- adoption of best practice technology and operating measures to reduce emissions.

The Commonwealth ***Department of the Environment (DOE)*** initially raised concerns about the adequacy of the biodiversity offset strategy, but has since consulted with Shenhua, OEH and the Department in relation to Shenhua's enhanced offset strategy.

DOE noted that the revised biodiversity offset strategy provides adequate direct offsets for Commonwealth-listed threatened species, but that the offsets for some endangered ecological communities (EECs), particularly the 'Grey Box' EEC, still falls (marginally) short of its direct offset requirements. DOE recommended that further compensatory measures be required for the Grey Box EEC.

DOE also provided advice from the Commonwealth's Independent Expert Scientific Committee (IESC), which has been established to provide DOE with advice in relation to water-related impacts of large coal and CSG projects. The IESC encouraged consideration of the potential cumulative impacts of the project on water resources, and considered that the project has a risk of increasing salinity in the region, particularly associated with overflow from water storages, long term seepage from overburden emplacements and voids, connectivity between aquifers and vegetation removal. The Committee made a number of comments on the adequacy of the water assessments undertaken for the project, and made recommendations to reduce impacts, including requirements for detailed water management plans, flood mitigation (of the Eastern Mining Area), and mitigating salinity through implementation of dryland salinity management measures (eg. revegetation). The Department has engaged independent surface water and groundwater experts to review the potential water resource impacts of the project in detail (see Section 6.1).

NSW Mining and Petroleum Gateway Panel (the Gateway Panel) raised a number of concerns in relation to the BSAL assessment for the project, in particular that Shenhua:

- had not defined the project area for BSAL assessment correctly;
- had not applied the BSAL verification protocol correctly;
- should undertake further salinity modelling of the final void; and
- should amend the project to 'clearly show that the project will not significantly reduce the agricultural productivity of any BSAL'.

The Gateway Panel requested that these issues be addressed by Shenhua, with the subsequent information provided back to the Panel for further consideration. However, as outlined in Section 4.7, as a gateway certificate is not required for the project the Department only sought the Panel's advice on the project's potential impacts on BSAL for consideration in the assessment of the proposal.

Accordingly, the Department has considered the issues raised by the Panel in its assessment of the project, including the perceived paucity of information in relation to certain matters, particularly the uncertainty about the area of BSAL within the site. The Department notes that the issues raised by the Panel are similar to issues raised by other submittors including the OAF&FS, and the Department has duly considered these issues in its assessment. Water resources-related issues associated with the project have also been considered by independent experts engaged by the Department (see Section 6.1).

Gunnedah Shire Council (GSC) does not object to the project, but has raised a number of residual concerns and/or issues relating to:

- *Roads:*
  - inadequacies associated with the traffic impact assessment;
  - the need to upgrade a number of local roads and intersections as a result of the project and the required road closures;
  - funding for ongoing road maintenance;
- *Flooding:*
  - particularly in relation to increased flooding risk on the Watermark Gully causeway on the Kamilaroi Highway;
- *Water Resources:*
  - ensuring ongoing sustainable water supply is available to surrounding landholders;
  - recommended that independent experts be engaged to review the water resource assessments;

- *Socio-economics:*
  - encouraging the workforce to live locally;
  - provision of apprenticeships and training programs for local people;
  - ensuring that the full range of socio-economic costs and benefits are considered;
  - ensuring that the full range of environmental impacts (particularly in relation to noise, dust, visual and water) on surrounding land users is appropriately considered;
  - ensuring consideration is given to potential cumulative impacts, including hard and soft infrastructure needs;
  - ensuring due consideration is given to potential impacts on agriculture; and
  - ensuring that Shenhua provides a financial contributions package (via a Voluntary Planning Agreement) that provides agreed contributions towards repair and maintenance of local roads, general community enhancement and compensation for project-related administration and management costs incurred by Council.

Liverpool Plains Shire Council (LPSC) also does not object to the project, but has raised a number of residual concerns and/or issues relating to:

- *Roads:*
  - inadequacies associated with the traffic impact assessment, and the need to upgrade local roads and intersections as a result of the project;
  - the need to consider flooding of local roads;
- *Socio-economics:*
  - ensuring that Shenhua provides financial contributions toward road upgrades and maintenance, and its ongoing project-related administrative costs, in addition to contributions towards community facilities; and
- *Cumulative Impacts:*
  - ensuring that cumulative impacts are appropriately considered, particularly in respect of traffic and transport related impacts.

5.2 Community and Interest Groups

Of the 121 submissions from special interest groups and the general public, all but 3 objected to or raised concerns about the project.

Special Interest Groups Submissions

Special interest groups that made submissions include:

- Caroona Coal Action Group;
- Breeza Progress Association;
- SOS Liverpool Plains;
- NSW Farmers Association[8];
- Hunter Environment Lobby;
- Marys Mount Protection Alliance;
- Namoi Water;
- Namoi Community Network;
- Northern Inland Council for the Environment;
- NTS Corp;
- The Wilderness Society;
- Cotton Australia; and
- Construction, Forestry, Mining and Energy Union (CFMEU).

All of the groups, with the exception of the CFMEU, either objected to or raised concerns in relation the project. A summary of the groups and their concerns is outlined below.

Caroona Coal Action Group (CCAG) comprises a group of concerned local landowners and community members and was formed in 2006 in response to the coal exploration licences issued for the Caroona and Watermark coal projects. CCAG seeks to ensure that mining and CSG development 'does not destroy the environment, agricultural production, people's livelihoods, health and attachment to the land'. CCAG's website (www.ccag.org.au) notes that it is not opposed to mining per se, and that it has consistently argued for the role of independent science in the planning process.

[8] Two submissions, including one from the parent association and one from the Gunnedah District Council

CCAG has produced very detailed submissions on the project (in response to the EIS and Response to Submissions), prepared by specialist environmental consultants Earth Systems on the organisation's behalf. Many of the other submissions from special interest groups and the general public acknowledge and support the CCAG submissions.

CCAG's submissions raise a broad range of concerns, with key concerns including:

- *General:*
  - mining developments will pose unacceptable risks to the agricultural future of the Namoi Valley, and co-existence with mining companies is not possible here;
  - gaps in baseline data, especially in relation to water quality and geochemistry, meteorology, archaeology and cultural heritage;
  - inadequate risk assessment and limited detail on mitigation measures and environmental management plans;
- *Water resources:*
  - Namoi catchment is one of the nation's most productive, and protecting the integrity of its water resources is essential to maintain agricultural viability;
  - long term impacts associated with the final void, particularly with regard to salinity;
  - mining on the floodplain appears to breach conditions of the EL;
  - water sources and supply requirements from each water source not adequately quantified;
  - lack of consistency about the need to discharge potentially contaminated (saline) water from the site;
  - inadequacy of the salinity balance;
  - long term seepage of saline, acidic or contaminated water from overburden emplacements and mine waste;
- *Soils and Agriculture:*
  - including direct loss of agricultural land and indirect impacts on surrounding agriculture;
  - uncertainty associated with rehabilitation of agricultural land, and availability of suitable soils for revegetation;
  - subsidence of backfilled material not addressed;
- *Air quality and greenhouse gases:*
  - meteorological (wind) data not representative of long term variation in the locality;
  - inadequacy of greenhouse gas accounting and mitigation strategies;
- *Biodiversity:*
  - inadequacy of Koala Plan of Management and assessment on highly mobile fauna;
  - inadequacy of offsets assessment, particularly in relation to Commonwealth guidelines;
- *Socio-economics and health:*
  - uncertainty about physical and health impacts;
- *Archaeology and heritage:*
  - inadequacy of survey coverage; and
  - procedures required to address discovery of previously unidentified sites.

Breeza Progress Association (BPA) was formed in 2005 to represent the community of Breeza 'as a united voice', and comprises community members that 'want to progress the village ahead'. BPA objects to the project, with its major concerns including:

- *General:*
  - potential health impacts, particularly related to air, noise and blasting;
  - impacts on some of the best farming country in Australia, if not the world;
- *Air Quality:*
  - impacts on town water supplies through contamination of rainwater tanks (from dust deposition) and impacts on bores;
  - meteorological (wind) data not representative of long term variation in the locality;
  - effects associated with blast-related emissions;
- *Water resources:*
  - contamination of the Mooki River and loss of flows;
  - lack of consistency about the need to discharge potentially contaminated (saline) water from the site;
- *Noise and light:*
  - due to the close proximity to the village;

- *Archaeology and heritage:*
  - impacts on Aboriginal axe grinding groove sites and scarred trees;
- *Biodiversity:*
  - impacts on the local Koala population, and potential isolation of the Breeza population;
- *Traffic:*
  - impacts on local roads and traffic safety; and
  - Shenhua should be required to contribute to road funding.

SOS Liverpool Plains (SOS) represents a group of about 60 country and city women, and was formed in 2007 with the mission of raising awareness of the effects of coal and CSG development on the people, communities, land, air and water. SOS raised a number of concerns broadly similar to those raised by CCAG, with key issues including impacts on biodiversity, Koalas, health (including dust emissions from coal trains), agriculture, water and noise (including low frequency noise). SOS's submission included a specialist review by Soil Futures Consulting, which raised a number of concerns including increased salt loading of the Mooki River, the ability to rehabilitate to agricultural land, and surface water flow declines in watercourses such as Watermark Gully.

NSW Farmers Association stressed the importance of agriculture and the Liverpool Plains to the people and economy of NSW, noting that the Liverpool Plains is an 'iconic food and fibre producing region'. Whilst recognising the importance of woodland re-establishment, the Association questioned why only 1,000 hectares of the project disturbance area was proposed to be rehabilitated to agricultural land, and noted that it supports the concept 'no net loss' of agricultural land. The Association was critical of the loss of BSAL in the offset areas as originally proposed (Shenhua has subsequently amended the offset strategy to avoid the BSAL), and made a number of comments and/or recommendations in relation to agriculture (including adequacy of the Agricultural Impact Statement), water resources, air quality, visual impacts and socio-economics.

The Association's Gunnedah District Council raised concerns about the project's potential impacts on water resources, biodiversity, Koala habitat, Aboriginal heritage, air quality, noise and socio-economic impacts on Breeza residents.

Hunter Environment Lobby is a Hunter-based community environmental organization, and raised broad concerns relating to noise, dust, soil degradation and run-off, and rehabilitation.

Marys Mount Protection Alliance (MMPA) comprises a group of concerned residents in proximity to the 'Kahlua' CSG project about 30 kilometres west of Gunnedah. MMPA raised concerns similar to those raised by the NSW Farmers Association's Gunnedah District Council.

Namoi Water is a peak industry group representing irrigated agricultural land users in the Peel, Upper Namoi and Lower Namoi valleys, and has approximately 1,000 members. The organisation criticised the issuing of the exploration lease for the project, noting that the project would have significant impacts on the region's water and agricultural resources. Its key water-related concerns include reduced groundwater availability to agricultural users and the environment, reduced surface water run-off, potential spills from mine water storages, mining on the floodplain, water quality impacts and long term impacts associated with, and justification for, the final void. It also raised concerns regarding socio-economic, air quality and biodiversity impacts.

Namoi Community Network (NCN) is an affiliated committee under Namoi Water, established in 2011 to oversee the development of the Namoi Water Study. NCN noted that the Namoi Water Study demonstrated that mining and extractive industry projects will impact the region's water resources, including impacts on water quality and impacts on aquifers, and criticised the perceived lack of reference to the findings of the Study. NCN also raised concerns in relation to air quality (including impacts to plant growth), biodiversity, Koalas, the final void (and potential future underground mining), rail traffic, noise and Aboriginal heritage.

Northern Inland Council for the Environment (NICE) is a community environmental organisation formed to campaign against mining activities in the Pilliga and Leard State Forests. NICE raised a number of concerns relating to water resources (particularly saline overflows from water storages), the final void, socio-economics and biodiversity (particularly the adequacy of the biodiversity offsets).

NTS Corp is the native title service provider for Aboriginal traditional owners in NSW and the ACT. It noted that the project site is within the native title claim for the Gomeroi People. The organisation criticised aspects of the Aboriginal cultural heritage assessment undertaken for the project, particularly in relation to the consultation process, involvement of traditional owners in the cultural heritage assessment, implementation of the recommendations made by Aboriginal groups, deficiencies in the ethno-historical analysis and a focus on scientific archaeology rather than cultural heritage value.

The Wilderness Society (Newcastle Branch) raised a range of concerns similar to other groups, with key concerns relating to the impacts of the project on Koalas and the adequacy of the original biodiversity offset strategy. With regard to Koalas, the Society noted that the density of Koalas on the site is higher than previous assessments (which brings into question the methodology used in the assessment, and is disputed by Australian Koala Foundation which believes there are less Koalas in the LGA), that the proposed translocation is not consistent with NSW policies, and that the proposed relocation areas had not been properly assessed.

Cotton Australia is a peak industry group representing around 1,500 cotton farming families in NSW and Queensland. The organization noted that it remains extremely concerned about the project and urges the highest level of scientific scrutiny in light of the potential impacts on the prime agricultural lands that neighbour the project site.

Construction, Forestry, Mining and Energy Union (CFMEU) represents over 120,000 members in the construction, forestry, mining and energy industries. The Union's Northern District Branch made a detailed submission supporting the project, citing its socio-economic benefits to the State. The submission noted that the socio-economic and environmental impacts of the project have been avoided or minimised as far as practicable.

General Public Submissions

Submissions from the general public were received from rural landowners surrounding the project site, residents of Breeza, residents of surrounding communities in the Gunnedah and Liverpool Plain LGAs, as well as individuals in the wider region.

Of the 107 public submissions, all but 2 objected to or raised concerns about the project.

The 2 submissions in support of the project (including one from a Councillor of LPSC) cited the economic and social opportunities and benefits that the project would generate, that the project avoids the high quality black soil plains and appears to minimise environmental impacts, and that it is well located near existing rail and port infrastructure.

The submissions objecting to and/or raising concerns cited a range of issues, with the key issues indicated in Figure 30 below.

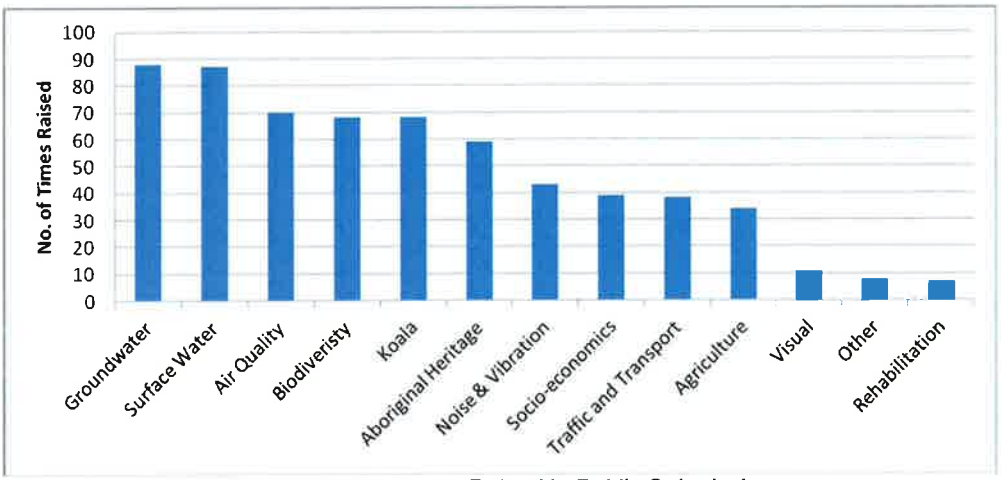

Figure 30: Key Issues Raised in Public Submissions

5.3 Summary of Key Issues Raised in Submissions

Whilst a wide range of issues were raised in the submissions, the key residual issues were related to the project's direct and cumulative impacts on:

- *Water resources* – particularly impacts to the significant Upper Namoi alluvial aquifer, the potential for saline water releases from mine water storages and long term seepage/migration from the overburden emplacements and final void;
- *Noise, vibration and dust* – including amenity and health-related impacts to surrounding residents, impacts to surrounding agricultural land use and issues associated with the assessment methodologies (including meteorological data used);
- *Biodiversity* – particularly the adequacy of the biodiversity offset strategy and potential impacts on Koalas;
- *Aboriginal heritage* – particularly the loss of Aboriginal sites within the project disturbance area;
- *Socio-economics, including agriculture* – particularly impacts on agricultural resources, impacts on local and regional infrastructure and community services, and ongoing impacts associated with the proposed rehabilitation strategy (including potential future expansion);
- *Traffic* – particularly impacts on local roads and increased rail traffic; and
- *Visual amenity.*

The Department has considered these and other issues associated with the project in its assessment of the project.

6. ASSESSMENT

In its assessment of the merits of the project application the Department has considered the:

- EIS, submissions, responses to submissions, and additional information provided by Shenhua and public authorities;
- the independent groundwater review, surface water review and traffic review;
- the Gateway Panel's advice on the project;
- relevant environmental planning instruments, policies and guidelines; and
- relevant provisions of the EP&A Act, including the objects of the Act.

6.1 Water Resources

Introduction

The potential impacts on water resources has long been recognised as a key risk associated with the development of the Gunnedah Coalfield.

As outlined in Section 3.5, the Namoi Catchment Water Study was commissioned in response to rising levels of concern within the community about the potential impacts of the growing mining and CSG industry on the significant groundwater and surface water resources in the region.

