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Attachment 3 – Aquifer Interference Policy Considerations

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A3 AQUIFER INTERFERENCE POLICY CONSIDERATIONS

A3.1 POLICY OVERVIEW

The New South Wales (NSW) *Aquifer Interference Policy* (the AIP) (NSW Government, 2012) has been developed by the NSW Government as a component of the NSW Government's *Strategic Regional Land Use Policy*. The AIP applies state wide and details water licence and impact assessment requirements.

The AIP has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The AIP will also enhance existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The NSW Water Management Act, 2000 (WM Act) *defines an aquifer interference activity as that which involves any of the following* (NSW Government, 2012):

- *the penetration of an aquifer,*
- *the interference with water in an aquifer,*
- *the obstruction of the flow of water in an aquifer,*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations, and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

Examples of aquifer interference activities include mining, coal seam gas extraction, injection of water, as well as commercial, industrial, agricultural and residential activities that intercept the water table or interfere with aquifers (NSW Government, 2012).

The AIP applies to all aquifer interference activities but has been developed in particular to address the following high risk activities (NSW Government, 2012):

- ***mining activities*** *such as open cut voids, underground mine workings and the disposal of water taken from an aquifer including water taken as part of coal seam gas extraction*
- *other* ***extractive industries****, such as sand and gravel extraction...;*
- ***coal seam gas activities****, including those related to both exploration and production*
- *other large projects which require* ***dewatering*** *such as for the construction and maintenance of associated works, such as buildings, roads and other civil works;*
- ***injection works*** *used to transmit water into an aquifer; and'*
- *activities with the potential to contaminate groundwater or result in unacceptable loss of storage or structural damage to an aquifer.*

A3.1.1 Licensing Requirements

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan. A water licence is required, whether water is taken either incidentally or for consumptive use, where any act by a person carrying out an aquifer interference activity causes (NSW Government, 2012):

- *the removal of water from a water source; or*
- *the movement of water from one part of an aquifer to another part of an aquifer; or*
- *the movement of water from one water source to another water source, such as:*
  - *from an aquifer to an adjacent aquifer; or*
  - *from an aquifer to a river/lake; or*
  - *from a river/lake to an aquifer.*

The AIP also requires consideration of the continued take of water from groundwater or connected surface waters following cessation of an aquifer interference activity. For example, the post-closure inflow that occurs until a groundwater system reaches equilibrium following cessation of open cut mining is required to be considered. Licences are required to be held to adequately account for the ongoing take of water until the system returns to equilibrium, or alternatively, sufficient licences are required to be surrendered to the Minister administering the WM Act (the Minister).

A3.1.2 Minimal Impact Considerations

In addition to licensing requirements, the WM Act includes the concept of ensuring *"*no more than minimal harm*"*. In this regard, the AIP includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality.

The AIP provides that (NSW Government, 2012):

> *Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.*
>
> *While aquifer interference approvals are not required to be granted, the minimal harm test under the Water Management Act 2000 is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to either the gateway process, the Planning Assessment Commission or the Minister for Planning.*

The AIP establishes minimal impact considerations for groundwater categories of both "highly productive" and "less productive" groundwater. Highly productive groundwater is defined by the AIP as groundwater which (NSW Government, 2012):

> *...is defined in this Policy as a groundwater source that is declared in the Regulations and will be based on the following criteria:*
>
> *a) has total dissolved solids of less than 1,500 mg/L, and*
>
> *b) contains water supply works that can yield water at a rate greater than 5 L/sec.*

The AIP further groups highly productive groundwater into the following categories:

- Alluvial.
- Coastal sands.
- Porous rock, including:
  - Great Artesian Basin – Eastern Recharge and Southern Recharge;
  - Great Artesian Basin – Surat, Warrego and Central; and
  - other porous rock.
- Fractured rock.

The AIP similarly defines categories for less productive groundwater which include:

- Alluvial.
- Porous rock.
- Fractured rock.

The minimal impact considerations developed for highly productive alluvial water sources are summarised in Table A3-1.

