



BHP Billiton – Illawarra Coal

**West Cliff Goaf Gas Project
Project Approval MP 07_0073**

**Environmental Assessment
s75W Modification Application (Mod 1)**

**Proposed changes to surface goaf gas extraction associated with
Longwall 34**

November 2009

Information Statement

Bruce Blunden, Manager – Environmental Approvals (Illawarra Coal) prepared this Environmental Assessment. Bruce Blunden holds a PhD in Environmental Engineering, MEng in Agricultural Engineering and BNatRes (Hons) in Environmental Science.

Certification

I certify that I have prepared this Environmental Assessment for the proposed changes to surface goaf gas extraction associated with Longwall 34 for the West Cliff Goaf Gas Project. To the best of my knowledge, it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.



Bruce Blunden

4 November 2009

Signature

Name

Date

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Introduction

The West Cliff Coal Mine – Surface Goaf Gas Drainage Project was approved by the Minister for Planning on 8 December 2008. Minor modification to the number of goaf gas extraction boreholes and goaf gas extraction infrastructure are proposed. The modification to the Project as approved necessitates a modification to the Project Approval in accordance with s75W of the Environmental Planning and Assessment Act 1979. All other aspects of the Project including the lands on which the Project will occur and the technologies for goaf gas extraction and management remain unchanged.

Scope of Modified Project

Goaf gas associated with mining Longwall 34 will occur using the same techniques and technologies as per the Approved Project. Illawarra Coal considers that the modification negotiated with the Department of Planning (DoP) to address construction noise generated during goaf gas well drilling (see DoP Assessment Report) has several other advantages, namely reduction in greenhouse gas emissions and avoidance of visual impacts. Illawarra Coal propose to extend this operational philosophy of linking gas extraction wells to a centralised extraction plant, flares and vent stack for Longwall 34 to take best advantage of these improved environmental outcomes.

In addition, two additional goaf gas extraction wells (from eight to ten) are proposed to be constructed above Longwall 34. The total number of goaf gas drainage boreholes will remain the same for the Project as approved due to fewer gas extraction wells being required for the shorter than expected Longwalls 33 and 34. A map describing the scope of the Modified Project and comparing the Modified Project with the Approved Project scope of works is shown in Appendix A. The works associated with the West Cliff Goaf Gas drainage Project over Longwall 34 will take place on:

- Lot 1 DP707208
- Lot 11 DP744101
- Lot 2 DP1113072
- Lot 3 DP 1113069

Landowner access to the above properties has been sought and agreed.

A comparison of the Approved and Modified Project is summarised in Table 1. Table 1 reflects the Project Description as published in Department of Planning (2008) Major Project Assessment: West Cliff Gas Drainage Project.

Table 1: Summary of Approved and Modified project Scope		
Aspect	Project Description – as approved	Project Description – as modified
Project summary	Construction and operation of up to 21 coal seam gas boreholes in ‘Area 5’ of West Cliff Coal Mine and flaring and venting the extracted gas. The extraction plant, flares and vent stack will be co-located with each borehole, except boreholes within 500m of residential premises will duct gas back to a central extraction plant/flares/vent stack to minimise operational noise. 8 boreholes were approved for Longwall 34	Construction and operation of up to 21 coal seam gas boreholes in ‘Area 5’ of West Cliff Coal Mine and flaring and venting the extracted gas. Gas extraction wells will be linked via pipeline to one of two centralised extraction plant/flares/vent stacks via surface pipelines. Where the pipelines will be visible from Appin Road, or at the request of the landowner, the pipelines will be buried. The extraction plant compounds will be located at least 1km away from the nearest residence. 10 boreholes are proposed for Longwall 34. The total number of goaf gas drainage boreholes will remain the same due to shorter Longwalls 33 and 34.
Project location	Area 5 of West Cliff Coal Mine, situated approximately 3km north of Appin. Individual boreholes would be located near the edges of longwall panels 32 to 34.	As approved
Project procedure	The following procedure would be undertaken for each borehole: • Site establishment, including clearing of a 30 x 40 m area of land, and installing drilling equipment and site facilities; • Drilling of boreholes to a depth of 500m, just above the Bulli Seam at a diameter of roughly 0.3 m; • Casing of boreholes with cemented steel; • Operational hiatus of approximately 3 months, until extraction of the underlying longwall has passed. Continuous operation of extraction plant on each gas extraction well; • Establishment of mobile gas extraction, pipelines and flaring on site at each borehole; • Extraction of gas using a diesel or gas powered vacuum pump for 6-8 weeks; • Detailed monitoring, then flaring and, if required, venting of the gas; and	The following procedure would be undertaken for each borehole: • Site establishment, including clearing of a 30 x 40 m area of land, and installing drilling equipment and site facilities; • Drilling of boreholes to a depth of 500m, just above the Bulli Seam at a diameter of roughly 0.3 m; • Casing of boreholes with cemented steel; • Continuous operation of the extraction plant once the longwall has passed a gas extraction well; • Establishment of two centralised mobile gas extraction, pipelines and flaring co-located with wells 34-4 and 34-5. Extraction will maximise volume of gas extracted and flared for well systems 34-1 to 4 and then 34-5 to10. Where the pipelines will be visible from Appin Road, or at the request of the landowner, the pipelines will be buried; • Extraction of gas using a diesel or gas powered

	Decommissioning of each borehole in accordance with the requirements of the DPI for exploration boreholes	vacuum pump – timing of extraction depending on rate of longwall extraction ; - Detailed monitoring, then flaring and, if required, venting of the gas; and - Decommissioning of each borehole in accordance with the requirements of the DPI for exploration boreholes
Associated facilities	Access roads, parking areas, diesel tanks, pipelines, fencing materials, buried polyethylene piping	As approved
Hours of operation	Construction (drilling etc) would take place between 7am and 6pm, Monday to Friday. Gas extraction, flaring and venting would occur 24 hours a day, 7 days a week	As approved
Rehabilitation	Each site would be rehabilitated upon decommissioning, with respreading of top soil, seeding with native vegetation species and ongoing maintenance.	As approved.
Employment	Three full time positions would be created over the lifetime of the Project	As approved
Residential receivers	The nearest residences are situated immediately east of Appin Road, each roughly 300m from one or more borehole sites.	The nearest residences are situated immediately east of Appin Road, each roughly 150-300m from the closest borehole site.
Capital cost	\$6.8 million	As approved

[Qualifying information on project as approved](#)

[Qualifying information on project as proposed and highlighting extent of any change](#)

Environmental Assessment of Modified Project

A comprehensive Environmental Assessment (EA) was undertaken for the Approved Project. This EA identified, investigated and justified a range impacts relevant to the Project. These include:

- Air quality and dust
- Surface water management
- Noise
- Flora & fauna
- Traffic
- Waste Management
- Cultural Heritage
- Visual Impact
- Greenhouse Gas

A comparison of the environmental impacts between the Approved and Modified Project is provided in Table 2.

Table 2: Summary of environmental aspects		
Aspect	Approved Project	Modified Project
Operational noise	For boreholes within close proximity to a residence, the boreholes are to be joined by pipelines and extraction plant/flares and vent was to be located at least 500m away in accordance with negotiated outcome with DoP. See Section 4.3 and Appendix II of the EA.	The Modified Project proposes to extend the operational philosophy negotiated with DoP for the Approved Project to link all boreholes to one of two centralised extraction plants. Extraction plants are the major source of operational noise and will be at least 1km away from the residential receivers. Extraction plants will be inaudible at new locations.
Construction noise	2-3 weeks for gas extraction boreholes. Construction between 7am and 6pm, Monday to Friday. See Section 4.3 and Appendix II of the EA. DoP Assessment Report	A Noise Assessment of the Modified project has been undertaken by Wilkinson Murray and is provided in Appendix C. The Noise Assessment concluded that the construction noise generated by the project will be in excess of the RBL +10 = 41 dB management level but less than the 75 dB management levels described in the DECCW (2009) Construction Noise Guidelines. The maximum construction noise level at a residential premises will be 63 dB, otherwise predicted construction noise levels are less than 56 dB. The management of construction noise for gas extraction wells will be in accordance with the requirements of the Project Approval and the DECCW (2009) Guidelines. This is: 2-3 weeks construction duration for gas extraction boreholes. - Construction between 7am and 6pm, Monday to Friday. - Orientation of the drill rig with the quietest side facing the residential premises - Using well maintained and quiet drilling equipment - Informing neighbours of the work and its duration