Whilst the study found that mining and CSG developments in the Namoi catchment are unlikely to have significant regional scale impacts on water resources – even with very substantial coal and CSG development scenarios – local scale impacts are more likely. The study noted that these local scale impacts cannot be determined by a catchment wide study (as undertaken in the Namoi Water Study), and stressed the need for comprehensive project-specific investigations, supplemented by comprehensive monitoring and operational management plans for approved projects.

In this regard, a number of specialist water resource assessments and reviews have now been undertaken for the Watermark Coal Project to assess the incremental and cumulative affects of the project.

To this end, the EIS includes specialist groundwater and surface water assessments, undertaken by Australasian Groundwater & Environmental Consultants and WRM Water & Environment, respectively.

Secondly, the EIS also includes a peer review of the groundwater assessment, undertaken by Dr Noel Merrick of Heritage Computing.

Thirdly, the EIS includes a number of subsidiary assessments to supplement the water resource assessments, with the key ones including:

- a transient electro-magnetic geophysical survey, by Groundwater Imaging, to define the extent of the alluvial material within and adjacent to the site, and identify potential conduits or barriers for groundwater flow from the mining area;
- a geochemical assessment, by RGS Environmental, to assess the quality of leachate (and hence groundwater) produced from spoil materials associated with the mine;
- a geomorphology assessment, by GHD, to define and characterise the watercourses in the project site;
- a seepage water quality assessment, by Terrenus Earth Sciences, to assess potential impacts associated with long term seepage from the three mining areas and overburden emplacements; and
- a stygofauna assessment, by Ecological, to assess the potential for impacts on subterranean fauna (ie. stygofauna), a groundwater dependent ecosystem.

Fourthly, the Department engaged Dr Frans Kalf of Kalf & Associates to undertake an independent review of the groundwater assessments and groundwater-related issues raised in submissions, and Dr Steve Perrens of Evans & Peck to undertake a similar independent review of the project's surface water impacts. These reviews are attached in Appendix C and Appendix D, respectively.

Finally, the project's water resource impacts were reviewed by specialist hydrogeologists of the NSW Gateway Panel, as part of the Gateway Panel's advice on the project, and by the Commonwealth's Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC).

The Department is satisfied that the body of work undertaken to assess the potential water resources impacts of the project has been substantial, and has involved reviews by some of the State's most respected water specialists. Based on these assessments the Department, NOW, Dr Kalf and Dr Perrens are satisfied that a thorough and robust prediction of the project's potential water resource impacts has now been undertaken, and that the assessments include satisfactory sensitivity analysis to account for the range of potential water resource impacts.

The Gateway Panel was also generally satisfied with the groundwater assessments, but did raise some residual concerns about salinity predictions in the final void and in surrounding aquifers, and noted that it considered the cumulative assessment to be minimal.

Catchment Context

The site is located in the Mooki River Catchment, a tributary of the Namoi River. Runoff from the site drains in 3 directions before entering the Mooki River (see Figure 31), either:

- north via Watermark Gully or other unnamed drainage lines;
- south to Native Dog Gully; or
- west towards Lake Goran, a large ephemeral lake which overflows intermittently (about every 5 years) to the east via Native Dog Gully.

The Mooki River catchment covers roughly 3,800 km^2, or about 9% of the total Namoi catchment area (of 42,000 km^2). The Mooki River catchment area to Breeza, located 5km downstream of the project site, is 3,630 km^2. The River has a mean annual flow at this point of approximately 107 gigalitres, although this varies widely depending on rainfall. The river does periodically cease to flow, with zero flows occurring approximately 15% of the time at Breeza.

Watermark Gully has a catchment area upstream of the Kamilaroi Highway of approximately 39 km^2. It is an ephemeral stream, being dry 98% of the time and flowing only in response to significant rainfall events. Native Dog Gully is also ephemeral, and has a catchment area of approx 72 km^2 to the Mooki River (excluding the Lake Goran catchment area). Lake Goran has a catchment area of approximately 1,320 km^2, storing approximately 131,000 megalitres (ML) below the overflow level of 296.5m AHD.

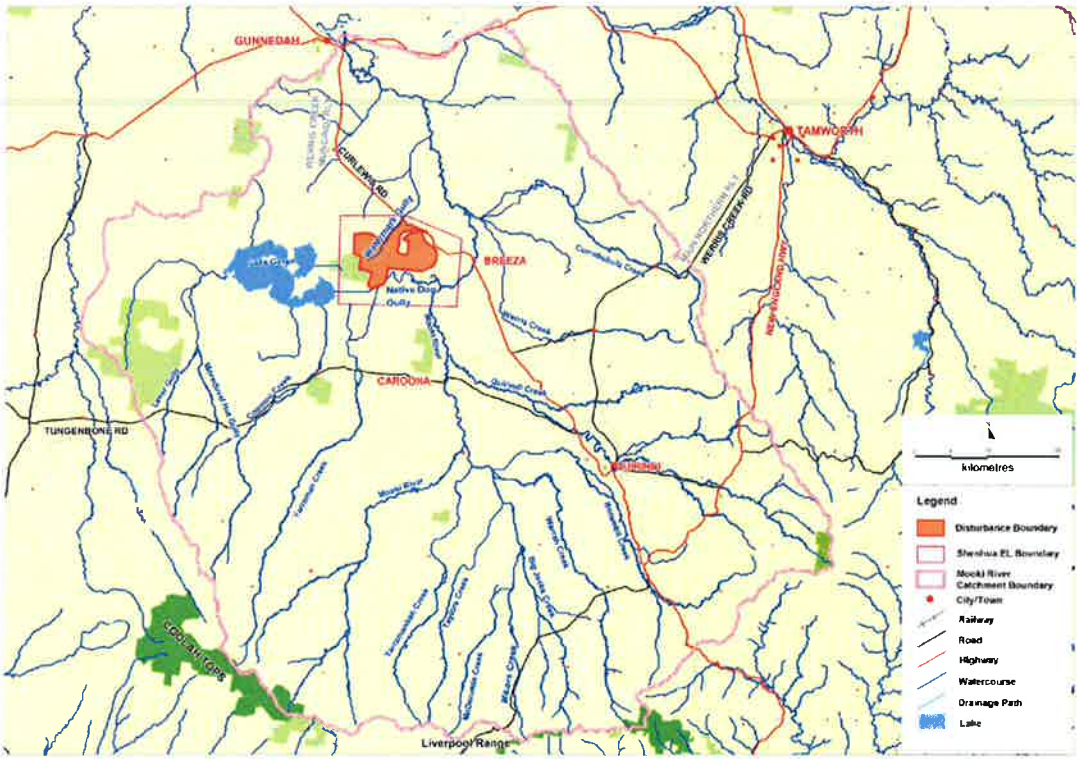

Figure 31: Mooki River Catchment

Groundwater Aquifer Context

There are two main aquifer resources in the vicinity of the project area, namely the:

- Upper Namoi alluvial aquifer; and
- Permian 'hard rock' aquifers associated with deeper bedrock strata including coal seams, weathered rock, sandstones, fracture zones and volcanics.

The Upper Namoi alluvial aquifer is the key groundwater resource in the locality. It comprises 2 major formations representing the black soil alluvials, including;

- the Narrabri Formation – the uppermost unit typically comprising a clay dominated aquitard. Average yield is 50 L/s and quality is brackish to saline, with total dissolved solids (TDS) greater than 10,000mg/L, which is not suitable for beef cattle production[9]; and
- the Gunnedah Formation – the underlying alluvials composed of thick beds of porous sand and gravel separated by clays. The aquifer is characterised by high permeability and variable yield (ranging from 5 to >50 L/s). Water quality is significantly better than that of the Narrabri Formation, and is typically fresh to slightly brackish (approximately 1,200 mg/L to 3,000 mg/L) in areas west of the Mooki River.

Recharge to the Upper Namoi alluvium occurs mainly at the base of the Liverpool Ranges, and from river leakage, including from the Mooki River.

Given its better quality, the Gunnedah Formation is commonly referred to as the primary aquifer system in the region, and is extensively used for irrigation, stock and domestic, and for town water supply. The location of the alluvial formations in relation to the project site is show on Figures 32 and 33.

[9] Sheep can tolerate up to 13,000 mg/L, therefore a small portion may be suitable for limited livestock production.

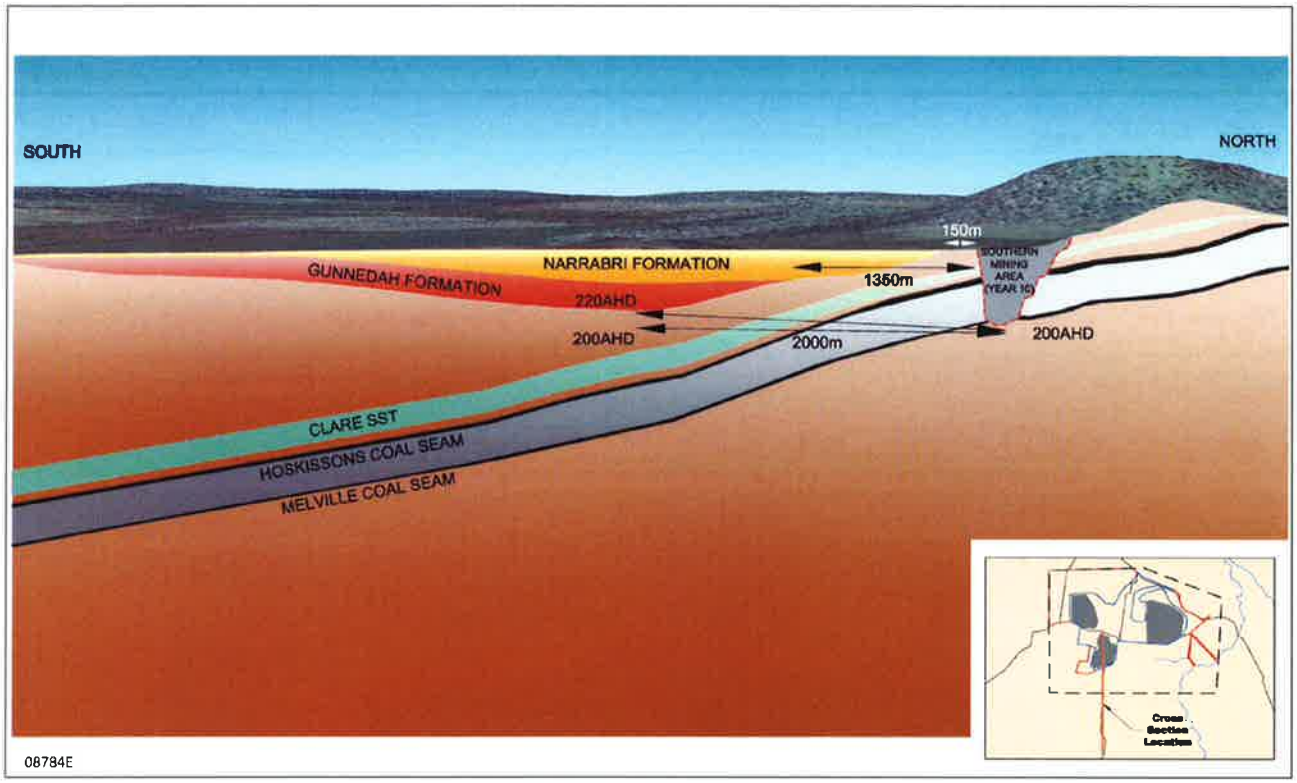

Figure 32: Alluvial Formations Cross Section

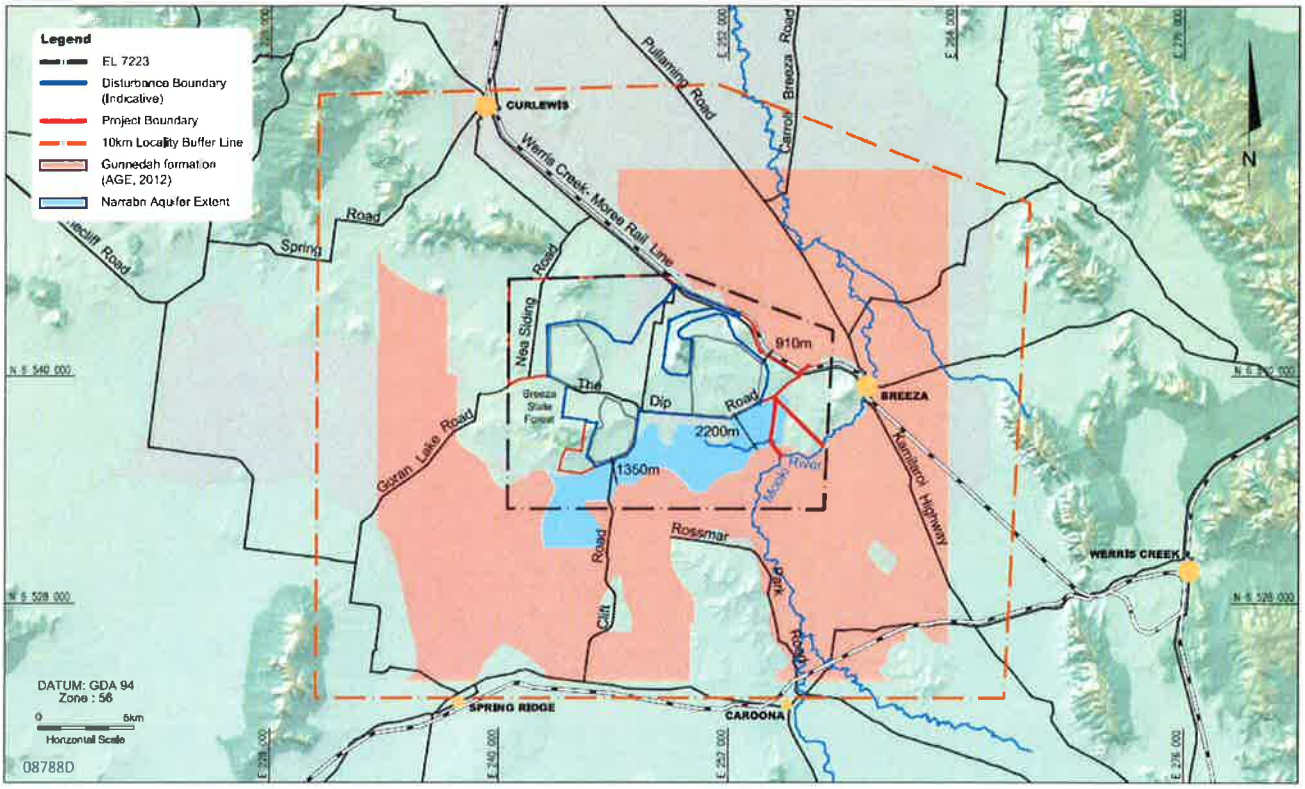

Figure 33: Alluvial Formations

The Permian hard rock aquifer is of lower yield and quality, with yields from bores in the formation typically less than 1 L/s. Salinity is variable, ranging from less than 3,000 mg/L in the upper ridgelines, 5,000-10,000 mg/L down slope of the ridges and 10,000-20,000 mg/L away from the elevated terrain and toward the alluvial plains. The aquifer is recharged via rainfall infiltration into weathered sandstone outcrops and fracture zones in elevated areas.

The varying value of the aquifers in the region is highlighted by Dr Kalf, whose review notes that:

> *"While there can often be a perception that all groundwater in the Gunnedah Basin is of prime importance, the hydrogeological evidence is that groundwater in the Permian strata where mining is to be conducted and elsewhere in the Basin is of poor quality with the bulk of salinity in the mining region that ranges from brackish to saline...There is better groundwater quality suitable for irrigation in the nearby deeper alluvium (Gunnedah Formation) with the overlying Narrabri alluvial Formation also having a very much higher salinity. The alluvium overall is impacted by naturally occurring inflow of the Permian groundwater creating higher salinity particularly along the margins of the alluvial flats..."*

A total of 508 registered groundwater monitoring and pumping bores are located within a 10 km radius of the project boundary, with most of these abstracting groundwater from the Gunnedah Formation for irrigation purposes (see Figure 34).

