Appendix C3

Surface Water Assessment

Xstrata Mangoola Pty Limited

Surface Water Assessment – Proposed Mine Plan Modification, Mangoola Coal

December 2010

Umwelt
Environmental Consultants

Surface Water Assessment – Proposed Mine Plan Modification, Mangoola Coal

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Xstrata Mangoola Pty Limited

Project Director:	Barbara Crossley		
Project Manager:	Susan Shield		
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Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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1.0 Introduction

Planning approval was granted in June 2007 to construct an open cut coal mine near Wybong, west of Muswellbrook in NSW (refer to **Figures 1.1** and **1.2**). The mine, then owned by Centennial Coal and known as the Anvil Hill Project, was approved to extract up to 10.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal for 21 years.

In October 2007, the mine was purchased by Xstrata Mangoola Pty Limited (Xstrata Mangoola), a wholly owned subsidiary of Xstrata Coal (NSW) Pty Limited, trading as Mangoola Coal.

Mangoola Coal has completed all of the pre-construction requirements and preparation of all pre-construction management plans and has commenced construction of the mine and ancillary works within the approved project disturbance area. No mining has been undertaken to date. Mining is scheduled to commence in September 2010.

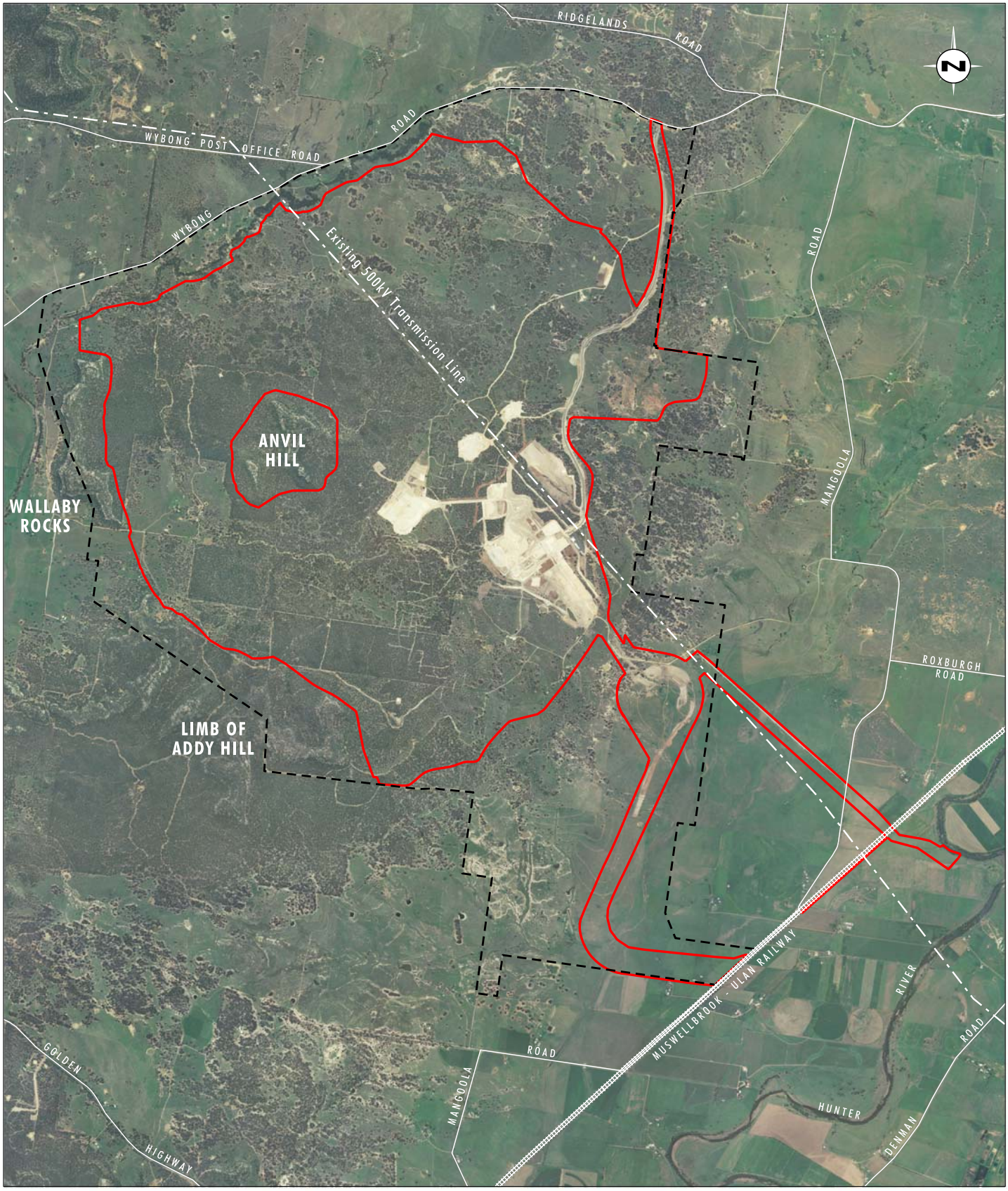
There have been three previous modifications to the Project Approval, including:

- PA 06_0014 MOD 1 – 'Early Works Modification' (approved 22 July 2008), which allowed for the following:
  - commencement of defined Early Works activities, consistent with the Anvil Hill Project Environmental Assessment (EA) (Umwelt, 2006) in parallel with the approved Wybong Road upgrade; and
  - access to the mine site for the purposes of conducting the Early Works by an alternate route to that presented in the original 2006 EA, due to delay in construction of the Bengalla Link Road.
- PA 06_0014 MOD2 – 'Hunter River Pipeline Modification' (approved 23 June 2009), which allowed for the following:
  - relocation of the approved Hunter River water supply pipeline and associated infrastructure;
  - access to the pipeline construction area for construction traffic from Mangoola Road;
  - change of use and capacity of the approved tailings dam to a Raw Water Dam (RWD);
  - minor changes to the disturbance footprint for construction of the rail loop; and
  - minor upgrade to an access track for access to the eastern portion of the pipeline corridor.
- PA 06_0014 MOD3 – 'Relocation of the Mining Infrastructure Area (MIA)' (approved 4 November 2009), which allowed for the following:
  - the relocation of the MIA; and
  - changes to components of the coal handling and preparation plant (CHPP), including the slight re-positioning of the Run-of-Mine (ROM) pad, the re-orientation of the CHPP building and a change in height of the rejects bin.

Mangoola Coal is now seeking to modify its mine plans approved under the current Project Approval 06_0014 (PA 06_0014). Following detailed feasibility investigations, Mangoola Coal has resolved that the operational efficiency and additional coal resource recovery warrants the relocation of a nine kilometre section of the Bayswater to Mount Piper 500 kilovolt (kV) electricity transmission line (ETL) that currently bisects the site to facilitate associated mine plans changes and production changes.

FIGURE 1.1

Locality Plan



Source: Dept. of Lands (2003), Xstrata Mangoola (2010)

Legend

Approved Project Disturbance Boundary

Mining Lease 1626 Boundary

FIGURE 1.2

Approved Project Disturbance Area

The key features of the proposed modifications compared to the approved operations are shown in **Table 1.1** below.

Table 1.1 – Key Features of Mangoola Coal Mine Modifications

Major Project Components/ Aspects	Approved Operations	Proposed Operations
Limits on Extraction	10.5 Mtpa	No change
Mine Life	21 years from 2007	No change
Operating Hours	24 hours per day, 7 days per week	No change
Number of Employees	Peak construction workforce of up to 200 employees and an operational workforce of up to 240 employees at peak production.	Peak construction workforce of up to 350 employees and an operational workforce of up to 300 employees at peak production.
Mining Methods	Open Cut mining operations to be undertaken using truck and shovel methods to handle overburden and coal.	No change to mining methods but change to the number and type of equipment to be used.
Mining Areas	Mining operations to be undertaken within the approved project disturbance area. Operations were based on the existing ETL being in the current location, resulting in two or more pits operating at any one time throughout the mine life.	The proposed relocation of the ETL away from the centre of the site allows for redesign of the mine plan. The mine plan changes also include alteration of the water management infrastructure, building on changes approved in the Pipeline Modification. In-pit management of tailings is now proposed, with a series of four tailings dams being progressively used over the life of the mine. Elements of the mine that will change include: • the re-design of the mine plan and staging allowing for more efficient resource recovery; • water management changes resulting from mine design changes; • tailings storage facilities changes as a result of relocating the ETL; and • temporary ROM stockpile for coal from box cut (developed for initial tailings storage) and a proposed extension to the approved ROM coal pad.

Table 1.1 – Key Features of Mangoola Coal Mine Modifications (cont)

Major Project Components/ Aspects	Approved Operations	Proposed Operations
		Small extensions to the approved project disturbance boundary: • an area of approximately 1.7 hectares where the raw water dam will inundate land at full supply; • an area of approximately 8.4 hectares where drilling has established that the coal crop line extends beyond the approved project disturbance boundary; and • four small areas with a total area of approximately 1.6 hectares (maximum area 0.6 hectares) where rail loop drainage designs have a minor affect on the overall footprint of the rail loop.

This Surface Water Assessment Report has been prepared to support an Environmental Assessment (EA) for the modifications to the mine plans (the Project) under Part 3A (section 75W) of the *Environment Planning & Assessment Act 1979* (EP&A Act).

This assessment has been undertaken in consideration of the Department of Planning (DoP) Director-General's Requirements (DGRs) for the Project with the relevant water resources requirements being:

- an amended site water balance for the mine (refer to **Section 3.2**);
- a detailed assessment (including quantitative modelling) of the potential impacts on:
  - the quantity and quality of both surface water and groundwater resources (refer to **Sections 3.4** and **3.6**);
  - water users, both in the vicinity of and downstream of the project (refer to **Section 3.6**); and
  - the riparian and ecological values of the watercourses both on site and downstream of the project (refer to **Sections 3.3** to **3.7**).

2.0 Surface Water Context

2.1 Overview

The Mangoola Coal Project is located within the catchments of Sandy Creek and Big Flat Creek, including the sub catchment areas Anvil Creek and Clarks Gully (refer to **Figure 2.1**).

Sandy Creek is a fifth order (category three) stream and flows in the southerly direction to the Hunter River.

Big Flat Creek is a fourth order (category two) tributary of Wybong Creek and flows from north to south along the western boundary outside the approved project disturbance area. Wybong Creek is a major tributary of the Goulburn River. Anvil Creek and Clarks Gully are second order (category one) tributaries of Big Flat Creek. Anvil Creek flows east to west in the southern portion of the approved project disturbance area and then flows northward to its confluence with Big Flat Creek outside the western boundary near the central portion of the approved project disturbance area. Clarks Gully flows east to west through the northern portion of the approved project disturbance area to its confluence with Big Flat Creek outside the approved project disturbance boundary north of the confluence of Big Flat Creek and Anvil Creek. A number of first order tributaries of Big Flat Creek also flow east to west through the northern portion of the approved project disturbance area.

All creeks within the approved project disturbance area are ephemeral, with flows only occurring in the creeks during storm events or after prolonged periods of heavy rain.

The currently approved project disturbance area includes open cut pits and overburden emplacement areas extending through the western portion of the project area, encompassing a portion of the Big Flat Creek catchment and all of the Clarks Gully and the Anvil Hill catchments excluding Anvil Hill itself. Approved development in the eastern portion of the approved project disturbance area includes the CHPP, rail loop, ROM and product stockpiles areas, water management system infrastructure and the MIA.

