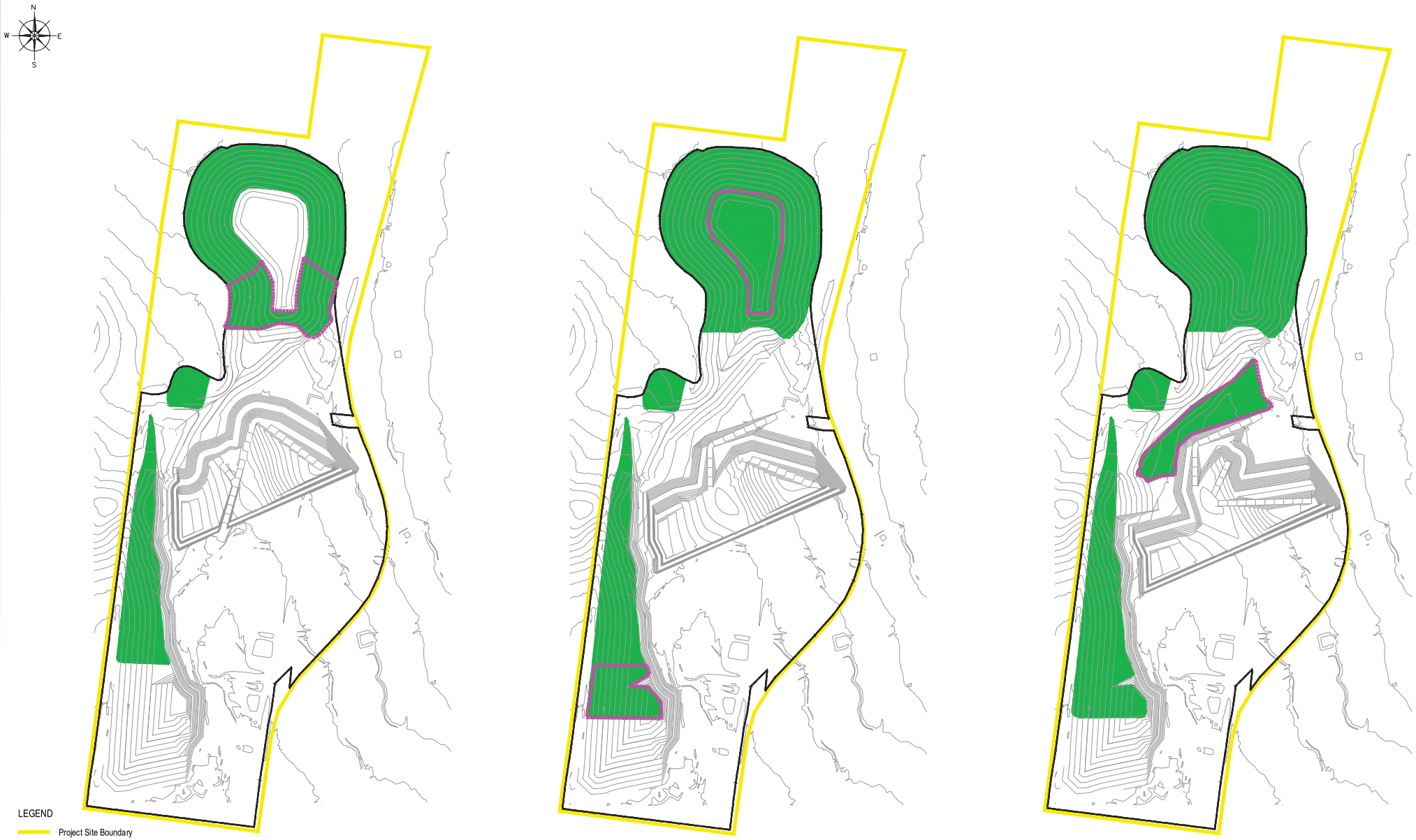

Base Plan Source: MMG Civil P/L

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Rocglen Coal Mine Extension Project
Progressive Rehabilitation Years 5 - 7

FIGURE 18

Base Plan Source: MMG Civil P/L

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Rocglen Coal Mine Extension Project
Progressive Rehabilitation Years 8 - 9

FIGURE 19

Base Plan Source: MMG Civil P/L

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Rocglen Coal Mine Extension Project Progressive Rehabilitation Year 10 - End of Mine Life

FIGURE 20

Subsoil and Topsoil Replacement

Whitehaven's adopted general practice of including an intermediate layer of subsoil between the overburden material and the topdressing, which improves the water holding capacity of the rehabilitated landform and reinstates a more natural soil profile, will continue. As described in **Section 5.4.5**, Whitehaven may reduce or remove subsoil replacement in targeted areas of woodland rehabilitation as a means of investigating impacts of different soil regimes on woodland development.

Where resources allow, as outlined above in **Section 5.4**, topsoil and subsoil will each be spread to a nominal depth of between 100 to 150 mm, giving a combined depth of soil material on the rehabilitated landform of between 200 and 300 mm. The subsoil layer will be spread on an even but roughened surface that has been ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping will also assist the keying of subsoil into the overburden, which will, in turn, assist in the prevention of land slip and can help vegetation penetrate deep into the soil profile, encourage ingress of water and minimise erosion.

Tree trunks and branches less than 300 mm diameter and other smaller vegetative debris removed during clearing will be spread over those areas to be restored as rehabilitated bushland where practical.

Drainage and Surface Water Structure Installation

Surface water management structures will be progressively installed on the rehabilitated landform. The heights (effective depths) and cross-sectional areas of the individual banks will be determined on the basis of individual sub-catchment areas, but will typically be less than 0.7 metres and 3 square metres (m^2), respectively. Rock-lined drains will be used, where required, to convey water safely from the rehabilitated landform into the surface water management system that takes water from the site.

Agricultural Land Pasture Sowing

The topdressed surfaces of those areas designated to be restored to rehabilitated pasture will be sown with a mixture of pasture species appropriate for the season. The seed mixture will include fast growing, short-lived species and perennial grasses and legumes. A proposed pasture mix for cool and warm seasons is presented in **Table 14**. Following establishment of these areas, it is anticipated rotational production of pasture and suitable crops will be undertaken at the discretion of the landowner.

