HYDROLOGY AND WATER MANAGEMENT CONSULTANTS

REPORT

Cowal Gold Mine E42 Modification

Hydrological Assessment

Prepared for: **Barrick Australia Limited**

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EXECUTIVE SUMMARY

Barrick Australia Limited (Barrick) is proposing to undertake a modification to the approved Cowal Gold Mine (CGM), known as the E42 Modification. Changes implemented to the approved CGM by the E42 Modification would result in the modified CGM. The modified CGM is scheduled to commence in approximately Year 5 of the CGM operations. The main changes to the approved CGM as a result of the E42 Modification would include those presented below:

- An increase to the operational mine life from 13 years to approximately 24 years.
- An increase in total production from approximately 76 million tonnes (Mt) to approximately 129 Mt.
- An increase in the maximum processing rate from approximately 6.9 million tonnes per annum (Mtpa) to approximately 7.5 Mtpa.
- An increase in gold production from approximately 2.7 million ounces (Moz) of gold to approximately 3.5 Moz of gold.
- An increase in the total surface area of the open pit from approximately 70 hectares (ha) to approximately 130 ha and depth of the open pit from approximately 325 metres (m) to approximately 440 m.
- An increase in the total volume of waste rock from approximately 128 Mt to approximately 184 Mt.
- An increase in the maximum heights and surface area of the northern and southern waste rock emplacements.
- A reduction in the height of the perimeter waste emplacement in places.
- An increase in the total volume of tailings produced from approximately 76 Mt to 129 Mt resulting in increased heights of tailings storage facilities (with area remaining constant at approximately 350 ha).
- An increase in the total surface area of low grade ore stockpiles.
- Extraction of saline water from a saline groundwater supply borefield located within Mining Lease 1535.
- Other associated minor changes to infrastructure, plant, equipment and activities.

The key changes to the water management system necessitated by the modified CGM would be:

- Realignment and associated changes to part of the Up-catchment Diversion System to incorporate the expanded northern waste emplacement.
- Changes to the sediment and erosion control system within the Internal Catchment Drainage System.
- Changes to the internal catchments, and associated changes to some contained water storages due to increased/modified catchment areas and changes to the internal drainage configuration.

- Changes to the external water supply to meet the increased water demands associated with higher ore processing rate and longer mine life of the modified CGM.

Assessing the surface water management implications of these changes involved:

- Simulating the performance of the water management system with the modified CGM using the site water balance model developed by others. The model was used to simulate the water management system under ‘dry’, ‘medium’ and ‘wet’ conditions. Changes to the storage capacity of existing internal water management storages and/or the need for additional water management infrastructure was assessed using hydrologic yield calculations for the 1 in 100 year and 1 in 1,000 year average recurrence interval storage capacity criterion adopted in the consented Cowal Gold Project Environmental Impact Statement (the EIS) (North Limited, 1998) – refer Section B4.2 of the report.

- Examination of the tailings or waste rock geochemistry study conducted by Geo-Environmental Management Pty Ltd (GEM) for the E42 Modification and the likely implications for water quality – refer Section B4.4 of the report.

- Examination of the capacity of the proposed external water supply arrangements (including the Bland Creek Palaeochannel Borefield and regulated Lachlan River sources), to provide adequate make-up for the modified CGM – refer Section B4.1.2 of the report.

- Examination and identification of the implications of the modified CGM on post-closure water management and the water and salt balance of the final void as a result of the E42 Modification – refer Section B5.1 of the report.

- Identification of any potential implications of the modified CGM on the water balance of Lake Cowal including changes to sediment and solute flux from the modified CGM to Lake Cowal as a result of the E42 Modification – refer Section B4.3 of the report.

The following conclusions are made based on the results of these assessments.

Changes to some of the internal contained water storages and some associated minor modifications to the internal drainage arrangements of the modified CGM would be required to manage surface water runoff. Details of these changes are provided in Section B4.2 of the report. With these changes in place, the site water management system model predicts similar/equivalent performance under dry, wet and average climate scenarios as those obtained with the originally approved CGM model.

The geochemical assessment undertaken by GEM (2008) concluded that there would be no change to the geochemical characteristics of mine waste rock or tailings as a result of the E42 Modification and as a consequence no additional water quality management requirements are needed for the modified CGM.

The demand for external water supply under dry, medium and wet climatic conditions was simulated using the CGM operational water balance model. The model results showed that external sources would adequately supply the simulated demands.

Results of void water balance modelling indicate that the filling behaviour of the final void would change as a result of the E42 Modification. The changes would be to the filling rate and final water level, which would be slower and lower than was predicted in the EIS, and the rate that void salinity would increase which was also predicted to be slower.

These changes would occur due to the larger void volume and surface area, and because with the benefit of observed pit groundwater inflows, long-term groundwater inflow rates are now expected to be significantly less than was originally predicted. The slower fill rates, the lower final void water level and the slower rate of increasing salinity in the void would enhance the long-term isolation and disconnection of the final void from Lake Cowal and are seen as beneficial changes.

The changes to the mine site catchments are relatively minor and when considered in the context of the overall water and salt balance of Lake Cowal would not measurably affect either the original prediction of change to the Lake's water balance or lake water levels (which were small); or the predicted effects on salinity and sediment flux from the modified CGM to the Lake.

B1.0 INTRODUCTION

Barrick Australia Limited (Barrick) is proposing to undertake a modification to the approved Cowal Gold Mine (CGM), known as the E42 Modification. The CGM is located on the western side of Lake Cowal in the central west of New South Wales (NSW) – refer Figure B-1. Changes implemented to the approved CGM by the E42 Modification would result in the modified CGM. The modified CGM is scheduled to commence in approximately Year 5 of the CGM operations. The main changes to the approved CGM as a result of the E42 Modification would include those presented below:

- An increase to the operational mine life from 13 years to approximately 24 years.
- An increase in total production from approximately 76 million tonnes (Mt) to approximately 129 Mt.
- An increase in the maximum processing rate from approximately 6.9 million tonnes per annum (Mtpa) to approximately 7.5 Mtpa.
- An increase in gold production from approximately 2.7 million ounces (Moz) of gold to approximately 3.5 Moz of gold.
- An increase in the total surface area of the open pit from approximately 70 hectares (ha) to approximately 130 ha and an increase in the depth of the open pit from approximately 325 metres (m) to approximately 440 m.
- An increase in the total volume of waste rock from approximately 128 Mt to approximately 184 Mt.
- A reduction in the height of the perimeter waste emplacement in places.
- An increase in the maximum height and surface area of both the northern and southern waste rock emplacements.
- An increase in the total volume of tailings produced from approximately 76 Mt to 129 Mt resulting in increased heights of tailings storage facilities (with area remaining constant at approximately 350 ha).
- An increase in the total surface area of low grade ore stockpiles.
- Extraction of saline water from a saline groundwater supply borefield located within Mining Lease (ML) 1535.
- Other associated minor changes to infrastructure, plant, equipment and activities.

Gilbert & Associates Pty Ltd was commissioned to undertake a surface water assessment of the proposed modification as part of the E42 Modification Environmental Assessment.

<u>Changes to Water Management</u>

The key changes to the water management system as a result of the E42 Modification would be:

- Realignment and associated changes to part of the Up-catchment Diversion System (UCDS) to incorporate the expanded northern waste emplacement.