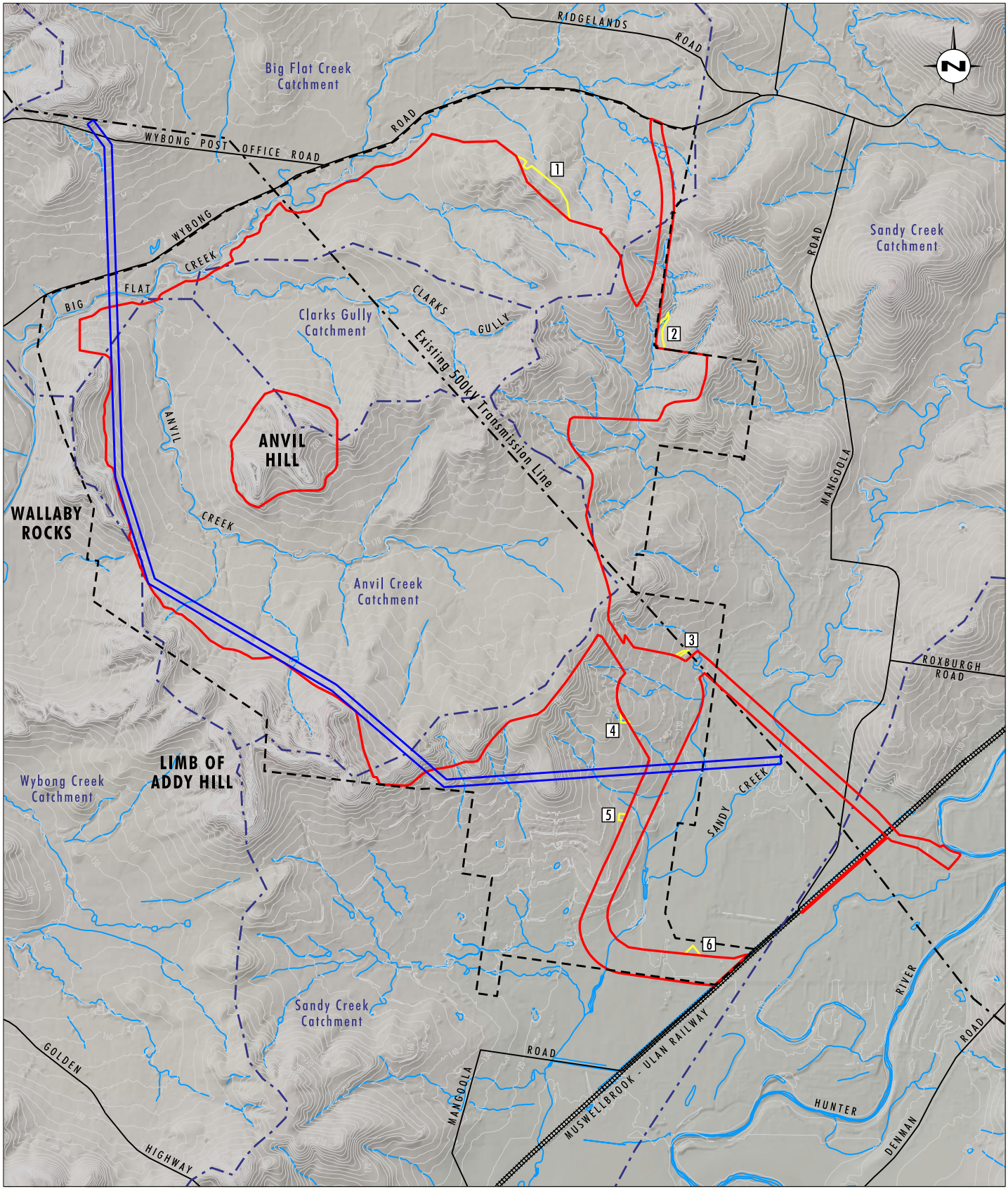
The proposed modifications involve mining activity within the approved project disturbance area with the addition of approximately 8.4 hectares, where drilling has shown that the coal crop line extends beyond the approved project disturbance boundary, and the other Project aspects outlined in **Table 1.1**. The proposed modifications will occur in the same catchments as the currently approved Mangoola Coal Project.

2.2 Surface Water Approvals

The surface water management strategy for the Mangoola Coal Project, including the proposed water management infrastructure and predicted site water balance, was developed as part of the original project approval (refer to **Section 1.0**) and documented in the *Surface Water Assessment – Anvil Hill Project* (Umwelt, 2006).

Consent condition 31 of the project approval (PA 06_0014) requires the preparation of a Site Water Management Plan (SWMP). The SWMP for the Mangoola Coal Project was approved by DoP in January 2009 and includes the following components:

- Site Water Balance;
- Erosion and Sediment Control Plan;



Source: Dept. of Lands (2003), Geospectrum (2004)
Note: Contour Interval 5m

0 1.0 2.0 2.5km

Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Mining Lease 1626 Boundary
- Proposed 500kV Transmission Line Easement
- Catchment Boundary
- Drainage Line

FIGURE 2.1

Pre Mining Topography

- Surface Water Monitoring Plan;
- Groundwater Monitoring Program; and
- Surface and Groundwater Response Plan.

The Site Water Balance was updated during 2009 to meet the Project Approval consent condition number 32A (refer to **Section 1.0**). The updated Site Water Balance was approved by DoP in January 2010 and forms part of the overall *Site Water Management Plan* (Xstrata Mangoola, 2008).

For the purposes of this assessment, the potential impacts of the proposed modifications have been compared to the original surface water assessment (Umwelt, 2006) and the predicted site water balance has been compared to the updated Site Water Balance for the currently approved development as approved by DoP in January 2010.

3.0 Potential Impacts and Management Measures

The proposed modifications to the Mangoola Coal Project that have the potential to impact on surface water management requirements for the Project include:

- changes to the mine plan requiring the relocation of components of the surface water management including the clean and dirty water controls (refer to **Section 3.1**);
- minor changes to the surface water management systems for infrastructure at the rail loop and around the temporary ROM stockpile facilities (refer to **Section 3.1**);
- changes to the site water balance associated with the proposed modifications to the mine plan (refer to **Section 3.2**);
- changes to flood flows in Big Flat Creek and Wybong Creek as a result of proposed changes to the mine plans (refer to **Section 3.3**);
- changes to water quality in Big Flat Creek as a result of proposed changes to the mine plans (refer to **Section 3.4**);
- changes to the proposed final landform associated with the proposed modifications to the mine plan and potential downstream impacts (refer to **Section 3.5**);
- changes to the annual flow volumes in the Big Flat Creek and Sandy Creek systems as a result of proposed changes to the mine plans (refer to **Section 3.6**); and
- changes to the proposed final void (refer to **Section 3.7**).

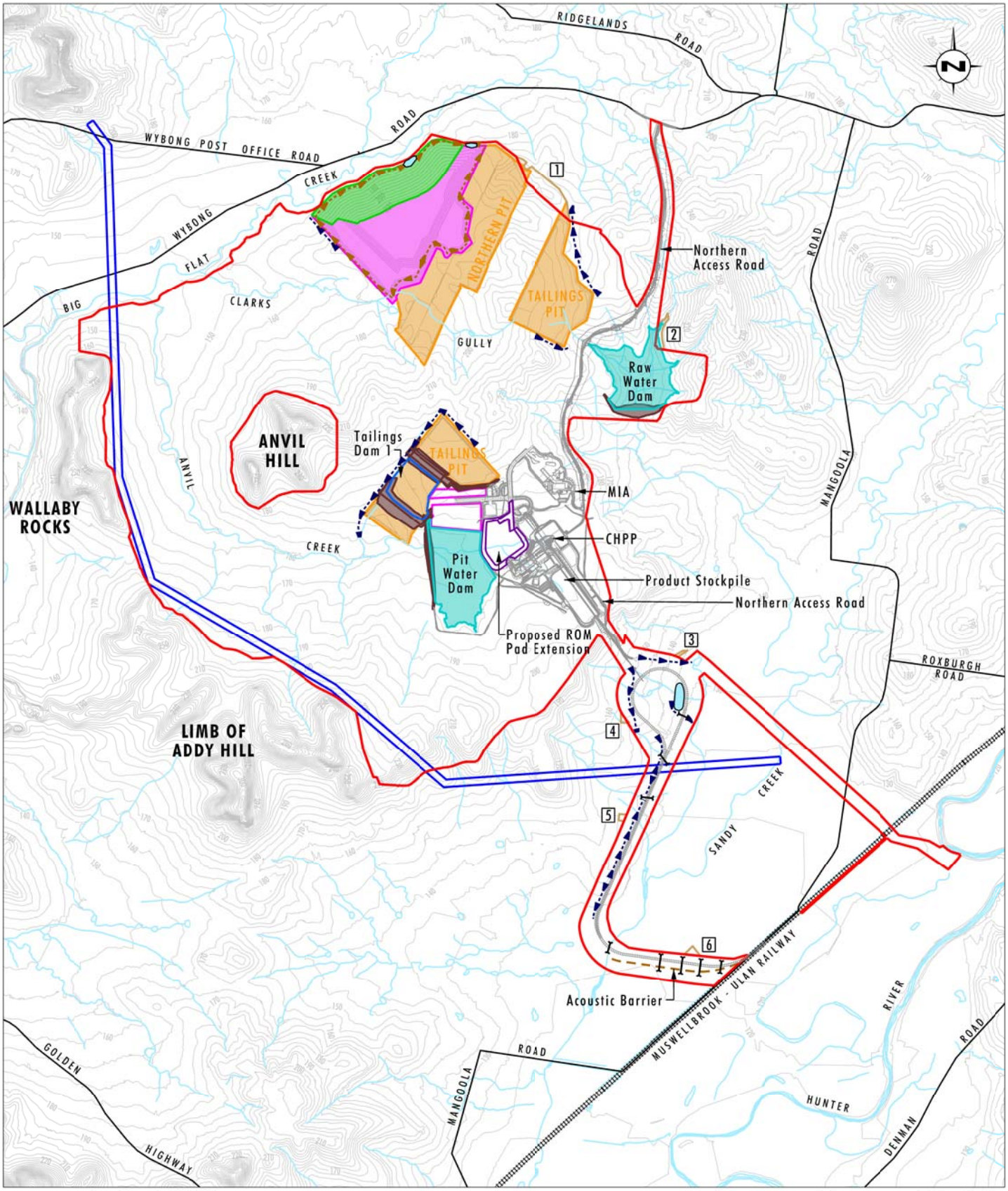
3.1 Water Management Systems

3.1.1 Overview

Proposed changes to the mine plans have resulted in the relocation and/or redesign of some of the detailed components of the water management system (WMS). However the broader water management strategy for the Project is unchanged from the water management strategy outlined in the approved *Site Water Management Plan* (Xstrata Mangoola, 2008). That is, the surface water management controls for the open cut pit and overburden emplacement areas have been designed to maintain the separation of clean, dirty and saline water and to prevent the contamination of clean water by proposed mining activities. The conceptual water management system for each stage of the proposed mine plans are shown on **Figures 3.1** to **3.5**. A schematic flow diagram of the proposed water management system is shown on **Figure 3.6**.

The original proposed mine water management (Umwelt, 2006) utilised on-site runoff from disturbed areas (including overburden emplacement, pit and infrastructure areas), collected in on-site sediment dams, as the major source of on-site water with this supply being supplemented by water imported from the Hunter River under licence.