Table 14 – Recommended Pasture Species Seed Mix

Pasture Species	Rate (kg/ha)	Fertiliser
Warm Season Grasses		
Bombatsi Panic	1 – 2	250kg/ha
Green Panic [2]	2 – 4	Di-Ammonium Phosphate (DAP)
Rhodes Grass[2]	1 – 2	
Purple Pigeon Grass	1 – 2	
Annual Legumes		
Subterranean Clover	4 - 5	
Cool Season Legumes[1]		
Barrel (Sephi) medic	2 – 4	
Snail (sava) medic [2]	3 – 5	
Woolly Pod Vetch	4 – 6	
Serradella (Elgara)	1 – 2	
Lucerne	0.5	
Cool Season Grasses		
Phalaris (Sirolan or Holdfast)	1 - 2	
Wallaby Grass	0.3 - 1	

1 – inoculated and appropriate rhizobia; 2 – specific soil conservation application

Native Vegetation Establishment

The topdressed surfaces of those areas designated to be restored as rehabilitated bushland will be initially stabilised with a non-persistent cover crop followed by planting of a selection of locally occurring trees. **Table 15** lists recommended species for the re-establishment of bushland within the Project Site.

Table 15 – Recommended Tree and Shrub Species

Common Name	Scientific Name	Common Name	Scientific Name
Trees		**Shrubs**	
		Western Golden Wattle	*Acacia decora*
Narrow-leaf ironbark	*Eucalyptus crebra*	Amulla	*Myoporum debile*
Pilliga Grey Box	*Eucalyptus pilligaensis*	Sandalwood	*Santalum lanceolatum*
White Box	*Eucalyptus albens*	Eastern Cottonbush	*Maireana microphylla*
Blakely's Red Gum	*Eucalyptus blakelyi*	Native Jasmine	*Jasminum lineare*
Yellow Box	*Eucalyptus melliodora*	Gargaloo	*Parsonsia eucalyptophylla*
Rosewood	*Alectryon oleifolius*	Yellow Berry Bush	*Maytenus cunninghamii*
Bull Oak	*Allocasuarina luehmannii*	Wild Lemon	*Canthium oleifolium*
Bimble Box	*Eucalyptus populnea*	Wild Orange	*Capparis mitchellii*
Brigalow *Acacia*	*Harpophylla*	Hopbush	*Dodonaea* spp.
Wilga	*Geijera parviflora*	Emubush	*Eremophila longifolia*
Belah	*Casuarina cristata*	Native Olive	*Notelaea macrocarpa*
Wild Orange	*Capparis mitchellii*	Butterbush	*Pittosporum angustifolium*
White Cypress Pine	*Callitris glaucophylla*	Cough Bush	*Cassinia laevis*

These species will encourage the re-establishment of the pre-mining vegetation communities and, in the medium to longer term, create habitat and corridors for native fauna. Tubestock will generally be propagated from locally-collected seed though Whitehaven's seed collection program and will be used in strategic landscape planting around the site for visual mitigation. Large areas may be planted by direct seeding methods if site conditions allow, and will require the purchase of bulk seed mixes. Where possible, these mixes will be complimented with the addition of seed collected in the immediate area.

All areas identified for bushland and pasture re-establishment will be fenced and have stock excluded until it can be demonstrated that the vegetation is stable and self-sustaining, and that grazing will not impact upon its establishment.

5.7.5 Rehabilitation Monitoring and Maintenance

A commitment to effective rehabilitation involves an on-going monitoring and maintenance program throughout and beyond the operation of the mine. Areas being rehabilitated will be regularly inspected and assessed against the long and short-term rehabilitation objectives. During regular inspections, aspects of rehabilitation to be monitored will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of initial grass cover establishment;
- Success of tree and shrub plantings;
- Adequacy of drainage controls;
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

Where the rehabilitation success appears limited, maintenance activities will be initiated. These may include re-seeding and where necessary, re-topdressing and/or the application of specialised treatments such as composted mulch to areas with poor vegetation establishment. Tree guards will be placed around planted tube stock if grazing by native animals is found to be excessive.

If drainage controls are found to be inadequate for their intended purpose or compromised by grazing stock or wildlife, these will be repaired and/or temporary fences installed to exclude animals. Should areas of excessive erosion and sedimentation be identified, remedial works such as importation of additional fill, soil material and/or the redesigning of water management structures to address erosion will be undertaken.

As detailed in the *Rehabilitation and Decommissioning Strategy* (GSSE 2011) in **Appendix J,** GSSE recommends that monitoring be conducted periodically by independent, suitably skilled and qualified persons at locations that are representative of the range of conditions on the rehabilitating areas. Annual reviews should be conducted of monitoring data to assess trends and monitoring program effectiveness. The outcome of these reviews should be included in each AEMR.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Maintenance will continue until such time as the objectives are met, although it is generally accepted that it will be at least five years beyond closure.

5.7.6 Preliminary Rehabilitation Success Criteria

Preliminary rehabilitation success criteria for the mine site, as presented in the *Rehabilitation and Decommissioning Strategy* (GSSE 2011) in **Appendix J**, have been taken from the document titled *Strategic Framework for Mine Closure* (ANZMEC 2000, as cited in GSSE 2011) to ensure the most appropriate and efficient rehabilitation techniques are applied. Whitehaven will also seek advice, as required, from representatives of the I&I NSW, DoP, DECCW and specialist consultants regarding any additional actions that may need to be adopted during the operation of the mine.