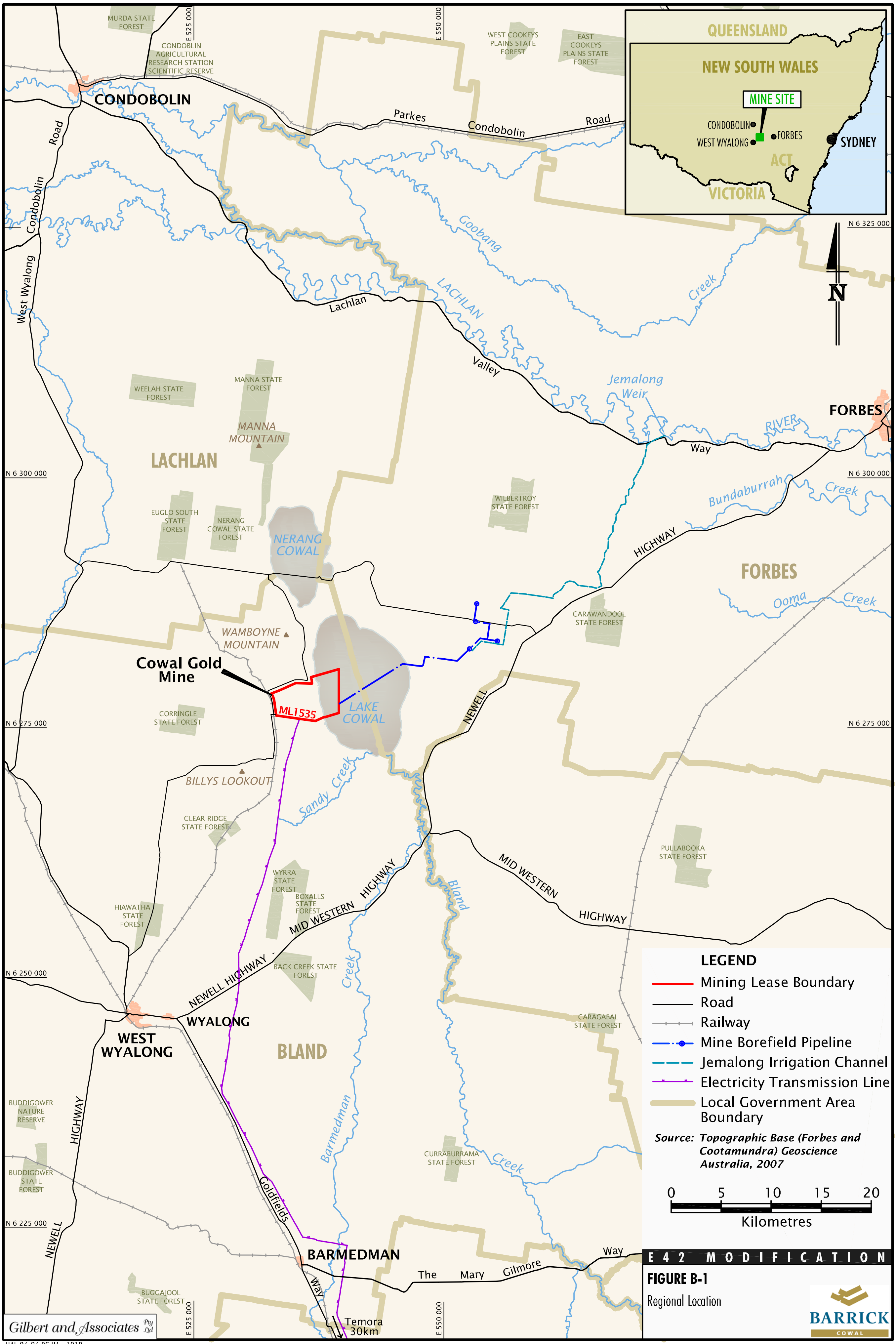


FIGURE B-1
Regional Location

- Changes to the sediment and erosion control system within the Internal Catchment Drainage System (ICDS).
- Changes to the internal catchments, and associated changes to some contained water storages due to increased/modified catchment areas and changes to the internal drainage configuration.
- Changes to the external water supply to meet the increased water demands associated with higher ore processing rate and longer mine life of the modified CGM.

Assessment Requirements

The NSW Department of Planning Director-General's requirements which are relevant to this assessment include:

- a description of the existing environment;
- an assessment of the potential impacts of the revised mining operations (incorporating the proposal);
- a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the potential impacts of the revised mining operations; and
- detailed modelling of potential surface and groundwater impacts of the revised mining operations, a geochemical assessment of the potential leachate impact, and a site water balance demonstrating that the mine has suitable measures in place to provide the necessary water for all stages of the revised mining operations.

Hydrological Assessment Methodology

The surface water assessment for the E42 Modification involved:

1. An assessment of the performance of the water management system with the modified CGM using a site water balance model developed by others. The model was modified to simulate the E42 Modifications under 'dry', 'medium' and 'wet' conditions. Changes to the storage capacity of existing internal water management storages and/or the need for additional water management infrastructure was identified from hydrologic yield calculations for the 1 in 100 year and 1 in 1,000 year average recurrence interval (ARI) storage capacity criterion adopted in the consented Cowal Gold Project Environmental Impact Statement (the EIS) (North Limited, 1998).
2. An assessment of the tailings or waste rock geochemistry study conducted by Geo-Environmental Management Pty Ltd (GEM) (2008) for the E42 Modification and the likely implications for water quality.
3. An assessment of the implications of the modified CGM on the capacity of the proposed external water supply arrangements including the Bland Creek Palaeochannel Borefield and regulated Lachlan River sources, as a result of the E42 Modification.

4. An assessment of the implications of the modified CGM on post-closure water management and the water and salt balance of the final void, as a result of the E42 Modification.
5. An assessment of the potential implications of the modified CGM on the water balance of Lake Cowal including changes to sediment and solute flux from the modified CGM to Lake Cowal as a result of the E42 Modification.

B2.0 PHYSICAL AND HYDROLOGICAL SETTING

The CGM is located on the western side of Lake Cowal. Lake Cowal is an ephemeral, fresh water lake which is recognized as a significant habitat for water bird species. It forms part of the Wilbertroy-Cowal Wetlands which are located on the Jemalong Plain. The Lake is in the lower reaches of the Bland Creek catchment. It also receives periodic inflows from the Lachlan River during periods of high flow[1] when flood waters enter the Lake via two main breakout channels. Lake Cowal is a large oval shaped lake which when full occupies an area of some 105 square kilometres (km^2) and holds some 150 giga litres (GL) of water. It overflows to Nerang Cowal, a smaller lake to the north. When flows are sufficient to get through the system they ultimately drain into the Lachlan River via Bogandillon Creek.

The Cowal region experiences a semi arid climate which is dominated by cool, wetter conditions in winter and hot and relatively dry conditions in summer. Rainfall averages some 440 millimetres (mm) per annum compared to an average pan evaporation of 1,740 mm. Flow records for the gauging station on Bland Creek indicate that runoff is low averaging about 5% of rainfall over the period of record.

Baseline water quality reported in the EIS was based on results of an intensive sampling programme conducted in 1991 and 1992 and included 34 monitoring locations along 4 transects across the Lake. Results indicated that Lake water was typically slightly to moderately alkaline (pH 8.27 to 8.67) with low to moderate suspended solids concentrations, (total suspended solids concentrations of 24 to 222 milligrams per litre [mg/L]) (North Limited, 1998). Conductivity, as a surrogate of dissolved solids, was also low varying between 222 and 1,557 micro Siemens per centimetre (µS/cm) and appeared to be inversely related to lake volume which suggests solute concentrations are responding to evapo-concentration effects (*ibid.)*. Metals (cadmium, arsenic, lead, mercury and zinc) were low and mostly below detection limits (*ibid.)*. However, particulate copper concentrations were found to be higher than Australia and New Zealand Conservation Council (ANZECC) limits for aquatic ecosystems (*ibid.)*.

Groundwater in the CGM area occurs in three separate aquifer systems. The upper two are hosted in the upper Quaternary sediments and a third in fractured basement rocks. These aquifers are typically low yielding and highly saline (31,000 to 38,100 mg/L) (Coffey Partners International Pty Ltd, 1995).

[1] Inflows from the Lachlan occur when flows at Jemalong Weir exceed 15,000 to 20,000 megalitres per day (ML/day).

B3.0 CURRENT CGM WATER MANAGEMENT

The approved CGM currently involves open cut mining and on-site ore processing. It has an approved operational life of some 13 years comprising 8 years of active mining and on-site processing, followed by 5 years of ore processing only. On-site processing involves traditional crushing and grinding followed by a combined flotation and carbon-in-leach circuits. Tailings produced from the processing plant are deposited in two tailings storage facilities (TSFs). Mine waste rock is stored in waste emplacements.

The CGM water management system has been designed such that the approved CGM does not impact on the integrity of Lake Cowal. Mine infrastructure and landforms have been constructed within a contained catchment (i.e. the ICDS). The ICDS combines with the lake isolation system to protect Lake Cowal from CGM development activities.

The lake isolation system comprises a temporary isolation bund and a permanent isolation bund (i.e. lake protection bund). The lake protection bund comprises a large engineered embankment that provides a permanent barrier between the lake and the open pit. Runoff from areas upslope of the ICDS is diverted via an UCDS, around the CGM to the lake.

Water supply for the approved CGM involves capture and re-use of mine and process water, and capture and re-use of runoff from areas within the ICDS. External make-up water is sourced from the Bland Creek Palaeochannel Borefield via the mine borefield pipeline (Figure B-1) and surface water obtained from the Lachlan River via the Jemalong Irrigation Channel (Figure B-1) using regulated flow licences purchased by Barrick on the open market. External water supply is reticulated to site via the mine borefield pipeline from the Bland Creek Palaeochannel Borefield (Figure B-1).

The following description of the currently approved CGM water management system and surface water hydrology has been derived from the EIS and other documentation associated with subsequent modifications to the approved CGM.

