4 Project Description

4.1 Project Background and History

McArthur River Mine (MRM) is a major open pit operation developing one of the largest known sedimentary stratiform zinc-lead-silver deposits. The ore-bodies making up the deposit, known as "Here's Your Chance" (HYC), were discovered in 1955 by Mount Isa Mines Limited geologists. However, initial development did not commence until 1975. This gap in time between the deposit's discovery and development was due to 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.

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 commercial technique of ore beneficiation. Technological advancements in mining, ore treatment and concentrate transport were required before the deposit's development was economically feasible.

In 1975 a small decline and pilot plant were constructed on-site, with the subsequent 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 resulted in MRM to be reassessed. Feasibility studies indicated that the project could be developed and following the preparation of an Environmental Impact Statement (EIS) in 1992, development of MRM's underground operation commenced in 1994, with the first shipment of concentrate commencing in mid-1995.

Up until 2006, MRM was an underground operation producing around 333,000 dry metric tonnes per annum (dmtpa) of bulk lead-zinc-silver concentrate for overseas and domestic markets. MRM converted to an open pit operation following the completion of the 2005 environmental impact assessment (EIA) process for the Phase 2 Project (Phase 2).

The total current operational workforce is approximately 440 permanent personnel. The majority of operational employees work either an eight days on/six days off roster (mill), with the mine mostly 14/7 with some 7/7. Most support and management staff working a five days on/two days off, four days on/three days off roster.

4.2 Proposed Project

McArthur River Mining Pty Ltd (the Proponent) proposes to expand the existing Phase 2 open pit mine with the development of the McArthur River Mine Phase 3 Development Project (the Project). The basis of the decision to proceed with the Project is discussed in Chapter 3 – Project Rationale and Alternatives**.**

A comparison of the key operational components of the existing operation and how they will change with the Project is shown in Table 4-1.

The Project will utilise all infrastructure currently being used by the existing operation, with some improvement, expansion or upgrade as required. An example of this utilisation is the mine accommodation village facilities, which will only require a relatively moderate expansion to cater for the Project's increased operational personnel.

Table 4-1 Summary comparison of existing operation compared to the Project

Component	Current Operations	Project Operations
Resource	53 Mt Reserve	115 Mt Reserve
Mining Rate	2.5 Mtpa of run-of-mine (ROM) ore	Up to 5.5 Mtpa of ROM ore
Mine Life	Until 2027 (at 2.5 Mtpa)	Until 2036 (at 5.5 Mtpa)
Mining method	Open pit mine using conventional drilling, blasting, loading and haulage methods	No change
Tailings	Tailings discharged to tailings storage facility	No change. Existing tailings storage facility used, with upgrades (conversion of a water management dam)
Pit Dimensions	Length – 1500 metres Width – 800 metres Depth – 210 metres Overall footprint – 145 hectares (within the existing approved bunded area)	Length – 1750 metres Width - 1500 metres Depth - 420 metres Overall footprint – 210 hectares (within the existing approved bunded area)
Waste rock	Stored on surface in overburden emplacement facility (OEF) – capacity 185 Mt	Stored on surface in existing and new OEFs – an additional 530 Mt
Processing	Heavy Media Plant treats some ore in a pre-concentration phase. Flotation process producing concentrate (46% Zn concentrate grade)	No change in method. Increase in processing capacity
Power	Gas fired turbines producing 20 MW. Fired with natural gas delivered to site via a pipeline from Daly Waters	No change in method. Gas power station capacity increased to a total of 45-50 MW
Product	360,000 dmtpa of lead-zinc-silver concentrate (166,000 tonnes of zinc in concentrate)	800,000 dmtpa of lead-zinc-silver concentrate (368,000 tonnes of zinc in concentrate)
Transport	Concentrate trucked 115 km to Bing Bong port, transferred to barge, barged to offshore loading area onto bulk carriers	No change in method. Approximate doubling of concentrate volume trucked to Bing Bong port concentrate storage and ship loading facility (up from 9 truck movements per day to 18) and barge movements (up from 110 to 250 per year)
Water Management	Bore fields water supply Mine water collected and utilised in the process Evaporation from on-site dams Water discharge licence granted	To continue. No creek/river diversions necessary Existing water management structures to be upgraded Irrigation scheme for beneficial use of excess groundwater to be investigated with adjoining pastoral lease.
Workforce	Approximately 440 permanent staff and contractors	Construction phase workforce peak at approximately 930 Operational phase workforce peak at approximately 735 permanent staff and contractors

The aim of expanding or upgrading the existing infrastructure is to:

- minimise land disturbance
- utilise existing infrastructure and increase efficiencies
- design around local issues (e.g. cultural considerations)
- located above known and calculated flood levels
- control potential contaminants.

ROM ore will continue to be trucked from the open pit to the processing plant where it will be crushed and ground. The ground ore will be slurried with flotation reagents and pumped to flotation cells where the zinc and lead bearing minerals will be recovered in the form of a bulk concentrate. The existing processing facilities that are currently used will be upgraded to have sufficient capacity to treat up to 5.5 Mtpa of ROM ore. The processing plant will produce 800,000 dmtpa of bulk concentrate, up from current levels of approximately 360,000 dmtpa.

The majority of the waste rock overburden from the Project will be stored at the existing North OEF located to the north of the mine area. Approximately 27% of the waste rock overburden would be stored in a new OEF to the east and south of the open pit, around the existing approved flood protection bund. The existing approved Tailings Storage Facility (TSF) will be utilised to accommodate the majority of the additional volume of Project tailings. The conversion of a new water management dam to a TSF, Cell 4, which will be joined to the western side of the existing TSF facility, will be used to store Project tailings from 2032 as current capacity is utilised. This new water management dam, that is being designed and constructed to facilitate future use as a TSF, is currently being considered under the annual Mining Management Plan process pursuant to Section 40 of the *Mining Management Act 2001*. This dam is required for water management purposes for current operations, independent of the Project.

As is current practice, the concentrate will be trucked to the Bing Bong concentrate storage and ship loading facility (Bing Bong) for export. After the completion of construction works being undertaken at Bing Bong in 2012 which are independent of the Project, the port concentrate storage facility will have the capacity to accommodate the increased output of Project concentrate and therefore no further upgrades are required.

The Project’s footprint is shown in Figure 4-1, which illustrates the proposed layout in comparison to the existing operations, while Figure 4-2 shows the proposed open pit stages.

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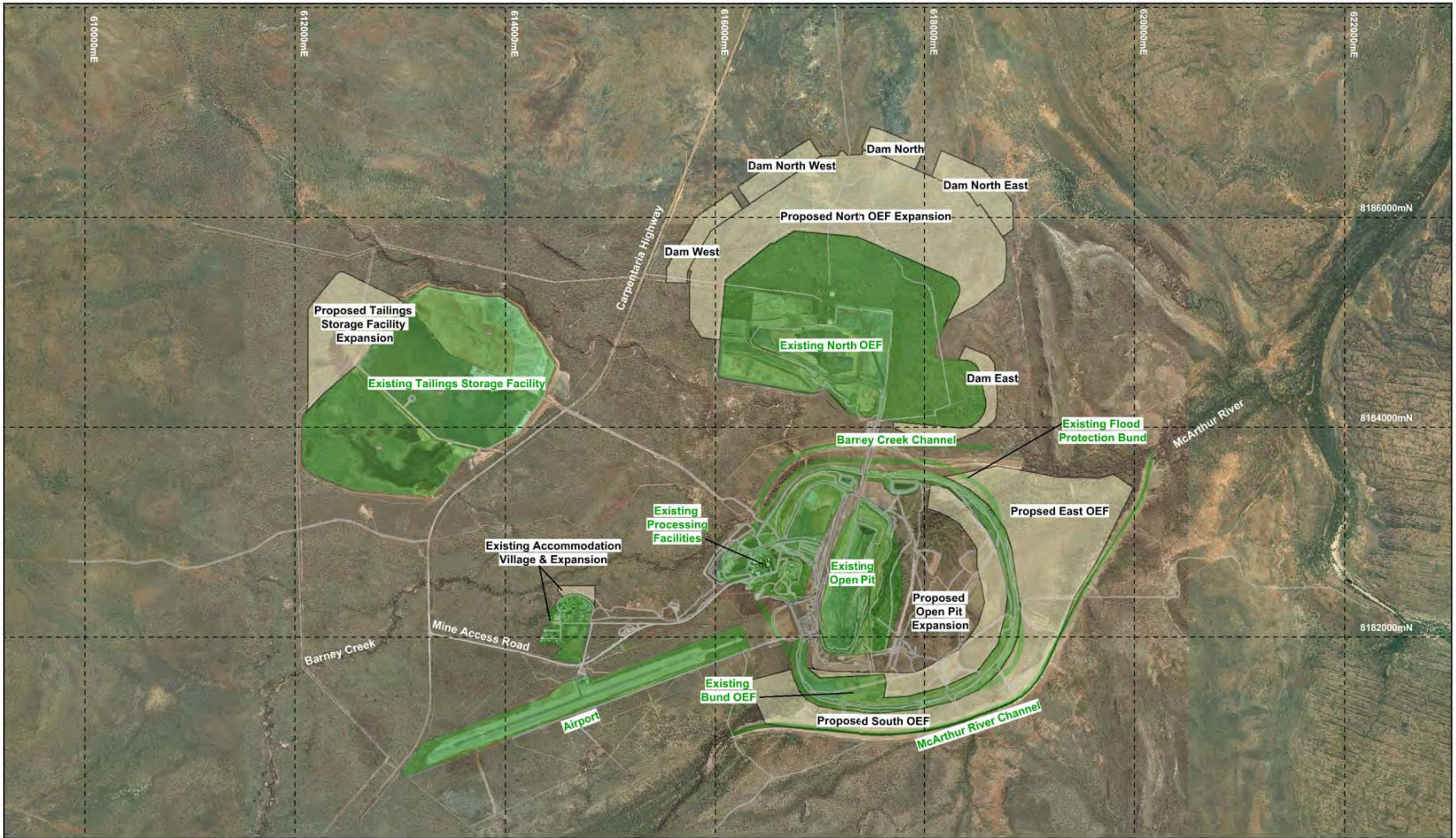

METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND
Existing Infrastructure
Proposed Infrastructure
Mine Roads