		Wilkinson Murray have also considered construction noise generated by pipe laying and trench excavations. The additional boreholes are adjacent to the Appin Road. Appin Road is a major arterial road between Campbelltown and Appin/Wollongong that has significant heavy vehicle traffic. Appin Road is significant noise source that impacts on nearby residential receivers. Appin Road is between the additional borehole sites and the residential receivers.
Greenhouse gas	Extraction could only occur from one borehole at a time (except the three most easterly boreholes that were to be linked by a pipeline to the one extraction plant). Mobile extraction plant would have to move from bore to bore as mining progresses. Residual goaf gas not extracted by surface extraction plant may enter the mine ventilation system and be emitted from vent shaft. Approximately ~154 kt CO₂-e has expected to be abated during the scope of the project See Section 4.9 and Appendix VI of the EA.	Gas extraction will occur simultaneously from several boreholes once goafing occurs. The centralised extraction plant will be moved once from Well 34-4 to Well 34-5 depending on longwall progression. The modified system is able to extract more residual goaf gas, thereby minimising gas entering the mine ventilation system. Increased number of boreholes enables more gas to be extracted and flared, as opposed to entering the mine ventilation system where it is ultimately emitted to the atmosphere at an upcast ventilation shaft. If gas extraction significantly exceeds the capacity of the existing dual flare system that oxidises the methane (Global Warming Potential of 21) to carbon dioxide (Global Warming Potential of 1) and water, then an additional flare units may be added to maximise GHG abatement. As described in the original EA (section 4.9), gas flows from individual wells is highly variable. The existing two flare GHG abatement system is estimated to abate ~154 kt CO₂-e during the scope of the project. However this could increase, possibly by up to a total of ~230 kt CO₂-e, if gas is extracted from more boreholes and over a longer time, and an additional flare units are utilised to abate the increased volume of gas extracted.
Air quality and dust	Minor concentrations of odour, airborne pollutants and dust impacts were predicted to occur well below DECCW impact assessment criteria. Emission sources moved from borehole to borehole, with the closest being 500m from the nearest residence. See Section 4.1 and Appendix I of the EA.	The air quality impacts from the modified Project will be similar or less than those predicted to occur in the Approved Project. The source of odour (from gas emissions from the vent stack) and airborne pollutants (from methane combustion in the flare and diesel generator) are associated with the extraction plant, and these are now located in excess of 1km from the nearest residence, thereby enabling more dispersion to occur.
Native vegetation	Two boreholes approved that require clearing of native vegetation. Rest of disturbance on highly modified agricultural land. See Section 4.4 and Appendix III of the EA.	One borehole location requiring native vegetation clearing. Well 34-1 requires some minor (< 1 ha) of clearing of Shale Sandstone Transition Forest that is currently in poor condition. Approximately 10 trees will be required to be cleared. The amount of clearing of native vegetation is less than the Approved Project. The location of Well 34-1 is in accordance with the recommendations made by Biosis Research (see Appendix III p32-33 of the original EA) in respect to the alternative location for borehole PA03. The rest of disturbance of highly modified agricultural land.
Visual	Extraction plant and flares just visible from Appin Road. See Section 4.8 and Appendix V of the EA.	Extraction plant and flares will not be visible from Appin Road. They are shielded by topography when viewed from Appin Road. Where the pipelines will be visible from Appin Road, or at the request of the landowner, the pipelines will be buried. The disturbed pipe line route re-grassed to minimise visual impact.
Landowner agreement	Obtained	Obtained
Cultural heritage	Biosis Research recommended that Leafs Gully 1 (52-2-2265) open artefact scatter that was located on the access track to PA01 and PA04 be avoided by using alternative access. See Section 4.7 and Appendix IV of the EA.	No cultural heritage sites have been identified for the modified Project associated with Longwall 34, and as such, no impacts are expected to occur.
Surface water	Soil and erosion control measures will be implemented during construction activities. See Section 4.2 of the EA.	Soil and erosion control measures will be implemented during construction activities.
Groundwater	Each vertical gas extraction well will be cased and grouted to a depth of ~410 m to prevent the ingress of	As approved.

	groundwater into the well and contamination of aquifers. See Section 1.2 of the EA.	
Traffic	No impact of local traffic was predicted to occur. See Section 4.5 of the EA.	As approved.
Waste	During construction, port-a-loos will be provided. All other wastes will be reused, recycled or disposed off at licensed facilities by licensed contractors. See Section 4.6 of the EA.	As approved.
Management Plans	Required for; vegetation clearing and rehabilitation, noise and erosion/sediment control.	The proposed design does not impact on any additional environmental aspects and the management plans submitted cover all the relevant aspects of environmental management for the project.

A revised Statement of Commitments is provided in Appendix B. The revised Statement of Commitments consolidate some commitments given that conditions of the Project Approval specifies environmental performance outcomes and preparation of management plans, and remove some commitments in respect of visual amenity that are now redundant given that the extraction plant and flares will be out of site from Appin Road.

The Environmental Management Plans that are required under Schedule 3 of the Project Approval have been prepared taking into consideration the proposed modifications to the project. The Environmental Management Plans are provided in Appendix D.

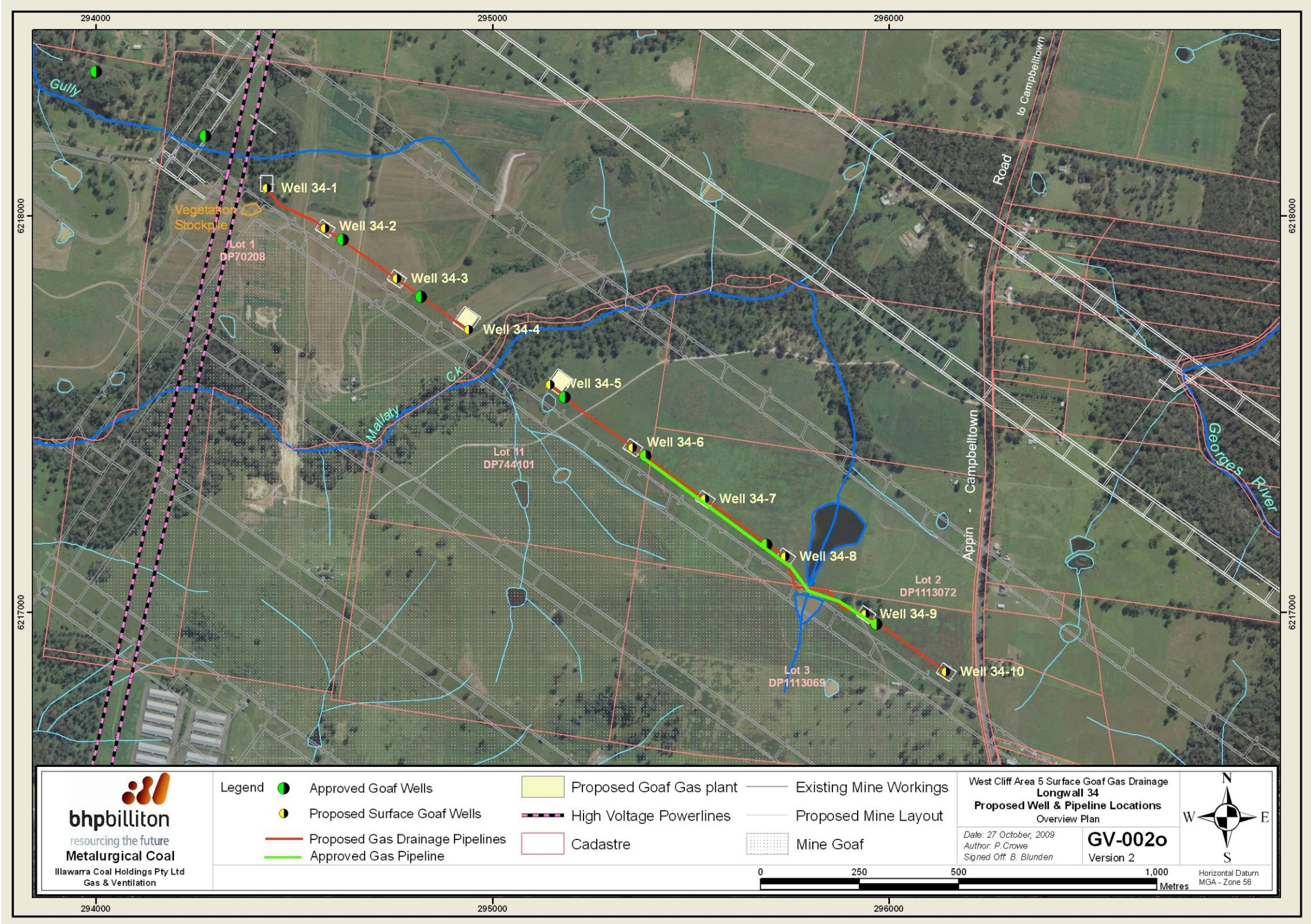
Conclusion

Illawarra Coal propose to modify the West Cliff Surface Goaf Gas Drainage Project Approval (MP 07_0073) in accordance with s75W of the Environmental Planning and Assessment Act 1979. The scope of the modifications include:

