Table 30 – Maximum Predicted 24-Hour Average PM_{10} Concentrations

Property Identification		Maximum Predicted 24-Hour Average PM10 Concentration (µg/m^3)		
Name	Ownership	Year 1	Year 5	Year 10
	Criteria	50	50	50
1 "Roseglass"	Private	10	8	11
2 "Costa Vale"	Whitehaven	21	15	15
3 "Yarrawonga"	Whitehaven	**60**	30	33
5 "Yarrari"	Whitehaven	27	19	42
6 "Belah"	Whitehaven	34	29	**60**
7 "Stratford"	Whitehaven	16	16	22
8 "Roseberry"	Private[1]	23	26	29
9 "Surrey"	Private	19	20	29
10 "Carlton"	Private	12	12	17
11 "Wundurra Stud"	Private	10	11	14
12 "Brolga"	Private	7	9	14
13 "Braemar"	Private	7	7	9

1 - "Roseberry" is subject to a negotiated private agreement between the landholder and Whitehaven.

As stated in **Section 7.2.2,** in more recent project approvals, the DoP has required acquisition of properties if the 24-hour average PM10 concentration is exceeded more than five times per year (i.e. the 98.6th percentile). Analysis conducted on the "Yarrawonga" and "Belah" properties determined that the 50 µg/m^3 criterion would be exceeded on 32 occasions and four occasions, respectively. However, both of these properties are already owned by Whitehaven and, as such, the acquisition criterion becomes irrelevant.

Cumulative 24-Hour Average PM_{10} Concentrations

PAEHolmes (2011) notes that it is not possible to accurately predict the cumulative 24-hour PM_{10} concentrations using dispersion modelling due to the variability in ambient levels and spatial and temporal variation in any day to day anthropogenic activity, including mining in the future. Experience shows that the worst-case 24-hour PM_{10} concentrations are strongly influenced by other sources, such as bushfires and dust storms, which are essentially unpredictable and dominate worst-case PM_{10} concentrations.

There are currently no continuous measurements of PM_{10} available in the area that can be considered 'background'. As shown on **Figure 24,** there are currently two HVAS operating within the vicinity of the existing Rocglen operation at "Glenroc" to the north and "Roseberry" to the south. The variability in 24-hour average PM_{10} concentrations can be clearly seen in **Figure 25.** The variation has a seasonal component, although clearly that is not the only factor.

The high values in December 2009 were likely to be the result of significant high winds and dust storms across NSW and bushfires in the Kelvin Range. Under these conditions, the proportional contribution of mining activities to the total PM_{10} concentration will be minimal. It should also be noted that PM_{10} concentrations in general in 2009 are likely to be higher than average due to the prolonged period of drought experienced over the previous six to seven years across NSW.

Figure 25 also shows that the values at "Glenroc" are generally higher than those at "Roseberry". This is not unusual given that the "Roseberry" site is more removed from current mining activity. In terms of making a crude estimate of a background 24-hour average PM_{10} level, PAEHolmes (2011) considers it reasonable to use data from "Roseberry". **Figure 26** shows a plot of these data, ranking the values from highest to lowest.

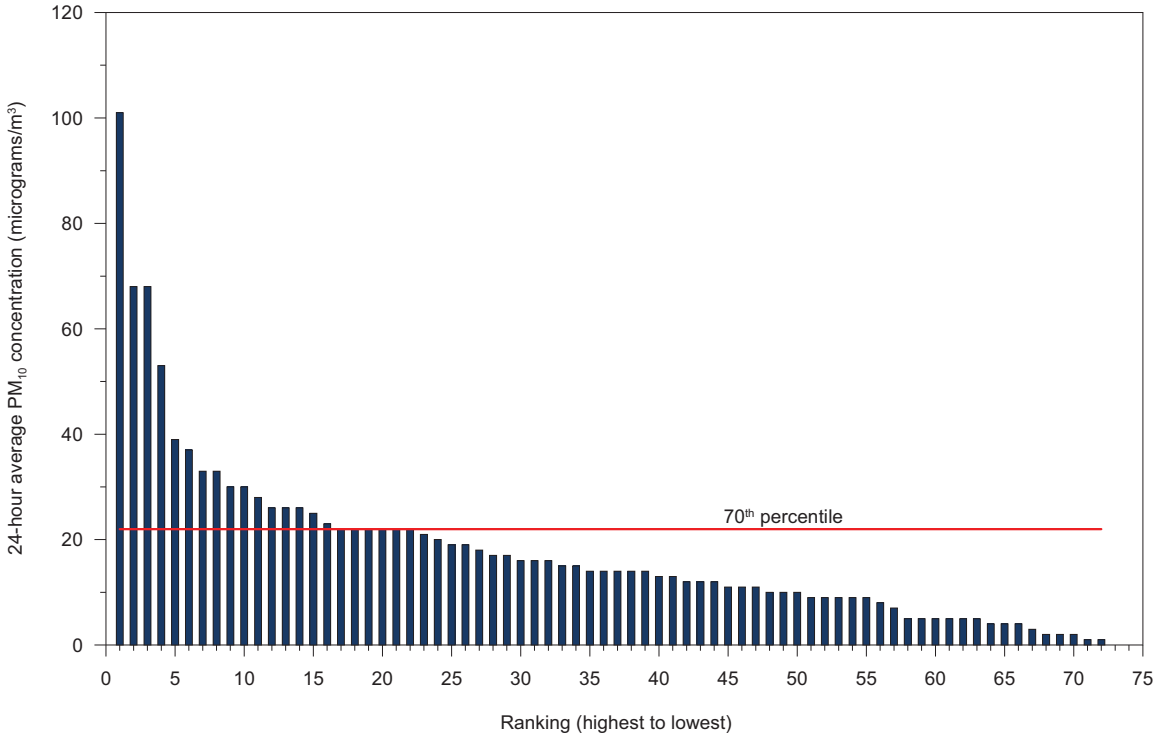


Figure 26 – PM_{10} Monitoring Data 2008 to 2009 at "Roseberry"

The 70th percentile (22 µg/m^3) provides a simplistic indication of PM_{10} concentrations in the absence of anomalous data due to extreme events such as bushfires and dust storms. However it does still provide a conservatively high estimation of 24-hour average background PM_{10} concentrations as contributions from the existing Rocglen operation are included. Using it as a background and adding it to modelling results also assumes that this level of 22 µg/m^3 will occur every day, which is clearly not the case as by definition it will be lower for 70 percent of the time.

As listed in **Table 31,** using the 70th percentile approach leads to predicted exceedances of the 50 µg/m^3 criterion at "Yarrawonga" "Yarrari", "Belah", "Roseberry" and "Surrey". Of these residences, only "Roseberry" and "Surrey" are not currently owned by Whitehaven. Exceedances at these two properties are only predicted for operations in Year 10.

PAEHolmes (2011) carried further analysis for "Roseberry" and "Surrey" to determine how many times exccedance may occur, when added to a background of 22 µg/m^3. For the 24-hour average PM_{10} concentration to exceed 50 µg/m^3 at these residences, a predicted concentration must be 29 µg/m^3.

The model was run to extract a predicted 24-hour average PM_{10} concentration for each day of the year at "Roseberry" and "Surrey", and these time series are shown on **Figure 27** (on following page). It can be seen that there is only one day of the year at each residence when 29 µg/m^3 is predicted to be exceeded, with the majority of values estimated to be less than 15 µg/m^3. Using this conservative approach, the mine is predicted to comply with the DoP's acquisition criterion at both "Roseberry" and "Surrey".

Table 31 – Maximum Predicted 24-Hour Average PM_{10} Concentrations

Property Identification		Maximum Predicted 24-Hour Average PM10 Concentration (µg/m^3)		
Name	Ownership	Year 1	Year 5	Year 10
Criteria		50	50	50
70th percentile background		22	22	22
1 "Roseglass"	Private	32	30	33
2 "Costa Vale"	Whitehaven	43	37	37
3 "Yarrawonga"	Whitehaven	**82**	**52**	**55**
5 "Yarrari"	Whitehaven	49	41	**64**
6 "Belah"	Whitehaven	**56**	**51**	**82**
7 "Stratford"	Whitehaven	38	38	44
8 "Roseberry"	Private[1]	45	48	**51**
9 "Surrey"	Private	41	42	**51**
10 "Carlton"	Private	34	34	39
11 "Wundurra Stud"	Private	32	33	36
12 "Brolga"	Private	29	31	36
13 "Braemar"	Private	29	29	31

1 - "Roseberry" is subject to a negotiated private agreement between the landholder and Whitehaven.