Data Source: Imagery - Xstrata

McArthur River Mine
Phase 3 Development Project

The Project

11/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 1

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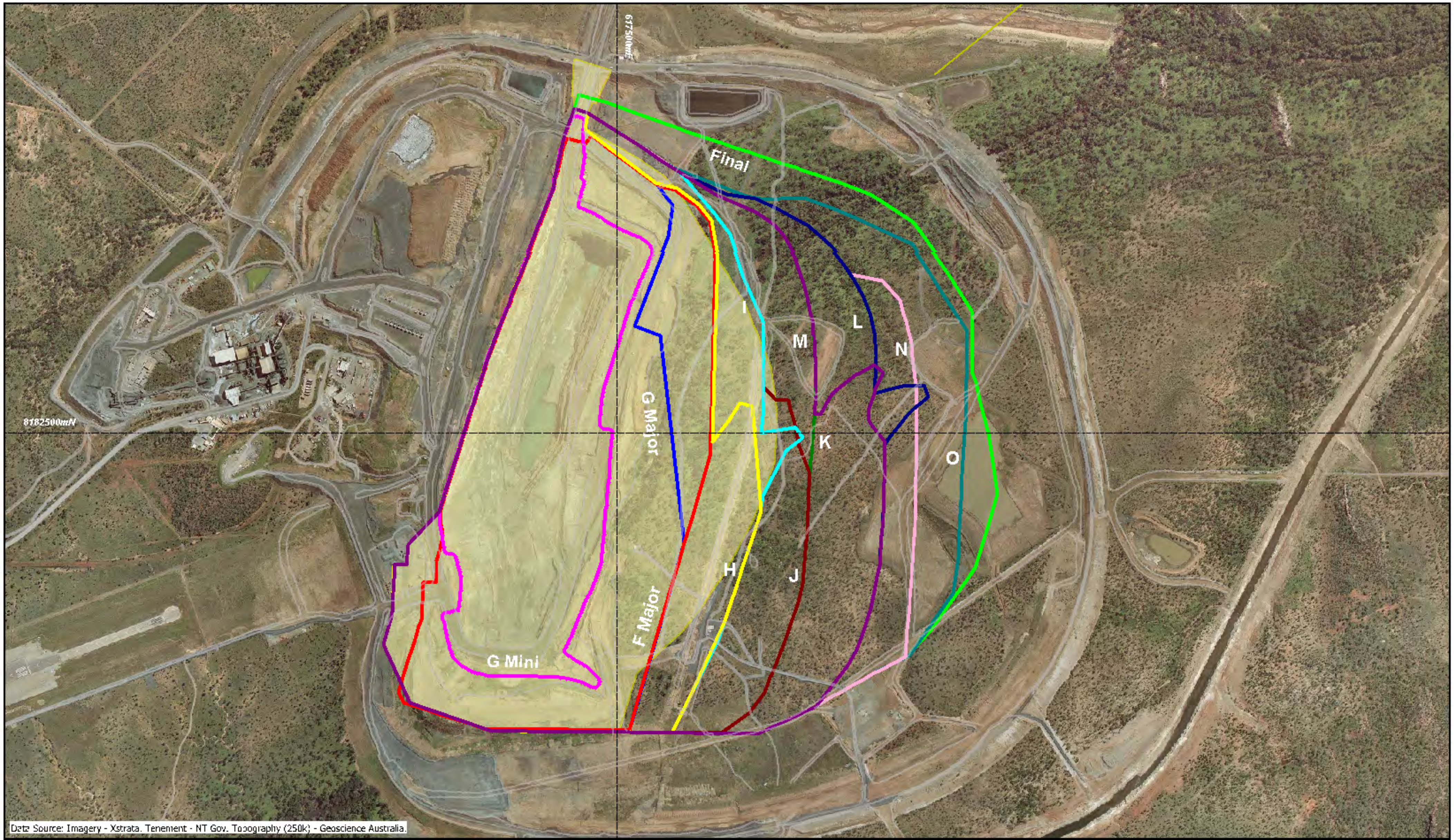

METSERVE

xstrata zinc

0 0.3

Kilometres

Scale: 1:15,000(A4)

LEGEND

Existing Open Cut Pit

PROPOSED PIT STAGES

H
I
J
K
L
M
N
O
Final

McArthur River Mine
Phase 3 Development Project

Proposed Pit Stages

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 2

4.3 Mining

4.3.1 Overview

The Project's mining process will involve the following activities:

- expansion of the existing open pit operation from 2.5 Mtpa to 5.5 Mtpa ROM, including excavation of the alluvial cover materials that lie above the bedrock. This material will be used for construction purposes, encapsulation of other overburden waste rock, or for rehabilitation purposes
- continued excavation of overburden above and in between the ore bodies. This material will be placed in the expanded and new OEFs
- excavation of ore from the pit. The ore will be hauled to a ROM pad where it will be fed into the upgraded ore processing plant
- decommissioning and rehabilitation of the disturbed mine areas in accordance with statutory requirements and agreed post-mine land uses.

Facilities associated with the Project's operations will include:

- ROM pad and ore stockpiles
- ore processing facilities
- OEFs
- borrow pits and topsoil stockpiles associated with rehabilitation activities;
- water management devices (pumps, drains, small receiving dams, dewatering bores, monitoring bores, evaporation dams and interception trenches)
- offices, crib facilities, and change house
- heavy vehicle hardstands (parking areas) and light vehicle car parks
- heavy equipment workshop with associated wash down bays and service areas
- stores warehouses and lay down areas
- blasting agent storage and explosives magazines
- village complex
- airport.

Most of these mine facilities are already in place and approved, with some requiring upgrade or relocation to accommodate the Project's expanded operations.

4.3.2 Open pit excavation and mine sequencing

The Project's open pit mining process will involve excavating overlying waste rock in horizontal benches to expose the target ore, which will then be removed for processing. As the majority of the ore-body dips at 25° to 35° to the east, the excavation will be undertaken in stages, commencing at the shallowest depths of the ore-body.

As the ore-body deepens, increasing amounts of overburden waste rock volumes will be removed for each tonne of ore mined. The ratio of overburden waste rock to ore mined (in tonnes) is defined as the 'strip ratio'. Above a certain strip ratio and depending on ore grades, metal prices, and mining and processing costs, it is no longer economic to mine ore by open pit methods. The Project's open pit size and mining schedule currently being considered will result in the removal of an additional 62 Mt of ore, increasing the Ore Reserve from 53 Mt to approximately 115 Mt.

To balance the strip ratio, mine excavation will be undertaken in 10 stages as shown in Figure 4-3 to Figure 4-7 (including those for the existing approved operations). Table 4-2 shows some key operational parameters associated with each stage. As it is relatively early in the mine planning cycle, the mine excavation stages may change as the mine plan is further refined and as actual conditions confirm the planning process.

The Project's open pit will be progressively excavated towards the east. Overburden will be hauled to various OEFs to best manage the haul distances and fleet requirements. Non-Acid Forming (NAF) overburden could be hauled to either the South, East and North OEFs, whilst Potentially Acid Forming (PAF) overburden will continue to only be stored in the North OEF. The OEFs would be developed in stages to balance disturbed area and rehabilitation with the schedule of overburden coming out of the pit.

The on-site water management system, including water management traps to contain sediment from the OEFs, will change throughout the mine life to account for the expansion of the OEFs and pit.

The average target ore production rate from the Project open pit is approximately 5.0 Mtpa of ore, with a range from between 4.3 Mtpa to 5.5 Mtpa depending on ore grades. At this rate, the life of the Project is planned to be until 2036. Upon completion, the open pit is planned to have a surface area of approximately 210 hectares (ha) and a depth of approximately 420 metres (m). The maximum length of the top of the open pit is planned to be approximately 1,750 m and the width is expected to be 1,500 m. The open pit will be contained within the currently approved bunded area. The operation open pit parameters are shown in Table 4-2. Note that a Phase 2 final pit would include part of the Project's stages J and K to total around 53 Mt of ore up to 2024.

Table 4-2 Project operational open pit parameters

Pit Stage	Year	Ore (Mt)	Overburden (Mt)	Total (Mt)	Strip Ratio	Mined Ore Grade (% Zn)	Area (ha)	Pit Depth (m)
G mini	2011 - 2011	0.6	0.1	0.7	0.2	10.6	52	104
G Major	2011 - 2013	5.9	21.4	27.4	3.6	9.2	102	120
F Major	2011 - 2016	12.0	38.4	50.4	3.2	8.9	102	152
H	2012 - 2017	6.7	45.3	52.0	6.8	9.2	118	176
I	2013 - 2020	14.1	59.0	73.1	4.2	9.1	126	200
Phase 2 Sub-total	**2011 - 2020**	**39.3**	**164.2**	**203.6**	**4.2**	**9.1**	**126**	**200**
J	2013 - 2021	5.0	54.0	59.0	10.8	9.7	141	224
K	2015 - 2022	7.2	70.5	77.7	9.8	9.5	157	224
L	2017 - 2031	12.1	107.3	119.4	8.9	10.0	175	312
M	2019 – 2030	13.3	97.0	110.2	7.3	10.0	190	304
Final	2022 - 2036	42.5	179.4	221.8	4.2	9.6	204	416
Phase 3 Sub-total	2013 - 2036	80.1	508.2	588.1	6.3	9.7	204	416
TOTAL		**119.4**	**672.4**	**791.7**	**5.6**	**9.5**	**204**	**416**

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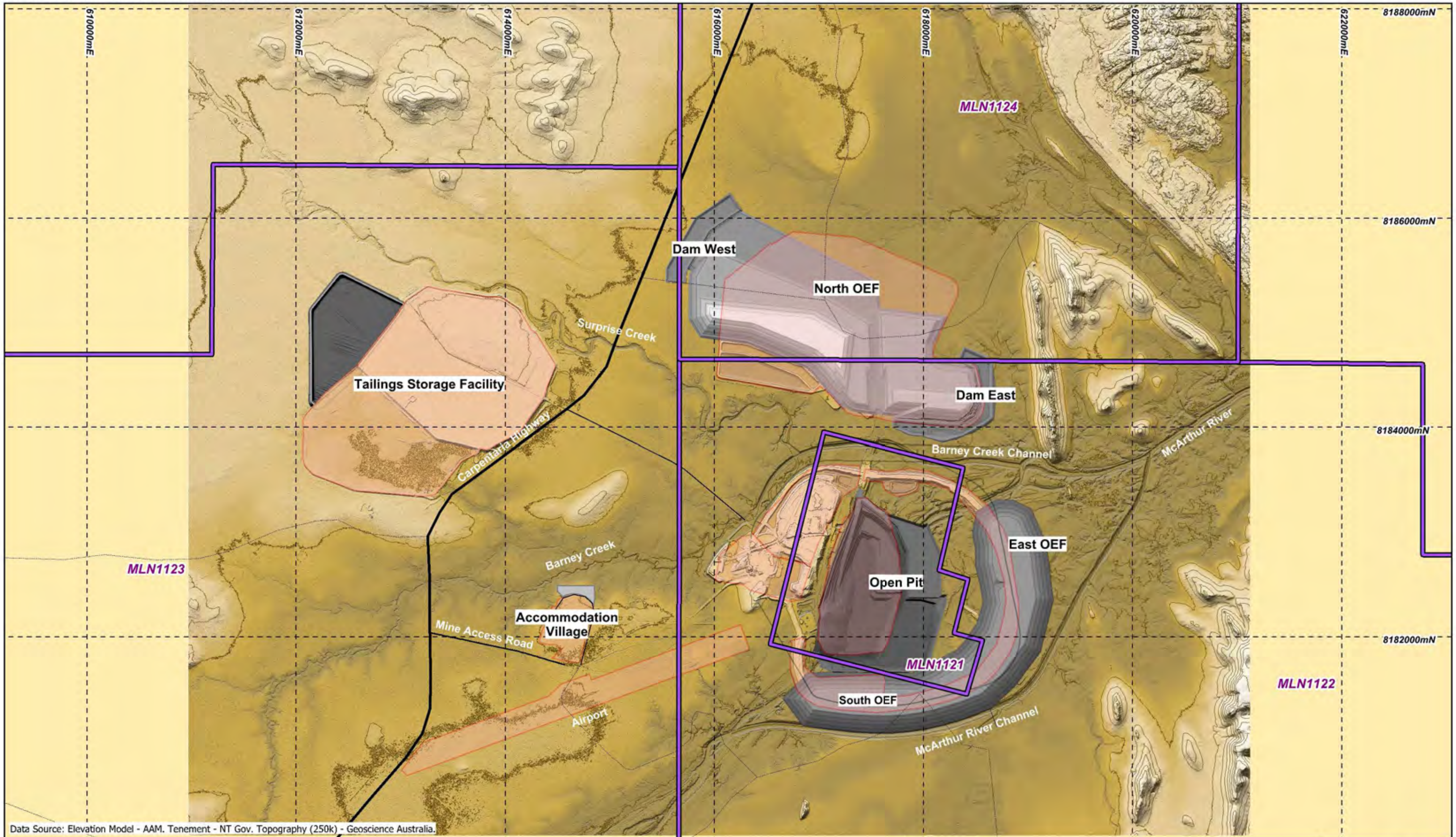


METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND
- Project tenement
- Proposed Infrastructure Expansion
- Existing / Approved Footprint
- Principal road
- Minor road
- Track

McArthur River Mine Phase 3 Development Project

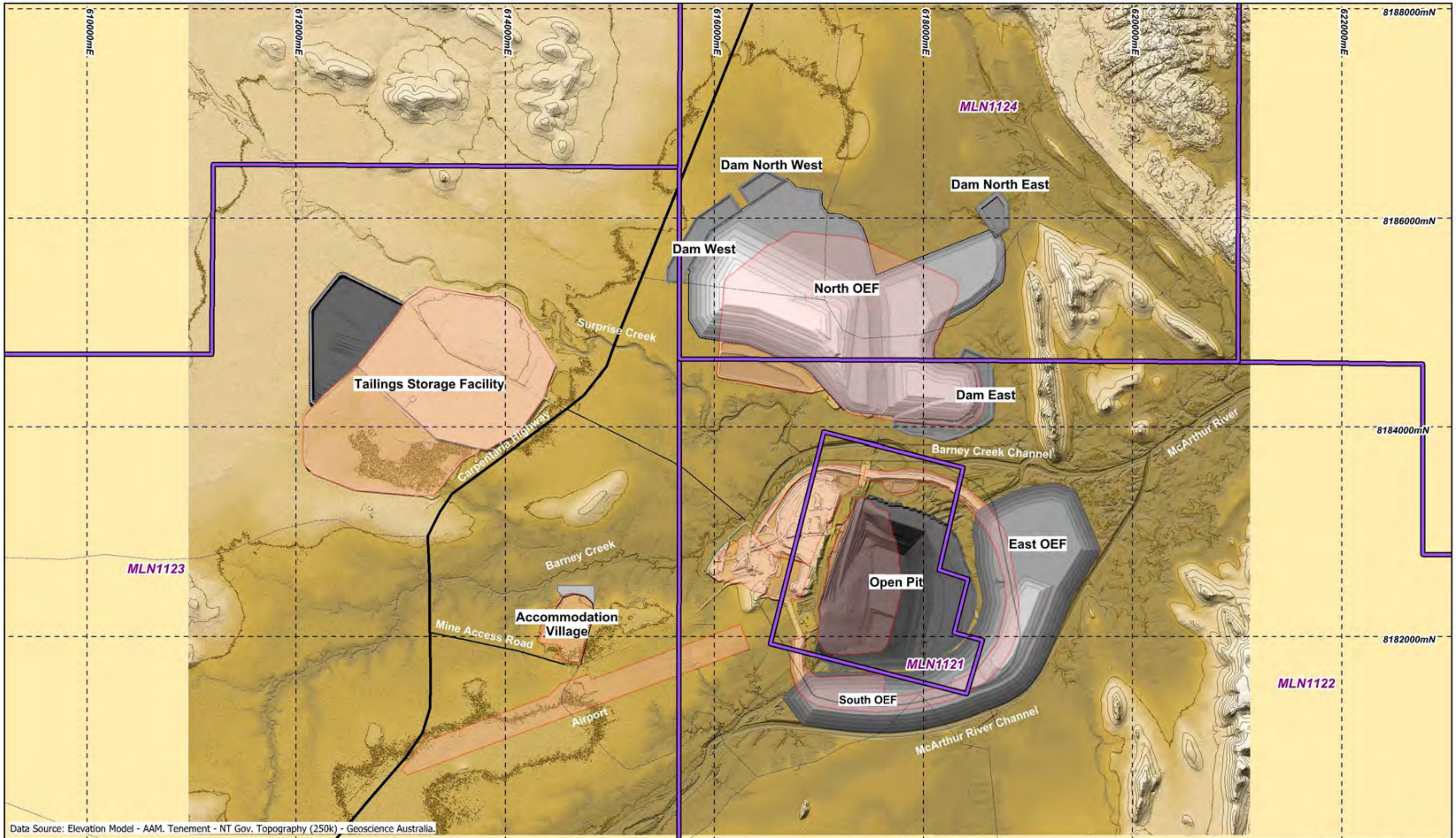
MRM Phase 3 Development Project - 2015

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 3

S:\Projects\XZ003 MRM Extension EIS_MapInfo\Workspaces\XZ003_M020C.wor



METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND
- Project tenement
- Proposed Infrastructure Expansion
- Existing / Approved Footprint
- Principal road
- Minor road
- Track

McArthur River Mine Phase 3 Development Project

MRM Phase 3 Development Project - 2020

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 4

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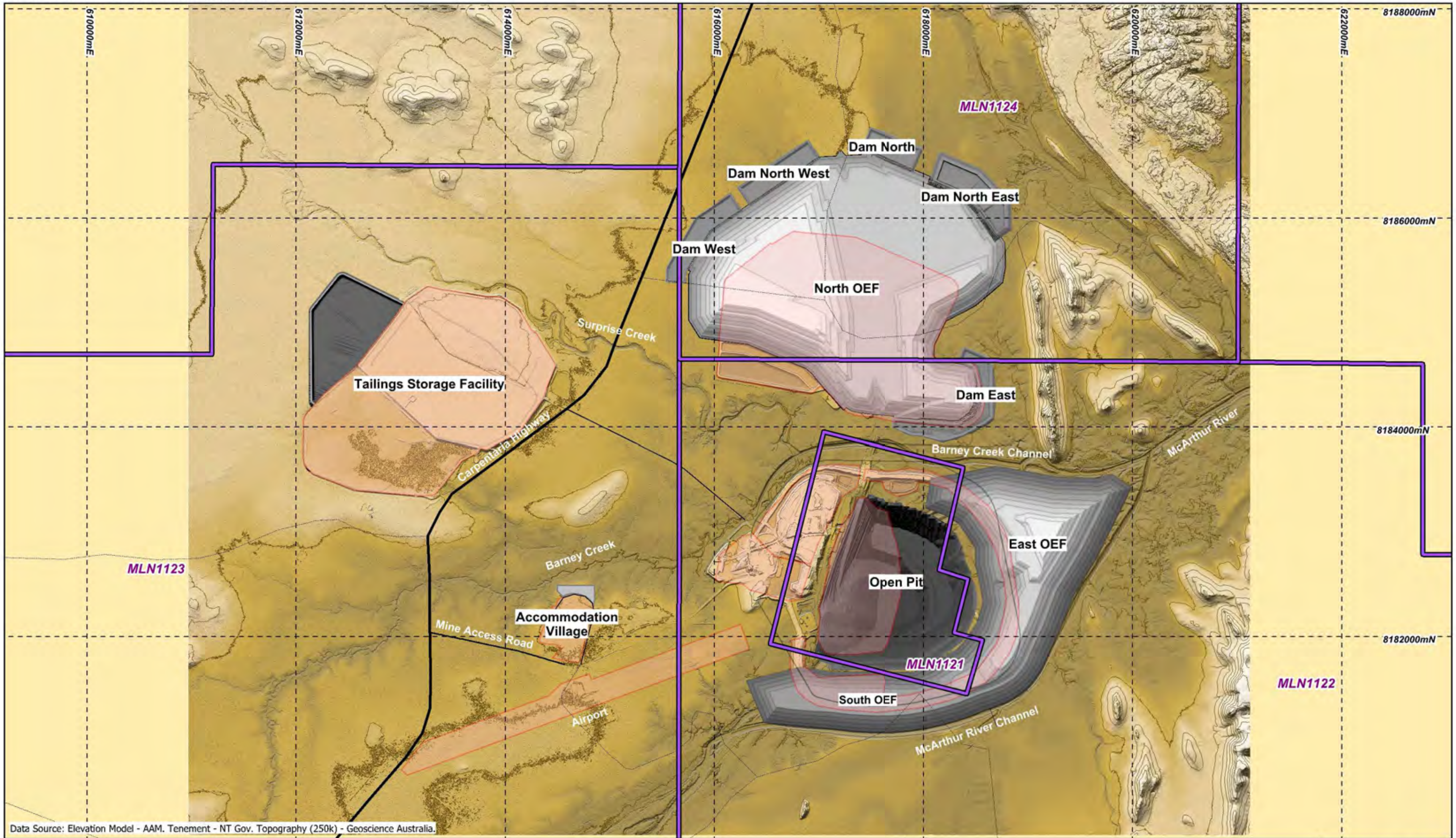

METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND
- Project tenement
- Proposed Infrastructure Expansion
- Existing / Approved Footprint
- Principal road
- Minor road
- Track