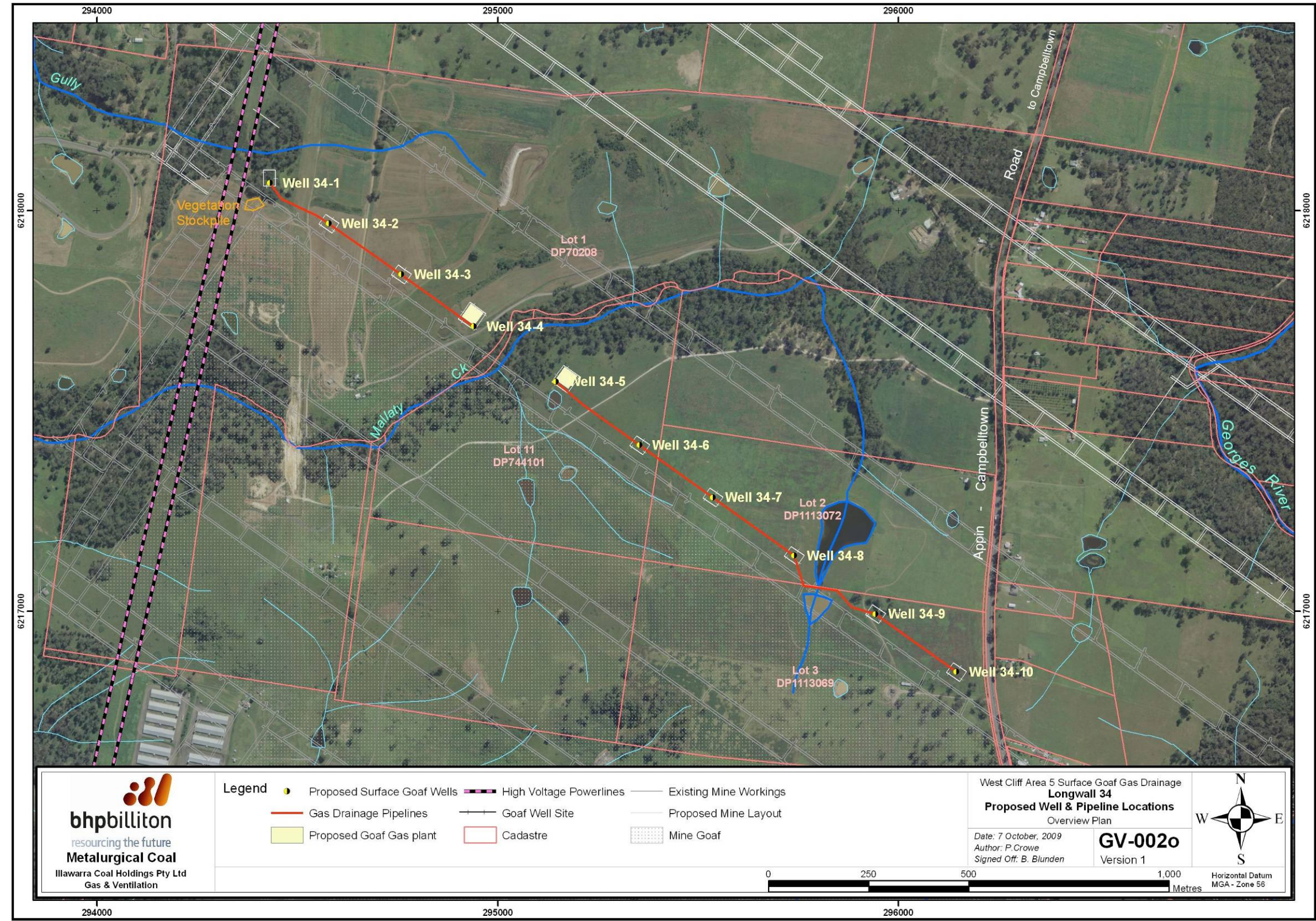
- The addition of two additional gas extraction wells over Longwall 34
- Linking the gas extraction wells over Longwall 34 to one of two extraction plants by buried pipeline
- The addition of flare units to maximise the abatement of greenhouse gas if gas flow rates consistently exceed the capacity of the existing flare units to oxidise methane

An Environmental Assessment of the modified project has been undertaken. The EA indicates that the modified Project has improved environmental performance for greenhouse gas emissions, operational noise, visual amenity and native vegetation clearing. Some potential for short term small increase in construction noise exists, however the noise assessment undertaken by Wilkinson Murray indicated that construction noise impacts are minor and generally consistent with the performance standards described in the DECCW (2009) Construction Noise Guidelines. Other impacts such as; waste, traffic, surface water and cultural heritage are unchanged.

Appendix A1: Scope of Project Modification



Appendix A2: Scope of Modified Project



Appendix B: Revised Statement of Commitments

- BHPBIC will continue to operate its office in the Appin Business and Shopping Precinct during the operation of the project.
- BHPBIC will continue to operate a 24-hour contact telephone line.
- BHPBIC will continue to support the operation of the Appin Area Community Working Group and associated community liaison activities.
- There will not be any on-site worker accommodation.
- Stormwater runoff and sediment/erosion will be managed in accordance with guidelines detailed in the Landcom Publication, “Soils and Construction” Volume 1, 4th Edition, dated March 2004.
- Each borehole will be plugged and abandoned in accordance with requirements of the Department of Primary Industries (Mineral Resources) for exploration boreholes, EDG01 Borehole Sealing requirements on Land: Coal Exploration.
- When appropriate and possible, gas will be flared utilising two existing flaring units, hired from Landfill Management Systems Pty Ltd (LMS). If additional gas is available, an additional flare units may be utilized to maximize the abatement of greenhouse gas emissions.
- BHPBIC proposes to minimise the disturbance of native vegetation. The proposed location of boreholes have been modified to achieve this objective. Where disturbance is unavoidable, borehole sites will be rehabilitated using brush-matting and bush generation techniques using cleared vegetation stockpiled on site.
- Exposed areas will be managed to minimise dust emissions.
- The Drill Rig will normally operate in the daytime hours of 7 am to 6 pm. However there may be occasions when for operational reasons drilling is conducted outside these hours, in consultation with the landowner. The Gas Extraction and Flaring equipment will operate continuously around the clock.
- Any chemicals used on site will be taken off site after use and disposed of appropriately.
- Appropriate safety measures will be implemented to ensure workforce and public safety during the times when heavy equipment is moved on public roads.
- Wastes will not be disposed on site. Port-a-loo facilities will be used on site. Packaging wastes will be recycled or sent to appropriate existing landfill sites.
- Metals will be recycled in the current system. Potential for timber to be recycled will be investigated, otherwise this material, which is classified as builders waste, will be sent to an appropriate landfill. Any protective packing materials will be recycled.
- To avoid impacting Archaeological Site Leaf’s Gully 1 further, access of all heavy machinery to borehole site PA04 will be via the existing track network within the paddock to the east, rather than along the track on which the artifact site is located.
- To avoid impacting upon unidentified Archaeological sites, all vehicles and work movements will stay in previously cleared and disturbed areas where safe and practicable. The construction methods of infrastructure installation will be kept to a minimum and above ground alternatives will be considered where possible.
- Should any Aboriginal relics be encountered during work, the work will cease within the vicinity of the find and the DECCW and Aboriginal stakeholders notified. A qualified archaeologist may also be required to assess the find.
- Should any historical relics be uncovered during works associated with the proposed pipeline, works will cease in the immediate vicinity of the find and the NSW Heritage Office will be notified. A qualified archaeologist may also be required to assess the find.
- Any disturbed surface area (other than necessary vehicle access tracks) external to the compound will be spray-grassed or seeded to reduce the amount of exposed soil.
- Any unnecessary lights will be extinguished and essential service lights will be shielded at night.
- The compound will be kept clean and tidy.
- BHPBIC will endeavour to minimise visible light emitted from the flaring of goaf gas.
- After the compounds are dismantled BHPBIC will remediate and revegetate the sites.
- All of the Contractor’s workforce will undertake West Cliff Colliery Safety and Environmental Training prior to commencing work on site.
- The Contractor will ensure all equipment is maintained in a safe and secure condition during the Project period.

- When the Project is complete the drilling and flaring equipment and all rubbish, damaged vegetation and construction debris will be removed from all areas disturbed by the works and the surface graded to smooth contours. The cleanup shall be to the satisfaction of BHPBIC's Site Engineer.
- The Contractor will ensure that employees, delivery trucks and sub-contractors do not park on public roads when working on the Project.
- The Contractor will also ensure that trucks and machinery leaving the site do not spill any waste materials on public roads. If this occurs it will be the Contractor's responsibility to clean up the spillage.

Appendix C: Project Modification Noise Assessment

WEST CLIFF GOAF GAS DRAINAGE PROJECT

WELLS 34-9 & 34-10 CONSTRUCTION NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 09328
VERSION A

WILKINSON  MURRAY

WEST CLIFF GOAF GAS DRAINAGE PROJECT

WELLS 34-9 & 34-10 CONSTRUCTION NOISE ASSESSMENT

REPORT NO. 09328
VERSION A

NOVEMBER 2009

PREPARED FOR

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A C O U S T I C S A N D A I R

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1 INTRODUCTION

BHP Billiton Illawarra Coal (BHPBIC) operates the West Cliff longwall coal mine in the Appin area. Part of the operation of this mine involves the removal of goaf gas. Goaf gas is the gas that remains in a mined section of the longwall and if it is not removed this presents a potential hazard to workers in the adjoining mine shafts. To remove this gas, boreholes are drilled from the surface and the gas is extracted.

BHPBIC have previously gained approval for a goaf gas extraction plant and associated boreholes for the extraction of goaf gas from longwall 34. This report presents an assessment of the drilling and construction noise associated with two additional boreholes, not included in the initial assessment and approval.

2 SITE DESCRIPTION

The site and surrounds are predominantly rural. Several sparsely located residents neighbour the site and are generally located on the opposite side of Appin Road.

An aerial photograph of the site showing the proposed boreholes, associated pipelines and also surrounding residents is shown in Figure 2-1.

Table 2-1 shows the identified surrounding receivers and the approximate distances to the nearest drill site (borehole) and pipeline construction. The receiver numbers correspond to the numbers in Figure 2-1.

Table 2-1 Surrounding Residential Receivers

Receiver #	Distance to Nearest Drilling Site (m)	Distance to Nearest Pipeline Construction (m)
1	270	270
2	110	110
3	220	220
4	340	340
5	380	380

2.1 Operations and Timing

Each of the two wells will take approximately 2.5 weeks to construct. During this time the site will be cleared and drilling will be conducted. Additionally the pipelines connecting these wells to the goaf plant will need to be constructed. This involves trenching and installing the pipes before backfilling and compacting. It is expected that these works will take 2-3 weeks to complete also.

All construction work is proposed to occur between 7am – 6pm Monday to Friday. This corresponds with the DECCW recommended standard hours of work specified in the *Interim Construction Noise Guideline (ICNG)*.