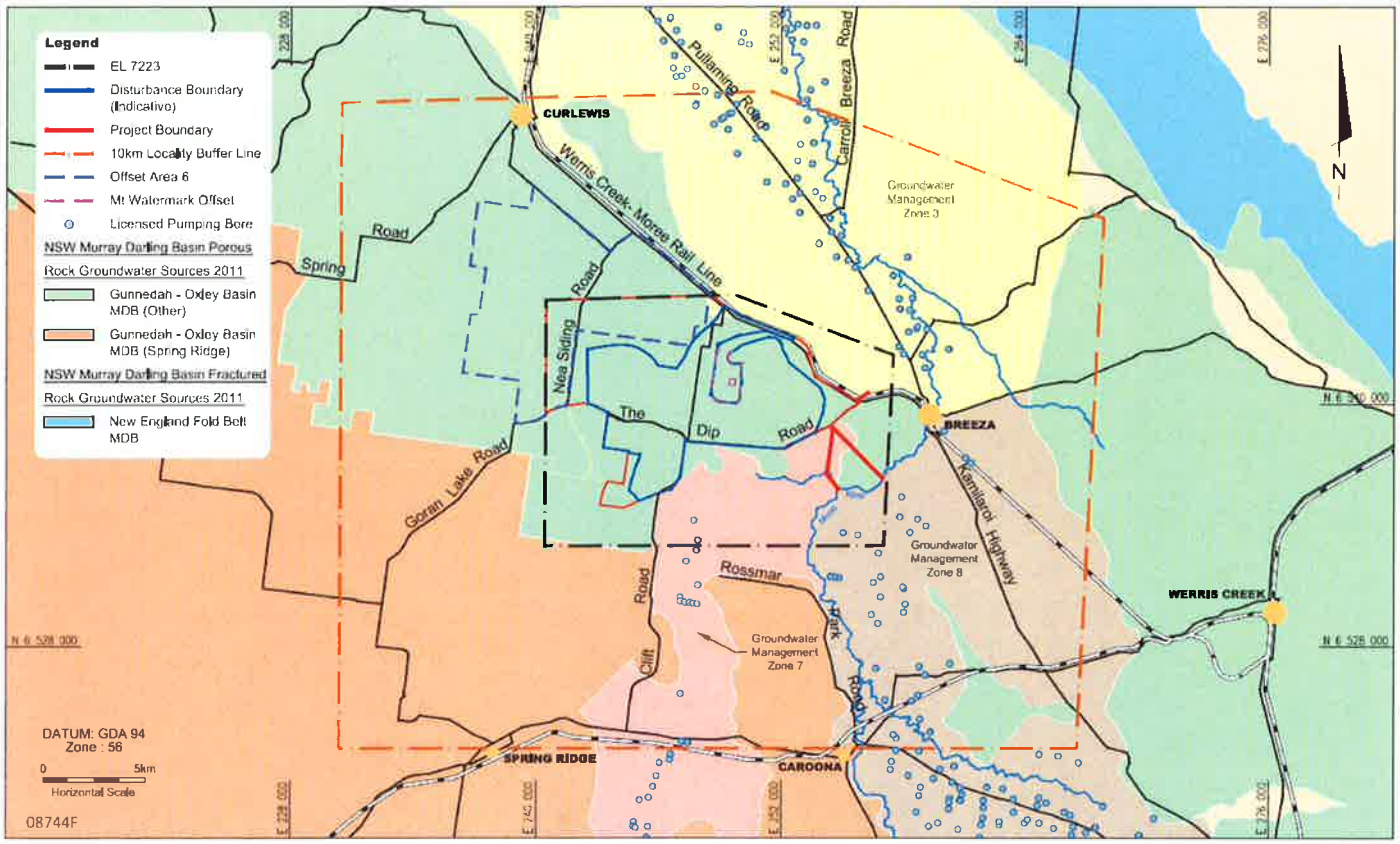

Figure 34: Groundwater Management Zones and Registered Bores

There are two main water sharing plans that regulate groundwater use in the area that are of relevance to the project[10].

Use of groundwater from the Upper Namoi alluvial aquifer is regulated under *Water Sharing Plan for the Upper & Lower Namoi Groundwater Sources 2003*. The project site is located in the vicinity of Zones 3, 7 and 8 of the Plan, but the disturbance area is predominately outside these zones (see

[10] There are other water sharing plans in the region, but the project is not predicted to have any significant impact on these resources.

Figure 34). Aquifer access licences in Zones 3, 7 and 8 total just over 50,000 ML/yr under the Water Sharing Plan.

Use of groundwater in the hard rock aquifer surrounding the site is regulated under the *Water Sharing Plan for the Murray-Darling Basin Porous Rock Groundwater Sources 2011*. Under the Porous Rock Water Sharing Plan, the project is located primarily in the 'Gunnedah-Oxley Basin MDB (Other)' zone, although a small portion of the south west corner of the EL is located in the 'Gunnedah-Oxley Basin MDB (Spring Ridge)' zone. The long term annual average extraction limit for access licences in the Other and Spring Ridge zones is 199,893 ML/yr, not including supplementary water.

Use of surface water in the vicinity of the project site is regulated under the *Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources 2003*. Water licences in the Mooki River water source total approximately 27,450 ML/yr under the Plan.

Avoidance and Mitigation Measures

In response to concerns raised by regulators and community stakeholders about the importance of protecting the highly productive black soil plains and the aquifers upon which they rely, Shenhua has designed the project to provide a minimum 150 metre buffer to the alluvial black soils, constraining the project to the ridge country of the EL.

In this regard, the project disturbance area provides:

- a minimum 150 metre buffer to the black soils associated with the (poorer quality) Narrabri Formation; and
- a minimum 900 metre buffer to the highly productive Gunnedah Formation aquifer. (As indicated on Figure 32, the closest occurrence is 900 metres to the north-east of the Eastern Mining Area. To the south, the aquifer is more than 1.3km from the project disturbance area).

This key avoidance measure would significantly reduce the potential impacts on the region's highly valued groundwater resources.

The water resource assessments are also based on a number of other avoidance and mitigation measures that Shenhua would implement to minimise, mitigate and/or compensate water-related impacts of the project. These measures include:

- backfilling the Eastern and Southern Mining Area voids, and designing the residual void in the Western Mining Area to be as remote as possible from the alluvial aquifers;
- avoiding disturbance of the majority of Watermark Gully, the only notable well-defined watercourse within the project disturbance boundary;
- avoiding flood-affected areas as far as practicable, and establishing levees in the two residual areas that may be inundated in extreme events (see further discussion below); and
- implementing standard best practice water management measures including:
    - diverting clean 'run-on' water around mining areas;
    - collecting and treating run-off water from overburden emplacement areas in sediment basins, with discharge only if water meets applicable criteria;
    - maintaining a dirty water management system designed to capture run-off and process water within the mine (ie. saline water that has come into contact with coal or other saline material), with no discharge to the external environment;
    - recycling process water from the CHPP, via the dirty water management system;
    - preparing and implementing detailed water management plans and monitoring programs; and
    - obtaining applicable licenses for all water used and discharged from the site.

Impacts on Groundwater Flows

The groundwater modelling indicates that seepage into the pits would average 180 ML/yr over the life of the project, peaking at 756 ML/yr in Year 23. Total inflows over the life of the project are estimated at 5,500 ML.

All of these direct inflows would be from the Permian hard rock aquifer. As outlined above, the mining areas would not directly impact the Gunnedah and Narrabri Formations, however regional depressurisation in the underlying Permian strata is predicted to induce downward vertical flow from the overlying alluvial aquifers near the mining areas, or reduce upward flow from the Permian to the alluvial in areas further from the mining areas.

The zone of depression in the Permian aquifer is predicted to extend to a maximum of:

- 1.8 km from the Eastern Mining Area;
- 3.2 km from the Southern Mining Area; and
- 1.0 km from the Western Mining Area.

These changes are predicted to result in relatively small indirect losses from the alluvials in groundwater management zones 3, 7 and 8 under the *Water Sharing Plan for the Upper & Lower Namoi Groundwater Sources 2003*, as outlined in the following table.

Table 5: Water Loss from Alluvial Aquifers

Groundwater Management Zone	Cumulative over Project Life (ML)	Average Loss (ML/yr)	Peak Loss (ML/yr)
3	14	0.5	1.1
7	1,020	34	101.8
8	-35*	-1.2*	0.4

* A negative number indicates a net gain to the alluvials

These losses represent a very small component of these groundwater sources (see Table 7 below), with the peak loss (ie. about 103 ML) amounting to less than the usage from a single licensed agricultural bore in the region, which averages 142 ML/year in the Upper Namoi alluvium.

The groundwater assessment also notes that most (90%) of the alluvial transfer loss would occur in the Narrabri Formation, which contains poor quality water and is not targeted by surrounding groundwater users.

Further, groundwater losses in the alluvials would recover relatively quickly following mining, as detailed under a separate heading below.

Dr Kalf accepted the findings of the groundwater modelling and assessment. To ensure that the modelling is periodically reviewed and updated, Dr Kalf recommended that Shenhua be required to periodically validate the model (recommended as 2 years after mining commences, then after an additional 5 years and 5 years after mining is completed). The Department agrees in principle, but has recommended that the model be validated on a more regular basis given the importance of the groundwater resource (ie. every 3 years, in conjunction with independent environmental audits).

The Department has also recommended conditions requiring Shenhua to appropriately account for all water used by the project, as outlined in more detail below.

Impacts on Groundwater Users

There are 4 privately-owned bores to the south of the Southern Mining Area that are predicted to experience water level reductions of greater than 1 metre, with the largest reduction predicted to be 1.4 metres. These bores are shown on Figure 35. A further 31 bores are predicted to experience maximum groundwater level reductions of greater than or equal to 0.1 metres.

The change in groundwater levels is not expected to result in any significant reduction in pumping yield from the privately-owned bores. The predicted water level reductions are also well within the 'minimal impact consideration' trigger in the Aquifer Interference Policy (ie. 2 metre drawdown at privately-owned bores). Further, the groundwater levels in the bores are predicted to recover within 5 years following mining with the backfilling of the mining pits.

The Department accepts that the assessment indicates that the project is unlikely to result in any significant impact to groundwater users in the locality. Nevertheless, the Department has recommended conditions requiring Shenhua to monitor impacts on surrounding groundwater users bores and to provide compensatory water supplies in the unlikely event that a user's water supplies are adversely affected by the project.

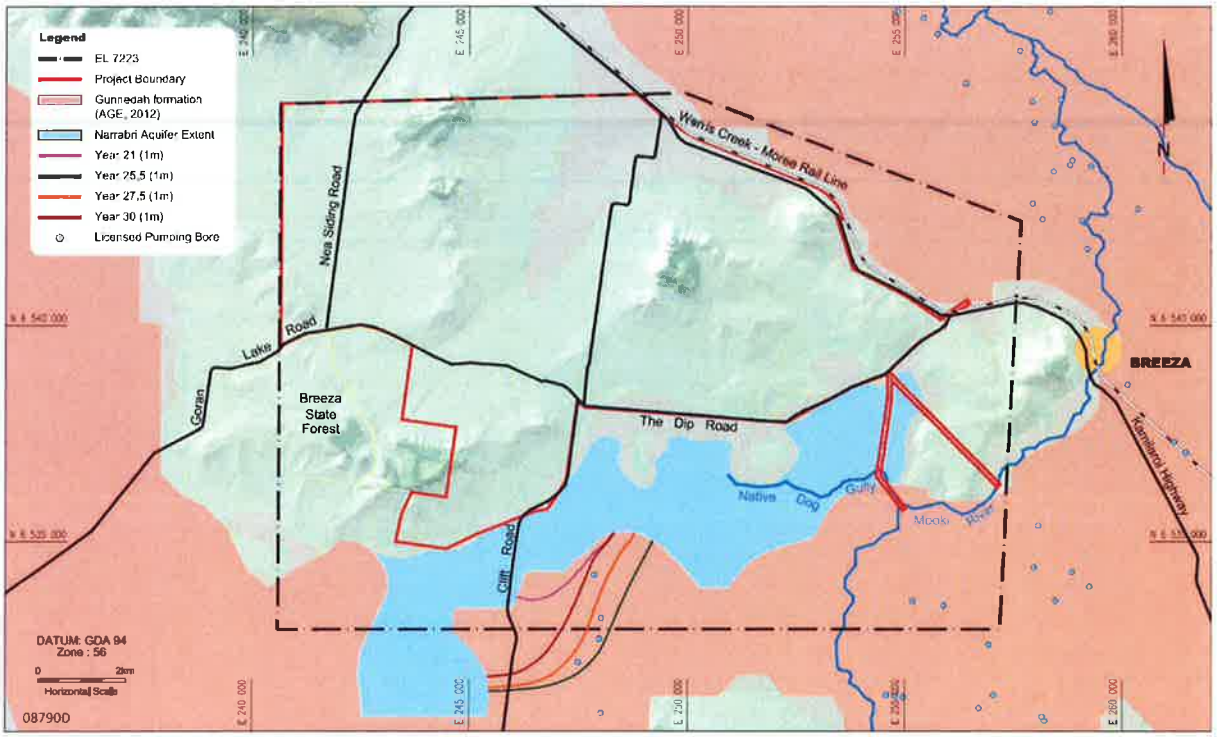

Figure 35: Groundwater Depressurisation and Affected Bores

Changes to Groundwater Quality

The seepage water quality assessment and geochemical assessment indicate that groundwater aquifers in the vicinity of the project disturbance area have salinity levels that are generally higher than the salinity of leachate that would be produced by the mining areas including the overburden emplacements, and therefore the project is expected to have low to negligible impact on local groundwater quality. Further consideration of long term seepage from overburden emplacements and the final void is provided under a separate heading below.

Some submissions raised concerns about the potential for 'cross-contamination' associated with potentially increased connectivity between aquifers. Dr Kalf was satisfied that this issue would not occur, and would more likely occur as a result of private bore pumping.

Impacts on Surface Water Flows

The project would affect surface water flows in surrounding waterbodies including the Mooki River, Watermark Gully, Native Dog Gully and Lake Goran through two main mechanisms, namely:

- directly reducing catchment areas (and therefore catchment flows) by interception of rainfall and runoff; or
- indirectly through groundwater depressurisation, resulting in reduced flow from groundwater to waterbodies and/or increased leakage from waterbodies to groundwater.

The maximum captured catchment areas during the project would represent approximately[11]:

- 14% of the Watermark Gully catchment;
- 29% of the Native Dog Gully catchment; and
- 0.3% of the Lake Goran catchment.

These areas represent less than 1% of the Mooki River Catchment (to the Mooki River's confluence with Watermark Gully). Accordingly, whilst the project would have some impacts on surface water flows in local ephemeral creeks during mining, any impacts on the broader regional catchment would be minor.

The captured catchment areas would gradually reduce as the mine is rehabilitated, with post-mining local catchments increasing or decreasing marginally due to changes in catchment boundaries following rehabilitation. The main long term loss from the Mooki River catchment as a whole would be

[11] These areas were updated in the Response to Submissions.

to the Lake Goran catchment, which would be reduced by around 0.5%, in part due to flows captured by the Western Mining Area final void. The surface water assessment concludes that this loss would have no measureable impact on inflows to the lake.

With regard to reductions in surface water flows due to groundwater depressurisation, the groundwater assessment predicts that the project would result in a total flow from the Mooki River to the underlying alluvial aquifer of 323 ML over the life of the project (max 0.13 ML/day), or a total of 489 ML including post mining loss until groundwater recovery (ie. 30 years post mining). On an annualised basis this loss is negligible, at less than 0.02% of the mean flow of the Mooki River (at Breeza).

Following groundwater recovery, baseflow to the Mooki River is predicted to actually increase by a small amount (ie. 0.02 ML/day), due to additional recharge through the overburden material.

The area of groundwater depressurisation would also extend below Lake Goran, although this drawdown is predicted to be very small (ie. 0.01 m) and is not expected to have any measureable impact on the lake water levels.

Surface Water Quality

One of the key concerns raised by farmers and landowners in the surrounding areas is the potential for the project to impact surface water quality, particularly via increases in salinity, which could occur through changes to catchment flows and pollution due to uncontrolled releases (overflows) from the project's sediment basins.

It is important to note that there would be no uncontrolled releases from the mine water system (ie. the high salinity water that has come into contact with coal), which would be collected in the base of the pit in the event of any overflow of the mine's storage system. The pit(s) would have ample storage capacity to accept any overflow of mine water.

Based on the proposed water management system, pre-development and full-development salt loads discharging to local catchments is presented in the following table.

Table 6: Long Term Surface Water Salt Balance

Source	Salt Load (t/day)	
	Existing	Year 30
Watermark Gully		
Catchment flows	2.4	2.5
Sediment dam overflows	0.0	0.8
Total	2.4	3.3
Native Dog Gully		
Catchment flows	3.0	2.9
Sediment dam overflows	0.0	0.2
Total	3.0	3.1
Lake Goran		
Catchment flows	59.9	59.6
Sediment dam overflows	0.0	0.0
Total	59.9	59.6
Gross offsite salt load	**65.2**	**66.0**

The assessment indicates that, on a regional basis, the project is unlikely to result in any significant increase in regional salinity levels, (ie. an increase of <1% across the catchments). However, the Watermark Gully catchment is predicted to experience localised increases in salinity of up to 33% towards the end of the project, with the increase due to overflows from the project sediment basins during high rainfall events.

With regard to these sediment basin overflows, Shenhua notes that:

> *"Under most rainfall conditions, water accumulating in sediment dams will be pumped back into the mine water system for recycling to meet water demands for coal processing and dust suppression. However, during major rainfall events that exceed the capacity of the sediment dams (which are designed to a government-specified standard), some overflows from sediment dams may occur after a period of time to allow any suspended sediment to settle out of suspension."*

Dr Steve Perrens considered this issue in detail (see Appendix D), noting that the data showed that overflows would constitute a 'relatively significant proportion' of overall runoff, with overflows accounting for an average of 30% (and a range of between 18% to 44%) of annual runoff over the life of the mine. Spill days per year would average 10 for a median rainfall year (or 30 days for a 90 percentile wet year). He also noted that for some mining years, the consequent salt loads may be higher than the years used in the modelling (eg. Year 29 salt loads are likely to be higher than Year 30 salt loads as shown in Table 6 above).