McArthur River Mine
Phase 3 Development Project

MRM Phase 3 Development Project - 2025

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 5

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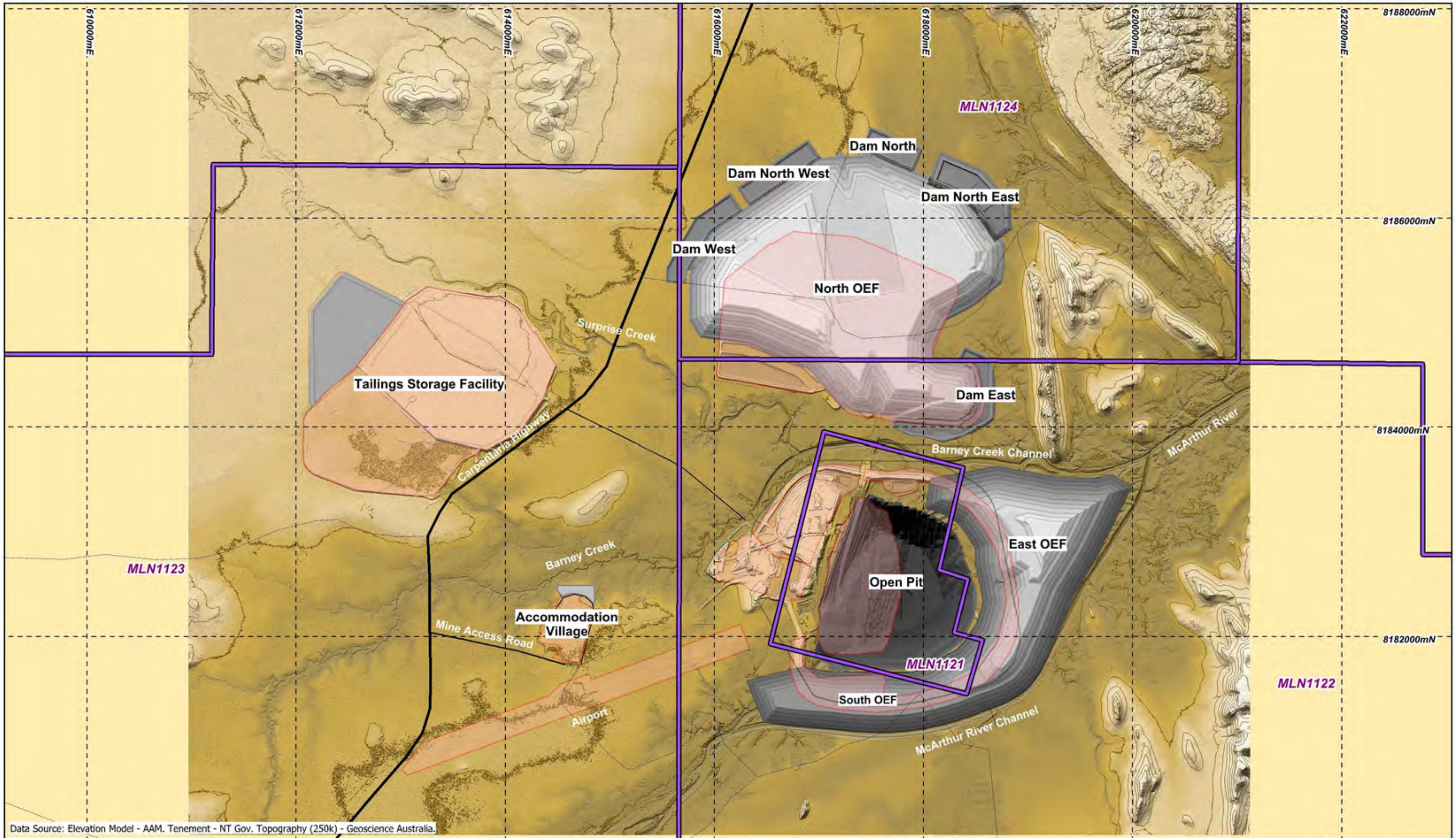

METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND

- Project tenement
- Proposed Infrastructure Expansion
- Existing / Approved Footprint
- Principal road
- Minor road
- Track

McArthur River Mine
Phase 3 Development Project

MRM Phase 3 Development Project - 2030

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 6

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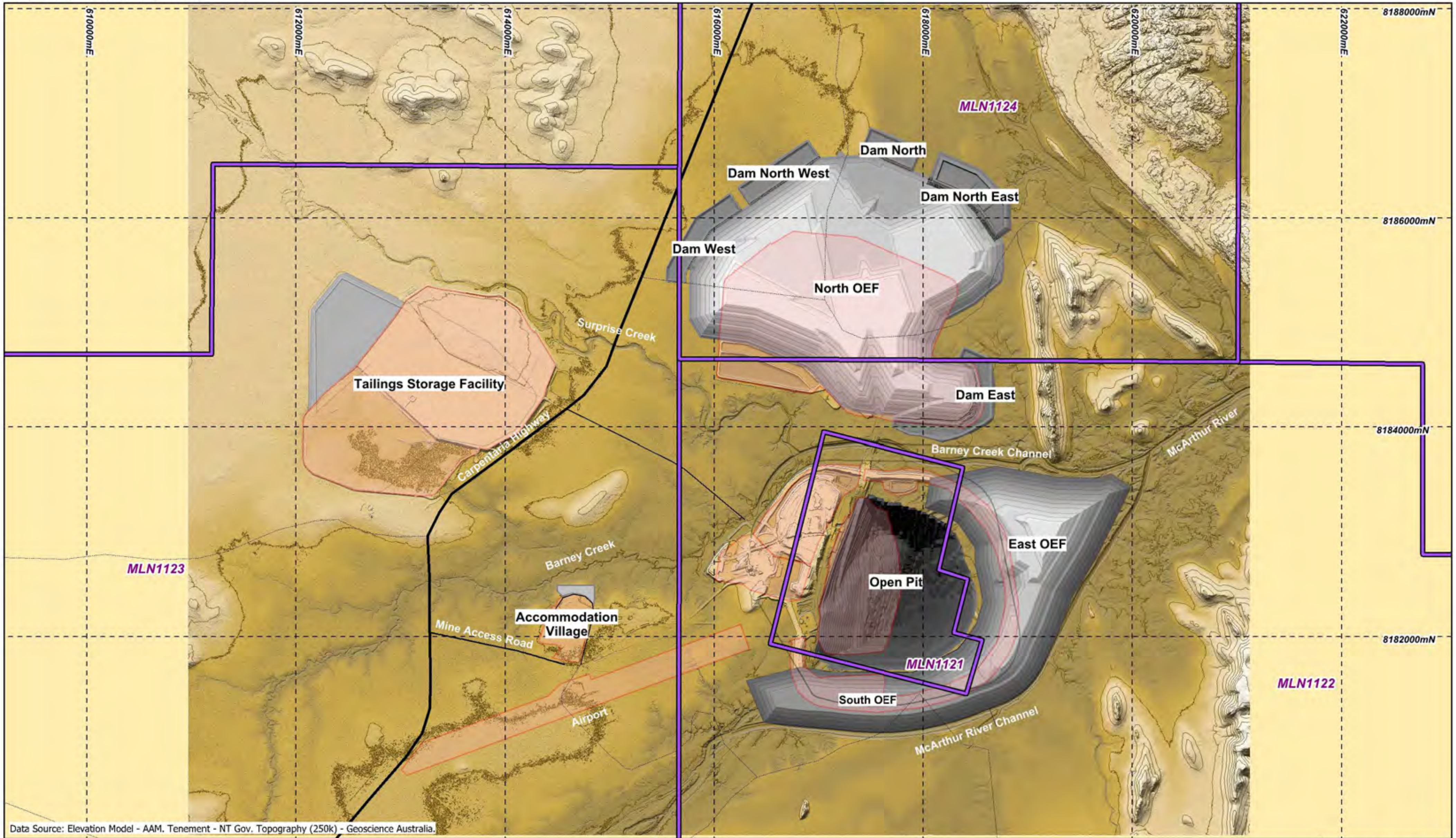

METSERVE

xstrata zinc

0 1
Kilometres
Scale: 1:50,000 (A4)

LEGEND
- Project tenement
- Proposed Infrastructure Expansion
- Existing / Approved Footprint
- Principal road
- Minor road
- Track

McArthur River Mine
Phase 3 Development Project

MRM Phase 3 Development Project - 2035

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 7

4.3.3 Open pit stability

Analysis of rock quality data has been undertaken to allow the Project to be designed with sound geotechnical engineering parameters. The main aspects of open pit mining that require careful design are:

- pit wall slopes, on an overall scale and on a bench scale
- batter angles and berm widths and intervals
- ground support requirements
- wall depressurisation through dewatering
- rock stability around the old underground workings.

The geotechnical parameters take into account the variation in rock types, orientations, geological structures and old underground workings.

4.3.4 Slope design

The Project will be divided into areas of discrete geotechnical properties, referred to as domains. Each domain will have a maximum slope angle between haul ramp segments. The relationship between overall slope angle, inter-ramp slope angle (IRSA), batters and berms is shown in Table 4-3.

When calculating the inter-ramp slope angles, a factor-of-safety (FoS) is used. The FoS is determined by numerous factors including rock properties, geometry of the open pit wall in relation to rock structure, stresses, weathering, life of the slope, interaction with underground voids, mining sequence and possible failure mechanisms. This quantifies the risk of failure of the slope, with a value below 1.0 indicating that the slope would be unstable. Walls that are required to stand until the end of mine life, or walls in areas critical to safe and/or effective production, are designed to a higher FoS (equal to or greater than 1.5). Temporary walls have a lower FoS, but are still greater than 1.0.

Use of the parameters in Table 4-3 resulted in FoS in excess of 1.0 for all slopes in the pit.

Table 4-3 Project - slope design parameters

	Alluvial and Weathered Zone	N, S, E Walls above Ore Zone	N, S, E Walls in Ore Zone	West Wall North of 2000 mN	West Wall South of 2000 mN
IRSA	12-22°	55°	45°	51°	22-25°
Batter angle	18-30°	65°	65°	65°	22-25°
Berm interval	24 m	16 m	16 m	32 m	0 m
Berm width	10-35 m	6 m	10 m	11 m	0 m

4.3.5 Haul ramp design

New haul ramps will be designed to be wide enough to allow the safe two-way passage of the largest trucks, with an allowance for drains and safety bunds. Industry practice recommends a road width of three and a half times the width of the largest truck using the road, with an allowance of approximately 6 m to 8 m for a safety windrow, berm and drain. The resultant road widths for various trucks that may be used over the life of mine are: a 27 m road for trucks of the 135 t class; and 35 m for trucks up to 250 t class.

4.3.6 Ground support

The Project's ore-body is affected by faults that can move the ore up or down relative to the adjacent rock. This could affect the pit where faults thrust blocks of rock in the ore zone upward, possibly exposing weaker rocks that lie under the footwall. Where geotechnical investigations determine potential for instability, ground support may be required. Ground support may involve using encapsulated cable bolts up to 30 m long to anchor the weaker exposed rocks to stronger rock further in the walls. Installation and monitoring practices to be implemented will be similar to those currently used at MRM to ensure that the support is satisfactory for the Project's proposed mine life.

4.3.7 Mining activities

The Project will have two distinct activities within the one open pit, as is the current practice with the existing operation: overburden removal and selective ore mining. The mining processes are similar to current practice for the extraction of overburden and ore, however, reflecting the Project's increased production rates, the type and number of mining equipment utilised will change.

The ore-body is interspersed with waste rock bands (interburden). To maximise the ore-body value, the mining operation will separate ore and waste rock material (overburden and interburden) so only economical ore will be fed to the processing plant. A dedicated trucking fleet will be utilised to transport ore to the processing plant and waste rock to the OEFs.