The mine water management system has since been redesigned, in accordance with the project approval, to not use any licensable water from the Wybong Creek Water Source for mining purposes (refer to **Section 5.2**). As such water demands on site are proposed to be met from the following hierarchy of water sources as outlined in the *Site Water Management Plan* (Xstrata Mangoola, 2008):



Source: Dept. of Lands (2003)
Note: Contour Interval 5m

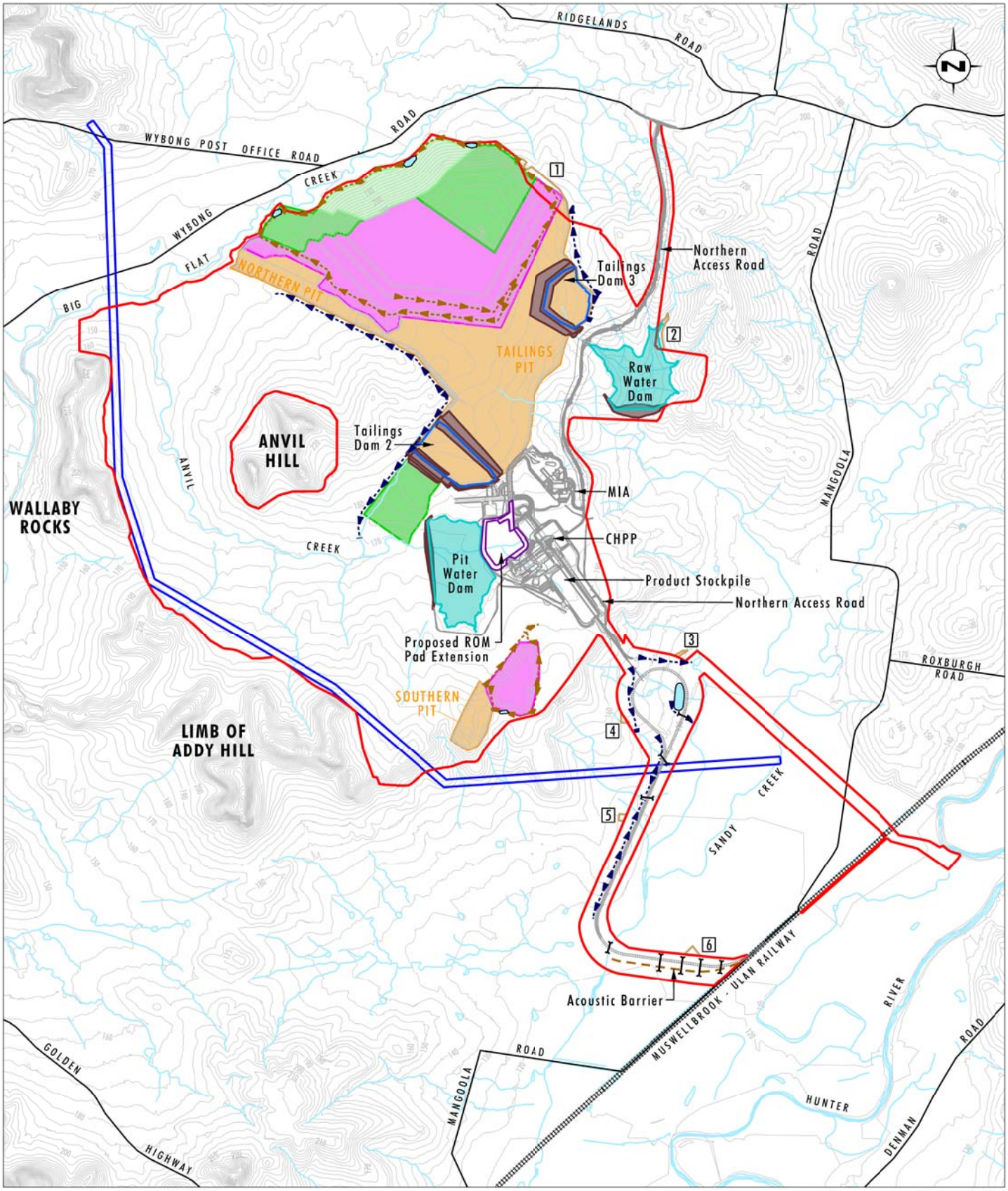
Legend

- Approved Project Disturbance Boundary
- Temporary ROM Infrastructure
- Proposed ROM Pad Extension
- Modified Project Disturbance Boundary
- Proposed 500kV Transmission Line Easement
- Overburden Emplacement Area
- Pit
- Rehabilitation - in progress
- Raw / Pit Water Dam
- Tailings Dam
- Dam Wall
- Sediment Dam
- Catch Drain
- Diversion Drain
- Culvert

FIGURE 3.1

Conceptual Surface Water Management for Year 2

File Name (A4): R18_V1/2497_240.dgn



Source: Dept. of Lands (2003)
Note: Contour Interval 5m

0 1.0 2.0 2.5km

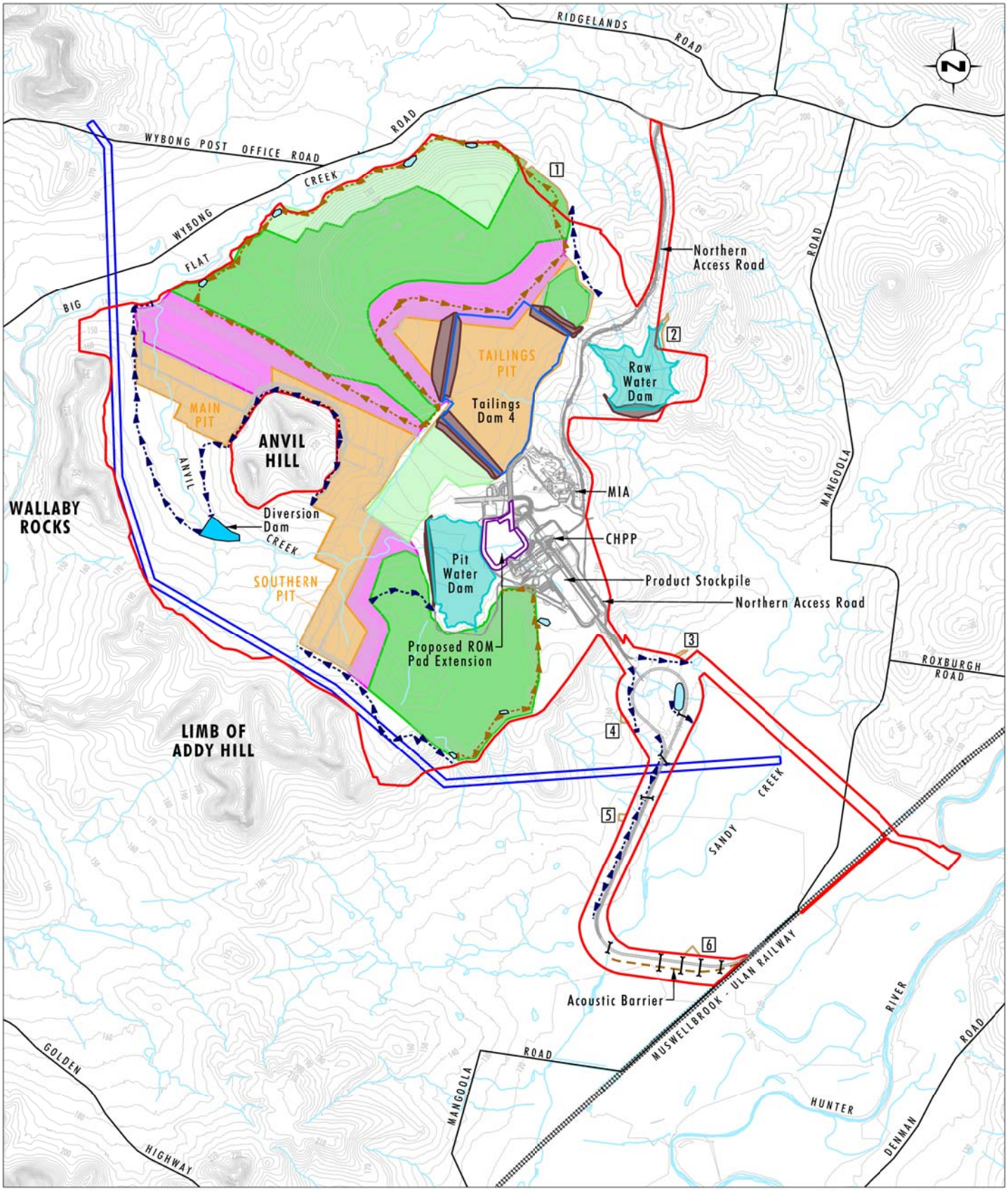
Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Proposed ROM Pad Extension
- Proposed 500kV Transmission Line Easement
- Overburden Emplacement Area
- Pit
- Rehabilitation - in progress
- Rehabilitation - completed
- Raw / Pit Water Dam
- Tailings Dam
- Dam Wall
- Sediment Dam
- Catch Drain
- Diversion Drain
- Culvert

FIGURE 3.2

Conceptual Surface Water Management for Year 5

File Name (A4): R18_V1/2497_241.dgn



Source: Dept. of Lands (2003)
Note: Contour Interval 5mAHD

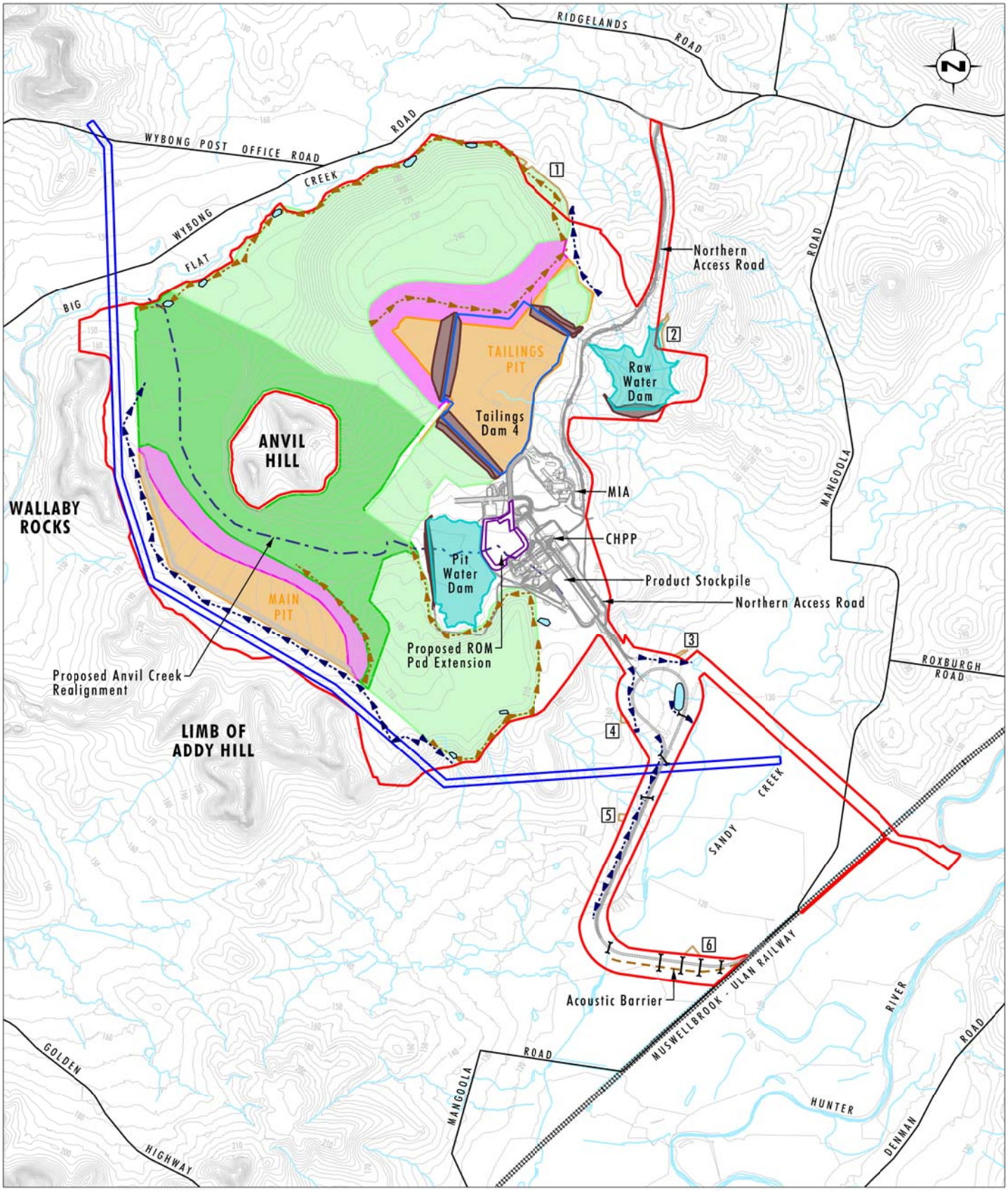
Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Proposed ROM Pad Extension
- Proposed 500kV Transmission Line Easement
- Overburden Emplacement Area
- Pit
- Rehabilitation - in progress
- Rehabilitation - completed
- Raw / Pit Water Dam
- Tailings Dam
- Dam Wall
- Sediment Dam
- Diversion Dam
- Catch Drain
- Diversion Drain
- Culvert