Nonetheless, Dr Perrens also noted that the salt contribution from sediment dams is likely to have been overestimated by the model (in some cases by around 50%), and that the salt loads are likely to be conservative and that, in practice, any increase is unlikely to be detectable from the background variation (background salinity varies considerably due to the ephemeral nature of the watercourses). In addition, if operational monitoring showed that salt loads discharging from the sediment basins were of concern, Dr Perrens noted that modifications to the size and operating regime for the basins would allow an increased percentage of runoff to be transferred back to the mine water management system and thereby reduce the actual exported salt loads.

Ultimately, Dr Perrens concluded that the salinity risk is able to be adequately managed using a number of reasonable and feasible strategies, including:

- ensuring selective stripping of soils to avoid reuse of soils that pose a salinity or sodicity risk. In this regard, some soil landscape units within the project disturbance area – including the Fullwoods Road unit subsoil and the Booloocooroo unit – have high salinity and should not be used in rehabilitation, and instead be buried in the overburden emplacements in locations where they can not contribute to long term groundwater seepage;
- managing sediment basin sizing and operating regimes to manage salt loads (as outlined above);
- preventing long term saline groundwater seepage from overburden emplacements through measures such as:
    - designing the geometry of emplacements to minimise groundwater recharge into the emplacements; and
    - implementing established dryland salinity measures, in particular through planting deeper rooted trees on higher areas of the emplacements, and salt tolerant vegetation in the lower areas where long term seepage is predicted.

Dr Perrens recommends that these measures are guided by a detailed surface water and groundwater monitoring program, including periodic re-assessment of groundwater predictions (say every 5 years) and the implications for groundwater seepage and salt loads.

The Department accepts and has recommended conditions consistent with Dr Perrens' recommendations. However, as noted above the Department has recommended that the groundwater model, along with the surface water model, salt balance and water balance be validated on a more regular basis (ie. every 3 years), given the significance of the resource to the region.

Water Balance and Water Sharing

The water balance assessment indicates that during wet years, the mine's water requirements would be met entirely through local runoff and groundwater inflows. However, during average and dry years external supplies would be required, with a relatively modest 170 ML/year required in an average year and up to a predicted maximum of 600 ML/yr during very dry conditions (ie. 10 percentile dry year).

Dr Perrens questioned some of the assumed water demands used in the water balance modelling (including that the water demand from the CHPP and haul road dust suppression may be underestimated), but concluded that any uncertainty could be managed as part of the operational management planning for the project.

Where external water is required, Shenhua proposes to source this water through either:

- a bore field to extract groundwater from the groundwater management zones 3, 7 or 8; and/or
- a pump to extract water from the Mooki River, although further analysis in the Response to Submissions indicates that the Mooki River is likely to be dry in times when make-up water is required, therefore this option is unlikely to be feasible.

A summary of total water use (or 'take') associated with the project – including direct water use and impacts on the various water sources – is presented in the following table.

Table 7: Predicted Water Take

Water Source	Predicted Peak Annual Water Take (ML)		Share Component held by Shenhua (units)	Long Term Average Annual Extraction Limit (units)
	During Mining	After Mining		
Namoi Groundwater Zone 3	1.1	0*	Nil	17,300 +supplementary
Namoi Groundwater Zone 7	101.8	0*	42	3,700 +supplementary
Namoi Groundwater Zone 8	0.4	0*	164	16,000 +supplementary
Porous Rock (Gunnedah-Oxley Basin – Other)	756	0*	240	199,893
Porous Rock (Gunnedah-Oxley Basin – Spring Ridge)	33	0*	Nil	
Mooki River	47.5	0*	Nil	***30,350 units currently issued
Lake Goran	0	0*	1,223**	***32,171 units currently issued
Make-up Water (Zone 3,7 or 8 or Mooki River)	600	0	Nil	N/A

* Long term net gain exceeds predicted losses immediately following mining
** Subject to issuance of certificate of title
*** Annual extraction limit calculated under cl.35 of WSP

NOW and a number of other submissions raised the issue that Shenhua does not currently hold adequate water licences for all water take associated with the project – for all but one of the relevant water sources.

In its Response to Submissions, Shenhua committed to ensuring that it held appropriate licences to account for the water take predictions up to Year 20 of the project, prior to the commencement of any mining operations. It also noted that this commitment was possible as it already held the required water licences to account for all water take up to Year 20, apart from the required one megalitre from groundwater management zone 3, which are readily available on the open market.

The Department accepts that the water take from all of the water sources is very small compared to the annual extraction limits and issued shares in each water source (ie. maximum of about 3% in groundwater management zone 7), and therefore that there is sufficient depth in the market for each water source to accommodate the water take associated with the project.

In this regard, the Department is satisfied that the water use associated with the project is unlikely to have a significant impact on water availability and water supply in the applicable water sources. The Department notes that, like any other significant water user in the State, access to adequate water supplies is a commercial risk for Shenhua. And like any other significant water user, if Shenhua is not able to secure enough water to meet its demands (eg. if existing allocations are reduced due to drought), its operations may need to be curtailed, or it may need to investigate additional water efficiency measures. This is consistent with the water sharing and water efficiency principles established under the Water Management Act.

That said, consistent with NOW's recommendation the Department believes that Shenhua should be required to demonstrate that it has secured adequate water supplies to account for the maximum predicted water demand for mining operations in each of the three mining areas, prior to commencing mining operations in each area.

The Department also believes that it would be preferable that the make-up water is obtained from the lower quality and less utilised Porous Rock aquifer, rather than from groundwater management zones 3, 7 or 8 or the Mooki River. Whilst it also acknowledges that gaining access to bores of sufficient

yield in the hard rock aquifer may be difficult (due to generally low yields), the Department has nonetheless recommended conditions requiring Shenhua to use its reasonable endeavours to obtain the make-up water from the hard rock aquifer.

Flooding

The project has been located largely outside flood affected land, however two relatively small areas are within the 1 in 100 year flood level as modelled in the surface water assessment (see Figures 36 and 37), including:

- the south-east corner of the Eastern Mining Area, which would be affected by regional flooding in the Mooki River, with inundation up to:
  - 1.7m in the 1 in 100 year event, with velocities less than 0.1 m/s;
  - 4.3m in the Probable Maximum Flood (PMF); and
- the south-east corner of the Western Mining Area, which would be affected by localised flooding in the headwaters of Watermark Gully.

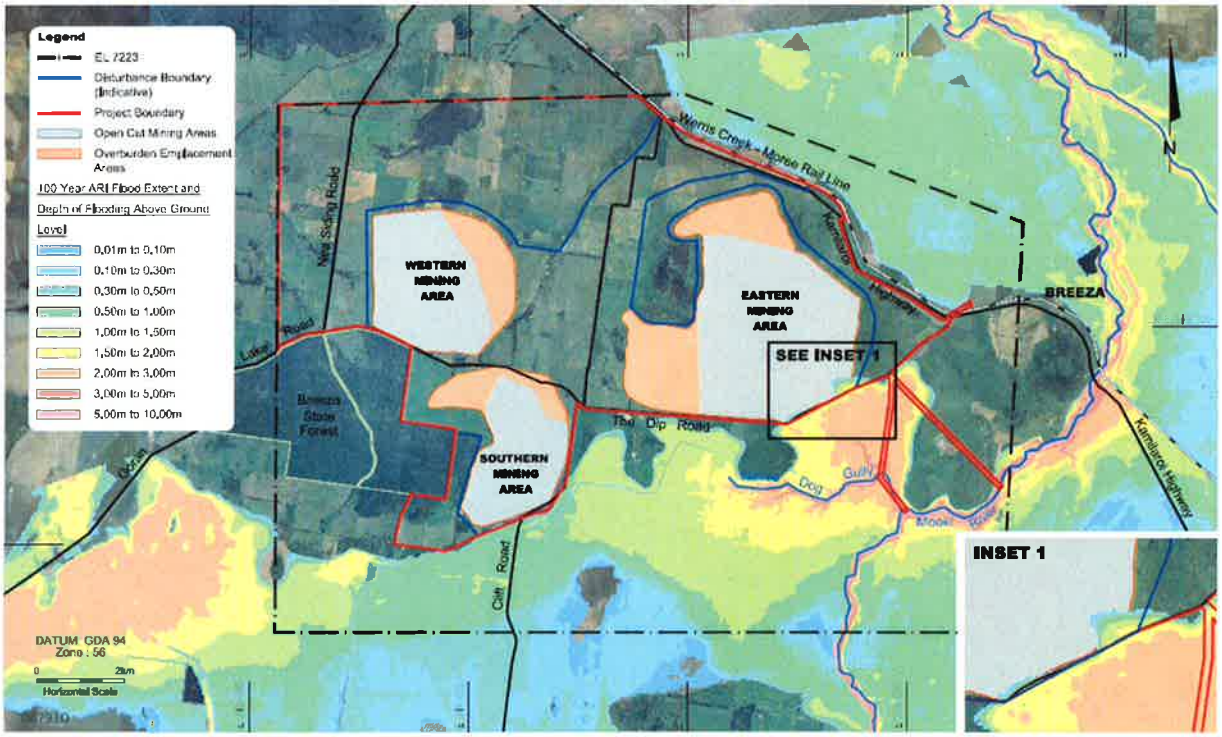

Figure 36: Flooding – Mooki River

With regard to the flooding of the Mooki River in the Eastern Mining Area, the EIS notes that 'limited and minor flood levees will be constructed as required in potential inundation areas', but provides no more detail on the levees. Given the predicted flood levels, levee height in the south-east corner would be in the order of 5 metres.

Whilst the Department does not consider this levee height to be minor, it is satisfied that the construction of the levee in this location is unlikely to have any significant affect on flood levels or behaviour on the surrounding floodplain. In this regard, the flood assessment indicates that the localised levee would increase flood levels on the adjacent floodplain by less than 5 mm in the 1 in 100 year event (grading to negligible within 100-200 metres from the project boundary), and have a negligible effect on the flood storage volume of the floodplain (ie. about 2% of the flood storage volume in the local northern Native Dog Gully floodplain). Dr Perrens also concluded that from a flood impact perspective, this impact is considered to have no consequences.

NOW recommended that the flood levee be designed to prevent inundation of the pit in floods of at least 100 year ARI, and that Shenhua should consider the benefit of excluding even greater floods to lower operational risk. The Department believes that this risk, both operationally and environmentally, should be minimised and has therefore recommended conditions requiring the levee to be built to exclude the PMF.

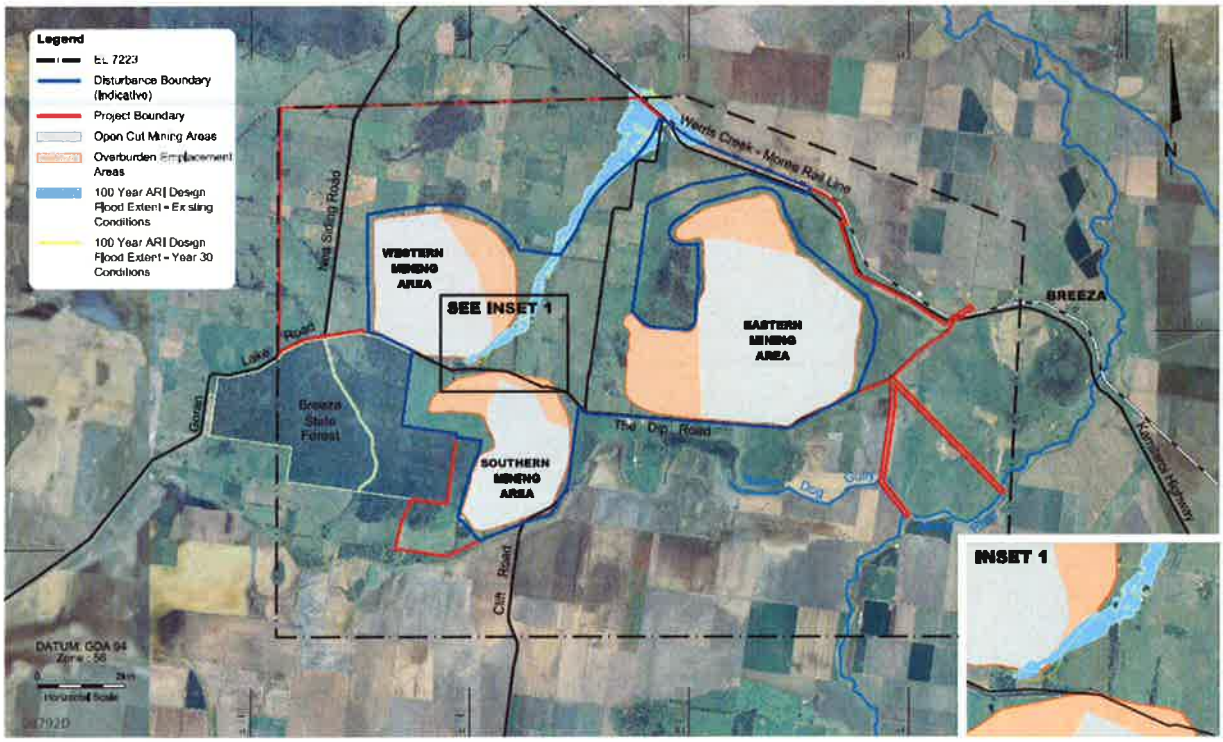

Figure 37: Flooding – Watermark Gully

With regard to the localised flooding in the upper reaches of Watermark Gully, the flood assessment indicates that the (largely undefined) headwaters of the creek would be diverted further to the east around the proposal overburden emplacement associated with the Western Mining Area. The assessment[12] predicts that the project would result in some localised changes to flood levels in Watermark Gully (due largely to catchment size changes[13]), with peak flood levels downstream of the Kamilaroi Highway increasing by:

- 40 mm in the 1 in 2 year event;
- 30 mm in the 1 in 100 year event; and
- 50 mm in the PMF[14].

No significant change to flood velocities are predicted.

RMS and Gunnedah Council raised concerns about the potential for these flood level changes in the lower reaches of Watermark Gully to affect flooding heights and frequency of key infrastructure including the Kamilaroi Highway.

Given that the proposed deviation of the highway is approximately 200 metres to the east of the existing Watermark Gully causeway on the highway, Council recommended that Shenhua should be required to upgrade the causeway simultaneously with the other highway diversion works.

Shenhua's additional flood modelling found that:

- the maximum 2 year ARI flood depth on the highway for both existing and post-mining conditions would be less than 300 mm, meaning that the project would not affect trafficability in this event; and
- for the 100 year event, the duration of flows greater than 300 mm deep would increase by 30 minutes, to 11 hours.

Whilst concluding that this impact is minimal, Shenhua has nonetheless committed to ensuring that the project maintains the catchment at pre-mining flood flow rates and velocities, via construction of an appropriately sized detention basin.

[12] The Response to Submissions provided an updated and more detailed flood assessment for Watermark Gully.
[13] The Watermark Gully catchment would increase by 3.6km^2 to 43.0km^2 post-mining.
[14] Based on the original flood modelling in the EIS.

The Department accepts that with such a basin, post-mining flows would be able to be restricted to no more than pre-mining flows, and there would therefore be no need or justification for upgrade of the Kamilaroi Highway causeway or other local roads to mitigate flood risk. The Department has recommended conditions reinforcing Shenhua's commitment, requiring Shenhua to ensure that flows in Watermark Gully mimic pre-development flows for all flood events up to and including the 1 in 100 year ARI event.

Development in the Floodplain

Some submissions also noted that the development in the flood-affected areas of the site appears to contradict condition 48 of the EL for the Watermark project, which excludes open cut mining anywhere on the 'floodplain'.

The term 'floodplain' is not defined in the EL. Subsequent to exhibition of the EIS, the Minister for Resources and Energy endorsed the following definition of floodplain for the purposes of the EL:

> *'A floodplain is an area of low-lying, nearly flat plain adjacent to a river, formed mainly of river sediment and subject to regular flooding.'*

The Watermark Gully flood-affected land within the project disturbance boundary is not low lying, being located within the upper reaches of the creek above the surrounding flood plain. Accordingly, the Department believes that the proposed disturbance in this area is outside the floodplain as defined for the purposes of the EL.

The flood affected land in the south-east corner of the Eastern Mining Area is lower lying and nearly flat, but it is outside the alluvial sediments associated with the Narrabri Formation and the Gunnedah Formation, and it is not subject to regular flooding. Dr Perrens considered this issue and added that this flood-affected area is not adjacent to a river (with the Mooki River approximately 3.5 kilometres away at the closest point) and would only be subject to minor incursion in a 1 in 20 year flood event and therefore is not considered to be subject to regular flooding.

Further, DRE has not raised any concerns about the proposed mine plan and the floodplain.

Consequently, the Department is satisfied for the purposes of its assessment that the project is consistent with the restrictions under condition 48 of the EL.

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which require access to groundwater (beyond soil-based groundwater from rainfall) to meet all or some of their water requirements. There are no significant GDEs in the area surrounding the Watermark project area that would be affected by the project. The EIS also includes a stygofauna (subterranean fauna) assessment, which did not identify any stygofauna on or near the project site and concluded that it is unlikely that any occur.

The Department is satisfied that the project is unlikely to significantly affect any sensitive GDEs or any extant stygofauna populations, given the relatively small predicted regional groundwater impacts.

Long Term Impacts and Final Void

As outlined above, groundwater levels would recover in the Eastern and Southern Mining Areas once they are backfilled, eventually exceeding pre-mining levels due to increased recharge on the backfilled overburden material.