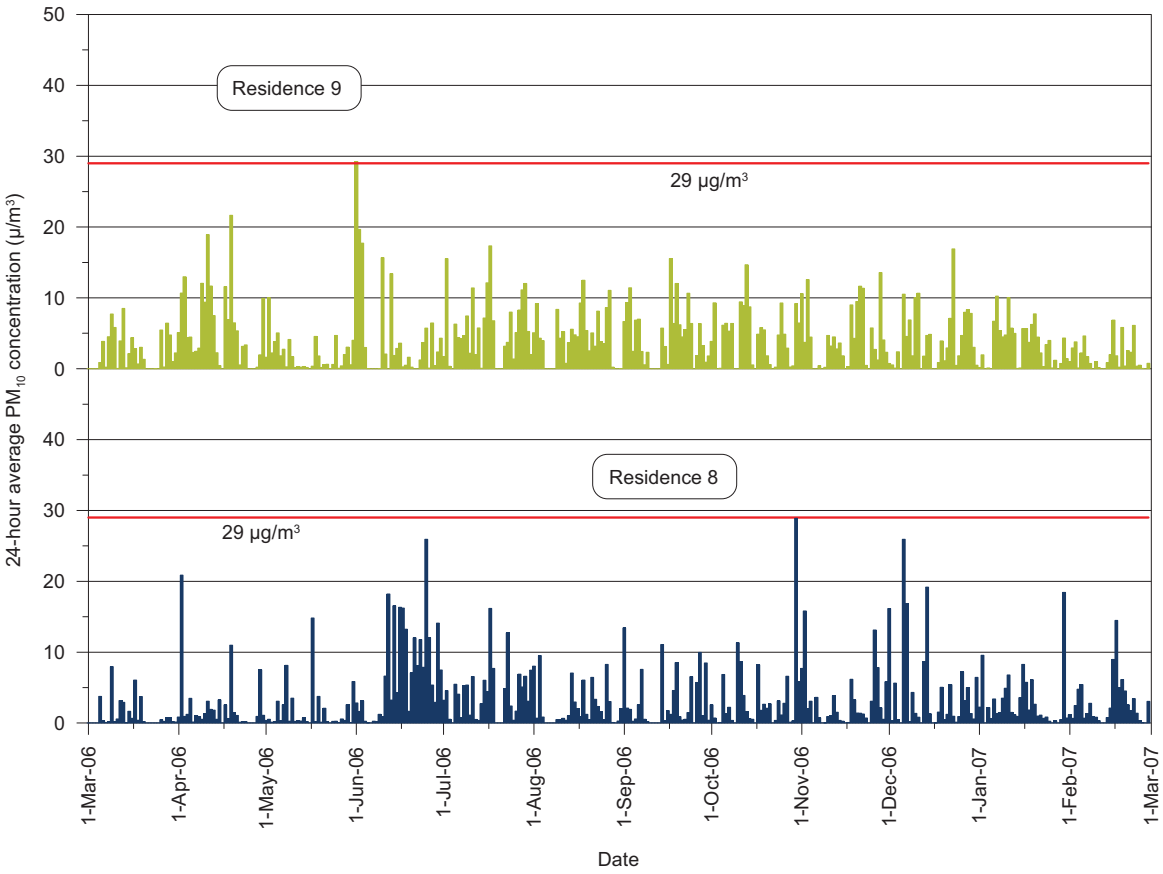


Figure 27 – Time Series of 24-Hour PM_{10} Model Predictions at "Roseberry" and "Surrey"

7.2.4 Management and Monitoring

While the dispersion modelling predicts acceptable air quality impacts at all privately-owned residences throughout the life of the mine, Whitehaven will continue to take reasonable and practicable measures to prevent or minimise the generation and dispersal of particulate matter. As listed below, a range of complementary air pollution management strategies, mitigation measures and monitoring activities are currently employed at Rocglen and these will continue to be implemented for the Rocglen Extension Project.

Vegetation Clearing and Soil Stripping

- Cleared trees and branches will be retained for use in stabilising slopes identified for restoration of rehabilitated woodland. No burning of vegetation is permitted or occurs on-site.
- Where practicable, soil stripping will be undertaken when there is sufficient soil moisture to prevent lift-off dust and at times that avoid periods of high winds. Where this is not possible, dust suppression by water application will be undertaken to increase soil moisture.
- Land disturbance, including groundcover removal, will be limited in advance of mining activities consistent with operational requirements. Under normal circumstances, a maximum of 100 metres will be prepared in advance of mining.
- Groundcover will be removed with the topsoil, as opposed to prior to topsoil removal.
- Where long-term stockpiling of soil materials is planned (typically greater than 3 months) the stockpiles will be seeded and fertilised.

Drilling and Blasting Activities

- Water injection will be used on the drilling rig.
- Coarse aggregates will be used for blasthole stemming at all times.
- Where practicable, blasting will be restricted during unfavourable weather conditions.
- When necessary, dust aprons will be lowered during on-site drilling.

Overburden Ripping and Placement

- Where practicable, ripping of softer overburden material will be avoided during periods of high winds.

Coal Mining

- When necessary, low moisture coal will be sprayed with water prior to excavation.

Crushing and Screening

- Notwithstanding the generally moist nature of the ROM coal pad, when necessary, water will be applied to the coal at the feed hopper, crusher and at all conveyor transfer and discharge points.
- When necessary, some flexibility does exist to enable cessation of coal processing activities during periods of concurrent high winds and temperatures that have the potential to cause coal dust dispersal independent of water applications.

Internal Transport

- As required, internal roads will be watered, with emphasis on those subject to frequent trafficking.
- The speed of all on-site vehicles and equipment will be restricted.
- All internal roads will be clearly defined to control their locations.
- As roads within the Project Site become obsolete, they will be promptly ripped and revegetated.

External Transport

- All trucks hauling product coal and coal rejects between Rocglen and the Whitehaven CHPP will be required to be fitted with roll-over tarpaulins.
- All trucks transporting coal will be well maintained to ensure optimal operation, which will minimise the potential for noise emissions.

Rehabilitation

- Rehabilitation of disturbed areas will be undertaken on a progressive basis to ensure that, where practicable, completed mining and overburden emplacement areas are quickly shaped, topdressed and vegetated to provide a stable landform.

Consultation

- Routine consultations will be undertaken with surrounding residents and the CCC to ensure any concerns in relation to air quality are addressed.

Monitoring

- The existing *Air Quality Monitoring Program* (Whitehaven 2009a) will be reviewed and, as necessary, revised to reflect the expanded mine operation and evaluate compliance with the applicable air quality assessment criteria.
- Whitehaven will install and operate a real-time PM_{10} monitor. As recommended by PAEHolmes (2011), it is proposed to locate this monitor at the "Roseberry" residence, co-located within one of the existing HVAS. This would enable comparisons between both monitors and also provide real-time information for the majority of privately owned residences, which are to the south of the mine. Whitehaven has advised that the real-time monitor selected will be one that is fitted with a weather station to enable better contemporaneous analysis of PM_{10} data collected from the site.
- The existing weather station and HVAS within the "Glenroc" property will be relocated to make way for the expanded Northern Emplacement Area and ensure appropriate operation. As recommended by PAEHolmes (2011), it is proposed to move these items to "Costa Vale", which is along the axis of prevailing winds. Meteorological data collected at "Costa Vale", in conjunction with that to be measured at "Roseberry", will be very helpful in determining the likely sources of airbourne dust on worst-case days and enable more effective management of mining activities.

7.3 Noise

Spectrum Acoustics (2010) undertook an assessment of operational noise levels and off-site road traffic noise levels associated with the Rocglen Extension Project. The full assessment report is contained within **Appendix Q**, with significant findings and recommendations summarised below.

7.3.1 Existing Environment

Unattended noise monitoring was undertaken on a quarterly basis at "Costa Vale" and "Surrey" (see **Figure 24**) between August 2008 and June 2009 to establish background noise levels for the mine. Unattended noise loggers record the total acoustic environment and it is not possible to identify various contributing sources. **Table 32** summarises the unattended noise monitoring results as reported in the 2008-2009 AEMR.

Table 32 – Unattended Noise Monitoring Results 2008-2009

Date	Location	Measure Noise Level dB(A)					
		Day L_{Aeq}	Evening L_{Aeq}	Night L_{Aeq}	Day L_{A90}	Evening L_{A90}	Night L_{A90}
Dec 2008	"Costa Vale"	43	44	46	31	30	32
Dec 2008	"Surrey"	44	41	40	31	31	27
Mar 2009	"Costa Vale"	55	47	44	32	29	25
Mar 2009	"Surrey"	48	47	44	28	31	27
Jun 2009	"Costa Vale"	46	36	46	30	28	36
Jun 2009	"Surrey"	47	40	46	29	32	27

Attended noise monitoring was undertaken on a monthly basis at "Costa Vale" and "Surrey" (see **Figure 24**) during construction (July, August and September 2008) and quarterly thereafter (December 2008, March 2009 and June 2009). **Table 33** summarises the attended operational noise monitoring results between December 2008 and June 2009, as reported in the 2008-2009 AEMR.

