3.0 Existing Operations

3.1 Background

McArthur River Mine is a major underground operation, which is developing one of the largest known sedimentary stratiform zinc-lead-silver deposits. The ore-bodies making up the deposit, named “Here’s Your Chance” (HYC), were discovered by Mount Isa Mines Limited geologists in 1955, but development did not commence until 1995. This gap in time between the discovery of the deposit and development resulted from the unusual structure and extensive faulting of the ore-bodies and the extremely fine-grained nature of the ore, which combined to make commercial exploitation of the resource unfeasible for many years. A number of technological advancements in mining, ore treatment and concentrate transport was required before the project could proceed on an economic basis. Small bulk ore samples were obtained in the late 1960s, with metallurgical trial work conducted in Mount Isa and Adelaide. This trial work failed to develop an economically viable technique of ore beneficiation.

A small decline and pilot plant were constructed on site in 1975, with the consequent preparation of a feasibility study and environmental report in 1979. That study was based on a high-tonnage, open pit operation. No market existed at that time for the low-grade bulk concentrate produced by the pilot plant.

Subsequent metallurgical developments in fine grinding technology and the emergence of a market for high-grade bulk concentrate for use by smelters using the Imperial Smelting Process (ISP) technique enabled the project to be reassessed. Feasibility studies indicated that the project could be developed and following the preparation of an EIS in 1992, construction of the project commenced in 1994, with the first shipment of concentrate loaded in mid-1995.

MRM is an underground operation, currently producing around 333,000 dmt of bulk lead-zinc-silver sulphide concentrate for overseas and domestic markets. The total workforce is approximately 330 permanent personnel. Most production employees work a 7 days on/7 days off roster, with most support and management staff working a 5/2, 4/3 roster.

The layout of the existing operations is shown on Figure 1.2.

3.2 Management Systems

The MRM Safety Management System (SMS) and Environmental Management System (EMS) are currently being restructured to be compliant with new Xstrata Health, Safety, Environment and Community (HSEC) Management Policy and Standards.

The Xstrata Policy and Standards, issued in November 2004, will provide the platform upon which the MRM Management Systems will be built. It is proposed that by the end of 2005 the SMS and EMS will be upgraded to conform to Xstrata Standards and incorporate all ISO 14001 (International Environmental Management Standard) and AS 4801 (Australian Standard for Health and Safety Management) requirements.

It is also proposed that further rigour will be developed in the area of community management and this will become a formal part of the MRM Management Systems. The aim is to develop an integrated MRM HSEC Management System that can be internally audited by Xstrata, and externally audited for compliance with the requirements of ISO 14001 and AS4801 by an independent certification body.

Further information on the safety and environmental management systems is given in Sections 18 and 21.

3.3 Mining

3.3.1 Ore Reserves

At 30 June 2004, the McArthur River Mine had proved and probable reserves of 32 Mt grading 11.8% zinc, 5.1% lead and 53 g/t silver. This is inclusive of a combined measured, indicated and inferred resource of approximately 122 Mt grading 12.6% zinc, 5.7% lead and 57 g/t silver. Current mill throughput is 1.6 Mt/y of ore.

3.3.2 Mining Method

Access to the mine is gained from the west via a 5 m by 5 m main decline. The No 4 main decline is currently used as a main ventilation exhaust airway and the No 2 main decline is the primary vehicle access to all parts of the mine. A conveyor decline connects the surface with the bottom of the tipple/crusher complex and can also be used as a means of access in the event of an emergency.

Most of the No 2 ore-body area has been mined using a room and pillar method. Ore structures suited to room and pillar mining are presently confined to out-lying regions of No 2 ore-body.

Where the ore-body dips at angles greater than 55 degrees, bench stope mining is used. Uninterrupted production requires an on-going waste filling program. Waste is generated from active headings as well as stockpiled waste, previously disposed of in completed room and pillar panels.