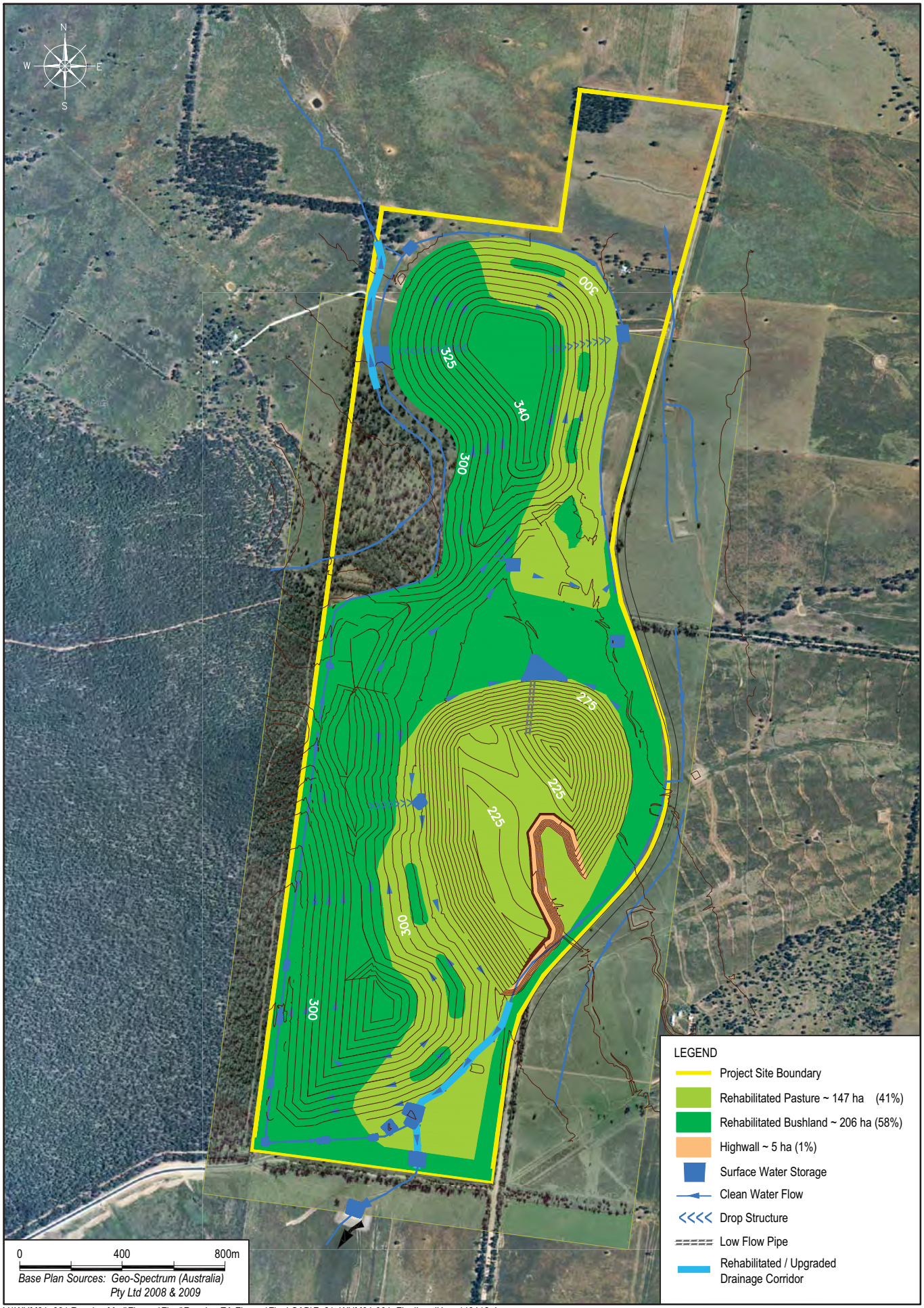
The success criteria comprise indicators for vegetation, fauna, soil, stability, land use and safety on a landform-type basis that reflects the nominated post-mine land use of a mosaic of rehabilitated bushland, rehabilitated grazing and open grasslands.

The success criteria are performance objectives or standards against which rehabilitation success in achieving a sustainable system for the proposed post-mine land use is demonstrated. Satisfaction and maintenance of the success criteria (as indicated by monitoring results) will demonstrate that the rehabilitated landscape is ready to be relinquished from the mine's financial assurance and handed back to stakeholders in a productive and sustainable condition.

5.7.7 Conceptual Post-Mining Landform

Primarily based on the annual sequencing of coal extraction and progressive rehabilitation, the post-mining landform has been developed and refined in order to ensure that a low maintenance, stable and safe landform remains that blends in with the surrounding topography and can support a mixture of rehabilitated bushland with areas of grazing consistent with the pre-mining conditions. Specific attention was given to the re-shaping and blending of emplacement areas with surrounding landforms (including the adjacent Vickery State Forest), as well as ensuring that the size of the final void is minimised and the location and configuration (including appropriate battering of the low walls and highwall) of the final void minimises possible geotechnical and safety issues.

Figure 21 presents the conceptual final post-mining landform. The major features of the proposed final landform include the following:



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Rocglen Coal Mine Extension Project
Post-Mining Landform and Land Use

FIGURE 21

- Coal extraction will leave an open pit void (final void) at mine closure covering an area of around 65 hectares in the eastern and southern extents of the open cut pit. It will have a maximum depth of around 65 metres below the natural surface, with elevations ranging between 220 and 285 metres AHD. The northern, western and part of the eastern slopes of the final void will be shaped to achieve between 10 and a maximum of 18 degree batter angles (1H:6V to 1H:3V) depending on the location of the slope within the extent of the void. The highwall on the south-eastern margin of the final void will be battered to approximately 45 degrees (1H:1V) through blasting.

- An elevated landform to the north, being the proposed expanded Northern Emplacement Area. This knoll will have a maximum design height of approximately 50 metres above the pre-mining landform, which is the approximate height of the adjacent ridge to the west of the Project Site at 340 metres AHD. Reshaping will ensure that the final batter slopes will not exceed 10 degrees (1H:6V).