Table 33 - Attended Noise Monitoring Results 2008-2009

Date	Time	Location	Measured Mine Noise dB(A),L_{Aeq}	Wind speed/ direction
16 Dec 2008	Day	"Surrey"	33	0-1m/s, W
16 Dec 2008	Day	"Costa Vale"	<25	1.0 m/s, W
16 Dec 2008	Evening	"Costa Vale"	<25	1-2 m/s, W
16 Dec 2008	Evening	"Surrey"	34	1-2 m/s, W
17 Dec 2008	Night	"Surrey"	30	Calm
17 Dec 2008	Night	"Costa Vale"	28	Calm
10 Mar 2009	Evening	"Costa Vale"	<25	>3 m/s, S
10 Mar 2009	Evening	"Surrey"	34	3 m/s, S
11 Mar 2009	Night	"Surrey"	<25	0.5 m/s, SE
11 Mar 2009	Night	"Costa Vale"	<25	0.5 m/s, SE
11 Mar 2009	Day	"Surrey"	<25	0-1m/s, SE
11 Mar 2009	Day	"Costa Vale"	30	1.0 m/s, SE
16 Jun 2009	Day	"Surrey"	<25	0.5 m/s, S
16 Jun 2009	Day	"Costa Vale"	29	0.5 m/s, S
16 Jun 2009	Evening	"Costa Vale"	32	1 - 2 m/s, S
16 Jun 2009	Evening	"Surrey"	25	1 - 2 m/s, S
16 Jun 2009	Night	"Surrey"	25	1 m/s, S
16 Jun 2009	Night	"Costa Vale"	33	2 m/s, S

As summarised in **Table 34**, quarterly attended noise monitoring results are now also available for 2010 at both "Costa Vale" and "Surrey".

Table 34 - Attended Noise Monitoring Results 2010

Date	Time	Location	Measured Mine Noise dB(A),L_{Aeq}	Wind speed/ direction
25 Mar 2010	Evening	"Surrey"	30	Calm
25 Mar 2010	Evening	"Costa Vale"	30	Calm
25 Mar 2010	Night	"Surrey"	31	<0.5 m/s, SW
25 Mar 2010	Night	"Costa Vale"	25	<0.5 m/s, SW
26 Mar 2010	Day	"Surrey"	24	Calm
26 Mar 2010	Day	"Costa Vale"	30	2 m/s, N
22 Jun 2010	Day	"Surrey"	28	1.5 m/s, SE
22 Jun 2010	Day	"Costa Vale"	30	1.5 m/s, SE
22 Jun 2010	Evening	"Surrey"	Inaudible	1.5 m/s, SE
22 Jun 2010	Evening	"Costa Vale"	Inaudible	1.5 m/s, SE
22 Jun 2010	Night	"Surrey"	Inaudible	1.0 m/s, SE
22 Jun 2010	Night	"Costa Vale"	28	1.0 m/s, SE
21/22 Sept 2010	Day	"Surrey" (22/9)	25	2.4 m/s, SSE
21 Sept 2010	Day	"Costa Vale" (21/9)	25	1.6 m/s, SSE
21 Sept 2010	Evening	"Surrey"	25	<0.5 m/s, N
21 Sept 2010	Evening	"Costa Vale"	34	<0.2 m/s, N
21 Sept 2010	Night	"Surrey"	<20	2 m/s, S
21 Sept 2010	Night	"Costa Vale"	<20	2 m/s, S
14 Dec 2010	Day	"Surrey"	<20	1.5 m/s, ESE
14 Dec 2010	Day	"Costa Vale"	30	1.5 m/s, ESE
14 Dec 2010	Evening	"Surrey"	Inaudible	3 m/s, E
14 Dec 2010	Evening	"Costa Vale"	Inaudible	3 m/s, E
14 Dec 2010	Night	"Surrey"	Inaudible	3 m/s, NE
14 Dec 2010	Night	"Costa Vale"	Inaudible	3.5 m/s, NE

The attended noise monitoring results summarised in **Tables 33** and **34** indicate that, under the operational and atmospheric conditions at the time, noise emissions from Rocglen did not exceed the criterion of 35 dB(A) (see **Section 7.3.2**) at any of the monitoring locations.

Additional attended noise monitoring was also undertaken on the 30 and 31 August 2010 at "Surrey" and the 21 September 2010 at "Penryn" following receipt of noise complaints. A summary of this additional noise monitoring is provided in **Table 35**.

Table 35 – Additional Attended Noise Monitoring Results 2010

Date	Time	Location	Measured Mine Noise dB(A),L_{Aeq}	Wind speed/ direction
30 Aug 2010	Night	"Surrey"	32	0.5 m/s, NW
31 Aug 2010	Day	"Surrey"	40	Calm
21 Sept 2010	Day	"Penryn"	<25	1.6 m/s, SSE
21 Sept 2010	Evening	"Penryn"	32	>0.2 m/s, N
21 Sept 2010	Night	"Penryn"	<20	2.2 m/s, S

The results shown in **Table 35** indicate that, under the operational and atmospheric conditions at the time:

- Noise emissions from Rocglen exceeded the criterion of 35 dB(A) during the day (morning) monitoring at "Surrey". The mine noise was attributed to engine revs (trucks and shovels), dozer tracks and general mine hum; and
- Noise emissions from Rocglen did not exceed the criterion of 35 dB(A) at "Penryn".

Refer to **Section 7.3.5** for historical cumulative road traffic noise monitoring results at "Brooklyn".

7.3.2 Assessment Criteria

Spectrum Acoustics (2010) based its assessment on the operational noise criteria and traffic noise criteria presented in the original Project Approval PA 06_0198 and EPL, as listed in **Tables 36** and **37**, respectively.

Table 36 – Operational Noise Impact Assessment Criteria

Location	Day $L_{Aeq(15\ minute)}$	Evening $L_{Aeq(15\ minute)}$	Night	
			$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
All privately owned residences	35	35	35	45

The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria at any residence on privately-owned land, or no more then 25 percent of any privately-owned land.

However, if the Proponent has a written negotiated noise agreement with any landowner and a copy of this agreement has been forwarded to the DoP and the DECCW, than the Proponent may exceed the noise limits in accordance with the negotiated noise agreement.

Table 37 – Road Traffic Noise Impact Assessment Criteria

Location	Day $L_{Aeq(15\ minute)}$	Evening $L_{Aeq(15\ minute)}$	Night	
			$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
All privately owned residences	35	35	35	45

The Proponent shall ensure that the cumulative noise generated by road traffic associated with the Project, Canyon and Tarrawonga mines on public roads does not exceed the criteria.

7.3.3 Potential Operational Impacts

Modelling Scenarios

The assessment of operational noise was conducted using the Environmental Noise Model (ENM Version 3.06). The sound power levels of major operational noise sources used in the modelling have been measured on-site by Spectrum Acoustics at various times since commencement of the mine. These items were modelled at their known positions (stationary sources) or typical positions (mobile sources) and noise contours and point calculations were generated for the surrounding area and residences.

Noise modelling was conducted for four atmospheric conditions, these being daytime calm (neutral); inversion; prevailing wind (all times) from south; and prevailing wind (all times) from north north-west.

Noise models were generated for each of the following operational scenarios considered to be the worst case in terms of noise generation and potential impacts:

- Year 1 of expanded operation - all overburden going to the expanded Northern Emplacement Area at approximately 330 metres AHD, 24 hours. Topsoil placement on the northern face of Northern Emplacement Area and spreading by dozer, occurring daytime only.
- Year 5 of expanded operation - all overburden going to southern edge of the expanded Northern Emplacement Area at approximately 310 metres AHD, 24 hours. Topsoil placement on the top of both the Northern and Western Emplacement Areas and spreading by dozer, occurring daytime only.
- Year 10 of expanded operation - overburden being placed in the south-western extent of the pit where coal extraction has been completed and on the eastern face of Western Emplacement Area at approximately 320 metres AHD, 24 hours. Topsoil placement on the southern face of the Western Emplacement Area and spreading by dozer, occurring daytime only.

For each of these scenarios, ROM coal haulage, processing and product haulage has been included within the modelling as occurring over the full 24 hours. However there is no change proposed to off-site product haulage, which will remain between 7.00 am and 9.15 pm Monday to Friday and between 7.00 am and 5.15 pm on Saturdays.