Figure 2-1 Aerial Photograph of the Site



3 ACOUSTIC PERFORMANCE CRITERIA

3.1 Background Noise Levels

The current acoustic environment was monitored as part of the initial assessment for the goaf plant. Information relevant to this assessment is reproduced below.

Unattended noise monitoring was conducted between 14th and 21st May, 2007. Table 3-1 shows the measured background noise levels from the initial noise assessment.

Table 3-1 Measured L_{A90} Noise Levels (RBL)

Monitoring Location	Day ¹	Evening ¹	Night ¹
Rural/Residential area nearby holes 6 & 7 (see initial assessment for details)	31	37 ²	31

Note: 1) Daytime 7.00am–6.00am; Evening 6.00pm–10.00pm; and Night 10.00pm–6.00am.
2) DECCW Industrial Noise Policy Application notes state if evening background noise levels are higher than daytime levels then criteria should be derived from daytime background levels

3.2 Construction Noise Goals

The NSW DECCW *Interim Construction Noise Guidelines (ICNG)* recommends the following objectives:

Recommended standard hours of work

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- No work on Sundays or Public Holiday

Management Noise Goals

Noise goals are detailed in Table 3-2.

Table 3-2 Noise at Residences using Quantitative Assessment

Time of Day	Management	How to Apply
	Level $L_{Aeq,15min}$	
Recommended standard hours: Monday to Friday 7 am to 6 pm	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15 min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Saturday 8 am to 1 pm No work on Sundays or public holidays	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

The site specific construction noise goals are presented in Table 3-3.

Table 3-3 Construction Noise Goals

Receivers	Acceptable L_{Aeq} Noise Level RBL + 10 (dBA)
All	41

4 NOISE SOURCE LEVELS

Noise level testing of an air drill rig, similar to that proposed for the borehole drilling on this project, has been conducted as part of the recent Appin Area 7 Goaf Gas project. From this data the sound power level of a drill rig was calculated to be up to 118dBA, though the level varies significantly depending on the direction from the rig. Because the orientation of the rig at each location is unknown at this stage the highest sound power level has been assumed in all directions. It should be noted that in other directions the noise level can be up to 9dB quieter.

The following construction plant items, shown with their associated maximum L_{Aeq} sound pressure levels at 7m, are expected to be used for the construction of the pipelines:

- Excavator 84dBA
- Truck 83dBA
- Wacka Packa 80dBA

From these levels the maximum $L_{Aeq,15min}$ level of pipeline construction activities is expected to be 85dBA at 7m.

5 PREDICTED RECEIVER NOISE LEVELS

Receiver noise levels were calculated using the CadnaA computer noise model. As the drilling and construction will be done during the day, meteorological effects such as temperature inversions are considered unlikely. Therefore only a still, isothermal condition was modelled, with the model accounting for attenuation due to distance, shielding, air absorption and ground effect/absorption.

Table 5-1 Predicted Receiver Noise Level – $L_{Aeq,15min}$ (dBA)

Receiver #	Predicted Receiver $L_{Aeq,15min}$ Noise Level (dBA)		
	Drilling		Nearest Pipeline Construction
	Well 34-09	Well 34-10	
1	54	46	46
2	63	51	55
3	56	52	48
4	52	51	44
5	48	50	42

Exceedances of criteria are expected at all the identified surrounding residences. This is typical of construction in close proximity to residential receivers, particularly in semi-rural areas where the background noise level is low.

6 DISCUSSION / ASSESSMENT

The ICNG offers the following advice for appropriate actions to minimize the noise impacts on surrounding receivers:

- Where the predicted or measured $L_{Aeq,15 min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level; and
- The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Due to the relatively short duration of works, and also the fact that the predicted noise levels are not excessively high, it is not considered reasonable to implement any significant mitigation measures such as temporary barriers. Instead consideration should be given to the orientation of the drill rig to try and position the quieter sides towards the most affected receivers. Measurements of a similar rig have shown that this can result in noise levels up to 9dB quieter than the maximum levels, which were assumed for this assessment.

Additionally the quietest possible plant, which is fitted with appropriate mufflers and silencers and is well maintained, should be utilized on this project.

7 CONCLUSION

Construction noise impacts associated with the proposed addition of two vertical wells and associated pipelines at the West Cliff Mine (Longwall 34) have been assessed in accordance with criteria recommended by the NSW Department of Environment, Climate Change & Water (DECCW).

Noise levels from construction and drilling are predicted to exceed relevant goal levels when works are nearest the residences. Due to the mobile nature of the works and the short duration the implementation of temporary noise barriers is considered unreasonable.

It is recommended that the following noise control measures be considered:

- Drilling should be limited to the DECCW's recommended standard hours of 7.00am-6.00pm Monday to Friday and 8.00am-1.00pm Saturday, with no audible work on Sunday or Public Holidays;
- Use of the quietest available plant, which is regularly maintained and fitted with appropriate mufflers;
- Orient the drill rig and equipment so that the quietest side (identified as being up to 9dB quieter than the loudest side) is faced toward the nearest receivers;
- Impacted neighbours should be contacted and informed of likely duration of work.

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose. The information contained in this document produced by Wilkinson Murray is solely for the use of the client identified on front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. Wilkinson Murray undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2000 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Final	3 November 2009	Adam Bioletti	Rob Bullen

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

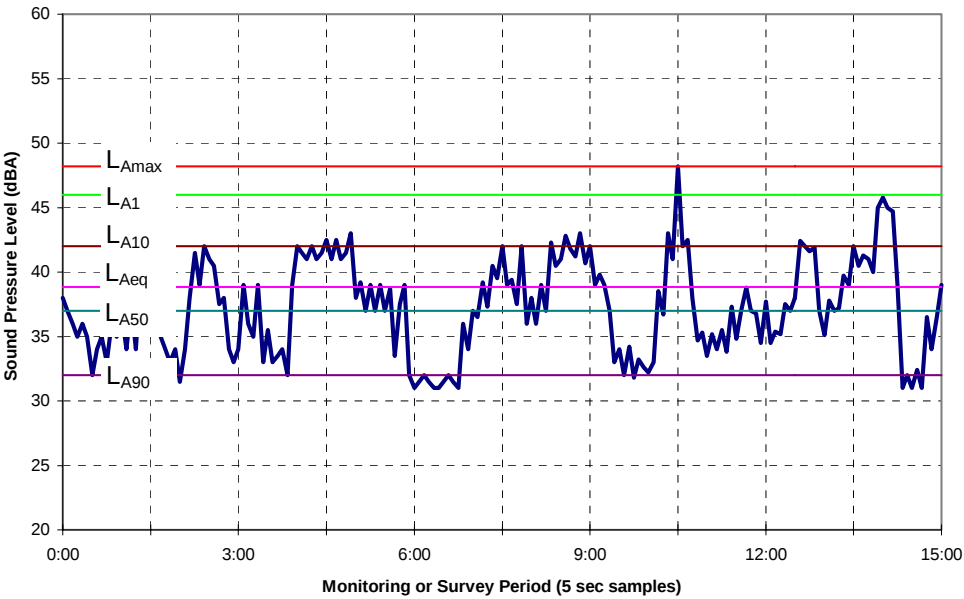
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.



APPENDIX B

NOISE MEASUREMENT RESULTS

Appendix D: Environmental Management Plans

West Cliff Area 5 Goaf Gas Drainage Project

Environmental Management Plans



Vegetation Clearing and Rehabilitation
Noise
Water
Erosion and Sediment Control

Review History

Revision	Description of Changes	Date	Approved
R0	New Document	September 2009	

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1 INTRODUCTION

1.1 Background

BHP Billiton Illawarra Coal (BHPBIC) currently operates West Cliff Colliery, near the township of Appin, NSW, within the Wollondilly Local Government Area (LGA).

In September 2006 the Department of Primary Industries (DPI) granted BHP Billiton Illawarra Coal BHPBIC Subsidence Management Plan (SMP) approval for West Cliff Area 5 Longwalls 31-33. In May 2009 the Department of Primary Industries (DPI) granted BHP Billiton Illawarra Coal BHPBIC Subsidence Management Plan (SMP) approval for West Cliff Area 5 Longwalls 34-36. An application to vary (shorten) the length of Longwall 34 was approved by the DPI on 26 May 2009.

BHPBIC has mined Longwalls 32 and 33 in West Cliff Area 5 in accordance with SMP approval. Longwall 34 is planned to commence in December 2009. In order to ensure safe and efficient mining, BHPBIC require surface equipment to drain methane gas from the goaf area of the mine. This methane gas is referred to as "goaf gas".

As a result, an application was prepared and submitted to the Department of Planning (DoP) for the proposal to install temporary gas extraction boreholes and mobile surface extraction plants and ancillary equipment to drain goaf gas from Longwalls 32-34. The project was approved by the Director General of Planning on 8 December 2008. The drilling and drainage of goaf gas had been undertaken in accordance with a Part 5 approval issued by the DPI prior to 8 December 2008.

Construction of the vertical wells, collector pipelines, goaf gas extraction plant and ancillary equipment for goaf gas extraction associated with Longwall 34 is expected to commence in November 2009. Operation of the goaf gas extraction system is expected to commence soon after the commencement of mining in Longwall 34.

This Management Plan (MP) details the proposed environmental management activities that will be undertaken during construction and operation of the West Cliff Area 5 Goaf Gas Drainage Project. This document is a module of the Environmental Management Strategy (EMS). It is envisaged that this management plan will be updated for future goaf drainage operations for the remainder of West Cliff Area 5 once the Bulli Seam Operations Part 3A application has been approved.