FIGURE 3.3

Conceptual Surface Water Management for Year 10

File Name (A4): R18_V1/2497_242.dgn



Source: Dept. of Lands (2003)
Note: Contour Interval 5m

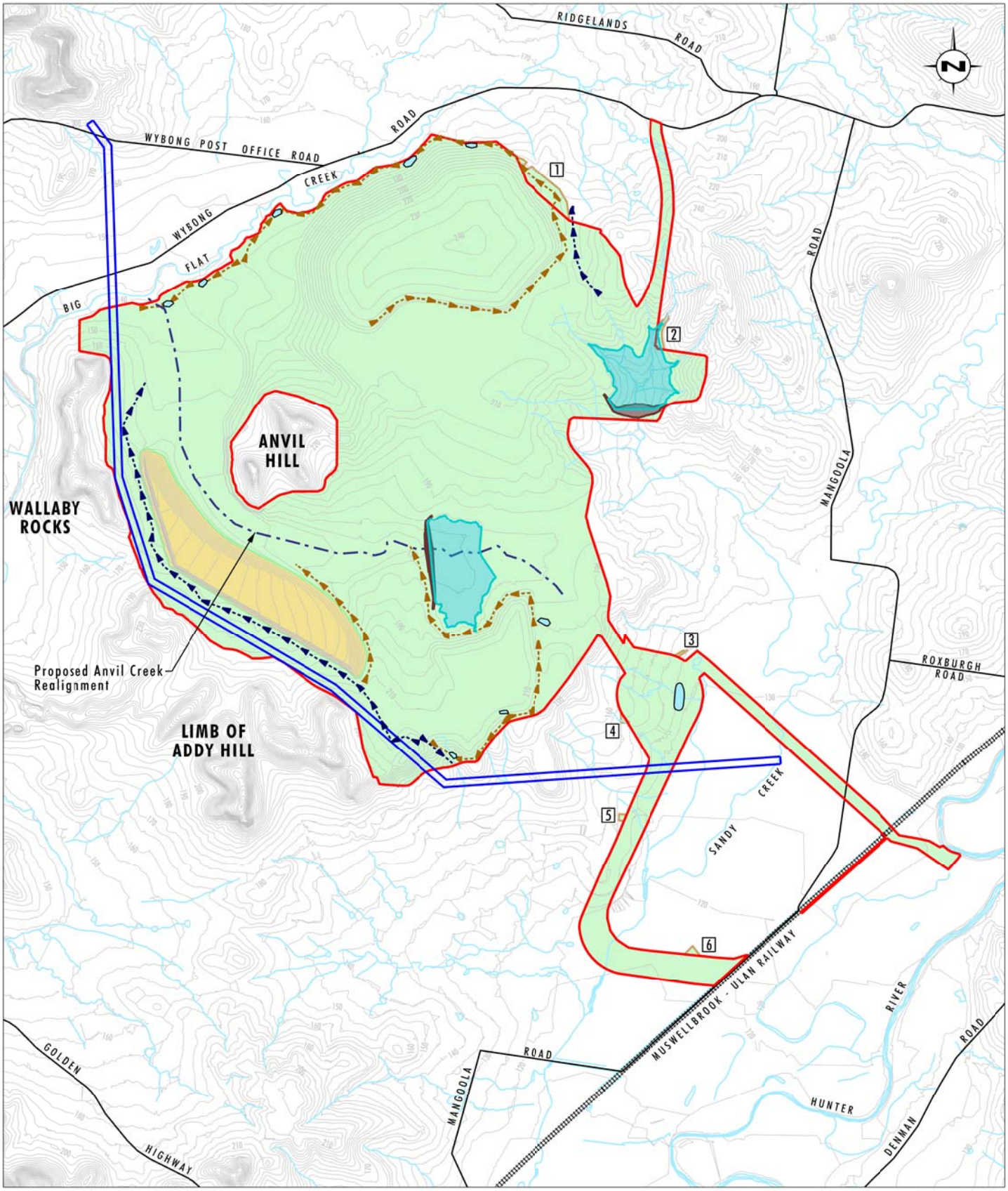
Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Proposed ROM Pad Extension
- Proposed 500kV Transmission Line Easement
- Overburden Emplacement Area
- Pit
- Rehabilitation - in progress
- Rehabilitation - completed
- Raw / Pit Water Dam
- Tailings Dam
- Dam Wall
- Sediment Dam
- Diversion Dam
- Catch Drain
- Diversion Drain
- Proposed Drainage Line
- Culvert

FIGURE 3.4

Conceptual Surface Water Management for Year 15

File Name (A4): R18_V1/2497_243.dgn



Source: Dept. of Lands (2003)
Note: Contour Interval 5m

0 1.0 2.0 2.5km

Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Proposed 500kV Transmission Line Easement
- Rehabilitation - completed
- Final Void
- Sediment Dam
- Raw / Pit Water Dam
- Dam Wall
- Catch/Diversion Drain
- Proposed Drainage Line
- Culvert

File Name (A4): R18_V1/2497_244.dgn

FIGURE 3.5

Conceptual Surface Water Management for Final Landform

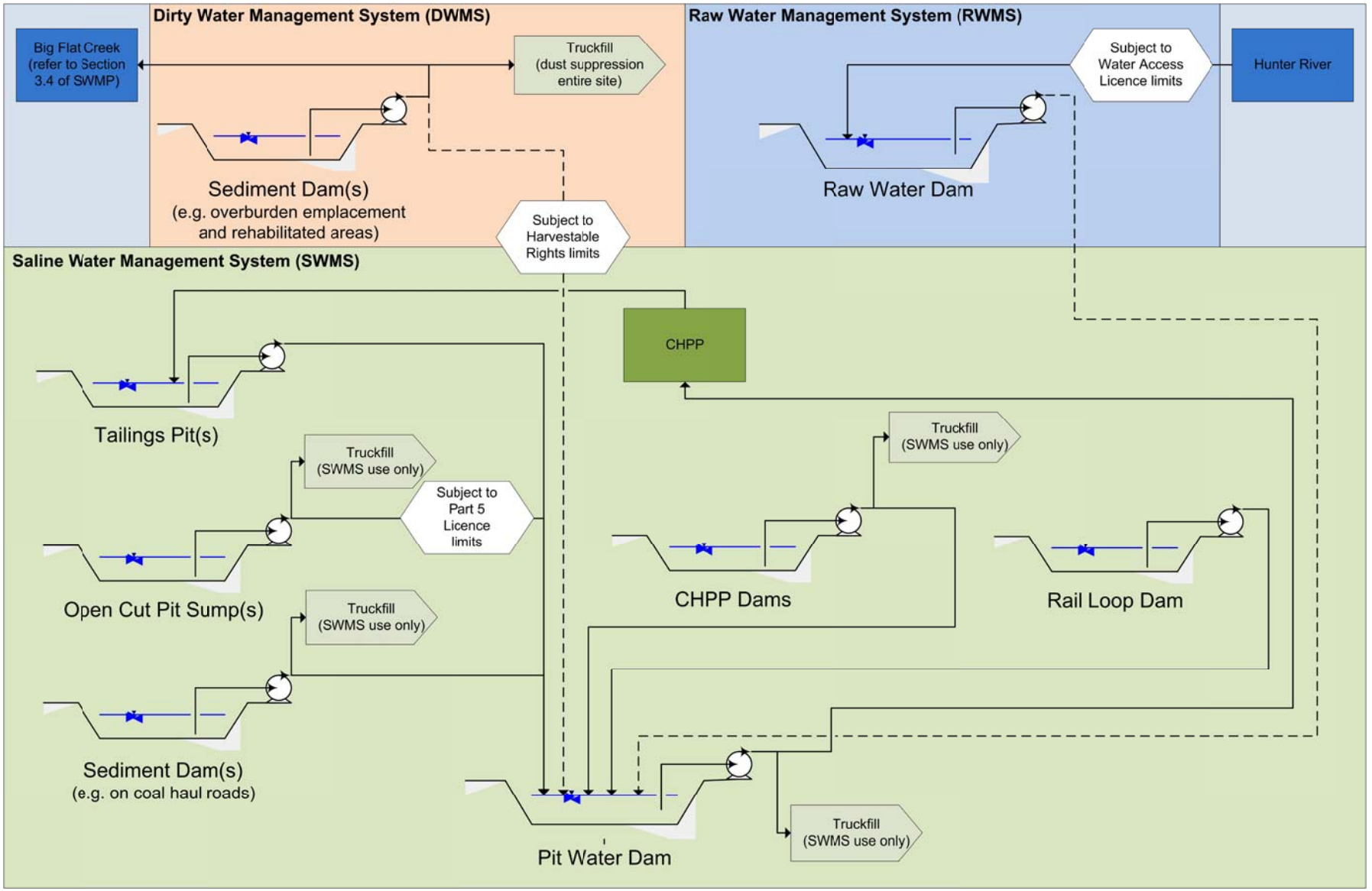


FIGURE 3.6

Schematic of Water Management System

1. groundwater from the mine water make or licensed constructed bores;

2. the Hunter River using existing water access licences (WALs);

3. clean water from harvestable rights; and

4. dams collecting water solely for the use of dust suppression (e.g. overburden emplacement area sediment dams).

The mine water management system has also been designed so there are no discharges of saline water from the mine site. As discussed, runoff from overburden dumps and rehabilitated areas will be channelled, stored and treated as required in various sediment ponds prior to reuse for dust suppression or discharge off site.

The Mangoola Coal Project currently holds approximately 3050 general security units and 17 high security units of Hunter Regulated River water shares. It is proposed to use water imported, under licence, from the Hunter River to supplement on-site water requirements (refer to **Section 6.0**). This water will be transported to the site via an approved pipeline.

One of the approved changes to the site water management system, as outlined in the *Environmental Assessment for Relocation of the Approval Hunter River Pipeline for Mangoola Coal* (Umwelt, 2008), is the change of use of a previously proposed tailings dam (Umwelt, 2006) to a Raw Water Dam with a storage capacity of approximately 2500 ML. Mangoola Coal is now proposing to operate the Raw Water Dam with a full supply level of approximately 187 mAHD. This increase in the full supply level from the approved operating volume will create additional storage capacity of approximately 900 ML and ensures that infrastructure on site is used to its full design capacity. As a result, it will provide the Mangoola Coal Project with additional flexibility in the management of water on site.