Model Predictions

Operational noise levels predicted using the ENM point calculation mode for privately-owned residences surrounding the Project Site are summarised in the below tables for the modelled operational and meteorological scenarios. Noise contours for the worst case scenarios are presented in **Appendix Q**.

Table 38 – Predicted Operational Noise Levels – Year 1

Receiver	Predicted Noise Level dB(A), $L_{eq(15min)}$						Criterion
	Neutral (day)	Wind (day)		Wind (eve/night)		Inversion (night)	
		S	NNW	S	NNW		
R1 “Retreat”	24	33	21	33	20	34	35
R2 “Penryn”	24	31	21	30	20	33	35
R3 “Roseglass”	24	30	21	28	20	32	35
R4 “Costa Vale”	32	**40**	30	**39**	26	**41**	35
R5 “Roseberry”	25	22	34	23	35	36	40[1]
R6 “Surrey”	21	<20	30	20	0	32	35
R7 “Carlton”	<20	20	26	<20	25	29	35
R8 “Wundurra Stud”	<20	<20	27	<20	27	31	35

1 - Elevated noise limit in accordance with negotiated private agreement between landholder and Whitehaven.

Exceedance of the criterion have been predicted at “Costa Vale” during Year 1, with the primary contributing noise sources being trucks depositing overburden on the expanded Northern Emplacement Area and, to a less extent, topsoil spreading activities (daytime only). Noise mitigation to achieve compliance at “Costa Vale” would require all trucks to be retro-fitted with attenuator packages. Whitehaven has advised that while this may be technically feasible, it would be impractical given the large cost involved and the fact that “Costa Vale” is now owned by Whitehaven and, as such, is considered project-related.

Table 39 – Predicted Operational Noise Levels – Year 5

Receiver	Predicted Noise Level dB(A),$L_{eq(15min)}$						Criterion
	Neutral (day)	Wind (day)		Wind (eve/night)		Inversion (night)	
		S	NNW	S	NNW		
R1 "Retreat"	22	31	20	30	<20	32	35
R2 "Penryn"	22	30	20	29	<20	33	35
R3 "Roseglass"	21	29	20	27	<20	32	35
R4 "Costa Vale"	29	**37**	26	34	20	**36**	35
R5 "Roseberry"	28	25	36	23	34	36	40[1]
R6 "Surrey"	25	23	33	20	31	34	35
R7 "Carlton"	22	<20	29	<20	27	30	35
R8 "Wundurra Stud"	21	<20	30	<20	27	31	35

1 - Elevated noise limit in accordance with negotiated private agreement between landholder and Whitehaven.

Minor criterion exceedances are again predicted at "Costa Vale" during Year 5 under adverse conditions.

Table 40 – Predicted Operational Noise Levels – Year 10

Receiver	Predicted Noise Level dB(A),$L_{eq(15min)}$						Criterion
	Neutral (day)	Wind (day)		Wind (eve/night)		Inversion (night)	
		S	NNW	S	NNW		
R1 "Retreat"	<20	27	<20	29	<20	30	35
R2 "Penryn"	<20	26	<20	29	<20	30	35
R3 "Roseglass"	<20	25	<20	27	<20	30	35
R4 "Costa Vale"	20	33	<20	34	<20	35	35
R5 "Roseberry"	30	27	38	26	38	39	40[1]
R6 "Surrey"	28	25	34	25	34	35	35
R7 "Carlton"	24	20	30	20	30	31	35
R8 "Wundurra Stud"	24	20	31	<20	31	31	35

1 - Elevated noise limit in accordance with negotiated private agreement between landholder and Whitehaven.

No exceedances of the criterion are predicted at any receiver for the 10 year scenario.

7.3.4 Potential Sleep Disturbance Impacts

Spectrum Acoustics (2010) advises that to assess the impact on potential sleep disturbance during night time hours, the maximum noise levels at the nearest or potentially worst impacted receiver for each component of the project are compared to background levels in the area. If the maximum noise levels exceed the background level by more then 15 dB, further consideration of potential disturbance to sleep is required including the nature and level of ambient noise in the area.

The most impacted receiver in the Year 1 scenario (apart from "Costa Vale", which is owned by Whitehaven and therefore project-related) is "Retreat"' to the north of the site. Maximum noise levels estimated from individual sources at "Retreat" are more than 10 dB below the 45 dB(A) sleep disturbance 'screening' level and are also no greater than the total LAeq level from the entire mine. This is typical at large distances from a coal mine, where the overall 'mine hum' is reasonably constant and individual sources are not generally identifiable.

Spectrum Acoustics (2010) did not consider the full analysis of maximum noise levels, in terms of sleep disturbance, for the Year 5 and Year 10 scenarios necessary.

7.3.5 Potential Off-Site Road Traffic Impacts

The nearest receiver to the public road section of the coal haul route between Rocglen and the Whitehaven CHPP is "Brooklyn", which is set-back from Blue Vale Road approximately 70 metres and is located several kilometres south of the intersection with Shannon Harbour Road. Coal trucks from the Whitehaven's Canyon (now closed), Tarrawonga and Rocglen mines all pass this receiver.

Table 41 summarises historical traffic noise measurements (all mine-related vehicles) conducted at "Brooklyn" by Spectrum Acoustics between March 2008 and December 2009.

Table 41 – Historical Traffic Noise Measurements at "Brooklyn"

Date	Trucks per Hour	Measured Noise Level dB(A) $L_{eq(1hr)}$
March 2008	36	54
September 2008	16	51
December 2008	38	51
March 2009	48	52
June 2009	27	54
September 2009	42	57
December 2009	40	52
Average	35	53.5

The measured traffic noise levels in **Table 41** range from 3 to 9 dB below the 60 dB(A) criterion. The Project will not alter the total number of trucks passing "Brooklyn" and therefore off-site traffic noise levels are expected to remain compliant with the applicable criterion.

7.3.6 Management and Monitoring

While the modelling predicts acceptable noise impacts at all privately-owned residences throughout the life of the mine, Whitehaven will continue to take reasonable and practicable measures to prevent or minimise noise generation and propagation. As listed below, a range of complementary noise management strategies, mitigation measures and monitoring activities are currently employed at Rocglen and these will continue to be implemented for the Rocglen Extension Project.

Project Design

The external batter slopes of the expanded Northern Emplacement Area will be re-shaped and revegetated in Years 1 and 2 of the expanded operation to, amongst other things, minimise the projection of noise from overburden transportation and emplacement activities towards privately owned residences located to the north and north-east later in the mine life.

General Operation

- Contractors, including all personnel and sub-contractors, will be advised of noise compliance limits prior to their work commencing. Contractors will be expected to take practical measures to limit noise generation during their activities where possible.
- Prior to being brought on-site, all earthmoving equipment will be tested to ensure sound power levels are consistent with the previous assessments undertaken by Spectrum Acoustics.
- Site personnel will be required to pay due attention to site weather conditions and modify or stand down from operational activities if directed by mine management.
- Where possible, equipment with lower sound power levels will be used in preference to more noisy equipment.
- All equipment used on-site will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling undertaken by Spectrum Acoustics.
- Mid-high frequency broadband reverse beepers are fitted to on-site mobile mining equipment.
- The on-site road network will be maintained to limit vehicle body noise.

External Transport

- All transport activities, including the haul route used between Rocglen and the Whitehaven CHPP and the hours of coal haulage, will continue to be undertaken strictly in accordance with that approved under PA 06_0198.
- The haul route between Rocglen and the Whitehaven CHPP is fully sealed and will continue to be maintained under an existing contribution plan with Council.
- Drivers will continue to operate in accordance with an existing Transport Policy and Code of Conduct, which identify aspects such as travelling speeds, general behaviour, avoidance of exhaust brakes, load coverage, complaints and disciplinary procedures. The Policy and Code apply to all employee and contractor-owned vehicles.
- The trucks are speed limited to 93 km per hour to, amongst other things, minimise engine noise.
- All trucks transporting coal will be well maintained to ensure optimal operation, which will minimise the potential for noise emissions.

Consultation

- Routine consultations will be undertaken with residents surrounding Rocglen and along the transport route, as well as with the CCC, to ensure any concerns relating to operational or traffic noise are addressed.

Monitoring

- The existing *Noise Monitoring Program* (Whitehaven 2008d) will be reviewed and, as necessary, revised to reflect the expanded mine operation and evaluate compliance with the applicable noise assessment criteria. The current noise monitoring network consists of two monitoring locations, being one at “Costa Vale” and one at “Surrey” (see **Figure 24**). As recommended by Spectrum Acoustics (2010), “Retreat” or “Penryn” will be included as a noise monitoring location in the revised Program in place of “Costa Vale”, which is now owned by Whitehaven.
- Traffic noise monitoring will continue to be conducted at the “Brooklyn” and “Werona” residences on Blue Vale Road in accordance with the existing *Road Noise Management Plan* (Spectrum Acoustics 2008).

