Rasp Mine

Zinc – Lead – Silver Project
Project Approval No. 07-0018

Preliminary Information Paper

Modification 4
Concrete Batching Plant
and
TSF2 (Blackwood Pit) Extension

August 2016

Broken Hill Operations Pty Ltd
BROKEN HILL

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Contents

Table of Figures

Table of Photographs

Table of Tables

1. INTRODUCTION

Broken Hill Operations Pty Ltd (BHOP), a wholly owned subsidiary of CBH Resources Ltd (CBH) seeks to modify its Project Approval 07_0018 for the Rasp Mine in Broken Hill to:-

- Install a Concrete Batching Plant for the manufacture of fibrecrete and concrete for use at the Mine site, and
- Extend the life of the Blackwood Pit Tailings Storage Facility (TSF2) by installing embankments and a retaining wall at low points along its perimeter.

The purpose of this document is to provide preliminary information including an overview of the proposed Project, its location and setting within the environment and identify the potential key issues to address in the Environment Impact Assessment to support the application.

2. CURRENT PROJECT APPROVAL

2.1 Project Approval

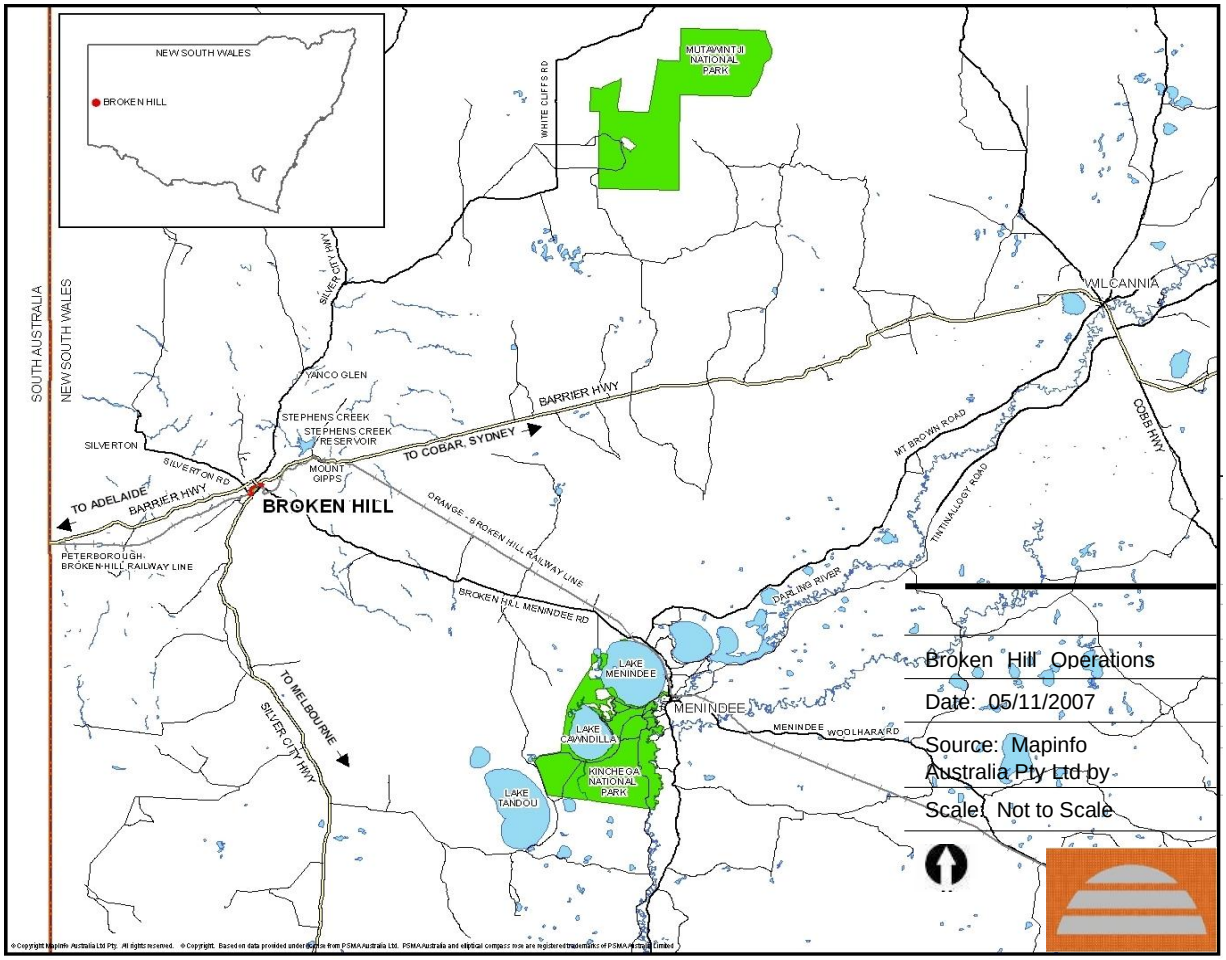
The current Project Approval permits underground mining of the Western Mineralisation, the Centenary Mineralisation (to the south/western lease boundary) and Main Lode from Blocks 7 to 12 until 31 December 2026 extracting up to 750,000 tonnes of ore per annum and 8,450,000 tonnes of ore over the life of the Project. It also permits the processing of ore and the despatch of concentrate products from the mine site by rail. There are a number of auxiliary facilities including maintenance workshops, inventory, chemical storage and explosives storages, backfill plant and rail siding.

2.2 Rasp Mine Setting

The Rasp Mine is located on consolidated Mining Lease 7 (CML7) which lies centrally within the City of Broken Hill (**Figure 1**) and is surrounded by transport infrastructure, areas of commercial and industrial development and some residential housing. The Rasp Mine is bounded by Eyre Street and Holten Drive to the south and east, Perilya Broken Hill Operations Pty Ltd (Perilya) North Mine to the northeast and Perilya's South Mine to the southwest, and the commercial centre of Broken Hill to the northwest. It is dissected by two major State roads South Road (Silver City Highway SH22) to the southwest and Menindee Road (MR66) to the northeast. These roads form part of the existing trucking route through Broken Hill. The Broken Hill railway station is located directly to the north of the mine and lies on the main Sydney – Perth railway line. Residential and commercial areas are located to the west, north and south of the Project Area, Perilya mine developments to the east (North Mine) and west (Southern Operations) and the E B Mawson and Sons Pty Ltd (Quarry) to the east.

The site has been mined for over 130 years leaving the site highly disturbed with a number of heritage buildings and structures. The majority of the site is covered with historic waste rock or tailings material, there is little topsoil and vegetation.

Figure 1 Regional Location of the Rasp Mine



3 REASON FOR MODIFICATION

3.1 Concrete Batching Plant

BHOP operates an underground mine that uses fibrecrete to support the underground excavations and concrete for general civil work around site. Currently a monopoly exists in Broken Hill for the supply of batched concrete/fibrecrete and the company is currently paying exorbitant fees for the supply of fibrecrete. Therefore, BHOP intends to construct its own batching facility to benefit the business. The Concrete Batching Plant is a cost effective alternative.

3.2 Blackwood Pit (TSF2) Wall Raise

The tailings waste stream from ore processing is permitted to be deposited in the historic tailings facility (TSF1) and in the disused Blackwood Pit (TSF2). The need to undertake more underground mining development than anticipated has reduced the capacity of underground voids to accept both waste rock and tailings material from the Backfill Plant. BHOP has chosen to place the additional waste rock underground to fill voids and stopes and to deposit tailings in TSF2 only as this facility had greater capacity and was more cost efficient. At current tailings deposition the life of this facility will be

completed in May 2019, the proposed embankments and retaining wall will increase the life of this facility to September 2021.

4 LOCATION OF PROPOSED PROJECT

4.1 Location of the Concrete Batching Plant

The proposed Concrete Batching Plant will be located approximately centrally on the Mine site adjacent to the Backfill Plant, **Figures 2 and 3**. The Concrete Batching Plant will cover an area of approximately 3,500 m^2 and its height (approximately 10 m) will be similar to the Backfill Plant (8.8 m), which was constructed as part of the original Project Approval. The top of the Batching Plant (and the current Backfill Plant) will be seen from Crystal Street and the café located on a waste rock hill within CML7 and to the north. **Photographs 1** and **2** provide views of the proposed site looking northeast towards the Café and northwest towards Crystal Street.

The closest residents to the Concrete Batching Plant are located in Crystal Street a distance of approximately 350 m and are separated from the Concrete Batching Plant by the Indian Pacific rail-line and railway yards. The Concrete Batching Plant will not be seen by South Broken Hill residence as Mt Hebbard, an historic tailings storage, acts as a barrier to the south residents.

This location is already disturbed and is denuded of vegetation.

