2.55	2.94	1.36	2.54	2.93
Value Added	1.35	2.54	2.88	1.35	2.50	2.88

Source: AnalytEcon.