These two mining areas would not present a long term groundwater sink, and there would be a zone of seepage in topographical low points at the base of the rehabilitated emplacements about 30 years after the completion of mining as groundwater levels in the overburden emplacements reached the surface. Dr Kalf agrees that most if not all of this seepage would evaporate given the relatively low predicted seepage rates, and accepts that the project is likely to slowly reduce the salinity of groundwater around the mined area post-mining, due to increased recharge through the backfilled material.

Dr Perrens also did not raise significant concerns about long term impacts of this seepage, but noted that management actions to manage or mitigate the predicted seepage would need to be undertaken during mining and rehabilitation to reduce long term risk. These measures include selective stripping

of soils, designing emplacements to minimise recharge and implementing dryland salinity measures (as outlined in the surface water quality section above). The Department has reflected these measures in its recommended conditions regarding water resources, biodiversity and rehabilitation management.

With regard to the Western Mining Area, groundwater levels are predicted by the 'MODFLOW' groundwater model to slowly recover and reach equilibrium after about 2,000 years at approximately 303 m AHD, due to the ongoing influence of the final void. These groundwater levels immediately surrounding the void would be about 1 to 2 metres below the regional water table, indicating that the pit lake void would act as a long term groundwater sink.

A second model, 'OPSIM', was also used to assess final recovery in the void. This model is based on simulation of daily rainfall (including storms), rather than average annual rainfall used in the MODFLOW model.

The OPSIM model predicts that water levels in the void would stabilise much more quickly, at about 280-290 m AHD after approximately 100 years.

Both models indicate that the final void water level would stabilise well below the crest height of the final void (ie. overflow level of 310 m AHD), and therefore there is no risk of external spillage of (saline) void water to the external environment.

The void lake would continue to increase in salinity over time as a result of evaporation from the lake surface, reaching a salinity comparable to seawater after about 400 years. Dr Perrens notes that the salinity would be expected to continue to increase progressively until the lake becomes hypersaline, which would suppress the evaporation rate and lead to a slightly higher equilibrium water level. Notwithstanding, both Dr Perrens and Dr Kalf agree that the final void lake level is likely to reach equilibrium at a level substantially below the overflow level, and that in the long term, the lake would remain a sink for regional groundwater. Accordingly, the lake would not pose a threat to the surrounding environment.

The Department accepts these findings, and is satisfied that the final void is unlikely to present any long term risk to regional water resources, with ongoing impacts restricted to the localised area within and immediately surrounding the void. The Department notes that Shenhua would be required to appropriately account for any long term groundwater take in accordance with the provisions of the Water Management Act (eg. through acquiring and retiring adequate water access licences), although the groundwater assessment indicates that the project would not result in any net long term groundwater take (see above).

Some submissions argued that Shenhua should be required to backfill the final void completely. The Department has considered this issue, and notes that Shenhua has designed the project to:

- fully backfill 2 of the 3 mining pits, and to locate the residual final void in the Western Mining Area as far as practicable from the alluvial aquifers;
- minimise the final void's catchment (ie. 100 hectares) and depth (ie. 80 metres below natural ground surface) as far as practicable; and
- ensure that the final void is as compatible with the surrounding landscape as practicable, including battering the slopes of the low wall to 10 degrees and blasting the high wall to reduce slopes and ensure long term safety.

These considerable measures would cost approximately $340 million to achieve. Full backfilling of the final void would:

- involve very significant additional cost (ie. approximately $460 million);
- require re-disturbance of rehabilitated overburden emplacements, with consequent environmental impacts; and
- affect potential future access to the deeper coal seams in the EL (which may be accessed via the highwall using underground mining methods, subject to separate approvals), potentially sterilising a significant coal resource.

For these reasons, the Department accepts that complete backfilling of the final void is not practicable or warranted. Nevertheless, the Department has recommended conditions requiring Shenhua to

minimise the size and catchment of the final void as far as practicable, and to minimise any ongoing environmental imapcts.

Cumulative Impacts

The EIS acknowledges that the other mining and coal seam gas projects in the Liverpool Plains, including BHP's Caroona Coal Project, may also result in depressurisation of the Permian strata and result in cumulative drawdown effects. However, as Shenhua does not have access to the BHP or CSG data to use in a cumulative assessment, the groundwater assessment relies on the detailed regional-scale assessment undertaken in the Namoi Water Study.

The assessment notes that the cumulative affect of the Watermark, Caroona and CSG projects (based on the Namoi Water Study's Scenario 2 modelling – see Section 3.5) would extend the zone of depressurisation in the Gunnedah Formation, particularly in the area to the south of Watermark and to the north of Caroona (ie. particularly in Groundwater Management Zone 7, which would experience a maximum drawdown of between 1.0 and 1.5 metres).

Some submissions argued that the cumulative assessment is minimal and that Shenhua should be required to undertake a cumulative or more regional assessment based on Scenario 3 in the Namoi Water Study (ie. the most extensive mining and CSG development scenario). However, the Department is satisfied that the cumulative assessment should be restricted to approved and/or planned projects (rather than hypothetical projects) where the potential impacts are reasonably well known, as is the standard approach for cumulative impact assessment.

The Department notes that as subsequent projects are developed, more detailed project-specific cumulative assessments will be required to be undertaken (using available data) by each successive applicant, which will appropriately consider cumulative impacts associated with existing and planned projects. These subsequent projects (including the Caroona Coal Project) will need to closely consider the cumulative impacts on the region's water resources.

At present, cumulative impacts are limited as the Watermark project is the first in this area and groundwater depressurisation does not interact with drawdowns associated with any other projects. Total cumulative water use associated with mining projects in the region is also minor compared to water use associated with other land uses, especially agriculture (as outlined in Section 3.5).

That said, the Department acknowledges that water is a finite and highly valued resource in the Liverpool Plains. In this regard, the Department notes that the water sharing principles established under the Water Management Act and relevant water sharing plans provides an equitable and appropriate means for addressing cumulative impacts on the water resources of the region. The Department also acknowledges the comprehensive assessment undertaken in the Namoi Water Study, which indicates that the development of coal and gas projects in the Namoi catchment are unlikely to result in significant catchment-wide impacts.

Conclusion

The Department is satisfied that Shenhua has designed the project to avoid significant impacts on key water resources, particularly through avoiding disturbance of the highly productive Upper Namoi alluvial aquifers, providing buffers of at least 150 metres to the less valued Narrabri Formation, and 900 metres to the highly valued Gunnedah Formation.

Based on this key mitigation measure, and following very comprehensive groundwater and surface water assessment – including regional level water studies (ie. the Namoi Water Study), detailed project-specific groundwater and surface water modelling, peer review by recognised groundwater expert Dr Noel Merrick, and independent peer review by recognised experts Dr Frans Kalf and Dr Steve Perrens – the Department is satisfied that the project is unlikely to significantly affect groundwater and surface water resources, water users or the environment.

However, the Department recognises the importance of the protection of the region's water resources to the people of the Namoi Catchment, and has recommended a broad suite of conditions to ensure that this occurs. These include conditions requiring Shenhua to:

- ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of mining operations on site to match its available water supply;

- ensure that it has adequate water access licences to account for all water used by the project, prior to the commencement of mining in each pit;
- not discharge any mine water (ie. 'dirty' or saline water) from the site under any circumstances;
- ensure that all surface water discharges of non mine water from the site comply with the limits set in any environment protection licence;
- provide compensatory water supplies to any private landowner whose supply is found to be adversely affected by the project, in the unlikely event that this occurs;
- comply with a range of water management performance measures and rehabilitation objectives;
- implement best practice dryland salinity measures as part of the Biodiversity Management Plan;
- prepare and implement a comprehensive Water Management Plan for the project, including a:
  - water balance;
  - salt balance;
  - surface water management plan and monitoring program;
  - groundwater management plan and monitoring program;
  - program to regularly (every 3 years) validate the water balance, salt balance, surface water model and groundwater model; and
  - a protocol to minimise any cumulative water-related impacts.

6.2 Noise, Blasting and Air Quality

Introduction

As outlined in Section 1.2, Shenhua owns all of the land within the project disturbance area, and all land within the wider project boundary, except for a parcel of Crown land on Mt. Watermark (see Figure 6).

Privately-owned land surrounds the project boundary, apart from Breeza State Forest which is located to the south-west. Most of the surrounding privately-owned land comprises broad scale agricultural farmland with associated homesteads and structures, although the small village of Breeza is located adjacent to the Kamilaroi Highway approximately 5 kilometres to the east of the project disturbance area, and 3 kilometres from the project boundary. The village has population of approximately 63.

The EIS includes specialist acoustics and air quality assessments, undertaken by Bridges Acoustics and PAE Holmes respectively. The assessments were undertaken in accordance with applicable guidelines, in particular the *NSW Industrial Noise Policy* (INP) and EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.

The noise assessment includes an assessment of blasting related impacts, and the EIS also includes a specialist assessment of blasting impacts on landforms and slopes, which was undertaken by SCT Operations.

Since the EIS, Shenhua has undertaken a 'mine planning optimisation review', which has led to the adoption of a modified equipment fleet for the project using larger and fewer trucks, with the result of an overall lowering of noise and dust emissions. The RTS includes revised noise modelling based on the optimised fleet. Revised air quality modelling was not undertaken in the RTS, however the emissions inventory for Year 25 of the project (the year of highest total emissions for the project) was re-calculated, with a decrease in emissions of approximately 15% utilising the optimised fleet. Whilst the RTS did not update the consequent modelling of dust impacts at surrounding receivers, Shenhua noted that the optimisation review ensures further conservatism of the emissions presented in the EIS.

Subsequent to the RTS, Shenhua undertook revised air modelling for Year 21 of the project, to assess the implications of the optimisation review on some broad acre agricultural properties located to the south of the project site (particularly Properties 60, 115 and 116). Year 21 was modelled as it was the only modelled year in which significant dust impacts were predicted at these properties. The additional modelling is attached in Appendix G.

The assessments indicate that background noise and dust levels in the local area are relatively low, and typical of the rural environment. Background noise levels gathered though long term monitoring in winter, spring and summer range from about 25 dBA to 45dBA, with most levels at or lower than 30 dBA. Noise decibel levels in the high 30's and 40's occur at all assessment locations generally in the summer (day, evening and night), as a result of the influence of insects. These higher levels have been conservatively ignored for the purposes for the noise assessment, and a blanket 30 dBA

background level (or 'rating background level', RBL) has been adopted at all receiver locations for the purposes of the assessment[15,16].

In accordance with the provisions of the INP, the adopted RBL leads to a project specific noise level (PSNL) criteria for the project's operational noise emissions of 35 dBA for all receivers for all time periods (ie. RBL + 5 dBA). The operational noise assessment includes consideration of low frequency noise, with applicable modifying factors applied to the adopted sound power levels for relevant equipment and the CHPP.

Background dust levels are generally within applicable air quality guidelines, with occasional exceedances of 24-hour goals due to regional dust sources, such as bushfires and dust storms.

Meteorological data for the purposes of the noise and dust assessment was gathered from Shenhua's 2 on-site meteorological stations (over a period of 1 year in 2010/11), and a Bureau of Meteorology (BOM) monitoring station at Tamworth Airport. In accordance with the provisions of the INP, the noise assessment included modelling under both calm conditions and noise enhancing conditions including prevailing winds (east, south and west/south-west) and temperature inversions.

Some submitters claimed that the wind data used was not representative of the long term variation in the region, particularly with regard to the air quality assessment. Submitters argued that stronger winds, particularly in the winter months, tend to come from the west and north-west, rather than south-east and east as indicated in the on-site meteorological stations used in the EIS.

Shenhua subsequently provided additional meteorological data in its RTS, including 2012 and 2013 data from its on-site meteorological stations, data from the Caroona Coal Project meteorological station, and data from the Gunnedah and Tamworth BOM stations. The data indicates that on an annualised basis, predominant winds are from the south to east quadrant, but that this does vary during the year, with more westerly winds in winter. Shenhua notes that while the predominant winds across most sites have a south south-easterly component, winds from all directions are measured and captured in the full year of hourly varying data used in the air quality dispersion model.

Reasonable and Feasible Mitigation Measures

The noise, blasting and air quality assessments are based on a number of avoidance and mitigation measures that Shenhua would undertake to reduce noise, vibration and air emissions associated with the project, including:

- optimising the mining fleet by using the largest possible truck size (within the constraints of the mine plan) to minimise vehicle trips and dust emissions (as outlined above);
- fitting all mobile plant with best practice noise attenuation;
- cladding the CHPP on all sides and the roof;
- partially enclosing the ROM coal hopper to minimise dust;
- enclosing elevated conveyor and conveyor transfer points;
- using a large radius rail loop to minimise train wheel squeal;
- avoiding use of mobile plant on elevated and exposed sections of the overburden emplacements and in other sensitive areas at night;
- avoiding drilling in higher elevations (less than 6 metres below natural ground level) at night;
- locating haul roads in shielded locations away from receivers;
- managing blast sizes to meet applicable overpressure and ground vibration criteria at all times;
- using blast mats (or equivalent) on Aboriginal axe grinding grooves to avoid impacts, and undertaking dilapidation assessments of all identified historic heritage items;
- implementing standard best practice measures to minimise safety risks associated with fly rock;
- delaying blasts in adverse weather conditions;
- using water sprays, filters and dust sprays to minimise dust emissions from applicable plant;
- achieving an 85% dust control efficiency on haul roads using speed control signage, water carts and/or dust suppressants;
- minimising disturbance, undertaking progressive rehabilitation and prompt revegetation/ stabilisation of overburden emplacements to minimise dust; and

[15] In accordance with the provisions of the INP, 30 dBA is the lowest RBL to be adopted for the purposes of noise impact assessment.

[16] A higher daytime RBL of 31 dBA was assessed for areas to the north east of the mine, however the additional 1 dBA has been conservatively ignored for the purposes of the assessment.

- implementing real time dust and noise monitoring systems and active management systems to manage day-to-day operations.

Shenhua also considered the potential to restrict mining to the day and evening periods only (ie. no night time operations) to mitigate noise, however it discounted this measure as the increased mining intensity required during the day and evening periods to maintain an economic project would result in higher impacts during the day than the predicted night time impacts. Consequently, day-time only operations would actually increase the number of affected receivers.

Three further scenarios involving reduced mining intensity at night were also considered (ie. idling 1, 2 and 3 of the 4 mining fleets at night) were also considered. Idling 1 fleet would only reduce noise levels by 1 dBA, which would not be perceptible. The other scenarios found that noise reductions of between 3 and 6 dBA could be achieved; however they would also result in a loss of revenue of between $149-297 million per annum, 1.5-2.4 million tonnes of product coal and 50-75 full time equivalent staff. These mine plans were consequently discounted, given the adverse economic outcomes, and result in a large amount of coal resource being sterilised (or uneconomic) due to mining inefficiencies.

NSW Health noted that the dust control efficiency used in the air quality assessment was 85%, whereas the 'Katestone Report'[17] found that most mines only achieve a control factor of 50-75% for haul road dust suppression. Accordingly, NSW Health questioned whether the air quality impacts have been underestimated. Shenhua responded by reiterating its commitment to the 85% control efficiency, citing numerous monitoring results which indicate that modern dust suppressants can achieve the adopted dust control efficiency.

Following the RTS and the mine optimisation review, the EPA confirmed that it was satisfied that Shenhua had adequately addressed all reasonable and feasible on-site mitigation measures. However, it noted that it *'is still concerned about the lack of detail about individual consultation and any success or otherwise with impacted residents on the acceptability of the noise limits above the PSNL'*, and that the RTS *'did not include any discussion on proposed mitigation to residences to address residual noise impacts above the PSNL'*.

The Department is satisfied that Shenhua has adequately considered reasonable and feasible noise and dust mitigation measures associated with the project, and is also satisfied with the level of consultation undertaken for the project. The Department has conservatively assumed that all privately-owned receivers with predicted residual noise impacts above the PSNL are not accepting of these impacts, and has completed its assessment on this basis. The Department has also considered potential mitigation to residence to address residual noise impacts.

Summary of Predicted Noise, Blasting and Air Quality Impacts

With the adopted mitigation measures in place, the assessment indicates that the project would result in residual impacts on a number of privately-owned properties in the area surrounding the project site. A summary of the affected properties is presented in the following table.

Table 8: Summary of Affected Privately-Owned Properties

Property	Significantly Affected Residence		Additional Significantly Affected Land (>25% affected)		Moderately Affected Residence		Marginally Affected Residence
	Noise	Dust	Noise	Dust	Noise	Dust	Noise
20			✓				
25[1]					✓(25b)	✓(25b)	
26			✓	✓			
27			✓	✓			
28			✓	✓			
32[1]	✓(32c)	✓(32c)			✓(32b)		
35							✓
39					✓		
40							✓
41					✓		

[17] NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining, prepared by Katestone Environmental Pty Ltd for the OEH (June 2011).