4.2 Location of Blackwood Pit TSF2

Blackwood Pit is located to the north of the current processing plant with the historic Thompsons Shaft and mine buildings to the north-east, waste rock storage areas to the east and west, and Proprietary Square to the north (**Figures 2** and **4** yellow marked buildings are located within the surface areas of CML7). Proprietary Square lies within a CML7 surface exclusion on Consolidated Mine Lease 4 (CML4) and is held by Perilya Broken Hill Pty Ltd who uses the area for some residential housing (10 residences not all occupied, a bowling green with club house and a tennis court), mine training and social club (**Figure 5).** Immediately adjacent to this north area of the Pit and within the surface rights of CML7 is British Flats a heritage listed building on the Broken Hill City Council Local Environment Plan 2013 (I21), and an old mining residence – Block 14 Flats (also known as Residences 27a and 27b) both of which are unoccupied (**Photographs 3, 4** and **5**). These buildings, although located on CML7, are owned by the Line of Lode Reserve Trust now managed by Department of Primary Industry - Lands.

Also in the vicinity located along Federation Way and west of Proprietary Square are three buildings; two used by members of the public and the third as a commercial premises:-

- Cameron Pipe Band Hall
- St Johns
- Jenmar Ground Control Products

The Concrete Batching Plant is approximately 1500 m from the nearest embankment proposed at TSF2.

Figure 2 Aerial View of CML7 Indicating Location of Proposed Project

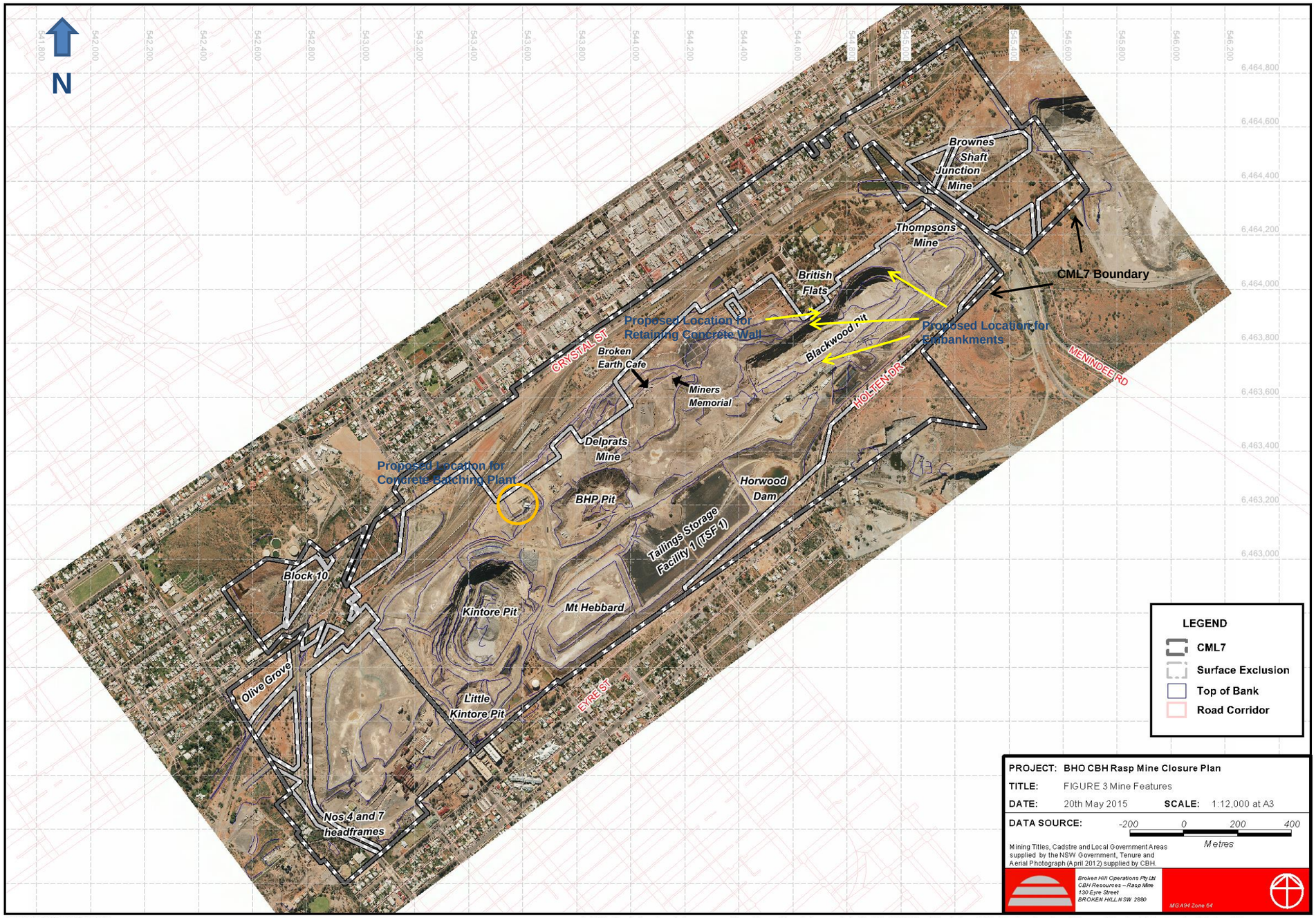


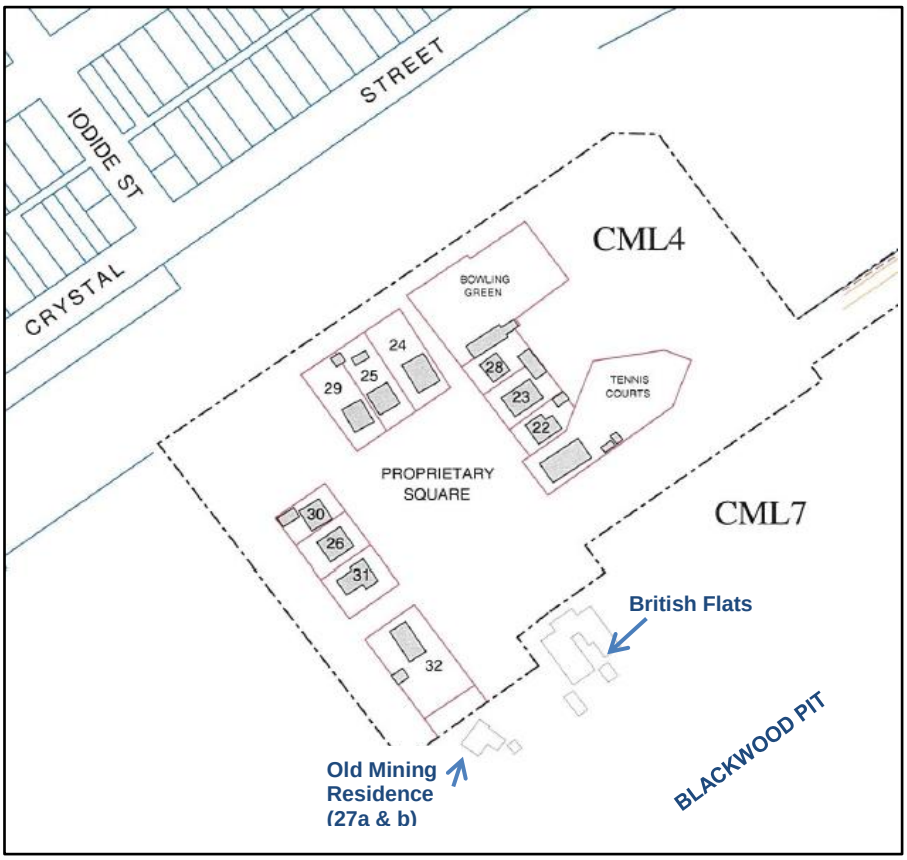
Figure 3 Aerial View of Concrete Batching Plant Area

Figure 4 Location of Blackwood Pit (TSF2)

Photograph 1 Location for Concrete Batching Plant Looking North East

Photograph 2 Location of Concrete Batching Plant Looking North West

Figure 5 Proprietary Square (Perilya)



Photograph 3 British Flats

Photograph 4 Old Mining Residence

Photograph 5 Rear of Residence Showing Proximity to Pit

5 DESCRIPTION OF CONCRETE BATCHING PLANT

BHOP operates an underground mine that uses fibrecrete to support the underground excavations and concrete for general civil work around site. Fibrecrete is essentially a batched concrete that consists of the following key components that are mixed together; aggregate, cement, steel fibres, water and various admixtures. **Photograph 6** depicts a typical Concrete Batching Plant.

