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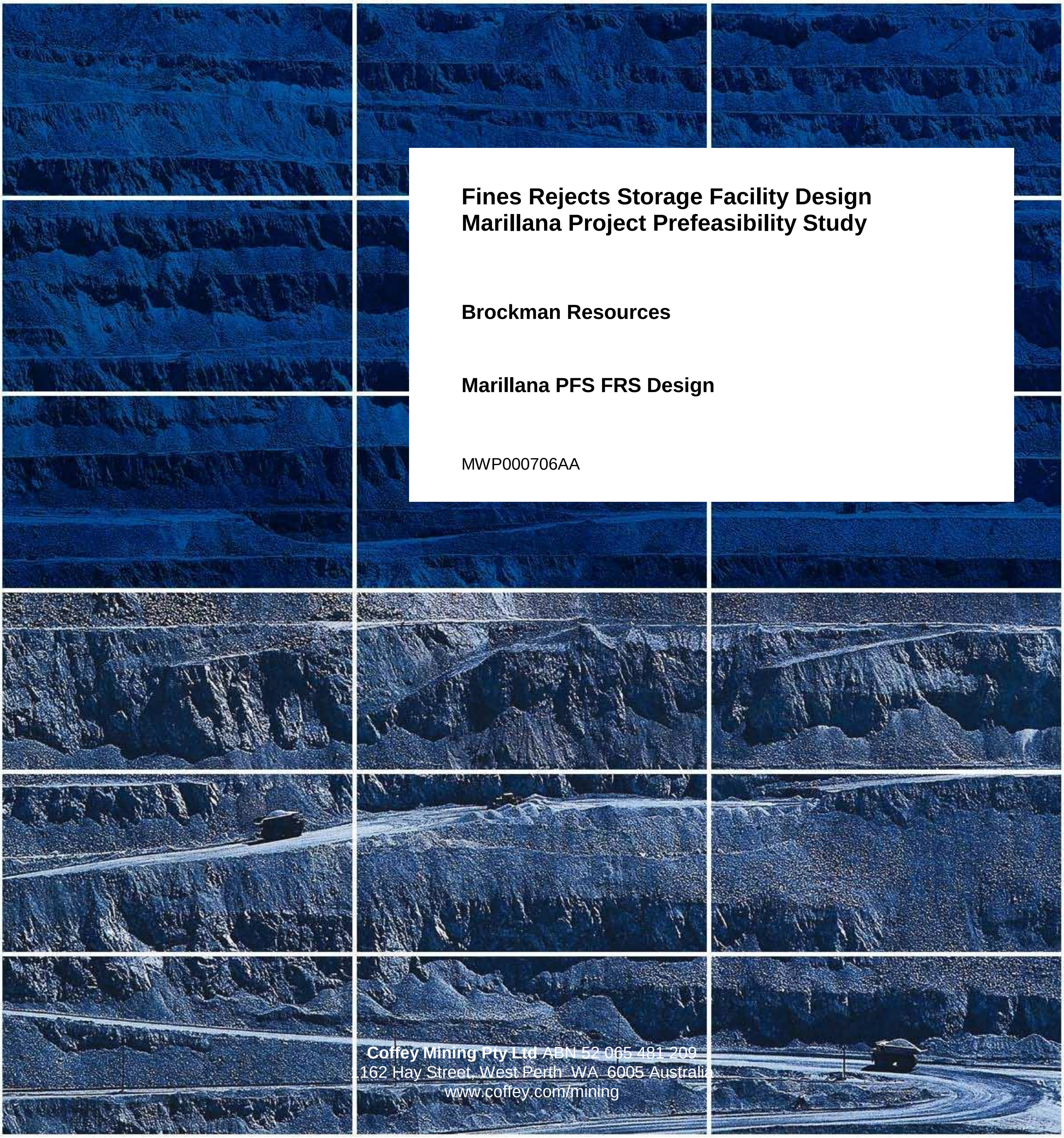

Fines Rejects Storage Facility Design Marillana Project Prefeasibility Study

Brockman Resources

Marillana PFS FRS Design

MWP000706AA

Coffey Mining Pty Ltd ABN 52 065 481 209
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2 September 2009

Brockman Resources
Level 1, 117 Stirling Highway
NEDLANDS WA 6009

Attention: Brendan Hynes

Dear Sir

RE: Fines Rejects Storage Facility Design Marillana Project Prefeasibility Study

Please find attached Revision 4 of the final report for the Prefeasibility Fine Rejects Storage Facility Design – Marillana Project. This revision amends the PFS report to include information on Fine Rejects Storage Facility 1 only.

