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SPECIALISTS FROM BOARDROOM TO MINE FACE

GRIFFITH CITY COUNCIL
STAGED OPERATIONAL AND DEVELOPMENT PLAN FOR THARBOGANG QUARRY AND LANDFILL

Bryce Atkinson, Robert Johnston

New Town

MINENTWN00167A RE04

12 December 2008

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12 December 2008

Griffith City Council

1 Benerembah St

Griffith

New South Wales 2680

Attention: Mr Dallas Bibby; Mr John Roser

Sent via email: Dallas.Bibby@griffith.nsw.gov.au

Staged Operational and Development Plan for Tharbogang Quarry and Landfill

Dear Dallas and John,

Please find attached our report detailing the staged operational and development plan for Tharbogang quarry and landfill. This report has been prepared pursuant to an application for approval for future quarrying and land filling operations. EPA guidelines detailing issues to be addressed, requirements relating to methodology, analysis of identified impacts and adequacy of the fieldwork are extant for such applications. We note that this report does not purport to conform to those guidelines and is based solely on the scope of work provided by Griffith City Council.

We trust this report fulfils your current requirements. If you have any questions relating to this report or if we can be of further assistance, please do not hesitate to contact the undersigned.

For and on behalf of Coffey Mining Pty Ltd

Bryce Atkinson

Principal Engineer

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Name	Position	Role	Signature	Date Issued
Bryce Atkinson	Principal Engineer	Author		12.12 2008
Robert Johnston	Chief Surveyor	Author		12.12 2008
Ian Reeves	Principal Mining Engineer	Review		12.12 2008

TABLE OF CONTENTS

FIGURES

1 BACKGROUND

Griffith City Council (GCC) has engaged Balance (a Coffey subsidiary) to prepare an Environmental Assessment of the expansion of Tharbogang road base quarry and waste landfill. A drilling program to define the future quarry resource has been completed and the results and resource assessment have been compiled into Coffey Geotechnics' report GF8526AB.01 Geological Assessment Stage 2. Coffey Geotechnics has also carried out a review of groundwater for the proposed quarry expansion in report GEOTLCOV23247AA-AH.

In order to finalise the Environmental Assessment, GCC has now engaged Coffey Mining to prepare a staged operational and development plan for the quarry and landfill. Details of the scope of work for this part of the project are contained in Appendix 1.

A meeting held at Griffith City Council on 13 November 2007 with all council officers and consultants involved in preparation of statutory approval submissions for the quarry expansion resolved that the operational and development plan for the quarry and landfill would be predicated on the assumptions set out in Appendix 2.

At the time the scope of works was prepared for this, and all earlier reports, it was envisaged that resource mining would be carried out in a manner that would create isolated excavations that would be suitable for subsequent use as solid waste disposal landfill cells. It has subsequently become apparent that only the first quarry stage will be required for land fill.

2 REPORT FRAMEWORK

2.1 Resource Estimate

A geological investigation carried out by Douglas & Partners in 1991 defined the current quarry resource. A preliminary drilling program was carried out in 2006 to define the regional extent of the potential resource for the proposed quarry expansion. Potential quarry sites were defined by a desk top review of development constraints such as topography and environmental considerations. A second, more detailed, drilling program was undertaken during 2007 to quantify the resource within each of the proposed quarry sites. Drilling was generally confined to the proposed footprint of those quarry stages, as was the resource estimate. Resource volume estimates have been carried out by Coffey Geotechnics Pty Ltd and are detailed in report GF8526AB.01. The total resource estimate for the site is 9 976 000m^3 or 25.9 million tonnes at a specific gravity of 2.6. The collar positions of the drill holes defining the resource are shown in Appendix 3 Figure 20.

2.2 Map Grid

All designs and digital data are referred to Map Grid of Australia GDA 94.

Several coordinate systems remain in use in Australia. Errors of up to 200 metres can occur if data overlays are generated from different coordinate systems. When comparing information and plans contained in this report with data from other sources care should be taken to ensure that the new data is referred to the same datum.

2.3 Nomenclature

The existing quarry and landfill is referred to as Stage 1. The quarry designs have been segregated into three zones, the southern, central and northern. The corresponding pit designs have been numbered by 100, 200 and 300 series respectively as shown Appendix 3 Figures 17 and 18.

The drill holes associated with each of the geological investigations are numbered as follows, and are located as shown in Appendix 3 Figure 20.

Holes 1 to 4 Douglas & Partners 1991

Holes 5 to 12 Coffey 2006

Holes 13 to 29 Coffey 2007

2.4 Resource and Reserve

Where the terms “resource” and “reserve” are used throughout this report and other associated reports they are used in the same general sense as the Australasian Code for Reporting of Mineral Resources and Ore Reserves published by the Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy which is referred to as the JORC Code. The code defines “resource” as a concentration or occurrence of material of intrinsic economic interest in or on the Earth’s crust and “reserve” as the economically mineable part of the resource. In the context of this report “resource” refers to the geologists estimate of the amount of material suitable for use as road base that is in the ground and “reserve” refers to the amount of that material that is intended to be mined.

2.5 Design Guidelines

The quarry and landfill design is generally predicated on recommendations contained in the following guidelines:

NSW Environment Protection Authority (1996) *Environmental Guidelines: Solid Waste Landfills*.

NSW Department of Environment and Conservation (1999). *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes*.

NSW Department of Environment and Conservation (2006) *Environmental Guidelines: Solid Waste Landills* 1996

2.6 Base Line Studies

The quarry and landfill design is generally predicated on recommendations contained in baseline environmental studies undertaken by Coffey Environments and others.

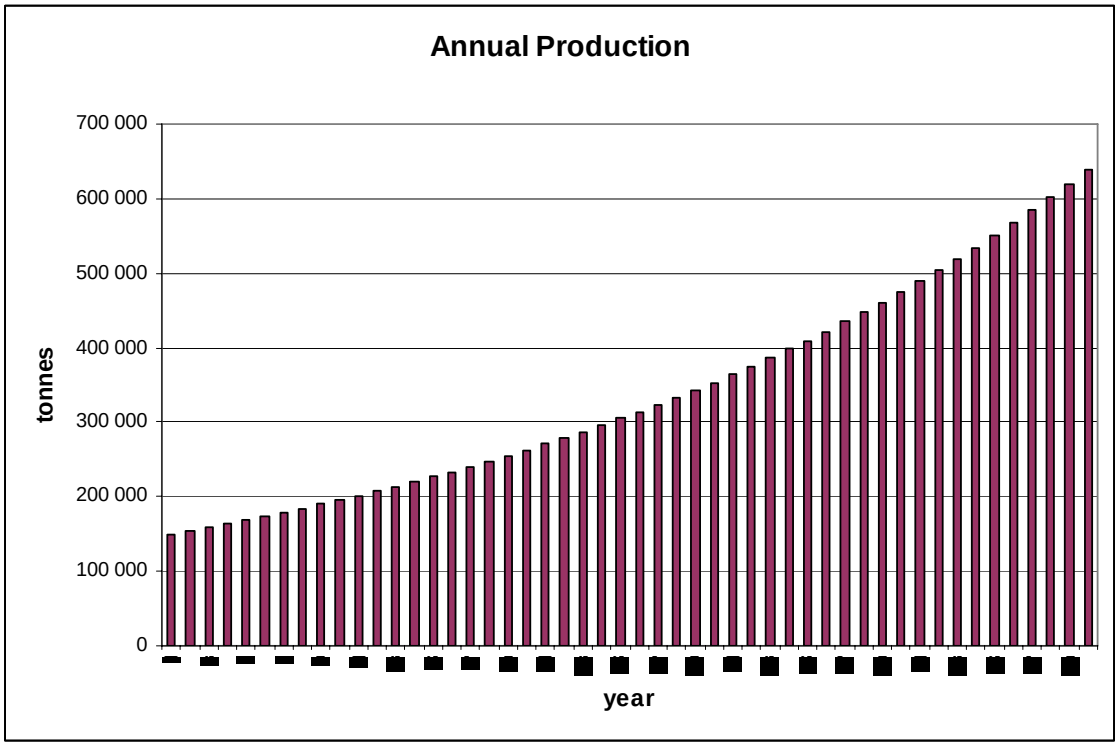
2.7 Design

Design parameters contained in this report are generic in nature and are intended only for overall conceptual planning and for estimation of probable material volumes and costs. They should not be used for construction purposes. Detailed construction designs should be carried out by suitably qualified geotechnical and environmental engineers.

2.8 Production Schedule

The production schedule is based upon an initial production rate of 150 000 tonnes per annum with a projected increase in demand of 3% per annum. For the purposes of scheduling and overall quantities it has been assumed production rates are constant for any given year with a stepped increase at the commencement of subsequent years. At this growth rate production would be required to ramp up to an annualised rate of 638 000 tonnes by year fifty. This equates to a cumulative tonnage of 16.9 million tonnes over the fifty year project life.

Figure 1 Annual Production



3 SITE DESCRIPTION

3.1 Geology

Two main near-horizontal stratigraphic sequences are present on the site: the Mailman Gap Conglomerate Member and the underlying Jimberoo Member. The road base materials are obtained from within the Mailman Gap Conglomerate and comprise coarse grained pale grey sandstones and conglomerates. This underlying red-purple sandstone that forms part of the Jimberoo Member is not suitable for road base.

The geological interpretation of the drilling results indicates that the resource forms a flat dipping tabular bed about 15 to 20 metres thick, with a strike bearing of 340º, a dip bearing 70º at dip of 4º. The resource therefore becomes deeper towards the north east. This general structural orientation is mirrored in the surface topography and the ground water table surface on the eastern side of the ridge line.

4 QUARRY DESIGN

4.1 Footprint

The design of the overall site footprint layout for the various quarry stages has been predicated on the following criteria:

- Disturbed areas to be wholly within the cadastral boundaries of Lots 201 and 202
- Wildlife corridors of at least 100 metres width between cadastral boundaries and disturbed areas
- Maintenance of at least 100 metres separation between disturbed areas and a known wedge-tailed eagle nest
- Provide a buffer zone between the quarry and adjacent residences to reduce the risk of excessive noise and vibration from quarrying activities
- Reduce the risk of excessive disturbance to the higher quality white pine habitat areas
- Provide an acceptable buffer between quarry and existing residences

These exclusion zones are depicted in Appendix 3 Figure 17. In addition to these specific criteria the following general criteria were also specified:

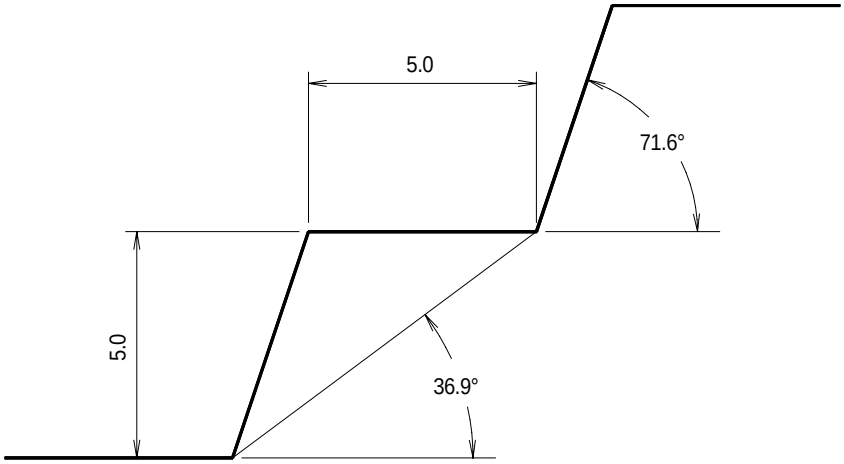
- Provision of a wildlife corridor of at least 300 metres width running north-south through the central section of Lots 201 and 202
- Provision of multiple wildlife corridors of at least 100 metres width running east-west across all of Lots 201 and 202
- Limit visibility of quarry benches from all surrounding locations of current and future permanent and semi permanent human habitation including residences and Lake Wyangan

The designs presented below conform to these requirements. Further analysis and discussion on visual impact is contained in Section 11.

4.2 Quarry Wall Parameters

Bench heights, wall angles, and batter angles have been specified in the GCC scope of works as: *"Batters should be no steeper than 1 horizontal to 3 vertical with 5 metre wide benches provided at 5 metre drops"*. This specification results in the wall geometry depicted in Figure 2 and an overall pit wall angle of 37º which is somewhat conservative for the material that is likely to be exposed, but considered appropriate given that all of the benches for all quarry pits will be exposed for prolonged periods or even permanently. Because the pits are relatively shallow, and located on the side of a gently sloping hill, the conservative pit wall angle does not cause any significant reduction in the available road base reserve.

Figure 2 Proposed Pit Wall Geometry



4.3 Pit Designs

Four pits have been designed utilising the aforementioned criteria. These satisfy the projected demands for quarry material for the fifty year life of the project. Table 4.3 shows the volumes and tonnages of quarry material available from each pit. The overburden volume is defined by all material above the Mailman Gap Conglomerate resource within the perimeter of each pit. The average depth of overburden is 1.9 metres. The soil and subsoil strata of this material is to be stockpiled for future quarry and landfill rehabilitation.

Pit 103 has been designed to abut the existing quarry and therefore negates the requirement for a separate access ramp.

As at January 2008 there was approximately 67 000 tonnes of quarry material contained within the un-mined peninsular separating the eastern and western sections of the existing Stage 1 quarry.

Table 4.3 Quarry Volumes and Tonnages

Pit ID	Surface Area (m^2) *	Total Excavation Volume (m^3)	Overburden Volume (m^3)	Reserve Volume (m^3)	Reserve Tonnage (tonnes) **
101	97 897	1 624 424	250 005	1 374 419	3 573 489
103	65 042	1 055 840	89 529	966 311	2 512 409
205	162 705	2 806 567	281 037	2 525 530	6 566 378
303	132 108	2 020 333	251 042	1 769 291	4 600 157
Totals	**457 751**	**7 507 164**	**871 613**	**6 635 551**	**17 252 433**

* area taken from start of access ramp
** SG of 2.6

4.4 Haul Roads

Where possible, existing site roads have been utilised to access the proposed quarry sites. A 925 metre haul road has been designed to access the northern most quarry, Pit 303 (Appendix 3 Figure 17). This road has been designed with a minimal cut and fill profile to minimise overall impact. It is anticipated that this road will have at least one culvert to divert water runoff.

4.5 Production Schedule

The production schedule is based upon the projected demand for quarry material as shown in the table in Appendix 5.1. The notional start date for the project is the second quarter of 2009.

Allowances have been made for pre-strip at the start of each pit. This project activity is for indicative purposes only. It is envisaged that only sufficient area will be stripped to commence quarrying operations and that future areas will be stripped as required. The schedules shown are for the life of each pit, in practice each pit would be staged. A more detailed schedule for each quarry phase is described in section 9.1.8.

Table 4.1 Production Schedule

Activity	Duration (days)	Start Date	End Date
Pit 103		**Apr 2009**	**Feb 2023**
Pre-strip and site preparation	21	Apr 2009	Apr 2009
Production of quarry material	5006	Apr 2009	Jan 2023
Site rehab	42	Jan 2023	Feb 2023
Pit 101		**Dec 2022**	**Apr 2036**
Pre-strip and site preparation	28	Dec 2022	Jan 2023
Production of quarry material	4807	Jan 2023	Mar 2036
Site rehab	49	Mar 2036	Apr 2036
Pit 205		**Jan 2036**	**Jan 2052**
Pre-strip and site preparation	35	Jan 2036	Mar 2036
Production of quarry material	5747	Mar 2036	Dec 2051
Site rehab	56	Dec 2051	Jan 2052
Pit 303		**Oct 2051**	**Nov 2059**
Construct Access Road	21	Oct 2051	Oct 2051
Pre-strip and site preparation	30	Nov 2051	Dec 2051
Production of quarry material	2861	Dec 2051	Oct 2059
Site rehab	48	Oct 2059	Nov 2059

4.6 Project Sequence

For practical operation these would be staged into reasonably managed areas allowing sufficient space for stockpiling material and for efficient utilisation of quarrying plant. The sequence of events for each pit is:

1. Remove soil horizon for first stage of each pit
2. Stockpile soil within the bounds of the second stage of the pit
3. Commence quarrying operation for first stage of the pit
4. Relocate stockpiled soil to first stage of each pit when there is sufficient room to do so
5. Commence subsequent stages of each pit stockpiling soil at convenient locations within the quarry
6. Rehabilitate the quarry base and batters at the completion of each stage
7. Repeat process for remainder of each pit

5 LANDFILL DESIGN

5.1 Landfill Site Preparation

The construction of the landfill will take place within the footprint of the Stage 1 quarry once exhausted of quarry material. The base of the quarry floor will be graded to a minimum of 1% to allow leachate and sub-surface drainage to flow in a generally eastern direction.

At the completion of the quarry operation a batter slope of no greater than 1V to 3H (18.4°) should be established between the lower and upper benches of the Stage 1 quarry. This batter will eventually form part of the back wall for subsequent landfill cells on the lower bench area.

5.2 Batter Stabilisation

Currently there exists near vertical batters along the south-western, north western and north eastern walls of the Stage 1 quarry. Figure 3 is typical of these walls.

Figure 3 Current Quarry Walls

In order to stabilise these inert landfill will be placed and compacted against these walls at an angle of 1V to 3H (18.4°) with a 0.5m capping of clean fill material this being overburden sourced from the quarrying operation (Figure 4). The sequence for this process will be dependent upon the availability of inert landfill. However, this process will need to be completed in the extreme south-western corner prior to the establishment of the first putrescible waste landfill cell.

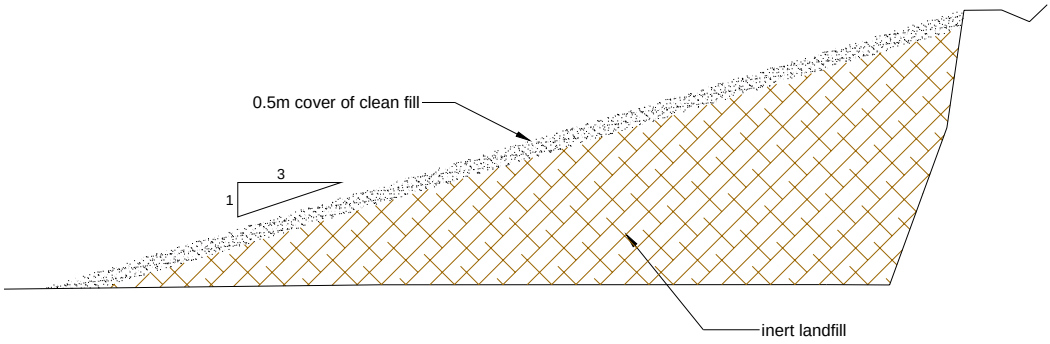
This process will eventually accommodate 56,000m^3 or approximately 38,000 tonnes of inert landfill (Table 5.2). Appendix 3 Figure 5 shows the location of the batter stabilisation cells. Batters 1 and 3 form part of the putrescible landfill cells and as such will require further engineered layers for sub-surface drainage and leachate control as depicted in Appendix 3 Figure 9.

