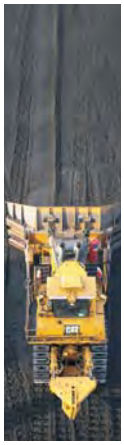
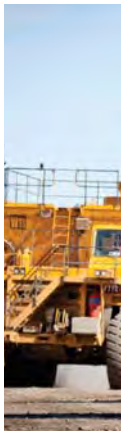
DURALIECOAL
Part of the Yancoal Australia Group

Duralie Open Pit Modification
Environmental Assessment





SECTION 4

ENVIRONMENTAL ASSESSMENT

YANCOAL
兖煤澳大利亚有限公司

Resource Strategies

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

4 ENVIRONMENTAL ASSESSMENT

The following sub-sections present the environmental assessment for the Modification, including a description of the existing environment, an assessment of the potential impacts of the Modification on the environment; and where relevant, a description of the measures that would be implemented to avoid, minimise, mitigate and/or offset the potential impacts.

4.1 NOISE

A Noise and Blasting Assessment for the Modification was undertaken by SLR Consulting (2014) (Appendix A).

Aspects relating to operational noise are discussed in the subsections below.

Potential blasting impacts are discussed separately in Section 4.10.1.

4.1.1 Background

Previous Assessment

An assessment of potential operation noise impacts associated with the DEP was conducted by Heggies (2009a and 2009b), which indicated 16 privately-owned residences would experience noise levels above the project-specific noise limit (PSNL) of 35 A-weighted decibels equivalent continuous noise level (dBA $L_{Aeq[15minute]}$), including:

- four residences in the noise affectation zone (greater than 5 dBA above the PSNL); and
- 12 residences in the noise management zone (i.e. 1 to 5 dBA above the PSNL).

In addition, two privately-owned vacant properties (118 and 122) were predicted to be affected by noise of 40 dBA or greater over more than 25 percent (%) of the properties.

Project Approval (08_0203) Noise Limits

These exceedances of the PSNL were approved, subject to the management, mitigation and monitoring of noise impacts from the DCM in accordance with the requirements of Project Approval (08_0203).

This includes:

- the right to request property acquisition for privately-owned residences predicted to be in the noise affectation zone and privately-owned vacant land predicted to be affected by noise of 40 dBA or greater over more than 25% of the property;
- Project Approval noise limits for privately-owned residences; and
- the right to request mitigation measures for residences with predicted exceedances of 3 to 5 dBA above the PSNL, and for residences predicted to be within the affectation zone.

All residences predicted to be within the affectation zone have since been purchased by DCPL (properties 125 [1] and 125 [2] as shown in Project Approval 08_0203), or DCPL has entered into a compensation agreement with the owner of the residence (properties 117 and 128 [Figure 4-1]).

In addition, DCPL has entered into a compensation agreement with the owner of one residence predicted to be within the management zone (property 131 [1]).

DP&E 2013 Compliance Audit

The DP&E conducted an audit of the Duralie operations in November 2013. In regard to noise, the DP&E audit found:

> *All conditions of the PA relating to noise were found to be compliant.*

Noise Management and Monitoring

Existing noise management and monitoring measures are described in the Noise Management Plan.

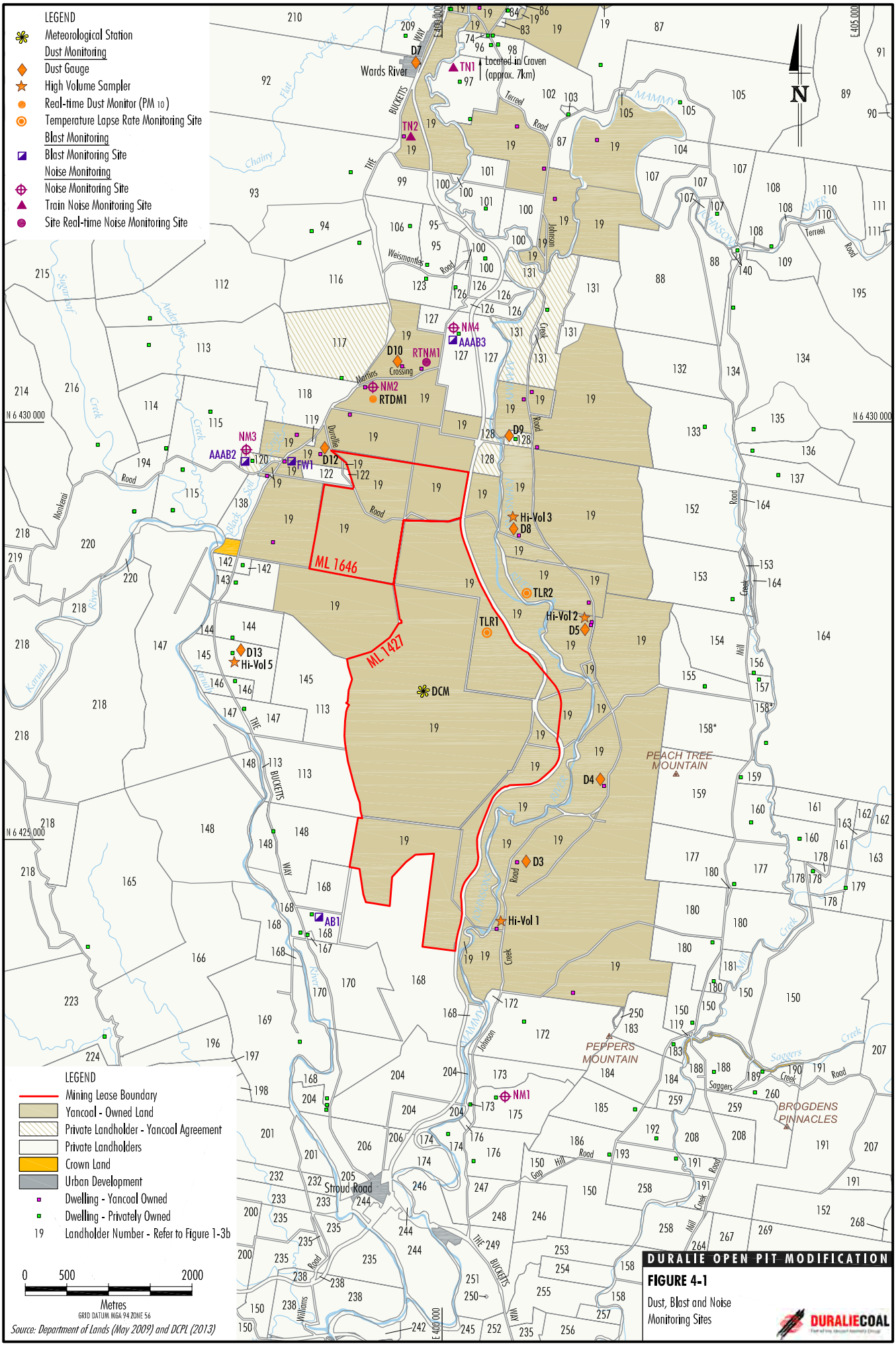
Operator-Attended Noise Monitoring

The DCM monitoring program includes operator-attended noise monitoring at locations surrounding the DCM (Figure 4-1).

Based on the results of operator-attended monitoring and consistent with the findings of the DP&E audit, operational noise from the DCM has been in compliance with the noise limits specified in Project Approval (08_0203) (Appendix A).

Real-time Monitoring

Continuous real-time noise monitoring is used at the DCM as a noise management tool to assist DCPL to take pre-emptive noise management actions.



GCL-14-23_Mod 2_Section 4_102B

Real-time noise investigation triggers set at levels below the Project Approval noise limits are specified in the Noise Management Plan.

An exceedance of the real-time noise investigation trigger results in an investigation into the potential noise source, and implementation of management measures (e.g. temporary stand-down of equipment), as required, to prevent an exceedance of the Project Approval noise limits.

Complaints

DCPL maintains a complaints register in accordance with Project Approval (08_0203).

All noise related complaints received by DCPL are responded to and investigated in accordance with the Complaint Response Protocol detailed in the Noise Management Plan.

4.1.2 Potential Impacts

SLR Consulting (2014) has conducted predictive noise modelling to determine potential noise impacts associated with the DCM incorporating the Modification.

Noise Modelling Methodology

The noise modelling methodology is based on previous predictive noise modelling conducted by SLR Consulting (formerly Heggies) for the DEP, with revisions as required to account for the Modification.

Assessable Meteorological Conditions

Assessable meteorological conditions for the DCM were determined in accordance with the NSW Industrial Noise Policy (INP) for the DEP.

For the Modification, recent meteorological data were reviewed, and no additional INP-assessable meteorological conditions were identified (Appendix A).

Therefore, consistent with the DEP, the predictive modelling for the Modification considered (Appendix A):

- calm conditions;
- 3 metres per second (m/s) prevailing winds during evening and night (with no prevailing winds identified for the daytime); and
- 3°C/100 m temperature inversions (including 2 m/s drainage flow for down valley receivers with no intervening topography).

Modelling Scenarios

The Modification involves an increase to the height of the waste rock emplacement (i.e. to approximately 135 m AHD), as well as minor changes in the surface development extent of the open pits (Appendix A).

The increased waste rock emplacement elevation has the potential to increase the propagation of noise emissions from mobile plant operating at the top of the waste rock emplacement in comparison to the currently approved waste rock elevation.

The minor changes in the surface development extent of the open pits would not materially change the potential noise impacts compared to the approved DCM, as the locations and elevation of the potential noise sources would not significantly change.

2015 was chosen for the noise modelling scenario as this year includes (Appendix A):

- waste rock emplacement at a height of 135 m AHD; and
- maximum fleet operations for the remainder of the DCM mine life.

Potential Impacts

Maximum predicted operational noise levels for the Modification at privately-owned residences (not subject to an existing noise compensation agreement with DCPL) are presented in Table 4-1. Noise contours for the Modification are shown on Figure 4-2.

There is a reduction in currently approved noise levels predicted for the Modification as mobile plant are now operating approximately 60 m deeper in the Clareval open pit in comparison to the DEP noise modelling scenario.

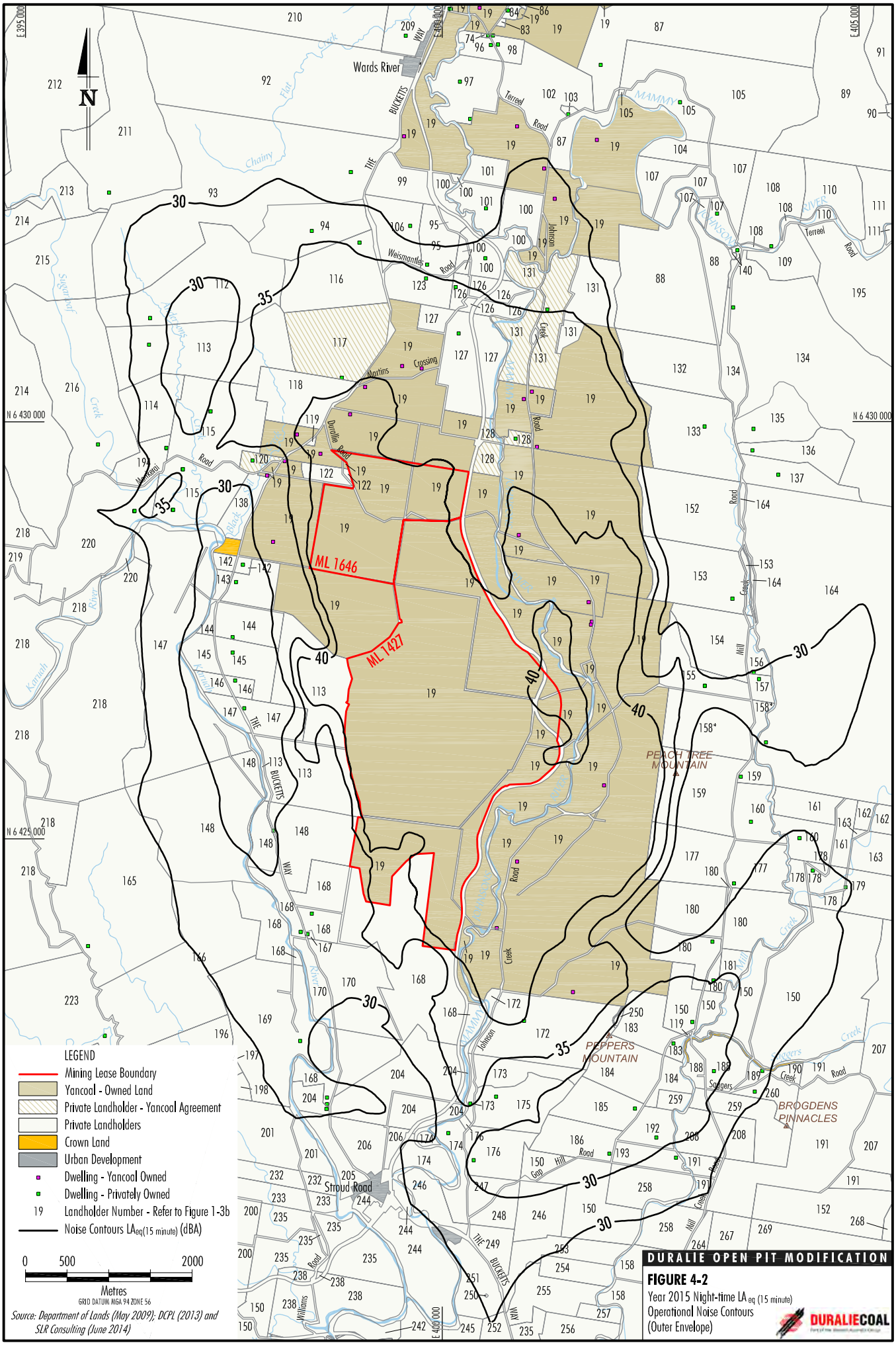
In summary, for the Modification it is predicted (Table 4-1):

- zero privately-owned residences[1] would be in the noise affectation zone; and
- five privately-owned residences[1] would be in the noise management zone (properties 123, 126, 127, 172 and 173).

By comparison, for the approved noise levels for the DEP there are:

- four residences in the noise affectation zone; and
- twelve residences in the noise management zone.

[1] Privately-owned residences not subject to an existing compensation agreement with DCPL.



GCL-14-23_Mod 2_Section 4_1018

Table 4-1
Existing Project Approval Noise Limits and Maximum Predicted Noise Levels for the Modification (at Privately-owned Residences not Subject to an Existing Noise Compensation Agreement with DCPL)

Residence	DEP – Project Approval Noise Limit	Modification – Maximum Predicted Noise Level
	dBA $L_{Aeq(15\ minute)}$	
172 (Lyall)	40	40
126 (Hamann Pixalu PL)	39	36
123 (Oleksuik & Carmody)	39	36
173 (Trigg & Holland)	37	36
116 (Weismantel)	37	35 or less
127 (Fisher-Webster)	37	36
180(1) (Thompson)	36	35 or less
95 (Smith & Ransley)	36	35 or less
144 (Wielgosinski)	36	35 or less
169 (Williams)	36	35 or less
177 (Thompson)	36	35 or less
All other privately-owned residences	35 or less	35 or less

Source: After Appendix A

Notes Refer to Figure 4-1 for residence locations.
Residences in the Noise Management Zone.

Two privately-owned vacant properties (118 and 122) were predicted to be affected by noise of 40 dBA or greater over more than 25% of the properties. The two properties both have unexercised acquisition rights under Project Approval (08_0203) (Appendix A).

Noise Management Measures

Modification Noise Modelling

DCPL has implemented reasonable and feasible on-site noise controls at the DCM, including the attenuation of mobile plant (e.g. for haul trucks).

For the Modification, DCPL would also construct earth bund walls up to 10 m above ground elevation on the southern and western sides of the evaporator units operating on the waste rock emplacement, and newer model evaporator units would be attenuated.

The noise management measures described above were included in the noise modelling conducted for the Modification (Appendix A).

Additional Noise Management Measures

The DEP Statement of Commitments includes noise management measures additional to those described above.

The noise modelling conducted for the Modification did not include these additional noise management measures and, notwithstanding, a reduction in approved noise levels was predicted for the Modification.

The maximum predicted operational noise levels presented in Table 4-1 demonstrate these additional noise management measures are no longer required and, therefore, are not proposed to be adopted for the remainder of the DCM mine life.