B3.1 Contained Water Storages

The ICDS comprises a series of seven internal drainage catchments (each served by a contained water storage for runoff collection) and two water supply storages. Details of the catchment areas and the capacities of the contained water storages are tabulated below in Table B-1. With the exception of D5, contained water storages are designed to collect runoff generated from its contributing catchment during a 1 in 100 year ARI rainfall event of 48 hours duration. Contained water storage D5 and supply storages D9 and D6 are sized to contain runoff and/or rainfall from a 1 in 1,000 year ARI rainfall event of 48 hours duration.

Table B-1
Summary of Existing Internal Catchments and Contained Water Storages

Storage Number	Catchment/Function	Catchment Area (ha)	Storage Capacity (ML)
D1	Runoff from northern perimeter of the northern waste emplacement. Collected water pumped to D9.	42	58
D2	Runoff/seepage from run-of-mine (ROM) and low grade stockpile areas from the northern waste emplacement area and the northern tailings storage facility. Collected water pumped to D9.	389	115
D3	Runoff from perimeter catchment surrounding the open pit and the perimeter waste emplacement areas. Collected water pumped to D9.	76	45
D4	Runoff from the southern perimeter of the southern waste emplacement. Collected water pumped to D9.	18	66
D5	Process plant area drainage collection. Water pumped to D9.	27	50
D6	Process water storage. Main source of plant make-up.	Incident area	25
D8A	Runoff from southern waste emplacement. Water pumped to D9.	72	28
D8B	Runoff from southern waste emplacement and southern tailings storage facility. Water pumped to D9.	50	148
D9	Process water storage. Storage for raw water. Water pumped to D6.	Incident area	802

B3.2 Pit Dewatering

Pit inflows occur via groundwater and incident rainfall and runoff from areas surrounding the pit. The catchment area draining to the pit has been restricted to relatively small perimeter areas. The pit would also be the final water containment point in the event of overflow from any of the internal contained water storages or in the very improbable event of a spill from the TSFs. Mining has and would continue to create a sink for surrounding groundwater which flows toward the depression created by the mine. Groundwater inflows to the open cut accumulate in the pit floor and are recovered by pumping to Storage D6. D6 has a design capacity sufficient to store runoff from the 1 in 1,000 year, 48 hour event above its normal operating level. The original prediction for groundwater inflows to the pit were for high initial rates up to 10 ML/day declining to about half this amount over the remaining life of the approved CGM. It is understood that actual groundwater inflow rates to date have been significantly lower than the pre-mine model based predictions (i.e. approximately 1 ML/day).

B3.3 Waste Emplacement Water Management

Mine waste recovered during the open cut mining operations has been placed in three waste emplacement areas comprising the northern, southern and perimeter waste emplacements. The northern and southern waste emplacements are integral with the perimeter waste emplacement which is a component of the permanent lake protection bund. The outside faces of the northern and southern waste emplacements form part of the perimeter catchment limits of the approved CGM. The approved CGM involves the placement of some 128 Mt of mine waste rock. The northern waste emplacement is the largest of the emplacement areas and was planned to occupy an area of some 150 ha.

The original natural surface contours underlying the northern waste emplacement sloped to the north and away from the open pit. The design objective was to facilitate containment of seepage from saline generating components in the waste rock within the mine site area. Construction works associated with the site included construction of a low permeability basal layer beneath the northern waste emplacement area - sloping inward toward the open pit. The basal layer was intended to provide control over the direction of internal seepage such that it would emerge from the internal rather than the external toe of the waste emplacement area where it would report to contained water storage D2. Any runoff from the external face of the northern waste emplacement would report to the external contained water storage D1 which has been constructed below the external (north-eastern) toe of the northern waste emplacement area.

The original southern waste emplacement area occupied some 115 ha on the southern side of the open pit. The southern waste emplacement was constructed over a low ridge line such that seepage would have naturally reported to both the southern and northern sides of the emplacement. A low permeability basal layer sloping to the north was incorporated into the pre-development construction works to facilitate drainage of seepage waters toward the open pit. The basal layer was intended to provide control over the direction of internal seepage such that it would emerge from the internal rather than the external toe of the waste emplacement area where it would report to contained water storages D8A and D8B. Any runoff from the external face of the southern waste emplacement would report to the external contained water storage D4 which has been constructed below the external (south-eastern) toe of the southern waste emplacement area.

The perimeter waste emplacement area forms part of the permanent lake isolation bund system. It provides a continuous elevated land form linking the northern and southern waste emplacement areas.

B3.4 Tailings Storage Facility Water Management

Tailings material is deposited into the two TSFs (i.e. northern and southern TSFs) as a slurry under sub-aerial conditions. Free water liberated during settling and runoff from incident rainfall accumulate in an internal decant pond area from where they are pumped out to dedicated contained water storage D6 for re-use in the processing plant. The TSFs have been designed to maintain a minimum freeboard in the TSFs sufficient to store at least the contingency 1 in 1,000 year ARI rainfall event at all times.

B4.0 CHANGES TO OPERATIONAL WATER MANAGEMENT

Changes to operational water management as part of the E42 Modification comprise:

- Changes to the external water supply needed to meet the increased water demands associated with the longer mine life of the modified CGM.
- Realignment and associated modifications to the UCDS to incorporate the expanded northern waste emplacement and associated marginal increase to the catchment areas reporting to the internal water management system.
- Increases to the capacity of two internal contained water storages. These changes would be necessitated by:
  - the increased size of the northern waste emplacement area;
  - changes to the layout of low grade ore and soil stockpile areas; and
  - removal of existing contained water storage D8A once the E42 Modification open pit encroaches on the D8A footprint.
- Minor changes to collection drains around enlarged stockpile and waste emplacement areas.
- Diversion of the catchment reporting to contained water storage D8A, to contained water storage D8B, after the E42 Modification open pit encroaches on the D8A footprint.

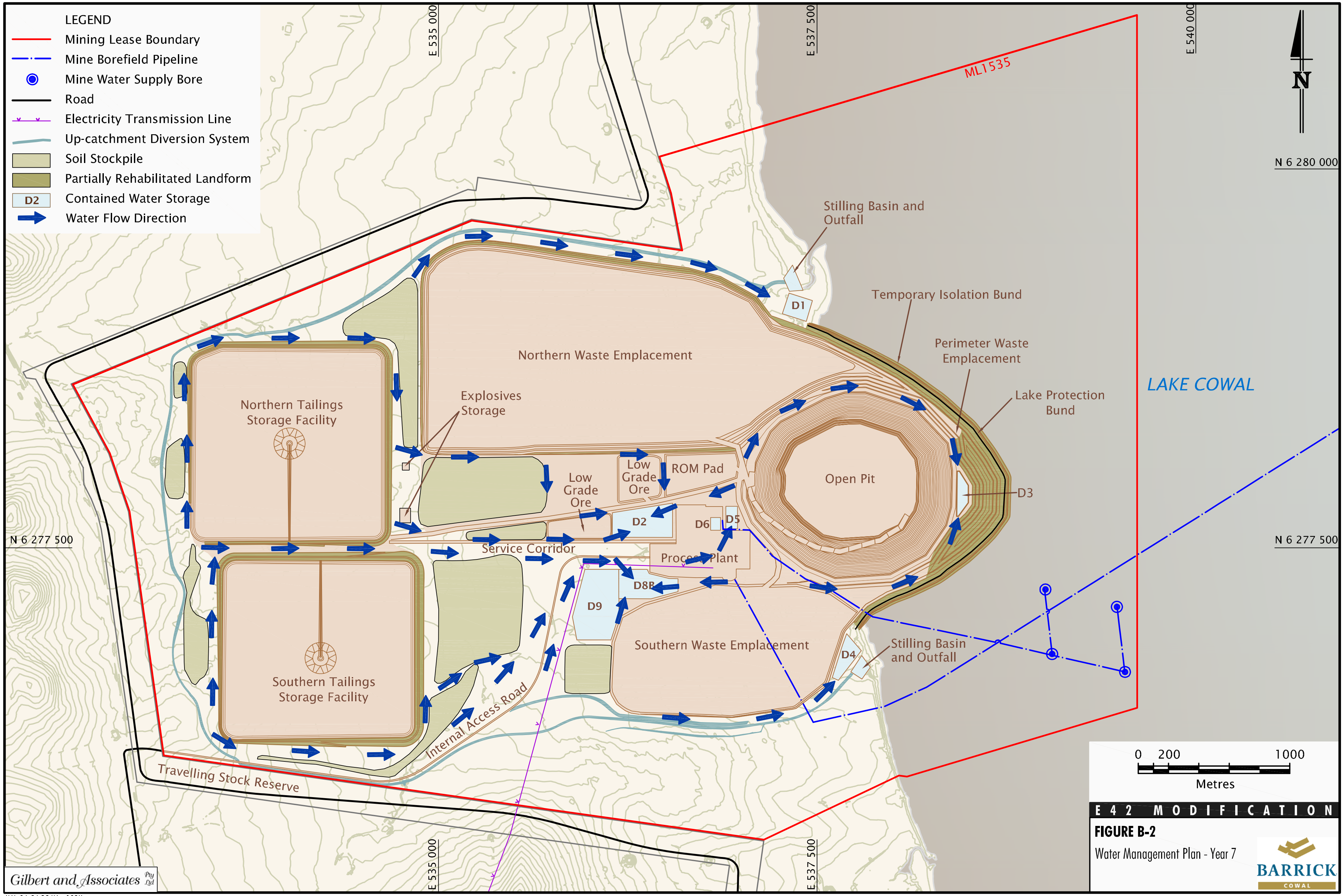
The layout of mine infrastructure and water management requirements of the modified CGM is shown on Figure B-2.