Table 5.2 Inert Landfill Volumes for Batter Stabilisation

Stabilisation Batter	Inert Landfill Volume (m^3)	Tonnes*
Batter 1	34 383	23 209
Batter 2	10 903	7 359
Batter 3	11 535	7 786
	56 822	**38 355**

* Compacted Density 675kg/m^3

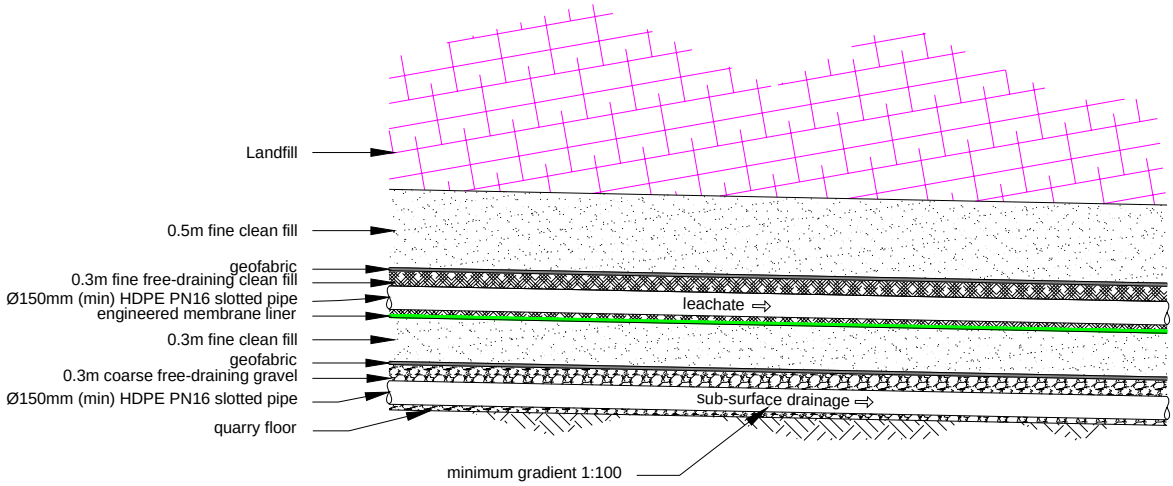
Figure 4 Batter Stabilisation – Typical Section



5.3 Landfill Cells

Landfill placement will commence with the exhausted Stage 1 quarry. Placement will occur within a landfill structure consisting of fully engineered landfill cells with an impermeable membrane lining to capture all leachate forming within each cell (Figure 6). The membrane liner will be inturn protected by a leachate drainage layer and a layer of clean fill.

Figure 6 Putrescible Landfill Base Layers



There will be a total of eight landfill cells constructed in the numerical order shown in Figure 8. Cells 7 and 8 will be constructed last to enable completion of the adjacent quarry stage (Pit 103) prior to the construction of these. However it is anticipated that this pit will be completed in just under 14 years

and that the landfill has an expected project life of approximately 30 years. An access corridor to the quarry is to be maintained along the north-western edge of the landfill between Cells 6 and 8 and the existing quarry wall.

Figure 8 Landfill Cells

5.4 Bund Construction

Bunds are to be constructed from compacted inert waste and capped with clean fill. The membrane liner is to extend up the walls of each bund and all other batters to form a 'bowl' to capture all leachate. With the construction of subsequent cells the membrane liner would be extended over the top of the bunds to produce a contiguous surface. The generic design for the putrescible landfill design is shown in Appendix 3 Figure 9.

5.5 Leachate Drainage

Landfill leachate will be isolated from all other sources of runoff. A pump well will be established at the low point of each cell. .This will be fed by a network of slotted 150mm diameter HDPE pipes located above the engineered membrane liner (Appendix 3 Figure 10). The pump wells would be made of 600mm diameter HDPE culvert pipes capped using HDPE manhole covers to prevent debris from entering the wells. The top level of the pump wells will be progressively raised and kept proud of the landfill horizon. Stainless steel borehole pumps would be placed at the base of each pump well to pump leachate to the interim holding tank. The leachate would then be pumped back to landfill areas where it will be used for irrigation to promote the bioreactor process (Appendix 3 Figure 11). This system will promote bioremediation of any pollutants contained in the leachate.

During periods of high rainfall overflow from the leachate holding tank will drain to a dedicated leachate holding dam that will have sufficient capacity for one in one hundred year rainfall events.

From here the leachate would be pumped back to the holding tank from where it would be pumped back onto the landfill as described above.

5.6 Landfill Filling Sequence

The landfill filling sequence is graphically depicted in Appendix 3 Figure 12. The cells are to be constructed in numerical order with the construction of each cell bund, drainage and lining to be completed prior to the filling of the previous cell. The capacities of each cell is shown in the Table 5.6 below. During construction and filling of the landfill an access ramp along the north-western edge of the landfill would be progressively built to access the currently utilised landfill cell.

Table 5.6 Landfill Capacities

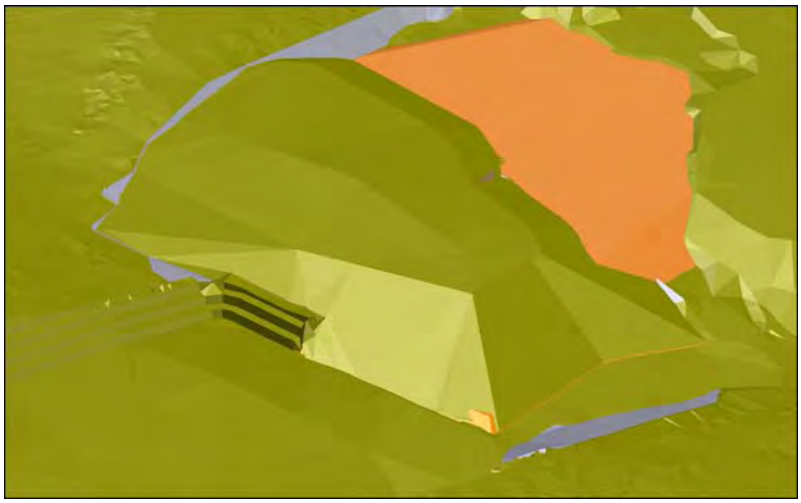
Landfill Cell	Volume (m^3)	Tonnes*
Cell 1	74 576	50 339
Cell 2	33 632	22 701
Infill 1-2	15 737	10 623
Cell 3	48 477	32 722
Cell 4	27 426	18 513
Infill 3-4	16 886	11 398
Cell 5	73 845	49 845
Cell 6	48 901	33 009
Cell 7	92 603	62 507
Cell 8	30 425	20 537
Infill 6-8	31 477	21 247
	493 986	**333 440**

* Compacted Density 675kg/m^3

5.7 Inert Landfill between Proposed Landfill and Existing Landfill

In addition to the inert landfill being utilised to stabilise batters and construct cell bunds, the area between the proposed and existing landfills is to be utilised for inert landfill. This area is shown in brown in Figure 13. Filling in this area could commence after the completion of Cell 2 and could continue provided it lagged the completion of Cells 4, 5 and 6 respectively.

Figure 13 Inert Landfill Area



The capacity of this area is estimated to be 65,000m^3 or approximately 44,000 tonnes at a density of 675kg/m^3.

5.8 Landfill Capping

The landfill is to be capped with 0.5m of compacted clay. The top profile is to be domed to allow shedding of water with a maximum gradient of 5% to prevent surface erosion. A 0.3-0.5m layer of soil will be placed over the clay in which shallow rooted indigenous grasses and shrubs shall be planted. Soil stripped for the quarrying operation should be set aside for this purpose.

5.9 Landfill Operation

The details of the landfill operations are contained in the document:

"THARBOGANG QUARRY & WASTE MANAGEMENT CENTRE – SITE OPERATIONS PLAN – EXISTING TRANSITIONAL & PROPOSED, Alf Grigg 2008, Alf Grigg and Associates"

5.10 Landfill Flaring

Disposal of putrescible waste generates significant amounts of greenhouse gas emissions. With increasing community concerns regarding climate change it is an imperative to reduce the emission of methane, the primary gas generated. This can be achieved by either flaring off the methane or by installing a small thermal electricity plant connected to the grid. The design and installation and operation of such a system would be carried out by contractors specialising in these systems such as AGL or Energy Developments, both of whom have developed systems in Australia.

Coffey Mining does not have expertise in this area. Figure 9 depicts flaring facilities for indicative purpose only.

6 NOISE AND VIBRATION

The noise assessment report prepared by Noise and Sound Services indicates that the quarry crusher should not be located at any time with line of sight to any of the residences to the west of Lots 201 and 202. Further Ken Scannell of Noise and Sound Services stated "It will not be possible to carry out blasting with 270 kg at 200 metres from the Bergamin's Residence and meet the vibration goal of 5 mm/s. We will need at least 550 metres to meet the vibration goal or a reduction in charge weight to 40kg at 200 metres." In order to meet these requirements delays will be used to control the magnitude of the vibration at the Bergamin residence. It is recommended that vibration monitoring be carried out at the commencement of Pit 205 and at various stages of this pit to empirically model explosive masses versus distance. Appendix 3 Figure 14 shows the proximity of the Bergamin residence to pits 205 and 303. The rims of Pit 205 and 303 are approximately 260 and 350 metres respectively from this residence.

Mining of the upper two benches of each quarry stage will be mined with the crusher located down-slope from each quarry stage on the eastern side of the ridge line. Thereafter the crusher can be relocated to within the footprint of each quarry stage.

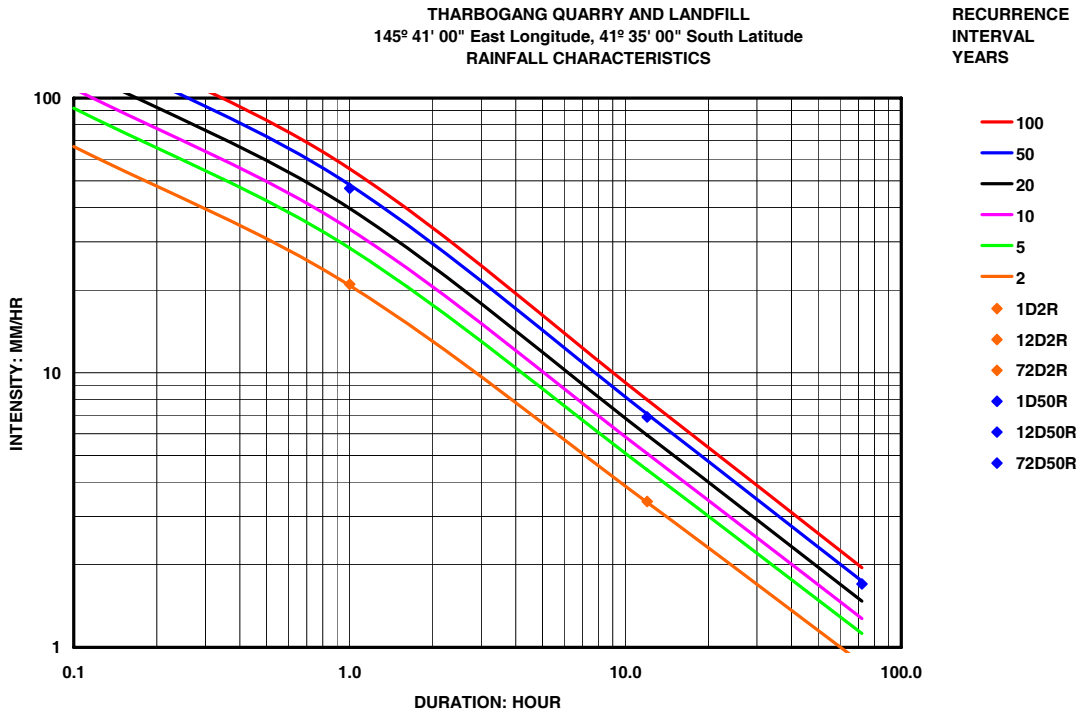
7 WATER MANAGEMENT

7.1 Rainfall

To analyse the adequacy of the water management arrangements it is necessary to consider worst case scenarios. Rainfall storm events are quantified in terms of the event duration expressed in minutes or hours, its intensity expressed in millimetres of rainfall per hour during the event, and the recurrence frequency of the event expressed in recurrence intervals of 2 to 100 years. The rainfall intensity duration and recurrence characteristics for a location can be depicted graphically in the form shown in Figure 15.

The graph parameters are derived from “Australian Rainfall and Runoff, A Guide to Flood Estimation” published by Engineers Australia. This publication provides statistical rainfall parameters for every location in Australia. Details of calculations and estimates cited in the following sections are presented in Appendix 7.

Figure 15 Rainfall Intensity Duration Recurrence Characteristics for Tharbogang Landfill Site



Rainfall intensity tends to decline exponentially with duration and the total volume of rain tends to approach an upper limit for rainfall events with durations of the order of 100 hours. High intensity events in excess of 100 hours duration are extremely rare and have not been modelled.

The analysis indicates that the worst case event with a 100 year recurrence interval would consist of a 72 hour duration event with an overall intensity of 1.95 millimetres per hour resulting in a total rainfall of 140 millimetres. This has been used as the basis for design of systems for handling runoff in the following sections.

Consideration has also given to abnormally high long term seasonal rainfall that may result in saturation of soils and over-topping of storage dams.

7.2 Runoff

The proposed water management circuit for rainfall runoff from landfill and quarries is shown diagrammatically in Appendix 3 Figure11. Cut off drains are to be constructed around all quarries on the uphill side to minimise the effective catchment area for rainfall runoff.

7.2.1 Quarry Runoff

The floor of each quarry is defined by the base of the Jimberoo conglomerate member which generally dips at 2 to 4 degrees to the north-west. The base of the Jimberoo resource in most quarry stages lies at an elevation which cannot be accessed from within the property boundaries to permit free drainage of those quarry stages. Those quarry stages will therefore require pumping facilities for removal of rainwater and process water. The access point for each quarry stage has been designed at the lowest point of the base of the Jimberoo member in that stage, to allow natural drainage away from the active quarry working face. An in-quarry water collection sump is provided adjacent to each of the access points.

Rainwater and process water will be pumped from the collection sumps to central stormwater collection dam. The dam is designed with sufficient operational freeboard to contain runoff from high intensity 72 hour duration 100 year recurrence storm events and to provide sufficient residence time for settling of suspended solids prior to discharge in the case of an over-topping event. The operating plan provides for stringent control of potential pollutants, of which nitrates from explosives and hydrocarbons from machinery would be the principal agents. It is therefore considered that the amount of these pollutants that are likely to enter the collection sumps and the stormwater storage dam will be minimal. The collection sumps and dam are nevertheless designed to be lined with a flexible membrane to prevent stormwater and process water from entering the groundwater aquifer. Any discharge from the collection dam would ultimately report to the Tharbogang swamp.

Most, if not all, water reporting to the collection dam will be used for irrigation of regeneration vegetation in quarry areas under rehabilitation. Landfill leachate water will not be permitted to enter the quarry runoff collection or irrigation systems.

During the mining of Pits 103, 101and 205, the collection dam will be located in the existing drainage gully. The Pit 205 quarry will ultimately be used as the main collection dam for the Pit 303 quarry.

7.2.2 Landfill Runoff

The permanent landfill rehabilitation is configured to ensure that there is no surface runoff from rainfall. Prior to final sealing, some rainfall will enter the landfill directly and combine with the leachate. Any runoff from intermediate sealing layers will be directed to the runoff collection dam. After final sealing and rehabilitation, rainfall will be absorbed by a soil mulch layer and disposed by evaporation.

The rehabilitation of the landfill provides for a 0.5 metre thick bed of compacted clay as an impermeable cap that will prevent rainwater from entering the landfill and gas from escaping. A layer of loose rocky soil mulch will be placed over the sealing cap and planted with suitable shallow rooted vegetation. The composition and thickness of this layer is designed to ensure that it has sufficient capacity to absorb all possible rainfall, including both storm events and abnormally high long term seasonal rainfall. Water will be removed by evaporation from the surface and transpiration by vegetation. Catch drains will be provided around the down hill perimeter of the landfill to direct any unexpected runoff to the storage pond.

7.3 Leachate

Landfill leachate will be isolated from all other sources of runoff. It will be collected in a dedicated storage pond. It will be pumped back to landfill rehabilitation areas where it will be used for irrigation of rehabilitation vegetation or to the active landfill to promote the bioreactor process. As noted in Section 7.2.2 above, landfill rehabilitation areas have been designed to avoid runoff from these areas. This system will promote bioremediation of any pollutants contained in the leachate.

7.3.1 Storage Ponds

Separate storages will be provided for quarry runoff and landfill runoff and leachate. Leachate and runoff from the landfill constitutes and aqueous waste that needs to be stored in ponds as specified in the EPA guidelines for aqueous liquid treatment ponds as set out in Section 7.3.2. Recirculation of the leachate to the landfill will be as specified in EPA guidelines for disposal of liquid waste to landfill set out in Section 7.3.3.

The leachate storage pond has been configured with a shallow draft and large surface area to maximise the dispersal of the water content of the leachate by evaporation. The pond has sufficient freeboard to accommodate a 100 year 72 hour duration high intensity rainfall storm event.

7.3.2 EPA Guidelines for Aqueous Liquid Treatment Ponds

The primary environmental goal for aqueous liquid treatment ponds is the prevention of pollution of water by leachate. Liquid treatment ponds should be designed and installed in accordance with the quality requirements specified in an approved Construction Quality Assurance Program.

The benchmark technique for liquid waste treatment ponds has a liner system that forms a barrier between groundwater, soil and substrata and the liquid. Characteristics of a suitable liner include:

- a recompacted clay or modified soil liner at least 90 cm thick, with an in-situ coefficient of permeability of less than 10^{-9} ms^{-1}. Successive layers should be of compatible material, and each underlying layer should be scoured to prevent excessive permeability due to laminations. The sides should generally have a slope not exceeding a gradient of one vertical to three horizontal, in order to allow suitable compaction of the barrier and to facilitate subsequent testing.

If the pond is located in an area of poor hydrological conditions, or otherwise, that has a significant potential threat to surface or ground waters, the clay or modified soil liner should be overlaid with a flexible membrane liner (FML) with a minimum coefficient of permeability of 10^{-14} ms^{-1}. The FML should have material properties that ensure it can maintain this permeability while the pond is in use. The FML should have a minimum thickness of 1.5 mm, and be laid according to procedures in an approved construction quality assurance program. All joins and repairs should be fully tested to ensure that the liner integrity is not breached, and the FML should be protected by an overlay of soil with low abrasive properties or synthetic non-woven geotextile of sufficient depth to protect it against load-induced damage.

Where the natural geology of the site is proposed to be used as the barrier system, an extensive hydrogeological investigation should be conducted by a competent entity to prove the efficacy of the barrier. This assessment should include, but not be limited to, the following:

- the extent of the material
- the permeability of the material to water
- the integrity of the material, and presence of any imperfections that may compromise its effectiveness (such as root holes, cracks, or gravel layers)
- any possible reactions between the material and the liquids treated.

The pond should be bunded in a manner that prevents the run-on of surface water into the pond.

The capacity of the pond should be such that it can accept rainfall from a 1-in-25-year one-day duration storm event without overflowing.

Observe the following when treating liquids specified in the facility's licence:

For discrete deliveries by road transport, the occupier of the facility or his/her authorised representative should be present at the site to:

- check before discharge that the liquid is of a type suitable for treatment
- directly supervise the discharge of liquids
- ensure that any spillage of liquid waste at the site is cleaned up as soon as practicable
- ensure that other users of the facility, if any, cannot come into contact with the liquid waste
- record the details of the amount and type of liquid discharged, the time and date of discharge, the discharge location within the site, and the transporter of the waste.

If, however, the liquid discharge is a continuous process, the occupier should propose alternative arrangements for satisfying the above conditions.

The discharge of odorous liquid wastes, such as septic tank effluent (which, if untreated, is also likely to contain high concentrations of pathogenic organisms) and grease-trap wastes, should not result in the degradation of the amenity of nearby residents or in health risks to workers,

other users of the landfill or nearby residents. It may be necessary for the occupier to use active measures designed to aerate liquid wastes containing high levels of organic nutrients in order to make sure that odour emissions from the treatment pond are reduced as far as is practicable.