- An elevated ridgeline extending southwards adjacent to the Vickery State Forest along the western boundary of the Project Site, being the approved Western Emplacement Area. The maximum design height of this ridgeline will, again, be approximately 50 metres above pre-mining landform, which is the approximate height of the adjacent ridge immediately to the west at 340 metres AHD. Reshaping will ensure that final slopes will generally be 10 degrees (1H:6V). In the northern section the eastern batters of this ridgeline will graduate to the gently sloping landform north of the final void, while in the middle section the ridgeline batters will blend with those of the final void. In the southern extent, the eastward and south facing batters of the ridgeline will blend into the undisturbed landform.

- The runoff from the Northern Emplacement Area and Western Emplacement Area will be managed by contour banks and rock drop structures conveying water off the relatively steep rehabilitated areas to the gentle surrounding slopes. Runoff from the Northern Emplacement Area will be directed to Dams A, B, C and E and discharged from the site into Driggle Draggle Creek. Runoff from the southern extent of the site, including the Western Emplacement Area, will flow southwards through Dam D to the east of the Western Emplacement Area and a series of small sediment dams to the west of the Western Emplacement Area before entering Dam SB 19.

  Overflows from Dam SB 19 will enter Dam SD 3 prior to leaving the site via an existing drainage line that eventually drains into the Namoi River approximately 10 kilometres from the Project Site. Rehabilitation of this drainage line, and others within the Project Site, will seek to reinstate the natural hydraulic functions and provide a revegetated riparian corridor in accordance with the *Blue Book* (LandCom, 2004 and DECC, 2008) and the *Guidelines for Controlled Activities – In-Stream Works* (DWE, 2008).

- An additional Dam F will be constructed to the north of the final void to assist with the prevention of surface water runoff entering into the void. Dam F will be sufficiently large (in the order of 15 megalitres) to capture large storm events (for example, 10 year Annual Recurrence Interval events) and allow this water to be used for stock watering purposes and evaporated to minimise discharges to the final void. A low flow pipe will be installed (below the primary spillway) to safely convey dam overflows to the base of the final void. Extreme rainfall events will result in flows over the spillway and into the final void.

- Other mine-related features forming part of the final landform within the Project Site will be the use of rock-lined drop structures, water storage dams and sediment basins used for surface water management and erosion and sediment control. The final landform would also incorporate contour/graded banks installed progressively as part of the rehabilitation program. The spacing and ultimate dimensions of these structures would be a function of the final slope and catchment area and, consequently, would be determined at the time of installation. On the steeper slopes, bank spacing should generally range between 50 and 80 metres.

Whitehaven undertook a review of the original preferred mine plan to improve the configuration of the final landform, particularly the configuration and location and configuration of the final void adjacent to the realigned Wean Road in terms of ensuring geotechnical stability and safety. On the basis of the revised mine plan, and as detailed in **Section 5.6.2**, GHA (2011) prepared a geotechnical report assessing the short and long term stability on the eastern highwall of the proposed open cut pit adjacent to the approved Wean Road realignment. A copy of this report is contained within **Appendix I**. The stability recommendations summarised in **Section 5.6.2** and detailed in GHA's (2011) report will be adopted as the pit progresses and the final landform is being developed.

While the final landform configuration shown on **Figure 21** provides a minimum 50 metre separation distance between the highwall to be retained as part of the final void and the realigned Wean Road, as recommended by GHA (2011), Whitehaven will undertake progressive stability reviews and monitoring of geological conditions once the pit moves within 250 metres of the realigned Wean Road to ensure geotechnical stability and safe conditions. If any unfavourable conditions are observed or detected, a detailed assessment will be undertaken by a suitably qualified geotechnical engineer before mining is allowed to continue towards Wean Road.

Limitations of land ownership and the relocation limits for Wean Road mean that realigning Wean Road further to the east away from the open cut pit limit and final void is not possible. Consideration was also given to additional backfilling to reduce the depth of the void and bring it above the modelled long-term groundwater recovery level. However this was determined unachievable and uneconomic given the volume and cost of backfill that would be required.

5.7.8 Final Void Stability

Low Walls
The low wall is considered to comprise mixed, disturbed and fragmented material. Stability of the low wall should be achieved in the following manner:

- The low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer on the basis of an assessment of the overburden material, the likely degree of settlement, and the degree of weathering expected in the long term. However it is expected that the low wall sides of the final void will be battered back to a maximum of 18 degrees with a goal of 10 degrees being optimal;
- Surface water drainage on and over the low wall will be minimised through the construction of drainage control structures, the construction of Dam F, and the aim of diverting as much of the catchment as possible away from the final void and back into the surface water system; and
- Erosion of the low wall will be controlled by limiting the length of slope through the use of contour and graded drains, minimising the slope, and by the establishment of suitable vegetation.

All low wall areas will be revegetated in accordance with the requirements outlined in Section 2.5 of the *Rehabilitation and Decommissioning Strategy* (GSSE 2011).

Highwall
The highwall is considered to comprise undisturbed, solid material generally occurring above the economically lower-most limits of the mineable seam in the final void. Depending on the geology of the deposit, the high wall material may comprise a range of natural occurring soil or rock materials of varying strengths or states of weathering.

To ensure the safety of the final void, the surrounding final slopes will be left in a condition where the risk of slope failure is minimised. The highwall of the final void will be left at 45 degrees to ensure long term geotechnical stability. This will be assessed by a suitably qualified geotechnical engineer.

The following will be considered when assessing the geotechnical stability of the highwall:

- Long term final void water level;
- Height and inclination of slope and number and spacing of intermediate benches (as may be required to achieve the final slope);
- Shear strength of the highwall soils and rocks;
- Density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them; and
- The effects of the external factors, such as surface runoff.

GHA (2010) undertook an assessment of the short and long term stability of the eastern highwall adjacent to the approved Wean Road realignment. A copy of GHA's report is contained within **Appendix I** and summary discussion in contained within **Section 5.6.2**. The report outlines the issues involved in ensuring a safe and stable highwall design, analyses the stability of the highwall adjacent to the road and provides recommendations to ensure the permanent integrity of Wean Road. The report includes reference to site geology being a key element relevant to the final highwall stability.