As is current practice, Project mining activities would operate 24 hours per day for 365 days per year, weather permitting. There may be times where material movement schedules require operation on day shift only.

The various stages of the mining process are described below in Sections 4.3.8 to 4.3.14.

4.3.8 Vegetation clearing and soil removal

The Project's open pit will be pegged out for clearing. Vegetation will be cleared in accordance with current site land disturbance procedures, before the removal of topsoil and subsoil by scrapers or loaders and trucks. The soil will be either stockpiled for later use rehabilitating disturbed areas, or used directly in rehabilitation, which is the current site practice.

The ore and waste rock in the Project's open pit is overlain by 5 m to 30 m of alluvial materials (such as sand, clays and gravels) that will be excavated using scrapers or diesel-powered excavators for loading this material into trucks. The alluvial materials may be used for Project construction purposes, capping PAF material in the North OEF or stockpiled for later use.

4.3.9 Drilling and blasting

Once hard material is encountered, drilling and blasting will be required to fragment overburden waste rock into suitable sizes for loading and hauling. Details of proposed blasting parameters for the Project's open pit are shown in Table 4-4. Blasts are expected to occur every two to three days with multiple shots potentially blasted at the same time.

As is the current practice, Project blasting would occur only on the day shift.

Table 4-4 Blasting parameters

Material	Bench height (m)	Hole depth (m)	Hole diameter (mm)	Holes drilled per day	Area of typical shot (m^2)	Shots per year
Ore zone	8	9.0	115-165	82	2,300	133
Overburden	16	17.5	140-250	67	8,800	133

The raw materials (blasting agents) which are not classed as explosives will be stored in the existing secured compound. These materials will be loaded into purpose built mobile manufacturing trucks for transport to the blasting area, as is current practice. The blasting agents will not become explosives until they are mixed as the product is loaded into the drill holes. Extra storage tanks will be required for the increased quantities of explosives used.

Detonators and boosters, which are classed as explosives, will be kept secure in licensed magazines in accordance with the relevant Northern Territory legislation and Australian Standards.

4.3.10 Loading, hauling and OEF management

Conventional mine loading and hauling equipment will be used in the Project's open pit. Selective ore mining will use diesel-hydraulic excavators ranging in size from 180 t to 550 t capacity. The excavators will load ore into 135 t to 220 t rear dump haul trucks. Overburden removal will occur via a dedicated trucking fleet. These machine sizes are similar to those envisaged for the current approved operations.

The proposed increase in ore production will require an increase of ROM stockpile capacity. Ore from the Project's open pit will be hauled to a new ROM pad for subsequent feed into the processing plant. Ore stockpiles on the ROM will be sized to hold one to two months of concentrator feed. The existing ROM pad is too small for current operations and is to be moved to the West OEF with a new primary crusher. Project operations would use this same infrastructure.

The majority of overburden from the Project open pit will be hauled to the existing North OEF and the new east and south OEFs surrounding the open pit. The OEFs will be continued to be managed in the same way as current practice, with PAF material being encapsulated by clay and NAF material. A new OEF to the east and south of the pit would be used to store only NAF material.

The locations of these OEFs throughout the mine life are shown in Figure 4–3 to Figure 4–7.

4.3.11 Ancillary tasks

As is the current practice, many support services will be required for the Project's mine operation to function safely and efficiently. The nature of these tasks and the type of equipment required are summarised in Table 4-5.

Table 4-5 Project ancillary tasks

Equipment	Tasks
Water cart	Dust suppression on roads, drills, rock piles and blasted ground
Grader	Formation and maintenance of haul roads and work areas, clearing of new mine areas, formation of drainage furrows and swales
Track dozer	Clean-up at loading areas, clearing of new mine areas, road building, pushing and rehabilitation on the overburden emplacement facilities
Compactor	Compaction of roads and parts of the overburden emplacement facilities
Small excavator	Rock breaking, pit wall scaling, pump moving
Wheel loader	Miscellaneous loading, crusher loading
Articulated trucks	Miscellaneous hauling, such as topsoil and construction materials
Wheel dozer	Cleaning up loading areas and roads, pushing on the overburden emplacement facilities
Scrapers	Topsoil stripping, dam and road construction
Lighting plants	Illumination of working areas at night

4.3.12 Mine water management

Changes to the existing surface water management measures will be required to accommodate the proposed changes to the mine site layout (e.g. increased open pit area, extended OEFs, TSF Cell 4). The proposed Project surface water management strategy will use a number of existing surface water management measures as well as a number of additional surface water management measures that will be implemented during both construction and operational phases. Due to the location of the Project open pit and OEF expansions, changes to water management infrastructure will be required that will involve the construction of new water management structures throughout different stages of the Project.

The overall philosophy and objectives of the MRM surface water management system will remain the same as existing operations. Clean water will be diverted around disturbed areas. To secure dry open pit working conditions and secure pit wall stability, a network of interception bores and cut-off trenches will be strategically located to intercept groundwater that would otherwise flow into the open pit. Water runoff from operational areas will be directed to appropriately sized sedimentation traps. All traps will be designed to appropriate standards and sized in accordance with calculations from the site water balance model. Final designs will be engineered as per regulatory requirements.

New water management measures to manage the beneficial use of groundwater flows as the open pit expands that are proposed for the Project include discharge into the McArthur River, under appropriate discharge criteria, and the investigation of an irrigation scheme on the adjoining pastoral lease.

MRM is committed to the efficient use and responsible management of water resources in its activities. By implementing water efficient work practices and recycling, the consumption of raw water will be kept to a minimum. The existing site water management system focuses on separating clean run-off from mine affected water and maximising the recirculation of process water for use within processing facilities and for dust suppression.

Suitably constructed haul roads will continue to allow open pit operations to continue during light to moderate rainfall events. Heavy rainfall events may cause the temporary interruption of pit operations because of the risk to operator safety. If flood waters are above the base of the existing flood protection bund, personnel would only be permitted to operate in areas deemed safe by continual risk assessments and monitoring. The Project would require additional surface haul roads to access the expanded pit and OEF areas.

No rivers or creeks will be diverted as part of the Project. A minor drainage line will be realigned to divert clean water around the North OEF.

Further detail on mine water management is provided in Chapter 10 - Water Resources, and Appendix D3 – Surface Water.

4.3.13 Interaction of previous underground and Phase 2/Project open pit operations

The current operations regularly intercept the old underground workings, as will the Project's operations. Work practices will be monitored and managed to ensure personnel safety within the Project's open pit. Extensive computer modelling was undertaken by geotechnical specialists to investigate the effects of previous underground mining on the stability of the Project's open pit. Modelling has predicted areas of tension in the rock above the underground voids, and outside the active open pit in some areas, which would result in zones of weakened rock.

These findings resulted in the following design and operations practice recommendations:

- a reduction in the recommended IRSA in the ore zone (Table 4-3)
- a crown pillar thickness of at least 20 m is required for safe Project operations above unfilled bulk stopes. The drill fleet will include a rig capable of drilling at least 70m long holes to adequately probe for old workings, and enable them to be filled where appropriate

- the water table should be drawn back to at least 100 m from the walls using weep holes. These are holes drilled into the walls at an upward angle to tap into water trapped in the rock, allowing it to drain freely. This reduces pressure build-up that may cause pit wall instability.

4.3.14 Industrial facilities

The existing facilities are currently being moved to make way for upgraded processing infrastructure, independent of the Project. This will include mining offices, change houses, crib rooms, hardstands, and heavy equipment workshops. The blasting agent storage compound will remain in its current location. The Project would use the same relocated facilities, though extra capacity would be required in the workshop, change house and crib rooms as the mining activities ramp up.

4.3.15 Project mining schedule

The conceptual Project mining schedule is summarised in Table 4-6 and illustrates that the mining rate will have several distinct phases over the Project’s life. The peak total mining rates of over 60 Mtpa will occur in years 2020 to 2025 of Project mining operation, and are associated with stripping down overburden in the major open pit cutbacks.

The mining rates will then drop to around 6 Mtpa until the end of mining in 2036. The mine sequence is also shown in Section 4.3.2**.**

Table 4-6 Proposed mining schedule

Year	Phase 2			Project			TOTAL		
	Ore (Mt)	Waste (Mt)	Total Mined (Mt)	Ore (Mt)	Waste (Mt)	Total Mined (Mt)	Ore (Mt)	Waste (Mt)	Total Mined (Mt)
2012	2.9	30.1	32.9	0.0	0.0	0.0	2.9	30.1	32.9
2013	3.1	23.3	26.4	0.1	5.5	5.6	3.2	28.8	32.0
2014	2.9	18.5	21.4	2.5	11.0	13.5	5.5	29.5	35.0
2015	2.9	18.5	21.4	2.3	11.3	13.6	5.2	29.8	35.0
2016	2.7	18.6	21.3	2.7	11.1	13.7	5.4	29.6	35.0
2017	3.1	14.0	17.1	2.1	15.8	17.9	5.2	29.8	35.0
2018	3.1	3.2	6.3	2.1	26.7	28.8	5.2	29.9	35.0
2019	3.0	2.1	5.1	1.7	31.0	32.7	4.7	33.1	37.7
2020	2.9	1.1	4.0	1.9	55.0	57.0	4.8	56.2	61.0
2021	2.9	0.8	3.7	2.2	55.0	57.2	5.1	55.8	61.0
2022	2.8	0.6	3.5	2.1	55.5	57.6	4.9	56.1	61.1
2023	2.6	0.4	3.1	2.1	55.9	58.0	4.7	56.3	61.0
2024	2.1	0.3	2.4	2.6	52.2	54.8	4.8	52.5	57.2
2025	0.0	0.0	0.0	5.1	53.4	58.5	5.1	53.4	58.5
2026	0.0	0.0	0.0	5.0	22.8	27.8	5.0	22.8	27.8
2027	0.0	0.0	0.0	4.9	23.1	28.0	4.9	23.1	28.0
2028	0.0	0.0	0.0	5.1	22.8	27.9	5.1	22.8	27.9

Table 4-7 Proposed mining schedule (cont)

Year	Phase 2			Project			TOTAL		
	Ore (Mt)	Waste (Mt)	Total Mined (Mt)	Ore (Mt)	Waste (Mt)	Total Mined (Mt)	Ore (Mt)	Waste (Mt)	Total Mined (Mt)
2029	0.0	0.0	0.0	5.0	6.4	11.4	5.0	6.4	11.4
2030	0.0	0.0	0.0	5.0	3.6	8.6	5.0	3.6	8.6
2031	0.0	0.0	0.0	4.9	2.3	7.2	4.9	2.3	7.2
2032	0.0	0.0	0.0	4.8	1.4	6.2	4.8	1.4	6.2
2033	0.0	0.0	0.0	4.6	1.1	5.6	4.6	1.1	5.6
2034	0.0	0.0	0.0	4.4	1.0	5.4	4.4	1.0	5.4
2035	0.0	0.0	0.0	4.3	1.2	5.5	4.3	1.2	5.5
2036	0.0	0.0	0.0	3.1	0.8	3.9	3.1	0.8	3.9
Total	**37.0**	**131.5**	**168.5**	**80.5**	**525.8**	**606.3**	**117.5**	**657.3**	**774.8**

The potential peak equipment fleet required to achieve the above mining schedule is shown in Table 4-7**.**

Table 4-8 Project peak equipment fleet

Machine Type	Example Machine	Average Number
180-250t excavator	Liebherr 994	1
300t excavator	Liebherr 9350	1
360t excavator	Hitachi EX3600	1
550t excavator	Komatsu PC5500	2
Total		**5**
Truck - 175t	Cat 789C	19
Truck - 220t	Cat 793D	18
Total		**37**
Small wheel loader	Cat 972	1
Medium wheel loader	Cat 980	1
Large wheel loader	Cat 993 HL	2
Rubber tyred excavator	Cat M322	1
40t excavator	Cat 345	1
Articulated truck	Cat 740	2
Track dozer 1	Cat D10	3
Track dozer 2	Cat D11	1

Table 4-9 Project peak equipment fleet (cont)

Machine Type	Example Machine	Average Number
Rubber tyred dozer	Cat 834	1
Grader	Cat 16H	4
Water cart	Cat 777	4
Smooth drum roller	Dynapac	1
Sheeps foot compactor	Cat 825	1
Total		**23**
Tophammer rigs	Sandvik DP1500i	4
Rotary rigs	Sandvik D75KS	3
Total		7
GRAND TOTAL		**72**

The expected major consumables for the Project are shown in Table 4–8.