7.3.3 EPA Guidelines for Disposal of Liquid Waste to Landfill

The primary environmental goal for disposal of liquid waste to landfill is the prevention of pollution of water by leachate. The disposed liquid waste should be securely contained within the landfill over the period of time that it is in a liquid form and therefore poses a potential for environmental degradation. For this reason, solid waste class 1 landfills that wish to receive certain aqueous liquid wastes should generally have effective leachate barrier and leachate collection systems.

If such landfills also recirculate leachate into the completed parts of the landfill, it may be quite feasible to inject certain liquid wastes received into the completed parts of the landfill as well, as long as the capacity of the waste in the landfill to absorb liquids is not exceeded. The injection may be achieved either by using the existing leachate-recirculating system or by constructing a separate liquid-injection system. It should be demonstrated that the capacity of the leachate-collection system is not exceeded by the additional quantity of liquids present.

If the direct injection described above is not feasible, liquid waste may be discharged directly on to non-liquid waste in a bunded secure area. The discharge of liquid wastes should take place only when the absorptive capacity of the non-liquid waste in the secure area is (and is expected to continue to be) sufficient to prevent ponding, run-off, infiltration into ground, or the pollution of waters, which is an offence unless the polluter holds and complies with the conditions of a licence under the Protection of the Environment Operations Act 1997.

The discharge of odorous liquid wastes, such as septic tank effluent (which if untreated is also likely to contain high concentrations of pathogenic organisms) and grease-trap wastes, should not result in the degradation of the amenity of nearby residents or in health risks to workers, other users of the landfill or nearby residents.

All records of liquid waste disposals must be kept for a period of three years and be made available to an authorised officer of the EPA upon request.

7.3.4 EPA Leachate Barrier System Guidelines

The primary environmental goal of the leachate barrier system is to prevent pollution of surface and ground water. The leachate barrier system should be designed to contain leachate over the period of time that the waste poses a potential environmental risk.

The benchmark technique for a leachate barrier system for new landfills and lateral expansions of operating landfills is a liner system that forms an impermeable barrier between groundwater, soil and substrata, and the waste. Characteristics of a suitable liner include:

A recompacted clay or modified soil liner at least 90 centimetres thick with an in situ co-efficient of permeability of less than 10^{-9} ms^{-1}. Successive layers should be of compatible material and

each underlying layer should be scoured to prevent excessive permeability due to laminations. The sides should generally have a slope not exceeding a gradient of one vertical to three horizontal in order to allow suitable compaction of the barrier and to facilitate subsequent testing.

If the landfill is located in an area of poor hydrological conditions or otherwise poses a significant potential threat to groundwaters or surface waters, the clay or modified soil liner should be overlaid with a flexible membrane liner (FML) of minimum co-efficient of permeability of 10^{-14} ms^{-1}. The FML should have material properties that will ensure that it maintains this permeability for a period at least equivalent to the reactive life of the waste contained by the FML. The FML should have a minimum thickness of 1.5 millimetres, and be laid following procedures in an approved construction quality assurance program. All joins and repairs should be fully tested to ensure liner integrity is not breached at these locations, and the FML should be protected by an overlay of soil with low abrasive properties or synthetic non-woven geotextile of sufficient depth to protect the FML against load-induced damage.

The surface of the liner or natural barrier should be so formed that once settling has finished, the upper surface of the liner or barrier must exhibit a transverse gradient of greater than three per cent and a longitudinal gradient of greater than one per cent.

Where the natural geology of the site is proposed to be used as the leachate barrier system, an extensive hydrogeological investigation is to be conducted by a competent entity to prove the efficacy of the barrier.

Because such an investigation has not been carried out for the Tharbogang site, it assumed that a flexible membrane liner will be necessary.

7.3.5 EPA Leachate Collection System Guidelines

The primary environmental goal of the leachate collection system is to prevent pollution of surface and ground water.

All leachate in excess of the field capacity of the waste should be collected in a leachate collection system and prevented from escaping from the landfill into groundwater, surface water or subsoil.

The leachate collection system should be designed and installed in accordance with the quality requirements specified in an approved Construction Quality Assurance Program.

Acceptable designs include the following:

Over the liner, a drainage layer should be installed of a thickness of greater than 30 centimetres. The drainage material should exhibit a co-efficient of permeability K > 1 x 10-3 ms-1.

The drainage media should be selected to have sufficiently large pore space to prevent encrustation. Gravel or a combination of gravel and a geonet may be used. The gravel selected ideally should be:

- rounded

- of grain size greater than 20 millimetres
- smooth-surfaced
- non-reactive in mildly acidic conditions
- relatively uniform in grain size, and
- free of carbonates that could form encrustations around the collector pipes.

Geotextiles should not be used where their low porosity and consequent encrustation could result in blockage of the drainage system.

Perforated collector pipes should be placed within the drainage layer at intervals of not more than 50 metres to facilitate the collection and discharge of leachate. These pipes should generally:

- be a minimum 150 millimetres in diameter
- be strong enough not to collapse under the weight of the waste
- have a minimum longitudinal gradient of one per cent, and
- be capable of being rinsed and monitored.

In order to facilitate predictable movement of leachate and prevent the creation of perched water tables, the occupier should puncture or remove previously applied daily or intermediate cover prior to further filling, or demonstrate that perched water tables will not form.

Leachate should be collected and stored either in a dam that is lined to a similar standard to the landfill liner, or in above-ground tanks surrounded by a bund with a capacity of 110% (or greater) of the tanks within the bund. The dam or tanks should have high level alarms that are interlocked to the discharge pump or line, so that they cannot be overfilled. If the leachate dam or tanks are open at the top, they should generally be capable of accepting a 1 in 25 year, one day- duration storm event without overflowing.

Leachate should be tested before its release to disposal. There will be individual requirements in relation to the concentration of pollutants, dependent on the site's soil chemistry and specific operating conditions.

Leachate should be disposed of only by one or more of the following methods:

- discharge to sewer in accordance with the water authority requirements
- spraying or land application over completed areas of the landfill or injection back into the landfill, in accordance with the conditions of the licence, or
- treatment to an acceptable quality and discharge in accordance with the conditions of the licence.

Alf Griggs & Associates has advised that in addition to these requirements, in the future DECC will also require that a further system is installed below the impermeable barrier to allow any leakage from

the barrier to be collected and monitored. This effectively means that two drainage layers will be required. The layers would be similar in construction.

7.3.6 Proposed System

The system proposed for leachate collection for the Tharbogang landfill is shown diagrammatically in Appendix 3 Figure 9. Dual layers comprising clay, gravel, collection pipes, and flexible membrane as specified in sections 7.3.4 and 7.3.5 are proposed.

Where landfill is proposed to be laterally contained by quarry walls it is proposed that the quarry wall would be stabilised and isolated from putrescible landfill by placing inert landfill against these walls to prevent escape of leachate through the walls.

7.3.7 Landfill Gas Collection

Landfill gas produced through the decomposition of putrescible wastes will be collected and flared. Each putrescible landfill cell is to be fitted with a collection and flare system which will be operational for a minimum of 20 years after decommissioning of the cell. Ignition will be by pilot light and the flare partly shrouded to reduce potential visual impacts and aid monitoring.

8 REHABILITATION

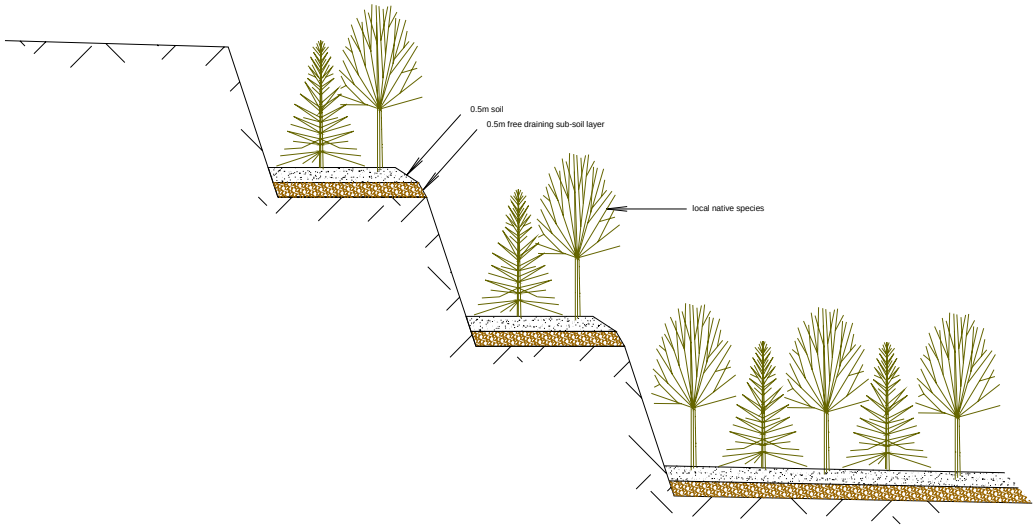
Topsoil and weathered rock that is unsuitable for use as road base will be stripped from the surface of quarry all quarry pits and used as the final soil mulch layer for rehabilitation of the land fill and the quarry floors. Stripping will not commence until material is required for final rehabilitation, or until access to the resource is required for road base production. In the latter case, the material will be stockpiled for future use for rehabilitation.

8.1 Rehabilitation Vegetation

8.1.1 Quarry Stages

After replacement of stockpiled topsoil, quarry floors will be revegetated with selected species that were present in the area prior to the quarrying operation and that are viable in shallow soils with extreme variation in moisture content. Species planted on quarry benches should be of sufficient height to screen the pit walls (Figure 19). Appendix 6 lists suitable local indigenous species.

Figure 19 Quarry Floor Rehabilitation



8.1.2 Stage 1 Landfill

Vegetation will need to be carefully selected to ensure that roots cannot penetrate into and disturb the clay sealing layer over the landfill. Species suitable for rehabilitation of the landfill are listed in Appendix 5.

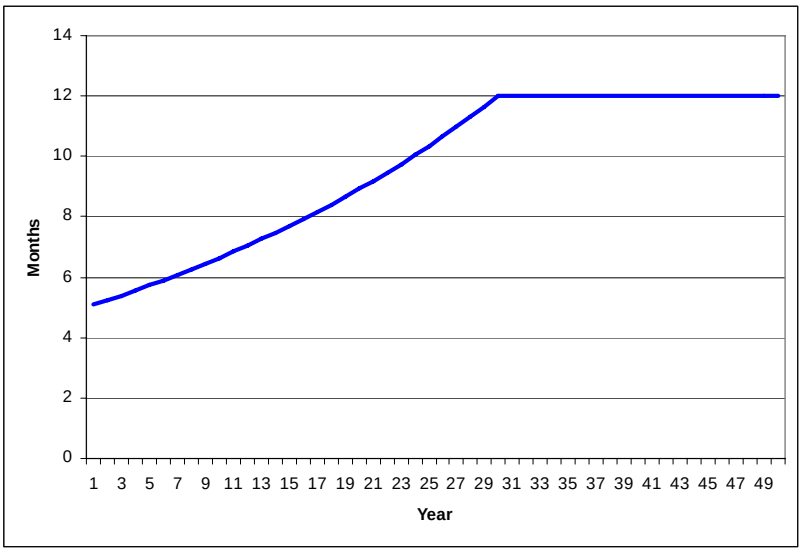
9 QUARRY OPERATION

9.1 Operating Parameters

9.1.1 Hours of Operation

To meet the anticipated crushed aggregate requirements supplied for this study, it is envisaged that a notional forty hour week be adopted for the quarrying operation working from 8.30am to 5.00pm, Monday to Friday. During the early years of the project that the operation would be managed by a contractor ‘campaigning’ the operation. Initially, the production targets could be met by campaigning a total of 5 months per year and ramping up to full-time production by year 30. Similarly, the operation would be required to operate for 6 days per week after year 31 and for 7 days per week after year 37. The chart below shows the number of months required to achieve the required material output.

Requisite Quarry Operating Months



These figures are based upon nominal machinery specifications at an 85% utilisation to allow for scheduled maintenance and unscheduled down-time. Actual machinery performance or changes in technology, departure from production requirements will vary these figures. Appendix 6 is a spreadsheet showing the operation parameters and assumptions.

9.1.2 Mobile Machinery

Mining equipment for this study has been selected as examples only and is used to illustrate the type and scale of equipment to be used in the quarry operation. The equipment is all readily available and is well regarded in the industry. Equipment specification brochures are supplied as Appendix 6.1. Exact aggregate specifications would be required to supply full screening plant configurations.

The requisite mobile machinery would be a tracked rock drill, and one front end loader initially with the projected requirement for a second loader at year 17. Sufficient parking for this mobile equipment along with parking for utility vehicles would also be required.

A bunded concrete wash-down area with an engineered oil trap would be constructed for washing of vehicles and would double as a service area to manage spillage of hydrocarbons during servicing. This should be located within the quarry footprint.

The amount of trucking activity will be proportional to the production from the quarry. Assuming B Double dump trucks with approximate capacity of 16m^3 (approximately 30 tonnes), the truck movements from the quarry will range from 19 movements per working day in Year 1 to 82 by Year 50. These figures are to illustrate the magnitude of truck movements and are averaged over a 12 month period. The actual number will be dependent upon actual equipment used, in addition to the magnitude of trucking activity undertaken within a specific time period.

Table 9.1.2 Trucking Movements from Quarry Site

Year	Annualised Production (tonnes)	Weekly Truck Movements *	Daily Truck Movements * (Mon -Fri)
1	150 000	96	19
10	195 716	125	25
20	263 026	169	34
30	353 485	227	45
40	475 054	305	61
50	638 433	409	82

* Assumes 30 tonnes per truck utilising B Double Dump Trucks

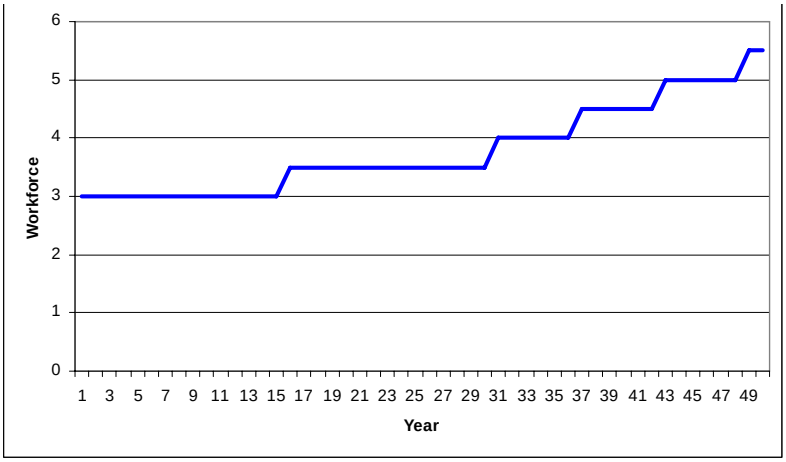
9.1.3 Fixed Plant

The fixed plant for the quarry will include a crusher, although this may be typically on tracks and a screening plant. The fixed plant is to be located within the footprint of the previous quarry pit and then relocated to the current operational pit after sufficient excavation has occurred to allow fixed plant to be relocated at a safe distance from blasting operations and where there is sufficient area to safely manoeuvre mobile plant. Based upon the crusher selected for this study a second or larger crusher would be required by year 31. Specifications would be dependent upon technology and plant available at that time.

9.1.4 Workforce

As production increases the crusher reaches 100% utilisation in year 30. A crusher upgrade or expansion would see the proposed hours of operation of the quarry continue, but for the purposes of this study the operation moves to a 48 hour week in year 31 and a 56 hour week in year 37. Further production shortfalls from year 43 are made up with additional labour. Workforce requirements for the quarry are shown on the chart below. Initially three operators would be required and ramping up to an anticipated 5/6 towards the end of the quarry life.

Chart 9.1.4 Quarry Manpower Requirements



9.1.5 Drill and Blast

The recommended drill and blast parameters adopted for this project are shown on bold text in Table 9.1.5 below. For the most part a 4.0m x 4.0m matrix drill pattern at a depth of 5.0m would be

recommended. The diameter of the drill holes will be 89mm. The explosive used for a given quantity of material is referred to as the powder factor (PF), in this case expressed as kilograms per cubic metre. By utilising the 4.0m x 4.0m pattern 52kg of Ammonium Nitrate Fuel Oil (ANFO) would be required at a powder factor of 0.65kg/m^3.

Where the distance to the nearest residence is less than 550m a 4.0m x 3.0m drilling pattern will be adopted. Again using a powder factor of 0.65 equates to 39kg of ANFO per hole. In order to keep the explosive mass below 40kg as recommended by Sound and Noise Services delays would be utilised to detonate each hole individually.

Table 9.1.5 Drill and Blast Parameters

						@ PF 0.6	@ **PF 0.65**	@ PF 0.7
					Drilled	ANFO	**ANFO**	ANFO
Pattern Size	Burden	Spacing	Vol/DH	t/DH	lm/t	kg/DH	**kg/DH**	kg/DH
3.0 x 3.0	3.0	3.0	45	117	0.050427	27	**29**	32
3.5 x 3.5	3.5	3.5	61	159	0.037049	37	**40**	43
4.0 x 4.0	**4.0**	**4.0**	**80**	**208**	**0.028365**	**48**	**52**	**56**
4.5 x 4.5	4.5	4.5	101	263	0.022412	61	**66**	71
5.0 x 5.0	5.0	5.0	125	325	0.018154	75	**81**	88
3.0 x 4.0	**3.0**	**4.0**	**60**	**156**	**0.037821**	**36**	**39**	**42**

9.1.6 Consumables

The main consumables: fuel, explosives and lubricants are tabulated in Appendix 6.1. Generally these are proportional to the annualised production requirements, however there is an upturn in fuel requirements between years 33 and 43 due to the higher drilling density required to limit vibration at the nearest residence.

The storage and handling of explosives is governed by the relevant state legislation which may change during the life of the quarry. Potential operators should be aware and appropriately licensed. Ammonium Nitrate is currently regarded as a security sensitive dangerous substance and as such is subject to separate laws and licensing.

Fuels, lubricants and hazardous materials stored on site are to be stored in a bunded and locked compound. Explosives are to be stored in an appropriate magazine complying with the relevant statutory security and safety requirements, or kept in appropriate storage conditions offsite.

Chart 9.1.6a Forecast Diesel Fuel Consumption

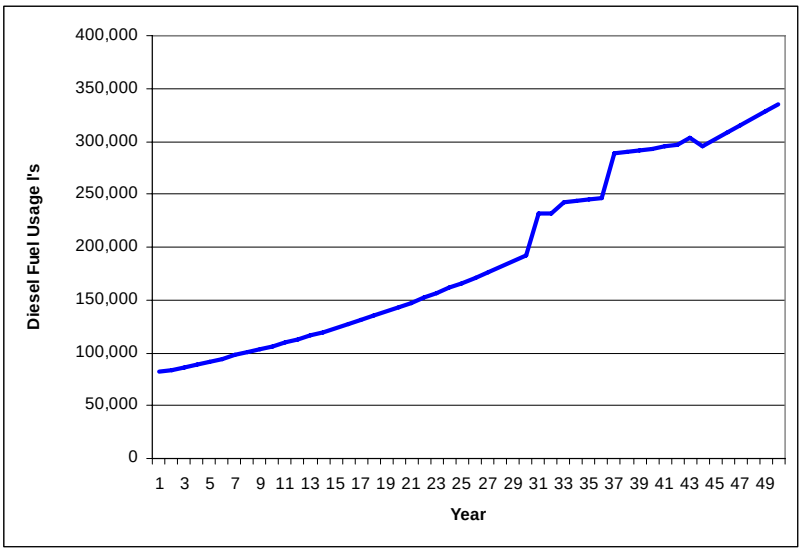
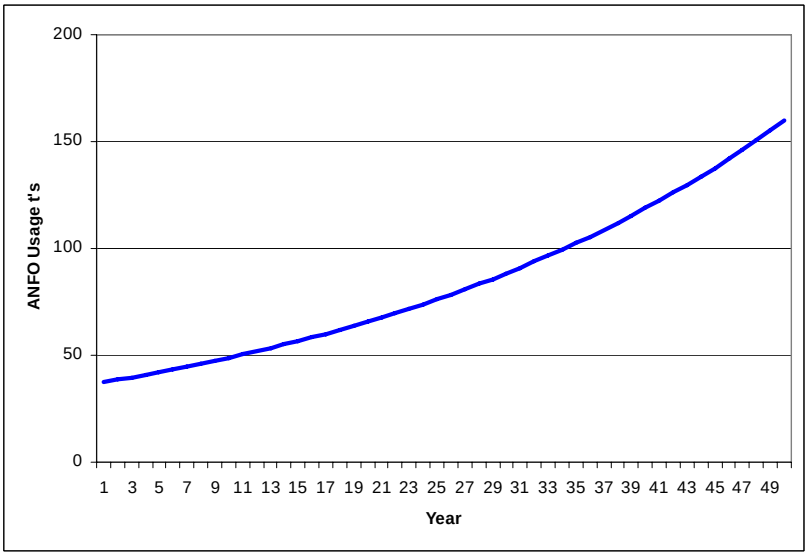


Chart 9.1.6b Forecast Bulk Explosive Consumption (ANFO - Ammonium Nitrate Fuel Oil)



9.1.7 Infrastructure

Secure fencing will be required around all quarries and the landfill area to prevent unwanted intrusion into these areas for both OH&S and security purpose.