We trust this report meets your immediate requirements. Should you require clarification of any details please do not hesitate to contact this office.

For and on behalf of Coffey Mining Pty Ltd

Chris Johns
Associate Geoenvironmental Engineer

MWP000706AA

DOCUMENT INFORMATION

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Version	Description (section(s) amended)	Author(s)	Date
4	Amend PFS report to include FRS1 only	WZP	02/09/09
3	Update FRS downstream batter to concave shape	CJ	27/07/09
2	Update fines rejects nomenclature	CJ	07/07/09
1	Incorporate additional client feedback	CJ	02/07/09

Document Review

Chris Johns
Associate Geoenvironmental Engineer

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EXECUTIVE SUMMARY

Fine Rejects Storage (FRS) facilities have been designed for the proposed Marillana Iron Ore Project, which is owned by Brockman Resources.

The FRS were designed to contain thickened fine rejects generated from beneficiation of Detrital and CID ore. The processing plant was designed to produce approximately 10 to 12 million dry tonnes of fine rejects per annum for a 20 year mine life.

The fine rejects properties were assumed based on the characteristics of typical beneficiated iron ore fine rejects from the Pilbara region.

The Marillana FRS design concept comprises both above ground storage and in-pit storage of fine rejects. For the first six to seven years of production fine rejects will be stored at FRS1, an integrated waste landform that will be constructed within a mine waste rock dump. For the remainder of mine life, fine rejects will be stored in a mined out portion of the pit. The design and operation of the in-pit FRS are described in a separate report (Coffey Mining, 2009, MWP000706AE-AB).

The operational design of the FRS has been aimed at:

- Optimising the removal of surface water for return to the processing plant.
- Maximising fine rejects density and storage capacity by undertaking cyclic deposition for the above ground storages.
- Minimising land disturbance and potential seepage.

Fine rejects in the form of a slurry will be discharged subaerially and spirally from the full circumference of the perimeter embankments of the above ground FRS. Fine rejects will be deposited in discrete layers from numerous spigot point discharges. For the in-pit storage, fine rejects placement will be from a single point spigot discharge location that may be varied throughout the operation to provide optimum fine rejects deposition and water pond manoeuvring.

Monitoring instrumentation is proposed and a preliminary rehabilitation plan is presented that involves placement of mine waste rock cover and installation of spillways on the above ground FRS.

Several recommendations are provided to progress the FRS design including a site geotechnical investigation, fine rejects testwork, and FRS embankment stability and seepage modelling.

1 INTRODUCTION

This document presents the design of Fines Rejects Storage (FRS) facilities for the proposed Marillana Iron Ore Project, which is owned by Brockman Resources Limited (Brockman). The design was developed as part of Pre-feasibility Study (PFS) for the project. The Marillana Iron Ore Project site is in the Pilbara region of Western Australia, approximately 100 km northwest of Newman, WA.

The design was prepared based on information supplied by Brockman and the PFS study team. A visual reconnaissance of the proposed site by Coffey Mining geotechnical personnel was carried out in support of the study. This site reconnaissance is described in the geotechnical design report included in the PFS report.

The Marillana FRS design comprises an above ground storage and in-pit storage of fine rejects. A site plan of the project area is shown on Drawing MWP00706-AA-01. Fine rejects will be stored at FRS1 for the first six to seven years of production. FRS1 is an integrated waste landform (IWL) that will be constructed within a mine waste rock dump. For the remainder of mine life, fine rejects will be stored in a mined out portion of the pit. The design and operation of the in-pit FRS are described in a separate report (Coffey Mining, 2009, MWP000706AE-AB).

The FRS design was developed in general accordance with the Western Australian Department of Minerals and Petroleum (DMP) standards (DoIR, 1999).

2 GENERAL INFORMATION

The regional topography of the project area is dominated by the Hamersley Plateau in the south and a gently sloping plain draining towards the Fortescue Valley. The average annual rainfall in the project area is in the order of 310mm and the annual evaporation in the order of 3000mm. The 1 in 100 year average recurrence interval 72 hour precipitation event in the project region has been estimated in the range of 300 to 400mm.