Photograph 6 Typical Concrete Batching Plant

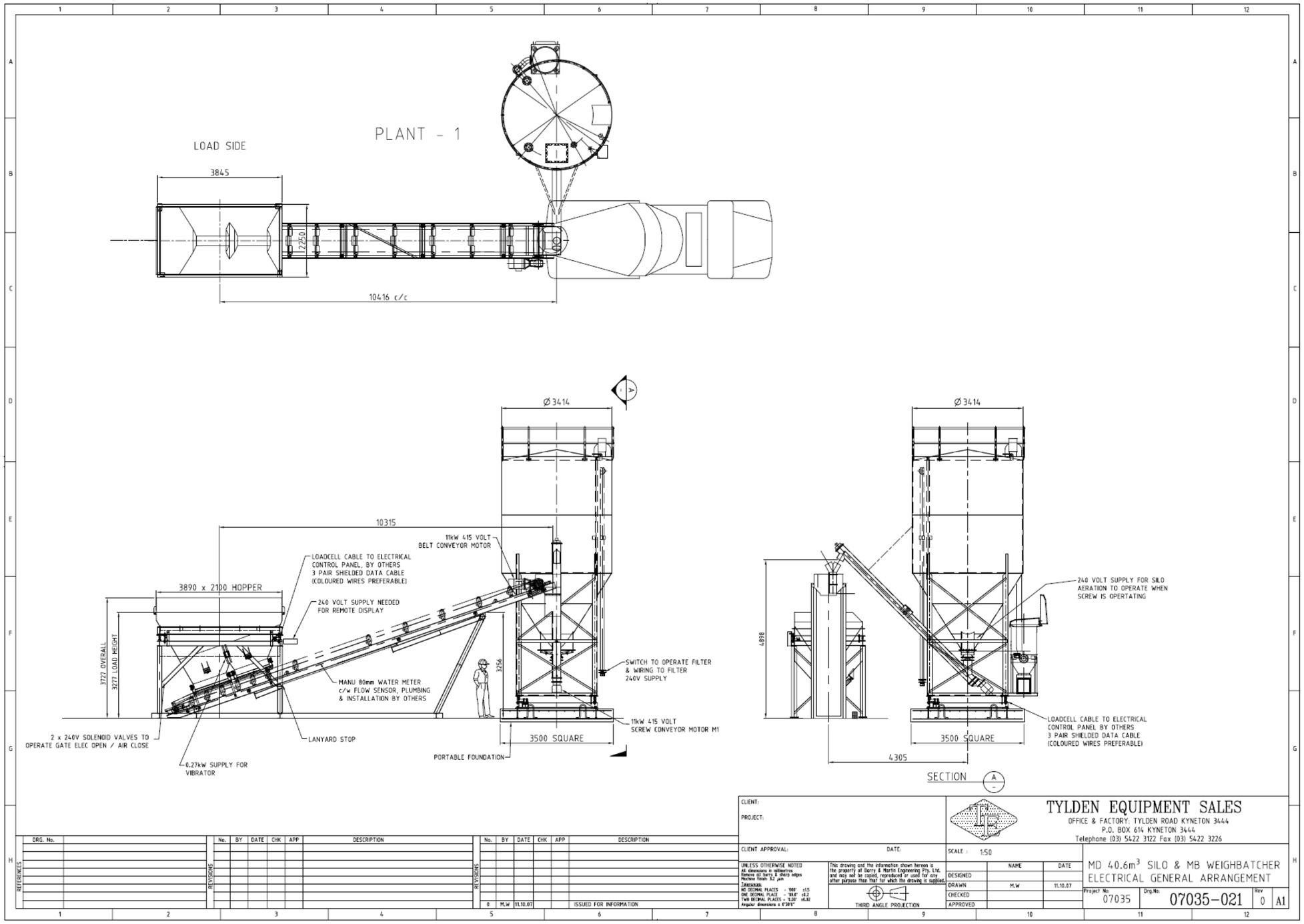
5.1 Concrete Batching Plant Main Components

The Concrete Batching Plant will consist of the following main components:

- Batch plant (silo, control room, loading hopper, leading belt, weightometer, cement auger)
- Compressor / blower shed
- Concrete bunkers for aggregate storage
- Raw water tank (10,000L)
- Wash-out sump
- Access roads
- Admixture storage

Cement will be stored in a silo which is the highest feature within the facility, approximately 10 m in height. Aggregate storage will be constructed of concrete bunkers. **Figure 6** provides general arrangements for a typical concrete batching plant.

Figure 6 Typical General Arrangements for a Concrete Batching Plant



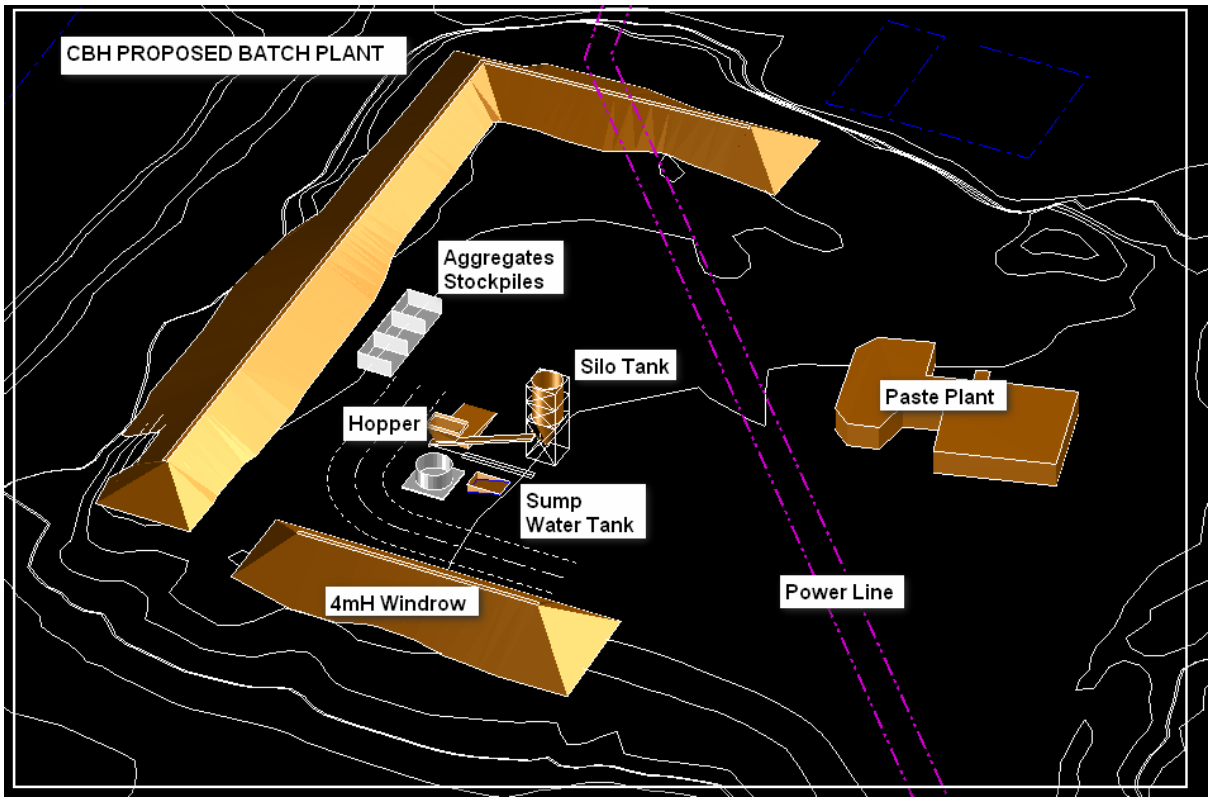
5.2 Concrete Batching Plant General Operation

Cement will be transported from the rail-loading station to the Concrete Batching Plant in ISO tank containers. The cement will be stored in the silo and the containers will be emptied into the cement silo using a blower.

Aggregates will be brought on site by suppliers and tipped into the purpose made concrete bunkers. A small front end loader (Volvo L50F or 90F, 2.3 m3 bucket, 90 kW) will be used to handle the material. When batching the aggregates will be loaded from the bunker and tipped into the batch-plant hopper before travelling up the conveyor belt and mixed with the cement which will be discharged from the silo using an auger. The cement and aggregates will be tipped into the Agi-truck where they will be mixed with water, admixtures and fibres.

Figure 7 indicates the proposed layout for the Concrete Batching Plant.

Figure 7 Proposed Layout for the Concrete Batching Plant



5.3 Consumables

At the design production rate of 15,000 m^3 of fibrecrete/concrete per annum the following volumes of materials will be consumed. Although current mining production requirements for shotcrete (6,500m^3) are well below this design rate BHOP wish to ensure there is appropriate capacity for any future increase in demand.

Table 1 Estimated Annual Consumables

Material	Annual Consumption
Aggregate coarse	6,660 t
Aggregate fine	2,688 t
Sand	14,960 t
Cement	6,600 t
Steel fibres, - ReCo 65/35 (10 or 20 kg bags)	90 t
Admixtures – accelerator, SA 160 (1000 L pods)	345,000 L
Admixtures – stabiliser, Delvocrete MasterRoc HCA20 (1000 L pods)	45,000 L
Admixtures – plastiser, Master Glenium SKY 8703 103 (1000 L pods)	60,000 L

All aggregates will be tipped directly into a concrete storage bunker and pushed-up with the front end loader. All Admixtures and steel fibres will be delivered to site as a part of general freight deliveries and will be stored in a designated shed or modified shipping container.

Aggregate

Aggregates shall comply with AS2758.1 Aggregates and Rock for Engineering Purposes – Concrete Aggregates. The combined grading of coarse aggregate and fine aggregate or sand will be in accordance with the sizing outlined in **Table 2**.

Table 2 Grading of Aggregate

Sieve Aperture (mm)	Minimum (mm)	Maximum (mm)
13.2	100	100
9.5	93	100
4.75	78	100
2.36	60	93
1.18	42	78
0.6	28	58
0.3	17	32
0.15	6	17
0.075	0	2

Coarse aggregate will have a maximum nominal size of 10 mm with water absorption limited to a maximum of 2 per cent. Aggregate will be non-reactive for alkali-aggregate reaction (AAR). Coarse and fine aggregates will be stockpiled separately to prevent segregation and contamination with other materials.