Extensions to the existing potable water supply and reticulation, electricity supply and reticulation, lighting, security, and communications will be installed as and when required.

9.1.8 Quarry Schedule by Phases

In order to schedule the advancement of individual pits, each pit has been subdivided into six to seven phases of near equal areas. The pit phases and phase start dates are depicted in Appendix 3 Figure 18. The tables below show the projected start and finish dates for each phase.

Table 9.1.8 Quarry Pit Schedules

PIT 103							
Phase	Surface Area (m2) *	Total Excavation Volume (m3)	Overburden Volume (m3)	Reserve Volume (m3)	Reserve Tonnage (tonnes) **	Start Date	End Date
1	11 076	173 621	11 890	161 731	420 501	Apr 2009	Dec 2011
2	9 364	142 397	14 002	128 395	333 827	Dec 2011	Dec 2013
3	10 716	159 800	14 164	145 636	378 654	Dec 2013	Feb 2016
4	12 762	191 377	10 872	180 505	469 313	Feb 2016	Aug 2018
5	9 939	181 118	14 517	166 600	433 161	Aug 2018	Oct 2020
6	11 186	207 526	24 083	183 443	476 952	Oct 2020	Jan 2023
	65 042	**1 055 840**	**89 529**	**966 311**	**2 512 409**		

PIT 101							
Phase	Surface Area (m2) *	Total Excavation Volume (m3)	Overburden Volume (m3)	Reserve Volume (m3)	Reserve Tonnage (tonnes) **	Start Date	End Date
1	17 630	213 077	22 042	191 035	496 692	Jan 2023	Mar 2025
2	19 171	306 601	21 463	285 138	741 359	Mar 2025	Mar 2028
3	21 638	382 159	42 805	339 354	882 321	Mar 2028	Jun 2031
4	24 181	435 409	79 638	355 771	925 004	Jun 2031	Jul 2034
5	15 278	287 177	84 057	203 120	528 113	Jul 2034	Mar 2036
	97 897	**1 624 424**	**250 005**	**1 374 419**	**3 573 489**		

PIT 205							
Phase	Surface Area (m2) *	Total Excavation Volume (m3)	Overburden Volume (m3)	Reserve Volume (m3)	Reserve Tonnage (tonnes) **	Start Date	End Date
1	29 876	450 051	419	449 632	1 169 043	Mar 2036	Jul 2039
2	20 097	345 617	15 166	330 451	859 173	Jul 2039	Nov 2041
3	30 769	549 149	64 877	484 272	1 259 108	Nov 2041	Dec 2044
4	33 609	558 217	26 022	532 195	1 383 708	Dec 2044	Jan 2048
5	24 709	478 882	91 118	387 764	1 008 186	Jan 2048	Mar 2050
6	23 644	424 650	83 435	341 215	887 160	Mar 2050	Dec 2051
	162 705	**2 806 567**	**281 037**	**2 525 530**	**6 566 378**		

PIT 303							
Phase	Surface Area (m2) *	Total Excavation Volume (m3)	Overburden Volume (m3)	Reserve Volume (m3)	Reserve Tonnage (tonnes) **	Start Date	End Date
1	19 624	271 174	49 285	221 890	576 913	Dec 2051	Jan 2053
2	17 818	291 390	36 496	254 894	662 723	Jan 2053	Mar 2054
3	20 292	355 206	69 566	285 639	742 662	Mar 2054	Jul 2055
4	20 903	335 119	49 065	286 053	743 739	Jul 2055	Oct 2056
5	18 788	282 916	22 278	260 638	677 658	Oct 2056	Nov 2057
6	18 583	263 496	13 616	249 880	649 688	Nov 2057	Nov 2058
7	16 100	221 032	10 734	210 297	546 773	Nov 2058	Oct 2059
	132 108	**2 020 333**	**251 042**	**1 769 291**	**4 600 157**		

10 WASTE TRANSFER STATION

10.1 Location of Transfer Station

A waste transfer is to be constructed adjacent to the current entry gate and booth. This area slopes upwards towards the north-west and is lightly forested. The station should be sited to minimise clearing of trees. By locating the station at the entrance to the site the general public will not be exposed to quarry and landfill machinery. This will allow for greater control of waste to ensure disallowed materials do not reach the landfill and recyclable materials are separated, and prevent public access to the quarry and landfill. The location of the transfer station is depicted in Appendix 3 Figure 21.

10.2 Transfer Station Layout

The transfer station will be constructed on two levels and orientated to take advantage of the natural topography. The upper level will be accessible by the general public for offloading waste into the bins on the lower level. Initially three 28m^3 bins will be required although provision for four bins has been made in the conceptual drawings, Appendix 3 Figures 21 and 22. The design is of a modular nature to allow for future expansion.

Each bin will have two offloading parking bays for light vehicles and trailers. Standard pre-cast concrete vehicle stops will be installed at each parking bay to prevent vehicles from reversing over the walls. The fence sections at the offloading face for each bin will have removable sections to allow for easy access to bins and to control of in-use bins. Guard rails and fencing will be required at strategic locations on the upper level to prevent vehicles and people from falling to the lower level.

The site has been laid out to facilitate one-way traffic through the site.

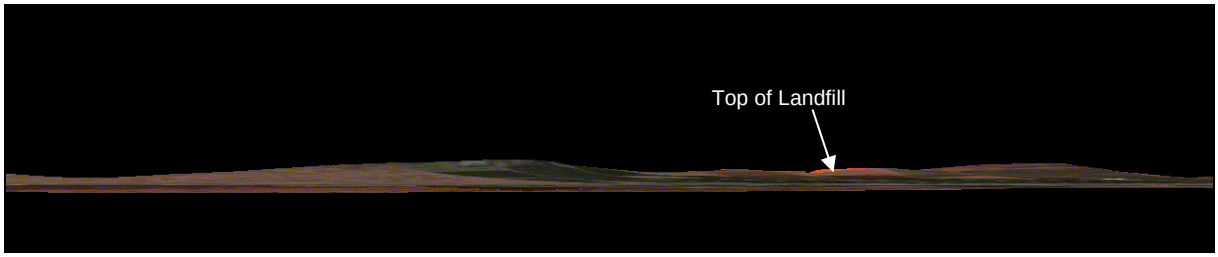
10.3 Recycling

Provision has been made for recycling skips and bins for general household recycling and bunded areas for recycling of lead-acid batteries and oils. Laydown areas for green waste and construction timber, scrap steel and whitegoods have been provided. These areas are accessible to heavy vehicles for removal of these bulky items.

11 VISUAL IMPACT

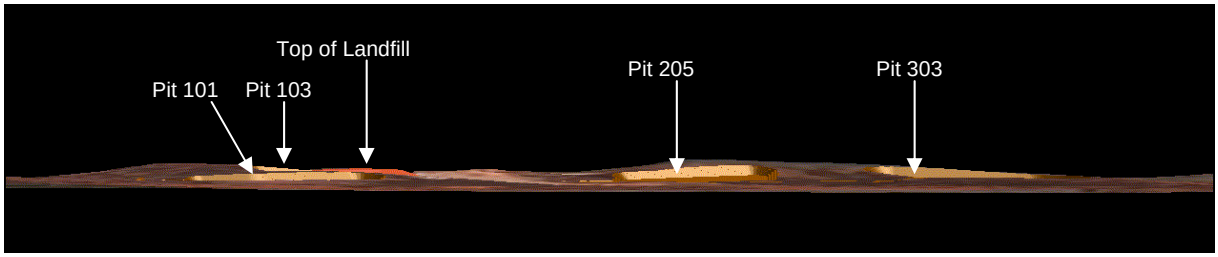
Quarry and landfill imperatives have been to reduce as far a practicable the visual impact from surrounding areas. To achieve this all quarries have been located to the east of the north-south ridgeline thus totally eliminating these from view from the west. The final finished crest of the Stage 1 quarry landfill will be slightly visible from the west, but with appropriate rehabilitation and revegetation the visual impact will be minimal from this direction.

Visual Impact from West



To limit the visual impact from the east and Lake Wyangan, the walls of the quarries have been extended around all sides as opposed to excavating the resource horizontally to the east to a contour.

Visual Impact from East



The quarry floor and batters are to be rehabilitated with native plant species to fragment the exposed quarry wall.

12 APPENDIX 1 SCOPE OF WORK

Prepare an operational plan for the quarry and landfill that maximises the use of suitable road base resource and minimises the environmental impacts of the quarry and associated landfill and includes an overall conceptual design for each of the progressive stages of the quarry, landfill and rehabilitation, and detailed designs for the next stage of the quarry and for the landfill.

The design is to include the following elements:

- Optimum quarry wall parameters: bench heights, wall angles, and batter angles for the various soil and rock types likely to be encountered, giving cognisance to likely exposure times and whether the batters are temporary or semi permanent in nature
- Pit designs for the relevant stages of the project, detailing haul roads, stockpile areas, parking and office areas, and security fencing
- Landfill placement sequence
- Designs for the capture, containment and treatment of runoff and leachate including estimates for rainfall frequency, duration and intensity; evaporation characteristics for the site, and; runoff and leachate volumes
- Life-of-quarry excavation schedule detailing volumes of soil, overburden, and economic material to be excavated and stockpiled in each quarry stage and volumes required for final quarry rehabilitation
- Life-of-quarry landfill schedule detailing nature and volume of material to be placed, and nature, volume of concomitant lining and capping, and leachate and stormwater management
- Rehabilitation plan detailing location and volumes of rock and soil required for final closure
- Schedule of lining, capping and overburden surfeits or deficits
- Basic landfill cell design and permanent storage or treatment specifications for hazardous wastes

Define and/or schedule the following parameters for both the mining and landfill operations:

- Hours of Operation
- Requisite mobile machinery and vehicles, location and nature of wash-down, parking, service and maintenance areas
- Requisite crushing and screening plant size and location
- Workforce (current and future)
- Consumable consumption and storage: reagents, fuel, lubricants, explosives and hazardous materials

Landfill should commence adjacent to the northern batter of the existing quarry and proceed to the west as gravel material is removed.

On completion of extraction at floor level of 135m AHD to the north western corner of Stage 1, landfill should be staged to extend to this corner and then proceed along the western face as required.

Provision of leachate collection, control and management (as specified in the Director General's requirements for the Environmental Assessment) by either constructing an impervious bund around the dump zone OR by providing an impervious base and batters with an impervious collection pond in the vicinity of the north eastern corner of the quarry void. Leachate would then be pumped back and irrigated over the surface of the landfill.

Landfill would then progress through the Stage 1 void until fill has been placed to an average depth of approximately 15 metres.

It is unlikely that landfill will completely fill the stage 1 void within the design period of 40 years.

Stage 2: Central Section

Designs for this stage are subject to the geotechnical findings.

A new access route will need to be constructed prior to commencement of extraction. This access road should extend from the end of the existing bitumen road in a north easterly direction to a point opposite Stage 2 extraction area and at a level of less than 135m AHD.

A spur should then be constructed west to the quarry zone and should include sufficient width (clear of the roadway) to allow for drainage from the extraction zone.

Extraction should then proceed progressively from the south eastern entry point to the north western extremity of Stage 2.

If material in the south eastern corner is of a sandy nature and is not generally suitable for road gravel (as is suspected) then sufficient soft material should be removed and used for landfill topping and/or rehabilitation of stage 1 so that a level area is created for the placement of the crushing plant.

As work progresses across the Stage 2 area, the crushing plant may be moved progressively but should again remain at the finished floor level of 135m AHD to minimise noise and visibility of the operation

A sedimentation pond should be constructed in the south eastern corner as soon as sufficient area is available and maintained throughout the life of the operation in stage 2.

Stage 3: Northern Section

Designs for this stage are subject to the geotechnical findings.

The access road should be extended from stage 2 north to a point opposite the south eastern sector of stage 3 and thence into the quarry zone.

Extraction should then proceed progressively from the south eastern entry point to the north western extremity of Stage 3.

- Infrastructure Requirements: water, electricity, lighting, security, communications

The plan is to take into account the following guiding principles but recognises that further information will be received shortly regarding the evaluation of the resource and groundwater parameters.

Stage 1 Quarry

The resource associated with the speedway track area is to be considered for inclusion in the design:

A design extraction rate of 250,000 tonnes per annum for forty years.

The floor level in existing quarry at about 135m AHD is to be continued through the remainder of Stage 1. This allows direct entry to the excavation from the existing access road, provides advantages from an energy point of view, allows the crusher to be located well below the ridge line thus reducing noise impacts and will allow trucks to enter the quarry at grade without the need for steep access roads.

Existing void and establish batters and benches are to be tidied up.

Batters should be no steeper than 1 horizontal to 3 vertical with 5 metre wide benches provided at 5 metre drops. The toe of each bench should be deep ripped to assist water penetration and promote establishment of vegetation.

The western section of the existing quarry has a base level of about 150m AHD. Excavation should continue west at the design floor level of 135m AHD across the remainder of the existing disturbed site to reach the western batter. This will yield approximately 600,000 tonnes of material, enough for 2 to 3 years supply.

Extraction should then proceed at a finished floor level of 135m AHD from the existing quarry in a generally southerly direction until stage 1 has been completed.

Depending on the rim level, rock should be drilled and blasted in 2 or 3 levels progressively from the surface to the floor level with all levels proceeding concurrently so that excavated material can be dozed to the floor level ready for processing through the crusher.

The crusher should remain at the finished floor level and be progressively moved to allow easy feeding.

All trucks will continue to enter and exit the extraction zone via the present established access gate.

The finished floor level should be sloped from the west to the east at 1% and a drain constructed along the foot of the eastern batter to allow drainage from the excavation zone.

1 or 2 sedimentation ponds should be created within the extraction zone by excavation into the softer material at the bed of the quarry.

Landfill in Stage 1 Excavation

Subject to site testing and detailed design, the following operational strategy should be considered for the extension of the existing land fill into the Stage 1 void:

If material in the south eastern corner is of a sandy nature and is not generally suitable for road gravel (as is suspected) then sufficient soft material should be removed and used for landfill topping and/or rehabilitation of stage 1/ 2 so that a level area is created for the placement of the crushing plant.

As work progresses across the Stage 3 area, the crushing plant may be moved progressively but should again remain at the finished floor level of 135m AHD to minimise noise and visibility of the operation

A sedimentation pond should be constructed in the south eastern corner as soon as sufficient area is available and maintained throughout the life of the operation in stage 3.

Rehabilitation

For all stages, a conceptual plan and strategy for rehabilitation is to be developed that allows rehabilitation to be carried out progressively and minimises the area and exposure time of exposure un-rehabilitated areas.

Data and Design Integration

All relevant data and designs will be collated into a single file set that allows the spatial relationships of all aspects of the proposal to be fully integrated. It is understood that Griffith City Council and/or Balance can provide the following information to establish the data set:

- Aerial photography
- Topography and surface drainage
- Cadastral information, land tenure, and zoning boundaries
- Existing built features: quarry excavation, access roads, stockpiles, landfill, roads, fences, gatehouses, crusher, and speedway
- Interpreted extent of quarry resource
- Fauna habitat and vegetation community zones
- Bore hole locations and depths

The system will be confined to two dimensional systems based on MAPINFO and AutoCAD software.

13 APPENDIX 2 FURTHER ASSUMPTIONS

A meeting held at Griffith City Council on 13 November 2007 with all council officers and consultants involved in preparation of statutory approval submissions for the quarry expansion resolved that the operational and development plan for the quarry and landfill would be predicated on the following assumptions.

1 Tharbogang will not become a regional waste disposal site and future sources of waste will remain the same as they are at present.

2 In two years from now no further recyclables will go to landfill.

3 In 5 years all waste will be processed in a transfer station

4 The Stage 1 quarry excavation will meet waste disposal requirements for the foreseeable future of 20 to 50 years.

5 The Yenda landfill will close in 2 years and become a transfer station. Non recyclables will be transferred to Tharbogang.

6 Sufficient offsets will be identified for environmental disturbance resulting from future Stage 1 to 7 quarry excavation.

7 If any significant groundwater contamination is occurring due to the existing landfill, future landfill must incorporate a robustly engineered floor liner and cover cap.

8 For the purpose of cost benefit analysis, in the absence of any better information, it is to be assumed that operational parameters such as availability of lining and capping clay for alternative sites will be the same as for Tharbogang.

9 Alternative landfill excavation strategies such as deeper excavation below the road base resource limit or excavation of sites with no road base resource will not be pursued on the short term.

There is a need to do everything possible within the operating plan to reduce Council's exposure to liability for public health and safety. As a minimum, use of Council land by the Speedway and public access to the tip face must be eliminated.

For effective management of greenhouse gas generation from either a conventional landfill or a bioreactor the capping must be robustly engineered. For any landfill in the future there will be a minimum requirement for gases to be contained, captured and flared off. Effective capping involves a significant additional cost, which implies that the volume of waste disposed per unit area of capping should be maximised. This tends to favour deep landfills with a small footprint rather than shallow landfills with a large footprint.

The loamy soil being used currently to form the lining and capping of the existing landfill is unlikely to be forming a satisfactory seal with respect to preventing contamination of ground water and leakage of greenhouse gases to atmosphere. Future landfill must incorporate a robustly engineered floor liner and cover cap. Detailed engineering design of liners and caps should be carried out by a suitably

qualified and experienced specialist engineering consultancy. The final rehabilitation and remediation of the landfill will be a major cost which further emphasises the need to maximise the volume per unit area of footprint.

It is likely that in the near future state or federal legislation will force collection of recyclable wastes. Beyond that the regulatory framework will continue to move towards further reduction or even elimination of waste. These factors will result in a very significant reduction in the volumes of waste that will be disposed in landfills in the future.

It is anticipated that when the options assessment has been completed Tharbogang will be the best site for ongoing landfill disposal of non-recyclable wastes.

The NSW Department of Planning have indicated that Tharbogang will be assessed as a Major Project under the NSW Environmental Planning and Assessment Act 1979 and this will ultimately determine what is required for the environmental surveys.

It will be necessary to clearly define what constitutes a properly rehabilitated site and the issues that need to be considered such a visual impact and restitution of habitat. Cognisance needs to be given to the fact that there will be practical physical restrictions that need to be accommodated such as the fact that the size and nature of revegetation on the landfill need to be commensurate with the capping thickness.