In particular, this is because mobile plant are now operating approximately 60 m deeper in the Clareval open pit up in comparison to the DEP noise modelling scenario (Year 5 of the DEP) that typically resulted in maximum predicted noise levels at surrounding residences. The depth of the open pit attenuates noise from this mobile plant (e.g. excavators, dozers and haul trucks) in comparison to the DEP noise model predictions.

The existing real-time noise monitoring, investigation triggers and associated management measures described in the Noise Management Plan would continue for the Modification to achieve compliance with Project Approval noise limits.

4.1.3 Mitigation Measures, Management and Monitoring

DCPL would continue to implement the noise management and monitoring measures detailed in the Noise Management Plan, which would be reviewed in consultation with the DP&E and EPA to reflect:

- the noise management measures considered in the Modification noise modelling (i.e. bunding of evaporation units operating on the waste rock emplacement); and
- an updated operator-attended noise monitoring network to reflect current land ownership and private compensation agreements.

4.2 AIR QUALITY

An Air Quality Assessment for the Modification was undertaken by Pacific Environment Limited (PEL) (2014) and is presented in Appendix B.

Aspects relating to dust emissions are discussed in the subsections below.

Potential blasting fume impacts and greenhouse gas emissions are discussed separately in Sections 4.10.1 and 4.10.2, respectively.

4.2.1 Background

Previous Assessment

An assessment of potential air quality impacts associated with the DEP was undertaken by Heggies (2009b).

The assessment predicted there would be no exceedances of annual average criteria for particulate matter with diameter less than 10 microns (PM_{10}), total suspended particulate (TSP) or dust deposition levels.

An exceedance of the 24-hour average PM_{10} criterion was predicted at one residence, which is now owned by DCPL.

The appeal of the NSW Minister for Planning decision to approve the DEP was lodged in the LEC on the grounds that (among other things) there would be health impacts from particulate matter with diameter less than 10 microns ($PM_{2.5}$) or less.

The LEC judgement found the potential risk to the health of persons in the locality from $PM_{2.5}$ emissions from the DEP would be acceptably small.

Air Quality Management and Monitoring

The existing Air Quality and Greenhouse Gas Management Plan describes the air quality management and monitoring regime at the DCM.

The Air Quality and Greenhouse Gas Management Plan describes:

- Project Approval air quality criteria.
- Dust monitoring locations and frequency, comprising:
  - one Tapered Element Oscillating Microbalance measuring PM_{10} and $PM_{2.5}$ continuously (i.e. real-time monitor);
  - four High Volume Air Samplers (HVAS) measuring PM_{10} on a one day in six cycle; and
  - nine dust deposition gauges.
- Ongoing dust management measures.
- Proactive dust management measures during adverse weather conditions.
- Performance indicators which, if exceeded, trigger the implementation of additional dust management measures.

Pollution Reduction Programs

Since the approval of the DEP in 2011, Pollution Reduction Programs (PRPs) have been included as requirements of the EPL 11701. As such, DCPL implements dust control measures in accordance with the following conditions of EPL 11701:

- PRP U2: *Particulate Matter Control Best Practice Implementation - Wheel Generated Dust*, which requires a haul road dust control efficiency of 80% or more to be achieved and maintained at the DCM. A monitoring program demonstrated a control efficiency 96 to 98% was achieved through the use of watering of haul roads, and that a control efficiency of 90% could be maintained on a day-to-day basis (Appendix B).
- PRP U3: *Particulate Matter Control Best Practice Implementation - Disturbing and Handling Overburden under Adverse Weather Conditions*, which requires DCPL to alter or cease the use of equipment handling waste rock during adverse weather conditions, which have been identified to be wind speeds greater than 5 m/s when the wind direction is from the north-west and rainfall in the last 12 hours is less than 2 millimetres (mm).

Existing Air Quality

Air quality monitoring conducted since approval of the DEP in 2011 shows cumulative dust levels are well below Project Approval criteria (Appendix B), with the exception of one exceedance of the 24-hour PM_{10} criterion, which was due to a regional bush-fire event, indicating the existing DCM has had minimal impact on local air quality (Appendix B).

Complaints

DCPL has received no dust-related complaints via the complaints register since approval of the DEP.

4.2.2 Potential Impacts

Modelling Methodology

Air quality dispersion modelling has been conducted by PEL (2014) to assess potential impacts for one operational scenario representative of 2015 for the DCM incorporating the Modification.

Relevant to potential air quality impacts, 2015 was chosen for the air quality modelling scenario as this year includes (Appendix B):

- maximum ROM coal and waste rock extraction for the remainder of the mine life (Table 3-1);
- maximum fleet operations for the remainder of the Duralie mine life (Appendix A);
- waste rock emplacement at a height of 135 m AHD.

Emissions of TSP (i.e. dust) associated with the DCM incorporating the Modification for 2015 were estimated by PEL (2014) using contemporary emission estimation methodologies.

The estimated annual emissions of TSP for the Modification are lower than those estimated for the maximum year for the DEP (e.g. due to the incorporation of additional emissions controls required under the PRPs) (Appendix B).

Predicted Impacts

Project Only Predictions

Concentrations of TSP, PM_{10} and $PM_{2.5}$ as well as dust deposition levels were predicted at privately-owned residences.

There were no predicted exceedances of the 24-hour average PM_{10} criteria, or annual average TSP, PM_{10} or dust deposition criteria, at any privately-owned residence due to emissions from the project only (i.e. the DCM incorporating the Modification) (Appendix B). In addition, predicted 24-hour average and annual average $PM_{2.5}$ concentrations are below reporting guidelines at all privately-owned residences (Appendix B).

The predicted compliance with air quality criteria is consistent with the assessment conducted for the DEP.

Contours showing predicted project only 24-hour PM_{10} concentrations are provided on Figure 4-3.

Cumulative Predictions

PEL has analysed monitoring data to estimate the contribution of other (i.e. non-DCM) sources to dust concentrations and dust deposition levels.

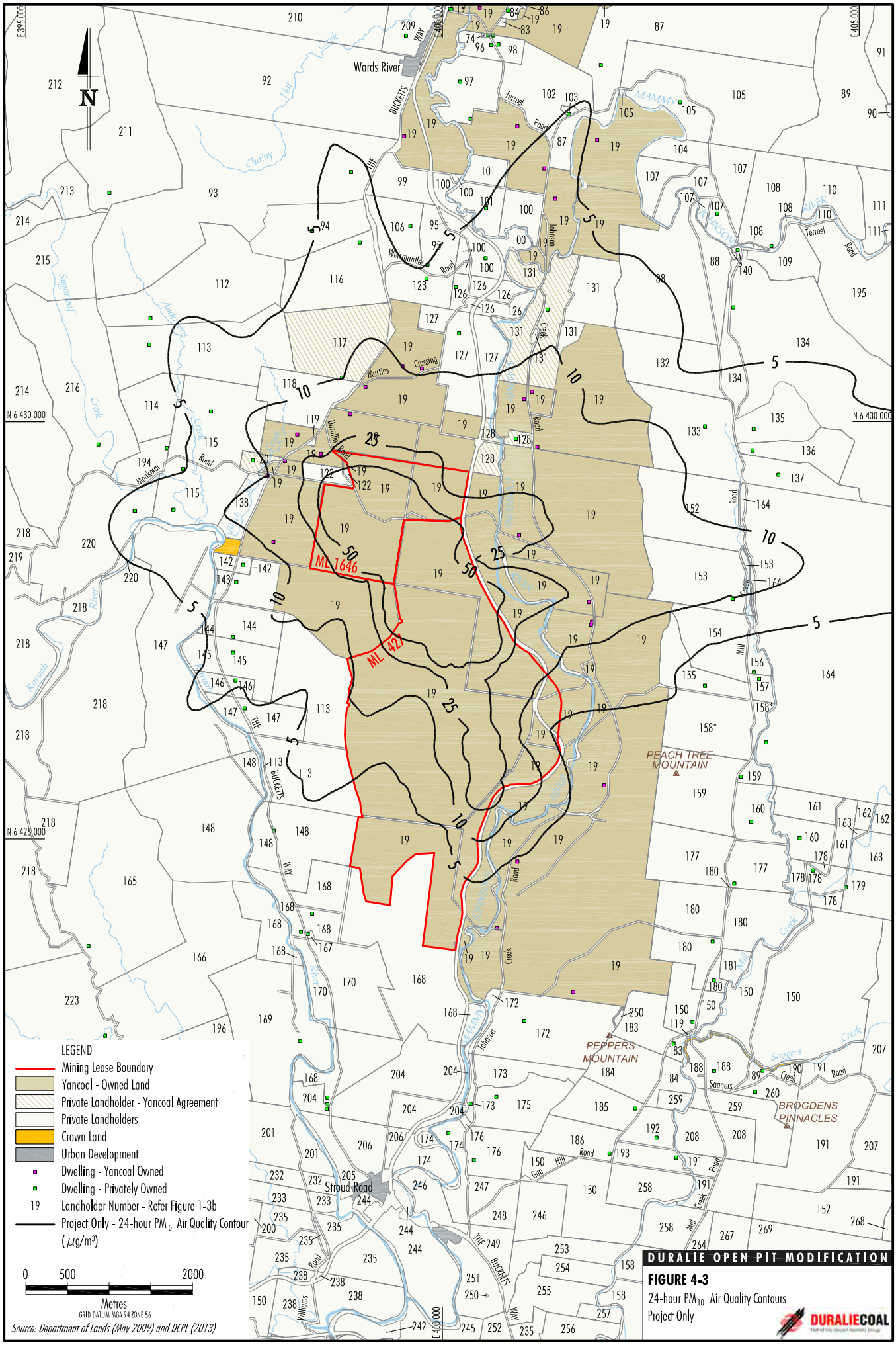
When considering project only dust emissions cumulatively with other sources, no exceedances of annual average PM_{10}, TSP or dust deposition criteria are predicted (Appendix B).

Statistical analysis, where all available 24-hour monitoring data is added to 365 days of Project only 24-hour predictions, has been used by PEL (2014) to demonstrate the Modification is unlikely to result in additional exceedance of the 24-hour average PM_{10} criterion at privately owned residences (i.e. in comparison to exceedances that may occur due to the background sources such as bushfires and dust storms).

During periods of elevated background dust levels (i.e. exceeding DCPL internal performance indicators) the real-time air quality management measures described in the existing Air Quality and Greenhouse Gas Management Plan would be implemented to target compliance with 24-hour average criteria at privately-owned residences. This may include, as required, additional watering of haul roads, or the temporary shutdown of mobile equipment.

4.2.3 Mitigation Measures, Management and Monitoring

DCPL would continue to implement the existing air quality management and monitoring measures detailed in the Air Quality and Greenhouse Gas Management Plan and PRPs for the Modification.



GCL-14-23_Mod 2_Section 4_104B

4.3 GROUNDWATER

A Groundwater Assessment was undertaken for the Modification by HydroSimulations (2014) (Appendix C).

4.3.1 Background

A Groundwater Assessment for the DEP was conducted by Heritage Computing (2009) and peer reviewed by Kalf and Associates (Dr Frans Kalf).

Hydrogeological Data

A conceptual model of the hydrogeological regime was developed for the DEP based on review of the available hydrogeological data. The data supports that there are two separate groundwater systems in the DCM area (Appendix C):

- shallow groundwater system – associated with alluvium (restricted in extent) and regolith; and
- deeper groundwater system, including:
  - the Weismantel and Clareval coal seams; and
  - low permeability/disconnected porous and fractured rock/coal measures of the Mammy Johnsons, Weismantels and Durallie Road Formations.

Recharge to the groundwater system is from rainfall and from lateral groundwater flow. Although groundwater levels are sustained by rainfall infiltration, they are controlled by topography, geology and surface water levels. Local groundwater mounds develop beneath hills and ridgelines. Groundwater moves from these higher elevations toward incised creeks and waterbodies.

Groundwater Use

Groundwater use in the DCM area is predominantly related to DCM mine dewatering. The number of privately held bores in the Project area and surrounds is low due to the high rainfall and subsequent high rates of runoff and widespread use of surface water storages.

Previous Assessment

The key conclusions of the Groundwater Assessment for the DEP were (Heritage Computing, 2009):

- The shallow alluvial groundwater system in which the Mammy Johnsons River sits is hydraulically disconnected from the deeper groundwater system.
- There would be negligible effect on water levels in the alluvials of the Mammy Johnsons River, or on baseflow to/from the Mammy Johnsons River due to mining.
- Negligible predicted drawdown in water levels at privately-owned bores.

Groundwater Monitoring and Management

DCPL implements a Water Management Plan, including a Groundwater Management Plan, which includes:

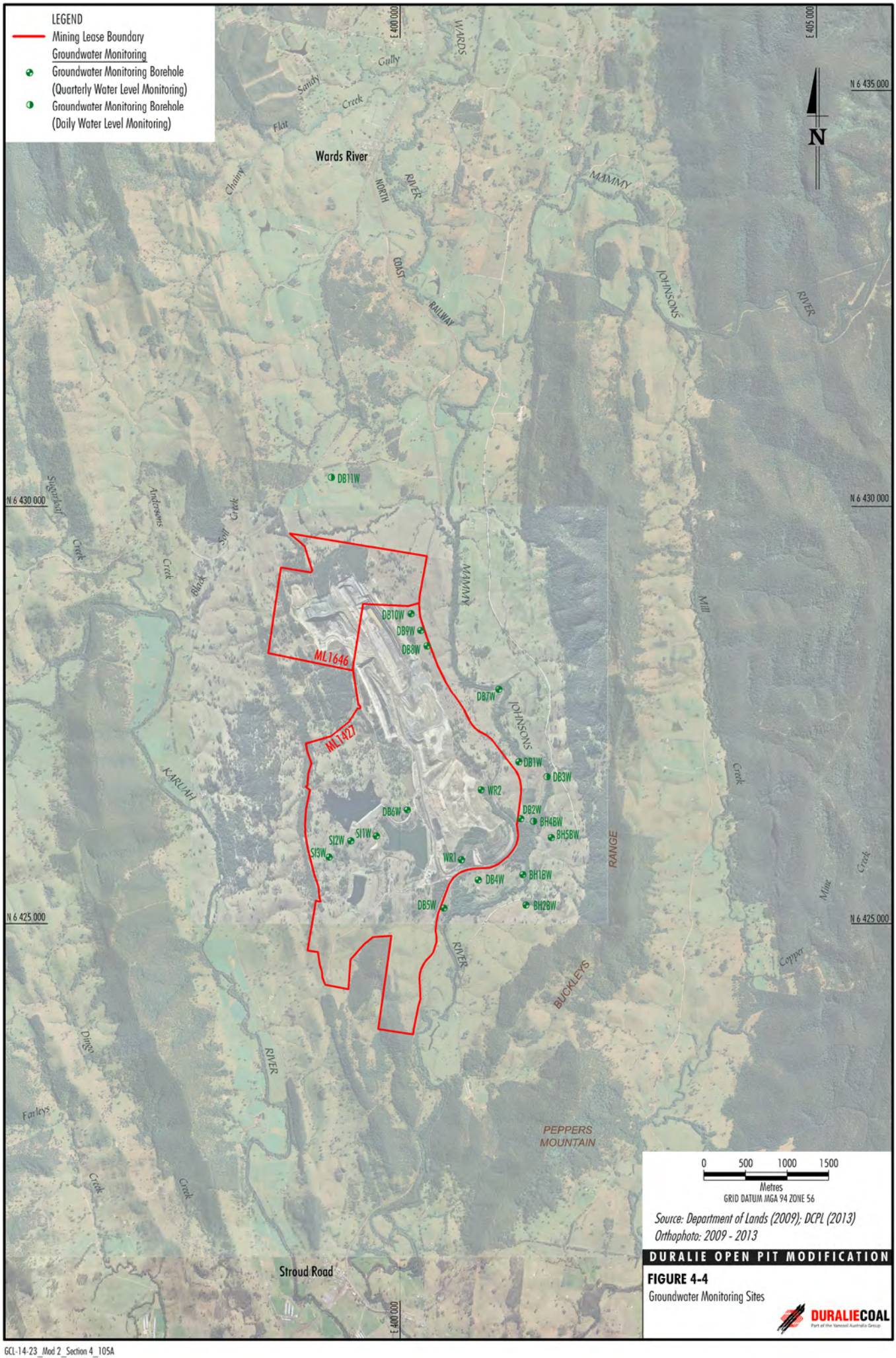
- the groundwater monitoring network (Figure 4-4);
- performance measures and indicators (trigger levels) for investigating any potentially adverse groundwater impacts to the Mammy Johnsons River or privately-owned bores; and
- a contingency plan to respond to greater than negligible impacts to the Mammy Johnsons River or privately-owned bores, including measures to offset any loss of baseflow to the Mammy Johnsons River and make-good provisions at privately-owned bores.