Cement

Cements used will be compliant to AS3972-2010 General Purpose and Blended Cements and comprise one of the following:-

- General purpose (GP), or
- Special purpose types (HES) (SR) or (SL)

Cement will be stored in a weather-tight silo protected from dampness and contamination.

Admixtures

Steel fibres will be delivered in 10 kg or 20 kg bags. The bags of fibres will be taken from the storage shed and placed directly into the Agi bowl on the truck where the fibres will be mixed.

Other Admixtures will be delivered in ISO pods and loaded as required.

5.4 Truck movements

The main off-site truck routes are from the Quarry, located in Holten Drive an extension to Eyre Street, and along the trucking route from Wentworth Road to the main mine site gate access on Eyre Street (**Figure 8**). The bulk of deliveries will be aggregates which will be sourced from the Quarry and transported by road using B-double or road train configurations. Sand will be transported via Wentworth Road and other raw materials used in the Admixtures will be sourced locally and interstate and will arrive at site via general freight deliveries.

It is anticipated that cement will be transported to site via rail in ISO containers from either Adelaide or Newcastle. The ISO's would be loaded/unloaded at the Rasp Mine's current Concentrate Rail Siding and then transported to the Concrete Batching Plant by truck on the Mine haulage road.

Changes to on-site trucking routes will include concrete supplies from the Concentrate Rail Siding to the Concrete Batching Plant (**Figure 8**) and fibrecrete from the Concrete Batching Plant to the Mine Portal located at the floor of Kintore Pit.

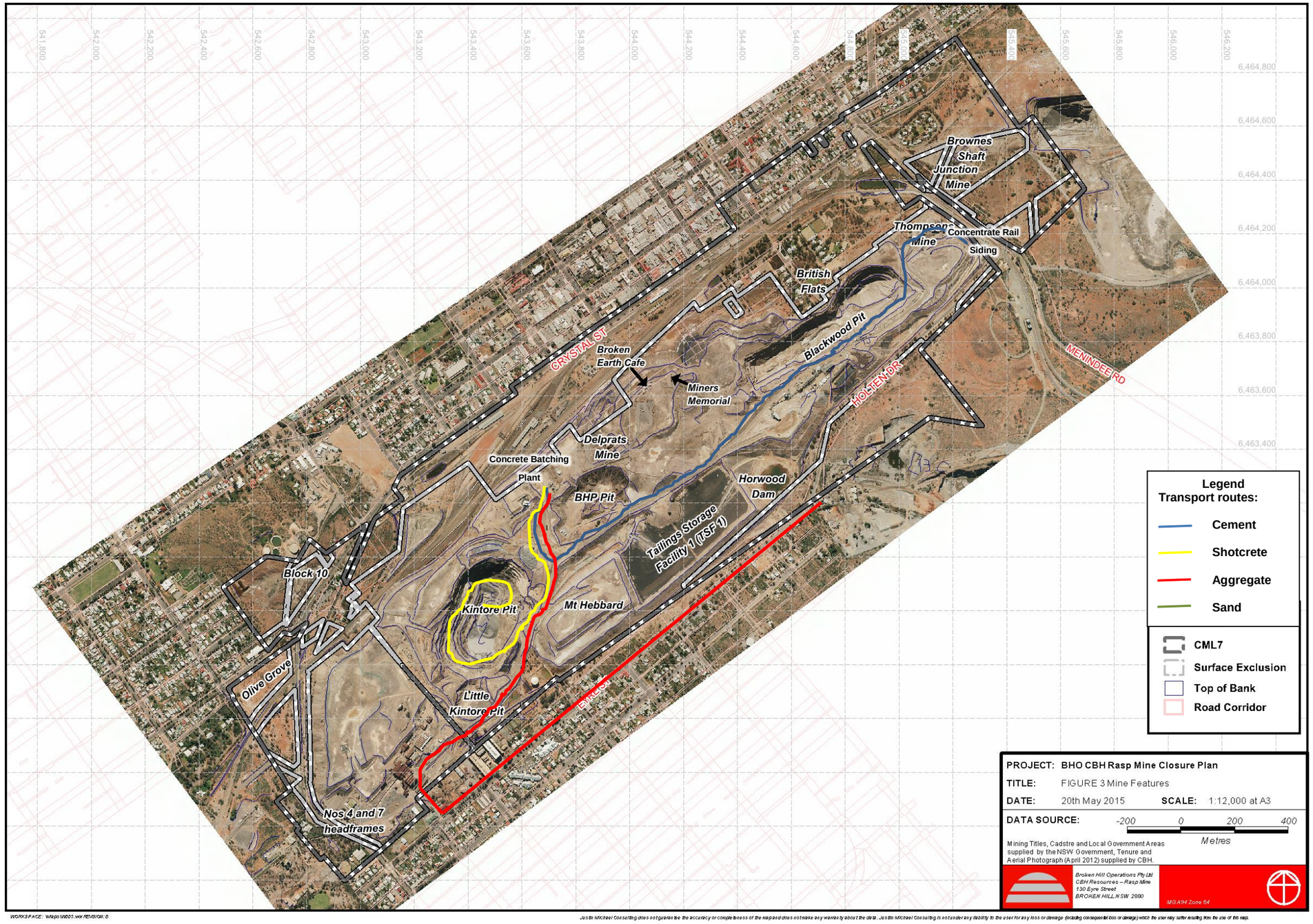
Table 3 indicates the estimated truck movements based on 15,000 m^3 per annum or 40 m^3 per day of fibrecrete/concrete production. This in excess of current batching requirements and this is required to accommodate the maximum projected consumption, hence the difference in current and proposed Agi truck movements.

Table 3 Estimated Truck Movements Based on 15,000 m^3 Production Annually

Transport Type	Monthly	Annual
Current External: Agi movements from Quarry to site, return trips	95	1,140
Proposed Road External: Aggregate B-Double transport from Quarry to site, return trips	50	600
Proposed Road CML7: ISO cement transport on mine site, return trips	21	252
Proposed Road CML7: Agi movements on mine site, return trips	253	3,036
No additional rail movements. ISO's added to existing trains	Nil	Nil

All external transport deliveries would be conducted between 06:30-17:00 Monday to Friday and 07:00-16:00 Saturday.

Figure 8 Rasp Mine Aerial Indicating Transport Routes



5.5 Water Usage and Supply

Water will be sourced from Essential Water via the exiting raw water mains located at the surface fill plant. At the estimated annual production of 15,000 m3 approximate raw water consumption would be 3,600 KL. The original EA estimated a raw water use of 288 ML/annum improvements in water use and consumption have reduced raw water usage the current raw water usage is 260 ML/annum therefore no increase in water usage as assessed in the original EA is anticipated.

5.6 Power Supply and Connections

Power will be fed from the current 300 kVA transformer located adjacent to the Backfill Plant opposite the proposed Concrete Batching Plant location. The feed will be located underground and the total power requirements will be less than 100 kW.

5.7 Wastes

Wastes that will be generated include:

- Wash-out from the Agi truck and general hose-down cleaning. The Agi trucks and general clean-outs will be washed out into a collection settling sump. The solids consist of aggregates, cement and water. The solids will be removed from the sump and disposed either to an underground stope or Blackwood Pit (TSF2).
- IBCs from Admixture materials. Empty IBCs will be washed out and returned to the manufacturer or crushed disposed of with general.
- Steel fibre bags. Empty bags will be disposed of as part of general waste collection and removed from site.

5.8 Construction Preparation for Concrete Batching Plant

The area identified for the location for the Concrete Batching Plant was designated for plant infrastructure in the original EA. There is no vegetation or topsoil located in this area which lies on consolidated waste rock (refer **Photographs 1** and **2**). Land preparation for the construction of the Concrete Batching Plant will consist of levelling the area (minor works), installing an earth (waste rock) bund and providing a surface finish that will minimise any dust take up from vehicle activities, including trucking and operation of the front end loader.

The surface area for the Concrete Batching Plant, aggregate storage and truck delivery and turnaround will be levelled using an excavator. Waste rock from Kintore Pit will be used to form a base over the proposed area of the Concrete Batching Plant and will be moisture conditioned and compacted, approximately 925 m^3 to provide a 300 mm cover.

Waste rock will also be used as material to construct a bund along the perimeter of the Concrete Batching Plant area. It is anticipated the bund will be a minimum of 4 m in height (to be confirmed following noise studies) and will act to reduce noise levels and reduce visual amenity impacts. The dimensions of the bund will be determined following noise modelling during preparation of the Environmental Assessment.

Waste rock currently stored in Kintore Pit will be utilised and will be tested with inert material selected for the base of the Concrete Batching Plant and bunding. The material for the base of the Concrete Batching Plant will be moisture condition and compacted to minimise dust take up and a chemical dust suppressant will be applied to minimise ongoing dust generation during operation. Approximately 6,500 t of this material may be required (or greater if the height of the bund exceeds 4 m).