Table 4-10 Peak Project mining operation annual average use of consumables

Consumable	Unit	Annual Average Use
Diesel	Million L	37.5
Electricity	MWh	2.5
Tyres	Number	420.0
Explosives	tonnes	13250.0

4.4 Processing

4.4.1 Processing facilities

The layout of the existing ore processing facilities is shown in Figure 4-1, and in more detail in Figure 4-8. The existing processing operation consists of the following basic steps:

- primary crushing
- secondary/tertiary crushing
- Heavy media pre-concentration for selected ore types
- primary grinding
- rougher flotation
- regrinding
- cleaner flotation
- thickening and filtration
- tailings.

The Project will use the same ore processing method as is currently used at MRM. This process is described in this section and the process flow sheet is shown in Figure 4-9. Processing facilities will be upgraded to handle the increased throughput of ore.

Concentrate will be produced at a rate of 800,000 tpa. It will be stored in the existing concentrate storage shed at the mine site before transport to Bing Bong.

4.4.2 Primary crushing

The new primary crusher currently under design for the existing operations will be located on the west side of the existing West OEF. This crusher could be upgraded to service the 5.5Mtpa crushing rate for the project if required. Ore will be loaded into the primary crushing circuit using front-end loaders or direct tipped by haul trucks. The primary crushing circuit will consist of the ROM receiving hopper, an apron feeder, a vibrating grizzly feeder and a primary jaw crusher. Product from the primary crushing circuit with a P_{80} of 125 mm will be conveyed approximately 400 m to the secondary/tertiary crushing area.

4.4.3 Secondary/tertiary crushing

Ore from the primary crushing circuit will be sent to a double-deck screen. Oversize from a 32 mm aperture top deck will be conveyed to the secondary crusher whilst oversize from the 15 mm aperture bottom deck reports to the tertiary crusher. Both secondary and tertiary crusher products will be directed to the same conveyor which discharges onto the primary crusher product conveyor for recycling back to the screen house.

Screen undersize at a P_{80} of 9.5 mm is conveyed to the transfer station at the tail end of a 1400CV04 conveyor. From there, ore can be diverted to the heavy media plant (HMP) feed stockpile via the HMP stockpile conveyor or the existing grinding circuit stockpile via the 1400CV04 conveyor.

4.4.4 Heavy media plant

The 1.8 Mtpa HMP constructed as part of the current operations will treat the 6-8 ore body, which is the most amenable to upgrade via heavy medium separation. The plant will also treat some 5 ore body to make up the shortfall during times of low 6-8 ore production. Ore diverted to the HMP reports to a 500 t live capacity HMP feed stockpile. From the stockpile it will be transported to the plant via the HMP feed conveyor and discharged onto the feed preparation screen.

Screen oversize (+1.2 mm) will be sent to the heavy medium cyclone circuit which uses ferrosilicon medium at a specific gravity of 2.8-3.0 to separate liberated low density reject material from the ore. The reject material (floats fraction) will then move to the cyclone overflow. The rejects pass over a drain and rinse screen to recover the ferrosilicon medium for it to be placed into a 3000 t reject stockpile via a two stage reject conveyor system. Rejects will be loaded from the stockpile into haul trucks and transported to the North OEF for disposal with the mine waste. Some rejects may also be used for backfilling mine voids.

The upgraded ore (sinks fraction) will then be directed to the cyclone underflow and will also pass over a drain and rinse screen to recover the medium. The washed product will be conveyed via the product conveyor to 1400CV01 conveyor and on to the grinding stockpile. Feed preparation screen undersize (-1.2 mm) will report to a dewatering cyclone. The coarser solids (-1.2 mm+0.3 mm) report to the cyclone underflow and are dewatered on a screen before discharge to the product conveyor with the heavy medium cyclone product.

The slimes fraction (-0.3 mm) is referred to the dewatering cyclone overflow and then to the slimes thickener together with the dewatering screen undersize. The slimes will be thickened to 35-40% solids w/w and pumped to the primary grinding circuit for further processing. Water recovered from the thickener overflow will be recycled into the HMP.

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METSERVE Mining & Energy Technical Services Pty Ltd

xstrata zinc

Scale: NTS

Data Source: McArthur River Mining

McArthur River Mine
Phase 3 Development Project

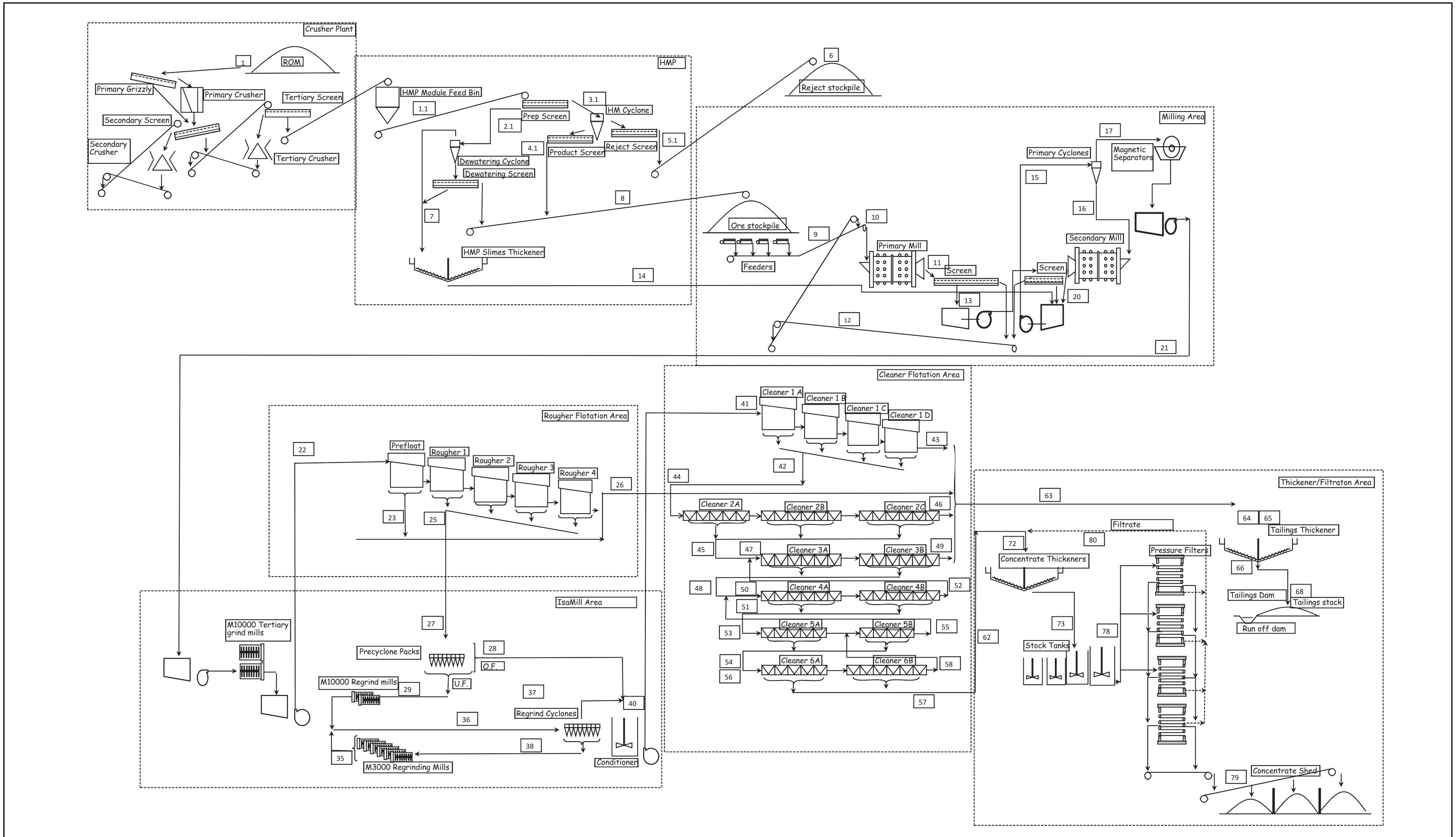
Proposed Processing Facilities

22/01/2012

N

Datum: AGD84
Projection: AMG53

FIGURE 4 - 8



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Scale: NTS

Data Source: AWAssociates

McArthur River Mine
Phase 3 Development Project

Processing Flowsheet - 5.5 MTPA

17/01/2012

Datum:
Projection:

FIGURE 4 - 9

4.4.6 Primary grinding

Ore from the grinding stockpile will be fed to a 5.1 Mtpa capacity primary grinding circuit via the existing 2300CV01 conveyor. The ore will be sent to a primary ball mill in open circuit followed by a secondary ball mill configured in closed circuit with hydrocyclones. Tramp oversize material will be removed from the discharge of each mill via a screen and recycled via scats conveyors back to the primary mill feed.

Primary and secondary mill discharge will be combined in the cyclone feed sump and pumped to a cluster of cyclones. Cyclone underflow will then be sent to the secondary mill feed. Cyclone overflow product from this circuit with a P_{80} of 150 µm will gravitate to magnetic separators to remove tramp steel which can potentially harm downstream IsaMills. The magnetic separator effluent will be pumped to the M10000 IsaMill building to reduce the ore down a P_{80} of 45 µm prior to flotation.

The slurry will be first passed through a set of cyclones so the fine solids (<45 µm) and some of the water can bypass the IsaMills via the cyclone overflow. The cyclone underflow will report to two M10000 IsaMills in an open circuit using ceramic beads as the grinding media. The IsaMill discharge and the cyclone overflow stream will then be combined and then pumped to the rougher flotation circuit.