B4.1 External Water Supply

The E42 Modification would extend the life of the approved CGM by approximately 11 years (i.e. from the currently approved 13 years to 24 years). Assuming commencement of the E42 Modification in 2009, approximately 19 years of additional external water supply would be required. Based on the current configuration of the process plant, ore processing rates, ore types and recorded process plant water demand to date, the average daily external water demand for the modified CGM would be approximately 10 ML/day. This demand is proposed to be met via the arrangements described below.

B4.1.1 Process Plant Reconfiguration – Water Demand Reduction

The potential to reduce demand within the process plant has been identified and would be implemented for the modified CGM. The process plant would be reconfigured to redirect discharges from the leach circuit and introduce a thickening process to achieve higher tailings slurry solids content, thereby reducing entrained and evaporative water loss at the TSFs. This would result in a reduction in water demand of 2 ML/day (RMDSTEM Limited, 2008) and a revised total external demand of 8 ML/day.



E42 MODIFICATION

FIGURE B-2

Water Management Plan - Year 7

BARRICK COWAL

Gilbert and Associates Pty Ltd

HAL-06-26 BS HA _102H

B4.1.2 External Water Supply Sources

External water supply sources proposed to meet the 8 ML/day demand are shown in Table B-2 and described below.

Table B-2
Proposed External Water Supply

External Supply Source	Average Water Supply		E42 Modification Life Total Extraction (ML)
	(ML/day)	(ML per annum)	
Saline Groundwater Supply Borefield	1.0	365	6,935
Purchase of Lachlan River temporary water entitlements	3.9	1,430	27,250
Bland Creek Palaeochannel Borefield*	3.1	1,130	21,300
Total proposed external water supply	8.0	2,925	55,485

*A total of 8,700 ML has been assumed to have been extracted from the Bland Creek Palaeochannel Borefield by E42 Modification commencement. A resultant total of 21,300 ML would be available for extraction without change to the life-of-mine approval limit (i.e. 30,000 ML).

Saline Groundwater Supply Borefield

A review of mineral drilling records has identified a prospective local saline aquifer located on ML 1535 to the east and south of the approved CGM open pit. Pump tests on this aquifer (Groundwater Consulting Services, 2008) indicate that a borefield of approximately four bores could supply 1 ML/day of saline water (i.e. electrical conductivity of approximately 40,000 µS/cm) to the process plant. Figure B-2 shows the proposed location of the borefield and associated pipeline.

The borefield would be operated during times when it is not inundated by Lake Cowal. The borefield would be shut-down and pumps would be removed during periods when the borefield is inundated by Lake Cowal. Accordingly, no surface water impacts to Lake Cowal are anticipated as a result of the saline groundwater supply borefield.

Lachlan River

The proposed external water supply arrangements for the modified CGM involve continued reliance on purchase of temporary water from the Lachlan regulated source. Barrick's high security and general security zero allocation water access licences enable trade of temporary water. On average approximately 1,430 ML/annum would be required from this source, however, volumes required would vary annually in accordance with the performance of the Bland Creek Palaeochannel Borefield, the availability of water within the Lachlan River and the availability of supply from the contained water storages on-site.

This supply source has proven to be reliable throughout the operating history of the approved CGM. Approximately 2,400 ML was extracted in 2007. The Department of Water and Energy's (DWE) trading records (DWE, 2008) show that between 4,000 ML and 36,000 ML of temporary water has been traded annually in the four water seasons since records began in the 2004 to 2005 season. It is clear that in relation to the projected requirements of the modified CGM there has been adequate temporary water available on the market from this source (i.e. approximately 1,430 ML/annum).

Bland Creek Palaeochannel Borefield

Extraction from the Bland Creek Paleochannel Borefield would continue in concert with other sources until the maximum total volume approval limit (i.e. 30,000 ML) is reached. Extraction would be managed to maintain groundwater levels above the established DWE trigger levels. Although Coffey Geotechnics Pty Ltd (Coffey Geotechnics) (2008a) have modelled continuous extraction of 8 ML/day as being sustainable with respect to maintaining groundwater levels above the DWE trigger level, it is intended that supply from this source would continue in a similar manner as is currently the case, by alternating between this source and the Lachlan River to manage groundwater levels and provide flexibility with respect to extraction rates and the availability of temporary water during "good" years.

B4.1.3 Potential Augmentation

Barrick have identified several additional water sources which have the potential to increase the security and flexibility of supply in the medium-term and to reduce reliance on the Bland Creek Palaeochannel borefield. These options include:

- development of additional borefields in other saline aquifers in the region;
- the purchase of rights to existing licensed groundwater entitlements from the alluvial aquifer associated with the Lachlan River in an area disconnected from the Bland Creek Palaeochannel Borefield;
- the purchase of additional Lachlan River surface water rights via purchase or trade of High and/or General Security water licences; and
- development of a surface water collection system which could be installed using Barrick's harvestable water rights.

Barrick are undertaking further investigations of these options which may lead to formal feasibility studies. Relevant approvals would be obtained should these options prove feasible.

B4.2 Site Water Balance

B4.2.1 Water Balance Model Simulation

The overall effect of the modified CGM on-site water management has been assessed using the CGM water balance model. The model, which was developed by others, was modified to simulate the changes to internal catchment areas, ore processing rates, and to the process plant and in particular process plant demand and the longer mine life. The model was set up to run over the full 20 year life of the E42 Modification. Consistent with the original model assessment undertaken for the EIS, the performance of the water management system has been assessed using “wet”, “dry” and “average” climatic scenarios. The wet and dry sequences were set to the wettest and driest 20 consecutive year periods on record whilst the average was set to the median of all 20 year periods.

The site water balance model simulates all internal water management storages within the mine area and their catchments, the use of water in the processing plant, the disposal and recovery of water from the tailings disposal facilities and the collection containment and reuse of runoff from the site catchments for haul road watering and make-up supply to the processing plant. Water which accumulates in the mine pit, from groundwater inflows and incident rainfall and runoff from its surrounding catchment, is also simulated as being recovered and re-used as make-up to the processing plant. A schematic of the water management system is shown on Figure B-3.

During periods when there is insufficient water generated on-site to meet the mining and processing water demands, additional water is imported from the external supply sources outlined above. These sources have not been explicitly included in the site water balance model but rather the model has been used to assess external water source demands and changes in demand over time under different climatic situations and E42 Modification changes.

B4.2.2 Results of Water Balance Model Simulation Runs

The simulated water movements around the modified CGM site over the life of the mine are shown on Figure B-4 for the three water management scenarios simulated. The following key observations have been drawn from results of these model simulations:

1. There were no simulated spills from any of the internal site storages and in particular, any instances of external spill.
2. Averaged over the mine life and in all years of all three simulations, there was a net negative (deficit) water balance – with a corresponding need to import water to meet process demands. The simulated external water supply demands over the modified CGM under the three different climatic scenarios were in all cases less than the combined rated capacity of the external sources.
3. The simulated peak volumes in the site water contained water storages compared to their existing/proposed as-built capacities are summarized in Table B-3 below:

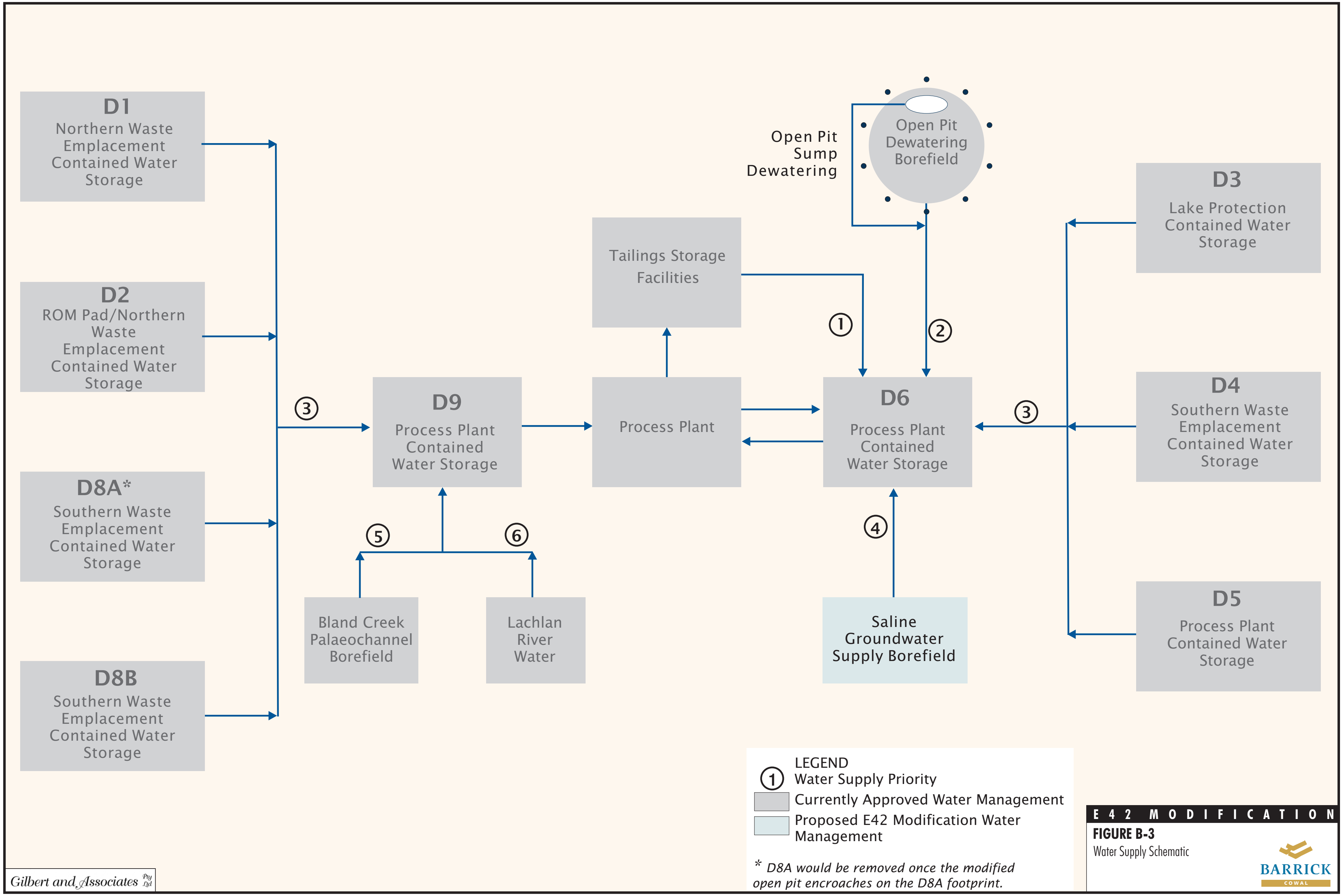
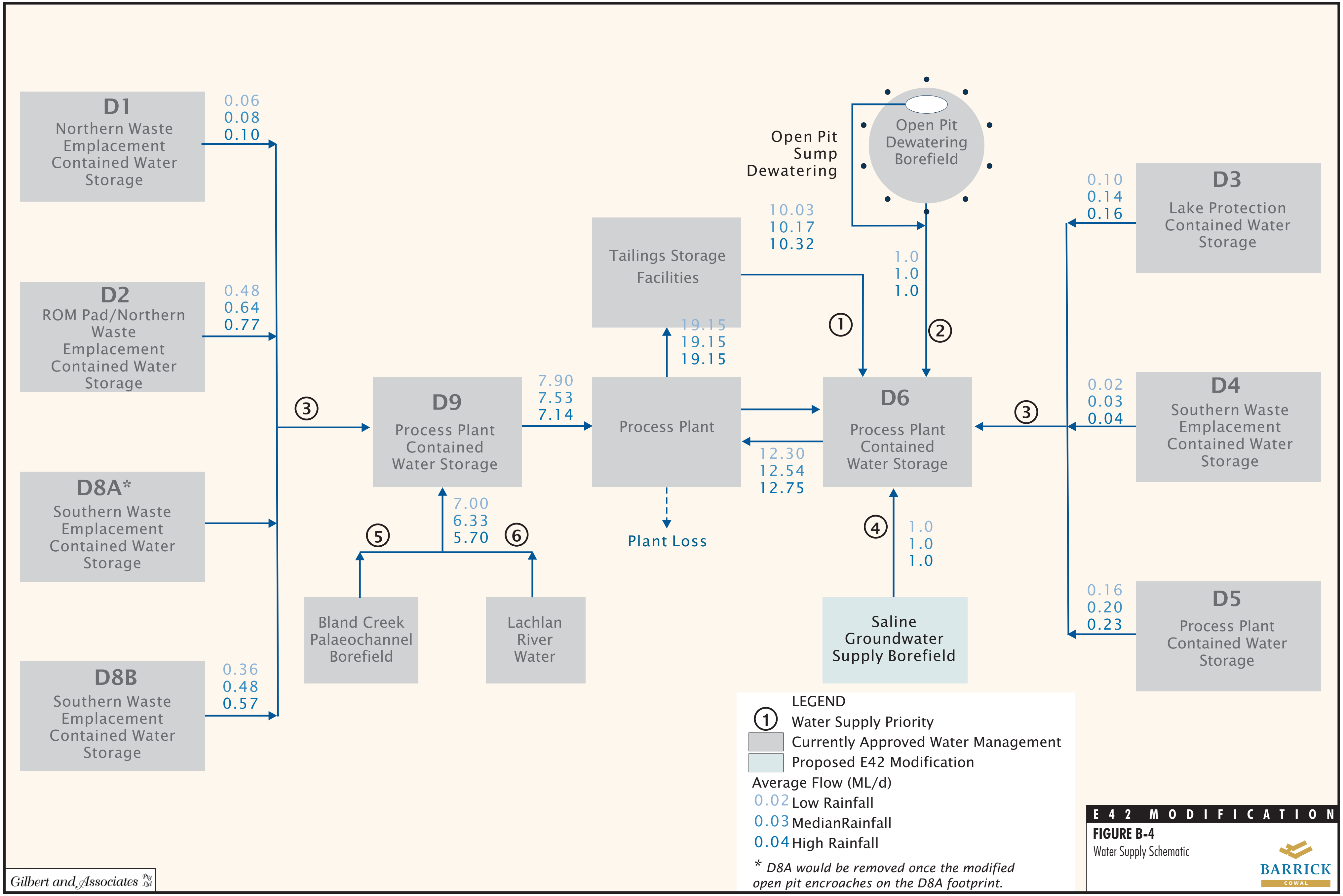


FIGURE B-3
Water Supply Schematic

HAL-06-26 BS HA_001G



E42 MODIFICATION

FIGURE B-4

Water Supply Schematic

BARRICK COWAL

Gilbert and Associates Pty Ltd

HAL-06-26 BS HA_002I

Table B-3
Water Balance Model Simulation Results – Site Contained Water Storages

Contained Water Storage	Maximum Simulated Contained Volume (ML)	Existing Capacity (ML)	Proposed Capacity (ML) (approx.)
D1	32.7	58	58
D2	210	115	225
D3	40	45	45
D4	33	66	66
D5	35.3	50	50
D6	210*	25	25
D8B	74	148	190
D9	494	802	802

* Additional volume would be stored in D9 or the TSFs, temporarily under wet conditions.

Table B-3 shows that due to changes in internal catchment characteristics additional storage capacity would be required for contained water storages D2 and D8B; and under wet conditions, D9 and the TSFs would be required as temporary storages for contained runoff, whilst storage capacities in runoff contained water storages (*viz.* D1-5, D8B) are being reinstated as required.

The expansion of the northern waste emplacement to the north would require the re-alignment of the northern component of the UCDS. The re-alignment would include construction of a low-flow channel and bund and a stilling basin and rock-armoured outfall at the point of outflow to Lake Cowal. This arrangement would mirror the existing features constructed for the southern component of the UCDS.

B4.3 Lake Interaction

As part of the original environmental assessment for the EIS a model of the Lake and its catchment was used to investigate the effects that the mine would have on the water balance dynamics of Lake Cowal including changes to average water levels in the Lake and changes to the frequency and volume of spills from Lake Cowal to Nerang Cowal downstream.

The mine area is physically isolated from Lake Cowal by virtue of the Lake isolation bund. The outer face of the isolation bund extends about 1 kilometre (km) into Lake Cowal and forms a new lake foreshore at times when the Lake is substantially full. The excursion of the isolation bund into the Lake floor has the effect of reducing the overall capacity of the Lake. The Lake isolation bund which was constructed during the initial mine construction phase would not change in any respect as a result of the E42 Modification and therefore the predictions made in respect to changes to lake volume and of the effects on runoff water quality from the isolation bund into the Lake remain valid. The actuality of these predictions has yet to be tested because the Lake has been effectively dry since the commencement of construction.