Underground waste rock material comprises the following geological units:-

- Metasediments – the most abundant rock type comprising psammite (quartz – feldspar) and pelite (biotite, sillimanite, garnet, feldspar);
- Potosi Gneiss – a leucocratic quartzo-feldspathic gneiss comprising quartz + feldspar + biotite + garnet with varying occurrences of sillimanite;
- Pegmatite – coarse grained leucocratic quartzo - feldspathic rocks comprising feldspar and quartz with lesser amounts of muscovite. Locally biotite may be present; and
- Amphibolites – a rock which contains greater than 40% mafic minerals, generally comprising pyroxenes, amphibole, plagioclase, garnet. Grades into garnet, amphibolite and foliated, quartz – feldspar – biotite – garnet rock.

These rock types do not generate acidic water, feldspar and sillimanite decomposition consumes acid.

The Potosi Gneiss unit is quarried as “blue metal” for the local Broken Hill market and surrounding areas in the adjacent Quarry and is predominantly used for road base.

No additional roads are required to be constructed for this Project. The roads from the rail load-out area to the Concrete Batching Plant and from the Concrete Batching Plant to Kintore Pit are sealed.

The main components of the Concrete Batching Plant will be pre-fabricated off site. Installation, including civil works, is expected to take 4 weeks and be undertaken between 07.00 and 18.00 Monday to Friday and 07.00 to 13.00 Saturdays.

6 DESCRIPTION OF EXTENSION TO BLACKWOOD PIT (TSF2)

6.1 Current Operation

The current phase of underground mining has been in operation since 2012 following Project Approval in 2011 and completion of the Decline. Golder Associates Pty Ltd (Golder) prepared the design for the existing Blackwood Pit to be used for the deposition of tailings from the new processing plant. The depth of the Pit varies from about 40 m at the south-western end to about 70 m at the north-eastern end.

The design of the Blackwood Pit tailings storage facility (the Pit) was for tailings deposition in the Pit up to just below the nominal pit rim at the north end, with a tailings beach from the southwest to the northeast. All tailings from the processing plant have been deposited in the Pit with approximately 1,883,000 dry tonnes of tailings deposited up to elevation RL 292 m at the north end from June/July 2012. **Photograph 7** shows the tailings deposition level as at July 2016.

Ongoing tailings deposition into the Pit has enabled the facility to be utilised in whole rather than in sections as initially developed and proposed. Flotation process tailings are currently pumped to and deposited at the south-western end of the Pit via a duty/standby configuration of centrifugal pumps. Particle solids settle out of the slurry stream along the length of the Pit in a north-easterly direction. Any excess water collects at the northeast end of the facility. From here the water is pumped back into the process water tank via a mobile diesel water pump.

As the facility is used as a whole the entire length of tailings surface is constantly wetted by deposition of tailings slurry. Furthermore, there is no disturbance of surface crust or dried tailings from earthwork excavation activities. Despite this, dust monitoring is continuous and ongoing. There are no visible

Photograph 7 Blackwood Pit TSF July 2016 Looking North East

signs of dust at the facility and data collected from the TEOM located adjacent to the facility to the north has shown no indication of an increase in dust since the tailings have been deposited and rising in the Pit, **Figure 9**.

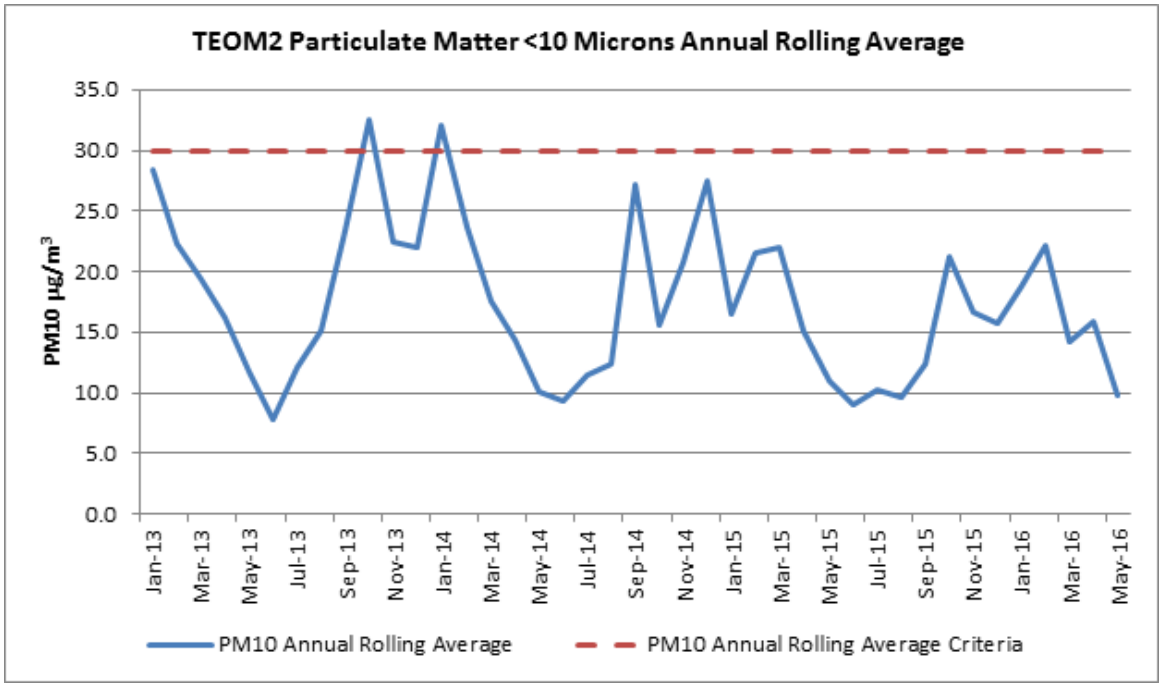
As outlined in the original EA at the cessation of tailings disposition into the Pit (TSF2), a final covering of inert wast rock will be placed over the top of the tailings to minimise the potential for dust generation as the tailings stabilise and consolidate. This will form a final cover to minimise the potential for wind take up of lead bearing dust from the mine site.

6.2 Description of Embankments and Retaining Wall

The current Pit rim has a lowest elevation of approximately RL 306.7 m. The existing topography outside the Pit rim at the north end of the Pit includes a gentle rise to a ridge line between 30 m to 80 m from the Pit rim. The elevation of the ridge is variable but is generally above RL 310 m.

The additional storage capacity in the existing Pit between the tailings beach surface on 25 April 2016 and a level surface 1 m below the lowest point of the Pit rim is 1.29 million m^3. At an expected tailings design dry density of approximately1.45 t/m^3 current capacity of 1.87 million dry tonnes, or 3.2 years of tailings production at the indicated 570,000 dry tonnes per year going forward is predicted. This indicates that the Pit will reach its design limit by approximately the end of July 2019.

Figure 9 Results from Dust Monitor Adjacent Blackwood Pit to the North



The Pit rim topography varies from RL 335 m in the southwest to a low of RL 312 m in the northeast corner. There is therefore an opportunity to continue deposition of tailings from the southeast end of the Pit and maintain the tailings beach sloping down to the northeast. There are three main areas where the rim of the Pit dips and works are required the:-

- North-east corner of the Pit (this is RL 306.7 m, the lowest point),
- Area adjacent the old mining residence, and
- Rim adjacent to the processing plant.

Golder was again engaged to develop a concept design to increase the storage capacity, hence life, of the Pit facility. Based on the above topographic considerations this design includes the construction of containment embankments and a concrete retaining wall (to protect the old mining residence). The alignment of the embankments has been selected to be near the existing topographic high areas to maintain access along the existing road from the processing plant to the Concentrate Rail Siding, to retain tailings deposition adjacent to the process plant, and to protect the old mining residence. The alignments of the embankments were adjusted so that the footprints of the embankments were inside the BHOP surface rights boundary within CML7.

Due to space constraints at the old mining residence (**Photograph 5**) an embankment is not feasible between it and the Pit. To enable Embankment 1 to extend over this area the old mining residence would need to be demolished. To protect this building it is therefore proposed to construct a reinforced concrete retaining wall along a portion of the Pit rim. The retaining wall would extent into the embankment to the west. A conceptual layout of the embankments and retaining wall are presented in **Figure 10.**

The layout of the embankments is selected so that the final elevation does not extend over the gentle rise next to the old mining residence or encroaches on British Flats. The storage capacity of the facility after construction of the proposed embankments and retaining wall is estimated to be 2.1 million m^3 or 3.05 million tonnes (from April 2016). The capacity is estimated 1.5 m below the top of the

embankment and retaining wall elevations (as potential for a freeboard). Construction of the embankments may be staged to suit the filling rate of the facility, with Embankments 1 and 2 and the retaining concrete wall being required for tailings deposition by July 2019 and Embankment 3 in July 2020.

Pending final design related to flood hydraulics and required tailing beach freeboards, the tailings storage capacity may increase or the western portion of the proposed embankments crests may be lowered.

Table 1 presents geometric and elevation information for the four components of the proposed embankments and retaining wall. Note the crest elevation of the embankments vary to reflect the grade of the tailings beach. The top of the retaining wall is indicated to be at a constant elevation to avoid construction complication, but could also be stepped or sloped.