7.4 Blasting and Vibration

An assessment of ground vibration and airblast overpressure associated with blasting undertaken as part of the Rocglen Extension Project has been undertaken by Spectrum Acoustics within the *Noise and Vibration Impact Assessment* (2010). The full assessment report is contained within **Appendix Q**, with significant findings and recommendations summarised below.

7.4.1 Existing Environment

Potential blasting emissions include ground vibrations, air vibrations (noise and airblast), fly rock and dust.

The results of blast monitoring conducted at the nearest residences to the north ("Costa Vale") and to the south ("Roseberry") between August 2008 and July 2009 are reported in the 2008-2009 AEMR. Measured peak airblast overpressure ranges between 87.4 and 115.0 dB, and measured peak particle velocity (vibration) ranges between 0.1 and 1.48 mm/sec. On this basis, the results show no exceedances of either the blast overpressure or ground vibration criteria reported in the below section.

7.4.2 Assessment Criteria

Spectrum Acoustics (2010) based its assessment on the blast overpressure and ground vibration criteria presented in the original Project Approval PA 06_0198 and the EPL.

Table 42 – Airblast Overpressure Impact Assessment Criteria

Airblast Overpressure Level dB(Lin Peak)	Allowable Exceedance
115	5% of the total number of blasts in a 12 month period
120	0%

Table 43 – Ground Vibration Impact Assessment Criteria

Peak Particle Velocity mm/s	Allowable Exceedance
5	5% of the total number of blasts in a 12 month period
10	0%

7.4.3 Potential Impact

Historical blast monitoring results show no exceedances of either the applicable ground vibration or blast overpressure criteria at the nearest residences surrounding the Project Site. On this basis, Spectrum Acoustics (2010) concludes that no significant blasting impacts are expected as a result of the Rocglen Extension Project.

Since coal production commenced at Rocglen in late 2008, there has only been one occasion when complaints have been received about blasting. On the 24 April 2009, four separate residents contacted Whitehaven to report a significant loud bang and vibration at their residences. Three out of the four residents advised that previous blasting had not resulted in any impact at their property.

Rocglen has two statutory blast monitoring locations, being the "Rosberry" point of interest (POI) and "Costa Vale" POI. On checking with Orica Mining Services (Orica), Whitehaven's blasting contractor, it was discovered that they had failed to properly initiate the blast monitors and therefore did not capture any wave trace data for this particular blast. Orica was requested to provide formal assessment and advice, which included the following points:

- The blast monitors were placed at the statutory POIs and turned on, however the operator unintentionally failed to set the monitors to capture wave trace data;
- The prediction data shows that it is unlikely that blasting vibration and air-overpressure limits would have exceeded the statutory limits at the monitoring locations. However without supporting blasting wave trace data this is inconclusive;
- Lower frequency air-overpressure has the ability to travel further than higher frequencies. In the event that this was the case, the lower frequency ranges are outside the audible range of the human ear. Low frequency events have been known to cause windows to rattle, which can be mistaken for vibrations;
- In unfavourable meteorological conditions, it is common for airblast levels to increase by up to 20 dBL as a result of the combined effects of a temperature inversion and/or wind velocity (windshear). There was some cloud cover on the day the blast was fired, which could have played a part in the increased affects of blasting induced air-overpressure;
- Orica organised a Toolbox Talk for all shot-firers and blast crew aimed at training all relevant personnel in the proper use of the environmental blasting monitors, which will assist Whitehaven in adhering to the statutory conditions/limits; and
- Orica recommended that meteorological conditions be analysed prior to blasting to ascertain the likelihood of increased blasting environmental impacts on outer residences

(Orica Mining Services 2009).

As a result of the complaints relating to the blast in April 2009 and Orica's subsequent report, Whitehaven now ensures that meteorological conditions are analysed prior to blasting to avoid times when the potential for impact is heightened, and also endeavours to blast at around midday over the winter period to avoid temperature inversions.

All blasting at Rocglen is designed to satisfy relevant environmental and safety criteria with respect to airblast overpressure and ground vibration, initially using conservative predictive models and subsequently using site laws developed and refined on the basis of operational experience.

7.4.4 Management and Monitoring

Through the implementation of appropriate design and procedure safeguards, blast emissions can be limited to a level where:

- The safety of the public, mine employees and visitors is not threatened;
- Ground vibration occurs at acceptable levels and ensures the continued integrity of nearby dwellings, structures and facilities;
- Noise, ground and air vibrations have no impact on nearby livestock;
- Noise and air vibration levels at nearby residences are within acceptable limits and compatible with the safety and comfort of human beings; and
- The generation of dust is minimised and maintained at acceptable levels.

Whitehaven will continue to take reasonable and practicable measures to prevent or minimise ground vibration and blasting overpressure. As listed below, a range of complementary blast management strategies, mitigation measures and monitoring activities are currently employed at Rocglen and will continue to be implemented for the Rocglen Extension Project.

Blast Design

- Blast design and implementation will continue to be undertaken by a suitably qualified blasting engineer and/or experienced and appropriately certified shot-firer.
- Blast design will continue to include the following features to ensure industry standards are met:
  - Ensuring that burden distances and stemming lengths are such that explosion gases are almost completely without energy by the time they emerge into the atmosphere; and
  - Ensuring that charges consistently detonate in carefully designed sequences.
- Whitehaven will analyse meteorological conditions prior to blasting to avoid times when the potential for impact is heightened, and also endeavours to blast at around midday over the winter period to avoid temperature inversions.

Air Vibrations (Noise and Airblasts)

- Noise and airblast generation will be controlled to ensure that all, or the majority of, explosion energy is consumed in fragmenting and displacing the overburden by the time the gases vent (via broken burden rock and/or ejected stemming material) into the atmosphere via:
  - Ensuring blasthole spacing is implemented in accordance with blast design;
  - Careful selection and implementation of burden distance and stemming length;
  - Using appropriate materials (for example, 20 mm aggregates) for stemming;
  - Ensuring that charges detonate in the correct sequence and with inter-row delays that provide good progressive release of burden;
  - Limiting the maximum weight of explosive detonated in a given delay period (the maximum instantaneous charge (MIC)) to conservative and proven levels; and
  - Refining these controls on the basis of the blast monitoring program.

Ground Vibrations

- Ensuring the minimum practicable weight of explosive detonates at an instant (minimising the MIC) by using the maximum number of delay periods in each blast.
- Ensuring that most of the energy liberated by the charge(s) on a given delay number is consumed in providing good fragmentation, adequate displacement and/or a loose, highly diggable muckpile.

Dust and Other Post-Blast Emissions

- Ensuring stemming columns are not ejected for considerable distances into the atmosphere, with stemming column lengths designed to ensure ejection velocities are low.
- Using aggregates for blasthole stemming and nonel delay-type or electronic detonators to initiate charges. This will avoid the requirement for detonating cord downlines and, with the absence of detonating cord trunklines (surface lines), this will prevent the dust cloud that is formed when such trunklines detonate on a dry dusty surface.

Road Closures

- The expanded limit of open cut mining encroaches within 500 metres of Wean Road, both in its current and proposed realigned position. The safety of traffic on Wean Road will be ensured via:
  - For all blasts within 500 metres of Wean Road, the road will be closed with blast notice boards updated at least 24 hours prior to each blast. Road closures typically occur for a period of up to 10 minutes;
  - Whitehaven will inspect the road following the blast and any rock fragments removed from the road surface prior to re-opening; and

- Whitehaven will monitor the distance flyrock travels (if any) beyond the designed blast envelope and identify if further safeguards are required.

Consultation

- Whitehaven will undertake the following blast notification activities:
  - The proposed blasting schedule will be provided to all residents within a 3 km radius of the blast providing advance notice of the date and time of each proposed blast. A verbal confirmation on the day of the blast will also be undertaken.
  - Whitehaven will update the blast notice board near the mine entrance on Wean Road notifying passing motorists when the next blast is scheduled.
  - Whitehaven will update the Wean Road blast notice boards for blasting events that will result in the temporary closure of Wean Road.
- Routine consultations will be undertaken with residents surrounding Rocglen, as well as with the CCC, to ensure any concerns relating to blasting are addressed.