Existing Influence of the DCM

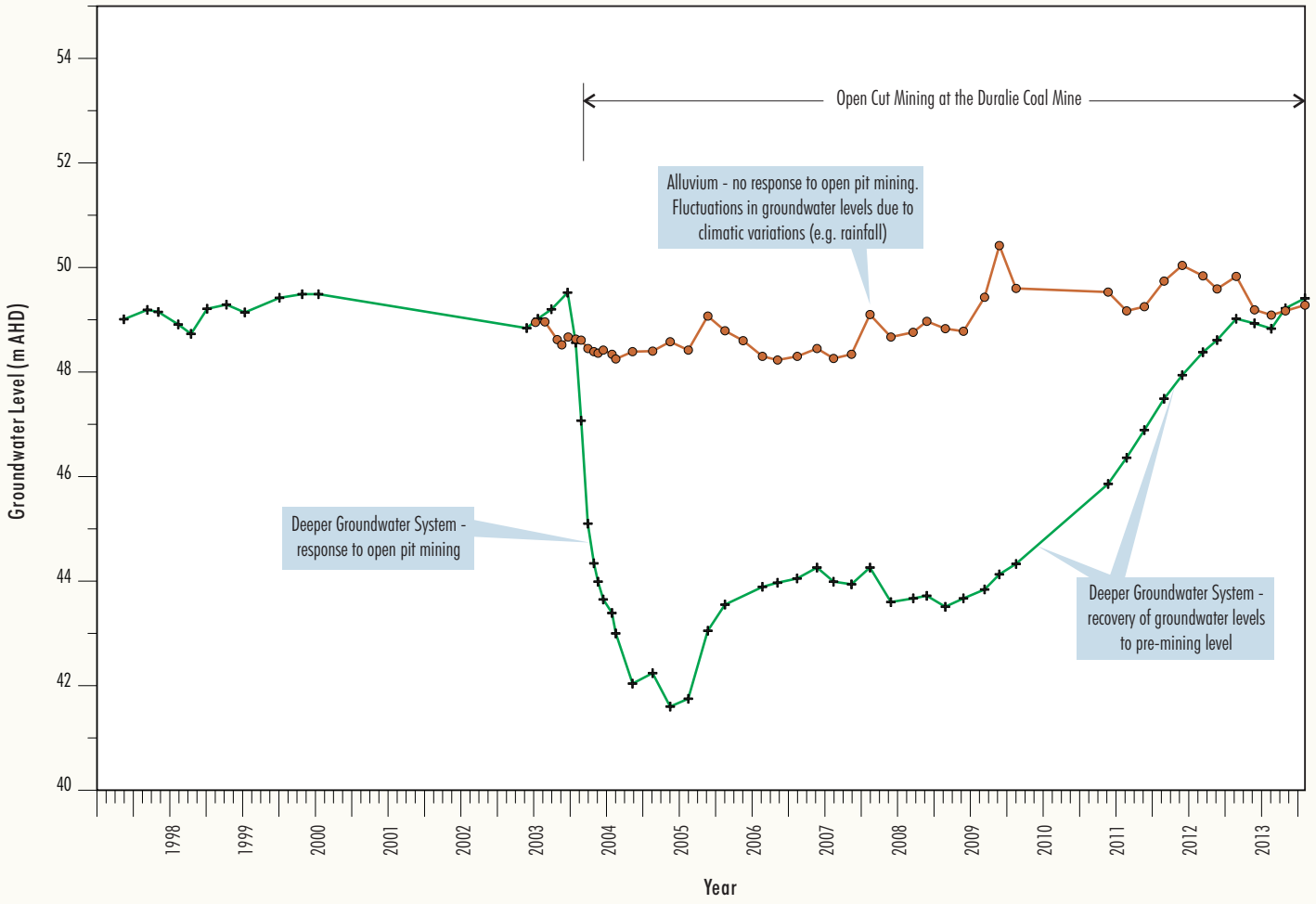
Monitored groundwater levels prior to and during mining at the DCM have been reviewed by HydroSimulations (2014). Consistent with the predictions for the DEP, the monitoring data shows (Appendix C):

- the DCM open pit acts as a groundwater sink, and groundwater nearby maintains a flow direction towards the pit;
- open pit mining at the DCM effects groundwater levels in the deeper groundwater system; and
- open pit mining at the DCM results in no discernible effect on the shallow groundwater system, with no mining effect observed for bores in the alluvium.

Figure 4-5 illustrates that open pit mining the DCM results in no discernible effect on the shallow groundwater system. Figure 4-5 presents groundwater levels at two monitoring bores (BH4BW and DB2W [Figure 4-4]), which are located approximately 265 m apart in the alluvium and Durallie Road Formation, respectively.



GCL-14-23_Mod 2_Section 4_105A



DURALIE OPEN PIT MODIFICATION

FIGURE 4-5
Groundwater Level Responses for the Alluvium and Upper Durallie Road Formation

DURALIECOAL

As shown, there is a clear response in the Durallie Road Formation (DB2W) due to the mining in the overlying Weismantel Seam, however, there is no effect of mining in the alluvium (BH4BW) (Figure 4-5).

By 2013 water levels at DB2W had recovered to their pre-mining (2003) levels.

Groundwater Quality

Groundwater salinity in the DCM area ranges from approximately 100 µS/cm to 7,600 µS/cm (Appendix C). The salinity in the alluvium is lower, generally less than 1,000 µS/cm, reflecting the higher rates of recharge and shorter residence times compared with the underlying strata (Appendix C).

Groundwater Licensing

DCPL currently holds Bore Licence 20BL168404 issued by the NOW to account for groundwater inflow (up to 300 ML in any 12 month period) to the DCM open pits.

4.3.2 Potential Impacts

HydroSimulations (2014) has updated the numerical groundwater model developed for the DEP to account for the following:

- groundwater monitoring data since 2009;
- the increase in the depth of the Clareval open pit (i.e. required to access the same coal reserves approved to be extracted for the DEP) (Section 3.2.2); and
- revised mining sequence (3.2.4).

Based on the updated modelling results, and consistent with the conclusions of the DEP Groundwater Assessment, it is predicted (Appendix C):

- There would be negligible impact to the shallow alluvial groundwater system in which the Mammy Johnsons River sits, or river leakage/baseflow contributions from/to the Mammy Johnsons River.
- There would be negligible impacts to other groundwater users.

In addition, there are no predicted impacts to groundwater dependent ecosystems (Appendix C).

Groundwater Licensing

Groundwater inflow to the open pit is predicted to be below the existing licensed allocation of 300 ML/annum for the remainder of the mine life (Appendix C).

As the *Draft North Coast Fractured and Porous Rock Groundwater Sources* water sharing plan has not yet commenced, groundwater inflow to the DCM open pits remains managed and licensed under the *Water Act, 1912*.

As such, no additional licenses are required, and licensing of groundwater inflow to the DCM open pits would continue in accordance with the conditions of the existing *Water Act, 1912* Licence 20BL168404, until such a time as a water sharing plan relevant to the DCM is implemented.

Further detail regarding water licensing for the Modification is provided in Attachment 2.

Aquifer Interference Policy

HydroSimulations (2014) concludes the Modification is within the 'Level 1' minimal impact considerations outlined in the Aquifer Interference Policy, which means potential impacts to groundwater aquifers would be 'acceptable' in accordance with the Aquifer Interference Policy.

Further detail on the Aquifer Interference Policy is provided in Attachment 2.

Final Voids

Consistent with the findings for the DEP, the final voids are predicted to slowly fill over time, with the final water levels predicted to stabilise below the spill levels (Section 3.4.4).

Negligible impact to groundwater quality in the shallow alluvium in which the Mammy Johnsons River sits is predicted post-mining (Appendix C).

4.3.3 Mitigation Measures, Management and Monitoring

Groundwater monitoring and management for the DCM would continue to be conducted in accordance with the Groundwater Management Plan, which would be reviewed and updated as required for the Modification.

4.4 SURFACE WATER

A Surface Water Assessment for the Modification was conducted by Gilbert & Associates (2014) and is presented in Appendix D.

The existing/approved DCM and modified DCM water management systems are described in Sections 2.4 and 3.4, respectively.

4.4.1 Existing Environment

The surface water quality and flow regimes in the DCM area are influenced by the existing DCM, and historical extensive clearing for grazing on native and improved pastures and other agricultural activities in the surrounding rural lands.

The sub-sections below present a description of the regional and local hydrology surrounding the DCM and a summary of the water quality data collected as part of the DCM environmental monitoring program. A description of the existing waste rock geochemistry management measures is also provided.

Regional and Local Hydrology

The DCM area is situated within the Mammy Johnsons River catchment, a tributary of the Karuah River.

Streamflows in the Karuah River and Mammy Johnsons River are characterised by low to moderate flows for long periods, with periods of higher discharge following heavy rains, typical of small and medium sized upland catchments (Appendix D).

The DCM is also situated in the catchments of Coal Shaft Creek (as diverted as part of the approved DCM) and an unnamed minor tributary stream which both flow into the lower reaches of Mammy Johnsons River.

A summary of the catchments within the DCM area and surrounds is provided in Table 4-2.

Table 4-2
Catchment Area Summary

Stream	Location	Catchment Area (km^2)
Coal Shaft Creek (following existing diversion [Figure 2-1])	Within existing DCM disturbance area and additional Modification disturbance areas	5.7
Unnamed Tributary to Mammy Johnsons River	Partly within existing DCM disturbance area and additional Modification disturbance areas	2.9
Mammy Johnsons River	To the north-east and south of the DCM area	320
Karuah River	To the north-west and south of the DCM area	1,470

Source: After Appendix D.

A detailed description of regional and local hydrology is provided in Appendix D.

Site Water Management and Monitoring

Surface water monitoring and management at the DCM is conducted in accordance with the Site Water Management Plan, including the approved Site Water Balance and Surface Water Management Plan (incorporating the Irrigation Management Plan.

The existing water management system has operated effectively to minimise potential impacts to the surrounding environment via the prevention of up-catchment runoff from entering the mining areas and the containment and reuse of water captured on-site (Appendix D).

Surface Water Quality

No change in water quality of the Karuah River or Mammy Johnsons River has been observed since the approval of the DEP (Appendix D).

DCM Potentially Acid Forming Material Management

Management of PAF materials at the DCM is currently conducted in accordance with the PAFMMP component of the Surface Water Management Plan. A description of the existing PAF material management at the DCM is provided in Section 2.2.8.

Open pit surface water monitoring results indicate the existing operational controls described in Section 2.2.8 have been successful in controlling the release of acid from PAF material (Appendix D).

4.4.2 Potential Impacts

The following sub-sections describe the potential operational and post-mining impacts of the Modification on site water management, surface water flow regimes and surface water quality.

Revised Site Water Balance

In general, there would be no changes to the existing water management system (Section 2.4.2) as a result of the Modification (i.e. the water management system schematic shown in Figure 2-2 would not change).

Notwithstanding the above, the Modification would result in a portion of the existing upslope diversion to the west of the Clareval open pit being relocated to accommodate the additional surface development extent of the Clareval open pit (Section 3.2.2) (Figures 3-1 and 3-2).

The proposed changes to the dimensions of the Clareval open pit and the revised progression of mining in the open pits would also change the timing of the availability of water storage in comparison to the simulated water balance for the DEP.

In addition, the proposed increased waste rock emplacement elevation (Section 3.2.8) would change the catchment area for surface runoff captured by the water management system.

To account for the minor changes to the water management system (Section 3.4.2), a revised site water balance has been conducted for the life of the DCM incorporating the Modification, and for post-mining.

The risk of overflow from the MWD and the open pits was evaluated as part of the site water balance (Appendix D). There was no overflow from the MWD and open pits during the 1,000 climatic sequences simulated.

Surface Water Flow Regimes

Changes in Contributing Catchment

The surface water flow regimes in Coal Shaft Creek and the unnamed tributary to Mammy Johnsons River would be affected by minor changes in catchment area as a result of runoff capture in Modification disturbance areas. Table 4-3 summarises the potential minor changes in catchment area in these creeks as a result of the Modification.

Table 4-3
Changes to Contributing Catchment of Local Creeks

Catchment	Total Pre-mining Catchment Area (km^2)	Area Captured in Water Management System (km^2)	
		Approved DCM	Modified DCM
Coal Shaft Creek	9	5.2	5.2
Unnamed Tributary to Mammy Johnsons River	2.9	0.8	0.9

Source: Appendix D.

The existing catchment area of Coal Shaft Creek and the unnamed tributary to Mammy Johnsons River contribute approximately 3.2% of the total catchment area of Mammy Johnsons River. The loss of a further 0.1 km^2 total catchment as part of the Modification (Table 4-3), represents approximately 0.1% of the total catchment of Mammy Johnsons River. The cumulative loss (with the existing DCM) of 8.0 km^2 total catchment represents approximately 2% of the total catchment of Mammy Johnsons River (Appendix D).

It should be noted that the catchments of Coal Shaft Creek and the unnamed tributary to Mammy Johnsons River would be progressively reinstated as the waste rock emplacements are rehabilitated and become free draining. Following the completion of rehabilitation post-mining, only the catchment areas of the final voids (approximately 1.2 km^2 or less than 0.05% of the total catchment of the Mammy Johnsons River) would remain excised from the catchment.

Given the change in the Mammy Johnsons River catchment would be minor, the impact of the Modification on the Mammy Johnsons River flow regime would be negligible (Appendix D).

Potential Impacts on Groundwater Baseflow Contributions

HydroSolutions (2014) concluded potential impacts on the Mammy Johnsons River as a result of the Modification would continue to be negligible (Section 4.3.2).

Surface Water Quality

Runoff and Contaminants

As described above, the risk of overflow from the MWD and the open pits has been evaluated and there was no overflow from the MWD and open pits during the 1,000 climatic sequences simulated (Appendix D).

Surface runoff from disturbed areas at the DCM would continue to be captured on-site and, therefore, there would be no change to approved impacts associated with the potential release of this surface runoff from disturbed areas (Appendix D).

Acid Rock Drainage

DCPL would continue to conduct the management of PAF materials at the DCM in accordance with the PAFMMP component of the Surface Water Management Plan.

No change to the geochemical characteristics of the waste rock is expected for the Modification, and as such, the existing operational controls (Section 2.2.8) would continue to control the potential release of acid from PAF material.

Runoff from Irrigation Areas

The approved irrigation system or management regime (including the first flush protocol) would not change as a result of the Modification (Section 3.4.2).

Direct runoff of irrigation water would continue to be avoided by management of irrigation in accordance with the Irrigation Management Plan.

Given there are no changes proposed to the approved irrigation system or management regime, the Modification is not expected to change potential surface water impacts associated with irrigation area runoff (Appendix D).

Groundwater Quality

There would be negligible impact on water quality in the Mammy Johnsons River due to interaction with groundwater (Appendix C).

Post-Mining Surface Water Impacts

Post-mining inflows to the Clareval and Weismantel final voids would comprise incident rainfall, runoff and seepage from the sides of the voids and their adjacent contributing catchment, seepage from coal seam groundwater and waste rock emplacement infiltration. Water would be lost from the voids through evaporation.

The revised final void water balance predicted the final voids would not overflow to downstream watercourses under all assessed climatic scenarios (Appendix D).

There would be no change to the seepage management measures at the southern toe of the existing waste rock emplacement, which are designed to prevent seepage from the waste rock emplacement for the Modification.

4.4.3 Mitigation Measures, Management and Monitoring

Surface water monitoring and management for the DCM incorporating the Modification, would continue to be conducted in accordance with the Water Management Plan.

The Water Management Plan would be reviewed and, where necessary, updated to incorporate the Modification.