3.1.2 Open Cut Pits and Overburden Emplacement Areas

The proposed clean water management system includes a series of diversion drains around the perimeter of the open cut pits and overburden emplacement areas in order to safely capture and convey upstream catchment runoff away from the mining disturbance areas. However, runoff from some minor areas of clean water catchment adjacent to the open cut pits and the infrastructure area will be captured in the mine water management system (refer to **Figures 3.1** to **3.5**).

The proposed dirty water management system includes a series of catch drains and sediment dams around the perimeter of the open cut pits and overburden emplacement areas in order to safely capture and treat runoff from mining disturbance areas. Dirty water runoff from the overburden emplacement areas will be captured in sediment dams for treatment and either used on site for dust suppression or released to downstream natural catchment areas once the required runoff water quality criteria are achieved (refer to **Figures 3.1** to **3.5**).

Surface water that has potential come into contact with coal, i.e. potentially saline water, will be captured in pit and re-used in the mine water management system (refer to **Figures 3.1** to **3.5**).

Saline water and water imported from the Hunter River (to supplement the on-site water supply) (refer to **Section 3.2**) will be stored in a series of major water storage dams. These dams are located adjacent to the infrastructure area and in the upper catchment of Sandy Creek (refer to **Figures 3.1** to **3.5**).

The conceptual water management strategies for each of the stage mine plans are discussed briefly below.

Year 2

A series of diversion drains will be established upslope of the open cut pits (refer to **Figure 3.1**) to limit runoff from natural/undisturbed catchment areas being captured in the mine water management system. Including minor areas upslope of open cut pits, there is approximately 253 hectares of natural/undisturbed catchment area in Year 2 of the conceptual mine plan that will potentially drain into the mine water management system.

One area of approximately 115 hectares of natural/undisturbed catchment will be captured in the Northern Pit (i.e. the area between the Northern Pit and the Northern Tailings Pit). To divert runoff from this area around the open cut pit would require substantial excavations for a gravity drainage system or considerable energy to be used in a pumped system, which would be in place for less than three years. As such, due to these environmental constraints, it is not considered feasible to direct runoff from this area away from the proposed site water management system. Runoff from this area will be captured under harvestable rights provisions (refer to **Section 6.1.4**).

Similarly, there is one area of approximately 110 hectares to the south of the Infrastructure Area and one area of approximately 15 hectares to the north of the Infrastructure Area from which runoff will be captured in the mine water management system under harvestable rights provisions (refer to **Section 6.1.4**).

A series of catch drains and sediment dams will be established to capture and treat runoff from the overburden emplacement areas (refer to **Figure 3.1**).

Year 5

The proposed water management controls for Year 5 will utilise and extend the controls for Year 2 (refer to **Figure 3.2**). This will include construction of additional diversion drains, catch drains and sediment dams.

The natural/undisturbed catchment area captured in the mine water management system during Year 2 will be reduced in Year 5 as a result of mining operations (refer to **Figure 3.2**). Including minor areas upslope of open cut pits, there is approximately 96 hectares of natural/undisturbed catchment area in the Year 5 conceptual mine plan that will potentially drain into the mine water management system (refer to **Section 6.4.1**).

Year 10

The proposed water management controls for Year 10 will utilise and extend the controls for Year 5 (refer to **Figure 3.3**). This will include construction of additional diversion drains, catch drains and sediment dams.

Based on the conceptual mine plans, the downstream reaches of Anvil Creek will be mined by approximately Year 8. To facilitate management of clean water runoff within the natural/undisturbed catchment areas of Anvil Creek it is proposed to construct a diversion dam on the creek to capture and divert runoff to Big Flat Creek (refer to **Figure 3.3**). It is proposed to construct diversion drains upslope of the open cut pit to gravity feed runoff into the diversion dam. The diversion dam will be sized to capture runoff from the 100 year Average Recurrence Interval (ARI) 24 hour storm event. Similarly, it is proposed to gravity drain the diversion dam to Big Flat Creek. The diversion dam and its associated drains have been designed to maximise the amount of clean water runoff flowing into the Wybong Creek catchment.

The natural/undisturbed catchment area captured in the mine water management system during Year 10 will include small areas upslope of the open cut mining pits and the infrastructure area (refer to **Figure 3.3**). Including minor areas upslope of open cut pits, there is approximately 114 hectares of natural/undisturbed catchment area in Year 10 of the conceptual mine plan that will potentially drain into the mine water management system (refer to **Section 6.4.1**).

Year 15

The proposed water management controls for Year 15 will utilise and extend the controls for Year 10 (refer to **Figure 3.4**). This will include construction of additional diversion drains, catch drains and sediment dams.

It is proposed to have mined through the full extent of Anvil Creek by Year 15. Placement of overburden in this area will be done in such a manner as to create a stable drainage line and provide a suitable landform for the re-establishment of riparian vegetation communities (refer to **Section 3.5**).

The natural/undisturbed catchment area captured in the mine water management system during Year 15 will continue to include small areas upslope of the open cut mining pits and the infrastructure area (refer to **Figure 3.4**). Including minor areas upslope of open cut pits, there is approximately 47 hectares of natural/undisturbed catchment area in Year 15 of the conceptual mine plan that will potentially drain into the mine water management system (refer to **Section 6.4.1**).

Final Landform

Open cut mining is proposed to cease after Year 15 and as such no major changes will occur to the mine water management system after Year 15. Major components of the mine water management system will remain in place as part of the final landform (refer to **Section 6.2**). The final void has been designed to become a self contained system that will not overflow or discharge to the surrounding environment (refer to **Section 3.7**).

3.1.3 Infrastructure Areas

The conceptual surface water management strategies for the proposed changes to infrastructure required for the Mangoola Coal Project have been designed to minimise the potential impacts on the surrounding environment and downstream catchment areas. For the MIA, these conceptual strategies were approved as part of the third modification (MOD3) to the project approval granted in November 2009. The objectives of the water management strategy are to:

- divert upslope runoff around the site;
- maintain water quality in downstream watercourses;
- provide the necessary facilities to capture any oil, fuel or chemical spills to prevent contamination of downstream catchment areas and watercourses;
- minimise the erosion potential of the site; and
- minimise the amount of sediment transported off the site.

Temporary ROM Pad

It is proposed to establish a temporary ROM pad to stockpile run-of-mine coal produced during the first two years of operation of the mine, and whilst the final stockpiles and infrastructure are being established. After the full commissioning of the CHPP and the permanent ROM pad, the temporary ROM pad will be rehabilitated (after Year 2 of mining) (refer to **Figures 3.1** and **3.2**).

Water management controls for the proposed temporary ROM pad will be constructed in accordance with the Blue Book (Landcom, 2004 and DECC, 2008) and in accordance with the erosion and sediment controls outlined in **Section 3.1.4**.

Rail Loop Acoustic Barrier

An acoustic barrier is proposed to be constructed for a length of approximately 600 metres alongside the rail loop (refer to **Figure 3.1**). The proposed acoustic barrier will be approximately four metres high above the invert of the proposed rail loop.

The proposed acoustic barrier is being designed so as to not adversely influence flood levels, flows or velocities in Sandy Creek. Water management controls for the proposed acoustic barrier will be constructed in accordance with the Blue Book (Landcom, 2004 and DECC, 2008) and in accordance with the erosion and sediment controls outlined in **Section 3.1.4**.

Rail Loop Modifications

The proposed modifications at the rail loop are related to the provision of drainage controls, including culverts, drains and clean water diversions around access roads, level crossings and the rail loop (refer to **Figure 3.1**). Water management controls for the rail loop will be constructed in accordance the strategies outlined in the Site Water Management Plan (Xstrata Mangoola, 2008) (refer to **Section 2.2**) and with the Blue Book (Landcom, 2004 and DECC, 2008). The drainage controls will be designed as part of detailed construction plans and will be designed to minimise the potential impacts on the surrounding environment and downstream catchment areas, including flood levels, flows and velocities in Sandy Creek. Typical sediment and erosion controls required during the construction phase are outlined in **Section 3.2.3**.

3.1.4 Erosion and Sediment Controls

The surface water assessment has been conducted on the basis that erosion and sediment control measures will continue to be incorporated into the detailed construction plans for, and built as a part of the additional infrastructure to be constructed as a part of the Project and within the Erosion and Sediment Control Plan which forms part of the *Site Water Management Plan* (Xstrata Mangoola, 2008).

Erosion and sediment control measures currently required on site are outlined in the existing management plans (Xstrata Mangoola, 2008). Relevant guidelines for erosion and sediment control include:

- *Managing Urban Stormwater Soils and Construction* (the Blue Book) *Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008); and
- *Draft Guidelines for the Design of Stable Drainage Lines on Rehabilitated Minesites in the Hunter Coalfields* (DIPNR, undated).

The erosion and sediment control measures proposed to be incorporated into infrastructure construction and rehabilitation works during the Project to control the quality of runoff are consistent with the existing management plans (Xstrata Mangoola, 2008) and include:

- construction of erosion and sediment controls prior to the commencement of any substantial construction or earth works;
- constructing diversion drains upslope of areas to be disturbed to convey clean runoff away from disturbed areas;
- clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited only to those areas, clearing vegetation only as required to achieve the works and minimising machinery disturbance outside of these areas;
- limiting the number of roads and tracks established;
- construction and regular maintenance of sediment fences downslope of disturbed areas, including the construction sites for sediment dams, diversion drains and catch drains;
- applying gypsum, where required, to reduce the dispersibility of the subsoils that will be disturbed and to minimise the potential for tunnel erosion and surface rilling of disturbed or reshaped areas. The application rate to be determined by site specific soil testing as required;
- seeding and controlled fertilising of disturbed areas to provide for rapid grass cover. Areas will be seeded with a grass mix specific to the needs of the area to be grassed;
- inspection of all works daily and immediately after storm events to ensure erosion and sediment controls are performing adequately;
- regular maintenance of erosion control works and rehabilitated areas;
- provision for the immediate repair or redesign of erosion and sediment controls that are not performing adequately;
- the placement and maintenance of oil management systems downslope of key infrastructure and high traffic hardstand areas; and
- prompt revegetation of areas as soon as earthworks are complete.

In addition to the above erosion and sediment control measures, construction and remediation plans will detail the specific inspection, maintenance and revegetation requirements for each works area based on the construction program schedule and remediation works requirements. These control measures will be set out in the revised Mangoola Coal Project Erosion and Sediment Control Plan should this modification be approved.

3.2 Site Water Balance

3.2.1 Overview

A site water balance for the Mangoola Coal Project was initially developed as part of the original surface water assessment (Umwelt, 2006). An updated site water balance was prepared as a component of the Site Water Management Plan (SWMP) (Xstrata Mangoola, 2008), and was updated following the approval of the pipeline modification (MOD2) to the

project approval (refer to **Section 2.2**). The proposed modification is expected to reduce the predicted site water deficit and result in minor changes to the associated water management infrastructure and external sourcing of water. The existing water balance and potential impacts of the proposed modification on the water balance and associated water management infrastructure and external sourcing of water is discussed in **Sections 3.2.2** to **3.2.5**.

3.2.2 Approved Site Water Balance

The primary components of the Mangoola Coal Project water balance are:

- Inflows:
  - saline catchment runoff and rainfall onto dam surfaces;
  - groundwater inflows into the open cut pits;
  - import of potable water; and
  - import of water from the Hunter River to supplement process and dust suppression water.
- Losses:
  - water lost to product coal (i.e. water lost in CHPP, dust suppression, etc.) of up to approximately 1825 ML per year;
  - haul road dust suppression of approximately 500 ML per year;
  - stockpile dust suppression of approximately 77 ML per year; and
  - evaporation from dam surfaces of approximately 800 ML per year.