Table 4 Features of Embankments and Retaining Wall

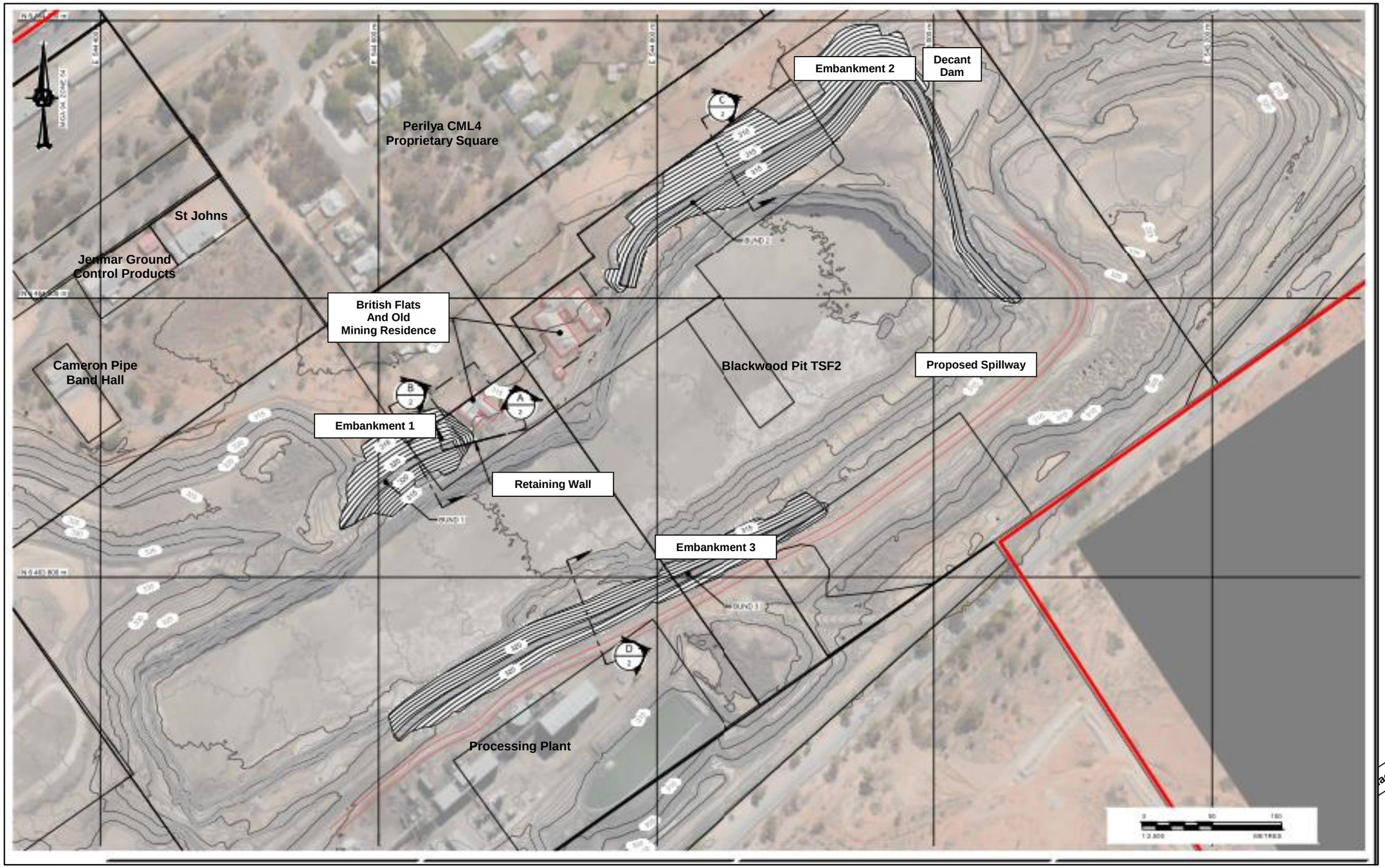
	Minimum Height (m)	Maximum Height (m)	Length (m)	Elevations (RL m)
Embankment 1 West of Old Mining Residence	**0**	**10**	**100**	**320 to 321**
Embankment 2 North-east Corner of the Pit	**0**	**10**	**460**	**318.5 to 315**
Embankment 3 Adjacent the Mill	**0**	**3**	**170**	**323 to 318**
Retaining Concrete Wall South of Old Mining Residence	**1**	**5**	**37**	**319.8**

The embankments comprise a zoned construction with a 5 m crest width and 2.5H in 1V side slopes. Embankments will be constructed with crushed and compacted waste rock source on site from Kintore Pit and placed over a geotextile liner. There is currently in excess of 500,000 t of material stored in Kintore Pit, the waste rock will be tested prior to use to identify inert material for use in the construction of the embankments. The outer slope is proposed to be constructed from uncrushed mine waste rock. The centre of the embankment is to include a vertical chimney drain to provide for drainage and piping erosion control at the embankments. The chimney drain is to be progressively installed by sand placement as the embankment is constructed. A slotted pipe is to be installed along the base of the chimney drain and solid wall outlet pipes are to be installed at selected locations.

Drainage from Embankment 1 will be directed to the drainage system installed by BHOP along the the bottom of the adjacent waste dump. Drainage from Embankment 2 will be directed to the Decant Dam which will be constructed adjacent to this embankment. Drainage from Embankment 3 will be directed either back to TSF2 or to the spillway. These proposals will be confirmed as drainage and management of surface water runoff will be addressed in the hydrological studies to be undertaken as part of the Environmental Assessment.

Embankment 3, adjacent to the processing plant, is located partially over the tailings beach, once the tailings reach an elevation of RL 320 m at the south-east end of the Pit. Embankment 3 is required approximately one year after Embankments 1 and 2 are constructed. Embankment 3 is proposed to be constructed with engineered fill including a geosynthetic reinforcement layer over the tailings footprint to allow for potentially soft foundation conditions. The embankment rests partially on the Pit rim and partially on the tailings beach to maximise storage capacity. Since the embankment extends

Figure 10 Design Concept for Embankments and Retaining Wall at TSF2



across the pit rim and onto tailings large differential settlements are expected to occur across the width and length of the embankment. The embankment is therefore proposed to be lined with a geosynthetic liner on the upstream slope for seepage control, and to provide a vertical chimney drain to control the risk related to potential deformation where the embankment is founded on the tailings.

All embankments include a track-able surface over the crest to provide inspection access and to protect the top of the embankment crest. Safety bunds or bollards are to be included along the sides of the crest as appropriate.

The retaining wall is a reinforced concrete cantilever wall, with a horizontal footing and vertical section. The retaining wall will be designed as a water retaining structure and should include drainage on the upstream side. Drainage on the upstream side will increase the rate of strength gain of the tailings. The upstream face of the wall is also to be coated to improve the durability of the wall with respect to seepage from the tailings and risk of effervescence of salts on the outside face of the wall. The layer will also reduce down-drag loads applied by the tailings on the wall. Again drainage and management of surface water runoff will be addressed in the hydrological studies to be undertaken as part of the Environmental Assessment.

In the long term the retaining wall is likely to require augmentation (buttressing) with fill placed against the downstream side to provide a long term restraint once the concrete and reinforcement in the wall reaches the end of their design life. The design of this feature will be undertaken during the Environmental Assessment when its potential impacts on the old mining residence will be assessed.

6.3 TSF2 Consequence Category

Golder considers that the changes to the Pit will convert the facility into a structure that is subject to the review and endorsement of the NSW Dam Safety Committee (DSC). The DSC is the authority charged with the responsibility to oversee the safety of dams in NSW.

The facility is located on a hill next to Broken Hill town-ship. The embankments and retaining wall will result in the proposed future level of the tailings being above the natural topography, which trends downslope towards the town to the north and north-west of Embankments 1 and 2 and the retaining wall. This area of Broken Hill includes residential and commercial areas, public infrastructure such as roads and railway, and some industrial areas.

Embankment 2 is on the south side of the hill, with mainly BHOP infrastructure in close proximity to the embankment. A public road is located approximately 170 m to the south east of the embankment, and approximately 15 m lower than the existing topographic elevation next to the proposed embankment.

Based on a preliminary overview of DSC guidelines related to hazard category classification Golder expect this facility is likely to be classified as a High A or High B Category, depending the results of a dam break analysis related to the embankments and retaining wall. This preliminary opinion by Golder on the hazard category is based on a more than 10 population at risk and the severity of damage or loss is Major. The concept design therefore includes an emergency spillway which will be designed to discharge the probable maximum flood (PMP) event for the facility.

It is proposed that the spillway be located at the south eastern end of the Pit, with a discharge chute down the existing mine spoil mounds and slopes towards the existing public road. The discharge rate is expected to be moderate to low due to the relatively small catchment of the pit, so spillway flow across the road during an extreme PMP event in the general area of Broken Hill is considered to have no material detrimental effect on the flow related risks at the road.

The design would require an approval issued by the DSC.

6.4 Construction Preparation for TSF2 Embankments and Retaining Wall

The majority of the perimeter surrounding Blackwood Pit consists of bedrock, waste rock and other unknown fill materials. The only area where some vegetation exists is sporadic opportunistic vegetation along the northeast boundary and around the old mining residence. This consists of both exotic and native vegetation.