Monitoring

- The existing *Blasting Monitoring Program* (Whitehaven 2008a) will be reviewed and, as necessary, revised to reflect the expanded mine operation and ensure blasting is completed in a manner that ensures continued compliance with the applicable air overpressure and ground vibration criteria. The current blast monitoring network consists of two monitoring locations, these being at "Costa Vale" and "Roseberry" (see **Figure 24**). As recommended by Spectrum Acoustics (2010), "Retreat", as the nearest privately-owned residence to the north of the Project Site, will be included as a blast monitoring location now that "Costa Vale" is owned by Whitehaven.

7.5 Surface Water

GSSE (2010c) has undertaken a surface water assessment for the Rocglen Extension Project, requiring a site wide approach and the re-development of a suitable surface water management system for the expanded operation. The key aspects addressed include the identification of potential surface water impacts as a result of the Project, a description of the proposed management strategies and mitigation measures to be implemented, licensing requirements, recommendations for on-going surface water monitoring and a detailed site water balance, including a discussion on water sources, water security and predicted discharges from site.

GSSE (2010c) concludes that if the surface water management strategies and mitigation measures identified and discussed within the *Surface Water Assessment* are implemented and maintained, it is anticipated that there would be minimal impact on surface water downstream of the Project Site as a result of the Rocglen Extension Project.

A copy of the *Surface Water Assessment* is contained within **Appendix M,** with the key assessment findings and recommendations summarised below.

7.5.1 Existing Environment

Surface Hydrology

The surface hydrology within and immediately surrounding the Project Site is described in **Section 3.10**.

Within the existing approved mining area there are currently two major catchments that generally drain north or south. As runoff exits from the south of the Project Site, it reports to the Namoi River via an un-named depression that flows generally in a southerly direction before turning west into the Namoi River approximately 10 km from the Project Site. To the north, runoff from the Project Site reports to Driggle Draggle Creek, which subsequently flows to the Namoi River via Barbers Lagoon drainage line approximately 14 km from the Project Site.

Overall, GSSE (2010c) considers that the local surface hydrology (with the exception of the State Forest areas) has been heavily disturbed by past agricultural activities and altered within areas of the Project Site as a result of the existing approved Rocglen mining operations.

Existing Flow Regimes
While all existing drainage lines that report to or lie within the Project Site are ephemeral in nature, they have very little flow primarily due to previous soil conservation works and current mining activities that have substantially diverted and dammed the drainage lines. Due to the extensive modification, the central drainage line now consists of a series of dams. For the majority of the time there is no off-site discharge from this drainage line, however, under high rainfall conditions, discharge events have occurred.

Surface Water Features of Conservation Significance
Based on existing documentation and the site visit conducted by GSSE in February 2010, there were no surface water features found within the Project Site to have conservation significance.

No drainage lines within the Project Site were found by GSSE (2010c) to contain significant riparian vegetation with the majority of the drainage lines having poorly defined bed and banks.

7.5.2 Existing Licensed Discharge Points

Runoff is discharged from the Rocglen site through two LDPs, which allow for wet weather discharges, held under the site's current EPL. LDP 11 is located at the outlet of Storage Dam SD3 at the southern end of the site and LDP 12 is located on the northern boundary of the site. As listed in **Table 44**, both LDPs have pollutant concentration limits to ensure discharged water is of a suitable quality.

Table 44 - Concentration Limits for LDP 11 and LDP 12

Pollutant	Unit of Measure	100th Percentile Concentration Limit
Oil and Grease	mg/L	10
pH	pH	6.5 – 8.5
Total Suspended Solids (TSS)	mg/L	50*

* The TSS concentration limits may be exceeded for water discharge provided that:
- The discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 mm over any consecutive 5 day period immediately prior to the discharge occurring; and
- All practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 mm, 5 day rainfall event.

While no concentration limits are specified, the EPL requires electrical conductivity (EC) and total organic carbon (TOC) to be monitored at the LDPs. The EPL also requires various pollutant concentrations at other sites within and surrounding the Project Site to be monitored, as well as yearly monitoring of numerous heavy metals in the Mine Water Dam. There are currently no volumetric limits on the LDPs.

7.5.3 Existing Surface Water Quality

Baseline Water Quality Data (prior to mining)
Due to the ephemeral nature of the drainage lines located in the surrounds of the Project Site, limited baseline data was collected prior to the approval of Rocglen in 2008. Some limited data collected in 2002, including six samples taken at different locations along the un-named central drainage line and one sample from Driggle Draggle Creek, is presented in **Appendix M**.

The one baseline sample taken from the un-named drainage line showed that there were high amounts of total phosphorous and EC levels slightly above those presented in the *Australian and New Zealand Guidelines for Fresh and Marine Water* Quality (ANZECC 2000, as cited in GSSE 2011) for slightly disturbed upland rivers in NSW. The samples taken along Driggle Draggle Creek showed a high nutrient load, with high phosphorous and nitrate readings. The water was also slightly alkaline with four of the six readings above the ANZECC (2000) pH guideline of 8.0.

Whilst the data is very limited, it does show slightly alkaline water quality in the region along with high nutrient levels. Unfortunately no analysis of total suspended solids (TSS) was reported.

Wet Weather Discharge Data

The site's EPL outlines the surface water monitoring that must be undertaken at nominated sampling locations during or immediately following discharge events. Since commencing operation in 2008, there have been a total of ten discharges, occurring between the 29 December 2009 and 20 August 2010 when the site received well above average rainfalls. **Table 45** presents the recorded water quality for these discharges.

Table 45 - Wet Weather Discharge Data

Sample Location	Sample Date	pH	EC (µS/cm)	TSS (mg/L)	TOC	Grease & Oil (mg/L)	Preceding 5 Day Rainfall Totals (mm)
LDP 11 (SD3)	29-12-09	7.51	180	552	4	N/A	79.6
	04-01-10	7.74	325	1490	2	<5	25.2
	08-02-10	7.87	323	157	6	6	NR
	15-02-10	7.48	329	406	3	<5	51.2
	31-03-10	8.14	435	108	12	<5	46.6
	02-06-10	8.21	410	260	35	<5	27.0
	26-07-10*	8.34	458	17	5	<5	
	28-07-10	8.23	437	23	4	<5	23.2
	11-08-10	8.04	466	54	6	<5	26.0
	20-08-10	8.04	508	172	10	<5	15.4
LDP 12 (SB18)	15-01-10	7.51	356	1490	3	<5	21.6
	15-02-10	7.37	395	556	5	<5	51.2
	11-08-10	7.37	261	2320	5	<5	26.0
	28-08-10	7.37	422	2300	10	<5	15.4
Un-named drainage channel (below LDP11)	29-12-09	6.87	94	236	7	N/A	79.6
	04-01-10	7.37	467	34	17	6	25.2
	15-02-10	7.15	318	186	8	<5	51.2
	03-08-10	7.43	109	45	17	<5	
	11-08-10	7.72	333	116	12	<5	
	20-08-10	7.90	390	152	25	<5	
Driggle Draggle Ck (below LDP12)	15-01-10	6.86	338	157	6	6	21.6
	15-02-10	7.37	359	15	6	<5	51.2
	18-08-10	7.40	151	964	12	<5	
	20-08-10	7.96	344	912	20	<5	

NR – Site Meteorological Station broken during this period
*SD – Storage Dam, SB – Sediment Basin, * - controlled discharge*

During several discharge events, the TSS concentration exceeded the 100% concentration limit of 50 mg/L at the LDPs. In letters dated 19 March 2010 and 27 September 2010 from Whitehaven to the DECCW detailing the above events, it was reported that due to earthworks associated with increasing the capacity of Sediment Basin SB19 there was significant amounts of disturbance immediately upstream of LDP 11. With the large volume of rainfall received immediately following construction, there was significant sediment flow into Storage Dam SD3 and insufficient time for settlement prior to additional rain causing discharge.

Since March, above average rainfall has exacerbated water management issues, with rainfall and runoff volumes exceeding the site's capacity for use of water prior to discharge. As a consequence of the above events, Whitehaven has taken action through the trialling of floc blocs and liquid flocculant in SD3 and SB18 to increase setting rates by chemical flocculation. The flocculation visibly reduced the sediment level of the dams, with surface water sampling during 2010 identifying significantly reduced TSS levels in SD3. Whilst effective, the use of floc blocs proved a relatively slow process and as a consequence, the site has commenced use of liquid flocculants to further enhance capacity for assisting the settling of sediment.

Dry Weather / Operational Water Quality Monitoring Data

Additional monitoring has been undertaken to meet the requirements of the site's EPL and the *Site Water Management Plan* (RCA Australia in conjunction with Soil Conservation Service 2009). A summary of the results, including average values where applicable, is presented in **Table 46**.