The isolation of the mine area catchment from the Lake via the UCDS and the lake isolation bund would also reduce, to a small degree, inflows to the Lake as a result of on-site containment and use of water that would otherwise have drained from this area into the Lake. The effects of the mine catchment excision from the Lake catchment were assessed as part of the EIS using the lake water balance model. It was found that in comparison with pre-mining inflows, the exclusion of the mine site catchments would reduce average inflow by less than 1%. The effect of the additional area that would be excised from the Lake Cowal (Bland Creek) catchment is some 1.5 km^2 or 10.8% of the total area excised. The implications of this increase on the water balance of the Lake are clearly too small to show up in the Lake water balance.

B4.4 Implications of Geochemical Characteristics of Mine and Process Waste from the E42 Modification on Surface Water Management

A geochemical study of mine waste and tailings as a result of the E42 Modification was undertaken by GEM. The study objectives were to assess and quantify

> *…any changes in the potential geochemical impacts of the current mining operation that may result from the proposed E42 Modification.*

The assessment was based on geochemical characterisation tests on representative samples of mine rock (drill-hole) and simulated tailings materials from drilling core samples recovered from the modified CGM area.

Based on the results of their investigations GEM concluded in regard to mine waste rock that:

> *the geochemical characteristics, including pH and salinity, acid forming characteristics and element enrichment and solubility of the oxide and primary waste rock are expected to be similar to the characteristics of the waste rock from the current operations. These characteristics include:*

- *Both waste types would be slightly alkaline, and the oxide waste would be highly saline and primary waste would be moderately saline.*
- *Both waste types would be NAF with the oxide waste being relatively inert (i.e. low sulphur and low ANC) and the primary waste being relatively reactive (i.e. high sulphur and moderate ANC).*
- *Elements that have been identified as being enriched in the waste rock (i.e. As, Cd, Pb and Zn) are not expected to be readily soluble.*

GEM also confirmed that as a consequence of these findings no additional recommendations for modifications to the operational or long-term mine waste management practices were required.

In regard to the tailings, GEM concluded that the geochemical characteristics of ore/tailings samples were similar to the sample results from the original study and that as a consequence

> *The tailings generated from the modified CGM would have similar geochemical characteristics to those from the current operations, based on the samples tested.*
>
> *Based on these assessments and the conclusion that the geochemical characteristics of waste and tailings materials would not change as a result of the E42 Modification there would be no requirement to change the water management practices and principles of the approved CGM.*

B5.0 POST-CLOSURE WATER MANAGEMENT

B5.1 Current Post-Closure Management Concepts

The post-closure water management strategy described in the EIS included concepts for runoff minimisation from waste rock emplacements and TSFs, and the provision of stable drainage channels to drain site surface water to the final void. These concepts are described below.

Waste Emplacements

At the completion of mining the top surface of the northern and southern waste emplacement areas were to be graded such that any surface runoff would flow toward the final void. A cover layer comprising low salinity sub-soil and topsoil was to be laid over the graded top surface of the waste emplacements. The cover material and thicknesses were to be selected consistent with the overall objective of minimising runoff from the emplacement surface by encouraging infiltration and storage of rainfall in a relatively thick cover layer where it would be available for surface vegetation. Deep rooting, high transpiration capacity vegetation species were to be utilised as cover vegetation to ensure take-up and use of available moisture in the cover layer. The final surface of the waste emplacement areas was to be purposely left with a high degree of irregularity to provide surface retention of excess rainfall for longer term infiltration and take-up in the surface cover and plant system. A network of low energy drainage swales were to be provided on both waste emplacement areas for drainage of any net runoff to the final void. The external faces of the waste emplacements were to be constructed in a regular series of batters and berms. The berms were to be constructed with reverse grades to prevent overflow of berm runoff over the batters. Runoff retention areas and deep vegetated soil cover layers were proposed as concepts to minimise net runoff.

Tailings Storage Facilities

Concepts developed for rehabilitation of the external batters and berms of the tailings storages involved a similar approach as those developed for the outer faces of the waste emplacements as described above. The concepts developed for the top surface of the tailings storages included retention of the final inverted cone shape of the final beach surface which would, by virtue of the planned peripheral tailings discharge regime, slope downward from the embankment perimeters toward the central decant area. The final surface was to be covered with a relatively thick layer of low salinity sub-soil and topsoil to support a deep rooting plant cover. A capillary break layer between the final tailings surface and the cover was also identified as a requirement of the surface rehabilitation to prevent salt rise into the overlying soil cover layer. Planned surface irregularities, mounds and swale-like channels were also proposed for transient retention of surface runoff, to enhance moisture retention within the cover system and to provide a formal pathway for any net runoff under extreme conditions to be diverted to the final void.

Final Void

The final pit was to be left as a void. The UCDS and the ICDS were to be retained. Surface drainage from the mine area was to be diverted to the final void via a series of low energy swales. Drainage from areas upslope of the mine area would flow to Lake Cowal via the UCDS and pre-mine creek lines.

At the completion of mining and processing, pit dewatering operations would cease and groundwater and inflows from rainfall runoff over the mine site area would accumulate in the open pit. Final void water and solute balance model simulations conducted as part of the EIS showed that, in the long-term, the void would fill over a considerable period of time to a level some 22 to 24 m below the original ground level at the low point in the perimeter of the pit. Modelling also indicated that water levels would fluctuate seasonally by a few metres above and below this level. The quality of final void was predicted to be dominated by the naturally high salinity of the surrounding groundwater which had reported salinity in the range of 31,000 to 38,000 mg/L – predominantly sodium chloride. The final void water levels were such that it was predicted to act as a permanent sink for the surrounding groundwater system. Because the void had no outflow - other than direct evaporation, the salinity of void waters was predicted to continue to increase in the longer term due to evapo-concentration. The quality of void water was also predicted to vary with depth due to stratification which would occur due to temperature and salinity differentials.

B5.2 E42 Modification Post-Closure Water Management Concepts

The concepts developed for the EIS are considered to remain valid for the post-closure situation of the modified CGM. The changes occasioned by the E42 Modification in relation to the post-closure scenario relate principally to the increased size (footprint area) of the northern waste emplacement and to the final void size. The proposed shaping, surface covering and surface treatments proposed for the waste emplacement areas and the tailings storages are equally applicable to the modified CGM.

The implications of these changes to the rehabilitation concepts are described below.

B5.2.1 Final Void

The final void would, as a result of the E42 Modification, be larger in area and deeper than the original void. These changes in void size would have an effect in the water balance during the filling phase and potentially to the longer term post-equilibrium water levels. Groundwater inflows to the void were originally estimated based on results of predictive groundwater modelling. Groundwater inflow rates to the mine during the operational phase were predicted to be initially high and to reduce over time. Experience with mining to date has shown that actual groundwater inflow rates to the mine are significantly lower than those that were originally predicted. In part this reflects the need to apply conservative assumptions to the original modelling which by necessity was inherently uncertain.

When adopting the lower groundwater flows obtained from experience and recent groundwater assessments undertaken by Coffey Geotechnics (2008b) the average inflow rates during the void filling phase would initially be about 1 ML/day and would decline to low levels as the water level in the pit approached the original (pre-mine) groundwater table. The original model predictions were based on an initial groundwater inflow rate of 3.5 ML/day reducing after void water levels exceeded the aquifer level in the pit. Remodelling the void filling and final void water balance with reduced groundwater inflows shows that these would have a larger effect on the final void water balance predictions than the changes to void geometry.

Modelling indicates that the void would fill slowly reaching relative level (RL) 48 m Australian Height Datum (AHD) after about 200 years – refer Figure B-5. Ultimately it would reach an equilibrium water level which is estimated to be between RL 140 m AHD and RL 150 m AHD. This is lower than the original predictions due to lower groundwater inflows and higher evaporation rates from the larger void surface area.