Property	Significantly Affected Residence		Additional Significantly Affected Land (>25% affected)		Moderately Affected Residence		Marginally Affected Residence
	Noise	Dust	Noise	Dust	Noise	Dust	Noise
43							✓
60		✓			✓		
61			✓				
62[1]	✓(62a)	✓(62a, 62b)			✓(62b)		
65			✓				
103[2]		✓			✓		
125	✓	✓					
Sub-total	**3**	**6**	**6**	**3**	**7**	**1**	**3**
Total Properties[3]	**5**		**6**		**7**		**3**
Total Residences	**6**		**-**		**7**		**3**

1 Property contains multiple residences (affected residence/s shown in brackets).
2 Although formally assessed as moderately noise affected, the Department has recommended that this residence be granted acquisition rights for noise as well as air quality because the assessed worst case operational noise level (ie. 39.9dBA) is very close to the 40dBA contour, the land is more than 25% significantly affected, and because of the potential sleep disturbance impacts at the residence (see below).
3 17 properties in total would be marginally to significantly affected.

As outlined in the table, the project is predicted to result in significant residual noise and/or dust impacts on 11 privately-owned properties, and a further 6 privately-owned properties would be marginally to moderately affected. The properties comprise a total of 6 residences that would be significantly affected, with a further 10 that would be marginally to moderately affected.

These impacts are discussed in the following sections.

The Department notes that, whilst the number of affected properties is not insignificant, the level of residual noise and dust affectation associated with the project is similar to contemporary mining projects in the Gunnedah and Hunter coalfields, particularly for greenfield projects (ie. new mines). Examples of such greenfield projects include:

- Maules Creek Coal Project (10_0138), approved on 23 October 2012: 6 privately-owned properties were predicted to significantly exceed applicable noise and/or dust criteria, although the PAC ultimately granted acquisition rights to 12 landowners;
- Moolarben Coal Project (05_0117), approved on 6 September 2007: 16 privately-owned properties were within the acquisition area for the project;
- Anvil Hill (now Mangoola) Coal Project (06_0014), approved on 7 June 2007: 36 privately-owned properties were within the acquisition area for the project;
- Mt Owen Coal Project (DA 14-1-2004), approved 8 December 2004: 18 private properties were within the acquisition area for the project;
- Mt Pleasant Coal Project (DA 92/97), approved 22 December 1999: Some 47 private properties were within the acquisition area for the project; and
- Bengalla Coal Project (DA 211/93), approved 7 August 94: Some 21 private properties were within the acquisition area for the project.

Operational Noise Impacts

The predicted worst case operational noise impacts for all modelled scenarios is shown on Figure 38, and a summary of the affected receivers and the Department's preferred management approach is presented in Table 9.

Table 9: Summary of Operational Noise Limit Exceedances.

Noise Exceedance	Management Approach	No. Affected Private Properties	Property ID
Marginally affected residences (1-2dB exceedance)	Noise mitigation at source	3	35, 40, 43
Moderately affected residences (3-5dB exceedance)	Noise mitigation, including mitigation at residence	7	25b, 32b, 39, 41, 60, 62b, 103[1]
Significantly affected residences (>5dB exceedance)	Acquisition	3	32c, 62a, 125

Noise Exceedance	Management Approach	No. Affected Private Properties	Property ID
Additional significantly affected land (>5dB exceedance on >25% of land)	Acquisition	6	20, 26, 27, 28, 61, 65
Total		**13 residences 17 properties**	

1 Although formally assessed as moderately noise affected, the Department has recommended that this residence be granted acquisition rights for noise because the assessed worst case operational noise level (ie. 39.9dBA) is very close to the 40dBA contour, the land is more than 25% significantly affected, and because of the potential sleep disturbance impacts at the residence (see below).

As outlined in the table, there are 3 privately-owned residences that are predicted to be significantly affected by operational noise at some stage during the project, and a further 10 privately-owned residences that are predicted to be marginally to moderately affected. A further 6 privately-owned properties are predicted to be significantly affected over more than 25% of the land area.

The revised modelling indicates that the optimisation review has reduced the area of affectation considerably, with the pre-optimisation modelling as presented in the EIS indicating that 7 privately-owned residences would be significantly affected, and 17 privately-owned residences would be marginally to moderately affected[18].

The residual affected privately-owned properties are all located in the rural area surrounding the project (on most sides), with the affected area not extending to the urban area of Breeza (see Figure 38).

A summary of the worst case noise levels at the significantly affected residences is presented in the following table.

Table 10: Significantly Affected Residences (significant exceedances in bold), dBA

Residence	Direction from Mine	Criteria	Worst Case Predicted Noise Level		
			Day Neutral	Day Prevailing	Evening/Night
32c	NE	35	30	**42**	**41**
62a	SW		30	39	**41**
125	S		38	**45**	**48**

Each of the significantly affected residences are located on large rural land holdings, with the landholdings extending to areas outside the 40 dBA contour, and in most cases the 35 dBA contour (except for Property 125, which is located immediately south of the mine, wholly within the 40 dBA contour).

The Department also notes that for most of the surrounding receivers (with the exception of the significantly affected residences), noise levels would remain below the applicable amenity criteria in the INP – ie. 50 dBA for the day, 45 dBA for the evening and 40 dBA for the night period.

Further, the Department acknowledges that the noise assessment is based on worst case scenarios with all equipment assessed to be operating under noise enhancing weather conditions. As outlined above, Shenhua has committed to the development of a real-time noise monitoring and management system for the project. This uses a combination of real-time noise monitoring and weather forecasting to guide the day-to-day planning of mining operations, and prevent noise impacts during adverse weather conditions. Such 'active' management systems are increasingly being used in the Hunter Valley, with results indicating that predicted impacts are able to be significantly reduced or eliminated.

With such a system in place, the Department believes that the number of marginally, moderately and significantly affected properties could be further reduced. Accordingly, the Department has recommended conditions requiring Shenhua to develop and implement such a system, as part of a comprehensive noise management plan for the project.

[18] Excluding properties that have been acquired by Shenhua since the EIS (ie. Properties 4, 13 and 14).

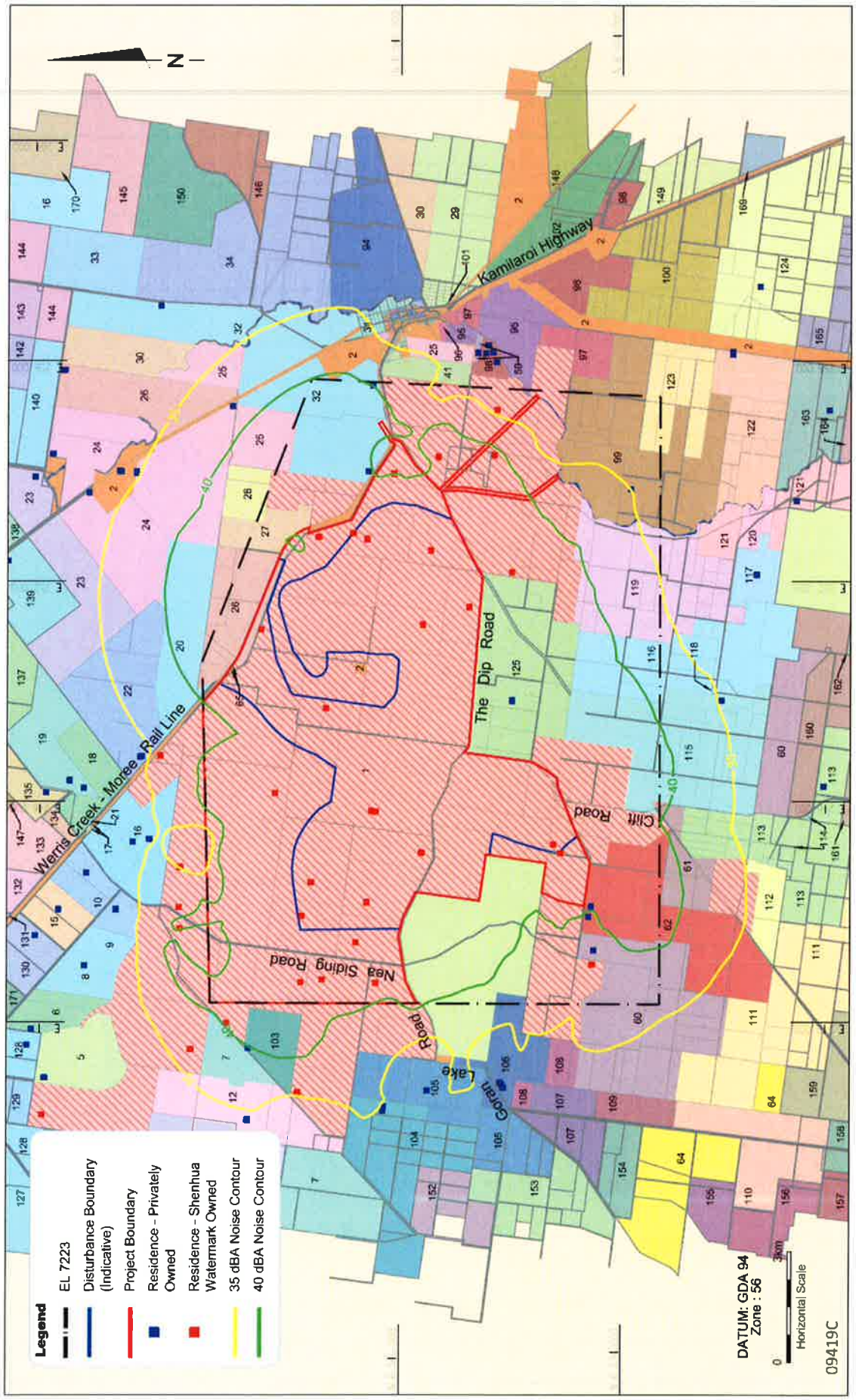

Figure 38: Operational Noise Impacts (All Years, Evening/Night)

Whilst the active management system is considered appropriate, there is some risk to the practical implementation of the system and proposed noise mitigation measures assumed as part of the noise model. Accordingly, the Department has recommended conditions requiring Shenhua to:

- acquire the properties predicted to be significantly affected properties, if requested by landowner;
- undertake additional noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at residences which are predicted to be significantly or moderately affected, if requested by landowner;
- comply with contemporary operational noise limits;
- develop a comprehensive Noise Management Plan, including real-time noise monitoring and an active management system which includes an early warning alert system to identify and manage potential exceedances;
- independently investigate noise complaints and undertake applicable management measures; and
- communicate mining operations with the community, including publicly reporting all monitoring results, and effectively responding to enquiries and complaints.

With regard to the additional landholdings that are predicted to be affected over more than 25% of the land area (but where the residence is not predicted to be significantly impacted), the Department acknowledges that the properties are largely broad acre cropping/agricultural land, and that higher noise levels are unlikely to significantly affect agricultural productivity of the land. In some recent coal mining approvals in the Gunnedah Basin – including the Boggabri Coal Project and the Maules Creek Coal Project – the PAC has diverged from longstanding NSW policy and withheld granting acquisition rights to these properties because of the limited impact.

The Department has considered this approach for the project (ie. withholding acquisition rights for these properties), but does not recommend its adoption for two main reasons. Firstly, some of the affected landholdings are very close to the project disturbance areas (eg. Properties 26 and 27), and would likely experience considerable amenity impacts. The project is likely to have a significant impact on the development potential and/or private property rights of these landholdings (including subdivision potential), which ought to be compensated for.

Secondly, granting acquisitions rights to these landowners does not compel the landowners to sell, it merely provides them with an option to sell their land (for a price as if unaffected by the project) if the owner decides that he or she is unable or unwilling to live with project-related impacts.

Consequently, the Department has recommended that its longstanding policy of providing acquisition rights to the properties where more than 25% of the landholding is significantly affected is applied to the project. The Department has also recommended conditions requiring Shenhua to maintain the agricultural productivity of any farmland that it does acquire (that is outside the operational areas of the project), to ensure that the agricultural productivity of these lands is maintained in the event that the landowner chooses to exercise his/her acquisition rights.

Construction Noise

Construction-related noise activities – including construction of the Kamilaroi Highway overpass, rail spur and loop, CHPP, mine access road and mine haul roads – have been assessed against the operational noise criterion (ie. 35 dBA). The assessment indicates that construction noise levels would remain within the applicable criteria for all receivers except Property 125, which would experience construction noise levels similar to or less than the predicted operational noise levels.

Sleep Disturbance

Intermittent and sharp project-related noises during the night time period – eg. reversing dozers and train wagon shunting – have the potential to cause sleep disturbance impacts. Shenhua believes that with the implementation of the noise mitigation measures outlined above, any exceedances of the applicable sleep disturbance criterion (ie. 45dBA L_{Amax}) are unlikely.

Notwithstanding, the noise assessment includes a worst case assessment of the potential for the sleep disturbance in the absence of the proposed noise control measures. The assessment indicates that maximum noise levels at night would comply with the sleep disturbance criteria at all receivers

with the exception of residences on Properties 32, 103 and 125 – all of which are also predicted to be significantly affected by operational noise at the residence or over the land area.

As outlined above, the Department has recommended conditions requiring Shenhua to acquire these properties on request, and to undertake additional architectural noise treatments on the residences at the landowners request.

The Department has also recommended conditions requiring Shenhua to implement the adopted best practice noise controls, and to comply with the relevant sleep disturbance criteria at all receivers outside the acquisition zone.

Road Traffic Noise

The project would provide direct access to the Kamilaroi Highway via the Mine Access Road. The traffic noise assessment indicates that the construction and operational phases of the project would increase noise levels at residences close to the highway by less than 1 dBA, with total traffic noise levels remaining below the applicable 60 dBA $L_{Aeq,15hr}$ traffic noise criteria at all privately-owned receivers.

Rail Traffic Noise

Rail noise on the proposed rail spur and loop was assessed as part of the operational noise assessment considered above.

The project would generate an average of 8 train movements a day (in + out), and a maximum of 16 movements a day, on the Werris Creek-Moree Railway Line and the Main Northern Railway. This would increase train movements on the Werris Creek Line from about 49 trains a day[19] to 59 trains a day. The rail noise assessment indicates that the existing and approved rail traffic exceeds the applicable night noise criteria (i.e. 60 dBA L_{Aeq}) at about 39 residences on the Werris Creek-Moree Railway Line and Main Northern Railway between the site and Muswellbrook (with noise levels up to about 65 dBA).

If project-related traffic were added to this traffic, rail noise levels are predicted to increase by a further 0.6 dBA L_{Aeq}, which would result in night time exceedances at a further 3 residences between Breeza and Willow Tree. On busy days, the rail noise contribution from Watermark trains would be higher, however it would be likely that this additional noise increase would be offset by a commensurate reduction in train movements from other mines using the railway.

One way of reducing night time rail noise increases would be to restrict train movements at night to minimise sleep disturbance. However, the Department notes that rail scheduling and the selection of rolling stock would both be largely beyond the control of Shenhua, with the Australian Rail Track Corporation (ARTC) and other bulk freight carriers being the entities which are responsible for the haulage and timing of coal delivery on the wider public rail network. The approval authority (ie. the PAC in this instance) does not have the power to include conditions in a project approval that place requirements on a third party, such as ARTC.

The Department acknowledges that ARTC's Environment Protection Licence (EPL) currently includes a Pollution Reduction Program requirement to minimise noise emissions. As part of this program, ARTC is required to monitor locomotive, noise levels, audit noise performance of locomotives, maintain an environmental hotline and implement all reasonable and feasible noise mitigation and management measures to reduce rail noise impacts. The Department is satisfied that these current measures are appropriate to mitigate rail noise associated with the project.

Notwithstanding, the Department has recommended conditions requiring Shenhua to:

- ensure that the project only uses locomotives that comply with the noise limits in ARTC's EPL;
- use its best endeavours to ensure that rolling stock are selected to minimise noise; and
- implement all reasonable and feasible measures to minimise rail noise associated with the project.

[19] Including existing train traffic and traffic from approved and recently proposed mining projects.

Cumulative Noise

Although there are no other approved or pending industrial noise sources that could contribute to the cumulative industrial noise levels in the locality, the EIS includes consideration of the potential cumulative impacts associated with the (conceptual) Caroona Coal Project. Whilst details of that project are yet to be confirmed, the conceptual noise assessment indicates that cumulative noise impacts associated with the Watermark and Caroona coal projects are unlikely particularly given the underground nature of the as the Caroona Coal Project. Notwithstanding, the Department has recommended conditions requiring Shenhua to co-ordinate noise management with any nearby mines to cumulative noise impacts.

Blasting and Vibration

The project involves blasting to facilitate removal of both overburden and coal, with up to 240 blasts proposed per year, or approximately 5 per week, undertaken between the hours of 9am to 5pm Monday to Saturday.

Blasting has the potential to affect people, structures or private property in a number of ways, including:

- annoyance and discomfort, or 'amenity impacts';
- structural damage to homes, buildings, property improvements, infrastructure heritage items and significant landforms;
- direct risks to the safety of people and livestock due to rock projectiles, or 'flyrock'; and
- blast fumes.

Blast fume-related impacts are addressed separately in the air quality assessment (see separate section below).

The blast assessment indicates that all blasting activities for the full range of blast sizes would remain below applicable amenity and structural damage criteria at all privately-owned residences, as shown in the following table.