Table 46 – Dry Weather / Operational Water Quality Monitoring Results

Sample Location	Sample Date	pH	EC (µS/cm)	TSS (mg/L)	TOC	Grease & Oil (mg/L)
Open Cut Extraction Pit Water (contained on-site)						
Mine Water Dam	24-06-09	9.30	1540	216	20	<10
	27-08-09	8.85	2260	60	3	<10
	16-12-09	9.15	4210	14	4	<10
	25-02-10	8.99	1390	106	5	<5
	12-05-10	8.90	2470	20	3	<5
	09-08-10	8.56	2330	8	2	<5
	08-11-10	9.12	2330	16	2	<5
	Mean	(8.90)	(2361)	(63)	(5)	(--)
Dirty Water (controlled discharged through LDP 11 at the south of the site as required)						
Un-named drainage channel (downstream of site below LDP 11)	23-09-08	7.70	150	510	NS	<2
	17-12-08	6.60	145	21	NS	<2
	Mean	(7.15)	(148)	(266)	(--)	(--)
SB8 (near offices)	17-12-08	7.80	295	1080	--	<2
	26-07-10	8.30	458	17	5	<5
	Mean	(8.10)	(376)	(548)	(5)	(--)
SB3	24-06-09	8.36	502	110	10	<10
	27-08-09	8.86	504	66	10	<10
	30-11-09	7.78	620	128	3	<10
	25-02-10	8.34	423	56	15	<5
	12-05-10	8.20	565	64	7	<5
	Mean	(8.31)	(523)	(85)	(9)	(--)
SD3* (at LDP 11)	24-06-09	8.56	354	1340	35	<10
	27-08-09	8.34	587	71	8	<10
	25-02-10	8.44	374	37	5	<5
	25-03-10	8.71	445	58		<5
	07-05-10	8.26	434	13		<5
	12-05-10	8.42	422	19	14	
	24-05-10	8.57	412	92	4	6
	09-08-10	7.62	458	239	12	<5
	12-10-10	8.31	575	11	5	
	02-11-10	8.25	478	33	6	<5
	08-11-10	8.42	472	107	7	<5
	25-11-10	7.40	522	52	9	
	Mean	(8.20)	(461)	(172)	(10)	(--)
SB7 (southern end)	16-12-09	9.38	600	18	8	<10
SB5 (southern end)	16-12-09	8.90	1440	50	7	<10
SB14 (southern end)	16-12-09	8.76	577	50	7	<10

* Not discharging at the time

NS - Not sampled, SB – Sediment Basin, SD – Storage Dam

There has been an increase in the Mine Water Dam's EC, possibly as a result of the samples being taken over a dry period with evaporation rates exceeding inflow leading to a concentration of salts. In addition, between August and December 2009, the Mine Water Dam was a receiving location for water trucked to site from a Santos Gas trial well as a water re-use scheme approved through the DECCW, NOW and I&I NSW. The waters received from this scheme were generally higher in EC. The TSS in the Mine Water Dam reduced over this period due to the dry conditions increasing retention times.

The remaining EC readings within the dirty water system generally showed only a slight increase from the limited background data available. According to the *Namoi Catchment Action Plan* (Namoi CMA 2007), a number of major tributaries within the catchment have inherently high salinity levels. Whitehaven preferentially uses this water for dust suppression to ensure it is contained within the site and limits the potential release of saline water to surrounding watercourses.

The water testing also shows slightly higher alkaline water being held in the dirty water dams collecting runoff from the emplacement areas than in surrounding watercourses. This is due to the subsoils being more alkaline and producing higher alkaline runoff than the topsoils.

7.5.4 Existing Surface Water Management

Rocglen Coal Mine currently operates under a *Site Water Management Plan* prepared by RCA Australia in conjunction with the Soil Conservation Service in 2008 (revised in 2009) in accordance with PA 06_0198. Current water management is partially segregated into clean and dirty water systems and is achieved through the use of purpose built controls. Clean water management comprises diversion of clean water away from disturbed areas through diversion banks and waterways, and includes retention in clean water storage dams. Dirty water management comprises capture and treatment of runoff water from disturbed areas across the site.

The majority of surface water drains to the south end of the site via catch banks where it is captured and treated within a series of interconnected sediment basins prior to reuse on the site or discharged through LDP 11. A small part of the site (primarily around the Northern Soil Stockpile area) drains to the north where it is directed to a sediment basin prior to discharge through LDP 12. Sediment basins located on the site, excluding the Mine Water Dam, have a combined total storage capacity of 36 ML. Captured water is re-used on-site for dust suppression, including around the crushing and screening operations.

In addition to the general description above, the current water management system includes:

- Sediment Basin (SB4) to specifically contain and treat flows from the ROM coal pad area;
- Sediment Basin (SB8) to specifically contain and treat flows from the facilities/amenities area;
- Mine Water Dam for water to be pumped to and from the open cut extraction pit;
- Bore Pump Dam for water to be pumped to and from a groundwater bore; and
- Various clean water storage dams (within Maximum Harvestable Right Dam Capacity (MHRDC)).

The existing water management system has adequately managed water for the mining operations with the exception of some instances of elevated TSS in surface water during discharge events (see above).

7.5.5 Site Water Balance

A detailed daily time step water balance was developed by GSSE (2010c) to examine the water requirements and available water storage against water availability of the Project Site. Site water balance calculations were undertaken for the scenarios referred to as Years 1, 5 and 10 of the expanded operation. The results based on dry, median and wet rainfall conditions are presented in detail in **Appendix M**.

With high quality site data and good model calibration, GSSE (2010c) is confident that the results of the model are an accurate reflection of the probable water balance to be experienced. It is considered that the site water balance for the three scenarios provides an appropriate representation of the range of conditions likely to be experienced across the site throughout the Project Life.

The overall results of the water balance indicate that the site has adequate water supply primarily through the rainfall runoff captured in sediment basins, which can be supplemented through the use of bore water when required. The model indicates that use of bore water is highly dependent on the water management practices adopted. Assuming controlled discharge is undertaken to draw down the Dirty Water Dams, the typical bore water usage will be 40 to 50 megalitres per year (ML/year) and will be within the licensed entitlement of 120 ML/year.

The model indicates that the number of overflow discharges is also highly dependent on the water management practices adopted. Assuming controlled discharge is undertaken, likely average annual overflow discharges of one day is expected, which will occur under extreme rainfall events (greater than the license threshold of 38.4 mm in 5 days). In practice the mine pit would provide substantial additional on-site storage (temporarily), which would reduce the potential for overflow discharge to occur.

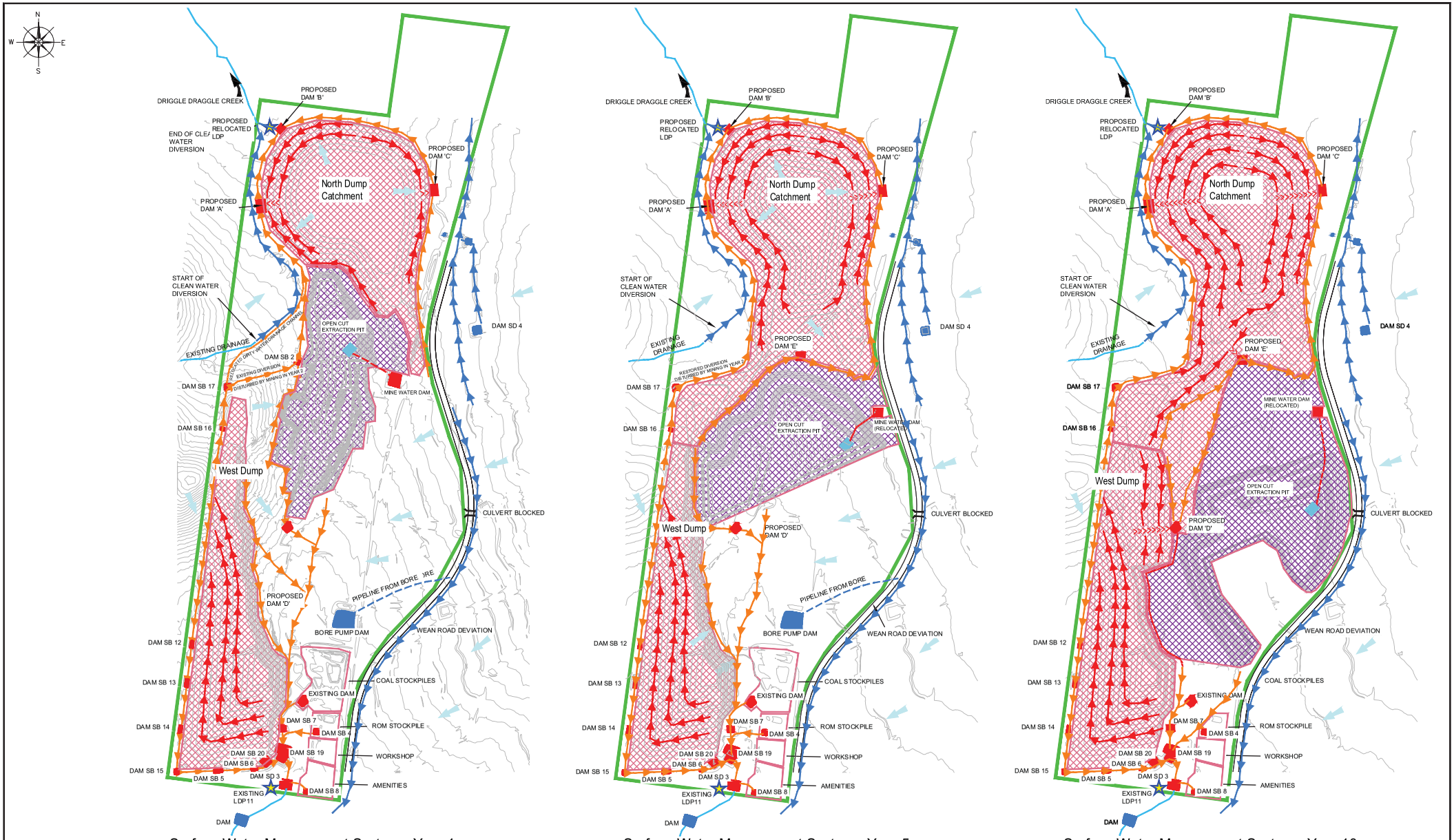
Overall the calculations indicate that the site will be relatively well balanced. As a result of the water balance, various management strategies and mitigation measures have been developed and are outlined in the below sections.