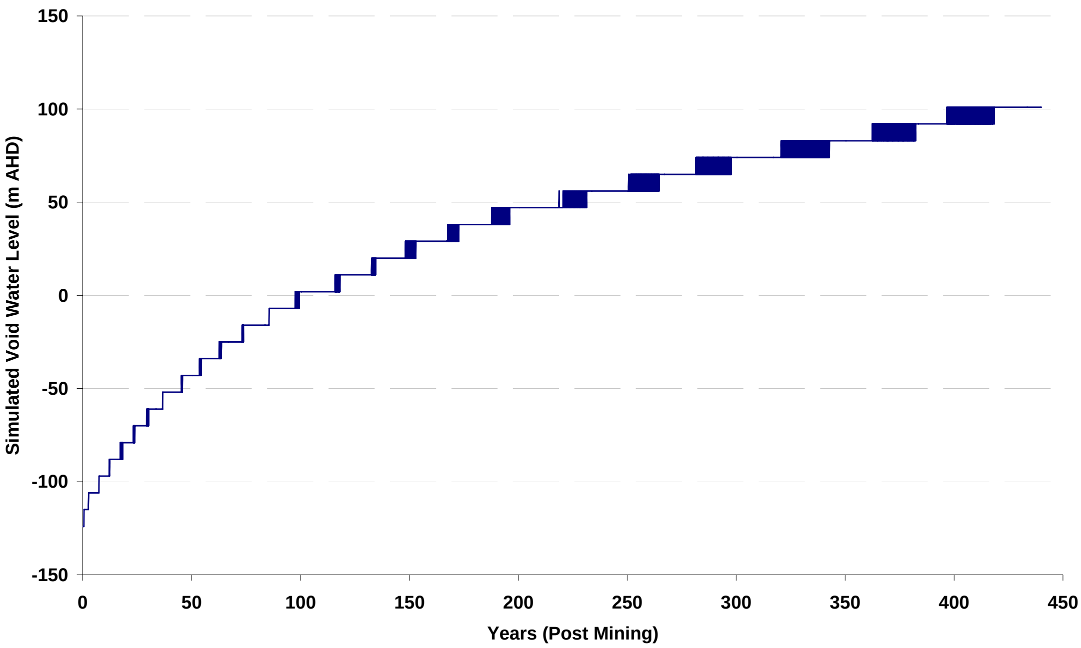


Figure B-5 Predicted Final Void Filling Behaviour - Water Level Response

The void water quality would reflect the influence of the high salinity in the groundwater. Predictions of average void salinity based on a solute balance between inflows and outflows confirm that salt concentrations in void waters would slowly increase. However, the lower groundwater inflow rates mean that salinity would increase more slowly than was originally predicted for the approved CGM – reaching about 67,000 mg/L after about 200 years – refer Figure B-6. Salinity is predicted to continue to increase trending to hyper-salinity.

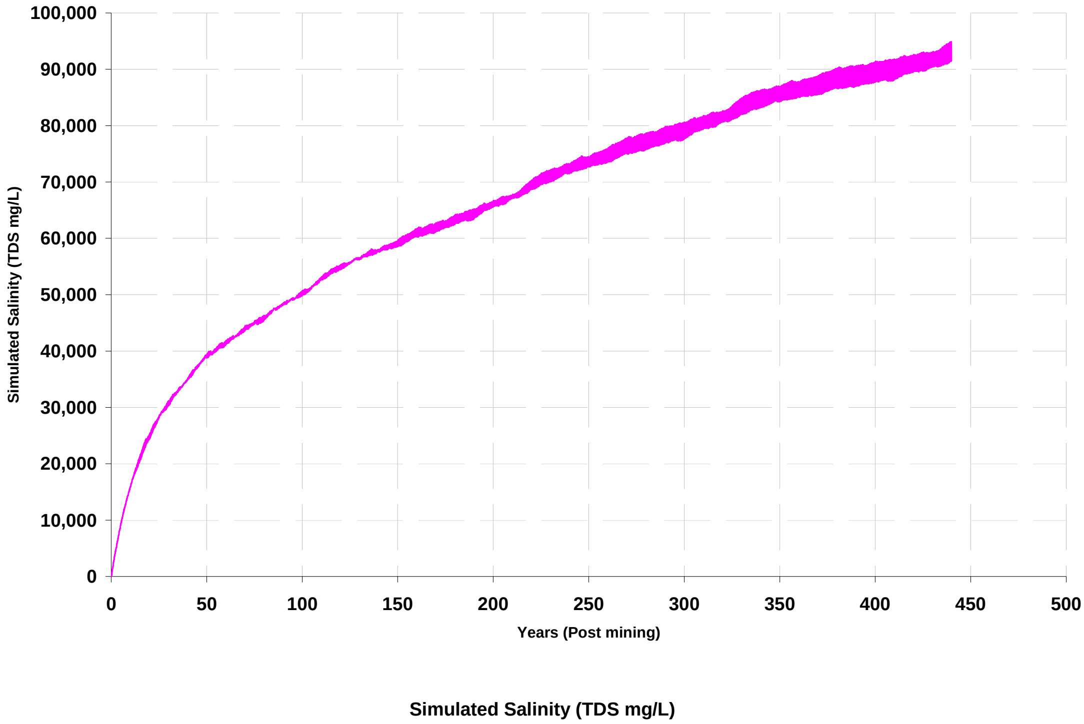


Figure B-6 Predicted Final Void Water Quality – (Salinity – TDS-mg/L)

B5.2.2 Implications of Climate Change on Final Void

Climate change has the potential to affect the validity of water balance predictions which have been based on historical climatic sequences. To assess possible effects of climate change on the longer term water balance of the final void, current predictions of the future effects of climate change were obtained from the CSIRO (Suppiah *et al.,* 2007). The CSIRO has provided monthly summaries of the average predicted change in monthly potential evaporation and precipitation at the site based on predictions from eight different climate prediction models (Commonwealth Scientific and Industrial Research Organisation [CSIRO], 2008). These predictions are summarized below in Tables B-4 and B-5, respectively.

Table B-4 Climate Change Predictions – Monthly Potential Evaporation (% change at 2070)

Organisation	CSIRO	Canadian Climate Centre	Hadley Centre	Max Planck	Max Planck	CSIRO	NCAR	Statistic		
Climate Model	**Mk2**	**CGCM1**	**HADCM3**	**ECHAM4 / OPYC3**	**ECHAM3 /LSG**	**DARLAM 125km**	**DOE-PCM**	**Average**	**Maximum**	**Minimum**
January	3.72	3.63	8.12	1.82	0.36	1.14	6.52	3.62	8.12	0.36
February	6.1	2.7	7.02	0.69	0.24	3.39	3.56	3.39	7.02	0.24
March	5.44	1.95	9.36	2.92	1.73	4.33	12.76	5.50	12.76	1.73
April	2.26	2.71	7.31	3.21	4.01	2.11	4.89	3.79	7.31	2.11
May	4.64	0.45	8.95	3.75	6.45	5.14	10.59	5.71	10.59	0.45
June	5.9	0.7	9.3	6.72	8.26	6.34	13.38	7.23	13.38	0.7
July	6.81	0.37	9.94	5.58	8.88	5.4	11.26	6.89	11.26	0.37
August	6.36	2.25	10.33	4.01	7.26	7.47	9.65	6.76	10.33	2.25
September	4.8	6.15	13.48	5.62	6.23	7.43	7.07	7.25	13.48	4.8
October	7.92	9.67	14.95	6.29	6.46	7.81	8.96	8.87	14.95	6.29
November	6.85	9.09	13.36	4.27	3.33	6.03	3.62	6.65	13.36	3.33
December	6.37	5.95	10.3	2.6	2.9	3.84	3.94	5.13	10.3	2.6
Average	5.60	3.80	10.20	3.96	4.68	5.04	8.02			

Source: CSIRO (2008)

Table B-5 Climate Change Predictions – Average Monthly Rainfall (% change at 2070)

Organisation	CSIRO	Canadian Climate Centre	GFDL	Hadley Centre	Hadley Centre	Max Planck	Max Planck	CSIRO	NCAR	Statistic		
Climate Model	**Mk2**	**CGCM1**	**R15-a**	**HADCM2**	**HADCM3**	**ECHAM4 / OPYC3**	**ECHAM3 /LSG**	**DARLAM 125km**	**DOE-PCM**			
January	4.91	0.17	2.12	-5.84	-2.16	12.40	15.65	10.42	-4.89	Average	Min	Max
February	0.87	0.64	2.26	-6.72	-2.14	12.34	9.05	4.52	-0.45	3.64	-5.84	15.65
March	-5.11	5.56	12.61	-15.76	-5.30	1.52	4.99	-0.65	-6.50	2.26	-6.72	12.34
April	7.43	3.09	-4.52	-6.06	2.17	1.11	8.86	7.17	-0.28	-0.96	-15.76	12.61
May	-2.02	3.03	7.41	-4.01	-2.59	0.66	3.03	-0.76	1.01	2.11	-6.06	8.86
June	0.51	-0.34	-0.70	-2.67	4.46	-5.84	-3.57	-0.67	10.20	0.64	-4.01	7.41
July	-1.80	-2.77	2.06	-10.00	-1.02	-3.41	-6.17	3.39	0.26	0.15	-5.84	10.20
August	-7.60	-3.93	1.72	-10.33	-7.20	7.64	-4.90	-8.73	-5.87	-2.16	-10.00	3.39
September	-3.49	-6.97	0.30	-9.85	-13.55	-6.78	-2.45	-4.33	-4.22	-4.36	-10.33	7.64
October	-7.58	-6.21	3.99	-4.15	-15.49	-3.80	-0.25	-4.73	-9.61	-5.70	-13.55	0.30
November	-6.42	-6.93	-4.43	-1.77	-8.05	3.86	3.79	-2.39	3.57	-5.31	-15.49	3.99
December	-1.45	-3.85	-13.79	-4.55	-4.03	8.81	3.15	2.37	1.77	-2.09	-8.05	3.86
Average	-1.81	-1.54	0.75	-6.81	-4.58	2.38	2.60	0.47	-1.25	-1.29	-13.79	8.81

Source: CSIRO (2008)

The predicted change in future rainfall and evaporation associated with climate change will affect the final void predictions. Amongst the currently available model predictions however there is a significant variability in the range of predicted changes to both rainfall and potential evaporation. For the purposes of assessing the implications and significance of current climate change predictions for the final void it is noted that most of the current predictions are for a decline in average rainfall and for an increase in potential evaporation. Using these lower rainfall and higher evaporation predictions would have the effect of slowing the rate of void filling and of reducing the final long term water level. It would also increase salt concentrations due to greater evapo-concentration effects.