Bulk stope mining, which is also used, is so named due to the fact that it uses conventional open stope mining method which “bulks” the mining reserve overlying the No 2 ore-body room and pillar panels. This method uses conventional drill and blast techniques to drop broken ore down to the No 2 ore-body horizon where conventional and remote mucking extraction takes place.

Historic depletion of No 2 ore-body has shifted the focus of mining from room and pillar mining to the point where in 2003, 30% of production came from bulk stope production and an additional 35% came from bulk stope development. The high level of reliance on bulk mining will continue over the life of the mine.

Approximately 5% of the material handled underground is waste. Prior to the introduction of stoping methods, this was disposed of in completed room and pillar panels. Presently, all mined waste is disposed of in bench stopes, as these have an ongoing requirement for backfill.

3.3.3 Underground Infrastructure

Ore is hauled from the production face to a central stockpile/tipple area by low profile articulated trucks. The ore is tipped into the underground tipple, where a 700 by 700 mm grizzly screens the material fed into a 2,000 t ROM bin. Material from the ROM bin is fed to the underground crusher. After crushing, the ore is conveyed to the surface for further crushing and stockpiling.

Two exhaust shafts expel 400 m^3 of air per second from the mine. Air enters the mine via the main access decline, the conveyor incline and two fresh air raises.

Ground support requirements have been assessed and implemented to ensure adequate geotechnical protection underground. There are eight ground support standards for development headings at MRM. The standards account for drive conditions with varying profiles and recommended mesh and bolts designs. Operators have been trained in the recognition of the varying ground conditions and site technical staff are available for assessments where conditions fall outside the standard.

3.4 Processing

The layout of the existing processing facilities is shown on Figure 3.1. The existing processing operation consists of the following basic steps:

- secondary crushing
- primary grinding
- rougher flotation
- regrinding
- cleaner flotation
- thickening and filtration
- tailings

The project flowsheet which includes the processing operation is shown on Figure 3.2.

3.4.1 Secondary Crushing

The conveyor from the underground mine delivers the ore to the secondary crushing system on the surface. This system consists of a double deck vibrating screen, cone crusher, and associated feed, recycle and product conveyors. The secondary crushing circuit feeds back on to the stockpile feed conveyor after reducing the ore to 13 to 15 mm.

The secondary crushed material is stored on the ore stockpile, which has a live capacity of approximately 5,000 t and a total capacity of approximately 20,000 t. The stockpile provides surge capacity between the crushing and grinding circuits allowing the decoupling of these two processing units.