The waste transfer station needs to be included in the operational plan and the environmental impacts assessment. The waste transfer station should have a footprint of no more than a hectare and should be designed so as to not require the disturbance of larger trees.

Council will need to estimate future operating cost for the facility. The operational plan should therefore include estimates for the volumes of all activities that will generate costs including items such as material to be handled in the waste transfer station, amount of capping and lining material required, and final rehabilitation and remediation quantities.

14 APPENDIX 3 FIGURES

Figure 5 Location of Batter Stabilisation Cells

Figure 7 Landfill Cells

Figure 9 Landfill Design Profile

Figure 10 Leachate Drainage System

Figure 11 Water Balance

Figure 12 Landfill Filling Sequence

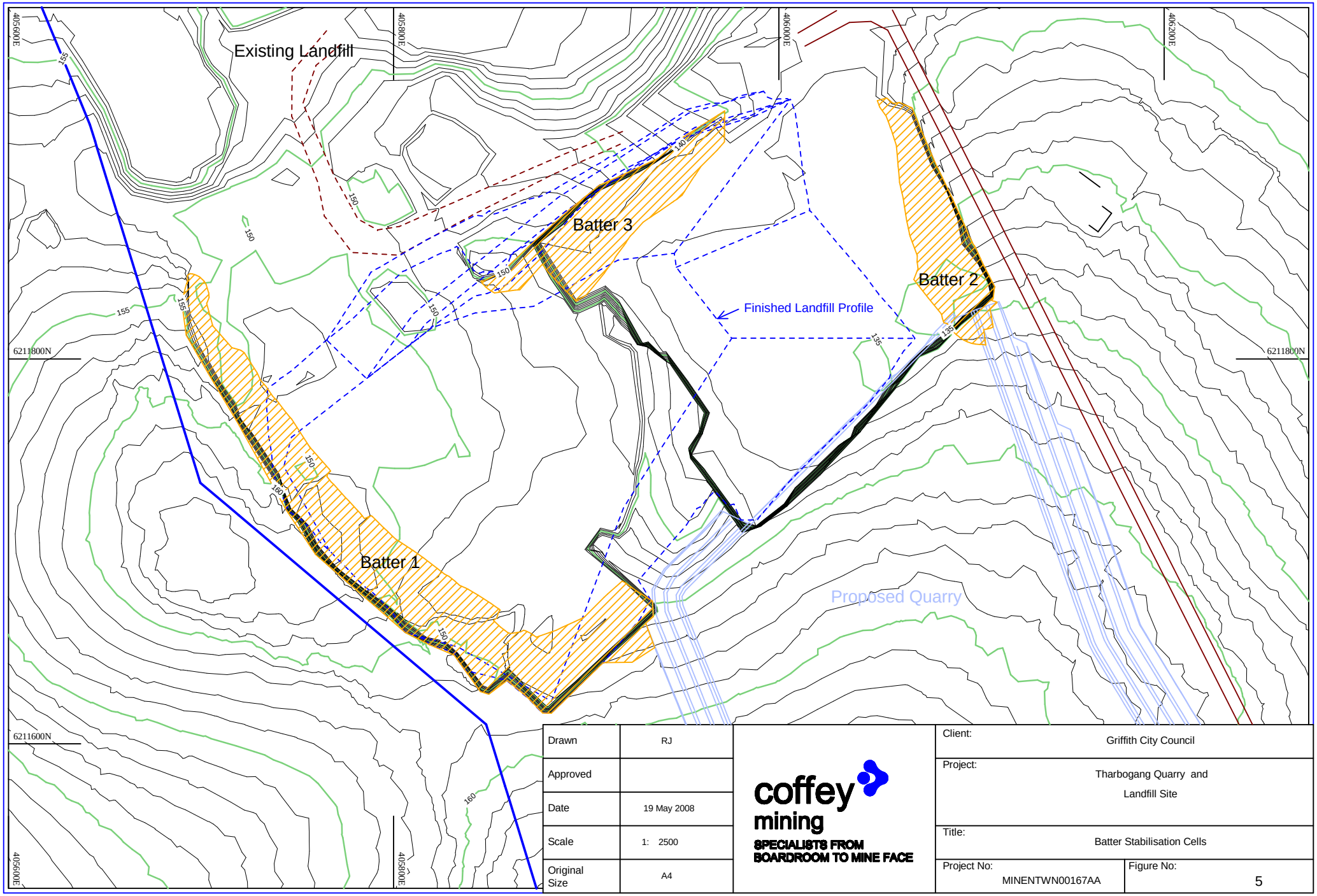
Figure 14 Cross Sections from Bergamin Residence

Figure 17 Proposed Quarry Site with Vegetation Types

Figure 18 Pit Phases

Figure 20 Resource Drill Holes

Figure 21 Waste Transfer Station



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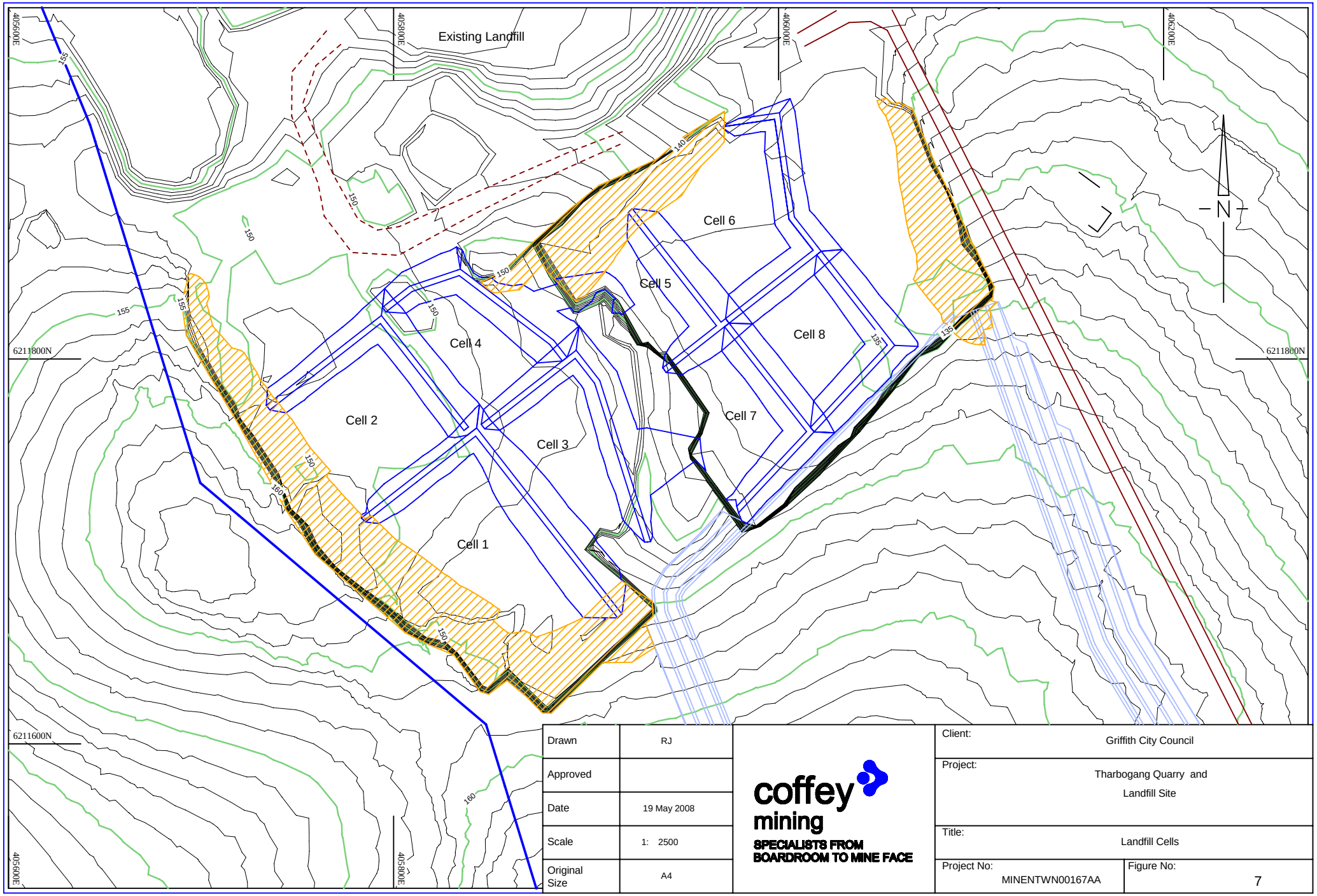
Approved	
Date	19 May 2008
Scale	1: 2500
Original Size	A4

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Client:	Griffith City Council
Project:	Tharbogang Quarry and Landfill Site
Title:	Batter Stabilisation Cells
Project No:	MINENTWN00167AA
Figure No:	5



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Approved	
Date	19 May 2008
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Original Size	A4

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

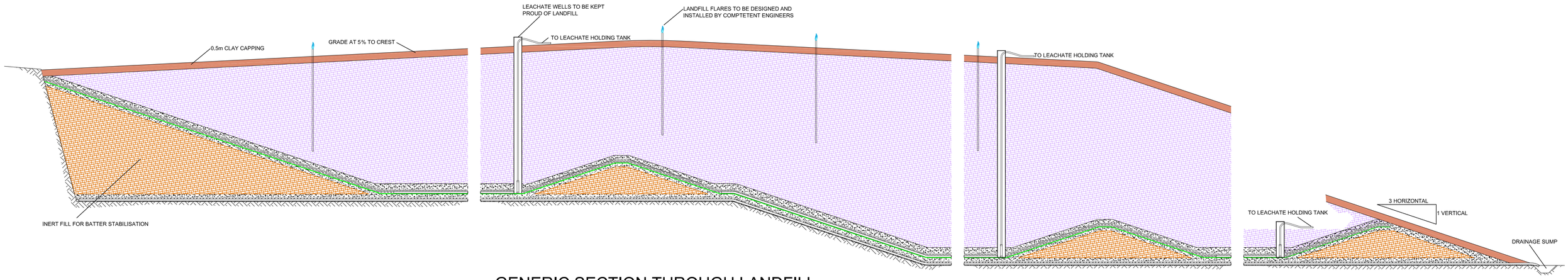
Client: Griffith City Council

Project: Tharbogang Quarry and Landfill Site

Title: Landfill Cells

Project No: MINENTWN00167AA

Figure No: 7



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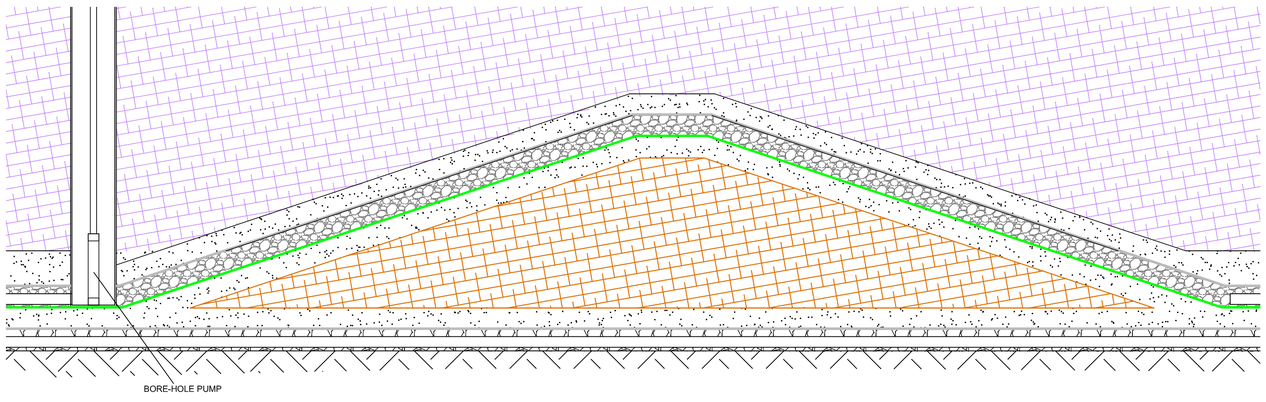

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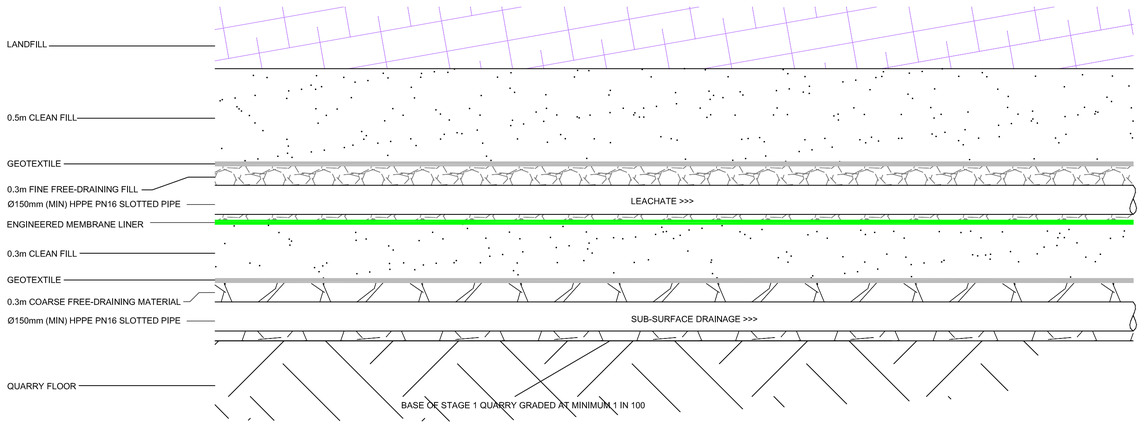


LANDFILL BASE DETAIL

LEGEND

- Mebrane Liner
- Geotextile Fabric
- Coarse Free-Draining Material
- Fine Free-draining Material
- Clean Fill
- Inert Landfill
- Purescible Landfill
- Compacted Clay Capping

revision	description	drawn	approved	date

drawn	**RJ**
approved	
date	**20 JUNE 2008**
scale	**NTS**
original size	**A1**

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

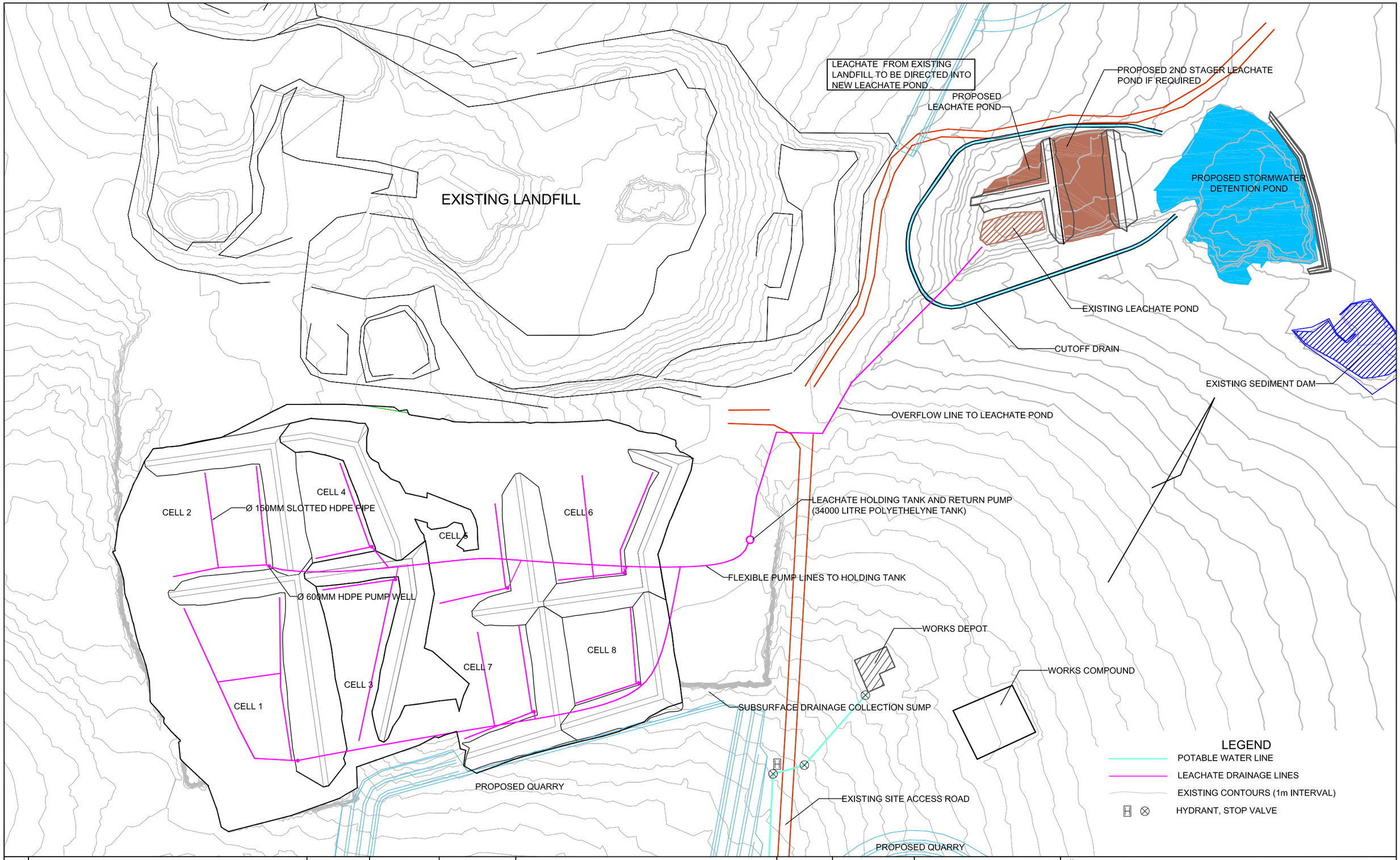
client: **GRIFFITH CITY COUNCIL**

project: **THARBOGANG QUARRY AND LANDFILL**

title: **LANDFILL ENGINEERING**

project no: **MINENTWN00167AA**

figure no: **9**



revision	description	drawn	approved	date

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Horizontal Scale (metres)

drawn	**RJ**
approved	
date	**13 OCT 2008**
scale	**1 : 2000**
original size	**A3**