Given that the critical outcome for the void is long-term containment security, the set of climate change predictions most likely to produce faster filling and the highest long-term final void water levels was tested even though it is contrary to the trend of most predictions. The climate prediction which is most likely to result in higher final void levels is the set generated by the Max Planck - ECHAM4/OPYC3 "model" – refer Tables B-4 and B-5 above. The void filling model was re-run with rainfall and evaporation inputs factored according to the monthly changes at 2070. These changes were assumed to apply as a constant over all years.

The void filling predictions obtained from this analysis are shown on Figure B-7 for both the original model predictions and with the adverse climate change prediction.

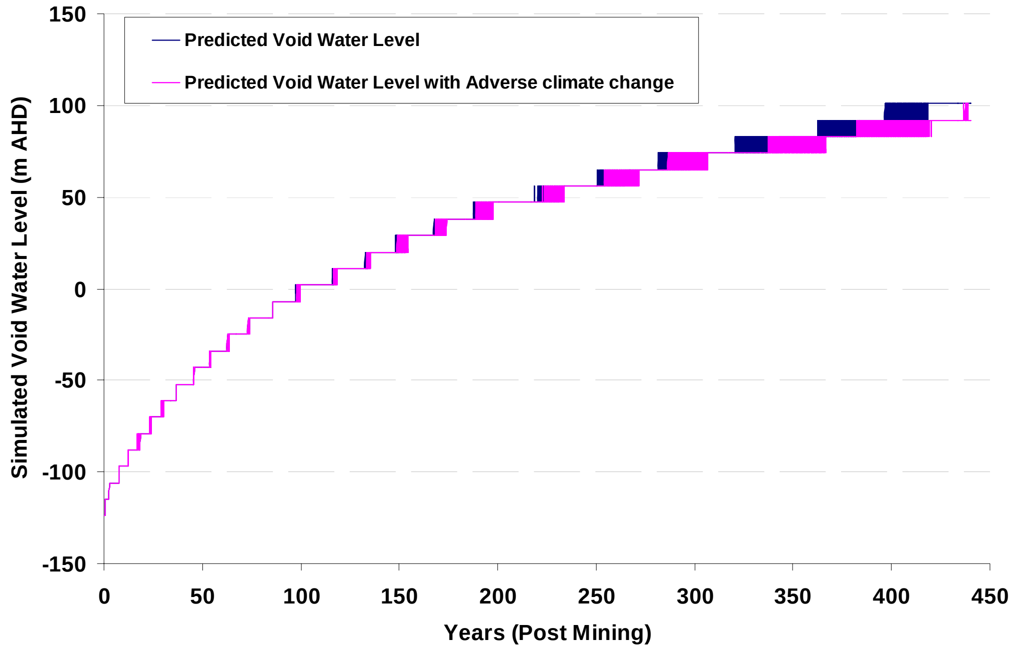


Figure B-7 Effects of Adverse Climate Change Predictions on Final Void Filling Behaviour

It is clear from this comparison that currently predicted effects of climate change, even those predictions which would produce adverse outcomes for void containment security, would not change final void water levels significantly.

B6.0 ASSESSMENT & CONCLUSIONS

Assessing the surface water implications of the modified CGM involved:

- Simulating the performance of the water management system with the modified CGM in place using the CGM site water balance model developed by others. The model was used to simulate the water management system under ‘dry’, ‘medium’ and ‘wet’ conditions. Changes to the storage capacity of existing internal water management storages and/or the need for additional water management infrastructure was assessed using hydrologic yield calculations for the 1 in 100 year and 1 in 1,000 year ARI storage capacity criterion adopted in the EIS. – refer Section B4.2 of the report.

- Examination of water management implications of the tailings or waste rock water geochemistry study conducted for the E42 Modification. – refer Section B4.4 of the report.

- Examination of the adequacy of the advised capacity of the proposed external water supply arrangements (including the Bland Creek Palaeochannel Borefield and regulated Lachlan River sources), to provide adequate make-up for the expanded modified CGM – refer Section B4.1.2 of the report.

- Examination and identification of the implications of the modified CGM on post-closure water management and the water and salt balance of the final void as a result of the E42 Modification – refer Section B5.1 of the report.

- Identification of any potential implications of the modified CGM on the water balance of Lake Cowal including changes to sediment and solute flux from the modified CGM to Lake Cowal as a result of the E42 Modification – refer Section B4.3 of the report.

The following conclusions are made based on the results of these assessments.

Expansion of contained water storages D2 and D8B and some minor modifications to the internal drainage arrangements of the approved CGM would be required to service the planned changes under the E42 Modification. Details of these changes are provided in Section B4.2 of the report. With these changes in place, the site water management system model predicts similar/equivalent performance under dry, wet and average climate scenarios as those obtained with the EIS model.

The geochemical assessment undertaken by GEM concluded that there would be no change to the geochemical characteristics of mine waste rock or tailings as a result of the E42 Modification and as a consequence it has been concluded that there are no additional water quality management requirements required for the modified CGM.

The simulated demands for external water supply obtained under all climatic conditions simulated using the CGM operational water balance model were all less than the advised capacity of the proposed external supply arrangements.

Results of void water balance modelling indicate that the filling behaviour of the final void would change as a result of the E42 Modification. The changes would be both to the filling rate and final water level, which would be slower and lower than was predicted in the EIS, and the rate that void salinity would increase which was also predicted to be slower. These changes would be as a result of the larger void volume and surface area, and because with the benefit of observed pit groundwater inflows, long-term groundwater inflow rates are now expected to be significantly less than was originally predicted. The slower fill rates, the lower final void water level and the slower rate of increasing salinity in the void would enhance the long-term isolation and disconnection of the final void from Lake Cowal and are seen as beneficial changes.

The changes to the mine site catchments are relatively minor and when considered in the context of the overall water and salt balance of Lake Cowal would not measurably affect the original prediction of change to the Lake's water balance or lake water levels (which were small); or to predicted effects on salinity or sediment flux from the modified CGM to the Lake.

B7.0 REFERENCES

Coffey Geotechnics Pty Ltd (2008a) *Cowal Gold Mine Water Supply Borefield Groundwater Model Predictive Results – E42 Modification.*

Coffey Geotechnics Pty Ltd (2008b) *Cowal Gold Mine E42 Modification Hydrogeological and Tailings Seepage Assessment.*

Coffey Partners International Pty Ltd (1995) *Lake Cowal Project Hydrogeological Modelling and Dewatering Study.*

Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2008) *OzClim.*
Website: http://www.csiro.au/ozclim/home.do
Date Accessed: June 2008.

Department of Water and Energy (2008) *Water Allocation Assignment Register.*
Website: http://wma.naturalresources. nsw.gov.au/wma/AllocationSearch.jsp?selectedRegister=Allocation
Date Accessed: June 2008.

Geo-Environmental Management (2008) *E42 Modification Tailings and Waste Rock Geochemical Assessment*.

Groundwater Consulting Services (2008) *Saline Groundwater Assessment – Alluvial Aquifer, E42 Modification, Cowal Gold Mine.*

North Limited (1998) *Cowal Gold Project Environmental Impact Statement.* Report prepared by Resource Strategies Pty Ltd.

RMDSTEM Limited (2008) *Development of Water Savings Initiatives for the Cowal Gold Project – Final Report.*

Suppiah, R., Hennessy, P.H., Whetton, K., McInnes, I., Macadam, J., Bathols, J., Ricketts, J. and Page, C.M. (2007) *Australian Climate Change Projections Derived from Simulations Performed for the IPCC 4th Assessment Report.*