7.5.6 Proposed Water Management

Overview
The proposed water management systems for Years 1, 5 and 10 of the expanded operation are illustrated on **Figure 28**, with the post-mining landform shown on **Figure 21**. The *Surface Water Assessment* (GSSE 2010c) in **Appendix M** provides a detailed overview of the proposed water management system for these four key stages of the mine life.

The principle objective of surface water management at the mine site is to segregate clean and dirty water flows and to minimise surface flows across disturbed areas. The key water management strategies proposed to be adopted across the Project Site are summarised as follows:

1. Dirty water generated from disturbed areas to be captured and diverted using contour banks and drop structures in a manner that minimises the potential for concentrated overland flow and subsequent erosion. This water will be channelled through a series of sediment basins to reduce sediment loads prior to discharge.
2. Water generated within the open cut pit, primarily as a result of rainfall/runoff and some groundwater seepage, to be managed within the open cut via in-pit sumps. This water will be directed to and contained within these in-pit sumps until it is necessary to pump the water to the new Mine Water Dam, which will be constructed as a ‘turkeys nest’ to receive mine water only.
3. Clean water diversions will be constructed wherever possible upstream of disturbance areas to minimise the amount of dirty water to be contained and treated within the dirty water management system.



Surface Water Management System - Year 1

Surface Water Management System - Year 5

Surface Water Management System - Year 10

Base Plan Source: Geo-Spectrum (Australia) Pty Ltd. 2009

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Environmental, Land and Project Management Consultants

Rocglen Coal Mine Extension Project
Surface Water Management System - Years 1, 5 and 10

FIGURE 28

4. Progressive rehabilitation of all re-shaped surfaces to assist in reducing the level of TSS (and possible high pH and salinity) in runoff from disturbed areas. This will also reduce the dependence on sediment controls and generally assist in improving water quality.
5. Water collected in the open cut extraction pit and/or dirty water dams will be used, as much as possible, for dust suppression purposes. This is the preferential use of water on-site to minimise the chance of pollution to downstream waterways.
6. Sediment control structures will be maintained to ensure the design capacities are preserved for optimum settling rates. This will be most critical for those 'end-of-line' sediment basins that discharge from the Project Site.
7. Implementation of an effective revegetation, maintenance and monitoring program.

The key changes proposed to be integrated into the existing surface water management system in order to effectively cater for the Rocglen Extension Project are:

- Additional water management controls to deal with water from the increased disturbance footprint in the northern area of the site;
- Additional water management controls to address TSS issues during wet weather discharge;
- Relocation of the Mine Water Dam; and
- More effective diversion of clean water from off-site catchments to the east.

Following Project Approval, a new *Site Water Management Plan* will be prepared to cater for the expanded mine operations in accordance with regulatory requirements and the *Blue Book (Volume 1 and Volume 2E).*

To protect the quality of local surface water resources, Whitehaven will continue to employ the following mitigation measures for the Rocglen Extension Project:

- All hydrocarbon products will be securely stored;
- All of the mining fleet will be refuelled within designated areas of the Project Site;
- With the exception of some maintenance activities on mobile equipment, all maintenance works requiring the use of oils, greases and lubricants would be undertaken within designated areas of the Project Site;
- All water from wash-down areas and workshops would be directed to oil/water separators and containment systems;
- All storage tanks will be either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum of 110% of the largest storage tank capacity;
- Chemical flocculation to help increase the settling times of the sediment (TSS) in the water column will also be employed as required;
- As required, appropriate drainage structures and erosion and sediment controls will be installed and maintained; and
- Efforts will be undertaken to ensure that any water discharged from the Project Site via the LDPs meets the quality limits imposed by the DECCW on the site's EPL.

Site Water Balance and Discharge

The following will be considered and, where appropriate, adopted by Whitehaven to improve site water balance and minimise uncontrolled overflow discharges:

- The proposed dams will be built to at least the specified sizes, and made larger where practical to provide additional storage in order to further reduce the chance of uncontrolled overflow discharge. Increasing the total storage will provide opportunity to retain and treat water prior to controlled discharge;
- Water will be promptly transferred amongst sediment basins to ensure the maximum available on-site storage capacity of rainfall events is maintained; and
- That controlled discharge of treated (settled and/or flocculated) water will be undertaken to draw down the water storage within all the dirty water dams on-site, which will provide the capacity to contain the majority rainfall events and reduce uncontrolled overflow discharge.

Primarily it is the controlled discharge (of treated water) that will have the most significant impact on reducing the potential for discharge of sediment laden water. Whilst the overall discharge volumes will not change significantly, discharge in a controlled manner allows adequate settlement of sediment to be achieved prior to discharge.

Drainage Lines
The Rocglen Extension Project will impact upon:

- Approximately 1 km of the head waters of Driggle Draggle Creek (first order) as a result of the expanded Northern Emplacement Area. The drainage line is currently heavily disturbed through past clearing practices associated with agricultural production combined with the construction of clean and dirty water storage dams along the drainage line;
- The upper section of the central unnamed drainage line (second order) where it exits the Vickery State Forest as a result of the expanded open cut pit. The drainage line is currently diverted north and into Driggle Draggle Creek via a temporary diversion and dams; and
- A disturbed section (approximately 125 metres) of the central drainage line within the expanded extent of the open cut pit. This section of drainage line to be removed is already heavily disturbed via the existing approved mining operations.

It is proposed that the upper section of the central drainage line be permanently diverted into Driggle Draggle Creek prior to disturbance. This will allow for the passage of clean water northwards around the open cut pit and the Northern Emplacement Area. The permanent diversion would join the existing alignment of Driggle Draggle Creek immediately downstream of the proposed disturbance areas and proposed Dam B, which is the proposed location for a new LDP (see **Section 7.5.7**). It will replace the existing approved temporary diversion and will also form the relocated alignment of the head waters of Driggle Draggle Creek that will be impacted upon by the Northern Emplacement Area.

It is also proposed that the majority of the central drainage line that lies outside the emplacement areas be reinstated as close as possible to its original path. All the affected drainage lines are in either the upper reaches of the catchment or have been previously heavily disturbed by agricultural practices and/or mining operations and are not considered to be of conservation significance. Despite this, it is proposed, where practical, that sections of drainage lines that are or will be impacted upon by the mining operation be rehabilitated post-mining. The rehabilitation program would seek to achieve a long-term enhancement of the ecological value of the drainage lines through the restoration of natural hydraulic conditions and appropriate revegetation of a riparian corridor.

The new *Site Water Management Plan* to be prepared following Project Approval will include further details on the drainage line rehabilitation works. Works within the restored drainage lines will generally be undertaken in accordance with Section 5.3.3 of the *Blue Book (Volume 1)* and the *Guidelines for Controlled Activities – In-Stream Works* (DWE 2008, as cited in GSSE 2010c) for watercourse rehabilitation and riparian zone rehabilitation. Key design elements of channel establishment works are listed in **Appendix M**.