4.4.7 Rougher flotat*i*on

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, uneconomic mineral, while recovering as much of the economic minerals as possible.

In the rougher flotation state, the primary grinding product slurry is referred to the first cell feedbox where dilution water and frother (Methyl Isobutyl Carbinol - MIBC) and activator (copper sulphate) reagents are added. The first flotation cell will be used as a pre-float cell to remove naturally floating gangue minerals like carbonaceous pyrite and talc. Froth from this cell will be directed to a pre-float concentrate sump and will be pumped to the final tails sump.

Collector (xanthate) is added to the second cell which causes the lead and zinc minerals to float. Concentrate collected from the rougher cells is pumped to the concentrate regrinding for further liberation. Rougher tails will discharge from the last rougher cell via gravity for pumping to the final tails sump where it will combine with the cleaner tails and pre-float concentrate for transfer to the tailings thickener.

4.4.8 Concentrate regrinding

The concentrate regrinding stage is designed to reduce the size of the particles recovered in the rougher flotation stage to a P_{80} of 8 µm so that the zinc and lead minerals can be further liberated and consequently upgraded in the subsequent cleaner stages.

The regrinding circuit consists of two stages of IsaMills. The rougher concentrate will be first pumped to pre-cyclones which remove material already finer than 8 µm via the cyclone overflow to be combined with the regrind circuit product. Cyclone underflow reports to M10000 IsaMills in open circuit which reduces the solids from 45 µm down to about 20 µm. The slurry will then report to the M3000 IsaMills in closed circuit with regrind cyclones.

Both stages of IsaMills use silica sand as the grinding media. The regrind cyclone overflow product with a P_{80} of 8 µm is combined with the precyclone overflow in a conditioner/surge tank. The primary role of this tank is to add more copper sulphate to reactivate the zinc minerals, however it also provides some buffer capacity to minimise the impact of short mill stoppages on cleaner flotation stability.

4.4.9 Cleaner flotation

The cleaner flotation stage continues the upgrading of mineral content in the concentrate.

Reconditioned slurry will be pumped from the conditioner tank to the cleaner flotation plant. It will consist of six stages of flotation to produce a final bulk flotation concentrate containing 46% zinc. Large amounts of dilution water will be added to the flotation slurry to aid the upgrading process.

The concentrate streams from each flotation stage will be pumped to the next stage for further upgrading. Tailings from the first three stages will report to the final tailings sump. The tailings from the second three stages are recycled within the cleaner circuit. The concentrate from the sixth cleaner stage will be pumped to the concentrate thickeners.

4.4.10 Concentrate thickening and filtration

The concentrate stream from the flotation circuit will use a large volume of process water which needs to be recycled. Concentrate will be split between two 25 m diameter thickeners where flocculant reagent is added to aid in solids settling. Clarified thickener overflow will gravitate to a process water tank for re-use in the plant. The concentrate is thickened in the underflow to 65% solids w/w and pumped to concentrate storage tanks which can hold approximately 48 hours of production.

Concentrate will then be pumped from the slurry storage tanks to one of three vertical pressure filters. The filters operate in a batch cycle of approximately 6-7 minutes and will produce a filter cake containing 12.5% moisture w/w. At the end of each cycle, each filter discharges the cake onto its own transfer conveyor which in turn feeds the concentrate stockpile conveyor 2700CV003.

This transfers the dried concentrate to the concentrate storage shed from where it will be loaded on to trucks and transported to Bing Bong. Filtrate from the filters is pumped back to the concentrate thickeners.

4.4.11 Tailings

Waste from the processing plant is called tailings, which is the finely ground material that remains after the mineral bearing component of the ore has been extracted during processing.

The final tailings stream from the flotation circuit will be pumped to the 36 m tailings thickener where flocculant reagent will be added to aid solids settling. Clarified overflow will gravitate towards the process water tank. Tailings solids will be thickened in the underflow to approximately 55% solids w/w and then pumped by three stage centrifugal pumps to the Tailings Storage Facility (TSF).

Further details of the existing and proposed tailings management operations are provided in Section 9 – Waste and Appendix E1 – Tailings Storage Facility Management Plan.

4.4.12 Tailings storage facility (TSF)

Tailings are water-based waste product generated through MRM's ore processing operation. Waste water and solids from the MRM processing plant are currently taken by pipeline to the existing TSF on the west side of the Carpentaria Highway, south of Surprise Creek. The existing TSF (Cells 1, 2 and 3) is an already approved structure (from the 2005 EIA Process), with an existing approved level of RL 68 m. Cell 1, which is closest to Surprise Creek, has been decommissioned and is now undergoing rehabilitation. Cell 2 is now used for tailings deposition, with water re-drawn to the processing plant and recycled for use. Cell 3 is currently used as a water management dam for fresh water and as a water overflow point for Cell 2.

The existing and approved TSF will accommodate the majority of Project tailings. To provide sufficient tailings storage capacity for the Project, the addition of another cell adjoining the existing approved TSF facility, Cell 4, is planned. Cell 4 will be a converted water management dam. This new water management dam, to be located on the western side of the existing TSF facility, adjoining Cells 2 and 3, is currently being considered under the annual Mining Management Plan process pursuant to Section 40 of the *Mining Management Act 2001*. This water management dam is being designed and constructed to facilitate future use as a tailings storage facility in 2032 as current approved TSF capacity is gradually utilised. Cell 4 will have a footprint of 73 ha and would be lined to minimise seepage.

The existing TSF with the proposed new Cell 4 option is shown in Figure 4 10. The proposed staged construction of Cell 4 is shown in Figure 4 11.

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METSERVE

xstrata zinc

0 300
Metres
Scale: 1:15,500 (A4)

LEGEND

- Cell 1 - Decommissioned (approved)
- Cell 2 - Existing Tailings Deposition (approved)
- Cell 3 - Existing Water Management Dam (approved)
- Existing Water Management Dam (approved)
- Cell 4 - Water Management Dam (to be converted to Tailings in 2032)

McArthur River Mine
Phase 3 Development Project

Tailings Storage Facility - Existing Cells and Proposed New Cell 4

12/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 10

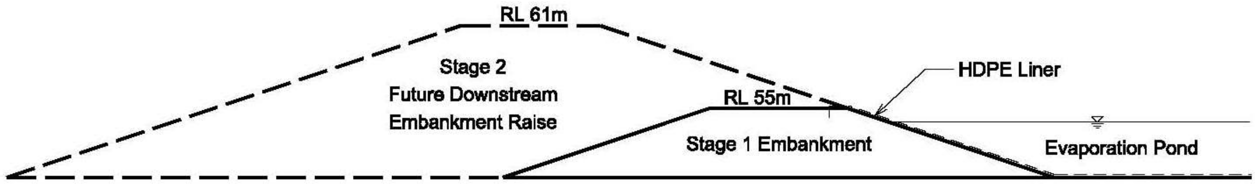

Figure 4-11 TSF Cell 4 – conceptual stage construction

4.4.13 Project process inputs

Table 4-9 lists the input materials required for the Project ore processing operation.

Table 4-11 Project process inputs

Process Stage	Input	Quantity (t/y)
Comminution	ROM ore (average)	5,250,000
	Mill steel media	5,555
	Liners	555
	Ceramic media	611
Heavy Media Plant	Ferrosilicon medium	450
Flotation	Ethyl xanthate	940
	Isopropyl xanthate	2,820
	MIBC	150
	Dextrin	1,300
	Suparex	1,430
	Copper sulphate pentahydrate	11,000
Thickening	Flocculent	150
Total Concentrator Water	Process and decant water	38,000,000

4.4.14 Project process outputs

The concentrate will be identical to that produced by the existing operation which is bulk concentrate containing zinc, lead and silver.

The process output quantities involved for the Project are provided in Table 4–10.

Table 4-12 Project process outputs

Type	Output	Quantity (t/y)
Product	Bulk Concentrate	800,000
	Water in Concentrate	114,286
Tailings	HMP Rejects	446,400
	Concentrator tailings	4,004,000
	Water in tailings	3,276,000

4.5 Concentrate Storage and Haulage

4.5.1 Storage

The dewatered concentrate will be 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 area is required to accommodate short-term market fluctuations. The concentrate storage shed will be extended to include a third compartment to cater for the Project's concentrate production.

4.5.2 Haulage

The concentrate will be transported to Bing Bong in covered concentrate haulage trucks as is the current practice. Road-trains with covered, side-tipping trailers are used and consist of prime movers with quad-axle trailers in a double AB configuration. Road-trains have a payload of approximately 120 t.

The concentrate will be loaded into trailers using a front-end loader. The loading bay will be expanded to allow three trailers at a time to be positioned for loading. Fugitive dust from the concentrate in the storage and load out area will be minimised due to the material's moisture content of approximately 12-13%.

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 haul route will be the same as that used for the existing operations - along the Carpentaria Highway from the mine to Borroloola and from Borroloola to the port at Bing Bong. This route is sealed for its full 115 km length and bypasses Borroloola.

The haulage rate will increase in line with the growth in annual concentrate production. The frequency of truck trips (return trips) will increase from approximately 3,285 per year to 6,570 per year. This equates to an approximate increase to 18 truck trips per day, seven days per week, an increase from the current rate of nine trucks per day.

4.6 Bing Bong

Project concentrate will continue to be exported via Bing Bong as is the current practice. The existing facilities are adequate to cater for the production from the Project's operations. The Project's load-out and bulk carrier ('Aburri') operations from Bing Bong to the off-shore export vessel will be the same as the current practice. The average number of return trips taken by the Aburri will increase from approximately 110 to 250 per year.

4.6.1 Bing Bong layout

Bing Bong consists of a concentrate storage shed that holds the product until it is loaded on the Aburri bulk carrier. 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 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. After the completion of expansionary works which are currently in progress at Bing Bong and occurring independent of the Project, the port concentrate storage facility will have the capacity to accommodate the increased output of Project concentrate and therefore no further onshore or offshore modifications are required.

The layout of Bing Bong is shown in Figure 4-12.

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Mining & Energy Technical Services Pty Ltd

xstrata zinc

Data Source: Imagery - Xstrata

McArthur River Mine
Phase 3 Development Project

Bing Bong Concentrate Storage and Ship Loading Facility

0 200 400
Metres

Scale: 1:10,000 (A4)

13/01/2012

Datum: AGD84
Projection: AMG53

FIGURE 4 - 12

4.6.2 Bulk carrier

The Aburri, designed specifically for MRM, is the bulk carrier used to transport bulk concentrate to ocean-going vessels. 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 unload at the same rate into an offshore, ocean-going vessel. The cargo capacity of each Aburri consignment varies, usually from 6,400 t 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.

The Aburri does not require modification for the Project.

4.6.3 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. The offshore loading zone has an average depth of 14.75 m at low tide.

Navigation lights lining the channel allow a 24-hour operation to take place. 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.