A3.2 AQUIFER INTERFERENCE POLICY REQUIREMENTS

A3.2.1 Water Licensing Requirements

As discussed in above, the AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan. The Water Sharing Plan relevant to the Modification is the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (the HURAWSP). Therefore, licensing under the HURAWSP is required to account for any loss of flow to the alluvium resulting from the Modification. Licensing to account for water taken from the Permian system under the NSW *Water Act, 1912* is also required.

Table A3-1
Minimal Impact Considerations for Aquifer Interference Activities

Water Source	Minimal Impact Consideration		
	Water Table	**Water Pressure**	**Water Quality**
Highly Productive Alluvial Water Sources	1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than 40% of the "post-water sharing plan" pressure head above the base of the water source to a maximum of a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	1. (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity; and (b) No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. Redesign of a highly connected surface water source that is defined as a "reliable water supply" is not an appropriate mitigation measure to meet considerations 1(a) and 1(b) above. (c) No mining activity to be below the natural ground surface within 200 m laterally from the top of high bank or 100 m vertically beneath (or the three dimensional extent of the alluvial water source - whichever is the lesser distance) of a highly connected surface water source that is defined as a "reliable water supply". (d) Not more than 10% cumulatively of the three dimensional extent of the alluvial material in this water source to be excavated by mining activities beyond 200 m laterally from the top of high bank and 100 m vertically beneath a highly connected surface water source that is defined as a "reliable water supply". 2. If condition 1(a) is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works. If condition 1(b) or 1(d) are not met then appropriate studies are required to demonstrate to the Minister's satisfaction that the River Condition Index category of the highly connected surface water source will not be reduced at the nearest point to the activity. If condition 1(c) or (d) are not met, then appropriate studies are required to demonstrate to the Minister's satisfaction that: • there will be negligible river bank or high wall instability risks; • during the activity's operation and post-closure, levee banks and landform design should prevent the Probable Maximum Flood from entering the activity's site; and • low-permeability barriers between the site and the highly connected surface water source will be appropriately designed, installed and maintained to ensure their long-term effectiveness at minimising interaction between saline groundwater and the highly connected surface water supply.

Table A3-1 (Continued)
Minimal Impact Considerations for Aquifer Interference Activities

Water Source	Minimal Impact Consideration		
	Water Table	**Water Pressure**	**Water Quality**
Less Productive Porous and Fractured Rock Water Sources	1. Less than or equal to a 10% cumulative variation in the watertable, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minster's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

Source: Table 1, AIP (NSW Government, 2012).

m = metre.

Details of the current groundwater licences held by Hunter Valley Energy Coal (HVEC) are summarised in Table A3-2. The maximum predicted annual groundwater volumes required to be licensed for the approved operations and for the Modification are summarised in Table A3-3.

Table A3-2
Groundwater Licence Summary

Licence Number	Licence Volume (ML)	Issue Date	Expiry Date
Licence under the WM Act			
WAL18175	13	16/11/2011	Perpetuity
WAL18141	104	25/07/2011	Perpetuity
WAL18247	247	25/07/2011	Perpetuity
Licences under the *Water Act, 1912*			
20BL171995	750	5/11/2008	4/11/2013
20BL168155	750	28/05/2007	27/05/2017
20BL171156	150	13/03/2007	Perpetuity
20BL170620	250	5/12/2011	4/12/2016

Source: BHP Billiton (2011).
ML = megalitres.

Table A3-3
Groundwater Licensing Requirement Summary

Relevant Legislation	Groundwater Source	Predicted Maximum Annual Licensing Requirements (ML/annum)		
		Approved	Incremental Increase due to the Modification	Total Including the Modification
HURAWSP	Hunter River Alluvium	252	12	264
Water Act, 1912	Porous Rock	1,270	No Increase	1,270

Source: After Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) (2013).
ML/annum = megalitres per annum.

Table A3-2 indicates that HVEC currently hold licence entitlements of 364 ML/annum for the HURAWSP and 1,900 ML/annum for water extracted from porous rock. Comparison of HVECs licence entitlements against the predicted maximum annual licensing requirements (Table A3-3) shows that adequate licences are available to account for the potential take of water associated with the approved operations and the Modification. If required, HVEC would transfer water entitlements between water management zones in order to adequately licence groundwater extraction.