Table 11: Worst Case Blast Impacts

Receiver ID		Amenity Criteria		Structural Damage Criteria		Predicted Level (@ max 2000kg MIC)	
		Airblast	Vibration	Airblast	Vibration	Airblast	Vibration
Privately-owned properties (worst case)		115 dB (Lin) for 95% of blasts in any year 120 dB (Lin) for 100% of blasts	5 mm/sec for 95% of blasts in any year 10 mm/sec for 100% of blasts	133 dB (Lin)	10 mm/sec	113	4.4
Shenhua-owned heritage homesteads	3	Not adopted – as owned by company		133 dB (Lin)[1]	15 mm/sec[1]	120	13.1
	7					109	2.5
	12					111	3.3
	13					114	4.9
Breeza Cemetery		N/A	N/A	N/A	2	N/A	0.9
Central Ranges Gas Pipeline		N/A	N/A	N/A	25	N/A	8.3

1 As adopted by Shenhua

Four Shenhua-owned farm complexes with some local heritage significance (see Section 6.5 for details) would be subject to some blast-related vibration and overpressure, with one of the homesteads (ie. Farm Complex 3 - The Wilgas) predicted to exceed the amenity criteria for all blast sizes.

Vibration and overpressure at this residence would be below the adopted structural criteria (of 15 mm/sec and 133 dB), however the Department notes that: (1) the adopted 15 mm/sec ground vibration criteria is higher than that adopted for privately-owned residences; and (2) Shenhua does not appear to have undertaken any specific engineering assessments on the building (or other heritage homesteads) to confirm the acceptability of the adopted criteria. In this regard, heritage buildings can be more susceptible to blast-related impacts and site specific assessment is often required to determine appropriate vibration limits.

Shenhua has committed to engaging a qualified expert to inspect the heritage buildings and confirm appropriate ground vibration and overpressure limits for each building. Whilst it would be preferable that these inspections occurred prior to determination of the project, the Department concedes that in practice blasting is able to be readily managed to achieve any reasonable set limit, through blast management practices such as reducing MIC size. In the absence of expert advice, the Department has recommended conditions requiring Shenhua to ensure that blasting does not damage the heritage farm complexes (and other heritage items), and to develop specific blasting criteria for the items based on site specific geotechnical investigations, as part of the Blast Management Plan.

Axe-grinding groove WM-GG2-11 is located adjacent to the Eastern Mining Area, and has the potential to be impacted by blast-related 'over break' (ie. cracking). The blasting impacts on landforms and slopes assessment indicates that a 100 metre buffer between blasting operations and the axe grinding groove would be sufficient to protect the site, and that the grinding groove site is well outside this buffer.

The risk of flyrock damage to the grinding groove site would be controlled by covering the grooves with blast mats or other materials when blasting within 500 metres of the grooves.

With regard to safety risks, it is noted that one privately-owned landholding (Property 125), some local roads (including the Kamilaroi Highway (in one small area) and The Dip Road), and other publicly accessible areas (including Breeza State Forest) are located within the range of potential flyrock impact (ie. approximately 500 metres) (see Figure 39). To manage safety risks associated with flyrock, the Department has recommended conditions restricting blasting to no closer than 500 metres of any privately-owned land or other land not owned by Shenhua, unless the company has:

- a written agreement with the landowner to allow blasting to be carried out closer to the land; or
- demonstrated to the Department's satisfaction that the blasting can be carried out without compromising the safety of people or livestock, and updated the mine's Blast Management Plan to include the specific measures that would be implemented to ensure this.

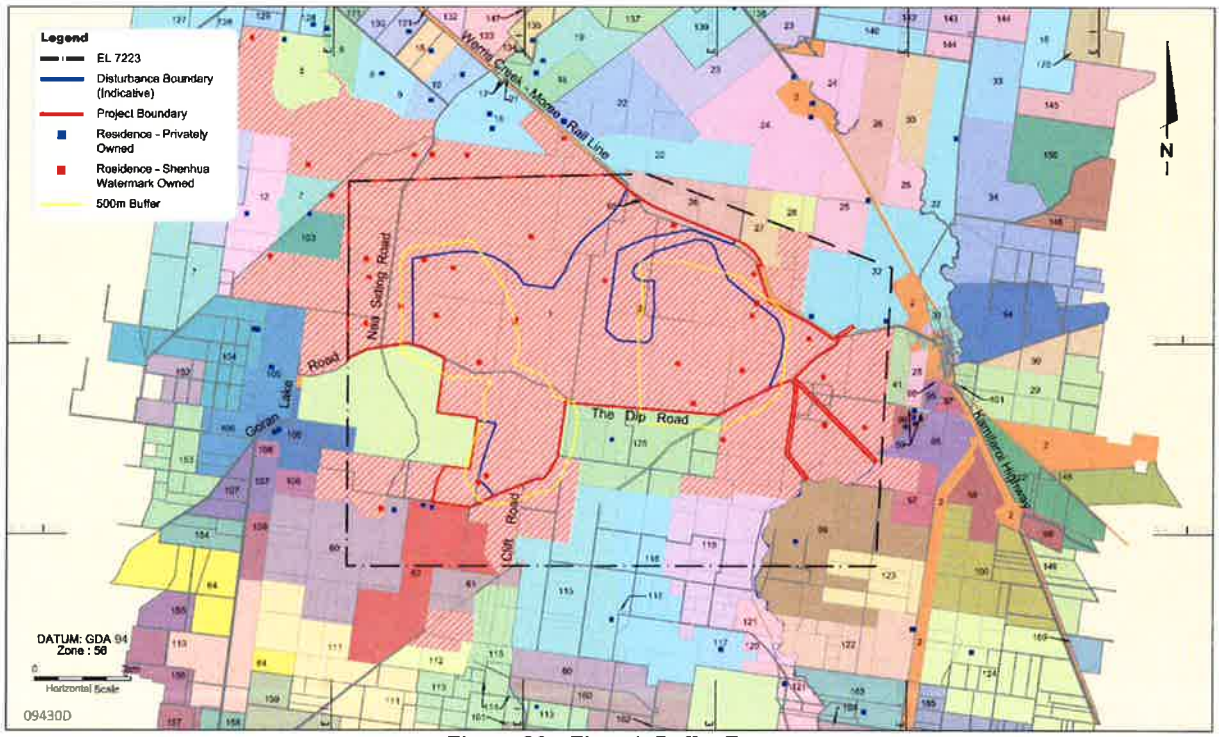

Figure 39: Flyrock Buffer Zone

In conclusion, the Department is satisfied that blasting and blast-related operations can be readily managed to meet the applicable amenity and structural damage criteria at all surrounding private residences, structures and heritage items, subject to implementation of strict blast management measures. To ensure this occurs, the Department has recommended conditions requiring Shenhua to:

- manage blasting operations to comply with all relevant criteria at private properties and public infrastructure;
- limit blast frequency and hours;
- keep the public notified and up-to-date regarding blasting operations, and facilitate feedback and complaint management;
- provide for structural property inspections and investigations on request;
- repair any structural damage to buildings or infrastructure caused by the project;
- manage blasting operations to avoid flyrock related safety risks; and
- develop a comprehensive Blast Management Plan.

Dust Impacts

The predicted worst case operational dust impacts for all modelled scenarios is shown on Figure 40, and a summary of the affected receivers is predicted in Table 12 below. As noted above, for most operating years these results conservatively reflect the original modelling undertaken for the EIS, and do not reflect the optimisation review undertaken for the RTS, which indicates that dust emissions sources may be reduced by around 15%. However, the results do reflect the revised modelling undertaken for Year 21 for properties to the south of the project site.

As outlined in Table 12, only 24-hour PM_{10} levels are predicted to exceed the applicable air quality criteria, with average-annual dust levels and dust deposition rates all expected to remain within applicable criteria of all privately-owned residences.

All of the significantly dust affected privately-owned properties are located in the rural area surrounding the mine, and all of the affected residences are also predicted to be significantly or moderately affected by project-related noise.

Table 12: Dust Affected Privately-Owned Properties (exceedances only shown)

Receiver	Direction from Mine	Worst Case Dust Level (all years)							
		PM_{10} ($50\mu g/m^3$)			$PM_{2.5}$ ($50\mu g/m^3$)		TSP ($50\mu g/m^3$)	Dust deposition (g/m^2/month)	
		24 Hour		Annual	24 Hour	Annual	Annual	Project alone	Project and other sources
		Max.	Days $>50\mu g/m^3$						
Criteria		**50**	**5**	**30**	**25[1]**	**8[1]**	**90**	**2**	**4**
Significantly Affected Residences									
62a	SW	152	26	-	-	-	-	-	-
62b	SW	131	20	-	-	-	-	-	-
125	S	86	6	-	-	-	-	-	-
Moderately Affected Residences									
25b	NE	57	1	-	-	-	-	-	-
32c[2]	NE	82	5	-	-	-	-	-	-
60[2]	SW	80	7	-	-	-	-	-	-
Additional Properties >25% Significantly Affected[3]									
26	N	>50	>5	-	-	-	-	-	-
27	N								
28	NE								

1 Advisory reporting standard only – there is no currently adopted air quality criteria for $PM_{2.5}$.
2 The residence is predicted to be significantly affected by cumulative 24-hour PM_{10} – see below.
3 Two additional properties (Properties 115 and 116) were originally predicted to also be significantly affected over more than 25% of the landholding, however the revised modelling undertaken for the mine optimisation review indicates that these properties would not be significantly affected.

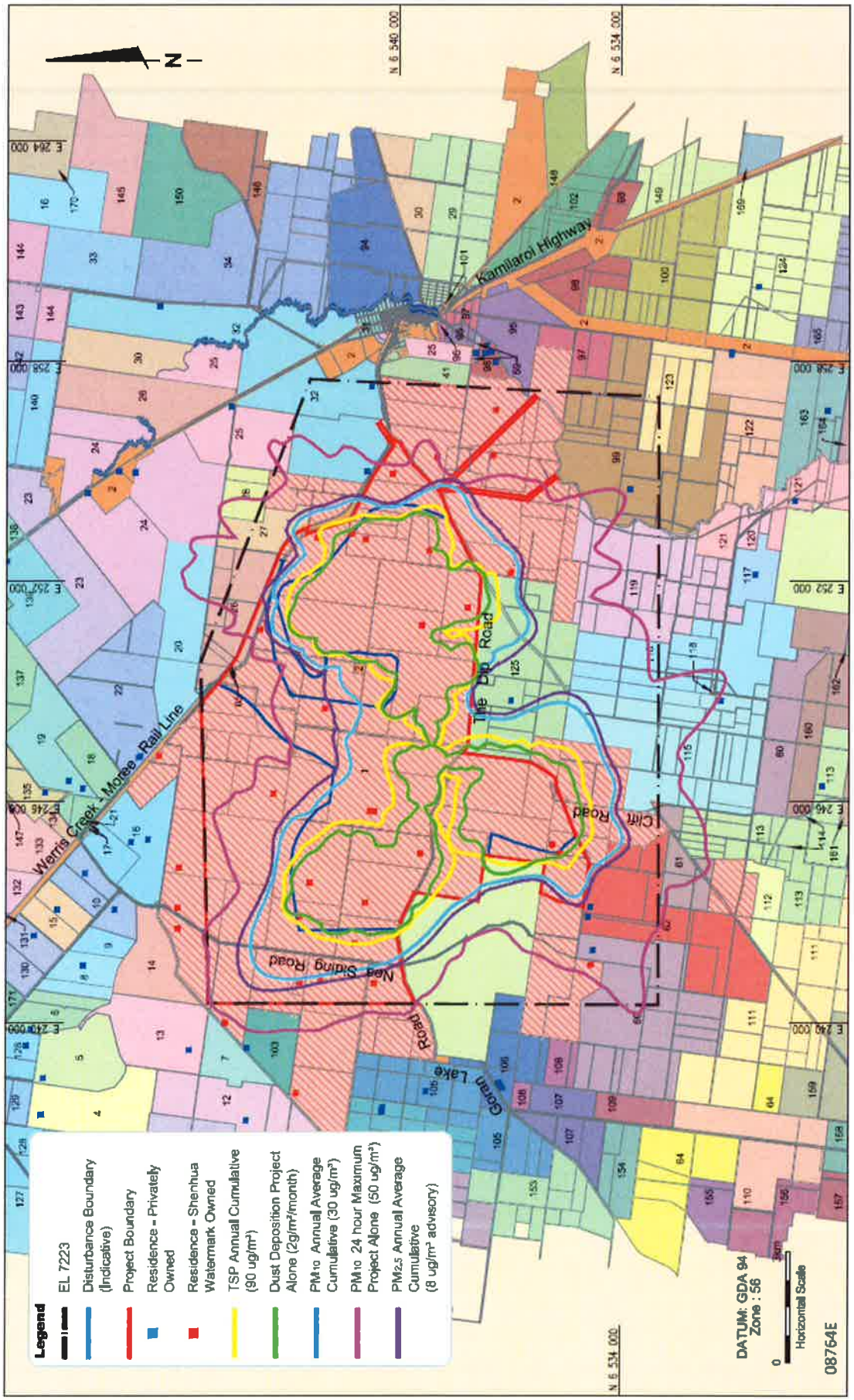

Figure 40: Worst Case Dust Contours – All Years

(Nb. The figure does not reflect the revised modelling for Year 21, which has constricted the contours to the south of the mine)

Cumulative 24-hr PM_{10} Impacts

Whilst the air quality assessment's quantitative assessment includes cumulative analysis for TSP, dust deposition and annual average PM_{10}, the analysis of 24-hour PM_{10} impacts is based on a project-only basis, as cumulative assessment of 24-hour PM_{10} is problematic for a number of technical reasons (including the large variance in background 24-hour PM_{10} levels).

To address cumulative 24-hour PM_{10} impacts in some manner, the assessment includes a 'Monte Carlo Simulation' (which is essentially a random sampling statistical tool) to examine the probability of cumulative 24-hour PM_{10} levels exceeding the applicable 50 $\mu g/m^3$ goal, based on available data. This assessment indicates that the residences most likely to experience 24-hour PM_{10} impacts are generally those already predicted to be affected by the project alone (ie. Residences 62a, 62b and 125), however there are 3 other residences where the 50 $\mu g/m^3$ 24-hour PM_{10} criteria may be exceeded for more than 5 days a year, namely:

- Property 32c – up to 20 days over 50 $\mu g/m^3$ a year;
- Property 60 – up to 11 days[20] over 50 $\mu g/m^3$ a year; and
- Property 103 – up to 7 days over 50 $\mu g/m^3$ a year.

Properties 32 and 103 are also predicted to be significantly affected by operational noise associated with the project.

A small number of additional properties are predicted to exceed the cumulative 24-hour PM_{10} criteria on 1 or 2 days a year, which is within the applicable air quality criteria.

The air quality assessment indicates that the operational dust-related impacts of the project on surrounding receivers would be similar or less than the operational noise impacts.

The Department notes that the modelling has not taken into consideration active (or adaptive) management measures to reduce air emissions during dusty conditions (especially during dry and windy conditions). As with active noise management, active air quality management uses a combination of real-time dust monitoring and weather forecasting to guide the day-to-day planning of mining operations, to prevent air quality impacts during these adverse weather conditions.

As outlined above, such active management systems are starting to become more and more common for mining projects in places like the Hunter Valley, with results indicating that predicted impacts (particularly in relation to 24-hour PM_{10}) are able to be significantly reduced or eliminated due to adaptive management in response to weather conditions. As outlined above, Shenhua has committed to the implementation of an active management system for the project.

Given the predicted project-specific impacts and the potential for wider cumulative impacts, the Department has recommended conditions requiring Shenhua to develop and implement an active dust management system for the project, as part of a comprehensive Air Quality Management Plan for the mine. With such a system, the Department believes that Shenhua should be able to avoid or at least reduce many of the predicted 24-hour PM_{10} impacts.

Nevertheless, the Department accepts that there is some risk to the practical implementation of the system, and has recommended that Shenhua be required to acquire the 8 properties predicted to be significantly affected (ie. Properties 26, 27, 28, 32, 60, 62, 103 and 125), if requested by the landowner. The Department has also recommended a range of best practice air quality management measures for the project, including requiring Shenhua to:

- comply with contemporary air quality criteria, for properties outside the predicted affected area;
- acquire any additional residence or property if dust emissions exceed the applicable land acquisition criteria, if requested by the landowner;
- undertake additional dust mitigation measures (such as air filters or air conditioning) at privately-owned or mine-owned residences predicted to be significantly or moderately affected, if requested by the landowner (or the tenant of any mine-owned residence);
- develop a comprehensive Air Quality Management Plan, including a real-time dust monitoring program and an active management system which includes an early warning alert system to identify and manage potential exceedances;

[20] Based on the revised modelling undertaken for Year 21.

- independently investigate air quality complaints and undertake applicable management measures;
- notify the affected landowners and tenants of the potential health-related impacts associated with mine dust;
- allow tenants of affected mine-owned residences to terminate tenancy agreements without penalty;
- respond effectively to enquiries or complaints; and
- publicly report on its environmental performance.

Other Air Emissions

The air quality assessment also includes consideration of oxides of nitrogen (NO_x), sulphur dioxide (SO_2) and particulates associated with blasting fumes, diesel use and potential spontaneous combustion.

Modelling for NO_x found that there could be a maximum of 8 hours per year (from 2,920 available hours) at any privately-owned receiver (ie. at Property 32c) where NO_x levels could exceed the applicable impact assessment criteria (ie. 246 $\mu g/m^3$ over 1 hour). Most of these exceedances were found to occur in the late afternoon (between 4pm and 5pm) in poor dispersion (ie. stable) conditions.