The transit route will remain the same for the Project.

4.6.4 Ship loading

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

Once the vessels are secure, the loading boom discharge point 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. This ship loading method will be identical for the Project.

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

4.6.5 Dredging

To enable the Aburri to move between Bing Bong and the offshore transfer zone, it was previously necessary to dredge a 3.5 km long channel through the shallow offshore area.

As discussed in previous EIA studies, there is an ongoing requirement for maintenance dredging and these documents were subsequently accepted as a component of previous MRM environmental assessments. Maintenance dredging at Bing Bong occurs approximately every four years. No increase in frequency of the dredging is expected to be required due to the project.

4.7 Infrastructure

4.7.1 Potable water supply

Potable water is currently sourced from nearby borefields and treated on site. This arrangement will continue for the Project. Chapter 10 – Water Resources provides more detail on water supply and management.

4.7.2 Power

Gas fired power generation already exists on-site (current generating capacity 24 MW) and will be expanded in 2012 to 27 MW for current operations. The annual energy requirement at MRM currently totals 150 gigawatt hours (GW.hr). There is sufficient capacity within this existing infrastructure to facilitate the Project's construction phase. The Project's operational phase will require an electricity demand of approximately 40MW. A range of options are being considered to increase generation capacity by another 20-25 MW for a total generating capacity of approximately 45-50 MW. Preliminary discussions with gas suppliers have indicated that the pipeline supplying MRM has the required capacity to facilitate the expanded power facilities. No other alternative sources of energy are planned to be used. The location of the extra generators is dependent upon the engines and contractor that wins a tender that is currently being prepared. Two possible sites are nominated, as shown in Figure 4-8.

4.7.3 Fuel storage

Primary fuel storage areas are currently located at the mine industrial area (500 kL), which has been constructed and bunded in accordance with the relevant specifications of AS 1940 *Storage and Handling of Flammable and Combustible Liquids* (AS 1940). The mine fleet for Phase 2 operations is predicted to require extra fuel storage facilities in the coming years – investigations into the optimal location for these facilities is currently underway. These facilities would be designed so additional storage is possible to meet Project requirements.

4.7.4 Explosives storage

An explosives storage facility on site currently stores explosives and detonators. This existing facility will be used for the Project and has been designed and constructed in accordance with AS 2187.1 *Explosive-Storage, Transport and Use.* Ammonium Nitrate Fuel Oil (ANFO) is an inherently safe explosive, widely used in the mining industry. The explosives storage facility will be licensed to hold ANFO along with the requisite amount of initiating explosives.

4.7.5 Sewerage

The existing accommodation village and mine, including shower, toilet and crib room facilities, has a reticulated sewerage system. Sewage is treated in an approved and commercially available treatment plant that undergoes a process of intermittent and extended aeration and settlement. The treatment plant has recently been expanded to a current capacity of 400 equivalent persons. This system is expandable to manage the proposed increase in Project related site personnel. During the construction phase, a temporary packaged sewage treatment plant will be installed to accommodate the Project's construction workforce. Treated effluent from the plant will be irrigated in the same manner as the existing sewerage plant effluent.

4.7.6 Telecommunications

The existing MRM telephone lines for both telephone and internet connections will have sufficient capacity to manage the proposed increase in site personnel for the Project. Mobile phones with the best available network coverage will also be utilised. Telstra currently operates mobile phone infrastructure in the vicinity of the MRM. No impacts on off-site telecommunications networks are anticipated as a result of the Project.

4.7.7 Accommodation village

The existing accommodation village (refer to Figure 4-13) will continue to house personnel working at the current operations and therefore additional accommodation capacity will be required to accommodate the Project personnel. The accommodation village will be expanded to the north with the installation of extra dongas to accommodate the Project's increased operational workforce. A temporary camp will be required for the Project's construction period, which will be decommissioned once all construction activities are complete.

4.7.8 Airport

A single sealed runway, 2,500 m in length and 23 m in width with a taxiway and turning areas mid-point of the runway, is currently used on the mine site for its FIFO operation. The airstrip is fenced to exclude cattle. The aerodrome will not require an upgrade for the Project and has sufficient capacity to accommodate the increased number of flights required during the Project's construction and operation phases.

4.8 Construction Activities

As the Project is an expansion of the existing operation, a significant construction phase is not required and much of the existing infrastructure will be used throughout the mine life. Construction will be undertaken by a number of specialist contracting entities that will employ a workforce to undertake these construction activities. A range of different construction plant will be mobilised to site including cranes and earthmoving equipment (i.e. scrapers, small excavators, articulated dump trucks, etc.) for civil construction purposes and other specific plant required for the upgrade of the processing facilities.

Where practicable, the construction workforce and equipment will be sourced locally. However it is anticipated that due to the limited locally available labour resources, it is expected that a majority of the labour force will be sourced from Darwin and nationally. The majority of personnel will be transported to site by the existing FIFO arrangements, with equipment being transported potentially by barge and road. Construction works required for the Project will be tendered and awarded in line with MRM's purchasing system procedures and approvals. It is anticipated that standard construction materials will be used including concrete and steel. Timber is not anticipated to be a primary construction material.

The construction phase will be undertaken over a two year period during 2012 and 2013. Most of the activities will be undertaken during the dry seasons of each year.

4.8.1 Pre-construction phase

Prior to on-site earthworks and construction commencing, a number of pre-construction activities will be completed. These will include:

- procurement of any large plant or ancillary support infrastructure components which require a long lead time for delivery
- development of a construction environmental management plan, including site management protocols for erosion and sedimentation control
- detailed design of all facilities
- tendering for civil contracts.

4.8.2 On-site civil construction

One of the initial construction phase tasks will be the earthworks associated with the construction of the processing plant upgrades. All concrete requirements for construction would be supplied from an appropriately licensed temporary, upgraded batch plant located adjacent to the construction site. The necessary construction laydown areas will be located within the industrial area to minimise disturbance.

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LEGEND

- Proposed Accommodation Village Expansion
- Existing Accommodation Village
- Mine Roads

McArthur River Mine
Phase 3 Development Project

MRM Accommodation Village and Expansion Area

12/01/2012

N

Datum: AGD84
Projection: AMG53

FIGURE 4 - 13

A soil and erosion management strategy for all disturbed areas will be incorporated in the construction environmental management plan and will be the responsibility of the Principal Contactor. Once construction work in an area has ceased, it will be rehabilitated by stabilising the surface against erosion and installing appropriate drainage measures.

4.8.3 Construction workforce

The Project's construction phase will extend over a two year period and the construction workforce will peak at approximately 400 during the 2012 and 2013 dry seasons. This workforce will include construction labour, suppliers, consultants, and other contractors.

The construction workforce will be accommodated in a purpose-built construction camp to be located adjacent to the existing accommodation village. The buildings and infrastructure at the construction camp will be built using conventional demountable components. All necessary infrastructure will be installed including water, sewerage, drainage and electricity.

The construction workers will use the facilities of the existing accommodation village, though extra service facilities are expected to be required including:

- dining
- wet canteen
- recreation/entertainment
- laundry.

The camp will provide single status accommodation only.

4.9 Operational Activities

The Project will utilise the identical process to the existing operations, but at a larger scale. As discussed in Section 4.2, the Project will increase the existing approved ROM extraction rate from 2.5 Mtpa up to approximately 5.5 Mtpa to generate an estimated production rate of up to 800,000 tonnes of bulk concentrate.

The mining processes will include vegetation clearing, topsoil salvage, overburden stripping, ore extraction, placement of topsoil or growth media and revegetation. Overburden will be stripped by shovel or excavator with trucks transporting mining waste rock material to the OEFs. Mined areas will be progressively rehabilitated where practicable.

The ore will be transported out of the open pit via trucks and stockpiled in the ROM area prior to processing. Expanded processing facilities will be used to process the bulk concentrate. Tailings will be produced as by-products and stored in the TSF.

The bulk concentrate will be trucked off-site to the Bing Bong port via the existing road network, and barged to an offshore loading area for loading into ocean-going ships for export.

4.9.1 Operational workforce

MRM currently employs approximately 440 people on site. This includes salaried staff and contractors. Efficiencies obtained from doubling production will result in the total on-site workforce increasing to a peak of approximately 735 employees following the expansion.

The existing workforce is accommodated in an on-site accommodation village located to the north of the airstrip (Figure 4-1). This camp provides self-contained living quarters together with dining and recreational facilities. Approximately 90% of the workforce works on a FIFO basis out of Darwin. The remainder live locally, mainly in Borroloola. The existing accommodation village will be expanded to cater for the Project's increased workforce.

An accommodation village with a capacity of 30 persons is currently provided at the Bing Bong port. These facilities house workers on a short-term basis during ship loading operations and are not planned to be expanded for the Project.

There will be a range of other indirect jobs created within the Northern Territory and nationally as a result of the Project and procurement contracts. Further details of this impact are provided in Chapter 16 – Economic Environment.

4.10 Rehabilitation and Decommissioning

4.10.1 Rehabilitation

The principal rehabilitation objective is to rehabilitate disturbed lands to a stable and self-sustaining state. Final landform construction will be undertaken using selective placement of materials by truck and shovel operations. Drainage networks will be constructed as required and stripped topsoil will be placed in areas available for rehabilitation.

All OEFs will be rehabilitated and decommissioned once the final rehabilitation success criteria have been achieved. The TSF will be capped, topsoiled and rehabilitated with native shrubs and grasses and measures to minimise seepage will be implemented.

The site will be rehabilitated to enable the post mine land use of native bushland or as negotiated with appropriate stakeholders. A final void with a footprint of approximately 210 ha will remain at the end of the mine life.

Chapter 5 - Rehabilitation and Decommissioning, Appendix E1 – Tailings Storage Facility Management Plan, Appendix E2 – Overburden Emplacement Facility Management Plan and Appendix E4 – Mine Closure Plan provides further information on the Project's rehabilitation activities**.**

4.10.2 Decommissioning

Preliminary mine closure plans have already been developed for the Project, and will be refined throughout the mine life. This plan will document how disturbed areas will be rehabilitated to meet closure and relinquishment requirements. It will be developed in consultation with appropriate stakeholders.

The objectives of the post-mine land use are to ensure that the:

- post-mine rehabilitated areas are self-sustaining and require no ongoing maintenance, while protecting the physical and biological integrity of the surrounding environment after mining activities have ceased
- existing and potential beneficial uses of the area are preserved where possible after mining activities have ceased.

Final landform designs for the ancillary infrastructure areas (i.e. other than the open pit, OEFs and TSF), such as the plant and buildings, access/haul roads and will be based on decommissioning the plant and equipment and re-profiling the base to match the original pre-mining landform where practicable, with contour ripping, top soiling and re-vegetating to encourage a vegetative cover. Unless determined to be suitable and requested by the landowner, water storages will be removed in a similar manner.

Refer to Chapter 5 - Rehabilitation and Decommissioning and Appendix E4 – Mine Closure Plan for more information.