Construction of Embankments 1 and 2 will take 4 to 6 months and the retaining concrete wall will also be constructed during this period. The construction of Embankment 3 will occur later when the tailings reach the required level and will take approximately two months.

Construction of the embankments will require earth moving equipment – excavator, bull dozer, front end loader, etc. Embankment construction materials will comprise waste rock sourced from the mine site. Material required to be crushed will be sourced in Kintore Pit and crushed at the base of Kintore Pit. Some other waste rock used in the outer embankments and not requiring crushing may be sourced on the surface. Any surface (external to Kintore Pit) waste rock is required to be crushed will be handled through the current processing plant primary crusher, an enclosed facility.

Current material estimates include:-

- Northern Embankments
  - Select fill (combination of crushed and compacted waste rock): 47,500 m^3
  - Geotech liner upstream: 7,800 m^2
  - Two anchor trenches for the lining works of total length 450 m
  - Retaining wall 5.0 m to 0.5 m high, 37 m length
- Southern Embankment
  - Bulk fill (weathered rock): 20,500 m^3
  - Foundation geotextile: 8,400 m^2
  - Geotech liner upstream: 4,100 m^2
- Chimney drain sand in embankments: 4,200 m^3
- Excavate spillway chute: 15,000 m^3

Liners will be sourced from either within Australia or overseas and will be transported to site via road as part of normal delivery supplies.

Trucks (50 t) will be used to transport waste rock on site and up to approximately 950 return trips may be required to move materials. The numbers and transport routes are still under consideration and will be addressed in the Environmental Assessment. Construction traffic will be considered as part of the Construction Management Plan.

The retaining concrete wall will be constructed in-situ.

6.5 Description of Operation

No changes are expected to the current general operations of the tailings facility which are described in the BHOP Tailings Management Operations Manual.

However given the possible severity consequence rating it is anticipated that additional inspections and engineering audits reportable to the NSW Dam Safety Committee, will be conducted over the life of the facility.

7 PRELIMINARY ENVIRONMENTAL REVIEW

7.1 Concrete Batching Plant

7.1.1 Concrete Batching Plant – Preliminary Risk Review

Table 5 provides identifies the key environment issues identified in the preliminary environment assessment for the Concrete Batching Plant and identifies the key environment issues relevant to this Project.

Table 5 Review of Environment Issues - Concrete Batching Plant

Environmental Issue	Relevance	Key Issue
(1) Construction - noise	Noise will be generated during construction from earthworks, plant construction and on-site road traffic.	Yes
(2) Construction - dust	Dust will be generated during construction from earthworks, plant construction and on-site road traffic.	Yes
(1) Operation - noise	Noise will be generated during the operations of the Concrete Batching Plant from the plant operation and from on-site road traffic. There will be additional on-site road traffic with concrete deliveries from the rail siding to the Concrete Batching Plant, aggregate deliveries and fibrecrete from the Batching Plant to the mine portal. There will be little change to public road traffic.	Yes
(2) Operation - dust	Dust may be generated from vehicle traffic and aggregate loading/unloading to storage point, dumping aggregate into hopper, and mixing of materials.	Yes
(3) Operation - water	Waste water will be generated by the batching process.	Yes
Community Health	The roads on site which will be utilised for additional truck movements are sealed. Bunding and the surface area for the Concrete Batching Plant and vehicle movements will be constructed using inert waste rock. There will be no additional impacts to community health.	No
Water Resources - supply	The operation of the Concrete Batching Plant will utilise some raw water (1164 m^3) however as there has been a reduction in raw water use since the original EA (288 ML predicted per annum down to an average usage rate of 260 ML per annum) no additional raw water is required to that outlined in the EA.	No
Ecology	Past mining has left the Rasp Mine and Project Area highly modified and disturbed. The original landform has been significantly altered, all vegetation has been removed and soils have been degraded and covered with waste rock.	No
Visual Amenity	There will be some impact on visual aspect from the town and the café located on the mining lease.	Yes
Traffic & Transport	There will be a number of changes to traffic and transport movements. There will be an approximate 50% decrease in external deliveries from the Quarry to the Mine. There will be some changes to surface activities with concrete deliveries from the rail siding to the Concrete Batching Plant (253 per month) and fibrecrete to the Mine Portal (21 per	Yes

Environmental Issue	Relevance	Key Issue
	month).	
Waste Management	There are no significant wastes generated from the Concrete Batching Plant, apart from packaging materials. These materials will be managed through the current Waste Management Plan.	No
Rehabilitation	The Concrete Batching Plant will be located in an area that is already highly disturbed, all traffic movements will occur on currently installed and sealed roads. There will be no additional surface disturbance and no requirement to remove vegetation.	No

7.1.2 Concrete Batching Plant – Key Environment Issues

Construction

(1) Noise may be generated by:-

- Vehicle movements, excavator, front end loader, trucks and light vehicles and construction of buildings and storage areas
- Plant construction

Measures to minimise noise will be determined following noise modelling as part of the Environmental Assessment, however the following will be considered:-

- Hours for construction
- Development of Construction Management Plan

(2) Dust may be generated by:-

- Surface displacement / excavations
- Bund construction
- Vehicle movements

Measures to minimise dust will be determined following dust modelling as part of the Environmental Assessment, however the following will be considered:-

- Use of a water truck
- Management of potential dust generating activities on wind days including suspension of works if required (ie exceeding 40 kph)
- Sealed roads
- Development of Construction Management Plan

Operation

(1) Noise may be generated by:-

- Loading and unloading of aggregate materials
- Delivery of cement, aggregates and admixtures
- Dumping of aggregate materials into hopper

- Revving of concrete truck when charging
- Air compressor
- Drives and motors
- Vehicle (trucks, FEL, light vehicles) movements

Measures to minimise noise will be determined following noise modelling as part of the Environmental Assessment, however the following will be considered:-

- Scheduling of noise generating activities to daytime, where possible
- Enclosure of noise generating plant or equipment
- Noise reduced reversing beepers
- Update of the site's Noise Management Plan

(2) Dust may be generated by:-

- Traffic movements
- Loading / unloading aggregate to storage areas
- Dumping of aggregate materials into hopper
- Mixing materials

Measures to minimise dust will be determined following dust modelling as part of the Environmental Assessment, however the following will be considered:-

- Moisture compacted surface for operations
- Use of chemical dust suppressant
- Use of water sprays
- Sealed roads
- Update of the site's Air Quality Management Plan

(3) Waste water will be generated during the batching process and will be contained within a sump, reused and/or allowed to evaporate. The Site Water Management Plan shall be updated to manage storm water run-off in this area.

Visual Amenity

Visual amenity may be affected by:-

- Lighting installations
- Noise bund
- Plant structures

It is not anticipated that there will be any significant visual impacts. Measures to minimise visual impacts will be determined and included in the Environmental Assessment with particular attention given to lighting design and direction.

Transport & Traffic

Transport and traffic impacts include:-

- 50% reduction in current external road traffic from the Quarry

- Additional transport movements on site
- Additional truck deliveries

It is not anticipated that there will be any impact to off-site traffic arrangements as the decrease in trucking movements from the Quarry offsets any increase in truck deliveries to the site for aggregates and additives.

Measures to minimise on-site traffic impacts will be determined and included in the Environmental Assessment and may include:-

- Arranged timing for deliveries to day time, where possible
- Arranged timing for transport of raw materials concrete, aggregate and additive materials on site to daytime, where possible
- Sealed site roads
- Update of the site's Traffic Management Plan

7.2 Extension to Blackwood Pit (TSF2) Wall Raise

7.2.1 Extension to TSF2 – Preliminary Risk Review

Table 6 provides identifies the key environment issues identified in the preliminary environment assessment for the wall raises on Blackwood Pit TSF2 and identifies the key environment issues relevant to this Project.

Table 6 Review of Environment Issues - Blackwood Pit TSF2

Environmental Issue	Relevance	Key Issue
(1) Construction - noise	Noise will be generated during construction from earthworks, mobile equipment, crushing activities and on-site road traffic.	Yes
(2) Construction - dust	Dust will be generated during construction from earthworks, materials placement and on-site road traffic.	Yes
(3) Construction - heritage	British Flats is a heritage listed building on the BHCC LEP and an old mining residence which is not heritage listed are located adjacent to Blackwood Pit.	Yes
(1) Operation - noise	There is no additional noise anticipated during operation to the current operation of this facility.	No
(2) Operation - dust	Some drying of tailings may occur as the deposition heads towards decommissioning and the level of tailings rises closer to the surface, as per original EA.	Yes
(1) Water - seepage	Seepage may occur from embankments and drainage.	Yes
(2) Water – rain runoff	Stormwater runoff will occur on embankments and post usage on the surface of TSF2.	Yes
Water – supply	The use of water sprays and the water truck for dust suppression was included in the original EA.	No
Embankment / Wall Failure	An embankment or retaining concrete wall failure may occur from a seismic event, flooding or from poor design and construction.	Yes
Community Health	It is anticipated that construction works will take a maximum of 6 months and no additional health impacts related to construction are anticipated. Only inert waste rock will be used in construction activities. There is no additional health impacts anticipated during	No