1.2 Scope

The proposed goaf gas drainage surface facilities will be located across a number of paddocks on private landholdings. BHPBIC has consulted with and obtained written agreements from all landowners on which the proposed goaf gas drainage activities will take place.

The scope of this document covers the following project sites within the Wollondilly LGA, formally described as:

- Lot 1 DP70208;
- Lot 2 DP1113072;
- Lot 11 DP744101
- Lot 3 DP1113069

2 OBJECTIVES

The objectives of this plan are to:

- Comply with all regulatory requirements set out in the West Cliff Coal Mine - Surface Goaf Gas Drainage Project Approval and other legislation with regards to vegetation clearing and rehabilitation, noise, water and erosion and sediment control management and monitoring;
- Ensure BHP Billiton environmental and other relevant Strategies and Policies are met and upheld;
- Identify activities that could cause noise impacts to nearby receivers;
- Identify activities that could cause impacts to surface and groundwater;
- Identify activities that could cause soil erosion and generate sediment;
- Identify the extent of vegetation clearing;
- Describe measures to minimise and monitor potential noise impacts;
- Describe measures to minimise and monitor potential water impacts;
- Describe measures to minimise soil erosion and the potential for transport of sediment to downstream waters;
- Describe measures to manage vegetation clearing and rehabilitation;
- Develop a program/inspection regime to ensure the rehabilitation, noise, water and erosion and sediment controls for the project are performing in a satisfactory manner; and
- Detail the procedures associated with reporting the results of the monitoring.

3 RESPONSIBILITIES

It is the responsibility of all employees and contractors to undertake practices to manage and minimise potential environmental impacts according to this Environmental Management Plan.

The West Cliff Mine Health, Safety, Environment and Community (HSEC) Manager is responsible for coordinating the implementation of this Management Plan and for the periodic review of the Plan.

The HSEC Manager will also be responsible for ensuring the commitments contained within this management plan are met. This will include:

- i. Overseeing the operation and maintenance of the vegetation clearing, site water management and sediment and erosion control system;
- ii. Overseeing the operation and maintenance of the noise monitoring and mitigation measures;
- iii. Production and dissemination of reports and appropriate summaries of information in reports.

4 LEGISLATIVE AND OTHER REQUIREMENTS

4.1 Legislative Requirements

Legislation applicable to noise, water, erosion and sediment control management includes but is not limited to:

- Protection of the Environment Operations Act 1997 (POEO Act);
- Environmental Planning and Assessment Act 1979;
- Soil Conservation Act 1938;
- Water Management Act 2000;
- Water Act 1912.

The NSW Industrial Noise Policy and DECCW Interim Construction Noise Guidelines are also relevant.

4.2 Project Approval Conditions

Project Approval for the West Cliff Goaf Gas project was granted by the Minister for Planning on 8 December 2008 and is available at www.planning.nsw.gov.au. Various Environment Management Plans are required as conditions of Project Approval. These include:

- Noise Monitoring Plan
- Water Management Plan
- Vegetation Clearing and Rehabilitation Protocol
- Environment Management Strategy

This document has been prepared in accordance with the conditions of this Project Approval.

4.3.1 Noise

The proponent shall construct and operate the project in accordance with the hours listed in **Table 1** below.

Table 1 Construction and operation hours of the project

Activity	Hours
Construction - Site establishment of borehole and extraction plant sites, including vegetation clearing and drill assembly/setup	Monday to Friday 7:00am to 6:00pm.

- Drilling of vertical boreholes - Surface pipeline reticulation system works	
Operation - Extraction plant, flaring, venting, maintenance and rehabilitation	24 hours 7 days per week

The proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria set out in **Table 2** below at any residence on privately owned land, or on more than 25 per cent of any privately owned land.

Table 2 Noise impact assessment criteria

Location	Day/Evening	Night	
		L _{Aeq} (15 min)	L _{A1} (1 min)
All privately owned residents	36	36	41

The proponent shall prepare and implement a Noise Monitoring Plan for the project to the satisfaction of the Director General. This plan must:

- a) be submitted to the Director General for approval prior to the commencement of construction activities;
- b) use attended noise monitoring measures to monitor the performance of the project; and
- c) describe how compliance with the noise impact assessment criteria would be established

4.3.2 Soil and Water

Except as may be expressly provided by a DECCW Environment Protection Licence, the proponent shall comply with section 120 of the *Protection of the Environment Operations Act 1997* (POEO Act 1997) during the carrying out of the project.

The proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Director General. This plan must:

- a) be submitted to the Director General for approval prior to the commencement of construction;
- b) include an Erosion and Sediment Control Plan, which must:
 - be consistent with the requirements of Managing Urban Stormwater: Soils and Construction manual (Landcom 2004 or its latest version);
 - identify activities that could cause soil erosion and generate sediment;

- describe measures to minimise soil erosion and the potential for transport of sediment to downstream waters;
- describe the location, function and capacity of erosion and sediment control structures; and
- describe what measures would be implemented to monitor and maintain the structures over time.

4.3.3 Vegetation

The proponent shall prepare and implement a Vegetation Clearing and Rehabilitation Protocol for the project to the satisfaction of the Director General. This plan must:

- a) be submitted to the Director General for approval prior to the commencement of construction;
- b) delineate the areas of vegetation to be cleared;
- c) describe the procedures that would be implemented for;
 - protection of Shale Sandstone Transition Forest and Cumberland Plain Woodland, as far as is practicable; and
 - conserving, stockpiling and reusing disturbed material;
- d) describe the procedures for revegetating and rehabilitating the areas of disturbance; and
- e) provide completion criteria, including a monitoring timetable, and measures that would be implemented to ensure the criteria are achieved.

4.3 BHP Billiton and Other Policies and Strategies

BHP Billiton operates in accordance with the Health, Safety, Environment and Community (HSEC) Management Standard (STA.009) which covers all operational aspects and activities of its business and the Environment Standard (STA.020) which prescribes the mandatory environmental performance requirements that support the aspiration of zero harm across BHP Billiton.

The HSEC Management System framework is consistent with internationally recognised standards. It aims to set benchmarks for the Company's diverse range of businesses to develop and implement their own HSEC Management Systems, to provide auditable criteria for these systems and to provide a basis from which to drive continuous improvement.

The Environmental Management Plan has been developed consistent with the principles of the HSEC Management Standard and Environment Standard.

West Cliff Mine maintains an environmental management system which is certified to ISO14001 standard.

4.4 Reporting

The details of the construction and operation of the West Cliff Goaf Gas Drainage Project and the performance of its vegetation, noise, water and erosion and sediment controls will be reported in the West Cliff Mine Annual Environmental Management Report. The reporting requirements relating to this project are detailed in the Environmental Management Strategy.

5 VEGETATION CLEARING AND REHABILITATION PROTOCOL

5.1 Area of clearing

The vertical goaf gas extraction well compounds for wells 34-2 to 34-10 and connecting pipelines are located on agricultural land consisting of improved pasture. Two discrete goaf drainage extraction plants over Longwall 34 will be co-located with wells 34-4 and 34-5 to avoid disturbance of Shale Sandstone Transition Forest in and adjacent to Mallatty Creek. Disturbance of pasture by well/extraction plant compounds, trenching and pipe laying operations will be short term, and the disturbed areas will be returned to pasture as soon as construction and/or decommissioning is complete.

The construction of the well 34-1 compound will require clearing of approximately 0.2 ha of highly degraded Shale Sandstone Transition Forest. The area of 'good condition' Shale Sandstone Transition Forest surrounding the borehole named PA03 in Biosis Research (2007) has been avoided, and well 34-1 has been located in accordance with the recommendations of Biosis Research (2007 – see pages 32-33) to minimise disturbance of 'good condition' Shale Sandstone Transition Forest.

Figures 1-4 show; an overview of the stand of Shale Sandstone Transition Forest vegetation and surrounds, the well 34-1 site and pipeline route, drill rig entry to the well 34-1 site, and aerial overview of well 34-1, respectively.



Figure 1: Overview of the stand of Shale Sandstone Transition Forest vegetation

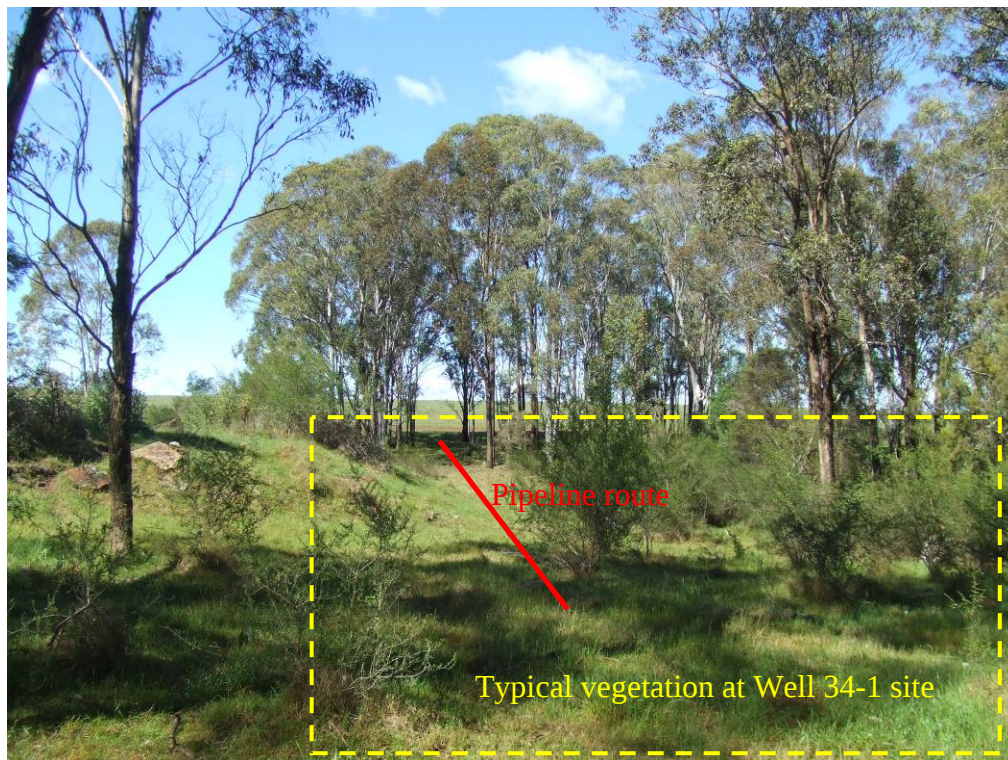


Figure 2: General location of Well 34-1.