GHA (2011) identifies that the open pit limits can be adjusted to ensure there is solid unmined ground to prevent instability collapsing the ground in a manner that could affect Wean Road as a result of the fault structures. Such adjustments will allow some flexibility if the fault structure changes location from that suspected at present. The stability recommendations to be adopted by Whitehaven are listed in **Section 5.6.2** and form part of the project commitments in **Section 8.0**.

Importantly, it will be some years before the pit approaches within 150 metres of the realigned Wean Road providing time to monitor and amend highwall design should any other stability issues arise. While the final landform configuration shown on **Figure 21** provides a minimum 50 metre separation distance between the highwall to be retained as part of the final void and the realigned Wean Road, as recommended by GHA (2011), Whitehaven will undertake progressive stability reviews and monitoring of geological conditions once the pit moves within 250 metres of the realigned Wean Road to ensure geotechnical stability and safe conditions. If any unfavourable conditions are observed or detected, a detailed assessment will be undertaken by a suitably qualified geotechnical engineer before mining is allowed to continue towards Wean Road.

The *Rehabilitation and Decommissioning Strategy* (GSSE 2011) in **Appendix J** should be referred to for further details regarding void slope stability, spontaneous combustion, control of surface water inflow and public safety considerations.

5.7.9 Conceptual Post-Mining Land Use

Figure 21 presents the conceptual final post-mining land uses at the completion of the Project. Of the total anticipated disturbance area of approximately 358 hectares, it is proposed to restore approximately 206 hectares as rehabilitated bushland (58 percent), 147 hectares as rehabilitated pasture (41 percent), with the remaining 5 hectares comprising the retained highwall of the final void (1 percent). Furthermore, there will be retained areas of existing remnant vegetation within the Project Site.

The area of the Project Site that is within the "Roseberry" property would be predominately restored to rehabilitated pasture, with grazing able to recommence once a stable vegetative cover is established. The western area of the property will be restored as rehabilitated bushland to link in with the existing remnant bushland to the west (Vickery State Forest) and create a viable connection with the surrounding environment.

The area of the Project Site formally known as the "Belmont" property will be established predominantly with rehabilitated bushland, with the south-eastern area returned to rehabilitated pasture. A corridor from the western rehabilitated bushland will extend between the Northern Emplacement Area and the final void to connect with remnant vegetation to the east of the Project Site and create a wildlife corridor.

The western slopes of the Northern Emplacement Area within the "Glenroc" property will be restored to rehabilitated bushland, which will connect to and enhance the existing areas of remnant native vegetation that are to remain undisturbed. The remaining sections of the "Glenroc" property will be restored to rehabilitated pasture, allowing for the recommencement of some grazing activities.

As evident on **Figure 21**, along the eastern boundary of the Project Site adjacent to the realigned Wean Road, a strip of rehabilitated bushland will be established to screen the view of the final void and generally improve the visual amenity from Wean Road, as well as provide vegetation connectivity north-south on the eastern side of the void.

The large area proposed to be returned to rehabilitated bushland, which includes the western slopes of the Northern and Western Emplacement Areas, will blend in well with the retained remnant vegetation areas within the Project Site and within the adjacent Vickery State Forest and "Yarrawonga" property. Furthermore, strategically placed bushland tree lots to be established within rehabilitated pasture areas will break-up the landform and act as wildlife refuges and linkages.

5.7.10 Preliminary Post-Mining Land Use Options for Final Void

The following preliminary potential options have been considered for the final void in terms of post-mining land use(s):

Backfilling with Overburden/Other Waste Material
During the life of the mine, emplacement of overburden and backloaded coal rejects (as approved under PA 06_0198) into the mined out areas will, to the extent practicable, be undertaken to minimise the overall size of the remaining void. Any future proposals to use the final void, or part thereof, as a long-term storage facility for overburden and/or coal rejects from other nearby mining operations will require consultation and approval from the I&I NSW and the DoP.

Post Closure Water Storage Area
Dam F will be constructed to the north of the final void to assist with the prevention of surface water runoff entering into the void. Dam F will be sufficiently large (in the order of 15 megalitres) to capture large storm events (for example, 10 year Annual Recurrence Interval events) and allow this water to be used for stock watering purposes and evaporated to minimise discharges to the final void. A low flow pipe will be installed (below the primary spillway) to safely convey dam overflows to the base of the final void. Extreme rainfall events will result in flows over the spillway and into the final void.

It is further anticipated that once mining is complete, recharge of groundwater into the pit will result in the eventual formation of surface water in the southern part of the void with locally deeper final surface levels. Douglas Partners (2010) expects that the inflow to the void will be offset by evaporation from the area of surface water due to the majority of the void being partially backfilled to an elevation above 250 metres AHD, therefore being generally dry in average years.

Douglas Partners (2010) states that the existing groundwater in the Maules Creek Formation is generally brackish with total dissolved solids in the range 1,000 to 5,130 milligrams per litre (mg/L). In general, the pore water in the backfilled mine spoil is expected to become less saline over time due to the percolation of rainfall through the spoil pile. The exception to this will be in the area of surface water in the non-backfilled portion of the pit. In this location, the salinity is expected to increase over time as the evaporation leads to a reduction in water volume and leaves the dissolved salt behind. The increase in concentration is expected to be generally isolated to the surface water in the locally deep area, with some minor mixing with the adjacent pore water in the mine spoil.

Consideration was given to raising the backfill levels such that surface water is never formed within the void, thereby reducing evaporation and associated increase in salinity over time. Calculations indicate that a final fill level of about 275 metres AHD is required to prevent surface water ever occurring. This level is above the pre-development groundwater level because the mine spoil will be relatively permeable and porous, and recharge rates into the mine spoil will be substantially higher than for the surrounding undisturbed ground. Such a high final ground level was determined to be unachievable and uneconomic given the volume and cost of backfill that would be required.