4.5 FLORA ASSESSMENT

A Flora Assessment has been prepared for the Modification by Dr Colin Bower of FloraSearch (2014) (Appendix E).

4.5.1 Background

Previous Assessment and Flora Surveys

Numerous flora studies have been undertaken as part of environmental assessments for various stages of the DCM (ERM Mitchell McCotter, 1996a; Woodward-Clyde, 1996a; FloraSearch, 2005; EcoBiological, 2009a, 2009b).

Surveys for the Modification

The vegetation within the 2.5 ha Modification disturbance area and proposed biodiversity offset area was surveyed by EcoBiological (2009a, 2009b) for the DEP. However, in recognition of the time that has passed since those surveys, additional flora surveys were conducted by FloraSearch in April and May 2014.

The flora surveys were designed and undertaken in conformance with the Department of Environment and Conservation (DEC) (2004a) and OEH (2013). Flora survey techniques included quadrat sampling, random meanders, vegetation mapping, vegetation condition assessment as well as searches for potentially occurring threatened flora species listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and their habitat.

Plant Community Types

As part of the Flora Assessment (Appendix E), the vegetation communities that occur within the Modification disturbance area and proposed biodiversity offset area were assigned to Plant Community Types, a new standard classification system for native vegetation in NSW (OEH, 2014).

The Modification disturbance area is predominantly cleared and comprises derived grasslands (Derived Grasslands in Coastal Valleys [HU670]) (Figure 4-6). There are two small patches of Spotted Gum – Grey Ironbark dry open forest of the lower foothills of the Barrington Tops, North Coast (HU630) (herein referred to as Spotted Gum – Grey Ironbark dry open forest) in the Modification disturbance area. Both patches of open forest are on the edge of the existing approved open pit (Figure 4-6).

The Spotted Gum – Grey Ironbark dry open forest occurs more extensively outside of the Modification disturbance area as do the derived grasslands (Figure 4-6). A review of historic aerial photographs for the general area shows that the area has been extensively cleared in the past with a greater vegetation cover in more recent years (Appendix E). A vegetation condition assessment was also undertaken by FloraSearch (2014) and the results are presented in Appendix E.

Grey Myrtle – Flintwood Dry Rainforest was also mapped during the flora surveys (Figure 4-6), but the proposed relocated water diversion infrastructure has been designed to avoid disturbance of this Plant Community Type (i.e. it is located outside of the Modification disturbance area).

Threatened Ecological Communities

No threatened ecological communities listed under the TSC Act or EPBC Act has been recorded within the Modification disturbance area (Appendix E).

Regionally Significant Vegetation and Vegetation Corridors

The Spotted Gum – Grey Ironbark dry open forest is moderately cleared in the region (35%) (Department of Environment, Climate Change and Water, 2008; Appendix E) and this open forest in the Modification disturbance area is not part of a recognised regional vegetation corridor.

Threatened Flora Species and Populations

No threatened flora species listed under the TSC Act or EPBC Act has been recorded at the DCM (despite surveys since 1996).

FloraSearch (2014) undertook additional targeted surveys for potentially occurring threatened flora species and no threatened flora species were recorded in the Modification disturbance area (Appendix E).

No threatened flora populations listed under the TSC Act are relevant to the Modification disturbance area (Appendix E).

Critical Habitat

No critical flora habitat occurs within the vicinity of the Modification disturbance area (Appendix E).

Groundwater Dependent Vegetation

No groundwater dependent vegetation has been identified on or near the Modification disturbance area (Appendix E).

Existing Mitigation Measures

DCPL implements the following environmental management plans and other documents relevant to the management of flora and fauna at the DCM:

- BMP;
- GBFMP; and
- DCM Rehabilitation Management Plan.

A summary of the mitigation measures at the DCM (relevant to flora and fauna and the Modification) are provided in Table 4-4. Additional mitigation measures at the DCM are provided in the environmental management plans listed above.

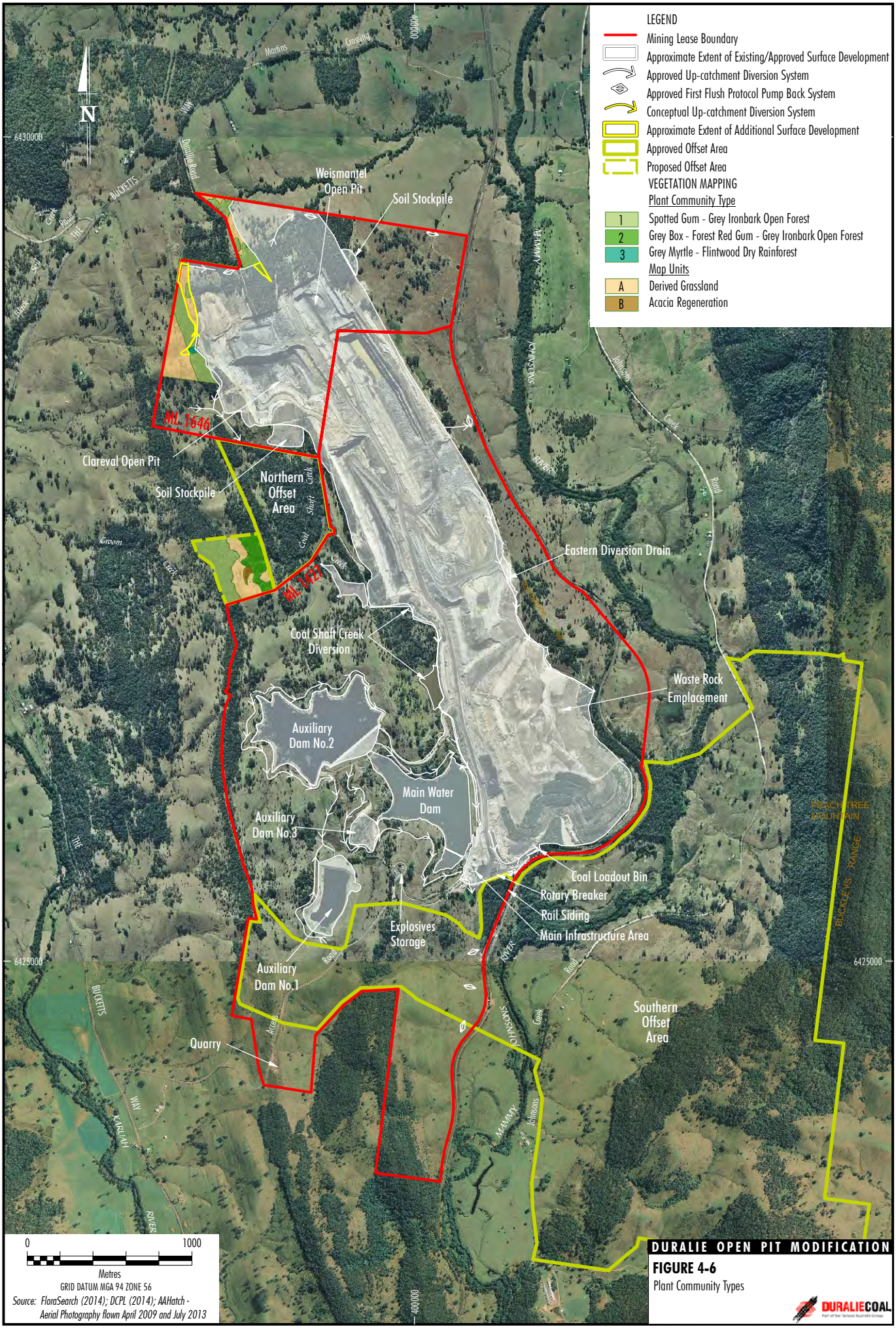

LEGEND
Mining Lease Boundary
Approximate Extent of Existing/Approved Surface Development
Approved Up-catchment Diversion System
Approved First Flush Protocol Pump Back System
Conceptual Up-catchment Diversion System
Approximate Extent of Additional Surface Development
Approved Offset Area
Proposed Offset Area
VEGETATION MAPPING
Plant Community Type
1 Spotted Gum - Grey Ironbark Open Forest
2 Grey Box - Forest Red Gum - Grey Ironbark Open Forest
3 Grey Myrtle - Flintwood Dry Rainforest
Map Units
A Derived Grassland
B Acacia Regeneration
N
6430000
6425000
400000
408000
Martins Crossing
Duralie Road
BUCKETTS WAY
THE Creek Road
Shaft Creek
Weismantel Open Pit
Soil Stockpile
ML 1646
Clareval Open Pit
Soil Stockpile
Northern Offset Area
Shaft Creek
Coal Creek
Croom Creek
ML 1477
Coal Shaft Creek Diversion
Eastern Diversion Drain
Waste Rock Emplacement
Auxiliary Dam No.2
Main Water Dam
Auxiliary Dam No.3
Coal Loadout Bin
Rotary Breaker
Rail Siding
Main Infrastructure Area
Explosives Storage
Auxiliary Dam No.1
Quarry
Southern Offset Area
HAMMY
JOHNSONS
Johnsons Creek Road
PEACH TREE MOUNTAIN
BUCKLEYS RANGE
KARUAH RIVER
0
1000
Metres
GRID DATUM MGA 94 ZONE 56
Source: FloraSearch (2014); DCPL (2014); AAHatch - Aerial Photography flown April 2009 and July 2013
DURALIE OPEN PIT MODIFICATION
FIGURE 4-6
Plant Community Types
DURALIECOAL

Table 4-4
Existing Impact Mitigation Measures at the DCM Relevant to Flora and Fauna

Measure	Description
Protecting Vegetation and Soil	During clearing activities or construction works, the boundary between proposed disturbance areas and vegetation immediately adjoining proposed disturbance areas is clearly marked or fenced to prevent accidental damage. Clearing is restricted to the minimum area necessary to undertake the approved activities.
Rehabilitating Creeks and Drainage Lines	The DCM Rehabilitation Management Plan describes management of the post-mine landforms. It also covers rehabilitation of the Coal Shaft Creek Diversion.
Managing Potential Impacts from Salinity Through Irrigation	The DCM Water Management Plan describes the vegetation monitoring programme for the irrigation areas. The following factors are monitored annually: flora species composition, growth rates, grazing levels (where relevant), harvesting (where relevant) and rotation of irrigation areas.
Vegetation Clearance Protocol	A vegetation clearance protocol has been developed as part of the BMP to minimise the impact of vegetation clearance activities on flora and fauna. The key components of the protocol are delineation of areas to be cleared of native remnant vegetation, pre-clearance surveys, fauna management measures and vegetation clearance supervision.
Replacement of Habitat Features	Hollow bearing trees that are required to be cleared as part of the clearing activities are to be substituted with artificial habitat boxes. The Nest Box Programme described in the BMP aims to provide supplementary habitat for birds, arboreal mammals and bats.
Speed Limits	Speed limits of 60 km per hour imposition on vehicles using the mine roads and tracks.
Collecting and Propagating Seed	During the vegetation clearance protocol, trees are checked for their provision of seed to use in the rehabilitation programme, followed by the collection of seed during felling activities. A key aim of seed collection is to collect local provenance seed stock for propagation purposes.
Salvaging and Reusing Material for Habitat Enhancement	Habitat features (e.g. trunks, logs, large rocks, branches, small stumps and roots) are salvaged during vegetation clearance activities and stockpiled for relocation to areas undergoing rehabilitation.
Weed Control	Weeds are identified via regular site inspections and communication with leasees and regulatory authorities. An active weed control programme is implemented.
Feral Pest Control	Monitoring of feral animals (including pigs, foxes, dogs, rabbits and other previously unnoted pest species) is undertaken by a suitably qualified practitioner. An active feral animal programme is implemented.
Controlling Vehicle Access	Vehicle access within the mine site is limited to authorised personnel only.
Bushfire Management	If a significant bushfire were to occur at the DCM the local Rural Fire Service would be called for assistance. The Rural Fire Service, if required, would be assisted by mine personnel and mine resources. The mine has a water cart with a water cannon and fire suppressant foam, trailer mounted fire-fighting equipment and dozers.

Existing Biodiversity Offset Strategy

DCPL has established offset areas on DCPL owned land to the west and south-east of the DCM (i.e. the Northern and Southern Offset Areas) (Figure 4-6). The existing biodiversity offset areas have a combined area of approximately 680 ha. The broad completion criteria from Project Approval (08_0203) are outlined in Table 4-5.

Table 4-5
Offset Strategy Completion Criteria

Domain	Completion Criteria
Enhancement areas (i.e. existing remnant vegetation)	Areas of remnant vegetation within the offset area (290ha) have been conserved and enhanced.
Revegetation areas	354 ha of revegetated woodland/open woodland habitat areas and 36 ha of revegetated forest habitat areas as a self-sustaining ecosystem.
Direct links between the offset area and rehabilitation area	Native vegetation has been established which directly links vegetation areas of the offset area with the rehabilitation area.

The approved BMP includes detailed management measures for the existing biodiversity offset areas, including:

- encouraging native regeneration by providing appropriate fencing to exclude grazing from existing treed areas;
- selective revegetation in derived grasslands by appropriate plantings or seeding using local seed sources;
- managing weeds and pests;
- managing fire including mosaic burnings likely needed to optimise species diversity;
- creating signage of the proposed biodiversity offset area;
- installation of artificial tree hollows;
- restricting vehicular and people access; and
- monitoring of ongoing management performance, habitat quality and diversity, species diversity, landscape resilience and landscape function within the existing biodiversity offset areas, by suitably qualified person(s).

Works associated with the existing biodiversity offset areas to date have included the following:

- installation and ongoing monitoring of 124 artificial tree hollows (nest boxes) for birds, arboreal mammals and bats;
- installation of fencing to exclude grazing of livestock;
- collection of seed for revegetation works (with revegetation works scheduled for August 2014);
- assessment of baseline landscape function analysis by Dr David Freudenberger (Australian National University);
- surveys of feral animals by Australian Museum Consulting;
- control of weeds and feral animals by licenced contractors; and
- lodgement of a conservation bond with DP&E.

4.5.2 Potential Impacts

Vegetation Clearance

The additional surface development associated with the Modification would involve the clearance of only small areas of native open forest (approximately 0.7 ha of Spotted Gum – Grey Ironbark dry open forest), with the remaining 1.8 ha of the Modification disturbance area having been previously cleared prior to the commencement of mining activity at the DCM (Table 4-6).

Table 4-6
Clearance of each Plant Community Type within the Modification Disturbance Area

Plant Community Type	Approximate Area to be Cleared (ha)
1. Spotted Gum – Grey Ironbark dry open forest of the lower foothills of the Barrington Tops, North Coast (HU630)	0.7
2. Derived Grasslands in Coastal Valleys (HU670)*	1.8
Total	**2.5**

* This is a native grassland which is derived as a result of previous clearance.

The Modification would, therefore, result in a negligible increase in the fragmentation of native vegetation. The two small patches of native vegetation that would be cleared for the Modification are not part of landscape corridors.

Potential Impacts from Irrigation

There would be no change to approved DCM irrigation practices due to the Modification and, therefore, no additional potential impacts on existing native vegetation are expected as a result of the Modification (Appendix E).

Introduced Flora and Fauna

DCPL has an existing weed management programme at the DCM. The Modification would involve minor additional clearance activities (which have the potential to act as a catalyst for weed incursion), however, the Modification would not present any different impact pathways for weeds to be introduced at the DCM.

Similarly, the Modification would not increase habitat opportunities for feral animals (since a portion of the Modification disturbance area would form part of the open pits) and the existing feral animal management program at the DCM would be continued.

Vegetation and Dust

There is no predicted increase in air quality impacts for the Modification in comparison to those currently approved for the DEP (Appendix B).

High Frequency Fire

The Modification would not change the existing fire management measures at the DCM (Section 4.5.1). The overall risk of increased bushfire frequency due to the Modification is likely to be very low (Appendix E).

Threatened Flora Species

No threatened flora species have been recorded in the Modification disturbance area (Section 4.5.1). Potential impacts of the proposed Modification on flora were assessed in accordance with the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) due to the Modification being assessed under Section 75W Part 3A of the EP&A Act (Appendix E).

Given no direct or indirect impacts are expected, the Modification would be unlikely to significantly impact any threatened flora species listed under the TSC Act (Appendix E). Similarly, the Modification would not significantly impact any threatened flora species listed under the EPBC Act (Appendix E).