Figure 3: Drill rig access to Well 34-1

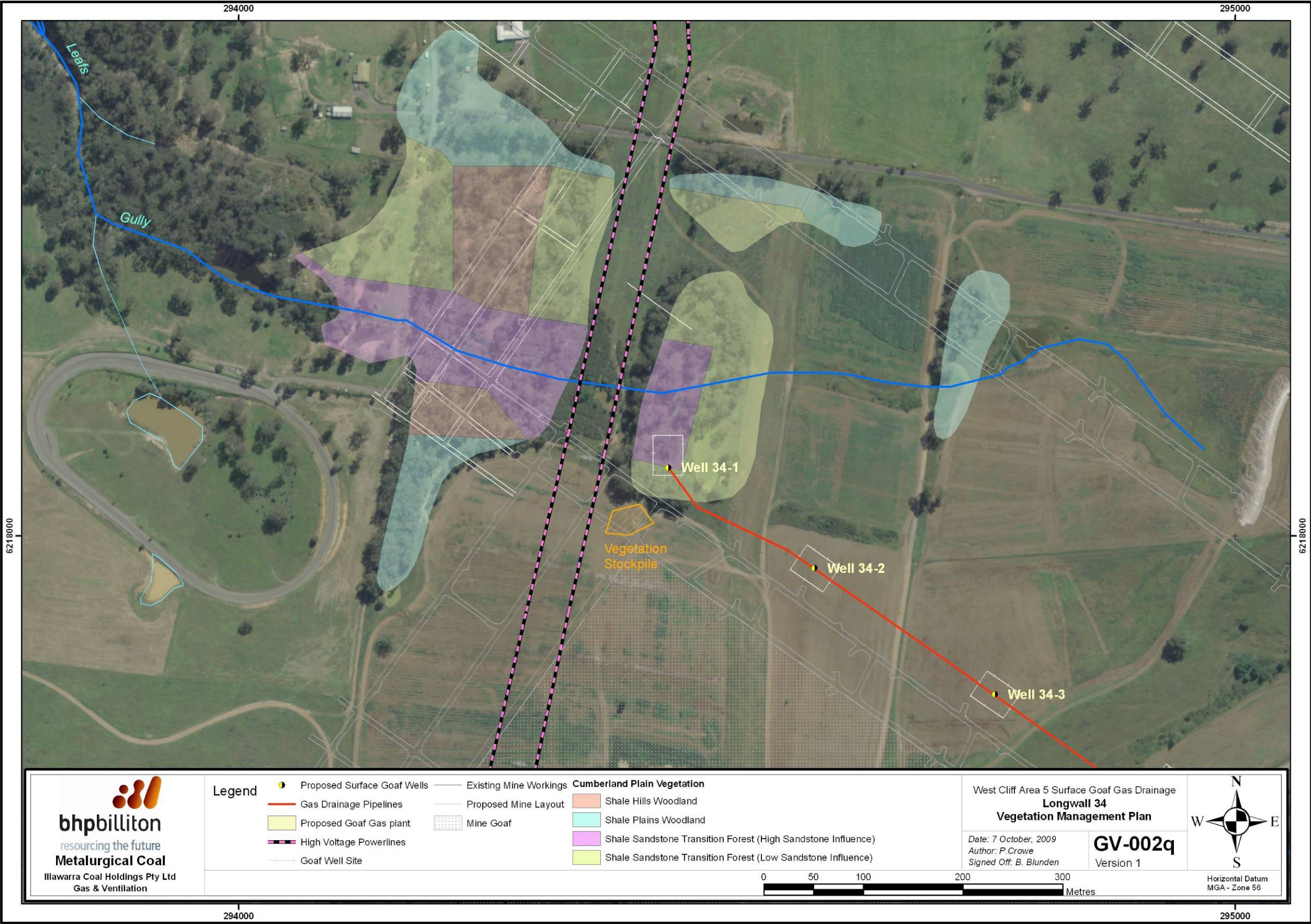


Figure 4: Well 34-1 compound and vegetation

5.2 Procedure to minimise clearing of native vegetation

In order to optimise gas extraction at the commencing end of Longwall 34, and to enable the mandatory safety stand off distances for the drill rig from the Transgrid 330 kV transmission line, construction of the well 34-1 compound will require disturbance of approximately 0.2 ha of Shale Sandstone Transition Forest. Site investigation have identified that less than 10 individual trees will required to be cleared. The drilling site will be located on an area that is a pre-existing track that is cleared/weedy-pasture to minimise clearing.

The pipeline connecting well 34-1 to the extraction plant will be routed along a pre-existing track to avoid any further disturbance to the vegetation.

All clearing and rehabilitation works will be undertaken in accordance with the Illawarra Coal – Resource and Exploration Procedure – Clearing and Rehabilitation. This procedure is available on iPick at <http://ipick.bhpbilliton.net/IC/viewer.php?docID=302>

5.3 Conserving, stockpiling and reusing disturbed material

At the commencement of site establishment for well 34-1, the boundary of the well compound will be marked with barrier tape. No vegetation beyond the tape will be cleared. All vegetation that will be cleared will be felled into open or already cleared areas to avoid damage to the adjacent vegetation that will not be cleared.

Vegetation selected for clearing will be felled by excavator and/or manual techniques (e.g., chain saw). Large vegetation (i.e., trees) will be cut into manageable size lengths. All vegetation will be stockpiled within cleared areas away from the Transgrid 330 kV transmission line. If it is practical and feasible to do so, seed from the cleared vegetation will be collected and stored for use in rehabilitation of well 34-1.

Once the well 34-1 site is cleared, temporary security fencing will be erected around the perimeter of the compound to prevent access and to avoid further disturbance of the surrounding vegetation.

5.4 Procedures for revegetating and rehabilitating the disturbed area

Revegetation and rehabilitation of the area cleared of native vegetation will be guided by DECC (2005) Recovering Bushland on the Cumberland Plain – Best Practice Guidelines for the Management and Restoration of Bushland (available at <http://www.environment.nsw.gov.au/threatenedspecies/CumberlandPlainManagementGuidelines.htm>) and DITR (2006) Mine Rehabilitation (available at <http://www.ret.gov.au/resources/Documents/LPSDP/LPSDP-MineRehabilitationHandbook.pdf>).

Once all site infrastructure is decommissioned and removed, the well compound area will be lightly tilled with the tines of an excavator bucket. Any seed collected during initial site clearing will be incorporated into the surface top soil. The stockpiled vegetation suitable for brush matting will be laid on the soil surface. Larger logs will be strategically placed on the soil surface to provide microclimate for seed entrapment and germination. The rehabilitation area will be temporally fenced to exclude stock (depending upon approval of the land owner – note the site is grazed by cattle prior to this project).

5.5 Completion criteria and monitoring

Completion criteria for the well 34-1 site rehabilitation is the establishment of non-erodible, self supporting vegetated land surface. The existing surface is predominantly grazed pasture species.

It is intended that Shale Sandstone Transition Forest type native vegetation will regenerate from the placement of brush matting, direct seeding (if applicable) and natural re-establishment from adjacent vegetation across the area that was cleared.

Monitoring to determine the success of the establishment of Shale Sandstone Transition Forest type native vegetation at the well 34-1 site will take place after three and six months from the completion of the rehabilitation works. Photo points will be established to assist with qualitative assessment of the rehabilitation.

Where monitoring of the rehabilitated well 34-1 site indicates poor establishment of native vegetation, then the following action(s) will be considered:

- Weed control if invasive weeds are restricting establishment of native vegetation;
- More robust fencing if damage to emerging vegetation by stock is occurring (dependent on landowner agreement)
- Planting of locally sourced tubestock
- Seeking the advice of qualified bush regeneration experts

6 NOISE MANAGEMENT STRATEGIES

6.1 Site Description

The layout of the West Cliff goaf drainage project has been revised to minimise noise impacts on nearby residential receivers by connecting goaf drainage boreholes via a PVC collector pipeline to a centralised extraction plant and flare system that is located in excess of 1km from the nearest residence. Two discrete goaf drainage systems over Longwall 34 will be constructed to avoid disturbance of vegetation in and adjacent to Mallatty Creek.