AGE (2013) have undertaken numerical modelling of the post-mining recovery of groundwater levels as described in Appendix B of this EA. Post-closure annual licensing requirements are expected to be less than the licensing requirements during operation. Given that HVEC currently holds adequate licenses to account for the potential take of water associated with the approved operations and the Modification it follows that HVEC will have adequate licences to account for the potential post-closure take of water.

Notwithstanding, the numerical groundwater model would be refined over progression of the mine life in order to more accurately calculate the post-closure licensing requirements associated with the Mt Arthur Coal Mine.

A3.2.2 Minimal Impact Considerations

As discussed above, the AIP establishes minimal impact considerations for highly productive and less productive groundwater. Figure A3-1 shows Strategic Agricultural Land mapped in the vicinity of the Modification.

No differentiation between highly productive and less productive groundwater has been undertaken as part of this assessment. Therefore the impacts of the Modification to the alluvium associated with the Hunter River have been conservatively assessed against the minimal impact considerations relating to highly productive groundwater. While the highly productive minimal impact considerations have been referenced, it is noted that the criteria for highly productive groundwater includes total dissolved solids of less than 1,500 milligrams per litre (mg/L) and groundwater monitoring within the alluvium associated with the Hunter River proximal to the Mt Arthur Coal Mine indicates that electrical conductivity (EC) ranges from 1,500 to 9,370 microSiemens per centimetre (µS/cm) (AGE, 2013), which is equivalent to approximately 900 to 5,622 mg/L (assuming 0.6 µS/cm EC approximates 1 mg/L total dissolved solids). The impacts of the Modification to porous rock have been assessed against the criteria for less productive groundwater.

AGE (2013) predicted that the Modification would not result in an increase in flux from the alluvium associated with Saddlers Creek. Further, no bores within the alluvium associated with Saddlers Creek were predicted to experience incremental drawdowns due to the Modification. On this basis, it is assessed that the Modification adequately satisfies the water table, water pressure and water quality minimal impact considerations defined in the AIP and outlined in Table A3-1.

Hunter River Alluvium Water Table and Water Pressure Minimal Impact Considerations

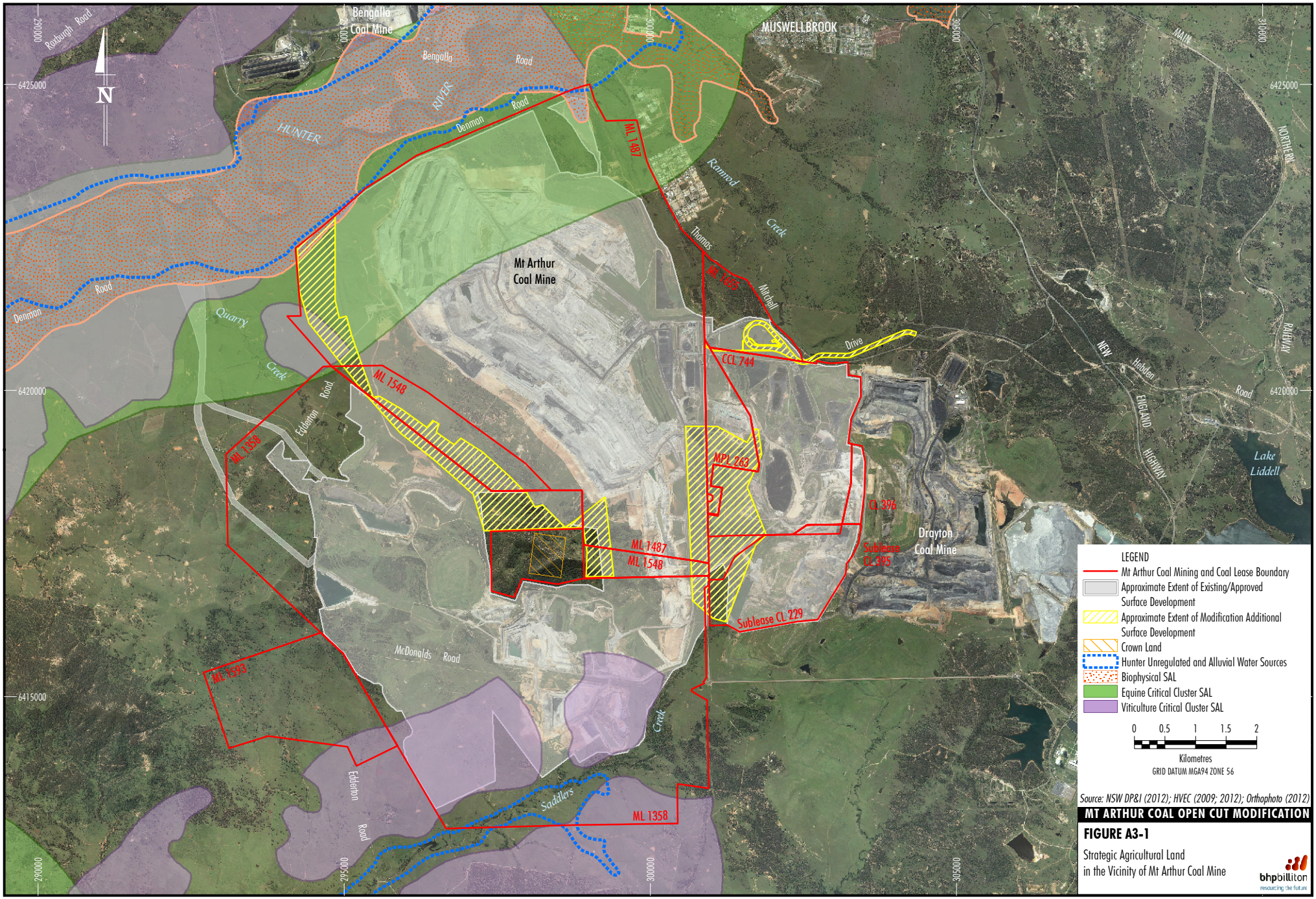
The water table minimal impact considerations for aquifer interference activities within highly productive alluvial water sources are presented in Table A3-1 and include:

- impacts to high priority groundwater dependent ecosystems;
- impacts to high priority culturally significant sites; and
- water decline at any water supply work.

In addition, the water pressure minimal impact considerations for aquifer interference activities within highly productive alluvial water sources are also presented in Table A3-1 and include a maximum of a 2 m decline at any water supply work.

The closest high priority groundwater dependent ecosystem in the Hunter Unregulated and Alluvial Water Sources as listed in Schedule 4 of the HURAWSP is located more than 60 kilometres from the Mt Arthur Coal Mine, outside of the extent of cumulative drawdown associated with the Modification. Further to this, no high priority culturally significant sites are listed in the HURAWSP.

AGE (2013) predicted that three bores located within the alluvium associated with the Hunter River would incur an incremental drawdown of more than 2 m due to the Modification. These bores are located within HVEC-owned land. Therefore, no privately owned bores located within the extent of the alluvium associated with the Hunter River would experience a decline greater than 2 m as a result of the Modification.



Source: NSW DP&I (2012); HVEC (2009; 2012); Orthophoto (2012)

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE A3-1

Strategic Agricultural Land
in the Vicinity of Mt Arthur Coal Mine

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Given the above, it is assessed that the Modification adequately satisfies the water table and water pressure minimal impact considerations defined in the AIP and outlined in Table A3-1. Notwithstanding, in accordance with Project Approval (09_0062) for the Mt Arthur Coal Mine – Open Cut Consolidation Project Statement of Commitments:

> *In the event of interruption to water supply resulting from the Project, an alternative water supply will be provided, until such interruption ceases.*

The process for identifying and compensating the interruption to water supply resulting from Mt Arthur Coal operations would be in accordance with the "protocol for adverse affects to nearby users" outlined in the *Surface and Groundwater Response Plan* (BHP Billiton, 2012).

Porous Rock Water Table and Water Pressure Minimal Impact Considerations

The water table minimal impact considerations for aquifer interference activities within less productive porous rock water sources are presented in Table A3-1 and include:

- impacts to high priority groundwater dependent ecosystems;
- impacts to high priority culturally significant sites; and
- water decline at any water supply work.

Water pressure minimal impact considerations for aquifer interference activities within less productive porous rock water sources are also presented in Table A3-1 and include a maximum of a 2 m decline at any water supply work.