4.5.3 Impact Avoidance and Mitigation Measures

Impact avoidance and mitigation measures for the Modification are provided below.

Impact Avoidance

The changes to the surface development extents of the open pits are required to improve geotechnical stability and, therefore, additional disturbance associated with these changes to the open pit limit cannot be avoided without potentially impacting the long-term stability of the open pit low walls (Section 3.2.2).

The relocation of existing water diversion infrastructure adjacent to the Clareval open pit (i.e. as a result of the Modification) has been designed to occur within derived grassland wherever possible to avoid additional disturbance of native vegetation. In addition, the relocated water diversion infrastructure has been designed to avoid disturbance of Grey Myrtle – Flintwood Dry Rainforest, which is not a threatened community, but is not found elsewhere in the immediate surrounds.

Impact Mitigation

Potential impacts to flora and fauna are currently managed through implementation of measures included in the BMP, GBFMP and DCM Rehabilitation Management Plan (Section 4.5.1). These measures would continue to be implemented and management plans would be updated where relevant. In particular, the BMP would be revised to incorporate the proposed biodiversity offset area.

4.5.4 Biodiversity Offset Strategy

Proposed Biodiversity Offset Area

The biodiversity offset strategy for the Modification is consistent with the existing DCM offset strategy, and involves conserving areas of land with existing conservation values and providing active management to maintain and enhance their values. DCPL propose to extend the Northern Offset Area to include an additional 12.5 ha of land for the Modification (Figure 4-6). The proposed biodiversity offset area is located on DCPL owned land.

Table 4-7 provides a summary of the revised biodiversity offset strategy. Within the proposed biodiversity offset area, existing native vegetation communities would be enhanced (approximately 9 ha) and cleared land would be revegetated (approximately 3.5 ha).

During consultation with OEH (5 June 2014) (Section 1.5), OEH indicated the biodiversity offset area appeared to be suitable for the proposed disturbance for the Modification.

Table 4-7
Revised Biodiversity Offset Strategy for the Modification

Domain	Existing Biodiversity Offset Strategy	Additional Biodiversity Offset Area	Revised Biodiversity Offset Strategy
Enhancement areas (i.e. existing remnant vegetation)	290	9	299
Revegetation areas	354	3.5	357.5
Total	**644**	**12.5**	**656.5**

Methodology for Selecting the Biodiversity Offset Areas

The proposed offset (its area, location and proposed management) was selected on the basis of a range of factors, including:

- the location of the proposed biodiversity offset area relative to the Modification disturbance area;
- the location of existing offset areas;
- the land tenure available on which to locate a proposed biodiversity offset area (i.e. DCPL owned land);
- the location of potential mineral resources;
- the occurrence of the same Plant Community Types and habitat types as the Modification disturbance area;
- the shape of the proposed biodiversity offset area in relation to the spatial arrangement of existing vegetation and offset areas;
- the vegetation/fauna habitat composition/condition of the Modification disturbance area relative to the proposed biodiversity offset area;
- the fauna species present (including threatened species) and the habitat needed to maintain local populations of the species;
- the size of the proposed biodiversity offset area relative to the Modification disturbance area;
- the ecosystem resilience and condition of the proposed biodiversity offset area; and
- existing infrastructure – e.g. roads, rail, powerlines, houses and the proposed Gloucester Gas pipeline corridor (all outside of the proposed biodiversity offset area).

In addition to the above, a reconciliation of the proposed biodiversity offsets against the relevant State (OEH's *NSW Offset Principles for Major Projects [State Significant Development and State Significant Infrastructure]*) was undertaken by FloraSearch (Appendix E) and Australian Museum Consulting (Appendix F). A summary of the reconciliation is provided later in this section.

Locality Information

The proposed biodiversity offset area is suitably located as it is:

- within the same general locality as the Modification disturbance area and, therefore, has the potential to benefit the same flora and fauna species populations that may be adversely impacted by the Modification;
- adjacent to an existing offset area thereby creating a larger single conserved area;
- the property is wholly DCPL owned land; and
- the location is not known to be prospective for mineral resources.

The proposed biodiversity offset area is currently being used for grazing by cattle and existing infrastructure in the proposed biodiversity offset area comprise tracks and fences. There are no roads, rail lines, powerlines, houses or pipelines within, or adjacent to, the proposed biodiversity offset area.

Plant Community Types

Table 4-8 compares the Plant Community Types within the Modification disturbance area with those in the proposed biodiversity offset area. The proposed biodiversity offset area:

- contains like-for-like vegetation (compared to the Modification disturbance area);
- is substantially larger than the Modification disturbance area (with greater representation of the same Plant Community Types that would be cleared);
- contains derived grasslands (3.5 ha) that will be revegetated to forest to result in an increase in forest area; and
- is a suitable shape that incorporates like-for-like vegetation and minimises the area to perimeter ratio.

FloraSearch (Appendix E) describe that the area of Community 1 is overall considered to be in very good condition and that of Community 3 varies from moderate to very good condition.

Table 4-8
Quantification of Native Plant Community Types in the Modification Disturbance Area and Proposed Biodiversity Offset Area

Plant Community Type	Approximate Area to be Cleared (ha)	Approximate Area in Offset (ha)
1. Spotted Gum – Grey Ironbark dry open forest of the lower foothills of the Barrington Tops, North Coast (HU630)	0.7	5.2
2. Derived Grasslands in Coastal Valleys (HU670)*	1.8	3.5
3. Grey Box – Forest Red Gum – Grey Ironbark open forest of the hinterland ranges of the North Coast (HU549)	0	3.5
4. Acacia Regeneration	0	0.3
Total	**2.5**	**12.5**

Source: After Appendix E.

* This is a native grassland which is derived as a result of previous clearance.

Broad Fauna Habitat Types and Threatened Fauna

Table 4-9 compares the broad fauna habitat types within the Modification disturbance area with those in the proposed biodiversity offset area. The proposed biodiversity offset area:

- contains the same broad fauna habitat types as those in the Modification disturbance area;
- is substantially larger than the Modification disturbance area (with greater representation of the same broad fauna habitat types that would be cleared);
- is currently being used for grazing by cattle and removal of cattle has the potential to improve the habitat complexity of the fauna habitat;
- contains known habitat for a number of threatened fauna species and potential habitat for all threatened fauna species recorded within, or near, the Modification disturbance area;
- contains patches or individuals of large old growth eucalypts (with tree hollows) surrounded by 40 to 50 year old regeneration (Appendix E); and
- has greater capacity to provide habitat for fauna when compared to the Modification disturbance area (e.g. the proposed biodiversity offset area is adjacent to an existing offset area and the habitat in the Modification disturbance area is fragmented and on the edge of the DCM approved open pit).

Five threatened fauna species have been recorded within the proposed biodiversity offset area (Figure 4-7):

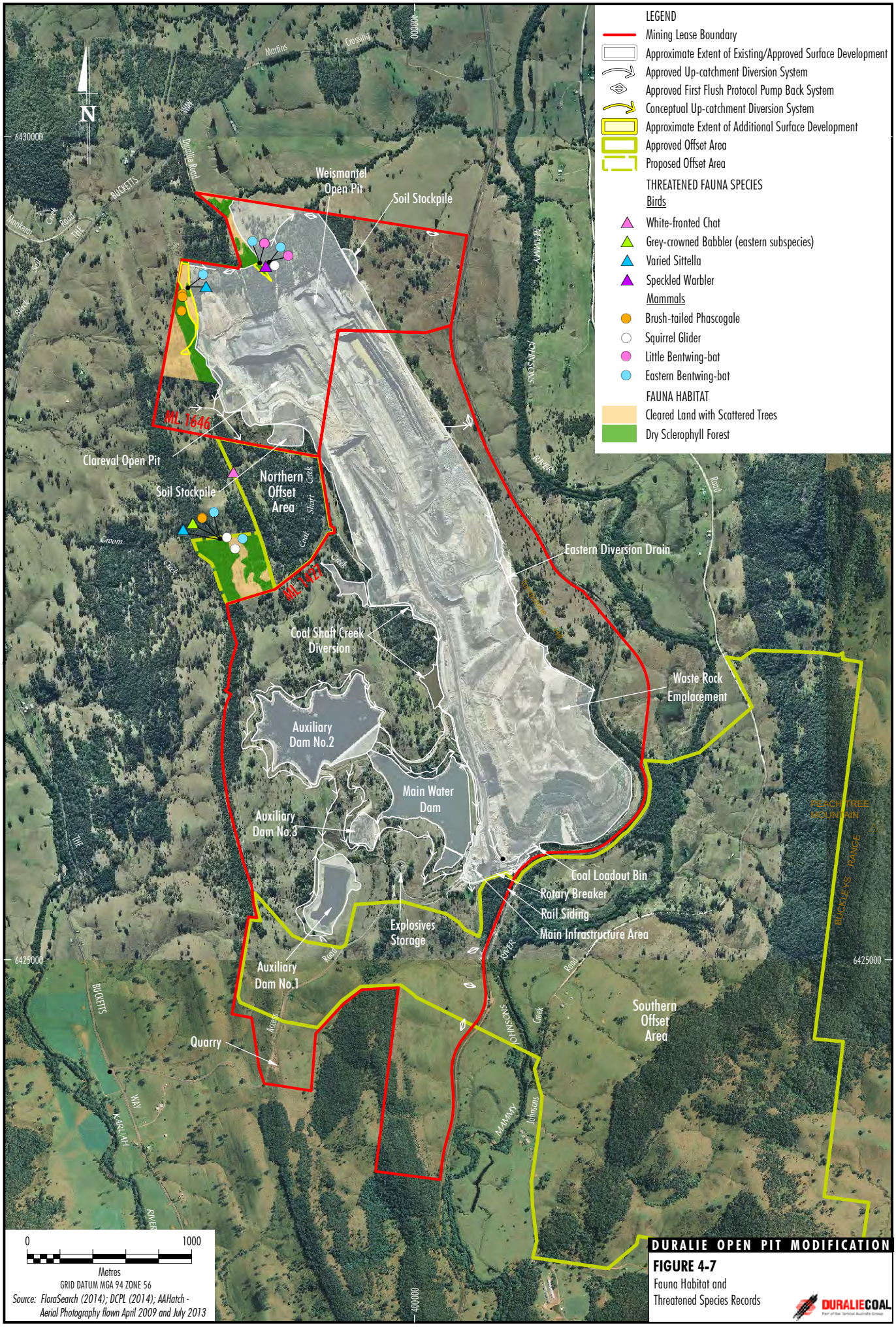
- Varied Sittella;
- Grey-crowned Babbler (eastern subspecies);
- Squirrel Glider;
- Brush-tailed Phascogale; and
- Eastern Bentwing-bat.

The offset area provides potential habitat for the Speckled Warbler and Little Bentwing-bat (two threatened fanua species recorded near the Modification disturbance area).

Table 4-9
Quantification of Broad Fauna Habitat Types in the Modification Disturbance Area and Proposed Biodiversity Offset Area

Broad Habitat Type	Approximate Area to be Cleared (ha)	Approximate Area in Offset (ha)
Dry Sclerophyll Forest	0.7	9
Cleared Land with Scattered Trees	1.8	3.5
Total	**2.5**	**12.5**

Source: After Appendix F.



GCL-14-23_Mod2_Section 4_202B

The existing consent condition for the DCM describes habitat for threatened species in the existing offset strategy. Table 4-10 provides the habitat for threatened species in the existing and proposed offset areas.

Ecological Gains

The land in the proposed biodiversity offset area is currently used for grazing purposes. Ecological gains from the proposed biodiversity offset area are listed below (Appendices E and F):

- The proposed biodiversity offset area provides an opportunity to provide a net gain in vegetation communities/broad fauna habitat types present in the proposed biodiversity offset area through natural regeneration.
- The proposed biodiversity offset area is adjacent to an existing conserved area thereby creating a larger single conserved area;
- The proposed biodiversity offset area is within the same general locality as Modification disturbance area and, therefore, has the potential to benefit the local fauna populations that would be adversely impacted by the Modification.
- The proposed biodiversity offset area contains existing records of the Varied Sittella, Grey-crowned Babbler [eastern subspecies], Squirrel Glider, Brush-tailed Phascogale and Eastern Bentwing-bat, thereby conserving known habitat for the local populations. Further, EcoBiological (2009a) recorded evidence of the Koala in the proposed biodiversity offset area in 2009.
- The proposed biodiversity offset area contains potential habitat for all threatened fauna species recorded within, or near, the disturbance area, such as the Swift Parrot.
- The condition of fauna habitat within the proposed biodiversity offset area is similar to the Modification disturbance area. For some habitat features, such as hollow-bearing trees and fallen logs, there is a greater density within the proposed biodiversity offset area.
- The ground cover and understorey features (which contribute towards structural complexity of fauna habitat) are likely to improve over time within the proposed biodiversity offset area, given appropriate management (e.g. reduction in cattle grazing and cessation of vegetation clearing).

Management of the Proposed Biodiversity Offset Area

The BMP would be revised to incorporate the proposed biodiversity offset area. A number of management measures are listed below based on detailed flora and fauna surveys of the proposed biodiversity offset area. These measures would include:

- fencing to exclude grazing;
- provision of signage;
- control of animal pests;
- control of weeds; and
- vehicle access management.

Monitoring of the Biodiversity Offset Areas

Similar to the existing biodiversity offset areas, the proposed offset area would be monitored against the performance criteria in accordance with a revised BMP.

Table 4-10
Habitat for Threatened Fauna Species - Existing and Proposed Offset Strategies

Fauna Species	Habitat (ha)		
	Existing Biodiversity Offset Strategy	Proposed Biodiversity Offset Strategy	Total
Swift Parrot/Brown Treecreeper/ Grey-crowned Babbler	174	9	183
Speckled Warbler	126	9	135
Varied Sittella	172	9	181
Squirrel Glider	128	9	137

Source: After Appendix F.

Enduring Conservation for the Proposed Biodiversity Offset Area

Consistent with the existing biodiversity offset areas, and existing DCM Project Approval, the proposed biodiversity offset area would be secured by:

- entering into a conservation agreement or public positive covenant and/or restriction on the use of the land to the satisfaction of the NSW Secretary of the DP&E;
- lodgement of a conservation bond with the DP&E to ensure availability of funding for implementation of the biodiversity offset strategy; and
- regular independent audits.

Consistent with the existing biodiversity offset areas, and existing DCM Project Approval, the proposed biodiversity offset area would be perpetually conserved.

Reconciliation of the Proposed Biodiversity Offset Strategy against NSW State Requirements

During consultation with OEH (5 June 2014) (Section 1.5), OEH requested that the proposed biodiversity offset area be assessed against the NSW Offset Principles for Major Projects (State Significant Development and State Significant Infrastructure) (OEH, 2014). Table 4-11 provides a reconciliation of the proposed biodiversity offset strategy against the offset principles.

Table 4-11
Reconciliation of the Proposed Biodiversity Offset Strategy against OEH Offset Principles

OEH Offset Principles (OEH 2014)	How the Proposed Offset Addresses the OEH Offset Principles
Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.	Existing measures to mitigate impacts are described in Section 4.5.1. Proposed measures to avoid and mitigate impacts are described in Section 4.5.3. The proposed offset strategy addresses residual impacts.
Offset requirements should be based on a reliable and transparent assessment of losses and gains.	The impacts and benefits have been reliably assessed as follows: • the flora and fauna have been surveyed in various studies since 1996; • the area of impact and proposed biodiversity offset is quantified in Tables 4-6 and 4-7 and shown on Figure 4-6; and • the types of ecological communities and habitat to be conserved are described and mapped.
Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.	The proposed offset provides at least a like-for-like outcome (i.e. the same Plat Community Types and broad habitat types to be disturbed are represented in the proposed offset area).
Offsets must be additional to other legal requirements.	The proposed offset is additional to previous offsetting commitments provided in relation to the DCM and is not currently part of any conservation reserve system.
Offsets must be enduring, enforceable and auditable.	The land tenure underlying the proposed Offset areas would be secured in perpetuity for flora and fauna conservation. Enduring conservation of the proposed biodiversity offset area would be secured to the satisfaction of the NSW Secretary of the DP&E. Management actions would be undertaken within the offset area in accordance with a revised BMP. Measures to monitor and independently audit the proposed biodiversity offset area are also provided in the BMP.
Supplementary measures can be used in lieu of offsets.	The proposed offset strategy addresses residual impacts. Supplementary measures are not proposed.
Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.	The Modification would result in social and economic benefits to NSW (Section 4.10.7).