To address this potential issue, Shenhua has committed to avoiding blasts in such conditions, and to applying best practice blasting techniques to minimise the formation of NO_x (such as ensuring appropriate oxygen balance for explosives and minimising time between drilling, loading and blasting).

The Department is satisfied that blasting operations should be able to be managed to avoid NO_x exceedances subject to the implementation of these controls, and has recommended conditions in this regard.

Modelling for other emissions associated with blasting and diesel use indicates that the project would comfortably comply with the applicable criteria. The assessment does note that some of the coal from the project (from the Lower Hoskinssons seam) does have the potential for spontaneous combustion due to its high sulphur content. To address this risk, Shenhua propose to mix the higher sulphur material with low spontaneous combustion risk material, in accordance in standard best practice spontaneous combustion management measures in the coal industry. The Department is satisfied that the risk of spontaneous combustion is able to be readily managed in this regard.

Coal Transport Emissions

Some submissions (including Liverpool Plains Shire Council) raised concerns about dust emissions from coal trains, with some recommending that coal wagons be required to be covered and/or dust suppressants applied to minimise emissions.

The EIS includes consideration of this issue, citing a Queensland Rail study in 2008 that found that fugitive coal dust at the edge of a typical rail corridor is within applicable criteria, and that there was minimal risk of adverse impacts throughout the rail network. It also cites an ARTC Study in 2013 that compared particulate emissions from coal trains, passenger trains and freight trains. That study found no substantial difference between trains types at one of the study sites. It did find a statistical difference at the other study site, although it found no statistical difference between loaded and unloaded coal trains.

Based on these studies, the Department does not believe that there is any evidence that coal trains are causing any significant adverse dust-related impacts on the rail network. Notwithstanding, the Department acknowledges that Shenhua has committed to the installation of a water spray/dust suppressant system at the train load out facility, and has recommended conditions reinforcing this commitment.

The Department also notes that ARTC is responsible for the management of the wider rail network, and that its EPL includes a requirement to prepare a Pollution Reduction Program that includes, amongst other things, requirements on ARTC to evaluate and reduce coal emissions on the rail network.

Dust Impacts on Cotton and Other Agricultural Products

A number of submissions from surrounding farmers in the locality raised concerns about dust deposition from the project affecting cotton quality (and therefore the prices received for cotton crops) and other crop products (eg. grains, legumes and vegetables). One nearby farming operation (Warmoll & Waugh) noted that it owns and operates a seed/grain grading and packing plant very close to the mine site (adjacent to Property 32c), and included letters in its submission from its customers indicating that its organic supply contracts could be threatened if dust were to impact its crops. Warmoll & Waugh noted that rejection of a shipment of its products could be ruinous to its business.

The Agricultural Impact Statement in the EIS includes considerations of dust impacts on grazing, plant growth and cotton quality. The AIS concludes that the project is unlikely to have any impacts on grazing animals and plant growth at the predicted dust deposition levels (and predicted noise levels). This conclusion is consistent with the Department's findings on other comparable mining projects, and the Department is satisfied the project is unlikely to result in any adverse impacts in this regard, noting that grazing and agriculture continue to successfully operate adjacent to many other mines in NSW and Australia.

With regard to impacts on cotton quality, the AIS included a literature review and consultation with industry professionals including the Australian Cotton Ginners Association.

The literature review cites a CSIRO study in 2006/07 that found that Australia had the lowest of contaminants imported by an international cotton mill with no mention of dust, sand or grit. The consultation found that in incidental cases of road dust on crops, the dust was easily and effectively removed at the pre-cleaning phase of the ginning process and did not affect cotton quality.

The key determinant of potential dust impacts to crops is dust deposition – ie. that portion of air emissions that settles on a given area. The AIS concludes that, given the predicted comfortable compliance with the applicable dust deposition criteria, the project would not impact on cotton quality. In this regard, the worst case increase in dust deposition at any receiver location is 0.4 g/m^2/month, compared to the applicable criterion of 2 g/m^2/month; and the worst case cumulative dust deposition level is 2 g/m^2/month, compared to the applicable criterion of 4 g/m^2/month.

The Department accepts that the predicted dust deposition levels are low and well within amenity limits and levels typically experienced in agricultural areas. Consequently, the Department believes that there is no evidence that suggests that the project would have an adverse impact on cotton quality or on any other organic and non-organic crop production and processing activities in the locality, or that farmers contracts and licences would be adversely affected by the project.

The recommendations to apply real-time monitoring and active dust (and noise) management systems would assist in reducing off site dust (and noise) levels.

Conclusion

The Department is satisfied that Shenhua has designed the project with number of reasonable and feasible measures so as to avoid or mitigate the noise, blasting and/or air emissions from the project.

However, even with the implementation of these measures, the project would result in significant noise and/or dust impacts at 11 privately-owned properties, including 6 residences.

The project would also have marginal to moderate noise and/or dust impacts on a further 10 privately-owned residences.

This level of impact is consistent with other large contemporary mining projects, particularly large, greenfield projects such as the Watermark Coal Project.

Importantly, the Department believes that the agricultural productivity of all of these affected landholdings is unlikely to be significantly affected by the project, and that most of the significantly affected residences are located on large broad acre properties that extend outside the affectation area.

The Department has recommended a broad range of conditions to ensure that the mine operates in accordance with best practice with regard to noise, blasting, and air quality, including requirements on Shenhua to:

- comply with contemporary applicable noise, blasting and air quality criteria;
- acquire the privately-owned properties predicted to be significantly affected, if requested by the landowner;
- acquire any additional residence or property if dust emissions exceed the applicable land acquisition criteria, if requested by the landowner;
- implement noise and/or air quality mitigation measures (such as double glazing, insulation, air-filters and/or air conditioning) on request at the significantly or moderately-affected residences;
- develop detailed Noise, Air Quality and Blast Management Plans, including real-time noise and dust monitoring and active management systems to identify and manage potential exceedances as they occur;
- notify the affected landowners and tenants of the potential health-related impacts associated with mine dust;
- allow tenants of affected mine-owned residences to terminate tenancy agreements without penalty;
- limit blast frequency and hours, and coordinate blasting operations with neighbouring mines;
- keep residences notified and up to date regarding blasting operations, and facilitate feedback and complaint management;
- provide for structural property inspections and investigations on request;
- repair any structural damage to buildings or infrastructure caused by the project;
- manage blasting operations to avoid fly-rock related safety risks;
- independently investigate complaints and implement applicable corrective and other management measures; and
- communicate regularly with the community, including publicly reporting all monitoring results, and effectively responding to enquiries and complaints.

With the implementation of these measures, the Department is satisfied that the project's noise, blasting and air quality impacts can be adequately minimised, managed and/or at least compensated for.

6.3 Greenhouse Gas Emissions

The EIS includes a greenhouse gas (GHG) emissions assessment, undertaken by PAE Holmes. The assessment was undertaken in accordance with applicable GHG guidelines, including the *National Greenhouse Account (NGA) Factors*, July 2010.

The assessment calculates direct and indirect GHG emissions associated with the project, including 'Scope 1' emissions (ie. direct GHG emissions from sources controlled by Shenhua), 'Scope 2' emissions (ie. indirect emissions associated with the import of electricity) and 'Scope 3' emissions (ie. other indirect emissions, such as those associated with the downstream combustion of product coal). The calculated GHG emissions associated with the project are presented in the Table 13.

Table 13: Direct and Indirect GHG Emissions

Scope	***GHG source(s)***	***Total GHG emissions (tonnes carbon dioxide equivalent, TCO2-e)***
Scope 1	Mining and extraction related	7,674,839
Scope 2	Upstream electricity	741,576
Scope 3	Downstream emissions, eg transport of product coal	1,594,340
	Downstream coal use	402,137,483
Total (exc. downstream coal use)		**10,010,755**
Total (inc. downstream coal use)		**412,148,238**
Average Annual GHG Emissions		**13,738,274**

The assessment indicates that 98% of the total GHG emissions generated as a consequence of the project are those associated with the downstream burning of the product coal at power stations – ie. Scope 3 indirect emissions. The annual average GHG emissions over the life of the project, including coal combustion, are estimated to be 0.04% of annual global GHG emissions. Annual Scope 1 GHG

emissions associated with the project represent approximately 0.04% of Australia's commitment under the Kyoto Protocol (ie. 591 Mt CO_2-e).

The Department acknowledges the threat posed by global warming/climate change, but does not believe that this threat should necessarily preclude the approval of this project.

Rather, the consideration of the project application with regard to GHG impacts needs to be balanced with consideration to:

- the project's contribution to global warming/climate change;
- whether refusing the project application would reduce global GHG emissions;
- the need for the project;
- the benefits of the project, including job creation and its contribution to the NSW economy;
- the objects of the EP&A Act, including the encouragement of ESD; and
- available GHG impact mitigation measures.

Following consideration of the project's contribution to global warming/climate change, the Department is satisfied that the project's contribution to global GHG emissions, even when assessed on a full life cycle basis (ie. including downstream GHG emissions), would be very small.

It must be noted that if the project was not allowed to proceed, the resultant gap in the coal supply would be almost certainly filled by another coal resource either in NSW, Australia or overseas. In other words, removing the GHG emissions from the project would not likely result in any decrease in global CO_2 emissions. This point illustrates the reality that the key response to the issue of global warming/climate change needs to be made at a policy or strategic planning level, outside and above the NSW planning assessment process.

The need for the project and its benefits are discussed in Section 3 and 6.8. Based on its consideration, the Department is satisfied that there is a clear need for the development of new coal deposits, for at least the foreseeable future, to meet society's basic energy needs. The Department is also satisfied that the project would have considerable socio-economic benefits.

The objects of the EP&A Act are outlined in Section 4.9, and these objects have informed the Department's assessment of the project. With regard to the principles of ESD, the Department acknowledges that global warming/climate change presents a clear threat of serious or irreversible environmental damage, as well as a threat to intergenerational equity and a threat to the conservation of biological diversity. However, the Department is satisfied that the project itself does not present such a threat (as the emissions from the project itself are minor in a global and national context), and it must also be acknowledged that the downstream energy and other socio-economic benefits generated by the project would also benefit future generations, particularly through the shoring up of national and international energy needs.

Shenhua has committed to a range of GHG impact mitigation measures, which would be administered via an Energy Savings Action Plan, including implementation of a detailed energy monitoring program. The Department has recommended conditions requiring Shenhua to implement all reasonable and feasible measures to minimise greenhouse gas emissions.

The Department does not believe it is reasonable to apply other requirements to Shenhua through the NSW planning system to significantly reduce GHG emissions, including Scope 3 emissions associated with the downstream burning of the product coal. Any such impost – for example a CO_2 levy on product coal – would unfairly penalise Shenhua and its ability to compete in the energy industry. The Department believes that such an ad hoc approach to the issue of global warming/climate change is not in the public interest. The Department is satisfied that much more effective measures have been, and are continuing to be, planned and implemented at the State, national and international levels to combat global warming/climate change.

6.4 Biodiversity

Introduction

As a result of its long history of farming, and the natural ecological characteristics of the low-lying areas, most of the project site comprises low diversity grassland and pasture. Woodland areas are generally restricted to the localised high points around Mt Watermark, Springhurst Hill and Smokey

Point, and along ephemeral watercourses (particularly Watermark Gully), as well as in scattered remnants across the site.

The largest area of treed vegetation in the vicinity of the site is in Breeza State Forest, located within the EL but immediately to the south-west of the project disturbance area.

The project site, its surrounds, and the Gunnedah LGA in general have an abundant population of Koalas, and a range of other threatened species have been identified in the locality.

To assess the project's impacts on biodiversity, the EIS includes a specialist ecological assessment undertaken by Cumberland Ecology. A draft Koala Plan of Management (KPoM) was also prepared by Cumberland Ecology, with input and peer review by nationally-recognised Koala experts including Dr Stephen Phillips of Biolink Ecological Consultants, Dr Kath Handasyde of the University of Melbourne and Dr Matthew Crowther of the University of Sydney.

A supplementary ecological assessment providing a revised biodiversity offset strategy was also prepared by Shenhua with Cumberland Ecology, in response to issues raised about the original assessment and particularly the adequacy of the original biodiversity offset strategy.

Avoidance and Mitigation

The ecological assessments are based on a number of avoidance and mitigation measures that Shenhua would implement to minimise impacts on the biodiversity values of the site as far as practicable. These measures include:

- designing the project to avoid disturbance of Breeza State Forest, Mt Watermark, Watermark Gully and the black soil plains, which provide important Koala habitat;
- designing the overburden emplacement for the Eastern Mining Area to avoid a 143 hectare area of endangered ecological community;
- positioning the mine infrastructure area to avoid preferred Koala habitat;
- progressively clearing and rehabilitating the site;
- undertaking pre-clearance surveys and vegetation clearing protocols;
- undertaking weed and pest control;
- implementing flora and fauna monitoring programs; and
- implementing fauna rescue and translocation programs, including for the Koala.

These measures would be supplemented by a biodiversity offset strategy to compensate for the residual biodiversity impacts of the project. The offset strategy comprises on-site and off-site offset areas, and was revised and enhanced in response to concerns raised during exhibition of the EIS. It is discussed under a separate heading below.

The draft KPoM (which was also revised and enhanced following the EIS) also includes a number of specific measures for avoiding and/or mitigating impacts on Koalas. These are detailed under a separate heading below.

Vegetation and Flora Impacts

The project would disturb (clear) approximately 4,084 hectares of land. A summary of the vegetation communities within the project disturbance area, and their conservation significance, is presented in Table 14, and shown on Figure 41.

Table 14: Vegetation Community Impacts

Community	***Conservation Significance***		***Area to be Cleared (ha)***
	TSC Act	***EPBC Act***	
White Box Grassy Woodland	EEC	CEEC	517
Regenerating White Box Grassy Woodland	EEC	CEEC	28
Blakely's Red Gum Grassy Woodland	EEC	CEEC	89
Regenerating Blakely's Red Gum Grassy Woodland	EEC	CEEC	17
Yellow Box Grassy Woodland	EEC	CEEC	14
White Box/Yellow Box/Blakely's Red Gum Woodland	EEC	CEEC	0
Derived Native Grassland	EEC	CEEC	73
Sub-total Box Gum Woodland EEC			***738***
Inland Grey Box Grassy Woodland	EEC	EEC	30
Weeping Myall Woodland	EEC	EEC	3

Community	Conservation Significance		Area to be Cleared (ha)
	TSC Act	EPBC Act	
Brigalow	EEC	EEC	0
Semi-evergreen Vine Thicket	EEC	EEC	0
Fuzzy Box Woodland	EEC	-	18
Sub-total Other EEC			***51***
Other Woodland Communities*	-	-	148
Sub-total Other Woodland Communities			***148***
Low Diversity Native Grassland	-	-	1,691
Cropland / Exotic Pasture	-	-	1,393
Cleared Areas (roads, dams, buildings, etc.)	-	-	63
Sub-total Other			***3,147***
Total			**4,084**

* Other woodland communities within the disturbance area include Poplar Box Woodland, Belah Woodland, Whitewood Woodland, Tumbledown Red Gum Grassy Open Woodland, White Box Shrubby Woodland, Regenerating White Box Shrubby Woodland and Blakely's Red Gum Shrubby Woodland.

As outlined in the table, approximately 789 hectares of the vegetation to be cleared by the project constitutes an endangered or critically endangered ecological community (ie. EEC or CEEC) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Most of this comprises communities commonly known as Box Gum Woodland, as well as derived native grassland (DNG) which, if left undisturbed and/or actively managed, would likely regenerate back to Box Gum Woodland over time.

One of the key issues initially raised by OEH was whether the assessed low diversity native grassland should also be classified as DNG, particularly as some of it appeared to be as diverse as the classified DNG. However, following provision of additional survey information and data, OEH confirmed that it was satisfied that the low diversity grassland does not constitute Box Gum Woodland DNG.

The woodland EEC's identified within the project site area are typically located on fertile soils that have historically been sought after by agricultural and other land uses, and as such have been extensively cleared in the region. The communities are generally poorly represented in the public conservation reserve system, again due to their occurrence on fertile and sought after arable land.

The ecological assessment concludes that, notwithstanding the above avoidance measures, the project would have a significant impact on these ECCs/CEECs in the absence of 'substantial' mitigation and offsetting measures.

The Department recognises that the project would remove a considerable area of good quality EEC and other native vegetation. Consequently, the Department (including OEH) and DOE agree that, for the project to be able to meet the general principles of 'improving or maintaining' biodiversity values over the medium to long term, it would require significant biodiversity offsets of suitable size and quality. This issue is discussed under a separate sub-heading below.

The ecological assessments identified one threatened flora species on the site, Lobed Blue Grass (*Bothriochloa biloba*), which is listed as vulnerable under the TSC Act. This species occurs mainly along Nea Siding Road and The Dip Road, and is partly within the disturbance area for the project. Four other species were also identified as potentially occurring within the project site, including:

- Bluegrass (*Dichanthium setosum*);
- Finger Panic Grass (*Digitaria porrecta*);
- Slender Darling-pea (*Swainsona murrayana*); and
- Ooline (*Cadellia pentastylis*).

The EIS includes tests of significance for each of these individual flora species, which concluded that the project is unlikely to result in any significant impact on the abundance, range and distribution of the species, given that large areas of similar habitat occur in the locality outside the project disturbance area.