6.2 Noise Management Strategies

The greatest noise generating activities is firstly the drilling of the vertical boreholes and secondly, the operation of the extraction plant. The closest vertical borehole is located approximately 115 m away from the nearest residence and on the other side of Appin Road (see Figure 5). The construction and operation of vertical drilling is restricted to Monday-Friday between 7am to 6pm and is expected to take approximately two weeks. The extraction plant is located in excess of 1km from the closest residence and is shielded by topography. It is unlikely that any noise from the operation of the extraction plant will be audible at any residential receiver.

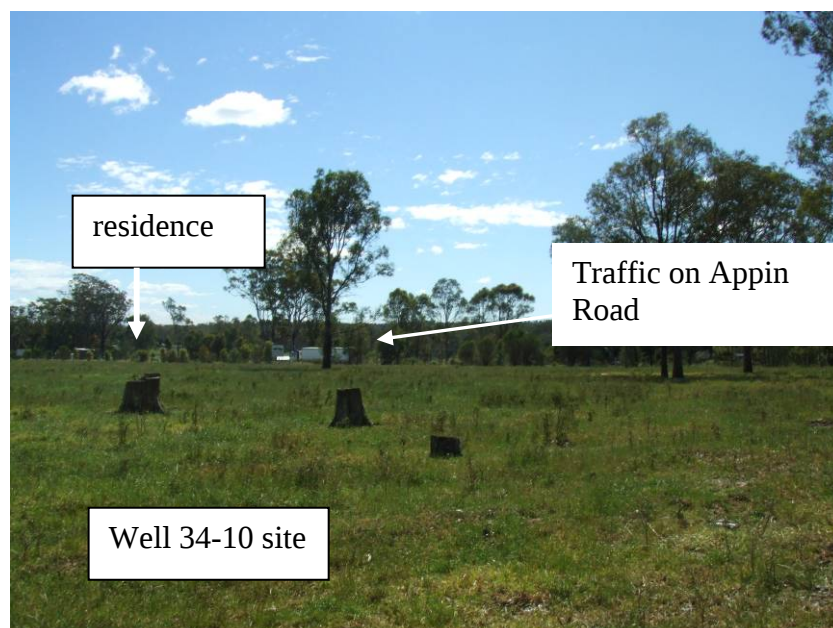


Figure 5: Well 34-10 proximity to Appin Road and nearest residence

If monitoring indicates non-compliance with the noise impact assessment criteria specified in the Project Approval or neighbours complain of noise impacts, then BHPBIC will consider the installation temporary noise barriers (see Figure 6) around the drilling or extraction plant compounds.



Figure 6 Noise Mitigation Barriers

6.3 Noise Monitoring and Determination of Compliance

Attended noise monitoring will be undertaken at the nearest residence within the first week of drilling of borehole 34-10. See Figure 7 for the location of the noise monitoring location and noise barriers if required.

If any noise complaints are received by BHPBIC in regard to construction or operational aspects of this project, then attended noise monitoring will be undertaken within one week to determine compliance with the noise impacts assessment criteria specified in the Project Approval.

The West Cliff Mine HSEC Manager will review the attended noise monitoring data to determine compliance with the noise impacts assessment criteria specified in the Project Approval within one week of the attended noise monitoring being undertaken.

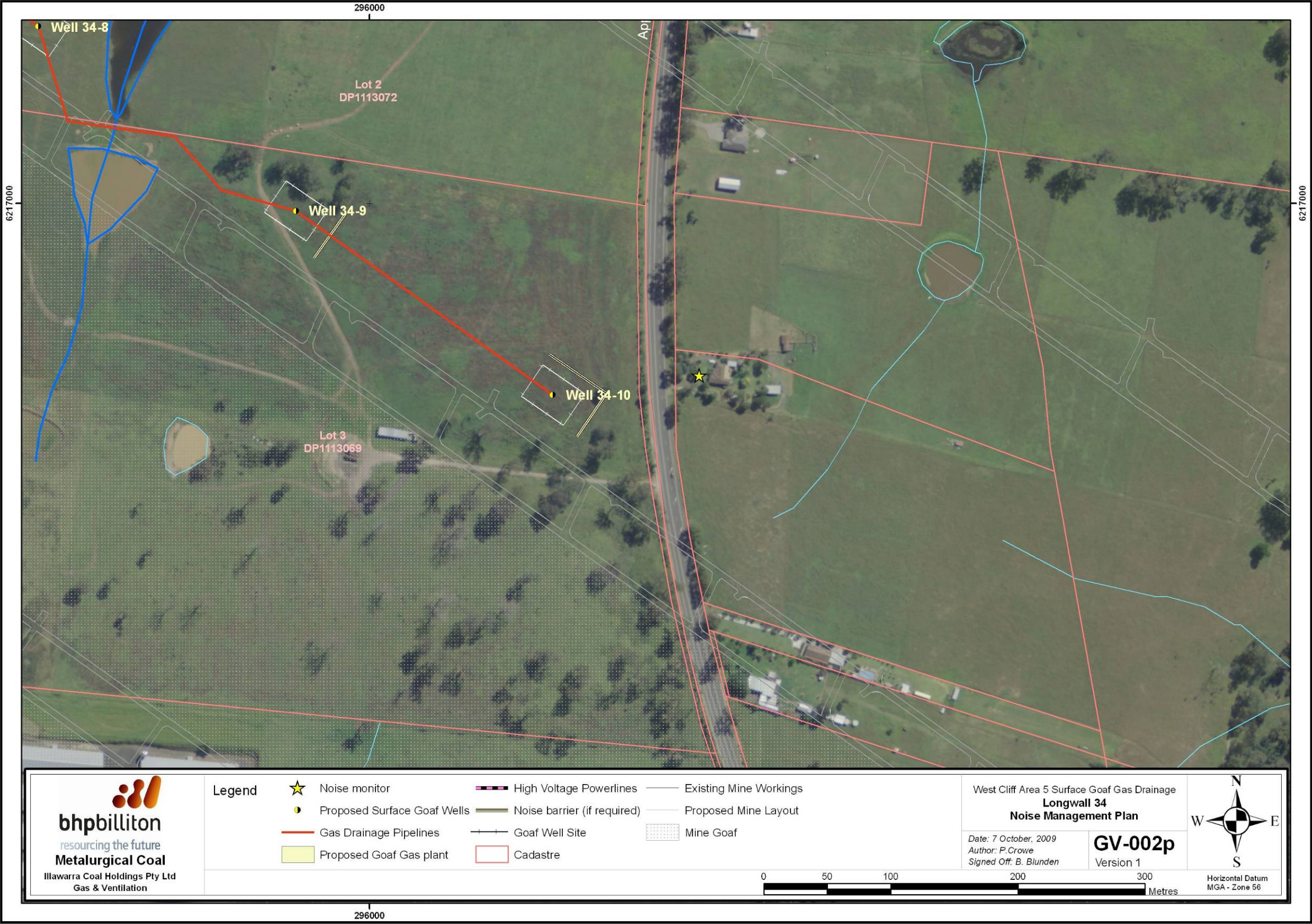


Figure 7: Noise Monitoring and Management Plan

7 WATER MANAGEMENT STRATEGIES

7.1 Site Description

The project sites and associated activities that water management strategies pertain to are as follows:

- i. The site establishment and drilling of ten vertical boreholes;
- ii. Site establishment and operation of the two goaf gas extraction plants and flare systems. The goaf gas extraction plants are co-located with boreholes to minimise site disturbance.

These sites can be described as unoccupied rural blocks consisting of undulating to hilly topography, which has been previously cleared of native vegetation to support agriculture. Improved pasture is the dominant vegetation within the paddocks but there are also a variety of weeds and exotic plant species. Borehole 34-1 will require the clearing of approximately 0.2 ha of native vegetation.

7.2 Proposed Management Strategies

The operation of the extraction plant requires water cooling and a small water tank will be located within the extraction plant compound/s. Potable water from supplied by a Sydney Water Authorised user will be brought onsite will used for this cooling process. Approximate cooling water volumes would be less than 2,000L and this will be pumped through a continuous recirculation system between the extraction plant and water tank. Small amounts (<100 L/day) of pipeline condensate will be collected in water traps in the pipeline, and discharged onto adjacent pasture.

For the drilling of each vertical borehole, a single pond lined with an impermeable liner will be excavated within each drilling compound to act as a drilling sump. The approximate dimensions of the pond are 15m length x 5m width x 3m depth and the approximate volume of water used throughout the drilling process is 10,000L per vertical borehole over a drilling period of approximately two weeks.

These works have the potential to impact both surface and groundwater at the abovementioned sites and thus require the implementation of management measures to mitigate or minimise these impacts. BHPBIC propose the following management strategies in relation to water management:

- i. Water used for drilling and extraction plant operations will be from a Sydney Water Authorised user or sources from on-site farm dams in accordance with landowner approval;
- ii. All excavated ponds will contain an appropriate impermeable liner to prevent water loss. The walls of ponds will be of an appropriate height to provide adequate freeboard to prevent inflow or overflow during rainfall;
- iii. The vertical boreholes will be cased with steel and grouted in place from the ground surface of the well to the top of the Bulgo Sandstone section of the strata above the coal seam (refer Figure 8) to prevent any cross contamination of groundwater;
- iv. The water used in the extraction plant cooling process and borehole drilling will be removed and reused at West Cliff Mine or irrigated onto nearby pasture well away from drainage lines or farm dams.