The total life of mine predicted water demand for the Mangoola Coal Project (i.e. predicted water losses), as described in the *Site Water Management Plan* (Xstrata Mangoola, 2008) and listed above, is approximately 60.3 GL.

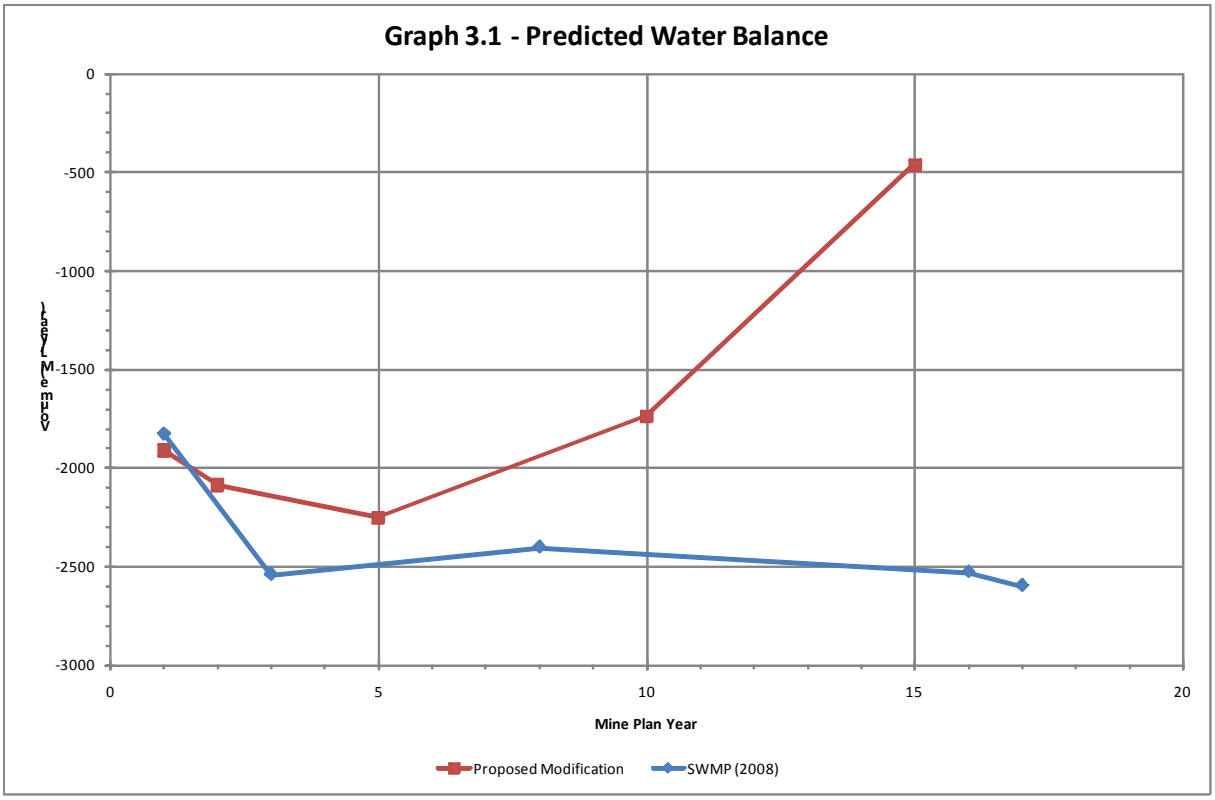
3.2.3 Potential Changes to Site Water Balance with Proposed Modifications

The site water balance has been updated to consider the proposed modifications to the mine plan. The primary influences of the proposed modification on the predicted site water balance are increases in the saline catchment runoff area (i.e. the open cut pit areas), changes to water demands during production ramp up and ramp down periods, and a shorter mine life.

The increase in saline catchment runoff area, as a result of larger proportions of open cut pit areas being open during the mine life, are the primary contributor to the reduced predicted site water deficit with the proposed modifications. The increase in saline catchment area has the potential to increase on site water sourcing relative to water demands and as a result reduce the predicted site water deficit, relative to the water balance included in the *Site Water Management Plan* (Xstrata Mangoola, 2008).

The predicted site water balance based on the current approved operations is included in Appendix 1 of the *Site Water Management Plan* (Xstrata Mangoola, 2008) with the average yearly predicted site water balance shown on **Graph 3.1**.

The predicted site water balance for an average rainfall year, incorporating the proposed modifications is also shown on **Graph 3.1**.



Each of the areas in which the proposed modifications could potentially influence the predicted site water balance are discussed below.

Saline Catchment Runoff

The catchment areas with potentially saline runoff are increased with the proposed modifications to the mine plan compared to the original approved mine plans (Umwelt, 2006) and the Site Water Management Plan (Xstrata Mangoola, 2008) this increase is a result of the larger proportions of open cut pit. The result is a potential increase in the water sourced on site from saline water runoff. The associated increase in the potential water sourced on site from saline water runoff results in a reduction in the overall site water deficit.

Although the proposed modifications will result in an associated increase in areas within the saline water management zone, the total volume of water required to be stored on site is not expected to increase relative to that outlined in the Site Water Management Plan (Xstrata Mangoola, 2008). The site storage capacities outlined in the Site Water Management Plan account for on-site runoff, water required for processing and contingency for prolonged wet periods.

Figures 3.1 to **3.5** show the conceptual water management strategy for the proposed mine plans for the Mangoola Coal Project for the various mine stages. These figures also indicate the areas of catchment runoff captured in the mine water management system.

Groundwater Inflows

Based on the groundwater assessment of the proposed modification (refer to Section 11.5 of the EA) the groundwater inflow volumes modelled for the approved mine plan are not expected to change significantly with the proposed modifications.

Water Lost to Product Coal

The production rate for the proposed modification is 10.5 Mtpa which is consistent with the original maximum approved production levels (Umwelt, 2006). The production rate used in the updated site water balance (refer to **Section 2.2**) was 10.5 Mtpa for the life of the Project with ramp up and ramp down production levels at the start and end of mining. As such the changes in water lost to product coal as a result of the proposed modification are due to changes to ramp up and ramp down production rates.

Haul Road Dust Suppression

The proposed modification will result in minor changes to the proposed haul road routes and associated lengths. However, these changes are minor and are expected to have negligible influence on the water demands for haul road dust suppression.

Stockpile Dust Suppression

Similar to water lost to product coal and haul road dust suppression it is considered that the proposed modifications will result in negligible changes to the predicted stockpile dust suppression water demands.

Evaporation

The proposed modifications will not result in any major changes to the water management infrastructure described in the Site Water Management Plan (Xstrata Mangoola, 2008). As such, the predicted losses to evaporation are not expected to change with the proposed modification.

The total life of mine predicted water demand for the proposed modification is approximately 51.9 GL. This equates to a reduction in total water demand for the Mangoola Coal Project in the order of 8.4 GL (i.e. a 14 per cent reduction in total water demand) over the life of the Project.

The analysis also indicates that, except for Year 1 of operations, the proposed mine plan modifications will result in potentially lower gross water deficits, ranging between approximately 250 ML per year and 2000 ML per year.

During Year 1 of the proposed operations the gross water deficit is slightly higher than previously predicted, increasing from a predicted gross water deficit of approximately 1830 ML per year to approximately 1910 ML per year. This predicted increase in gross water deficit is a result of higher production rates in Year 1 for the proposed modification of 5 Mtpa compared to 4 Mtpa in the earlier approved water balance. The increase in predicted water deficit for Year 1 of the operations is less than the maximum predicted gross water deficit of approximately 2250 ML per year. It is considered that the gross water deficit in Year 1 can be met from the proposed site water management system sources (refer to **Section 3.1.1**).

3.2.4 Potential Impacts of Climate Change on the Site Water Balance

Hunter Councils, through their environmental initiative known as the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS), has recently completed the Hunter, Central and Lower North Coast Regional Climate Change Project 2009 (Blackmore and Goodwin, 2009). The series of four reports that support this body of work provide analysis of climate change projections for the period 2020 to 2080 relative to historic climate based on instrumental records.

Based on climate change projections for the time period between 2020 and 2080, Blackmore and Goodwin (2009) found the following in relation to rainfall:

- Summer rainfall increases of up to 25 per cent are projected relative to the relatively dry period 1977 to 2007. However, changes to rainfall in summer and spring are within the bounds of natural climate variability (that is the changes projected for 2020 to 2080 relative to the periods 1948 to 1976 and 1977 to 2007 are no greater or less than that measured historically).

- Autumn rainfall increases of up to 33 per cent relative to 1948 to 1976, or 22 per cent relative to 1977 to 2007.

- There is a slight increase in winter rainfall relative to both periods of historic record.

For the western zone, in which the Mangoola Coal Project is located, the annual predicted rainfall for 2020 to 2080 relative to 1970 to 2007 shows no propensity to extend beyond the bounds of natural variability shown during the period from 1970 to 1996.

As such, it is expected that the potential influences of climate change on the site water balance will lie within the existing historical meteorological influences which have been considered in the water balance work to date as detailed in the Site Water Management System (Xstrata Mangoola, 2008).

3.2.5 Summary of Potential Impacts on Site Water Balance

The analysis indicates that with the proposed mine plan modifications that the Mangoola Coal Project will potentially have a lower gross water deficit typically in the order of 500 ML per year. This potential decrease in predicted water deficit will provide the Mangoola Coal Project will additional flexibility in water management though less reliance on Hunter River water (refer to **Section 6.0**).

The analysis also indicates that with the proposed mine plan modifications that the Mangoola Coal Project will potentially have a lower total water demand in the order of 8.4 GL (i.e. 14 per cent) over the mine life. This total reduction is primarily driven by the reduced mine life.

In the Anvil Hill Surface Water Assessment (Umwelt, 2006) it was estimated that the construction phase prior to mine start up would take approximately one year to complete and would require access to approximately 400 ML of water over that period to meet construction and dust suppression requirements. Construction of infrastructure at Mangoola Coal Project has commenced and combined with the proposed mine plan modifications, the start up period is not expected to extend significantly past one year or increase the estimated water demands. Mangoola Coal proposes to continue to extract water for dust suppression during construction from on-site farm dams and supplement these requirements by imported water, under licence, from the Hunter River (refer to **Section 6.0**).

3.3 Flooding

The potential impact of the Project on flood flows, velocities and extents on Big Flat Creek and Wybong Creek were assessed as part of the original surface water assessment (Umwelt, 2006). The assessment indicated that the Project would have negligible impacts on flooding in Big Flat Creek and Wybong Creek (Umwelt, 2006).

A review of the proposed changes to the mine plan indicates that there will be negligible changes to the landform within the floodplain area of Big Flat Creek associated with the proposed mine plan modifications. As such it is considered that the proposed modifications will result in negligible changes to the approved impacts as discussed in the Surface Water Assessment for the Anvil Hill Project (Umwelt, 2006).

3.4 Water Quality

3.4.1 Sediment Loads

Mangoola Coal proposes to continue to operate in accordance with the Site Water Management Plan (Xstrata Mangoola, 2008), including the sediment and erosion controls outlined in **Section 3.1.4**.

As such, it is considered that the proposed mine plan modifications will not adversely impact on in stream habitat or sediment levels in Big Flat Creek or the downstream drainage systems.