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McARTHUR RIVER MINE
OPEN CUT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Drawn: VH
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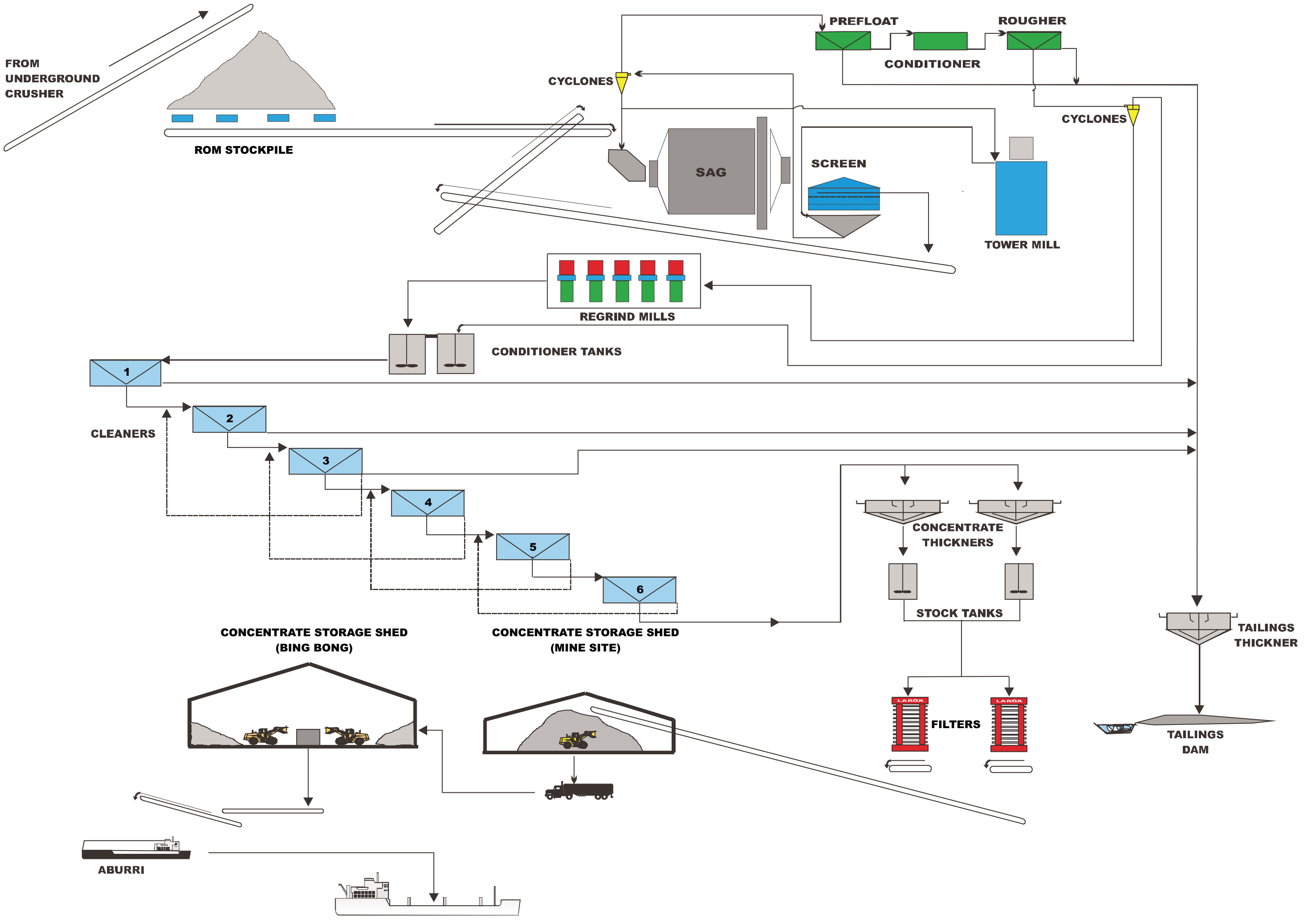
EXISTING PROCESS FACILITIES

Figure: **3.1**

Rev: A

A4

Horizontal Datum: AGD84, Zone 53
Date of Aerial Photography, 2001



McARTHUR RIVER MINE
OPEN CUT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

EXISTING PROJECT FLOWSHEET

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Figure: **3.2**
Rev. B
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3.4.2 Primary Grinding

The secondary crushed ore is reclaimed from the stockpile using plate feeders, which are situated in a tunnel beneath the stockpile, to feed ore into the Semi Autogenous Grinding (SAG) mill. The SAG mill is approximately 6 m in diameter and 7 m in length and rotates at 12 rpm. Approximately 20% of the SAG mill internal volume is occupied by 92 mm steel balls which assist in the breakage and size reduction processes inside the mill. The discharge end of the mill contains a grate with 20 mm apertures. Particles which are smaller than the grate flow out of the mill onto a vibrating screen. Particles that are larger than the grate apertures remain in the mill for further size reduction.

The vibrating screen provides further size classification, with particles finer than 0.8 mm passing through to the cyclone feed sump. Particles coarser than 0.8 mm are returned to the SAG mill feed for further grinding. The particles which report to the cyclone feed sump, are pumped to cyclones which separate fine and coarse material. The coarse particles are recycled back to the SAG mill and a vertical tower mill for further grinding. The fine particles report to the rougher flotation stage. The product size from the primary grinding circuit is 70% passing 38 microns.