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

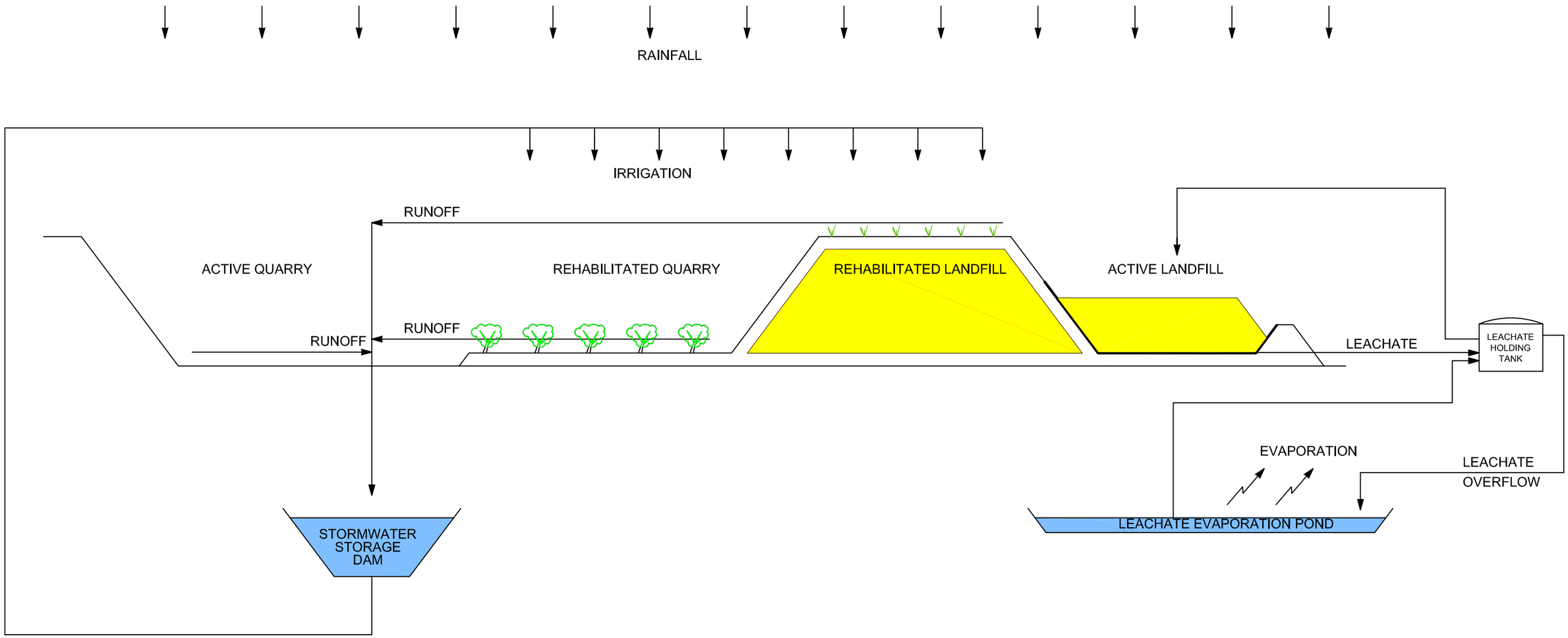
client: **GRIFFITH CITY COUNCIL**

project: **THARBOGANG QUARRY AND LANDFILL SITE**

title: **LEACHATE DRAINAGE SYSTEM**

project no: **MINENTWN00167AA**

FIGURE 10



revision	description	drawn	approved	date

drawn	MH
approved	BA
date	02.01.08
scale	NTS
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

client: **GRIFFITH CITY COUNCIL**

project: **THARBOGANG QUARRY & LANDFILL PROPOSED QUARRY EXPANSION**

title: **WATERBALANCE PLAN**

project no: **MINENTWN00167AA**

figure no: **11**

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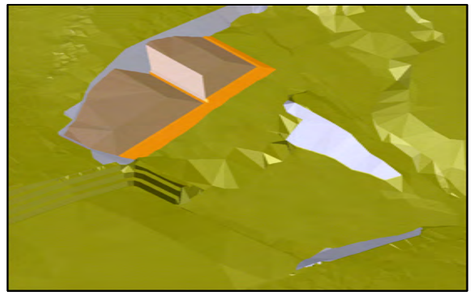
2. Filling of Cell 1

3. Construction of Cell 2



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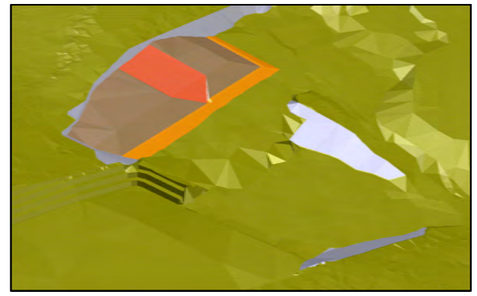

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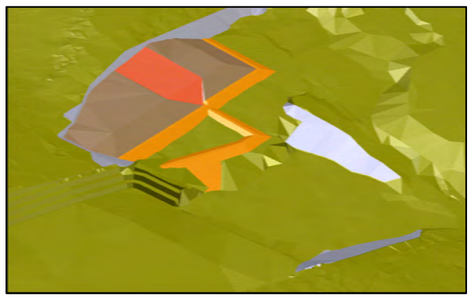

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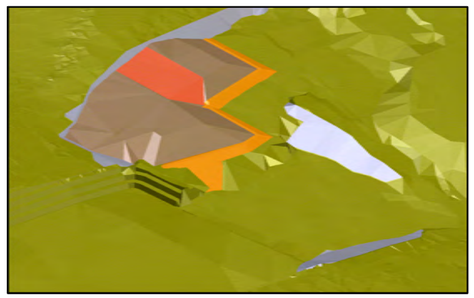

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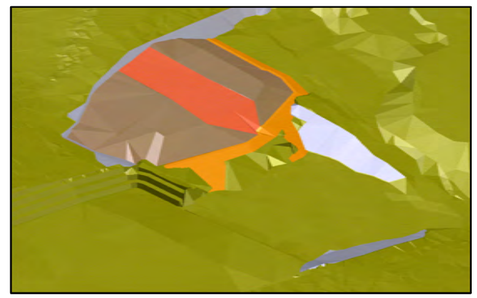
8. Construction of Cell 4

9. Filling of Cell 4



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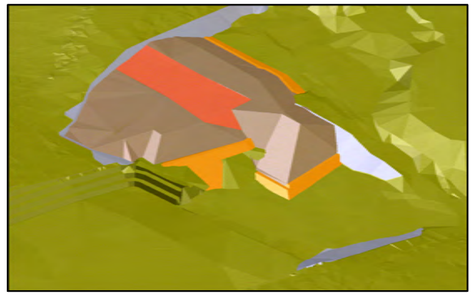

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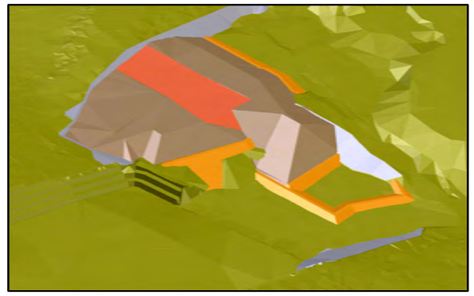

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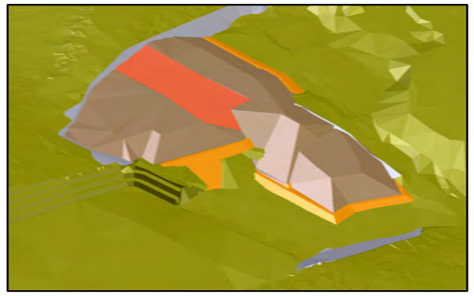

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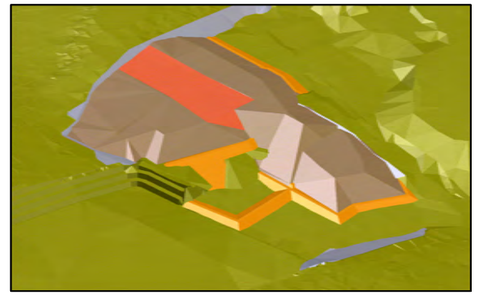

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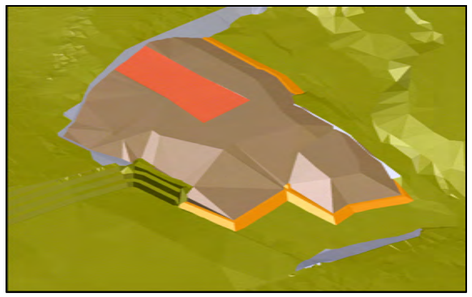

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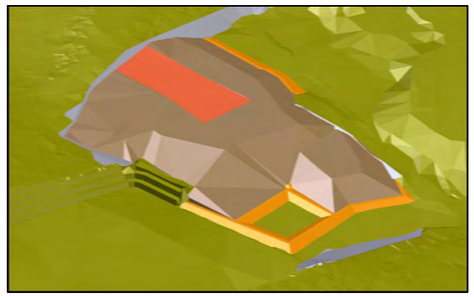

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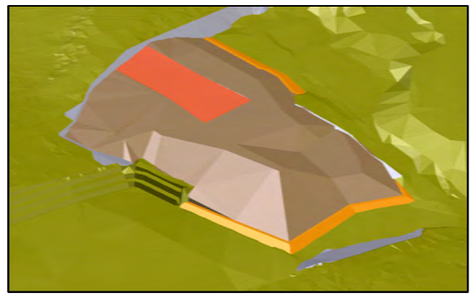

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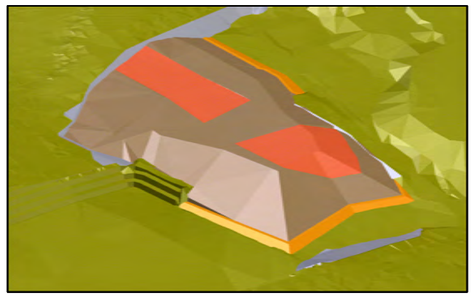

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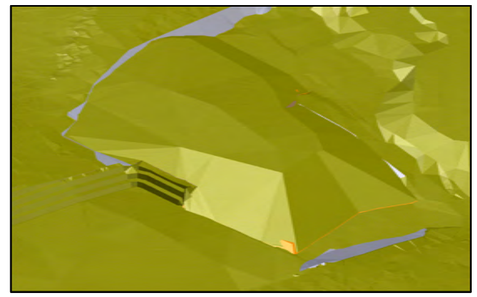


20. Capping and rehabilitation of landfill

revision	description	drawn	approved	date

drawn	RJ
approved	
date	26 May 2008
scale	
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

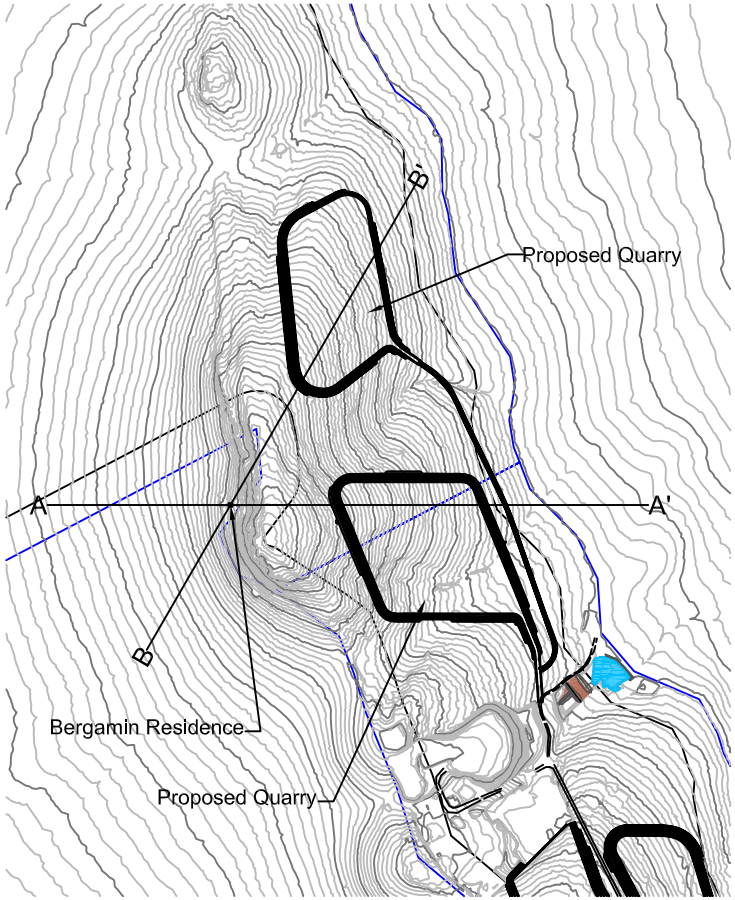
client: Griffith City Council

project: Tharbogang Quarry and Landfill

title: Landfill Filling Sequence

project no: MINENTWN00167AA

figure no: 12



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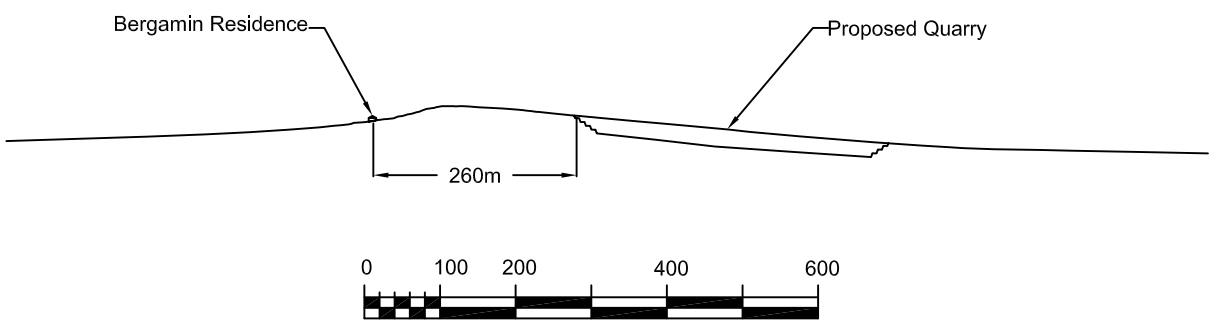

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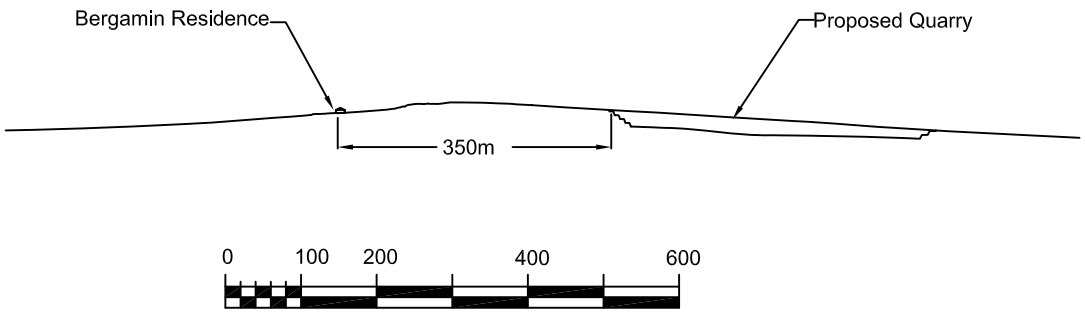


drawn	MH
approved	RJ
date	29.02.08
scale	AS SHOWN
original size	A4

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

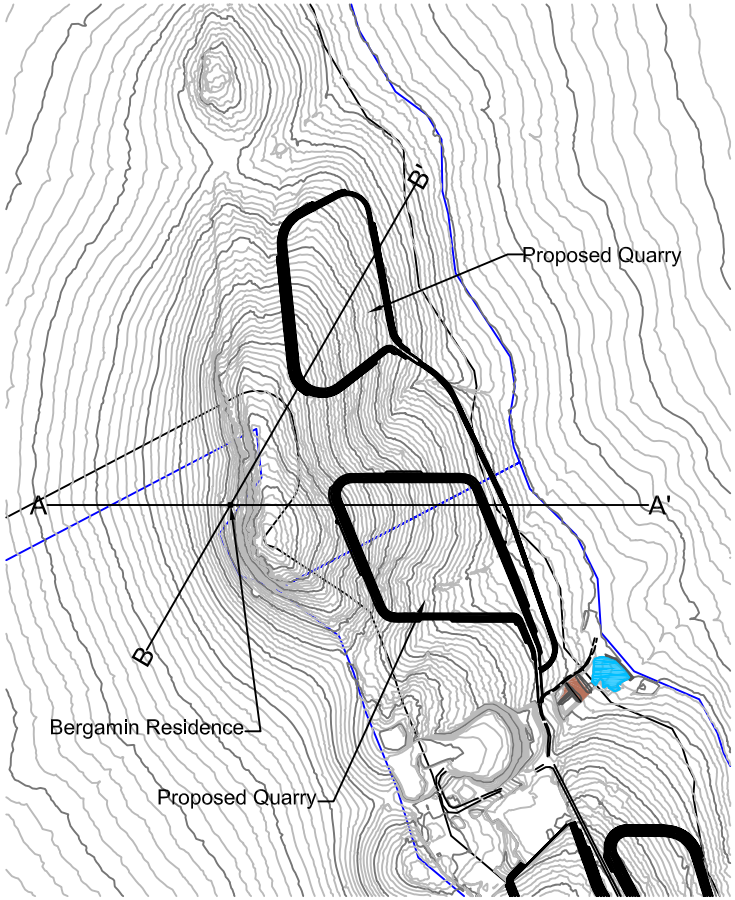
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY & LANDFILL
PROPOSED QUARRY EXPANSION

title: CROSS SECTIONS FROM BERGAMIN RESIDENCE

project no: MINENTWN00167AA

figure no: 14



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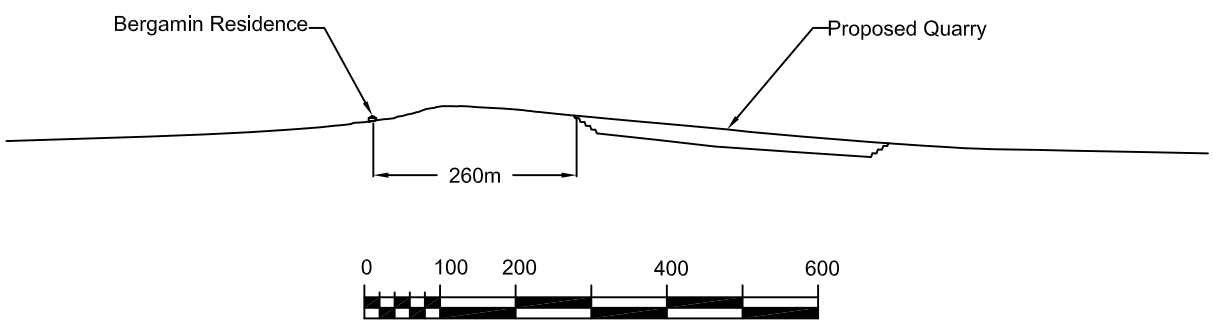

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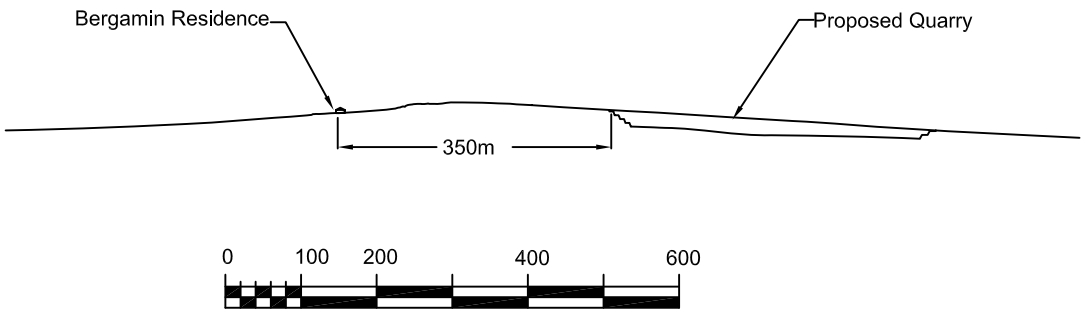

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approved	RJ
date	29.02.08
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original size	A4