It is considered that, although the proposed final void form will, over time, lead to increasing salt concentrations in the localised area of surface water within the final void, this will be of minimal impact outside the final void for the following reasons:

- The final void will behave as a groundwater sink. Therefore any increases in salinity within the sink will not affect the surrounding groundwater quality as the flow will be towards the area of higher salinity and not away from it;
- The surface water level at equilibrium will be well below surrounding groundwater levels; and
- The surface water will be located within a small final void with relatively steep sloping sides. This small area will be unsuitable for alternative land uses which would be sensitive to the potential saline surface water

(Douglas Partners 2010).

Leaving the void as a stable landform with the possible additional use of a long-term water storage is, at this point in time, the preferred option. There may be additional appropriate land use options at mine closure, and in consultation with stakeholders at that time, any such options will need to be assessed as appropriate.

5.8 Revised Biodiversity Offset Strategy

The direct and indirect impacts to threatened species, populations and ecological communities and their habitats as a result of the Rocglen Extension Project are documented in the *Flora and Fauna Assessment* (RPS 2010a) contained within **Appendix K** and summarised in **Section 7.7**. In summary, these impacts comprise 95.44 hectares of vegetation consisting of 47.04 hectares of intact vegetation in moderate to good condition and 48.4 hectares of derived native grassland (DNG) in moderate condition.

To address and offset these impacts, Eco Logical Australia (ELA) was engaged to prepare a revised *Biodiversity Offset Strategy* that meets the offset requirements for an approval under the EP&A Act and the EPBC Act. While the following sections summarise the assessment, findings and recommendations of ELA (2010), the full *Biodiversity Offset* Strategy (ELA 2010) contained in **Appendix L** should be referred to.

Field Assessment for Biodiversity Offset Strategy

RPS (2010a) and ELA (2010) identified five biometric vegetation communities within the Project Site plus cleared land. These vegetation communities and their correlation to the vegetation mapping undertaken for the original development approval (Geoff Cunningham Natural Resource Consultants 2007b) and the impacts of the Rocglen Extension Project are summarised in **Table 16**. Impacts to EPBC Act listed communities are highlighted in yellow.

ELA conducted a quantitative assessment of vegetation condition at the Project Site and adjoining properties (“Yarrawonga” and “Greenwood”) utilising the BioBanking Assessment Methodology (DECC 2009) (‘the BioBanking Methodology’) from 20 to 22 October 2010. As recommended by DECCW, the BioBanking Methodology was used to ‘inform’ the ‘improve or maintain’ assessment and provide a ‘quantum’ of area required to offset the impacts of the Project.

Table 16 – Biometric Vegetation Types

Vegetation Community (Geoff Cunningham Natural Resource Consultants 2007b)	Biometric Vegetation Type	Biometric Condition	Ancillary Code
1 - Narrow-leaf Ironbark – Pilliga Grey Box Community	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Moderate to Good	
2 - Pilliga Grey Box – White Cypress Pine Community	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone	Moderate to Good	
3 - Pilliga Grey Box – White Box – Yellow Box – White Cypress Pine Community	Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)	Moderate to Good	
	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate to Good	
6 - Brigalow Community	Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)	Moderate to Good	
8 - Cleared Lands – Used for Grazing and / or Cultivation	Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)	Moderate to Good	Derived Native Grassland
	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate to Good	Derived Native Grassland
	Cleared		

Impacts of the Rocglen Coal Mine

In accordance with discussions with Peter Christie of the DECCW, two separate BioBanking credit calculations were undertaken for the proposed *Biodiversity Offset Strategy*. The first was undertaken to determine the credit value of the existing approved (PA 06_0198) biodiversity offset areas, which are now going to be impacted upon (i.e. a 'BioBank' site scenario), and the second was undertaken to determine the value of all remaining vegetation within the Project Site that is going to be impacted as part of the Rocglen Extension Project outside of previously approved development areas (i.e. a 'Development' site scenario).

This methodology was required to be implemented to account for the impacts to the existing approved biodiversity offset areas (see **Section 4.17**) and for the removal of vegetation within the Project Site as part of the Rocglen Extension Project.

While not all vegetation within the Project Site is likely to be cleared, the *Flora and Fauna* Assessment (RPS 2010a) and revised *Biodiversity Offset Strategy* (ELA 2010) have been prepared on the assumption that all remaining vegetation will be cleared with the exception of approximately 30 hectares in the north-eastern corner of the Project Site encompassing a small area of Poplar Box Grassy Woodland. This approach has been adopted, regardless of whether the clearing/disturbance occurs, in order to allow more flexibility, if required, to site associated infrastructure and undertake site management in peripheral areas (for example, vehicle access and manoeuvring, surface water management and stockpiles). This approach will also provide flexibility if future geological exploration and economic modelling determine recoverable coal reserves within these peripheral areas, which, if approval was granted for extraction, would enable Whitehaven to further maximise coal recovery using existing infrastructure at an approved operation and also maintain the on-going socio-economic benefits of the mine for a longer period of time.

All of the vegetation to be impacted as part of the Project, with the exception of the DNG areas, provides foraging habitat for the EPBC Act listed Regent Honeyeater and Swift Parrot, even though they have not been recorded on site. On this basis, the proposed *Biodiversity Offset Strategy* addresses the loss of up to 62.04 hectares of foraging habitat (47.04 hectares from the Rocglen Extension Project and the equivalent of 15 hectares associated with the loss of part of the original offset areas).

As the Rocglen Extension Project requires the removal of the existing Biodiversity Offset Areas, the areas of each vegetation type within the approved Biodiversity Offset Areas have been calculated and are listed in **Table 17**.

Table 17 - Impacts to Existing Biodiversity Offset Areas

Vegetation Type	Condition	Ancillary Code	Impact Area (ha)
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone	Moderate to Good	Remnant Woodland	25.2
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate to Good	Remnant Woodland	0.9
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Moderate to Good	Remnant Woodland	8.8
Cleared (assumed to be rehabilitated as part of Biodiversity Offset)	Cleared	N/A	8.9
Approved Development (assumed to be rehabilitated during mine closure)	Cleared	N/A	1.5
Approved habitat enhancement via replanting (northern area) Assumed to be rehabilitated with trees and shrubs as specified by Cunningham (2007) and Table 3	Cleared	N/A	2.6
		Total	**47.9**

The cumulative losses of all impacts at the Rocglen Coal Mine are therefore the combination of the clearing approved under PA 06_0198 and the clearing proposed as part of the Rocglen Extension Project, which, as listed in **Table 18**, totals 131.74 hectares.