The hematite deposit is to be mined using open pit methods, via a series of staged pits striking East-West. The rocks within the deposit are part of the Brockman, Mt. McRae Shale, and Mt Sylvia Formations. Mineralisation is hosted within Detrital and Channel Iron Deposits (CID). Overburden material will include variable cemented silts, clays, and gravely clays.

Fine rejects will be generated from the process plant thickener underflow (-1mm). Coarser rejects (-8mm to +1mm) from the detritals plant is to be dewatered and disposed in a separate surface dump. No significant amount of process chemicals are to be added to the process water in the beneficiation process.

The processing plant is designed to produce approximately 10 to 12 million dry tonnes of fine rejects per annum for a 20 year mine life. The variability in fine rejects production is related to the mix of CID and detrital feed.

The design fine rejects production schedule for material to be stored in the fine rejects storage facilities is provided in Table 1.

Table 1
Fine Rejects Production Schedule

Production Year	Fine Rejects Production	
	Million tonnes (dry)	Million cubic metres*
1	10	6.7
2	11.6	7.7
3	11.6	7.7
4	11.6	7.7
5	11.6	7.7
6	10.9	7.3
7	10.9	7.3
8	11	7.3
9	10.9	7.3
10	10.9	7.3
11	10.9	7.3
12	9.9	6.6
13	9.9	6.6
14	9.9	6.6
15	9.9	6.6
16	9.9	6.6
17	11.6	7.7
18	11.1	7.4
19	11.6	7.7
20	4.9	3.3
Total	210.6	140.3

* Fine rejects volume assumes settled density of 1.5 t/m^3

3 FINE REJECTS STORAGE FACILITY SITE SELECTION

The constraints on selection of a suitable location for fine rejects storage included the following:

(i) Sited within current lease limits.

(ii) “No go” areas included BHPB rail line, proposed mine pit, processing plant, and train loading area, and one major surface water drainage channel (Weeli Wolli Creek).

(iii) No other “no go” areas were identified (heritage, flora/fauna, infrastructure, active faults, other environmental, groundwater quality sensitivities).

(iv) Munjina-Roy Hill Road was able to be re-aligned if required, but preferred exit points at lease boundary be maintained.

(v) Adequate space for installation of perimeter seepage interception ditches was allowed for in the FRS design, in case they are required.

(vi) to mitigate risk of potential dust impact, there should be sufficient distance between the FRS and potential receptors including the site administration offices and camp site.

(vii) Locating the FRS close to a surface drainage route would require erosion protection and there is limited competent rock available to the project.

(viii) Sufficient space should be available around the FRS to mitigate the consequences of a potential embankment failure, particularly with respect to major infrastructure and lease boundaries.

Several alternative sites were examined within the lease. The benefits of locating FRS1 at the southwest corner of site as shown on the drawings include:

(i) Relatively close proximity to plant and mining operations allows use of mine waste rock to contain fine rejects and limits distance for slurry and water recovery pumping and piping requirements.

(ii) Location south of the existing rail line results in no requirement to convey substantial amounts of embankment material across the rail line (safety, infrastructure cost).

4 FINE REJECTS STORAGE FACILITY DESIGN: FRS1

The operational design of FRS1 has been aimed at:

- Optimising the removal of surface water for return to the processing plant.
- Maximising fine rejects density and storage capacity by undertaking cyclic deposition for the above ground storage.
- Minimising land disturbance and potential seepage.

FRS1 was sized to contain fine rejects until the mine operation was sufficiently progressed to allow in-pit disposal, and yet fit within lease limits and proposed site infrastructure.

The following considerations have been incorporated into the above ground FRS design:

(i) A seepage cut-off and underdrainage system is incorporated into the design to limit potential seepage losses from the facility and recover seepage for reuse in the process plant.

(ii) Fine rejects in the form of a slurry will be discharged subaerially and spirally around the FRS. Fine rejects will be deposited in discrete layers from one or more discharges to promote low velocity discharge. The active discharge points will be regularly moved to ensure that an even development of the fine rejects beach is achieved. The length of time between successive depositions (i.e. drying time) on any one area will be maximised.