Environmental Issue	Relevance	Key Issue
	operation to the current operation of this facility. Refer dust management. There will be no additional impacts to community health.	
Water Resources - supply	Construction will use some raw water for compaction and dust suppression. It is not anticipated that the level of raw water usage outlined in the original EA will be exceeded.	No
Ecology	Past mining has left the Rasp Mine and Project Area highly modified and disturbed. The original landform has been significantly altered, all vegetation has been removed and soils have been degraded and covered with waste rock. However there are some planted trees and vegetation adjacent to the old mining residence and adjacent area which will require removal. This is less than a hectare and is not considered significant.	Yes
Visual Amenity	There will be some impact on the visual aspect from the Crystal Street, Federation Way and Menindee Road. However this will be in keeping with the current mining profile of CML7.	Yes
Traffic & Transport	There will be increased vehicle movements during construction, in particular to collect and deposit waste rock materials. There will be no additional vehicle movements for normal operations.	Yes
Waste Management	There are no significant wastes generated from the construction or operation of the facility.	No
Rehabilitation / Closure	The surrounding area of Blackwood Pit is already highly disturbed. However some vegetation may be required to be removed adjacent the old mining residence and in the north-east corner of TSF2. Dust may occur from the drying out of the tailings and the placement of waste rock as the final cover. Noise will occur during decommissioning activities and the placement of waste rock as the final cover. Severe floods may cause overtopping of the TSF walls. Seepage may occur through the embankments and/or retaining concrete wall. Concrete engineered wall may attract salts which may cause the concrete to deteriorate. There will be a slight increase in the disturbance footprint, approximately 2 Ha	Yes

7.2.2 Extension of TSF2 – Key Environment Issues

Construction

(1) Noise may be generated by:-

- Vehicle movements, excavator, front end loader, bulldozer, grader,
- Trucks and light vehicles
- Dumping of materials

- Material crushing
- Material compaction
- Concrete wall construction

Measures to minimise noise will be determined following noise modelling as part of the Environmental Assessment, however the following will be considered:

- Hours for construction
- Crushing to be undertaken in Kintore Pit or current crushing facility
- Development of Construction Management Plan

(2) Dust may be generated by:-

- Surface excavations
- Vehicle movements, excavator, front end loader, bulldozer, grader,
- Trucks and light vehicles
- Dumping of materials
- Material crushing
- Material compaction
- Concrete wall construction

Measures to minimise dust will be determined following dust modelling as part of the Environmental Assessment, however the following will be considered:-

- Use of a water truck and water hoses
- Management of potential dust generating activities on wind days including suspension of works if required (ie exceeding 40 kph)
- Development of Construction Management Plan

(3) There is one heritage building located to the north of Blackwood Pit, British Flats, this building will not be impacted by the construction of embankments or the concrete retaining wall.

Also located in this area is an old mining residence, the construction date is unknown but is similar in construction to other heritage items on CML7 which dates from around 1900. BHOP has given lengthy consideration to this structure and the possible impacts from embankments in this area. The initial design put forward by Golder was an extension of Embankment 1 which would have required the demolition of this building. Given its age and relatively good condition BHOP asked Golder to reconsider plans for this area and a concrete retaining wall was proposed to protect this building.

Operation

(1) Dust may be generated by:-

- Drying out of tailings
- Wind take up

Measures to minimise dust will be determined following dust modelling as part of the Environmental Assessment, however the following will be considered:-

- Method of tailings deposition
- Use of water hoses/sprays
- Application of chemical dust suppressant
- Update of the site's TSF2 Operations Manual

Water – management

(1) Seepage of rain water may occur through the walls of the embankments. In the most cases this can be managed through current drainage systems. A hydrology review will be undertaken to identify sources of seepage its management.

(2) Rain water runoff will occur on the embankments and a hydrology review will identify measures to update the Site Water Management Plan.

Embankment / Wall Failure

An embankment or concrete retaining wall failure may occur from a:-

- Seismic event
- Flooding
- Poor design and construction.

Measures to minimise a failure will be determined following the dam break study as part of the Environmental Assessment, however the following will be considered:-

- Dam break study
- Engagement of competent design contractor
- Engagement of competent construction contractor
- Audits and inspections during design and construction
- Peer review of design
- Dam Safety Committee review

Ecology

Some vegetation will be lost around the old mining residence and along the north-east boundary. Vegetation removal is minimal and is related to exotic and opportunistic native plantings.

Visual Amenity

Visual amenity may be affected by:-

- Lighting installations
- Increase height of walls

It is not anticipated that there will be any significant visual impacts. Measures to minimise visual impacts will be determined and included in the Environment Assessment with particular attention

given to lighting design and direction. It is expected that the embankment extensions shall be consistent with the current mining profile of the Hill.

The retaining concrete wall will be visible from the old mining residence and its surrounds and a depiction of the wall will be contained in the Environmental Assessment together with the consideration of any mitigation measures eg rock placement in line with the rest of the embankments.

Transport & Traffic

Transport and traffic impacts will occur during the 6 month construction period from:-

- Increased site vehicle movements
- Earthworks and mobile equipment
- Additional truck deliveries

Measures to minimise on-site traffic impacts will be determined and included in the Environmental Assessment and may include:-

- Scheduled deliveries to day time only, where possible
- Scheduled transport of construction materials to day time only where possible
- Update of the site's Traffic Management Plan

Rehabilitation and Closure

A conceptual design for the closure and rehabilitation of TSF2 was included in the original EA with the primary consideration to be to minimise dust, in particular lead-bearing dust, take up by wind across the surface of the facility. As part of the Environmental Assessment a more detailed rehabilitation strategy and closure criteria shall be included. This will also address the following potential issues:-

- Dust may occur from the drying out of the tailings and the placement of waste rock as the final cover.
- Noise will occur during decommissioning activities and the placement of waste rock as the final cover.
- Severe floods may cause overtopping of the TSF walls.
- Seepage may occur through the embankments and/or retaining concrete wall.
- Concrete engineered wall may attract salts which may cause the concrete to deteriorate.

There will be a slight increase in the disturbance footprint, approximately 2 Ha

The surrounding area of Blackwood Pit is already highly disturbed. However some sporadic vegetation will be required to be removed adjacent the old mining residence and in the north-east corner of TSF2.

7.2.3 Cumulative Environmental Impacts

Cumulative impacts by the combined risks for both project areas are unlikely to be significant given the difference in activities and their locations. However, the potential for cumulative risks will be considered in the Environmental Assessment, particularly in relation to potential noise and dust impacts.

8 CONSULTATION

BHOP has identified a number of key stakeholders and will consult with each of these parties to gain an understanding of any relevant environmental concerns to be addressed for this Project.

Preliminary discussions are outlined in **Table 7**.

Table 7 Summary of Preliminary Discussions with Stakeholders

Stakeholder	Type of Discussion	Issues Raised
Department of Planning and Environment	AEMR Meeting Meeting (12/8/2016) Telephone discussions	Inspected and discussed area for Embankment 2. Visual amenity for embankments and retaining wall. Noise for operation of concrete batching plant.
Environment Protection Authority	Telephone discussions	Notification of embankment and wall construction.
Broken Hill City Council	Meeting	Noise for operation of concrete batching plant. Impacts on old mining residence.
Department of Primary industries - Lands	Meeting	Impacts on old mining residence.
Department of Industry - Resources and Energy	AEMR Meeting Telephone discussion	Inspected and discussed area for Embankment 2. Yet to occur.

It is intended to continue discussions with these stakeholders during the Environmental Assessment process to provide information on the environmental studies and identified mitigation measures to be undertaken.

It is also intended to hold a presentation event for the community of Broken Hill prior to finalisation of the Environmental Assessment.

Details of this consultation will be included in the final Environment Impact Assessment report.

9 BENEFITS OF MODIFICATION

9.1 Concrete Batching Plant

At the maximum Concrete Batching Plant capacity of 15,000m3 there would be a saving of $1.9 M per annum.

It would also be cost effective for the construction of the concrete retaining wall for TSF2 if the Concrete Batching Plant was constructed and in operation prior to construction of this wall.

9.2 Extension to Blackwood Pit TSF2

At current mining and processing rates deposition to TSF2 ceases in July 2019, hence mining will also cease at that time if no additional storage for tailings is identified. The extension of the life of the Blackwood Pit TSF2 tailings facility will allow mining to continue to late 2021 providing sufficient time

for investigations to be undertaken to identify any further potential for on-site tailings containment and if this is not feasible to locate a new tailings storage facility off site.

The granting of this modification is therefore critical for mining to continue at the Rasp Mine beyond 2019, given that variations to the environment protection licence and mining operations plan will also be required prior to construction and together with endorsement of the TSF facility by the DSC required prior to tailings deposition can occur the timing of the approval of this modification is crucial.

10 APPROVAL REQUIREMENTS

In addition to the application to the Department of Planning and Environment to modify the Project Approval 07_0018 BHOP will also seek a modification to its Mining Operations Plan and will consult with the EPA to determine if any variation to its Environment Protection Licence 12559 is required.

The proposed changes to TSF2 is considered by Golder to convert the facility into a structure that is subject to the NSW Dam Safety Committee Review and endorsement. This process shall be undertaken concurrently with the application for this modification.

11 ADDITIONAL INFORMATION

For additional information please contact:

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