3.4.2 Salinity Levels

Wybong Creek has been identified in the Hunter and Central Rivers Catchment Action Plan as being a major salt contributor to the Goulburn and Hunter River systems. Water quality monitoring undertaken for original project approval indicates that Big Flat Creek catchment, which occupies approximately 6 per cent of the Wybong Creek catchment, is contributing up to 30 per cent of the total salt load in the Wybong Creek system (Umwelt, 2006).

Soil testing undertaken as part of the original project approval indicated the that soils that are suitable to be used to topsoil reshaped landforms are typically non-saline and hence are unlikely to generate saline runoff or contribute significantly to existing salt loads in the Big Flat Creek system. As a result, it was considered that the Project was unlikely to increase total salt loads in the Big Flat Creek system (Umwelt, 2006). The proposed modifications to the mine plans are not expected to alter this finding.

3.5 Channel Stability and In-Stream Habitat

Consistent with the existing approved mine plans, Anvil Creek and Clarks Gully will continue to be mined and the landform within the catchments will be modified as part of the Mangoola Coal Project (refer to **Figure 3.5**). The final landform and associated drainage will be addressed in detail in the Mine Closure Plan, which will be prepared in accordance with Project Approval.

Consistent with the existing approval (Umwelt, 2006), during the rehabilitation phase it is proposed to shape the final landform to provide a free-draining broad vegetated drainage line along the approximate current alignment of Anvil Creek. This drainage line will be designed and constructed to provide a stable vegetated channel that is capable of conveying flows from the final landform to Big Flat Creek system. Native trees and shrubs will be planted along the drainage line alignment to enhance the long term stability of the drainage system and to provide suitable habitat for native fauna. It would also possible to re-establish in-channel habitat such as pools and riffles, rock bars etc., similar to that existing in the current Anvil Creek system.

The Project will continue to result in the removal of Clarks Gully effectively from Year 1. Over the life of the Project, and consistent with the original approved surface water

assessment (Umwelt, 2006), new drainage lines will be established to convey runoff from the Clarks Gully area to Big Flat Creek. These drainage lines will be designed and constructed to provide a stable vegetated channel that is capable of conveying flows to Big Flat Creek.

The Mangoola Coal Project will continue, as detailed in the original approved surface water assessment (Umwelt, 2006), to result in changes in the flow regime within Big Flat Creek as the mine water management system is developed and mining progresses. This will result in reduced annual flow volumes in the creek (refer to **Section 3.6**). The frequency and duration of flows within the creek system is not expected to be significantly changed by the proposed modification, however the magnitude of these flow impacts will decrease as a result of the proposed shortened mine life and reduced catchment area of the mine water management system. It is considered that sufficient flow volumes will be maintained in the creek system to fill the pools and holes along Big Flat Creek that sustain the current aquatic and riparian habitat characteristics of the creek system.

The flooding assessment indicates that the proposed modification will, consistent with the original assessment (Umwelt, 2006), not significantly alter the flow regime in Wybong Creek in terms of peak discharges, flood levels or peak in stream velocities. As a result, the proposed modification is unlikely to adversely impact on channel stability or in stream habitat of the Wybong Creek system.

The Mangoola Coal Project will continue to occupy only a small section of Sandy Creek catchment and with the proposed water management and sediment and erosion controls in place is unlikely to impact on the flow regime or habitat characteristics within the Sandy Creek system.

3.6 Annual Flow Volumes and Downstream Users

Anvil Creek, Clarks Gully and Big Flat Creek flow through the approved project disturbance area. A section of the Sandy Creek catchment area also is included within the approved project disturbance area.

During the life of the Project, with the current site water management strategy (Xstrata Mangoola, 2008) and with the proposed mine modifications, the area of natural catchment captured in the mine water management system is significantly less than the original project approval as detailed in the Surface Water Assessment (Umwelt, 2006).

The catchment areas of Wybong Creek and Sandy Creek proposed to be captured by the mine water management system during the life of the Project are listed in **Table 3.1**.

Table 3.1 – Catchment Areas Captured in Mine Water Management System

Year	Wybong Creek Catchment Area			Sandy Creek Catchment Area	
	Area (ha)	Proportion		Area (ha)	Proportion of Total Catchment Area
		Upper Catchment Area	Total Catchment Area		
2	717	1.1%	0.9%	29	0.2%
5	509	0.8%	0.6%	61	0.4%
10	891	1.3%	1.1%	52	0.4%
15	587	0.9%	0.7%	51	0.4%

Note 1 – Upper catchment area is defined as the catchment area upstream of the confluence of Big Flat Creek and Wybong Creek

The analysis indicates that runoff from up to 1.3 per cent of the upper catchment area of Wybong Creek and up to 1.1 per cent of the total catchment area of Wybong Creek will be captured within the mine water management system. This occurs during Year 10 of the proposed mine plan. In addition, runoff from up to 0.4 per cent of the catchment area of Sandy Creek will be captured in the mine water management system. The areas captured within the mine water management system will in general form part of the saline water zone of the mine water management system. Saline water consists of water that has been in contact with coal or carbonaceous material and subsequently has the potential to be saline. These areas include the open cut pits, internally draining overburden dump areas, the Pit Water Dam, tailings dams, CHPP, ROM and product stockpile areas, rail loading facilities and coal haul roads. As discussed in **Section 3.1.2** and shown on **Figure 3.6** the dirty water catchment areas of the water management system will drain, via sediment controls, to the downstream water systems, including Big Flat Creek and Sandy Creek

At the end of the mine life it is estimated that approximately 0.2 per cent of the catchment area of Wybong Creek will be captured in the final void. In the original project approval it was also estimated that approximately 0.2 per cent of the catchment area of Wybong Creek would be captured in the final void.

At the end of the mine life none of the catchment area of Sandy Creek will be captured in the final void. This is consistent with the final landform for the previously approved project (Umwelt, 2006).

The current site water management strategy (Xstrata Mangoola, 2008) and proposed modification to the mine plans will result in reductions in the potential impacts on downstream annual flow volumes during the life of the mine and similar minimal reductions after mine closure compared with the original approved surface water assessment (Umwelt, 2006).

3.7 Final Void Analysis

Under the current proposed mine plans there will be a single final void rather than the two final voids under the approved mine plan (refer to **Figure 3.1**).

Modelling indicates that the water level in the final void will take approximately 100 years to stabilise to an elevation of approximately 129 mAHD. The modelled maximum water level in the final void of approximately 129 mAHD for the current proposed mine plan compares to a modelled maximum water level of approximately 135 mAHD under the approved mine plan (MER, 2006).

The proposed edge of the final void is at approximately 150 mAHD which is approximately 21 metres above the final modelled water level (i.e. 129 mAHD). As a result, it is considered that the water in the final void will not be able to spill into the downstream drainage systems and that the final void will become a self contained system that will not overflow or discharge to the surrounding environment.

4.0 Cumulative Impacts

The main potential cumulative impacts of the proposed modification in terms of surface water relate to:

- the overall demand for water in the Hunter River system and the potential to impact on annual flow volumes in the Wybong, Goulburn and Hunter systems;
- the potential for land use practices to result in greater sediment generation and deposition in the Wybong Creek catchment; and
- the potential to increase salt loads in the Wybong, Goulburn and Hunter systems.

The strategies to provide the water required to meet the operational and dust suppression needs of the Mangoola Coal Project will be consistent with those outlined in the Site Water Management Plan (Xstrata Mangoola, 2008). Analysis of the proposed mine modifications indicate that the project will potentially have less reliance on Hunter River water and will have more flexibility in management of on-site water as a result of the proposed modifications compared to the site water balance discussed in the Site Water Management Plan (Xstrata Mangoola, 2008).

Modelling indicates that at the largest open cut pit extent, the Mangoola Coal Project (with the proposed modifications) has the potential to reinstate runoff into the Wybong Creek system compared to the original surface water assessment. At the largest open cut pit extent approximately 0.64 per cent of the Wyong Creek catchment area is captured in the mine water management system, compared to 1.3 per cent associated with the original surface water assessment (Umwelt, 2006).

As discussed, it will continue to be necessary to import water for the Project during the construction phase when the water management infrastructure is being established and to meet the predicted site water deficit. This water will continue to be sourced from existing water licences and hence will not have a cumulative impact on water supplies in the Hunter and Goulburn River catchments.

In terms of potential sediment generation, a range of sediment and erosion controls will continue to be incorporated into the Project in accordance with the current Erosion and Sediment Control Plan which forms part of the Site Water Management Plan (Xstrata Mangoola, 2008) to minimise the potential for sediment export from the site.

In terms of salt loads, as discussed in **Section 3.4**, the modification is unlikely to impact on the potential impacts on salt loads in the Wybong, Goulburn and Hunter systems.

5.0 Water Planning Context

The proposed modification has been assessed against the relevant requirements of the following water planning policies/plans and legislation:

- *State Water Management Outcomes Plan* (SWMOP) (DNR, undated) (refer to **Section 5.1**);
- *Hunter and Central Rivers Catchment Action Plan* (CAP) (refer to **Section 5.1**);
- *Water Management Act 2000* and associated water sharing plans (refer to **Section 5.2**);
- *Protection of the Environment Operations Act 1997* (refer to **Section 6.0**);
- *National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) (refer to **Section 6.0**);
- *NSW Office of Water (NOW) Water Reporting Requirements for Mining Operations 2009* (refer to **Section 6.0**); and
- *Draft Department of Water and Energy (DWE) Guidelines for Management of Stream/Aquifer Systems in Coal Mining Developments – Hunter Region* (undated) (refer to **Section 6.0**).

Although works approvals are not required under the *Water Management Act 2000* for approvals being assessed under Part 3A of the *EP&A Act 1979*, the details of the assessment against the *Water Management Act 2000* and associated licensing requirements are included in **Section 6.0**.

5.1 State Water Management Outcomes Plan and Catchment Action Plan

The State Water Management Outcomes Plan (SWMOP) and the Hunter-Central Rivers Catchment Action Plan (CAP) provides guidelines for water management in NSW and the Hunter Valley respectively and is therefore relevant to the Project.

The introduction of the *Water Management Act 2000* led to the development of a statewide policy on water management known as the SWMOP. This plan provides direction for all water management actions in NSW by setting out the overarching policy context, targets and strategic outcomes for NSW water management.

The intent of Catchment Action Plans (CAPs) is to identify the key natural resource features of the catchment that the community and government wish to see protected or improved, and then to determine the best way to achieve these outcomes. The CAPs guide how improvements in natural resources will be achieved in the next ten years and define where effort and funding should be focussed to get the best protection and improvement in natural resources and the most benefits for the community. The CAPs build on planning and activities defined in the catchment blueprints, regional vegetation management and water sharing plans.

The Hunter-Central Rivers CAP commenced in 2006 and has a term of ten years.

The Project is consistent with the SWMOP and the CAP objectives both within the project application area and on potential downstream interactions. This will be achieved as:

- the majority of surface infrastructure will continue to be located within the Mangoola Coal Project site water management system minimising the potential for off-site impacts;

- the Project will result in only minor additional disturbance of land outside of the approved disturbance area. The proposed monitoring measures and associated erosion and sediment controls will effectively minimise environmental impacts (refer to **Sections 3.1.4** and **6.0**);

- to meet on-site water demands Mangoola Coal proposes to source additional water required from the Hunter River. Extraction will be undertaken in accordance with licensing provisions (refer to **Section 6.0**); and

- no water will be discharged from the site from the saline water management system. Any discharges from other areas of the site will be in accordance with the Blue Book requirements (Landcom, 2004 and DECC, 2008) (refer to **Section 4.0**).