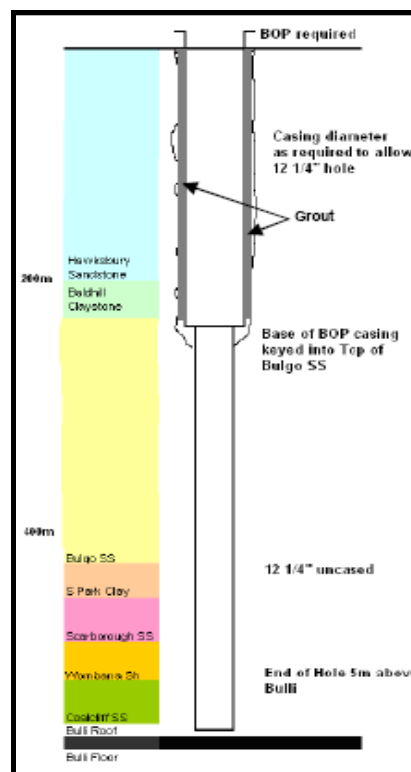


Figure 8 Example of Grout in Vertical Borehole

7.3 Maintenance/Monitoring of Water Management Structures

The drilling water sumps will be inspected on a weekly basis as well as after every significant storm and rainfall event (i.e. >10mm in a 24hour period) to ensure the integrity of the impermeable liner and the sumps continue to operate satisfactorily and to perform any maintenance work and repairs that may be required. Regular maintenance will include:

- Repairs of areas which may become unstable following periods of high rainfall; and
- Checks on sump wall and liner integrity to ensure no leakage of water.

8 EROSION AND SEDIMENT MANAGEMENT STRATEGIES

8.1 Site Description

The project sites and associated activities that erosion and sedimentation management strategies pertain to are as follows:

- i. Establishment of ten vertical drilling compounds approximately 30 m x 40 m;
- ii. Establishment of goaf gas extraction and flare compounds at well 34-4 and well 34-5 to minimise site disturbance;
- iii. Trenching works to bury the pipeline connecting the vertical gas extraction wells.

Drainage from these sites can be generally described as falling from the east to the west, within the Nepean River catchment.

8.2 Proposed Management Strategies

The civil works described above have the potential to generate sediment laden runoff and erosion and thus management measures are proposed to be implemented to minimise these impacts.

An Erosion and Sediment Control Plan has been prepared for the project outlining specific soil and water management measures as shown in Figure 11.

Erosion and sedimentation control measures will be implemented in accordance with the above mentioned Soil and Water Management Plans and the requirements of the "Blue Book" (Soils and Construction, Volume 1, 4th edition March 2004, Landcom). The following types of management strategies are proposed:

- i. Weekly inspection of site drainage and erosion/sediment controls and implementation of maintenance as needed;
- ii. Identification of drainage channels and effective management of surface water during construction and operational phases of work (refer Figure 9 & 11);
- iii. Disturbed areas will be revegetated and stabilised to minimise erosion and scour;
- iv. Reducing the amount and velocity of any water flows over the construction site;
- v. Sediment filters or fences downslope of disturbed areas (refer Figure 10);

- vi. Clean water diversion drains;
- vii. Minimising the length and duration of exposed excavations during pipe line laying operations. Where trenches and soil stockpiles are exposed for more than one week then silt fences will be deployed immediately adjacent to the disturbed areas on the downslope side. Soil stockpiles will be placed on the uphill side of any excavated trench so that any sediment flows into the trench during runoff;
- viii. Maintain pasture adjacent to any disturbed areas and direct runoff to flow through pasture prior to any flow to waterways.



Figure 9 Erosion and Scour Control Structure



Figure 10 Sedimentation Control Structure

Drilling compounds will be leveled to accommodate safe drilling operations. Small cut/fill operations of generally less than 200 m³ may occur. No import or export of earth is envisaged. Crushed sandstone or gravel may be used to create non-erodible surface working areas within the drill and extraction plant compounds. All sediment control structures will have sufficient capacity to trap sediment mobilized from cleared areas and sump overflows during 'normal' rainfall events. Any overflow from sediment control structures will be directed to grassed paddocks. Drilling for wells 34-1 to 34-10 will occur in sequence commencing with well 34-1 in November 2009. Pipelines will be constructed to relevant extraction plants concurrently. Pasture will be re-established on disturbed areas such as buried pipelines and drilling compounds (where it is reasonable and practical to do so) after construction is complete to minimize potential for sediment runoff.

At the end of effective gas extraction, the extraction plant compounds, well heads and pipelines will be decommissioned, removed and rehabilitated. The boreholes will be rehabilitated in accordance with Department of Industry and Investment requirements. Any cut/fill areas will be reshaped to the original land surface unless requested by the landowner to leave as it is. The extraction plant and drilling compounds as well as the pipelines will be rehabilitated in accordance with the Vegetation Clearing and Rehabilitation Protocol within one month of completion of the site decommissioning.

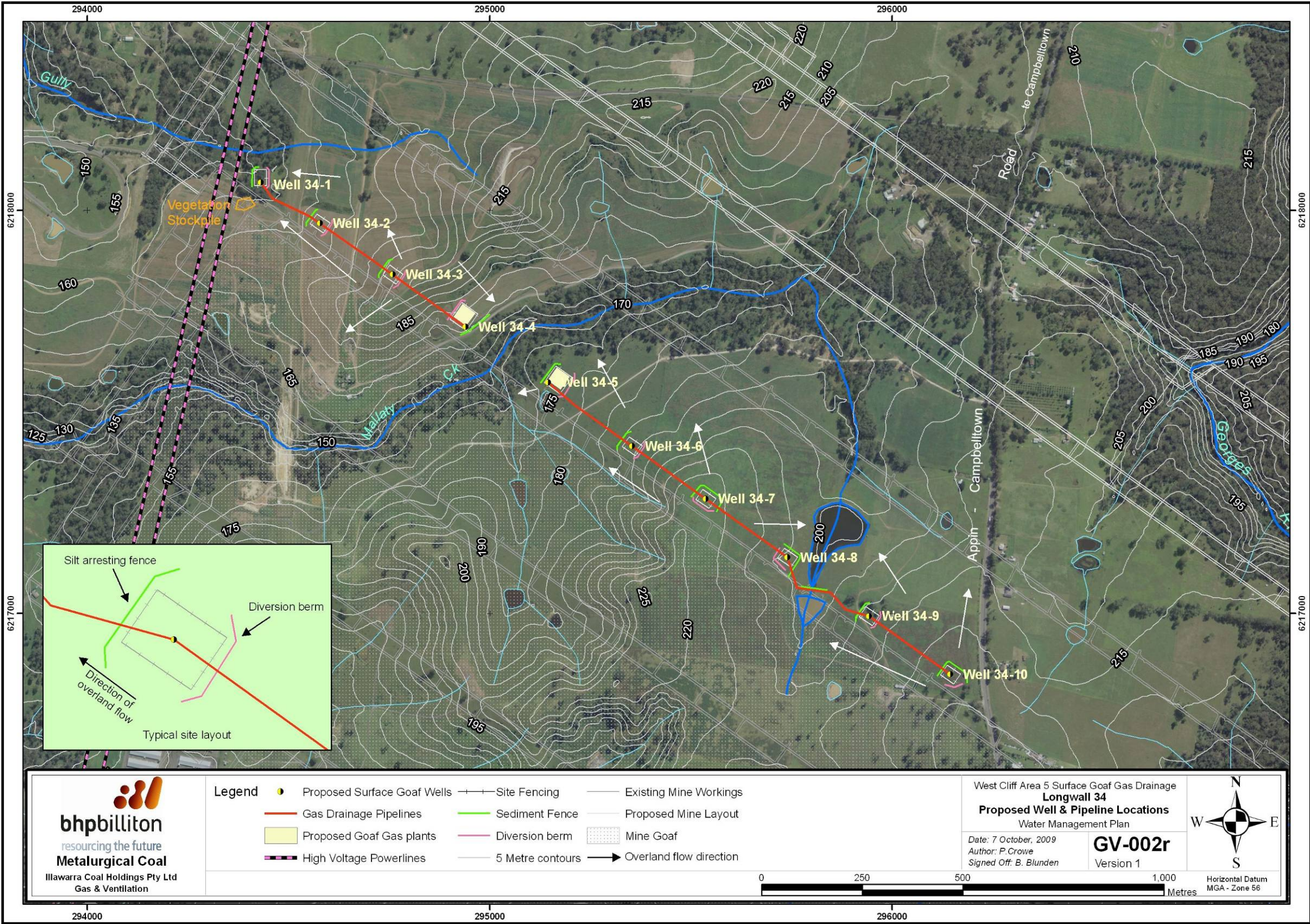


Figure 11: Erosion and Sediment Control Plan

8.3 Maintenance/Monitoring of Sediment and Erosion Control Structures

The erosion and sediment control structures (i.e. drainage lines and silt fencing) associated with the construction of the project will be inspected on a weekly basis, as well as after every significant storm and rainfall event (i.e. >10mm in a 24hour period) to check that they are operating satisfactorily and to perform any maintenance work and repairs that may be required.

Regular maintenance will include:

- Sediment removal from sediment traps;
- Repairs of areas, which become unstable following periods of high flow; and
- Checks on bund integrity and diesel fuel/chemical storage to ensure compliance with the appropriate standards.

9 REFERENCES

Biosis Research (2007) Flora and Fauna Impact Assessment: West Cliff Colliery Surface Gas Drainage.

Olsen Environmental Consulting (2008) *Environmental Assessment West Cliff Mine Surface Goaf Gas Drainage Project*.

Department of Planning (2008) *Project Approval – West Cliff Mine Surface Goaf Gas Drainage Project*

Landcom (2004) *Soils and Construction – Managing Urban Stormwater (Volume 1), 4th Edition*.