Adapted source: Appendices E and F.

4.6 TERRESTRIAL FAUNA

A Terrestrial Fauna Assessment has been prepared for the Modification by Australian Museum Consulting (2014) and it is presented in Appendix F.

Section 4.6.4 describes the components of the modified biodiversity offset strategy relevant to fauna, with further detail provided in Section 4.5.4.

4.6.1 Background

Regional Setting

The regional and local setting of the Modification disturbance area is described in Section 4.5.

Fauna Surveys

Numerous fauna studies have been undertaken as part of environmental assessments for various stages of the DCM (Debus, 1995; ERM Mitchell McCotter, 1996b; Fly-by-Night Bat Surveys Pty Ltd, 1996; Paul Webber Consulting Services, 1996; Woodward-Clyde, 1996b; Greg Richards and Associates, 2001; Place Planning and Design, 2003; EcoBiological, 2009a, 2009b). Australian Museum Consulting (2014) undertook a review of these studies, other relevant literature as well as databases (Appendix F).

The fauna habitats in the Modification disturbance area and proposed biodiversity offset area were surveyed by EcoBiological (2009a, 2009b) for the DEP. However, in recognition of the time that has passed since those surveys, additional fauna surveys of the Modification disturbance area and proposed biodiversity offset area were conducted by Australian Museum Consulting in April and May 2014.

The surveys by Australian Museum Consulting were designed in consideration of the significant survey effort previously undertaken (Section 4.6.1) and the relatively small size of the Modification disturbance area (approximately 2.5 ha) which is partly surrounded by disturbance associated with the currently approved open pit.

The survey methodology was guided by relevant State and Commonwealth guidelines (DEC, 2004a; OEH, 2013; Department of Environment, Water, Heritage and Arts, 2010a to 2010c; Department of Sustainability, Environment, Water, Population and Communities, 2011a, 2011b). Fauna survey techniques that were used are diurnal bird survey, diurnal reptile search, nocturnal spotlighting, harp trapping, Anabat recordings, opportunistic records, infra-red cameras and koala spot assessment. A habitat assessment was also undertaken.

Fauna Habitat

The Modification disturbance area is predominantly cleared of native vegetation (Cleared Land with Scattered Trees) (Section 4.5.1). There are two small patches of Dry Sclerophyll Forest in the Modification disturbance area. Both patches of open forest are on the edge of the approved open pit (Figure 4-6) (Appendix F).

The majority of the Modification disturbance area is regrowth forest, and very few old growth trees with potential tree hollows were observed within the Modification disturbance area. No major rock formations or continuous rock formations were observed by Australian Museum Consulting (2014) in the Modification disturbance area. Fallen wood and stags were present but uncommon within the Modification disturbance area (Appendix F).

Threatened Fauna Species

Threatened fauna species listed under the TSC Act that have been recorded in the Modification disturbance area and/or surrounds by Australian Museum Consulting (2014) are shown on Figure 4-7. A total of six threatened fauna species were recorded in the Modification disturbance area or immediate surrounds (Appendix F):

- Speckled Warbler;
- Varied Sittella;
- Squirrel Glider;
- Brush-tailed Phascogale;
- Little Bentwing-bat; and
- Eastern Bentwing-bat.

These species (except the Little Bentwing-bat) were already previously recorded in the mining lease by EcoBiological (2009a). The Little Bentwing-bat has a widespread distribution in NSW (Churchill 2008) and the species is not at the limit of its known distribution (Appendix F).

State Environmental Planning Policy No. 44 – Koala Habitat Protection

An assessment of potential and core Koala habitat for the purposes of *State Environmental Planning Policy No.44 – Koala Habitat* (SEPP 44) has been undertaken for the Modification. The assessment determined that some vegetation communities in the Modification disturbance area meet the definition of potential Koala habitat, but the Modification disturbance area does not fall within the definition of core Koala habitat (Appendix F).

Existing Mitigation Measures

Section 4.5.1 provides a description of existing biodiversity mitigation, management and offset measures.

4.6.2 Potential Impacts

Fauna Habitat Removal

The additional surface development associated with the Modification would involve the clearance of only small areas of Dry Sclerophyll Forest (approximately 0.7 ha) as the majority of the Modification disturbance area is already cleared (approximately 1.8 ha). The area to be cleared is on the edge of the open pit and indirect impacts (e.g. edge effects) on surrounding habitats are unlikely to increase substantially from those that would occur as a result of the approved DCM.

The Modification has the potential to cause mortality of some animals through removal of habitat during clearing. However, an established vegetation clearance protocol would continue to be implemented to minimise the impact of vegetation clearance activities on flora and fauna (Table 4-4).

Very few old growth trees with potential tree hollows were observed within the Modification disturbance area. The threatened fanua species that are likely to use the hollow-bearing trees in the Modification disturbance area (e.g. Squirrel Glider, Brush-tailed Phascogale and microbats) are all known to occur more widely in the locality.

Potential and Indirect Impact

Section 4.5.2 provides a summary of potential indirect impacts associated with introduced flora and fauna, and with high frequency of fire.

In addition, the Modification would not result in an increase in noise and air quality impacts above those currently approved for the DCM (Appendices A and B).

Potential Impacts from Irrigation

As described in Section 4-4, approved irrigation activities would not change as part of the Modification. Therefore, the Modification would not result in additional impacts to fauna (e.g. frogs) (Appendix F).

Fauna Interaction with the Final Landform

Consistent with approved DCM, final voids would remain in the Clareval and Weismantel open pits at the cessation of mining. A portion of the Modification disturbance area is associated with changes to the open pit limits and form part of the DCM final void, which would be expected to fill with water until an equilibrium level is reached.

Other water management infrastructure such as rock-lined diversion channels would remain at the cessation of mining, consistent with the approved DCM final landform concepts.

The final voids and water management infrastructure retained at the cessation of mining for the Modification are unlikely to pose a greater risk to native animals compared to the approved DCM.

Threatened Fauna Species

Potential impacts of the proposed Modification on fauna were assessed in accordance with the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) due to the Modification being assessed under Section 75W Part 3A of the EP&A Act (Appendix F). The assessments conclude that the Modification would be unlikely to significantly impact any threatened fauna species listed under the TSC Act given:

- the relatively small area of potential habitat that would be impacted;
- very few old growth features were observed;
- habitat fragmentation within the locality would be minor;
- a greater area of potential habitat would be conserved and enhanced within the proposed offset area;
- no additional indirect impacts are expected; and
- impact avoidance and mitigation measures would be implemented.

Similarly, the Modification would not significantly impact any threatened fauna species listed under the EPBC Act.

Cumulative Impacts

The Modification disturbance area is approximately 2.5 ha, which is less than 1% greater than the approved DCM surface development extent. This small increase is not considered to be significant in terms of cumulative impacts on fauna (Appendix F).

4.6.3 Impact Avoidance and Mitigation Measures

Section 4.5.3 describes the avoidance of additional disturbance relevant to the Modification.

Impact Mitigation

Potential impacts to flora and fauna are currently managed through implementation of measures included in the BMP, GBFMP and DCM Rehabilitation Management Plan (Section 4.5.1). These measures would continue to be implemented and management plans would be updated where relevant, including the revision of the BMP to incorporate the proposed biodiversity offset area.

4.6.4 Biodiversity Offset Strategy

The biodiversity offset areas are described in Section 4.5.4. The proposed biodiversity offsets would constitute a suitable area to offset residual fauna impacts associated with the Modification, given the existing biodiversity values of the proposed biodiversity offset area as well as the anticipated improvement in the fauna habitat values in the medium to long-term.

4.7 ABORIGINAL HERITAGE

4.7.1 Background

An Aboriginal Cultural Heritage Assessment was undertaken for the DEP by Kayandel Archaeological Services (2009).

Consultation

Stakeholders who registered an interest in being consulted in relation to the DEP ACHA process are listed in Appendix H.

Table 4-12 summarises the main components of the Aboriginal heritage consultation/survey program undertaken for the DEP.

Surveys of ML 1646 and ML 1427

A comprehensive survey across ML 1646, ML 1427 and the surrounds was undertaken for the DEP (Kayandel Archaeological Services, 2009).

As such, the survey conducted for the DEP included the Modification disturbance areas (Figure 4-8), which are located wholly within ML 1646.

The survey conducted for the DEP followed previous surveys of the DCM area conducted between 1981 and 2008 (Appendix H).

A total of 13 Aboriginal heritage sites were identified during the DEP Aboriginal Cultural Heritage Assessment within ML 1646, ML 1427 and surrounds (Figure 4-8 and Table 4-13).

The archaeological significance rankings determined for the DEP for the nine known sites within ML 1646 and ML 1427 are provided in Table 4-14.

Modification Disturbance Areas

As shown on Figure 4-8 and in Table 4-13, there are no Aboriginal heritage sites located within the Modification disturbance areas.

The closest site to the Modification disturbance areas was site DM2, which was located immediately north of the northern Modification disturbance area, and was considered to be of moderate significance (Table 4-14).

Given its proximity to the edge of the open pit, this site was described as being potentially impacted in the DEP ACHA (Kayandel, 2009).

As such, and as described in the approved Duralie Coal Mine Heritage Management Plan (DCPL, 2013a), site DM2 was recovered by Karuan Local Aboriginal Land Council (KLALC) representatives on 8 February 2013. Following the salvage works, the KLALC agreed to take full responsibility of the heritage items (Appendix H).

Duralie Coal Mine Heritage Management Plan

Aboriginal heritage sites at the DCM are managed in accordance with the approved Duralie Coal Mine Heritage Management Plan, which has been prepared in consultation with registered stakeholders for the DEP (Appendix H).

As described in the Duralie Coal Mine Heritage Management Plan, KLALC representatives are engaged by DCPL to inspect development areas during initial disturbance.

Table 4-12
Summary of the DEP Aboriginal Heritage Consultation/Survey Programme

Date	Consultation/Survey Conducted
Previous Consultation	
January 2008	Public advertisement and registration of interested stakeholders.
Duralie Extension Project Consultation/Survey	
May/June/July 2009	Identification of stakeholders with an interest in being consulted in regard to Aboriginal heritage at the Project.
27 July 2009	Provision of a proposed methodology for undertaking the ACHA to registered stakeholders.
August 2009	Feedback from the registered stakeholders in regard to the proposed methodology. Consideration of all comments received on the proposed methodology.
18 August 2009	Invitation to registered stakeholders to attend the Aboriginal cultural heritage survey and site inspection.
25-27 August 2009	Aboriginal cultural heritage survey and site inspection. Cultural significance of the area and Aboriginal heritage sites discussed with the Aboriginal participants.
1 October 2009	Draft ACHA report issued to the registered stakeholders for review, including survey results, archaeological and cultural significance assessment (based on feedback received during previous consultation and fieldwork), potential impacts and proposed management and mitigation measures.
October 2009	Further consultation with the registered stakeholders to discuss the draft ACHA.
October/November 2009	Written feedback and advice received from registered stakeholders (including comments on the consultation, survey, assessment and proposed management and mitigation measures).
November 2009	Comments received from registered stakeholders on the draft ACHA (in relation to cultural heritage) were considered and/or addressed in the ACHA.
Duralie Open Pit Modification Consultation	
16 May 2014	A copy of the draft ACHA was provided to all registered stakeholders who were involved in the Duralie Extension Project plus any additional groups or individuals who have since expressed an interest to DCPL to be included in the ACHA and/or the management of Aboriginal heritage at the DCM. These registered stakeholders included: • Barrington-Gloucester-Stroud Preservation Alliance Inc.; • EB Phillips; • Forster Local Aboriginal Land Council; • Garigal Aboriginal Community Inc.; • Garry Smith; • Gavin Callaghan; • Gidawaa Walang Cultural Heritage Consultancy; • Gloucester Environment Group; • Harry Callaghan; • Johnson Creek Conservation Committee; • KLALC; • Maaiangal Group; • Minimbah and District Aboriginal Elders Group Inc.; • Norma Fisher; • Native Title Services Corporation; • Edward Moran; and • Wonnarua Elders Council Inc.
3 June 2014	ICAG contacted DCPL to request a copy of the draft ACHA. As a result, the ICAG was added to the list of registered stakeholders.
6 June 2014	DCPL provided a copy of the draft ACHA to the Ironstone Community Action Group.
16 June 2014	Maaiangal Group and the Johnson Creek Conservation Committee contacted DCPL to request an extension on the draft ACHA review period.
17 June 2014	DCPL granted a 7 day extension to the draft ACHA review period and formalised the extension by provided a letter to all registered stakeholders.
14 July 2014	Comments received from the registered stakeholders on the draft ACHA (in relation to cultural heritage) were considered and/or addressed in the ACHA.

Source: After Appendix H.

Note: Refer to Appendix H for a detailed account of the consultation programme undertaken for the Aboriginal Cultural Heritage Assessment.

GCL-14-23_Mod 2_Section 4_1078

Table 4-13
Known Aboriginal Heritage Sites at the DCM and Surrounding Area

Site Type	Site[1]	Located within ML 1646 or ML 1427	Located within Modification Disturbance Area	Salvaged
Isolated Artefact	DM1	No	No	No
	DM2	Yes	No	Yes
	DM6	Yes	No	No
	DM11	Yes	No	Yes
Open Artefact Scatter	DM7	No	No	No
	DM8	No	No	No
	DM9	Yes	No	No
Scarred Tree	DM3	Yes	No	No
	DM4	Yes	No	No
	DM5	No	No	Yes
	DM10	Yes	No	No
Scarred Tree – Honey Tree	38-1-0033	Yes	No	No
Open Site – Burial	38-1-0034 (Mammy Johnson's Grave)	No	No	No

Source: After Appendix H.

Note: Refer to Figure 4-8 for Aboriginal heritage sites.

Table 4-14
Archaeological Significance of Aboriginal Heritage Sites within ML 1646 or 1427

Archaeological Significance Ranking	Aboriginal Heritage Site[1]	Number of Sites
High	38-1-0033	1
Moderate	DM2, DM3, DM4, DM5, DM9, DM10	6
Low	DM11, DM6	2

Source: After Appendix H.

Note: Refer to Figure 4-8 for Aboriginal heritage sites.

The protocol should previously unidentified site(s) be encountered during pre-clearance surveys is described in the Duralie Coal Mine Heritage Management Plan, and may include further assessment by a suitably qualified archaeologist and notification of the find (e.g. to the OEH).

4.7.2 Potential Impacts

Further Consultation for the Modification

Given the Modification disturbance area is located wholly within the area surveyed and assessed for the DEP ACHA (i.e. within ML 1646), the consultation process undertaken for the Modification builds on the consultation undertaken for the DEP (Table 4-12).

In addition, consultation for the Modification includes the preparation of a Draft ACHA and finalisation of the ACHA following review and comment by the registered stakeholders.

The Draft ACHA was provided to the registered stakeholders for the DEP plus additional groups who expressed an interest to DCPL in regard to involvement in Aboriginal heritage for the DCM (Appendix H).

Modification Disturbance Areas

There are no known Aboriginal heritage sites located within the Modification disturbance areas (Appendix H) (Figure 4-8).

As such, the Modification would not result in the disturbance of any known Aboriginal heritage sites.

The closest *in situ* sites (i.e. sites that have not been subject to salvage) to the Modification disturbance areas are sites DM9 and DM10 (Figure 4-8). Site DM9 is an open artefact scatter (of moderate significance) and site DM10 is a scarred tree (of moderate significance). In accordance with the Duralie Coal Mine Heritage Management Plan (DCPL, 2013a), both of these sites have been signposted to avoid accidental damage.

4.7.3 Mitigation Measures, Management and Monitoring

Aboriginal heritage sites at the DCM would continue to be managed in accordance with the Duralie Coal Mine Heritage Management Plan.

KLALC representatives would be engaged by DCPL to inspect the Modification disturbance areas (i.e. the approximate extent of additional surface disturbance shown on Figure 4-8) during initial disturbance, consistent with the existing protocols.

4.8 LAND RESOURCES

4.8.1 Background

Landforms and Topography

The DCM is situated in the Gloucester Valley, which is bounded by Buckley's Range to the east and the Linger and Die Ridge to the west. The Mammy Johnsons River is located immediately to the east of the DCM (Figure 4-4).