5.2 Wybong Creek Water Sharing Plan 2003

The majority of the Mangoola Coal Project lies within the Wybong Creek catchment and as such is managed under the *Wybong Creek Water Sharing Plan 2003*. The Project Approval (consent condition 29) states that the Project "*shall not use any licensable water from the Wybong Creek Water Source for mining purposes*".

Mangoola Coal proposes to continue the current approach of not using any licensable water from the Wybong Creek Water Source for mining purposes. Any surface water captured within the Wybong Creek catchment area will be managed under Harvestable Rights, or be used for dust suppression or be classed saline water (i.e. water that has potentially come into contact with coal (refer to **Sections 4.0** and **6.0**). This approach is consistent with the approach outlined in the Site Water Management Plan (Xstrata Mangoola, 2008).

5.3 Hunter Regulated River Water Sharing Plan 2003

This water sharing plan is only applicable to the Project regarding extractions from the Hunter Regulated River Water Source (refer to **Section 6.0**).

5.4 Hunter Unregulated and Alluvial Water Sources Water Sharing Plan 2009

Key aspects of the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* are listed below and commented on in regard to the surface water interactions with the Project.

- The Plan provides for no new growth in water entitlements with the annual extraction limit typically set to the current annual extraction limits.

  The Project does not propose to extract surface water from the Sandy Creek catchment area except Harvestable Rights Provisions (refer to **Section 6.0**).

- Extraction of water from a runoff harvesting dam requires an unregulated river access license for extraction of water and construction of the dam unless the dam is within the maximum harvestable right dam capacity for the property on which it is located, in which case no licences or approvals are required.

  There are several existing farm dams located at the Mangoola Coal Project. The water captured in the farm dams will either be used for dust suppression, used under harvestable rights (refer to **Section 6.0**) or discharged to downstream watercourses.

  No new runoff harvesting dams are proposed for the Project.

6.0 Monitoring, Licensing and Reporting Procedures

6.1 Surface Water Monitoring and Reporting

The Mangoola Coal Project will continue to monitor the water management systems and associated erosion and sediment control measures in accordance with the existing strategies and plans. This monitoring will be undertaken on a monthly basis and after storm events.

During the construction of the proposed infrastructure, all works and their erosion and sediment controls will be inspected on a regular basis to ensure that all required controls are in place and effective.

Following the completion of construction works, the work areas will be inspected in accordance with Mangoola Coal Project's current inspection program as per the approved Site Water Management Plan (Xstrata Mangoola, 2008) and after any rainfall events generating runoff until revegetation and stabilisation of drainage structures are complete.

All erosion and sediment controls and their monitoring and maintenance requirements for the construction phase of the proposed infrastructure will be detailed in a construction plan.

The existing surface water quality monitoring network for the Mangoola Coal Project will be continued for the Project. The Surface Water Monitoring Program section of the Site Water Management Plan (Xstrata Mangoola, 2008), will be reviewed and incorporated into an updated Site Water Management Plan (WMP) for the Mangoola Coal Project should consent be granted for this modification.

The walls of all water management dams will be inspected biennially (every two years) for their structural integrity and for any maintenance requirements. The walls of the water management dams will be grassed and kept free of any trees and shrubs.

Water usage, rainfall, dam volumes and discharges (including transfers) at the Mangoola Coal Project will also continue to be monitored for the entire operation to assist in the management of the mine water management system. The water management dams will continue to be monitored to ensure that any overflows or discharges are to an appropriate standard and in accordance with licence conditions.

All monitoring results will continue to be reported in the Mangoola Coal Project Annual Environmental Management Report (AEMR) which is distributed to DoP, Industry and Investment NSW (I&I NSW) (formerly Department of Primary Industries), Department of Environment, Climate Change and Water (DECCW) (including the NSW Office of Water (NOW)) and other relevant government agencies. All monitoring data will continue to be retained in an appropriate database.

The results of the water quality monitoring will continue to be used to review the effectiveness of the Mangoola Coal Project mine water management system on an ongoing basis.

6.2 Decommissioning

Assuming that the mine is decommissioned at the end of the existing Project Approval water management dams will either remain in use as farm dams or will be removed (refer to **Figure 3.5**). If the dams are to be retained, the capacity of the dams will be reviewed and

the size/volume modified, if required. The proposed diversion drains, catch drains and site bunding will remain in place as part of the final landform. All buildings/workshops and associated hardstand and sealed areas will be removed and revegetated.

Any future development application beyond the life of the Project will include a revision of the existing soil and mine water management system.

6.3 Protection of the Environment Operations Act

The proposed mine water management system will continue to be licensed under the *Protection of the Environment Operations Act 1997* Section 120, with the existing licence (EPL No. 12894) varied as required to include new activities associated with the Project.

Water discharges from the water management system (i.e. not the saline water management system) will be from treated sediment dams within the dirty water management system to Big Flat Creek and Anvil Creek in accordance with Blue Book requirements (Landcom, 2004 and DECC, 2008). Additional discharges from the water management system (i.e. not from the saline water management system) may occur to the Hunter River via the approved pipeline to the Hunter River and will be managed under the Hunter River Salinity Trading Scheme (HRSTS). This contingency is requested in order to provide for the potential need to pump back to the Hunter River from the Raw Water Dam. The EPL currently does not include any water discharge points from the site and would need to be modified to allow for such contingency.

In accordance with the original project approval conditions no saline water (i.e. water from the saline water management system) will be discharged from the site. Water in the saline water management system is defined in the Site Water Management Plan (Xstrata Mangoola, 2008) as water that has been in contact with coal or carbonaceous material and subsequently has the potential to be saline. The saline water zone on site includes the open cut pits, internally draining overburden dump areas, the Pit Water Dam, tailings dams, CHPP, ROM and product stockpile areas, rail loading facilities and coal haul roads.

6.4 Water Act 1912 and Water Management Act 2000

There are three water sharing plans commenced for the areas in the vicinity of the Mangoola Coal Project, as listed:

- Wybong Creek Water Sharing Plan 2003;
- Hunter Regulated River Water Sharing Plan 2003; and
- Hunter Unregulated and Alluvial Water Sources Water Sharing Plan 2009.

The surface waters of the Mangoola Coal Project are governed by the *Water Management Act 2000* and the groundwater associated with the hardrock aquifers (i.e. coal seams) is governed under the *Water Act 1912.* Extractions from the Hunter River are also governed by the *Water Management Act 2000*.

The potential implications of the applicable *water sharing plans* are considered in **Sections 5.2** to **5.4**.

Groundwater that flows into the open cut pits will, as approved, be pumped from the open cut pits under a Part 5 licence of the *Water Act 1912*. This water will be pumped to the mine water management system and re-used. No changes are proposed to the management of groundwater from that currently approved.

All water extractions from the Hunter River will be managed under appropriate water access licences (WALs), as discussed in **Section 4.0**.

6.4.1 Harvestable Rights

The proposed water management system will result in the capture of runoff from several undisturbed/natural areas with potentially clean runoff (refer to **Figures 3.1** to **3.5**). The use of this captured runoff within the mine water management system will be limited by the harvestable rights provision of the Mangoola Coal Project.

Calculation of Harvestable Rights

Under the Harvestable Rights regulations, landholders may harvest up to 10 per cent of the average regional runoff on the property. Using the online Farm Dams Calculator (DLWC, 1999), the average regional runoff for the area is 0.7 ML per hectare per year which equates to a harvestable right of 0.07 ML per hectare per year. The current total contiguous landholdings of the Mangoola Coal Project are approximately 8575 hectares. This equates to a harvestable right of approximately 600 ML per year.

There are numerous minor farm dams located on within the landholdings of the Mangoola Coal Project. These farm dams are used for stock watering purposes with an estimated total volume of 135 ML. This volume equates to approximately 23 per cent of the harvestable rights of the Mangoola Coal Project. As such the remaining harvestable rights for the Mangoola Coal Project, based on the current contiguous landholding, is approximately 465 ML per year. This is equivalent to capturing 10 per cent of runoff from approximately 6640 hectares or 100 per cent of runoff from approximately 664 hectares.

Management of Harvestable Rights

The Mangoola Coal Project proposes two strategies to manage the potential use of harvestable rights.

1. Clean water runoff upslope of the Raw Water Dam.

   There is approximately 195 hectares of catchment area upslope of the Raw Water Dam. Based on a harvestable rights allowance of 0.07 ML per hectare per year this equates to a harvestable right from the catchment of approximately 13.7 ML per year.

   Mangoola Coal Project proposes to maintain the Raw Water Dam with a flood freeboard equivalent to the harvestable rights volume. As such runoff volumes in excess of the harvestable right for the catchment area will spill from the dam into the Sandy Creek system. Mangoola Coal Project proposes to not extract water from the Raw Water Dam for use in the operations in excess of the summation of the harvestable rights volume plus the volume of water pumped, under licence, from the Hunter River.

2. Clean water runoff upslope of the open cut pits and the infrastructure areas.

   The natural/undisturbed catchment areas upslope of the open cuts pits and infrastructure areas that are proposed to be incorporated into the water management system (refer to **Section 4.0** and **Figures 3.1** to **3.5**) range between approximately 47 hectares in Year 15 to approximately 253 hectares in Year 2 (refer to **Section 3.1.2**). Year 2 has the largest area of natural catchment. After Year 5 the open cut mine pits progress and mine

through the majority of these natural/undisturbed catchment areas (refer to **Figures 3.1** to **3.5**).

During the mining operations it is likely that 100 per cent of runoff from these areas will be captured in the mine water management system. These volumes need to be considered within the harvestable rights provisions for the Mangoola Coal Project.

Management of the Raw Water Dam (as discussed above) will reduce the area of landholdings available for harvestable rights from approximately 8575 hectares to 8380 hectares. Accordingly the area of land from which 100 per cent of runoff can be harvested is reduced from approximately 664 hectares to approximately 651 hectares. During the Project it is proposed to capture 100 per cent of runoff from up to approximately 253 hectares of natural/undisturbed catchment area. This area is significantly less than the available Harvestable Rights for the Mangoola Coal Project based on current contiguous landholdings.

7.0 Conclusion

This surface water assessment considers the potential surface water impacts of the proposed modifications to the current Project Approval 06_0014 (refer to **Table 1.1**). The assessment has indicated that:

- changes to the mine plan, requiring the relocation of components of the surface water management system, including pit, overburden emplacement area and infrastructure area site water management controls, can be managed in accordance with the current existing and proposed site water management strategies and controls (refer to **Section 3.1**);

- the changes to the site water balance associated with the proposed modifications to the mine plan will result in a lower water deficit for the site, which will provide additional flexibility within the site water management system and potentially reduce demands on extractions from the Hunter River (refer to **Section 3.2**);

- there will be negligible changes to flood flows in Big Flat Creek and Wybong Creek as a result of proposed changes to the mine plans (refer to **Section 3.3**);

- there will be negligible changes to water quality in Big Flat Creek as a result of proposed changes to the mine plans (refer to **Section 3.4**);

- the proposed final landform and associated final void will have negligible impacts associated with the proposed modifications to the mine plan (refer to **Section 3.5**);

- the changes to the annual flow volumes in the Big Flat Creek and Sandy Creek systems as a result of proposed changes to the mine plans will reduce relative to the original approved impacts (refer to **Section 3.6**);

- the final void will become a self contained system that will not overflow or discharge to the surrounding environment and will be smaller than the original proposed final void (refer to **Section 3.7**); and

- the Mangoola Coal Project will continue to operate in accordance with the relevant water planning policies/plans and legislation, including relevant licensing requirements under the *POEO Act 1997*, *Water Act 1912* and the *Water Management Act 2000* (refer to **Section 5.0** and **6.0**).

8.0 References

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