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

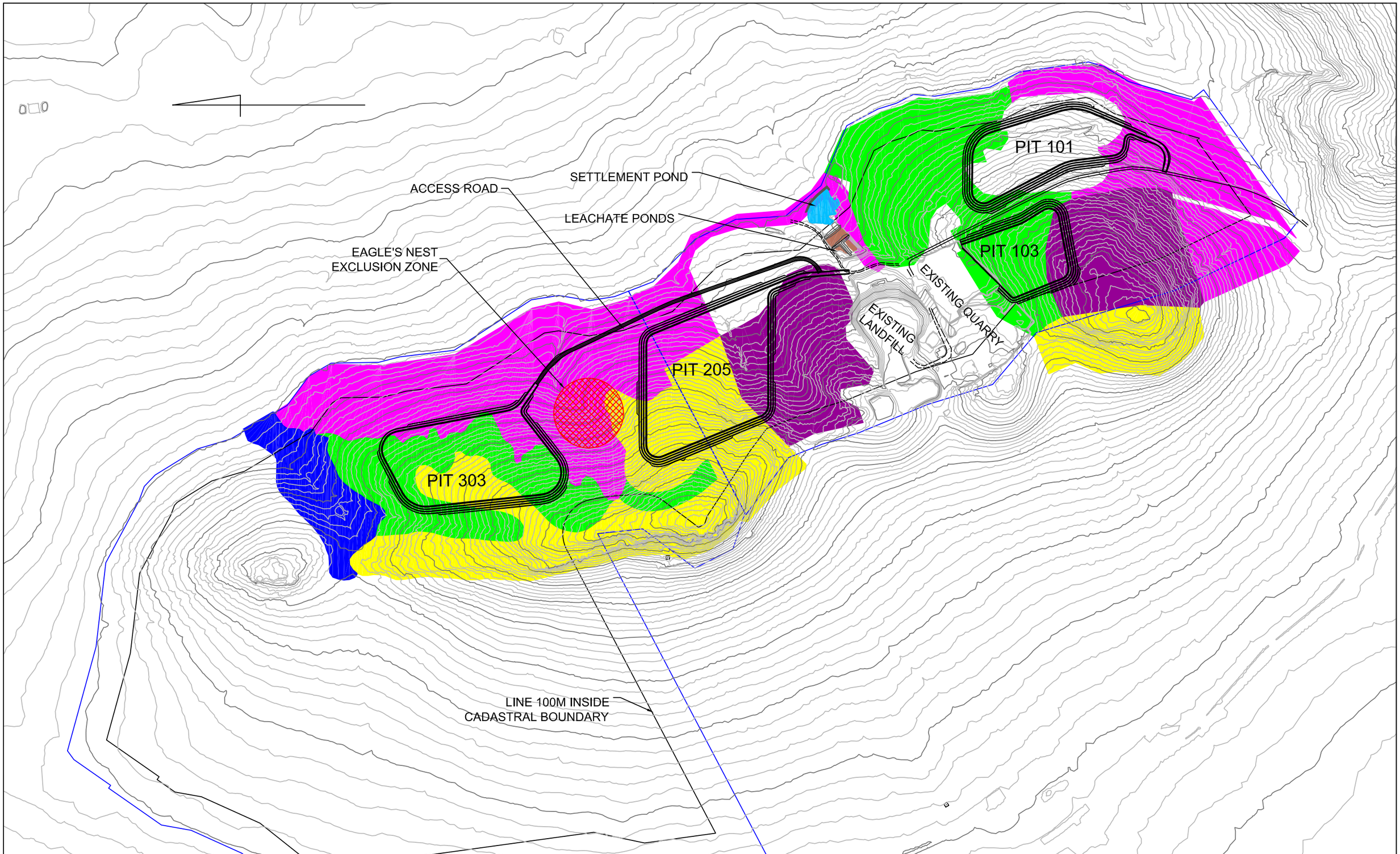
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY & LANDFILL
PROPOSED QUARRY EXPANSION

title: CROSS SECTIONS FROM BERGAMIN RESIDENCE

project no: MINENTWN00167AA

figure no: 14



revision	description	drawn	approved	date

LEGEND

- WHITE CYPRESS PINE - POPLAR BOX WOODLAND
- MIXED BRIMBLE BOX / CYPRESS PINE / DWYER'S MALLEE GUM OPEN FOREST
- DWYER'S RED GUM / CURRAWONG WOODLAND
- WHITE CYPRESS PINE OPEN FOREST / REGROWTH
- POPLAR BOX GRASSY WOODLAND

drawn	MH
approved	RJ
date	17 OCT 08
scale	1:10000
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

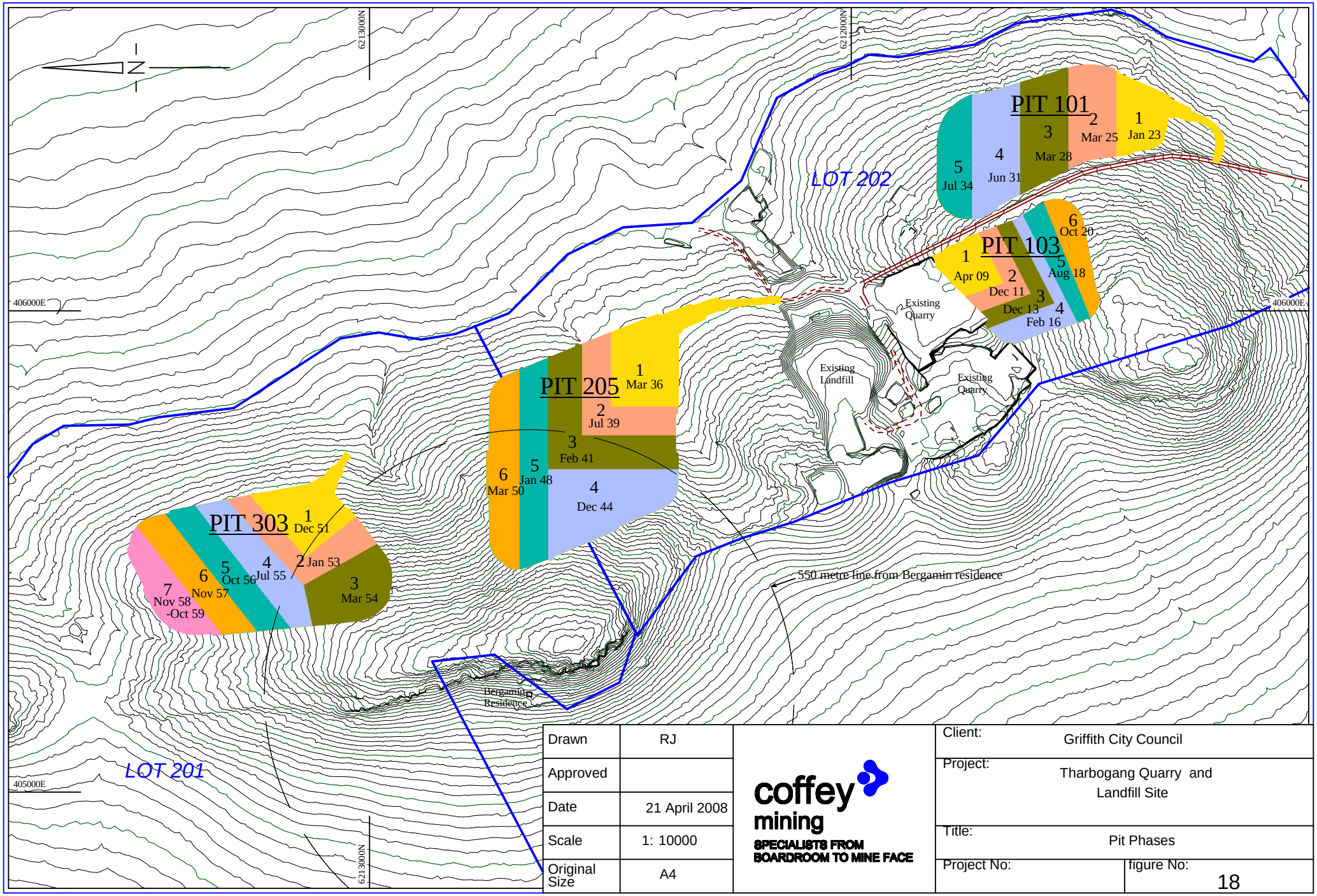
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY & LANDFILL
PROPOSED QUARRY EXPANSION

title: PROPOSED QUARRY SITES WITH VEGETATION AREAS

project no: MINENTWN00167AA

figure no: 17



Drawn	RJ
Approved	
Date	21 April 2008
Scale	1: 10000
Original Size	A4

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

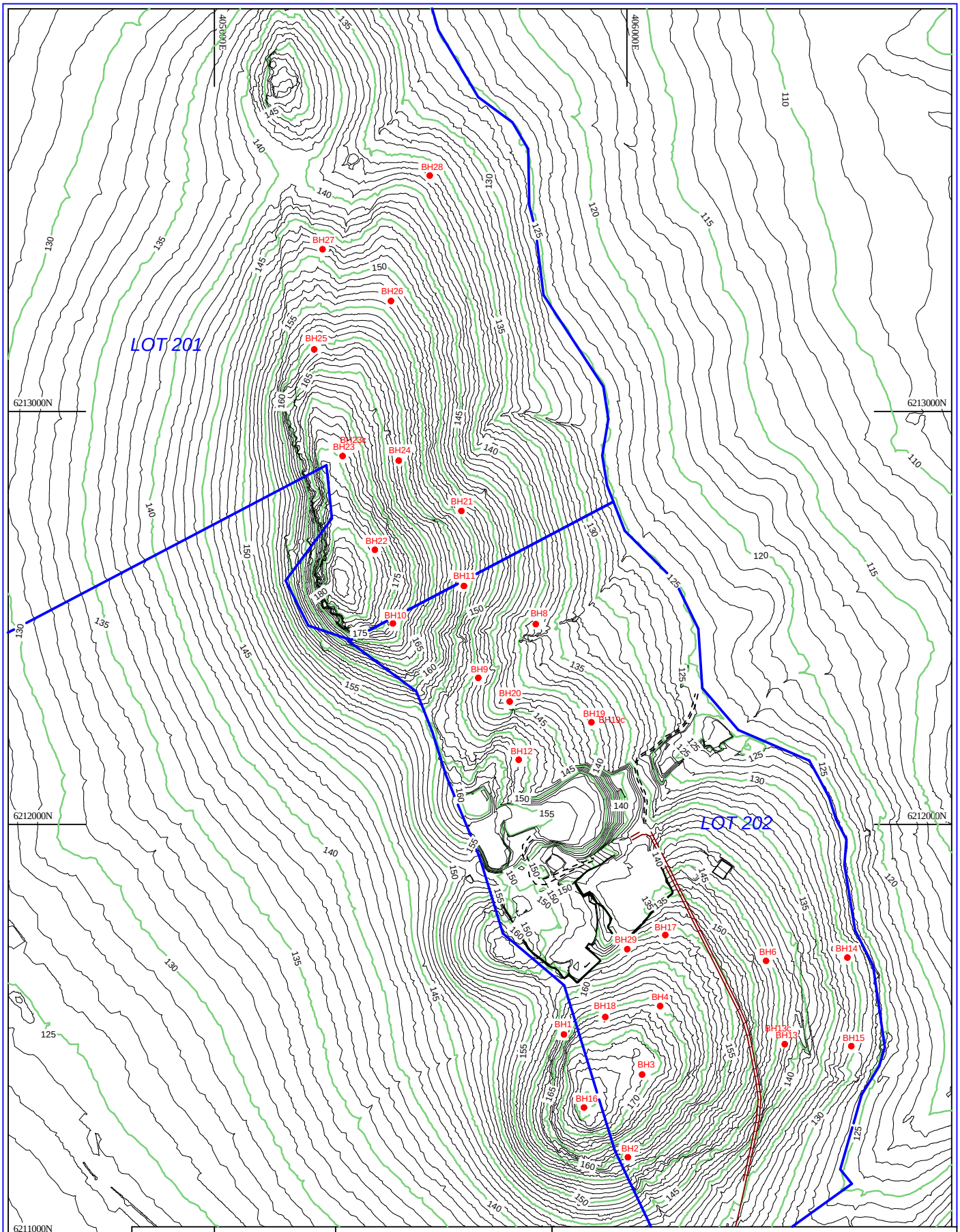
Client: Griffith City Council

Project: Tharbogang Quarry and Landfill Site

Title: Pit Phases

Project No:

figure No: 18



Drawn	RJ	coffey mining SPECIALISTS FROM BOARDROOM TO MINE FACE	Client: Griffith City Council	
Approved			Project: Tharbogang Quarry and Landfill Site	
Date	12 May 2008		Title: Resource Drill Holes	
Scale	1: 12500		Project No: MINENTWN00167AA	figure No: 20
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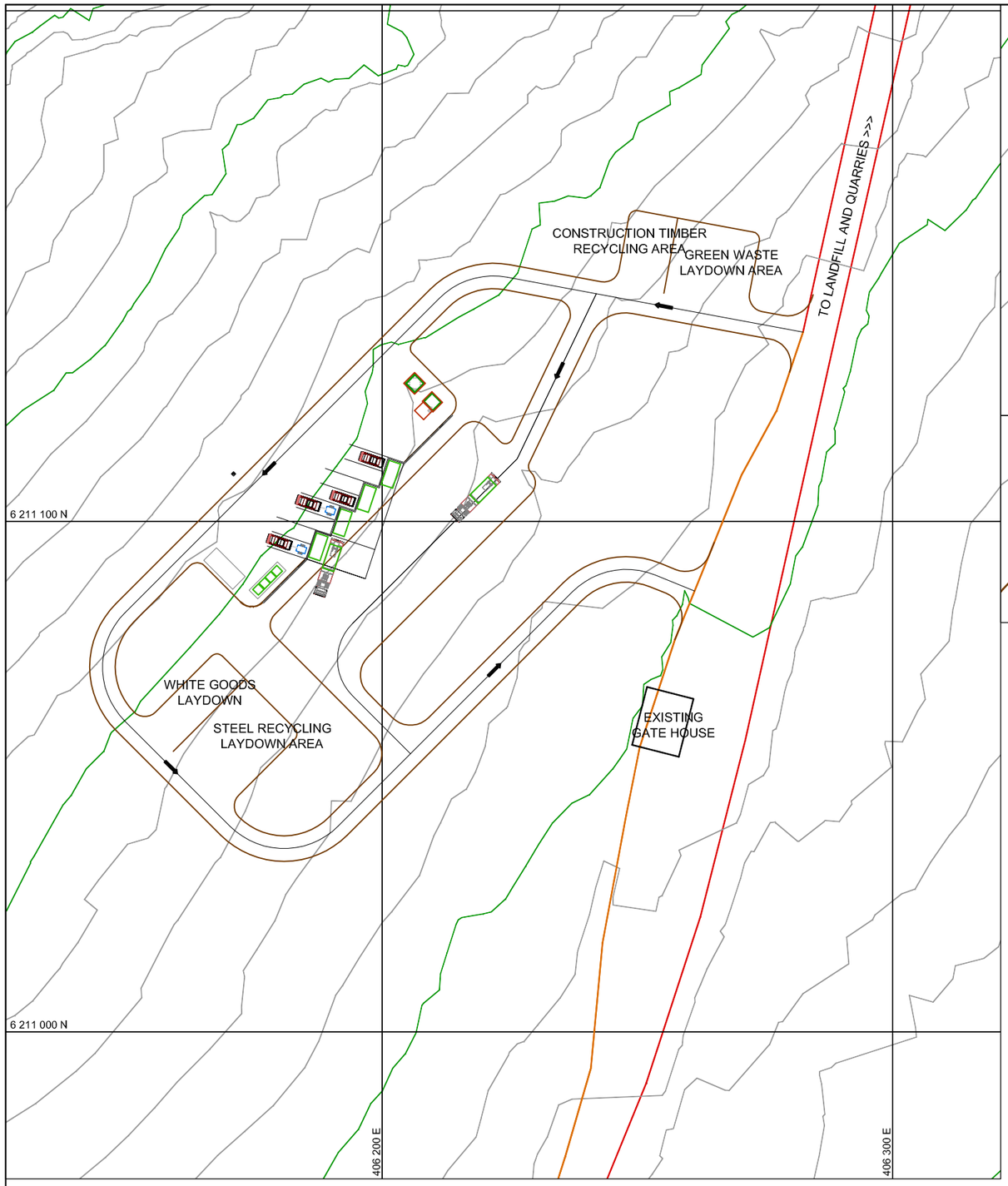
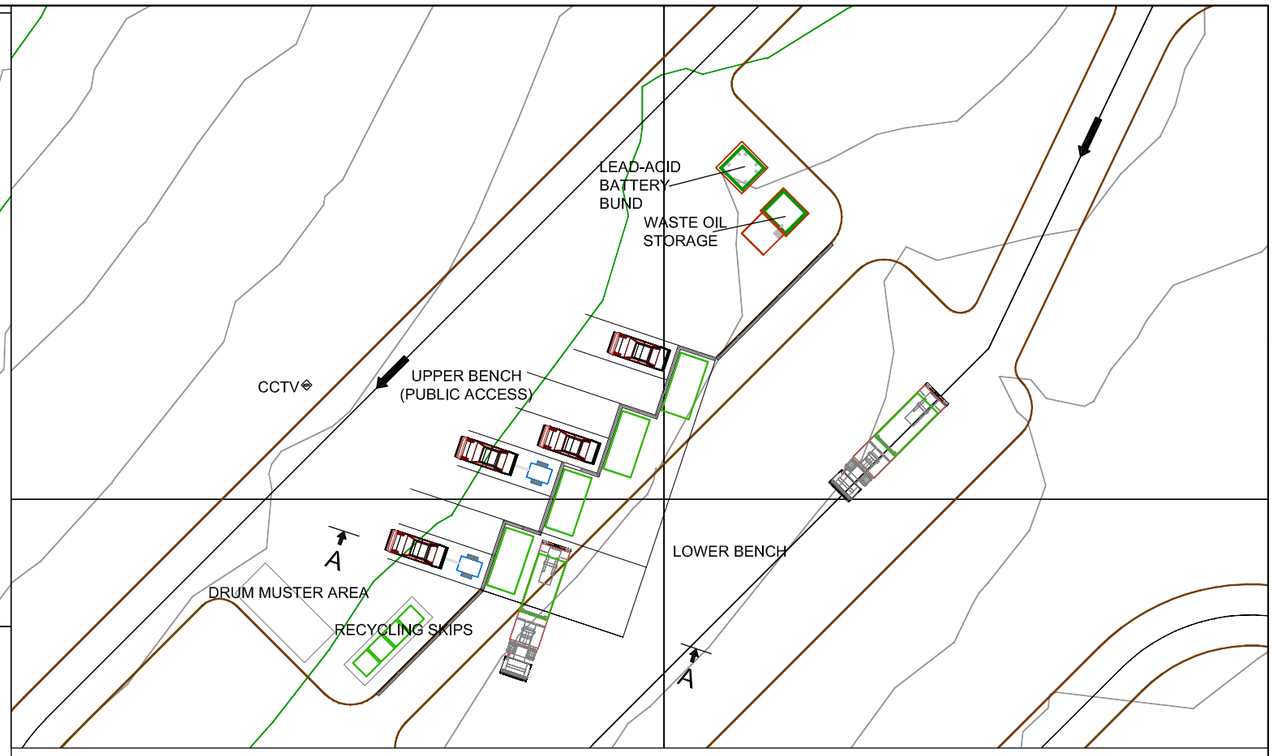


TRANSFER STATION LOCATION PLAN

SCALE 1:1000



TRANSFER STATION

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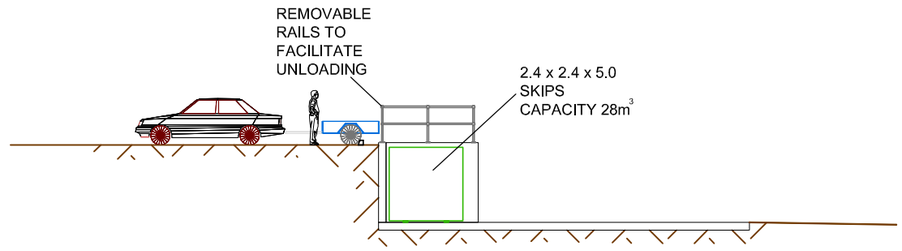


VIEW A-A

SCALE 1:200

revision	description	drawn	approved	date

drawn:	RJ
approved	
date	15 OCT 2008
scale	AS SHOWN
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