No Water Sharing Plan has been developed for the Permian groundwater system, however, it is noted that the high priority groundwater dependent ecosystems listed in the HURAWSP are located outside the extent of the cumulative drawdown associated with the Modification. In addition no high priority culturally significant sites are listed in the HURAWSP.

AGE (2013) predicted that one bore outside the extent of the alluvium associated with the Hunter River would incur an incremental drawdown of more than 2 m due to the Modification. This bore is located within HVEC-owned land. Therefore, no privately owned bores located outside the extent of the alluvium associated with the Hunter River would experience a decline greater than 2 m as a result of the Modification. Therefore the Modification is considered to adequately satisfy the water table and water pressure minimal impact considerations relating to less productive porous rock water sources defined in the AIP and outlined in Table A3-1.

Hunter River Alluvium Water Quality Minimal Impact Considerations

The water quality minimal impact considerations for aquifer interference activities within highly productive alluvial water sources are presented in Table A3-1 and include:

- impacts to groundwater quality in relation to the beneficial use category of the groundwater source;
- impacts to the long-term average salinity in highly connected surface water sources;
- consideration of the location of mining activities in relation to a highly connected surface water source defined as a "reliable water supply" (i.e. the Hunter River); and
- limits to the extent of excavation of alluvial material.

The Modification is located outside of the extent of the Hunter River alluvium and would not result in a mining activity below the natural ground surface within 200 m laterally from the Hunter River high bank or 100 m vertically beneath the Hunter River alluvial aquifer. Further, the Modification would not result in extraction of alluvial material of the Hunter River. Notwithstanding, in accordance with Project Approval (09_0062) for the Mt Arthur Coal Mine – Open Cut Consolidation Project Statement of Commitments:

> *Mining (other than that already approved in the MAN EIS) will not extend beyond a nominal 150 m buffer zone from the Hunter River Alluvials until agreement is reached with NOW regarding the installation of a lower permeability barrier along the point of connections of mining and the alluvium or other appropriate safeguards.*

The Modification is not predicted to result in a significant migration or deterioration in groundwater quality (AGE, 2013). Therefore, the Modification is not expected to lower the beneficial use class of groundwater within the vicinity of the mine lease. The environmental value of the Hunter River alluvial groundwater proximal to the site has been classified as "primary industry" with the main use being for irrigation and stock dewatering (AGE, 2013).

In addition, a decrease in salinity has been observed in alluvial monitoring bores to the north of the Northern Open Cut and it is likely that this is due to a decrease in flux of more saline groundwater from the Permian Coal Measures to the alluvium as a result of pit dewatering (AGE, 2013). Therefore, as the Modification is predicted to result in flux from the alluvium to the Permian coal measures (i.e. continued dewatering in the mine pit area resulting in an ongoing "sink" in the local Permian coal measures), the Modification is not expected to result in an increase in long-term average salinity in the Hunter River.

On this basis, it is assessed that the Modification adequately satisfies the water quality minimal impact considerations defined in the AIP and outlined in Table A3-1.

Porous Rock Water Quality Minimal Impact Considerations

The water quality minimal impact considerations for aquifer interference activities within less productive porous rock water sources are presented in Table A3-1 and relate to impacts to groundwater quality in relation to the beneficial use category of the groundwater source.

The Modification would result in local depressurisation of the Permian groundwater system during mining (AGE, 2013). Following completion of mining the final void pit lake would behave as a sink in the local groundwater environment (AGE, 2013).

In consideration of this, there is not expected to be a migration of groundwater away from the Modification area in the Permian system either during mining or following completion of mining activities. On this basis, the Modification would not lower the beneficial use category of the groundwater within the Permian system.

Therefore it is assessed that the Modification adequately satisfies the water quality minimal impact considerations relating to less productive alluvial water sources defined in the AIP and outlined in Table A3-1.

A3.3 REFERENCES

Australasian Groundwater and Environmental Consultants Pty Ltd (2013) *Mt Arthur Coal Mine Open Cut Modification Groundwater Impact Assessment*.

BHP Billiton (2011) *Annual Environmental Management Report*.

BHP Billiton (2012) *Surface and Groundwater Response Plan.*

New South Wales Government (2012) *Aquifer Interference Policy.*