(iii) Fine rejects discharge or spigotting will be carried out such that the sloped beaches that are formed will be controlled to ensure that the surface water pond, formed from the liberation of water from the deposited fine rejects slurry, is maintained around the central decant structure. A pump will be deployed in the decant structure to return water to the plant. Any supernatant pond formed will be kept away from the containment embankments at all times.

The following considerations have been incorporated into the IWL design of FRS1:

(i) Clayey mine waste from the open pit will be used in the construction of the Stage 1 embankment to provide approximately 4 years initial storage capacity.

(ii) Stage 2 of embankment construction will be undertaken in Year 4. Clayey mine waste will be used for construction purposes. Staged construction will provide additional capacity on an as required basis, generally aimed at allowing for generation and placement of the minimum amount of waste material for the adjacent waste dump.

(iii) The storage life has been estimated based on the fine rejects production summarised in Table 1. Stage 1 will provide approximately 28 Mm^3 of fine rejects solids and Stage 2 will provide approximately 24 Mm^3 at a settled fine rejects dry density of 1.5 t/m^3.

(iv) Beach slopes are expected to be in the range of 0.5%, but in the event steeper beach slopes form there is likely sufficient mine waste rock to create finger walls perpendicular to the perimeter embankment. These finger walls will allow fine rejects deposition to extend further into the facility and thus maximise the use of the storage volume within the depressed cone formed in the facility centre.

(v) The upper surface of the FRS will assume the form of a truncated prism with a depressed cone. The facility will have the potential to contain a considerable body of water during a rainstorm. A minimum freeboard will be maintained to contain a 1 in 100 year Annual Exceedance Probability (AEP) 72-hour rainfall event, plus operational (300mm) and beach freeboard (typ. 200mm) requirements.

(vi) On decommissioning, the FRS will remain a permanent feature of the landscape but be completely enclosed in a mine waste rock dump forming the IWL. The fine rejects will drain to an increasingly stable mass. Only the top surface will require rehabilitation as the facility will be surrounded by mine waste rock.

4.1 Drawings

The following design drawings are provided in Appendix A:

Title	Drawing No.	Rev
Fine Rejects Storage Site Plan	MWP00706-AA-01	G
Fine Rejects Storage Facility Sections	MWP00706-AA-02	E

4.2 Fine Rejects Properties

The fine rejects properties were assumed based on the characteristics of typical beneficiated iron ore fine rejects from the Pilbara region. The settled dry density of the fine rejects was estimated to be 1.5 t/m^3 and the fine rejects beach slope was assumed to be 0.5%. Some segregation of fine rejects by particle size may be anticipated at the FRS. The fine rejects were assumed to be geochemically inert (non acid generating material), and the particle sizes were expected to be predominantly in the medium sand to silt size range (<1mm). It was assumed the average fine rejects slurry density ex-plant would be approximately 55% solids by mass.

4.3 Integrated Waste Landform Construction Methods: FRS1

The perimeter embankment of FRS1 will comprise a starter embankment constructed using compacted clayey mine waste which will be formed against the adjacent mine waste rock dump. The clayey mine waste materials will be sourced from the adjacent open pit. The embankment earthworks were calculated based on a geometry of a 20m wide crest and 3H (horizontal) : 1V (vertical) downstream batters and 2.5H:1V upstream batters. This geometry was selected to allow for waste dump construction with large mine earthmoving equipment.

The design concept also incorporates water recovery systems comprising underdrainage and a decant.

The underdrainage is designed to recover water from the base of the deposited fine rejects and assist with seepage control and fine rejects consolidation. A trench drain to intercept seepage outside the waste dump toe is included in the design as an extra seepage control measure. The requirement for the extra seepage control should be reviewed following the site geotechnical assessment and FRS seepage modelling. The decant system comprises two decant structures with slotted concrete riser sections stacked vertically on one another and surrounded by select filter rock. This structure will be raised along with the perimeter embankments as part of staged construction works.

Typical FRS construction quality control/assurance requirements include the following:

- Monitoring of the underdrainage pipework and outfall sump.
- Monitoring of the seepage cut-off and the alignment of the embankment.
- Compliance testing of seepage cut-off and the compacted perimeter embankment fill in order to check compliance with the specification. Typical specifications include:
  - Moisture content at the time of placement is within ±2% of the optimum moisture content as determined from laboratory test AS1289.5.1.1.
  - Each layer is compacted to achieve a density ratio greater than 95% of standard maximum dry density, as determined from laboratory test AS 1289.5.1.1.