3.4.3 Rougher Flotation

Rougher flotation is the first stage of upgrading the zinc and lead minerals in the feed while rejecting the iron, silica and other non-valuable minerals. The objective of the flotation stage is to remove as much of the unwanted, worthless mineral, while recovering as much of the valuable minerals as possible.

The following three chemicals are added to the rougher stage to aid the flotation of zinc and lead:

- Frother to provide stable froth (bubbles).
- Copper sulphate, which coats the zinc minerals and makes them more readily floatable.
- Collector, namely xanthate, which allows the copper coated zinc minerals to adhere to air bubbles and float to the surface.

The fine particles from the cyclones in the primary grinding stage flow into a series of interconnected agitated tanks, called flotation cells. Each flotation cell contains a hollow agitator, which allows air to be pumped into the base of the cell. The motion of the agitator inside a stationary stator provides agitation for the flotation cell and shears the delivered air into fine bubbles. The zinc and lead minerals attach to the rising air bubbles and report to the surface as a froth, called rougher concentrate, which reports to launders positioned around the lip of the flotation cells. The unwanted minerals remain in the slurry and gravity flow to the tailings disposal sump.

The rougher concentrate is pumped to another set of cyclones for particle size classification. The coarse underflow stream is directed to the regrinding circuit while the fine overflow size is directed to the cleaner flotation circuit.

3.4.4 Regrinding

The regrinding stage is designed to further reduce the size of the particles recovered in the rougher stage so that the zinc and lead minerals can be further liberated and consequently upgraded in the subsequent cleaner stages.

The regrinding circuit consists of horizontal stirred mills. They consist of a stationary rubber lined outer shell, with the grinding motion being imparted by a rotating internal stirrer. They are filled with 2 to 4 mm silica sand which acts as the grinding media. The stirrer is rotated at high speed and provides the grinding action and classification mechanism at the rear of the mill.

The mill discharge reports to a nest of hydrocyclones that provide further size classification. The coarse underflow from the cyclones reports back to the regrinding circuit, and the fine overflow reports to the cleaner flotation circuit.

3.4.5 Cleaner Flotation

The cleaner flotation stage continues the upgrading of the zinc and lead content in the concentrate. Additional copper sulphate and xanthate are added at this stage as well as a depressant reagent which is used to retard the flotation of the iron and silica minerals.

Multiple stages of cleaner flotation are used to increase the concentrate grade to saleable levels. Large amounts of dilution water are added to the flotation slurry to aid the upgrading process. The concentrate streams from each flotation stage are pumped to the next stage for further upgrading. The stream from the final stage is pumped to the concentrate thickener. The tailings streams from the initial cleaners report to the final tailings while the tailings from the last three cleaners are recycled back to the feed of the previous cleaner bank.

The tailings streams from the rougher and the cleaner circuits are combined and pumped to the tails thickener.

3.4.6 Thickening and Filtration

The concentrate stream from the flotation circuit contains a large volume of process water, which needs to be recycled. The concentrate is fed to thickeners where the water and solids are separated. A thickener is a large diameter tank, which allows the solid particles to settle while providing an overflow launder around the periphery of the tank to collect to the clear overflow water. The settled solids are raked to the centre of the thickener via a rotating rake arm. The solids are removed from the centre of the thickener via pumping. Flocculant is added to the thickener feed to increase the solids settling rate and to aid the overflow clarity.

The solids from the concentrate thickener are pumped to holding tanks ahead of the pressure filters which reduce the water content in the concentrate to approximately 12%. This is the ideal moisture level for transport: not too dry so as to avoid dust issues, and not too wet to cause problems with ocean transport.

3.4.7 Tailings

The tailings stream from the flotation circuit is pumped to thickeners which operate in the same way as the concentrate thickeners. The solids from the tailings thickener are pumped to a tailings disposal hopper, and then pumped to the tailings storage facility. The tailings settle in the storage facility allowing the water to run off and be collected and returned to the concentrator for reuse.