Table 18 - Cumulative Loss of Vegetation from Approved and Proposed Projects

Vegetation Type	Condition	Impact Area (ha)	
		Approved Project	Proposed Project
Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)			0.14
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone		23.4	27.9
Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)		1.3	3.4
Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)	DNG		37.5
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions			5.6
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	DNG		11.3
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion		11.6	9.7
Total		**36. 3**	**95.44**

Offset Requirements to 'Like for Like' and 'Maintain or Improve' Outcomes

ELA consulted with the DECCW's Peter Christie to clarify the methodology required for the assessment and to determine the 'like for like' requirements in relationship to the impacted vegetation types. ELA report that the DECCW advised that the methodology outlined in the *Biodiversity Offset Strategy* (**Appendix L**) would be considered appropriate to determine the cumulative impacts of the Rocglen Extension Project. As requested by the DECCW, any proposed offsets for the Project must be based on sound ecological principles, meet the 'like for like or better' requirement and provide information on the 'maintain and improve' conservation outcomes.

In this regard, both the DECCW (DECC 2008) and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DEWR 2007) have published a list of principles that must be considered when developing offset strategies. These principles are included and discussed within the *Biodiversity Offset Strategy.*

Proposed Biodiversity Offset Strategy

The *Biodiversity Offset Strategy* proposed for the Rocglen Extension Project, including replacement of original offset areas, is to retire the full 4,859 credit requirement as calculated in the *Strategy* (**Appendix L**) from the Whitehaven Regional BioBank Site (see **Figures 2** and **3**), which is in the final stages of registration by the DECCW as a BioBank Site under Part 7A of the TSC Act. It will be actively managed via a BioBanking Management Plan with in-perpetuity management funding, and will have the highest level of conservation status outside of National Parks via a BioBanking Agreement registered on the land title in-perpetuity.

The numbers and types of credits to be retired are summarised in **Table 19** and corresponds to the 'like for like or better' evaluation. This is equivalent to an area of around 525 hectares or an offset ratio of 4.75:1 for the 95.44 hectares of impact from the Rocglen Extension Project and replacement for the 47.9 hectares of the 111.3 hectares of the original offset area impacted by the Extension Project (this equates to approximately 15 hectares of the original 36.3 hectares of impacts resulting from PA 06-198). In summary, a total impact of 110.44 hectares for the Rocglen Extension Project and 131.74 hectares of cumulative impact for all approvals.

ELA (2010) reports that the proposed *Biodiversity Offset Strategy* meets the specific principles of offsets in NSW, particularly principles 6 and 10. Key components of the *Strategy* include:

- The vegetation at the Whitehaven Regional Biobank Site is of equal or greater conservation status to the Project Site;
- The offset area is almost five times the size of the cumulative area to be impacted at the Project Site;
- The Whitehaven Regional Biobank Site will have the highest level of conservation status outside of National Parks (via a registered BioBanking Agreement that is currently being assessed by DECCW);
- The Whitehaven Regional Biobank Site is to be actively managed via a BioBanking Management Plan with in-perpetuity management costs held in Trust; and
- The Whitehaven Regional Biobank Site enhances and provides strategic conservation outcomes to the west of the Kelvin CCA Zone 2 Aboriginal Area and provides protection to vegetation types not well represented in the existing reserve system (White Box Grassy Woodland). The Whitehaven Regional BioBank Site also enhances north-south connectivity on a regional scale and will eventually form part of an east-west link with Vickery State Forest once the Rocglen Coal Mine is rehabilitated.

Table 19 – Proposed Biodiversity Offset Strategy

Vegetation Type Impacted	Credits Required	'Like for Like' Equivalent Offset Area Vegetation Types	Credits Available at Whitehaven Regional BioBank Site (cumulative by type)	Credits to be Retired
Brigalow – Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)	6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1,402	6
Pilliga Box – Poplar Box-White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone	1,793	Semi-evergreen vine thicket of basalt hills of the NSW north western slopes	1,820	720
		White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	2,822	1,073
Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)	1,712	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1,396	612
		Semi-evergreen vine thicket of basalt hills of the NSW north western slopes	1,100	1,100
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	784	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	784	784
White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	564	White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	2,415	564
Total	**4,859**			**4,859**

The offset package also meets the draft Commonwealth offset principles in that:

- The offset package is a direct package (Principle 4) that is targeted to the EPBC Act matters that are being impacted and determined to be a Controlled Action (Principle 1), are on a like for like basis (Principle 5):
  - 784 White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland biodiversity credits (equivalent to 75 hectares of the CEEC are being retired to offset impacts to 5.9 hectares of intact White Box along Wean Road and Jaeger Lane and 10.9 hectares of derived native grassland within the mine site boundary), an offset ratio of 4.46:1;
  - an additional 618 White Box credits, equivalent to 59.4 hectares is being protected to offset impacts to other non EPBC Act listed vegetation communities (a total area of 134.4 hectares of White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland will be protected which is of an equivalent condition to that being impacted); and
  - 525 hectares of habitat suitable foraging habitat for the Regent Honeyeater and Swift Parrot will also be protected to replace the loss of 47.04 hectares of suitable foraging habitat (intact woodland remnants) as a result of the mine extension and for the replacement for impacts to the original offset areas which provided offsets for approximately 15 hectares of the original impacts, a ratio of 8.5:1.