- Materials used in the embankment construction shall comprise clayey material having fines content (material finer than 75 microns) in excess of 25%.

4.4 Area

The footprint area of FRS1 after Stage 2 (24m high) and including the mine waste rock has been estimated at 285 ha.

4.5 Capacity

The estimated storage capacity and earthworks material required for each stage of FRS1 is summarised in Table 2.

Table 2

Summary of Fine Rejects Storage Capacity and Embankment Construction Material Requirements for FRS1 by Construction Stage

Stage	**Earthworks** million m^3	**Storage Capacity**	
		million m^3	years
1 – 13 m Starter	4.65	28	3.8
2 – 11 m Raise	9.46	24	3.2
Total	**14.1**	**52**	**7**

The estimated capacity of FRS1 is 52 million cubic metres of fine rejects, which is equivalent to 78 million dry tonnes of fine rejects at a settled dry density of 1.5 t/m^3. The capacity estimate incorporates a beach slope at 0.5% and freeboard requirements. The estimated storage life of FRS1 based on the fine rejects production rates summarised in Table 1 is 7 years. Approximately 4.65 million cubic metres of mine waste rock will be required for Stage 1 Earthworks (including the mine waste rock dump) and 9.46 million cubic metres will be required for Stage 2 Earthworks.

While current mine planning indicates there is sufficient mine waste rock for this design, it would be possible to reduce the height of the Stage 1 or Stage 2 embankment and delay the earthworks volume requirement if there is insufficient mine waste rock at the required time. A Stage 3 of embankment raising would then be required.

4.6 Wall Angles

FRS1 has design slopes of 2.5 (horizontal):1 (vertical) upstream and 3:1 downstream (overall angle). The downstream slopes will be constructed in a concave shape to facilitate closure design requirements.

4.7 Embankment Stability

The embankment designs for the Marillana FRS have been shown to be adequate at other sites when correct operational procedures have been followed. Stability analyses of the embankments are recommended at the next phase of FRS design work.

4.8 Water Recovery System

For all Marillana FRS, surface water liberated from the fine rejects slurry will be recovered from the impoundment area. For FRS1, water return will be achieved via pumps deployed within the decant structures. For the in-pit storage, water return will be achieve by either a land based pump located on the pit access ramp or via a pontoon mounted pump. Monitoring bores will be located in the potential major seepage pathways (geological features or discontinuities) associated with the pit and could be used as recovery bores, if required. Return water will be pumped back to the process plant water tank.

5 OPERATING PROCEDURES: FRS1

Fine rejects in the form of a slurry will be discharged subaerially and spirally from the full circumference of the perimeter embankments of FRS1. Fine rejects will be deposited in discrete layers from numerous spigot point discharges (i.e. multipoint spigotting). The discharge points will be regularly moved to ensure the even development of sloped fine rejects beaches. The length of time between successive depositions (i.e. drying time) on any one area shall be maximised. The deposition regime is aimed at maintaining the water pond adjacent to and around the decant structure.

Fine rejects discharge or spigotting is to be carried out such that the supernatant water pond is maintained around the decant structure. Keeping the supernatant pond to a minimum size will have the effect of minimising evaporation from the surface of the pond and hence will assist in optimising the water recovery and fine rejects density.

Frequent inspections (on a daily basis) should be made of the spigot, fine rejects lines, water return lines, pumps and related facilities, the position of the pond in relation to the water recovery pump and the pit walls. The return lines should be checked regularly for quantity and quality of water return.

Monitoring bores adjacent to the FRS will be utilised as monitoring / recovery bores. Water samples will be taken periodically to check groundwater quality and elevation.

Operation, safety and environmental aspects should be periodically reviewed during an audit by an experienced engineer. It is recommended that this inspection should be undertaken every year as part of the annual fine rejects storage audit, inspection and management review.

6 INSTRUMENTATION AND MONITORING

The installation of standpipe piezometers is recommended to measure water levels in the embankments and the area adjacent to the FRS. The results of this monitoring can be utilised for embankment stability assessments.

Water levels within the piezometers should be measured periodically and results compared to previous measurements to assess changes in the phreatic surface. Water sampling and laboratory testing of water samples from monitoring bores around the FRS is recommended to characterise potential seepage and impacts to groundwater. Collected information shall be reviewed regularly and reported in an annual facility audit.