There is significant topographic relief in the DCM area, with elevations ranging from approximately 50 m AHD along the river flats of the Mammy Johnsons River to approximately 150 m AHD on the ridgelines to the west of ML 1427. Within ML 1646, elevations range from approximately 70 to 170 m AHD and the topography is steeper in the west along a north-west to south-east oriented ridgeline, and more gently sloping in the north-east of ML 1646.

The development of the DCM has altered the pre-mining topography within the mining area, with the open pit and waste rock emplacement and water management structures being the primary alterations (Figure 1-2).

In the Modification disturbance area, elevations range from approximately 95 to 150 m AHD. Slopes in the majority of the Modification disturbance area are greater than 10%.

Land Use

The DCM is located in a rural area characterised by cattle grazing on improved and unimproved pastures. Areas managed for forestry, conservation, poultry farming and other types of agricultural production also occur in the wider area.

DCPL's local landholdings outside of DCM area (Figure 1-3a) are used for agricultural production (predominantly beef cattle production) and for the biodiversity offset areas.

The majority of the DCM area is currently subject to mining development. The remaining areas are managed for agricultural production or are forested.

The unvegetated components of the Modification disturbance area are managed for pastoral uses (typically beef cattle production).

Soil Characteristics

Soil landscapes in the vicinity of the DCM have been broadly mapped by the Soil Conservation Service of NSW as described in the document *Soil Landscapes of the Dungog 1:100,000 Sheet* (Henderson, 2000). Four key soil landscapes have been mapped in the DCM area, namely Wards River, Stroud Road, Gloucester Buckets and Gloucester River (landscape variant) soil landscapes.

Table 4-15 summarises the key characteristics of the soil landscapes mapped within the DCM (including the Modification disturbance area), as well as the dominant soil materials within each soil landscape and where they are generally found within the soil profile.

Erosional soil landscapes cover the majority of the DCM area, with the Wards River soil landscape occurring in the eastern portion of the area and the Stroud Road soil landscape occurring in the west. The Gloucester Buckets soil landscape occurs on the top of ridgelines in the southern portion of ML 1427 and in the north-west portion of ML 1646.

The Wards River and Stroud Road soil landscapes were mapped in the Modification disturbance area. It is noted that these soils have moderate to high limitations for cultivation and low to medium limitations to grazing (Table 4-15).

Table 4-15
Soil Landscapes of the DCM

Soil Landscape	Characteristics	Dominant Soil Materials
Erosional Landscapes		
Stroud Road	• Rolling to undulating low hills on Permian Alum Mountain Volcanics. • Low limitation for grazing, moderate limitations for cultivation, with localised high limitations. • Limitations include high engineering hazard, gully erosion risk, mass movement hazard, steep slopes, seasonal waterlogging and sheet erosion risk.	• Brown crumbly clay loam (topsoil). • Brownish black polyhedral clay (topsoil). • Brownish black weak crumb ped loam (topsoil). • Gravelly brown earthy loam (subsoil). • Brown plastic sticky clay (subsoil). • Reddish brown polyhedral clay (subsoil). • Gravelly mottled pale clay (deep subsoil).
Wards River	• Rolling low hills on sediments of the Gloucester Coal Measures. • Generally moderate limitations for grazing and high limitations for cultivation. • Limitations include high gully erosion risk, high sheet erosion risk, rock outcrop, high run-on and seasonal waterlogging and steep slopes.	• Brownish black earthy loam (topsoil). • Brown hardsetting, bleached loam (topsoil). • Brown prismatic clay (subsoil). • Yellow prismatic clay (subsoil).
Colluvial Landscapes		
Gloucester Buckets	• Rolling to very steep hills on Permian basic and acidic volcanics and sediments. • Generally extreme limitations for cultivation and high limitations for grazing. • Limitations include steep slopes, mass movement hazard, rockfall hazard, high sheet erosion risk and rock outcrops.	• Dark weakly structured loam (topsoil). • Dark friable clay loam (topsoil). • Bleached earthy loam (topsoil). • Gravelly brown earthy loam (subsoil).

Source: After Henderson (2000).

A soil sampling programme was conducted by Veness & Associates (1996). Within the DCM disturbance areas Veness & Associates (1996) identified the following five soil mapping units based on geological formations:

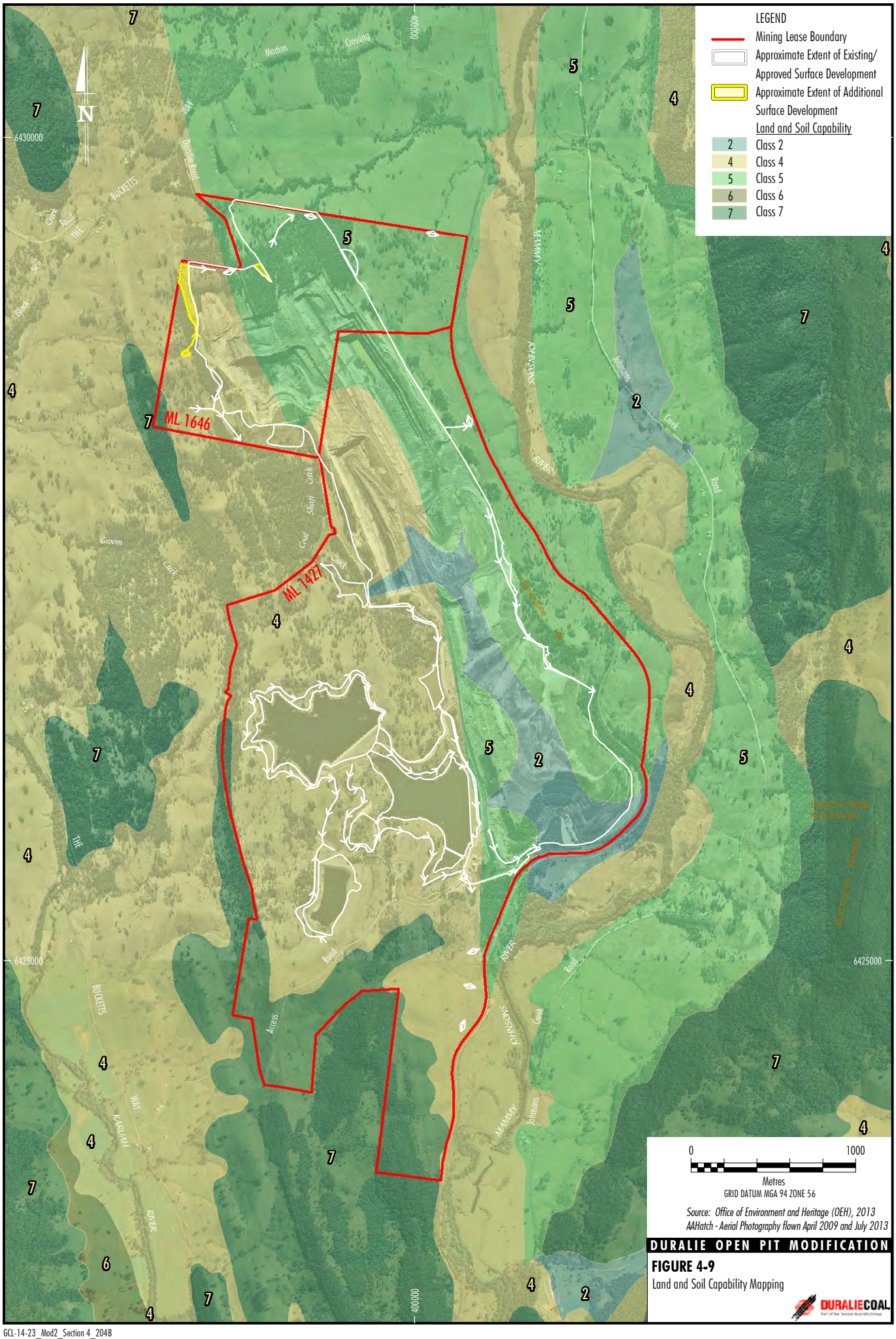
- alluvial soils (restricted to lower Coal Shaft Creek – now removed);
- fine grained sandstone (lower) and coarse and medium grained sandstone with minor conglomerate (associated with the Dewrang Group);
- conglomerate with minor interbedded basalt and welded tuff, thin coals (associated with the Alum Mountain Volcanics);
- basalt intermediate and acid lavas and pyroclastics (associated with the Alum Mountain Volcanics); and
- undifferentiated Carboniferous sediments.

Land and Soil Capability

Regional land and soil capability mapping (OEH, 2013) is available for the DCM area. Classes 2, 4 and 5 are mapped at the DCM (Figure 4-9). Classes 4 and 5 occur in the Modification disturbance area (Figure 4-9).

Regional land and soil capability Classes 4 and 5 are defined as (OEH, 2012):

> ***4 - Moderate capability land:*** *Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.*
>
> ***5 – Moderate–low capability land:*** *Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.*



GCL-14-23_Mod2_Section 4_204B

Strategic Agricultural Land

Regional strategic agricultural land (i.e. Biophysical Strategic Agricultural Land [BSAL] and Critical Industry Clusters [CIC]) mapping prepared for the *Strategic Regional Land Use Policy* (NSW Government, 2012a) is available for the DCM area. BSAL has been mapped in the DCM site and surrounds, including in areas that had been open pit mined prior to the release of the mapping.

No BSAL is mapped in the Modification disturbance area and no CIC are mapped in the vicinity of the DCM.

Soil Management and Rehabilitation

Land preparation, soil stripping, soil resource management and rehabilitation at the DCM are conducted in accordance with the Mining Operations Plan and Rehabilitation Management Plan.

4.8.2 Potential Impacts

The Modification would result in the disturbance of approximately 1.8 ha of land potentially available for agriculture located within ML 1646. An additional 0.7 ha of vegetated land (i.e. not agricultural land) would be disturbed as a result of the Modification (Section 4.5.2).

Consistent with the approved DCM final landform, the Modification disturbance area would be rehabilitated to woodland habitat or would form part of the final void (Section 5) and, therefore, would not be used/available for agricultural uses post-mining.

The Modification disturbance area is not considered to be highly productive agricultural land, given the soil limitations for cultivation (Table 4-15) and the previous agricultural activities conducted (i.e. beef cattle production on rain-fed unimproved pasture).

In relation to potential agricultural productivity of the Modification disturbance area, it is also worth noting:

- The majority of the Modification disturbance area has slopes greater than 10% slope and would not meet the criteria for BSAL under the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government, 2013).
- The Modification disturbance area is located within the existing ML 1646 and immediately adjacent to an active open cut coal mine.

Given the above, the potential impacts on agricultural enterprise as a result of the Modification would be minimal.

Potential impacts of the Modification on visual amenity are assessed in Section 4.9.

4.8.3 Mitigation Measures, Management and Monitoring

The land resource mitigation measures, management or monitoring outlined in the Mining Operations Plan and Rehabilitation Management Plan would continue for the Modification.

The Mining Operations Plan and Rehabilitation Management Plan would be revised to incorporate the Modification.

4.9 VISUAL CHARACTER

A Visual Assessment for the Modification was prepared by Marc&Co and Resource Strategies (2014) (Appendix G).

4.9.1 Previous Assessment

Existing Landscape

The DCM area and surrounds comprise a number of distinct land use types and landscape units. These include agricultural areas, the existing DCM, rural residential dwellings, mountains, ridgelines and streams, including Coal Shaft Creek and the Mammy Johnsons River (Section 4.8.1). The topographical features (which contribute to the level of scenic quality) of the regional, sub-regional and local settings of the DCM area are described in Appendix G.

In general, views of the existing DCM from surrounding public and private viewpoints are effectively screened by topography and vegetation, except for some areas to the east and north. In these areas, the number of privately owned dwellings with potential views of the DCM landforms and infrastructure is restricted by DCPL ownership of the majority of land (Figure 1-3a).

Views of the DCM are available from sections of public roads (e.g. The Bucketts Way and Johnsons Creek Road) to the north and east of the DCM. DCPL has constructed a visual screen adjacent the section of The Bucketts Way identified in the DEP to have the greatest potential for unmitigated views of the approved DCM to minimise potential visual impacts from this location (Appendix G).

The glow produced by night-lighting at the DCM is visible at nearby residences and along transport routes (i.e. rail and road), while direct views of mobile machinery lights and operational lighting are available from some locations. The night-glow is generally similar to that associated with existing villages in the Gloucester Valley (Appendix G).

Previous Assessment

A visual assessment was undertaken for the DEP EA.

It was assessed that the extension and development of the open pits and waste rock emplacement (including associated vegetation clearance) would potentially increase the views available from nearby public roads (e.g. The Bucketts Way) and privately-owned residences to the north of the DCM. However, the assessment concluded that with the implementation of mitigation measures (e.g. progressive rehabilitation), the potential visual impact would be "very low" to "low" at relevant sensitive receivers.

The privately-owned residences identified as having the greatest potential of visual impacts for the DEP are now either owned by DCPL, or DCPL has a private compensation agreement with the landholder.

Existing Mitigation Measures

DCPL has implemented a number of measures at the DCM to minimise potential visual impacts (Appendix G):

- progressive rehabilitation of the waste rock emplacement (Section 5);
- the waste rock emplacement has been designed to produce a landform that integrates with the adjoining natural landform (i.e. Tombstone Hill) and incorporates relief to integrate with the surrounding natural landforms (Section 5);
- boundary vegetation has been retained along the eastern toe of the waste rock emplacement to provide a visual screen between users of the North Coast Railway and the DCM;
- substantial fabricated infrastructure has been painted with a colour ("Rivergum") that assists it to blend in with the adjoining landscape;
- the placement, configuration and direction of lighting has been designed to reduce off-site nuisance effects of stray light;
- all external lighting has been operated in accordance with Australian Standard 4282 (INT) 1995 - *Control of Obtrusive Effects of Outdoor Lighting* as required by Condition 49, Schedule 3 of Project Approval (08_0203); and
- a visual screen has been constructed along an approximate 360 m section of The Bucketts Way in accordance with Condition 51, Schedule 3 of Project Approval (08_0203) to minimise views of the DCM and potential night-lighting impacts along the section of The Bucketts Way identified in the DEP EA as having the greatest potential for unmitigated visual impact to occur.

4.9.2 Potential Impacts

The aspects of the Modification considered to have the potential to impact on the visual landscape include (Appendix G):

- modification of topographic features including an increase in the maximum height of the central portion of the waste emplacement to approximately 135 m AHD; and
- minor changes to the approved Weismantel and Clareval open pit surface development extents, resulting in minor additional surface development/vegetation clearance.

The scale and intensity of night-lighting for the Modification would be similar in intensity to the existing night-lighting at the DCM.

Visual Assessment Methodology

The potential visual impacts of the Modification were assessed by evaluating the level of visual modification of the development in the context of the visual sensitivity of relevant surrounding land use areas.

The degree of visual modification of a proposed development can be measured as a function of the contrast between the development and the existing visual landscape, and is generally considered to decrease with distance (Appendix G).

Visual (viewer) sensitivity is a measure of how critically a change to the existing landscape would be viewed from various use areas, where different activities are considered to have different sensitivity levels (Appendix G). Visual impacts were then determined generally in accordance with the matrix presented in Table 4-16.

Table 4-16
Visual Impact Matrix

Visual Modification \ Viewer Sensitivity	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L
VL	L	VL	VL

VL = Very Low
L = Low
M = Moderate
H = High

Source: Appendix G.

Visual Impact Assessment

No viewpoints identified in the regional (greater than 5 km away) or sub-regional (1 to 5 km away) setting would have significant views of the modified DCM landforms due to undulating topography and vegetation, and any incremental visual impacts as a result of the Modification would be negligible. The potential visual impact of the Modification on the regional and sub-regional setting is, therefore, considered to be low (Appendix G).

At the local level (less than 1 km away), visual simulations were prepared for the locations identified in Table 4-17 and shown on Figure 4-10. These locations are considered to be representative of public locations from which the modified DCM landforms would be most visible.

The visual simulations are shown on Figures 4-11 to 4-13. Simulations presented for the modified DCM landforms during 2018 represent the landforms at their maximum heights and with the greatest area of disturbance, the greatest potential for visual impact. The post-rehabilitation simulation illustrates the conceptual landform following completion of mining and rehabilitation activities.