3.5 Concentrate Storage and Haulage

3.5.1 Storage

The dewatered concentrate is transported from the filter building to the mine site concentrate storage shed via an enclosed 600 mm wide conveyor. The storage shed comprises two compartments, each of approximately 3,000 t capacity and a load-out area. Storage is required to facilitate short-term market fluctuations.

3.5.2 Haulage

Road-trains with covered, side-tipping trailers are used for the transport of concentrate from the mine site to the port at Bing Bong. The trailer arrangement consists of prime movers with quad-axle trailers in a double AB configuration. The road-trains usually have a payload of approximately 120 t.

The concentrate is loaded into the trailers using a front-end loader. The loading bay is wide enough to allow two trailers to be positioned for loading at a time. Hence the road-train is repositioned several times to complete the loading activity. Fugitive dust from the concentrate in the storage and loadout area is minimised by the material’s moisture content of approximately 12%.

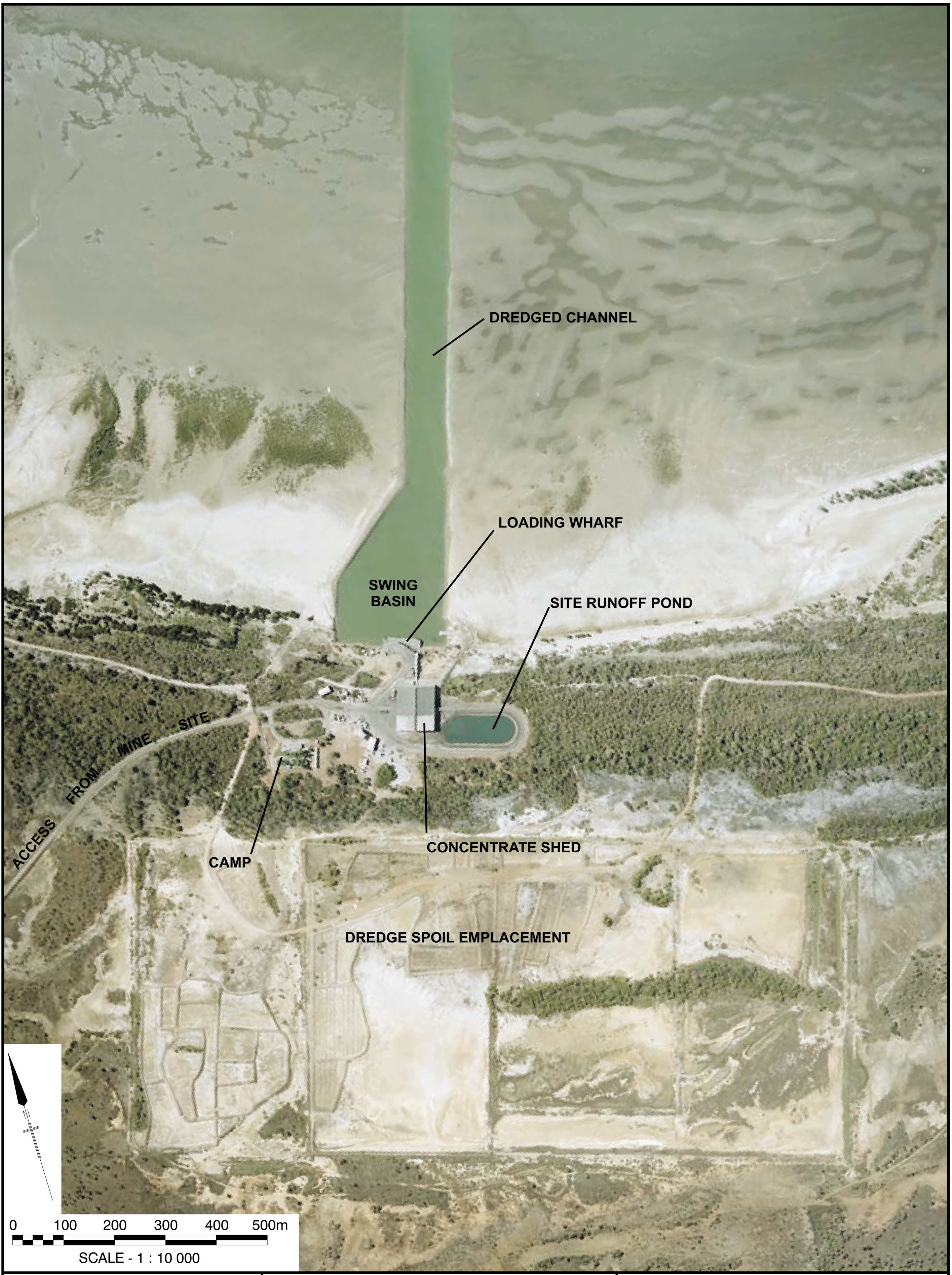
The loaded road-trains pass through a wheel wash as they leave the mine site. Dust emissions while in transit are controlled by a protective cover that is placed over each trailer.