- The Whitehaven Regional Biobank Site will have the highest level of conservation status outside of National Parks (via a registered BioBanking Agreement on the land title that is currently being assessed by DECCW) (Principles 3 and 7);
- The Whitehaven Regional Biobank Site is to be actively managed via a BioBanking Management Plan with in-perpetuity management costs held in Trust (Principles 3 and 7);
- The offset area is less than 1 kilometre to the east of the Project Site and is therefore in the same general area as the development activity (Principle 6);
- The offset is enforceable and will be monitored and audited in accordance with the BioBank Agreement (Principle 8); and
- The Whitehaven Regional Biobank Site enhances and provides strategic conservation outcomes to the west of the Kelvin CCA Zone 2 Aboriginal Area and provides protection to vegetation types not well represented in the existing reserve system (White Box Grassy Woodland). The Whitehaven Regional BioBank Site also enhances north-south connectivity on a regional scale and will eventually form part of an east-west link with Vickery State Forest once the Rocglen Coal Mine is rehabilitated (Principle 2).

In summary, the proposed *Biodiversity Offset Strategy* compensates for the direct loss of 95.44 hectares of vegetation in various condition states (intact and DNG) and replacement offsets for impacts to 47.9 hectares of the 131.74 hectares of approved offsets on a 'like for like' basis with over 525 hectares of vegetation in the Whitehaven Regional Biobank Site. The *Biodiversity Offset Strategy* provides an offset (525 hectares) to impact (110.44 hectares comprising 95.44 hectares of impacts for mine extension and the equivalent of 15 hectares of original impacts which now needs a replacement offset) ratio of 4.75:1.

The improvements in conservation values at the Whitehaven Regional Biobank Site (through the cessation of current grazing and implementation of conservation management practices outlined in the BioBank Site Management Plan, including enhancement tree and shrub planting and weed control) will lead to an 'improve and maintain' conservation outcome.

The retirement of these credits, brings the total number of credits proposed to be retired from the Regional Biobank Site to 10,154 of the total 13,754 generated (ELA 2010) or 73.83%.

5.9 Other Minor Project Related Works

The Rocglen Extension Project also seeks approval to undertake the works outlined in the following sections.

5.9.1 Altered Surface Water Management

The Rocglen Extension Project will require the implementation of changes to the surface water management system within the Project Site in order to cater for the expanded operation. The altered system will ensure the effective management of all surface water on-site and minimise the risk for any off-site impacts on downstream water resources, as well as ensure the water demands of the Project can be met at various stages of the mine life.

The proposed management strategies for clean water, dirty water and mine water are outlined in **Section 7.5** and detailed in the *Surface Water Assessment* prepared by GSSE (2010c) in **Appendix M.**

5.9.2 Relocation of Mine Water Dam

Water generated within the open cut pit, primarily as a result of rainfall/runoff and possible groundwater seepage, would be managed within the open cut via in-pit sumps. This water would be directed to and contained within these in-pit sumps until it is necessary to pump the water to the Mine Water Dam.

The current location of the 11 ML Mine Water Dam (see **Figure 6**) is predicted to be mined through during Year 2 of the expanded operation. Before this date, a new Mine Water Dam will be constructed to the south-east of its current location between the eastern extent of the open cut pit and the realigned Wean Road. It will be constructed as a 'turkeys nest' dam with no catchment and will be kept at a level that does not overflow. In-pit sumps will continue to be used to collect runoff from within the pit and pump to the new Mine Water Dam as required.

5.9.3 Relocation of Jaeger Lane

As stated above in **Section 4.10**, a section of Jaeger Lane traversing through the Rocglen site from Wean Road has been relocated under the provisions of PA 06_0198 to the north to provide continued access to "Yarrawonga". Application to formally close that section of Jaeger Lane within the Project Site has been made to the NSW Department of Lands and is pending approval.

The Rocglen Extension Project will require this section of Jaeger Lane to be relocated again in order to cater for the expanded Northern Emplacement Area. Upon receiving Project Approval, Whitehaven will undertake consultation with Gunnedah Shire Council in order to negotiate and agree upon a suitable alignment.

5.9.4 Removal of "Glenroc" Building Improvements

The "Glenroc" property owned by Whitehaven and located in the northern extent of the Project Site, encompasses an unoccupied residence and several outbuildings, including hay and stock sheds. The Rocglen Extension Project proposes the removal of the "Glenroc" outbuildings identified on **Figure 6** in order to cater for the expanded Northern Emplacement Area. It is also likely that the unoccupied "Glenroc" residence further to the north, while outside of the proposed disturbance areas, will also be removed.

5.9.5 Relocation of Meteorological Station

The "Glenroc" property, which is again owned by Whitehaven and located in the northern extent of the Project Site, encompasses a meteorological station established by Whitehaven in 2002 specifically for the Rocglen operation. While this meteorological station is located outside of the proposed disturbance areas, it will be relocated in order to ensure adequate separation distance from the expanded Northern Emplacement Area and optimal operation. Upon receiving Project Approval, Whitehaven will investigate and decide upon a suitable position within the Project Site for relocation of the meteorological station.

5.9.6 Relocation of High Volume Air Sampler

Adjacent to the meteorological station within the "Glenroc" property (see **Section 5.9.5**) is a high volume air sampler (HVAS) for measuring the concentration of particulate matter less then 10 micrometres (PM_{10}). This HVAS will be relocated in order to cater for the expanded Northern Emplacement Area and ensure appropriate operation. This relocation will be undertaken in consultation with the DECCW and will be documented in a revised Air Quality Monitoring Program following receipt of Project Approval. An appropriate location will be selected taking into consideration local meteorological conditions, the proximity of surrounding residences and the locations of predicted dust emission sources from within the Project Site.

5.9.7 Realignment of Overhead Powerline

As identified on **Figure 6,** an overhead high voltage (HV) feeder powerline, owned by Country Energy, traverses through the northern extent of the Project Site adjacent to Wean Road. The Rocglen Extension Project will require the realignment of this powerline to ensure adequate separation distances from the expanded Northern Emplacement Area and Eastern Soil Stockpile Area.

As outlined above in **Section 2.3.5**, consultation has been undertaken with Country Energy in November 2009 in this regard. Country Energy confirmed, via email correspondence, that the preference for realignment is along the eastern edge of the Wean Road reserve. Upon receiving Project Approval, Whitehaven will undertake further consultation with Country Energy in order discuss and ascertain the required path in terms of planning and commissioning the realignment.