7 REHABILITATION

Topsoil removed from the FRS area during the construction of the facilities will be redeployed on the final surfaces of the FRS to assist with rehabilitation, where appropriate. The downstream slopes of the final embankments will be covered with topsoil, contour ripped, seeded with native species and fertilised as appropriate.

Once fine rejects deposition has been completed and little further settlement is expected, the top surface of the storages will capped with a layer of mine waste rock (0.5m nominal thickness) in order to minimise dust generation from the dried fine rejects surface and provide support for topsoil / ‘growth’ medium for re-vegetation of the top surface.

At final closure, the decant structures should be sealed by:

- backfilling of the slotted concrete pipe annulus with dried fine rejects
- removal of the slotted concrete pipes and filter rock to the level of the surrounding fine rejects, and
- capping of the central area of the FRS using clayey mine waste.

A spillway will be required for decommissioning the above ground storages to control the release of excess water on the facility surface resulting from large rainfall events. The design of the spillway will be prepared during the decommissioning/rehabilitation planning stage.

Rehabilitation/decommissioning (closure) plans should be produced by the mine and be submitted to the regulator for approval during mine decommissioning planning.

8 RECOMMENDATIONS

To progress the project and refine the FRS design, the following tasks are recommended:

- Geotechnical site assessment, including sampling and testing of FRS footprint area and the proposed construction materials
- Refine the FRS design details and assess FRS seepage and stability
- Confirmation of fine rejects geochemical characteristics (potential for acid generation, leaching constituents). Graeme Campbell and Associates have been engaged for this work
- Update Aquaterra’s preliminary hydrogeological model with the impacts of potential seepage from the FRS
- Fine rejects material characterisation testwork to provide a guide to settling rates, settled density, beaching characteristics, % potential water recovery.

- Develop in-pit fine rejects storage facility design and operations based on advanced mine planning to assess location, timing, and design for backfilling of voids.

9 REFERENCES

The following standards and references were used in the preparation of this report.

ANCOLD (1999), 'Guidelines on Tailings Dam Design, Construction and Operation'.

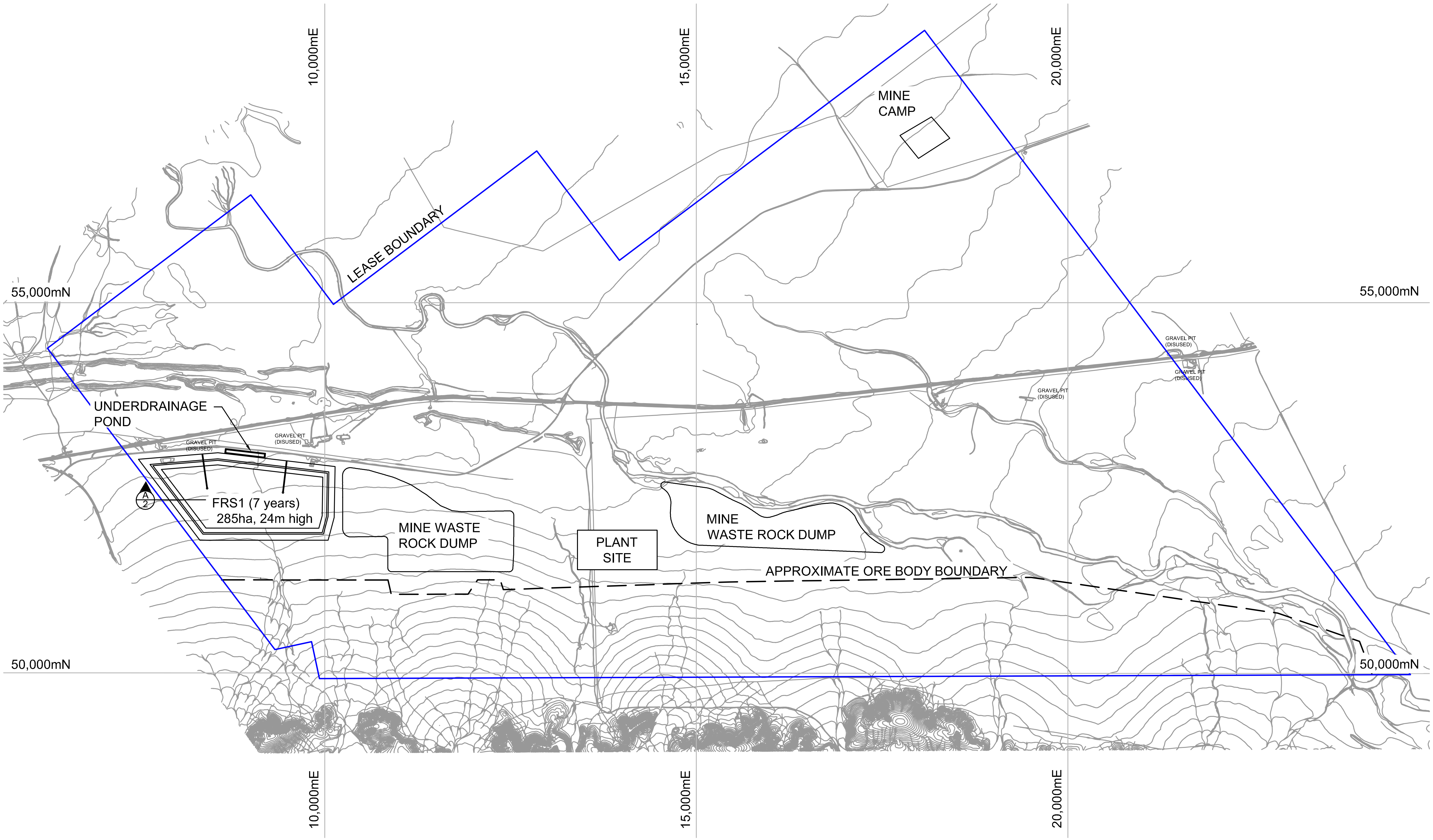
DoIR (1999), 'Guidelines on Safe Design and Operating Standards for Tailings Storage'.