The distance from the mine site to Bing Bong is approximately 115 km. The Northern Territory and Federal Governments have upgraded the road to a two-lane highway, including a new section, which bypasses the town of Borroloola.

3.6 Bing Bong Port

3.6.1 Layout

The layout of MRM’s Bing Bong Port Facility is shown on Figure 3.3. The concentrate storage shed has the capacity of 60,000 t of concentrate. A central ramp divides the shed in half, with the conveyor tunnel creating four compartments. Depending on which compartments are to receive the load, the road-train



McARTHUR RIVER MINE
OPEN CUT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

BING BONG PORT

Drawn: VH	Approved: CMP	Date: 29-11-2004	Figure: **3.3**	Rev. A
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either proceeds directly into the shed via the western entrance, or proceeds around the site runoff pond and through the eastern entrance.

Stockpile control and maintenance is carried out using front-end loaders to move concentrate away from the truck discharging area to be stacked at the rear of the shed compartments. The moist concentrate reduces dust generation during handling.

To the east of the concentrate shed is the site runoff pond and to the west is the administration area and worker accommodation facilities.

3.6.2 Bulk Carrier

The Aburri is the bulk carrier used to transport concentrate to sea-going vessels and was designed specifically for MRM. Its dimensions are 80 m by 18.5 m with a draft of 3.5 m and a capacity of 3,200 t. The Aburri was built to all applicable Northern Territory Marine and Australian Standards and has an International Lloyd’s classification of “100 A1”.

A feature of the Aburri is its ability to self-load (from a single shore mounted loading chute) at an average rate of 900 to 1,000 tonnes per hour (tph) and then discharge at an average rate of 900 to 1,000 tph into an ocean-going vessel. The cargo capacity of each consignment may vary from 6,400 to 45,000 t.

The concentrate handling system consists of conveyor belts, a plough station (for even distribution of the load within the hold) and a bucket wheel. The bucket wheel is the primary discharge unit that feeds concentrate onto internal conveyors, then onto a discharge boom that reaches across and into the hold of the sea-going vessel.

3.6.3 Transit Route

Once the Aburri is loaded it disengages its moorings and shuttles out to the ocean-going vessel waiting in the designated and approved offshore transfer zone (Figure 1.3). The zone has an average depth, at low tide, of 14.75 m.

Navigation lights lining the channel enable 24-hour operation. Accurate direction is provided by a channel leading beacon which emits a bright white light when centred and red and green for either side of the channel when off-centre. The wharf and bulk carrier have adequate lighting for safe night loading operations.

3.6.4 Ship Loading

The transfer of concentrate cannot commence until the masters of both the Aburri and the ocean-going vessel are satisfied that all necessary preparations are completed and that the prevailing weather conditions are acceptable.