Predicted visual impacts at the three locations included in Table 4-17, based on expected maximum visual modification, are summarised in Table 4-18 and discussed below.

Privately-owned Residences

Assessment of the potential visual impacts for the DEP concluded that impacts at the closest privately-owned residences would be "very low" to "low" after rehabilitation (Appendix G). Residences that were previously assessed (i.e. "Weismantel", "Hattam" and "Zulumovski" dwellings) are now either owned by DCPL or DCPL has a compensation agreement with the landholder.

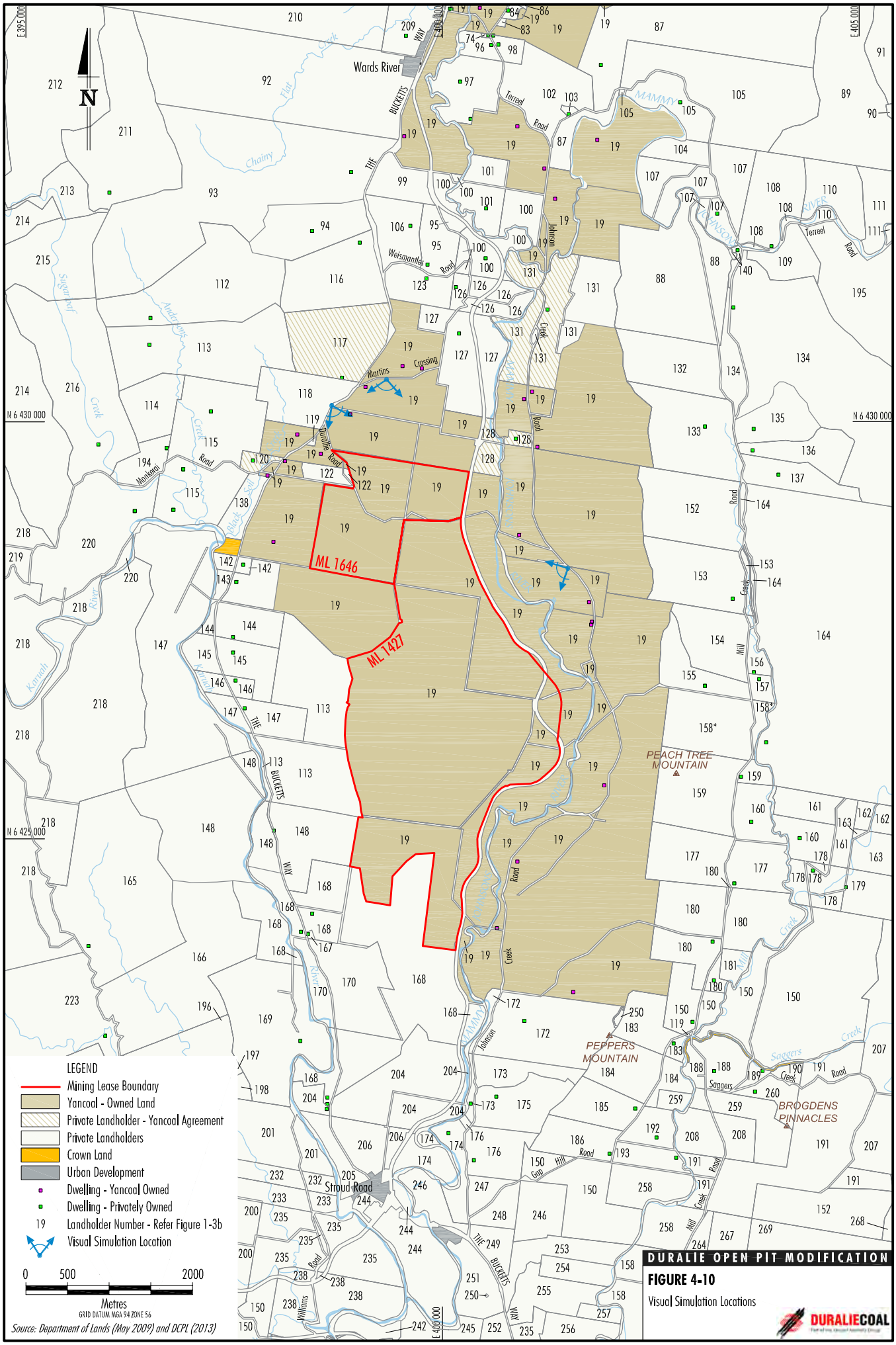
Table 4-17
Locations of Visual Simulations

Visual Simulation Location	Potential View of DCM Landforms	Simulation Figure
Road – Johnsons Creek Road	West over partially cleared agricultural land and riparian vegetation to the waste rock emplacement.	Figure 4-11
Road – Martins Crossing Road	South over cleared agricultural land to the open pit wall and waste rock emplacement.	Figure 4-12
Road – The Bucketts Way	South-east over cleared agricultural land to the open pit wall and waste rock emplacement.	Figure 4-13

Table 4-18
Summary of Visual Assessment

Location	Visual Sensitivity	Visual Modification Level	Potential Impact	Potential Impact After Rehabilitation
Johnsons Creek Road	L	M	L	VL
Martins Crossing Road	L	L	L	VL
The Bucketts Way	M	L	L	L

Note: H – High; M – Moderate; L – Low; VL – Very Low.



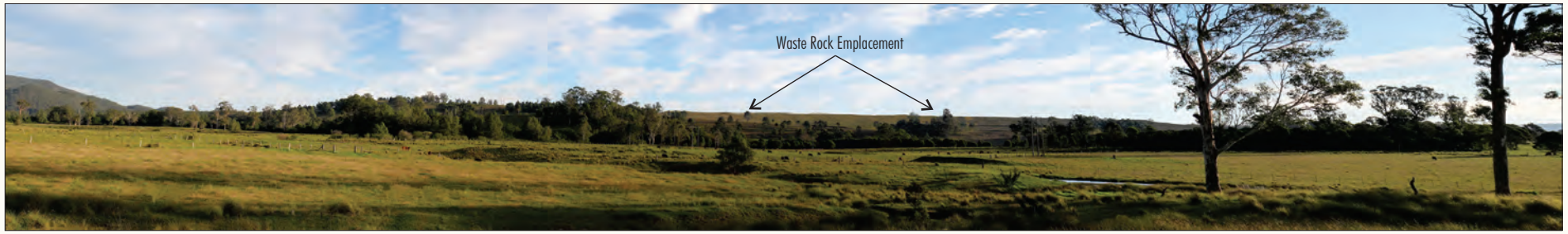
DURALIE OPEN PIT MODIFICATION

FIGURE 4-10

Visual Simulation Locations

DURALIECOAL

Existing View



Year 2018 Simulation

Post-Rehabilitation Simulation

Source: Marc & Co (2014)

DURALIE OPEN PIT MODIFICATION

FIGURE 4-11
Existing View and
Visual Simulations -
Johnsons Creek Road

DURALIECOAL

Existing View

Year 2018 Simulation

Post-Rehabilitation Simulation

Source: Marc & Co (2014)

DURALIE OPEN PIT MODIFICATION

FIGURE 4-12
Existing View and
Visual Simulations -
Martins Crossing Road

DURALIECOAL

Existing View

Year 2018 Simulation

Post-Rehabilitation Simulation

Source: Marc & Co (2014)

DURALIE OPEN PIT MODIFICATION

FIGURE 4-13
Existing View and Visual Simulations - The Bucketts Way

DURALIECOAL

GCL-14-23_Mod2_Section 4_004A

Other privately owned residences located further away from the DCM would be expected to experience the same or lower level of visual modification as the locations for which visual simulations have been prepared for the Modification (i.e. as shown in Figures 4-11 to 4-13).

Views of the DCM would not be available from the villages of Wards River, Stroud or Stroud Road.

Roads

Johnsons Creek Road

For users of Johnsons Creek Road, the moderate level of visual modification coupled with the low level of visual sensitivity indicates a low level of potential visual impact would be expected. Following progressive and final rehabilitation, the level of potential visual impact associated with the Modification at Johnsons Creek Road would reduce to very low (Appendix G).

This predicted level of visual impact is consistent with the visual assessment conducted for the approved DCM landform. The Modification would, therefore, not change the previously assessed level of visual impact on Johnsons Creek Road (Appendix G).

Martins Crossing Road

The low level of visual modification coupled with the low level of visual sensitivity at Martins Crossing Road indicates a low level of potential visual impact would be expected. Following final rehabilitation, the level of potential visual impact associated with the Modification at Martins Crossing Road would reduce to very low (Appendix G).

It is anticipated that this level of visual impact associated with the Modification would be similar to the approved DCM as the DCM landforms visible from Martins Crossing Road (i.e. Clareval open pit and northern extent of the waste rock emplacement) would not change significantly due to the Modification (Appendix G).

The Bucketts Way

Views would be available from The Bucketts Way looking south towards the DCM. The section of The Bucketts Way with the greatest potential for views of the DCM was identified in the DEP EA as being between the intersection of Martins Crossing Road and Durallie Road. This location has, therefore, been selected for a visual simulation consistent with the visual assessment location prepared for the DEP EA.

Views from this location have been mitigated by the visual screen constructed adjacent to The Bucketts Way in accordance with Condition 51, Schedule 3 of Project Approval (08_0203) (Appendix G).

For users of The Bucketts Way, the low level of visual modification coupled with the moderate level of visual sensitivity indicates a low level of potential visual impact would be expected. The existing visual screen would continue to mitigate potential worst-case visual impacts (e.g. of the Clareval open pit) and, therefore, the screen would not need to be modified as a result of the Modification (Appendix G).

Following final rehabilitation, the level of potential visual impact associated with the Modification at The Bucketts Way would remain low.

This predicted level of visual impact is consistent with the visual assessment conducted for the approved DCM landform. The Modification would, therefore, not change the previously assessed level of visual impact on The Bucketts Way (Appendix G).

Night-Lighting

The scale and intensity of night-lighting for the Modification would be of a similar intensity when compared to the existing night-lighting at the approved DCM (Appendix G).

4.9.3 Mitigation Measures, Management and Monitoring

The existing measures implemented at the DCM to minimise potential visual impacts (Section 4.9.1) would continue to be implemented for the Modification.

4.10 OTHER ENVIRONMENTAL ASPECTS

4.10.1 Blasting

Existing Compliance and Complaints

Potential impacts associated with blasting at the DCM are monitored and managed in accordance with the Blast Management Plan. Blast monitoring (ground vibration and overpressure) is conducted for every blast. Blast monitoring locations are shown on Figure 2-3.

Since approval of the DEP in 2011, blast monitoring indicates ground vibration and overpressure levels associated with blasting at the DCM were compliant with Project Approval blast limits, with the exception of exceedances of the blast overpressure limit at one residence (property 120). DCPL has entered into a private compensation agreement with the owner of property 120.

In addition, Project Approval (08_0203) requires DCPL to minimise fume emissions from blasts. The Blast Management Plan outlines the risk assessment procedure conducted prior to every blast to minimise fume generation based on historic observations. In addition, DCPL conducts video monitoring of each blast, and in situations where fume has been generated, an assessment is made of the extent the fume has travelled, as well as its dispersion time.

A visible blast fume event occurred on 5 May 2014. Review of video monitoring indicates the blast fume had dispersed prior to leaving the mine site. DCPL continues to minimise potential blast fume emissions through the implementation of the risk assessment procedure described in the Blast Management Plan.

Between four and 21 blast-related complaints have been received per year since 2008. Investigations undertaken in response to blast related complaints indicate that for each case the DCM was operating in accordance with the Project Approval conditions relevant to blasting (Appendix A) or DCPL subsequently entered into a private compensation agreement with relevant landowners.

All blast related complaints were responded to and investigated in accordance with the Complaint Response Protocol detailed in the Blast Management Plan.

Potential Blast Impacts

The typical blast design details and blast frequency for the existing DCM operations would remain unchanged for the Modification (Section 3.2.6).

Notwithstanding, SLR Consulting (2014) has conducted an assessment of potential ground vibration and overpressure impacts associated with blasting in the areas where the surface development extent of the open pits would marginally increase for the Modification (Figure 1-2).

It is predicted the DCM incorporating the Modification could continue to operate in compliance with existing Project Approval blast ground vibration and overpressure limits at privately-owned residences (not subject to an existing compensation agreement with DCPL) (Appendix A).

Mitigation Measures, Management and Monitoring

Blast mitigation, management and monitoring would continue in accordance with the Blast Management Plan for the Modification.

DCPL is currently seeking a variation to EPL 11701 for the removal of the blast monitoring location at property 120 (i.e. DCPL has entered into a private compensation agreement with the owner of the property) and for an additional monitoring location at a nearby private-owned residence.

4.10.2 Greenhouse Gas Emissions

DCPL calculates and reports annual greenhouse gas emissions and energy consumption from the DCM in accordance with the existing requirements of the Commonwealth National Greenhouse and Energy Reporting System (NGERS).

Existing greenhouse gas abatement measures implemented at the DCM are described in the Air Quality and Greenhouse Gas Management Plan.

The major source of direct greenhouse gas emissions from the DCM are associated with fuel consumption of mining equipment. The Modification would not change the existing mining fleet or hours of operation and, therefore, no change to greenhouse gas emissions from fuel consumption is expected due the Modification.

For the Modification, annual reporting of greenhouse gas emissions from the DCM would continue in accordance with the NGERS requirements, and the existing abatement measures would continue to be implemented.

4.10.3 Non-Aboriginal Heritage

The only non-Aboriginal heritage item identified within the vicinity of the DCM on any heritage register or inventory is the Former Weismantels Inn, which is located outside of ML 1646 and ML 1427.

The Modification would not disturb the Former Weismantels Inn. Predicted blast levels at the Former Weismantels Inn are presented in Appendix A, and are predicted to remain below building damage criteria for the Modification.

Consistent with the approved DCM, the Modification is not considered likely to significantly impact the scenic values of the Vale of Gloucester Landscape Conservation Area (Appendix G).

4.10.4 Road Transport

There would be no change to the DCM operational workforce or deliveries to the DCM due to the Modification. Accordingly there would be no change to road traffic movements generated by the DCM, and no additional road infrastructure would be required.

4.10.5 Aquatic Ecology

No threatened fauna listed under the NSW *Fisheries Management Act, 1994* are likely to be affected by the Modification as there is no aquatic habitat within the Modification disturbance area, and ephemeral watercourses nearby the Modification disturbance area are unlikely to provide potential habitat (Appendix F).

In addition, no impacts to aquatic ecology in the Mammy Johnsons River or Coal Shaft Creek are expected due to the Modification, as the revised site water balance predicts no releases of water from the MWD or the Auxiliary Dams to the surrounding environment in any of the 1,000 climatic sequences simulated (Appendix D), and there would be no change to the irrigation first flush protocol for the Modification (Section 3.4).

4.10.6 Hazard and Risk

A Preliminary Hazard Analysis (PHA) was conducted for the DEP to assess the potential hazard and risk associated with the DCM. It is considered the Modification would not change the existing potential risks or hazard consequences identified in the PHA conducted for the DCM as the proposed activities associated with the Modification (e.g. open cut mining activities, transport to site and on-site storage) are consistent with those for the approved DCM.

4.10.7 Socio-Economic Benefits

The operation of the DCM results in direct and indirect socio-economic benefits to the local and State economies, including:

- Direct employment for the operation of the DCM and the operation of the SCM CHPP (i.e. as DCM coal is washed at the SCM CHPP), with the majority of employees residing the Great Lakes or Gloucester Local Governments Areas.
- Indirect employment resulting as a flow-on effect of DCPL's direct expenditure in the local and State economies (e.g. for the technical services sector, retail sector and accommodation, cafe and restaurant sector).
- State Royalty payments.
- Commonwealth and State tax payments.

The Modification is required to enable the efficient extraction of coal, continuation of waste emplacement at the DCM and to improve the geotechnical stability of the open pit low walls.

Without the Modification, waste emplacement at the DCM would be constrained and a portion of the coal reserves approved to be extracted from the Weismantel and Clareval open pits until 2019 would be foregone, resulting in a truncation of the mine life.

As such, the Modification would enable the continuation of the socio-economic benefits associated with the operation of the DCM via the continuation of employment, direct expenditure in the local and regional economies, and payment of royalties and taxes.