IEAUST (2001) ,'Australian Rainfall and Runoff.'

Coffey Mining (2009), 'Conceptual Design of In-pit Fines Rejects Storage, Newman, Western Australia'. Coffey Mining Reference MWP00706AE-AB. Unpublished report prepared for Brockman Resources.

Appendix A

Drawings



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Date:	02/02/09			
Scale:	1:50 000		Title:	FINES REJECT STORAGE SITE PLAN
Original size:	A3		Project no: MWP00706AA	Fig no: MWP00706AA - 01 Rev: G

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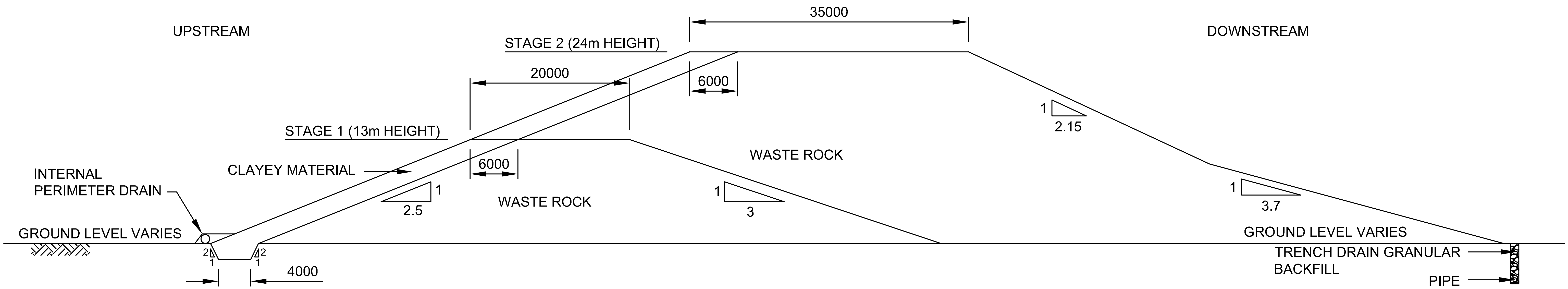

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FRS1 EMBANKMENT
TYPICAL SECTION
SCALE 1:500

Drawn:	LM/CF	coffey mining SPECIALISTS FROM BOARDROOM TO MINE FACE	Client:	BROCKMAN RESOURCES
Approved:	CJ		Project:	MARILLANA IRON ORE PROJECT
Date:	02/02/09		Title:	FINES REJECTS STORAGE FACILITY SECTIONS
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