Once the vessels are secure, the discharge point of the loading boom is positioned in the centre of the nominated open hatch, with the chute below the hatch coaming. The concentrate in the Aburri is progressively fed onto the conveyor belts by the bucket wheel and into the discharge chute with the rate averaging 900 to 1,000 tph.

Xstrata supports all Australian Quarantine Inspection Service requirements to ensure that sea-going vessels carrying MRM concentrate comply with current ballast and quarantine guidelines.

3.6.5 Dredging

Background

To enable the Aburri to move between the port facilities and the offshore transfer zone, it was necessary to dredge a 3.5 km long channel through the shallow offshore area. Prior to 2004, the channel had not been dredged since its construction in 1995. The Aburri was able to maintain shipping schedules until the 2001 cyclones. Since February 2001, the channel has been filled with sediment and shipping movements were considerably restricted resulting in significant economic impact to the operation.

The 1992 EIS for the project (Hollingsworth Dames & Moore, 1992) and supplementary documents indicated there may be an ongoing requirement for maintenance dredging and these documents were subsequently accepted by DBIRD as a component of the MRM environmental assessment. More details were provided to DBIRD about the need for maintenance dredging and the dredging was approved via the 2002/2003 Mining Management Plan. The approval was for an initial dredging campaign to be undertaken in 2004 with ongoing dredging campaigns each year for the next four years.

Dredging Program

Dredging will be undertaken progressively over a number of years. Hydrographic surveys have indicated that approximately 400,000 to 500,000 m^3 of sediment will need to be relocated to return the channel to the original dredge depth. This is to be undertaken over approximately five years, commencing in 2004.

The 2004 dredging campaign involved the removal of approximately 90,000 m^3 of material from the central section of the dredged channel. In subsequent years both this and other sections of the channel will be dredged until the channel’s design depth of 4 m is obtained.

Dredging Methodology

A cutter suction dredge is used for the dredging and it operates at a rate of approximately 2,000 m^3 per day.

Dredged material is to be relocated to two designated areas 100 m to the west of the channel: one nearshore site with a capacity of 145,000 m^3; and one offshore site near the end of the channel with a capacity of 200,000 m^3. The material will be located on the western side of the channel because the currents are generally easterly. The balance of the dredged material is to be used in geosynthetic socks to be placed along the eastern side of the channel to minimise ongoing sedimentation.

Potentially contaminated material has been identified in the immediate swing basin area. This material will be assessed in terms of its bioavailability and potential impacts. Alternative disposal options such as land disposal will be considered. This material will not be dredged until later in the dredging program. Prior to that time an evaluation will be made and alternatives considered. A full assessment will be provided to DBIRD.

Turbidity

Monitoring undertaken by Parry and Munskgaard (1994) during the capital dredging program showed that the plume was relatively small and confined to a small area around the dredging. A similar methodology is used for the maintenance dredging. Turbidity is monitored to ensure that turbidity levels do not significantly exceed that of background levels as determined by sampling progressively away from the plume until readings level out and are not influenced by the dredging.

Monitoring data are used to set appropriate operating boundaries so that future dredging conditions do not impact turbidity outside the lease area. Research has shown that turbidity is a natural seasonal occurrence in this region. Seagrass in the area is adapted to recover from these natural fluctuations.

3.7 Workforce

The existing project workforce is accommodated in an on-site accommodation village located to the north of the airstrip (Figure 3.4). This camp provides self-contained living quarters together with dining and recreational facilities. Approximately 90% of the workforce works on a fly-in/fly-out basis out of Darwin. The remainder live locally, mainly in Borroloola.

In addition, an accommodation camp with a capacity of 30 is provided at Bing Bong. These facilities house workers on a short-term basis during ship loading operations.

The current (2005) workforce of the MRM operations is 330 with 8 trainees.

McARTHUR RIVER MINE
OPEN CUT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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ACCOMMODATION VILLAGE

Figure: **3.4**

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