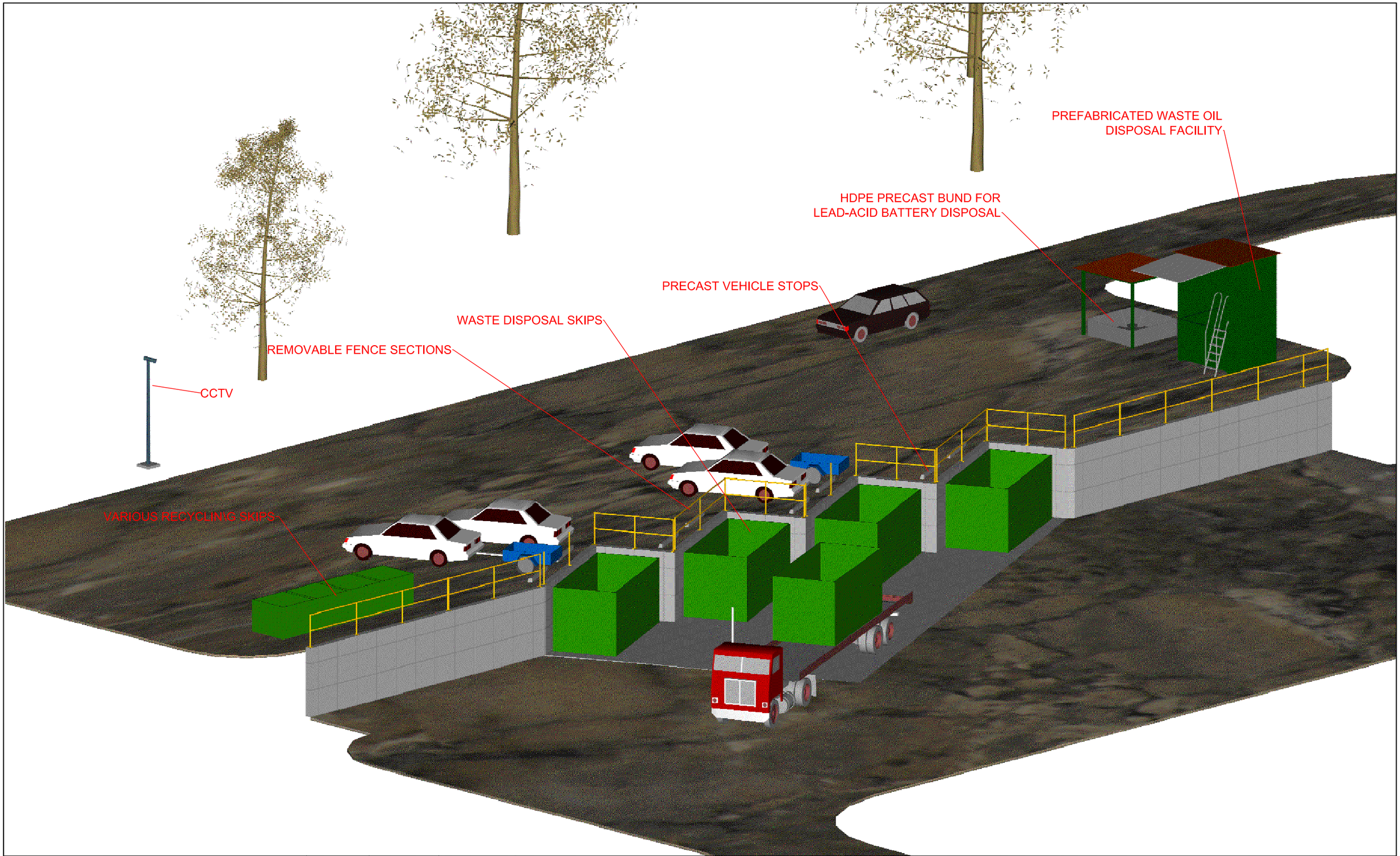
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY AND LANDFILL SITE

title: WASTE TRANSFER STATION

project no: MINENTWN00167AA

figure no: 21



revision	description	drawn	approved	date

drawn	RJ
approved	
date	19 NOV 2008
scale	NTS
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

client: **Griffith City Council**

project: **Tharbogang Quarry and Landfill**

title: **Waste Transfer Station Isometric View**

project no: **MINENTWN00167AA**

figure no: **FIGURE 22**

15 APPENDIX 4 QUARRY MACHINERY STUDY

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Tharbogang Quarry Operations

Bench Height (m) **5.0**
Subdrill (m) **0.9**
Material SG **2.6**

PF = kg/BCM

Pattern Size	Burden	Spacing	Vol/DH	t/DH	Drilled lm/t	@ PF 0.6 ANFO kg/DH	**@ PF 0.65 ANFO kg/DH**	@ PF 0.7 ANFO kg/DH
3.0 x 3.0	3.0	3.0	45	117	0.050427	27	**29**	32
3.5 x 3.5	3.5	3.5	61	159	0.037049	37	**40**	43
4.0 x 4.0	**4.0**	**4.0**	**80**	**208**	**0.028365**	**48**	**52**	**56**
4.5 x 4.5	4.5	4.5	101	263	0.022412	61	**66**	71
5.0 x 5.0	5.0	5.0	125	325	0.018154	75	**81**	88
3.0 x 4.0	**3.0**	**4.0**	**60**	**156**	**0.037821**	**36**	**39**	**42**

Hole Diameter: 89mm

Go to 3.0 x 4.0 pattern when noise suppression in affect.
1 delay and 1 det used when noise suppression in affect, would probably switch to full range of long lead dets with no surface delays

Assumptions used below in bold.

FEL Cat966 Med Load 19.5 - 23.8 l/hr
FEL Cat950 Med Load 14 - 18 l/hr

Detcord Calc as DH*spacing*burden + (200m per blast of 50 DH)

Utilisation 85%
Quarry Dry

Year	Average BCM	Production t	Drilled lm	Drilled DH	ANFO t Used	Production Times: Drill @ 12 lm/hr 40 hr Week	Crusher @ 200t/hr 40 hr Week	Loader x 1.5 Crushe 40 hr Week	Manpower (No Supervison)		Total MP Weeks
1	57,692	150,000	4,255	721	38	10	22	33	3	0.5 on Drill and 0.5 on 2nd Loader.	66
2	59,423	154,500	4,382	743	39	11	23	34	3	0.5 on Drill and 0.5 on 2nd Loader.	68
3	61,206	159,135	4,514	765	40	11	23	35	3	0.5 on Drill and 0.5 on 2nd Loader.	70
4	63,042	163,909	4,649	788	41	11	24	36	3	0.5 on Drill and 0.5 on 2nd Loader.	72
5	64,933	168,826	4,789	812	42	12	25	37	3	0.5 on Drill and 0.5 on 2nd Loader.	74
6	66,881	173,891	4,932	836	43	12	26	38	3	0.5 on Drill and 0.5 on 2nd Loader.	76
7	68,888	179,108	5,080	861	45	12	26	40	3	0.5 on Drill and 0.5 on 2nd Loader.	78
8	70,954	184,481	5,233	887	46	13	27	41	3	0.5 on Drill and 0.5 on 2nd Loader.	81
9	73,083	190,016	5,390	914	48	13	28	42	3	0.5 on Drill and 0.5 on 2nd Loader.	83
10	75,275	195,716	5,552	941	49	14	29	43	3	0.5 on Drill and 0.5 on 2nd Loader.	86
11	77,534	201,587	5,718	969	50	14	30	44	3	0.5 on Drill and 0.5 on 2nd Loader.	88
12	79,860	207,635	5,890	998	52	14	31	46	3	0.5 on Drill and 0.5 on 2nd Loader.	91
13	82,255	213,864	6,066	1,028	53	15	31	47	3	0.5 on Drill and 0.5 on 2nd Loader.	93
14	84,723	220,280	6,248	1,059	55	15	32	49	3	0.5 on Drill and 0.5 on 2nd Loader.	96
15	87,265	226,888	6,436	1,091	57	16	33	50	3	0.5 on Drill and 0.5 on 2nd Loader.	99
16	89,883	233,695	6,629	1,124	58	16	34	52	3.5	0.5 on Drill and 1.0 on 2nd Loader.	102
17	92,579	240,706	6,828	1,157	60	17	35	53	3.5	0.5 on Drill and 1.0 on 2nd Loader.	105
18	95,357	247,927	7,033	1,192	62	17	36	55	3.5	0.5 on Drill and 1.0 on 2nd Loader.	108
19	98,217	255,365	7,244	1,228	64	18	38	56	3.5	0.5 on Drill and 1.0 on 2nd Loader.	112
20	101,164	263,026	7,461	1,265	66	18	39	58	3.5	0.5 on Drill and 1.0 on 2nd Loader.	115
21	104,199	270,917	7,685	1,302	68	19	40	60	3.5	0.5 on Drill and 1.0 on 2nd Loader.	118
22	107,325	279,044	7,915	1,342	70	19	41	62	3.5	0.5 on Drill and 1.0 on 2nd Loader.	122
23	110,544	287,416	8,153	1,382	72	20	42	63	3.5	0.5 on Drill and 1.0 on 2nd Loader.	126
24	113,861	296,038	8,397	1,423	74	21	44	65	3.5	0.5 on Drill and 1.0 on 2nd Loader.	129
25	117,277	304,919	8,649	1,466	76	21	45	67	3.5	0.5 on Drill and 1.0 on 2nd Loader.	133
26	120,795	314,067	8,909	1,510	79	22	46	69	3.5	0.5 on Drill and 1.0 on 2nd Loader.	137
27	124,419	323,489	9,176	1,555	81	22	48	71	3.5	0.5 on Drill and 1.0 on 2nd Loader.	141
28	128,151	333,193	9,451	1,602	83	23	49	73	3.5	0.5 on Drill and 1.0 on 2nd Loader.	146
29	131,996	343,189	9,735	1,650	86	24	50	76	3.5	0.5 on Drill and 1.0 on 2nd Loader.	150
30	135,956	353,485	10,027	1,699	88	25	52	78	3.5	0.5 on Drill and 1.0 on 2nd Loader.	155
31	140,034	364,089	10,328	1,750	91	25	52	78	4	**Introduce 48 hour week**	155
32	144,235	375,012	10,637	1,803	94	26	52	78	4		156
33	148,562	386,262	14,609	2,476	97	36	52	78	4		166
34	153,019	397,850	15,047	2,550	99	37	52	78	4		167
35	157,610	409,786	15,498	2,627	102	38	52	78	4		168
36	162,338	422,079	15,963	2,706	106	39	52	78	4		169
37	167,208	434,742	16,442	2,787	109	40	52	78	4.5	**Introduce 56 hour week**	170
38	172,225	447,784	16,935	2,870	112	42	52	78	4.5		172
39	177,391	461,218	17,443	2,957	115	43	52	78	4.5		173
40	182,713	475,054	17,967	3,045	119	44	52	78	4.5		174
41	188,194	489,306	18,506	3,137	122	45	52	78	4.5		175
42	193,840	503,985	19,061	3,231	126	47	52	78	4.5		177
43	199,656	519,104	19,633	3,328	130	48	52	78	5		178
44	205,645	534,678	15,166	2,571	134	37	52	78	5		167
45	211,815	550,718	15,621	2,648	138	38	52	78	5		168
46	218,169	567,239	16,090	2,727	142	39	52	78	5		169
47	224,714	584,257	16,573	2,809	146	41	52	78	5		171
48	231,455	601,784	17,070	2,893	150	42	52	78	5		172
49	238,399	619,838	17,582	2,980	155	43	52	78	5.5		173
50	245,551	638,433	18,109	3,069	160	44	52	78	5.5		174

Fuel & Lubricant Usage

Year	Drill @ 20.0 l/hr	Crusher @ 25.0 l/hr	Screen @ 20.0 l/hr	FEL 1 @ 21.6 l/hr	FEL 2 @ 16.0 l/hr	Total Tot+10%	Lubricants 2% of Fuel
1	8,343	22,059	17,647	19,059	7,059	81,583	1,632
2	8,593	22,721	18,176	19,631	7,271	84,030	1,681
3	8,851	23,402	18,722	20,220	7,489	86,551	1,731
4	9,116	24,104	19,283	20,826	7,713	89,148	1,783
5	9,390	24,827	19,862	21,451	7,945	91,822	1,836
6	9,672	25,572	20,458	22,094	8,183	94,577	1,892
7	9,962	26,339	21,072	22,757	8,429	97,414	1,948
8	10,261	27,130	21,704	23,440	8,681	100,337	2,007
9	10,568	27,943	22,355	24,143	8,942	103,347	2,067
10	10,885	28,782	23,025	24,867	9,210	106,447	2,129
11	11,212	29,645	23,716	25,613	9,486	109,641	2,193
12	11,548	30,535	24,428	26,382	9,771	112,930	2,259
13	11,895	31,451	25,160	27,173	10,064	116,318	2,326
14	12,252	32,394	25,915	27,989	10,366	119,807	2,396
15	12,619	33,366	26,693	28,828	10,677	123,401	2,468
16	12,998	34,367	27,494	29,693	10,997	127,104	2,542
17	13,388	35,398	28,318	30,584	11,327	130,917	2,618
18	13,789	36,460	29,168	31,501	11,667	134,844	2,697
19	14,203	37,554	30,043	32,446	12,017	138,889	2,778
20	14,629	38,680	30,944	33,420	12,378	143,056	2,861
21	15,068	39,841	31,873	34,422	12,749	147,348	2,947
22	15,520	41,036	32,829	35,455	13,131	151,768	3,035
23	15,986	42,267	33,814	36,519	13,525	156,321	3,126
24	16,465	43,535	34,828	37,614	13,931	161,011	3,220
25	16,959	44,841	35,873	38,743	14,349	165,841	3,317
26	17,468	46,186	36,949	39,905	14,780	170,817	3,416
27	17,992	47,572	38,057	41,102	15,223	175,941	3,519
28	18,532	48,999	39,199	42,335	15,680	181,219	3,624
29	19,088	50,469	40,375	43,605	16,150	186,656	3,733
30	19,660	51,983	41,586	44,913	16,635	192,255	3,845
31	24,300	62,400	49,920	53,914	19,968	231,552	4,631
32	25,029	62,400	49,920	53,914	19,968	232,354	4,647
33	34,373	62,400	49,920	53,914	19,968	242,632	4,853
34	35,404	62,400	49,920	53,914	19,968	243,767	4,875
35	36,467	62,400	49,920	53,914	19,968	244,935	4,899
36	37,561	62,400	49,920	53,914	19,968	246,138	4,923
37	45,135	72,800	58,240	62,899	23,296	288,608	5,772
38	46,489	72,800	58,240	62,899	23,296	290,097	5,802
39	47,884	72,800	58,240	62,899	23,296	291,631	5,833
40	49,321	72,800	58,240	62,899	23,296	293,211	5,864
41	50,800	72,800	58,240	62,899	23,296	294,839	5,897
42	52,324	72,800	58,240	62,899	23,296	296,515	5,930
43	54,856	74,100	59,280	64,022	23,712	303,568	6,071
44	43,120	75,400	60,320	65,146	24,128	294,925	5,898
45	45,179	76,700	61,360	66,269	24,544	301,457	6,029
46	47,323	78,000	62,400	67,392	24,960	308,083	6,162
47	49,556	79,300	63,440	68,515	25,376	314,805	6,296
48	51,879	80,600	64,480	69,638	25,792	321,628	6,433
49	54,297	81,900	65,520	70,762	26,208	328,555	6,571
50	56,814	83,200	66,560	71,885	26,624	335,591	6,712

Explosive Usage

Year	# of Blasts 50DH each	ANFO t Used	Detonators 1per DH	Boosters 1per DH	Delays 1 per 4 DH	DETCORD (m)	Crusher Months
1	14	37.5	736	721	180	16,346	5.1
2	15	38.6	758	743	186	16,837	5.2
3	15	39.8	780	765	191	17,342	5.4
4	16	41.0	804	788	197	17,862	5.6
5	16	42.2	828	812	203	18,398	5.7
6	17	43.5	853	836	209	18,950	5.9
7	17	44.8	878	861	215	19,518	6.1
8	18	46.1	905	887	222	20,104	6.3
9	18	47.5	932	914	228	20,707	6.4
10	19	48.9	960	941	235	21,328	6.6
11	19	50.4	989	969	242	21,968	6.8
12	20	51.9	1,018	998	250	22,627	7.0
13	21	53.5	1,049	1,028	257	23,306	7.3
14	21	55.1	1,080	1,059	265	24,005	7.5
15	22	56.7	1,113	1,091	273	24,725	7.7
16	22	58.4	1,146	1,124	281	25,467	7.9
17	23	60.2	1,180	1,157	289	26,231	8.2
18	24	62.0	1,216	1,192	298	27,018	8.4
19	25	63.8	1,252	1,228	307	27,828	8.7
20	25	65.8	1,290	1,265	316	28,663	8.9
21	26	67.7	1,329	1,302	326	29,523	9.2
22	27	69.8	1,368	1,342	335	30,409	9.5
23	28	71.9	1,409	1,382	345	31,321	9.8
24	28	74.0	1,452	1,423	356	32,261	10.0
25	29	76.2	1,495	1,466	366	33,228	10.3
26	30	78.5	1,540	1,510	377	34,225	10.7
27	31	80.9	1,586	1,555	389	35,252	11.0
28	32	83.3	1,634	1,602	400	36,310	11.3
29	33	85.8	1,683	1,650	412	37,399	11.6
30	34	88.4	1,733	1,699	425	38,521	12.0
31	35	91.0	1,785	1,750	438	39,676	12.0
32	36	93.8	1,839	1,803	451	40,867	12.0
33	50	96.6	2,526	2,476	2476	18,983	12.0
34	51	99.5	2,601	2,550	2550	19,552	12.0
35	53	102.4	2,679	2,627	2627	20,139	12.0
36	54	105.5	2,760	2,706	2706	20,743	12.0
37	56	108.7	2,843	2,787	2787	21,366	12.0
38	57	111.9	2,928	2,870	2870	22,006	12.0
39	59	115.3	3,016	2,957	2957	22,667	12.0
40	61	118.8	3,106	3,045	3045	23,347	12.0
41	63	122.3	3,199	3,137	3137	24,047	12.0
42	65	126.0	3,295	3,231	3231	24,768	12.0
43	67	129.8	3,394	3,328	3328	25,512	12.0
44	51	133.7	2,622	2,571	643	58,266	12.0
45	53	137.7	2,701	2,648	662	60,014	12.0
46	55	141.8	2,782	2,727	682	61,815	12.0
47	56	146.1	2,865	2,809	702	63,669	12.0
48	58	150.4	2,951	2,893	723	65,579	12.0
49	60	155.0	3,040	2,980	745	67,546	12.0
50	61	159.6	3,131	3,069	767	69,573	12.0

16 APPENDIX 5 LONGTERM QUARRYING SCHEDULE

16.1 Annual production rates at 3% increase per annum

Year	Start	End	Annual Volume m^3	Cumulative Vol	Annual Tonnes	Cumulative Tonnes
1	01-Apr-09	31-Mar-10	57 692	57 692	150 000	150 000
2	01-Apr-10	31-Mar-11	59 423	117 115	154 500	304 500
3	01-Apr-11	31-Mar-12	61 206	178 321	159 135	463 635
4	01-Apr-12	31-Mar-13	63 042	241 363	163 909	627 544
5	01-Apr-13	31-Mar-14	64 933	306 296	168 826	796 370
6	01-Apr-14	31-Mar-15	66 881	373 177	173 891	970 261
7	01-Apr-15	31-Mar-16	68 888	442 065	179 108	1 149 369
8	01-Apr-16	31-Mar-17	70 954	513 019	184 481	1 333 850
9	01-Apr-17	31-Mar-18	73 083	586 102	190 016	1 523 866
10	01-Apr-18	31-Mar-19	75 275	661 378	195 716	1 719 582
11	01-Apr-19	31-Mar-20	77 534	738 911	201 587	1 921 169
12	01-Apr-20	31-Mar-21	79 860	818 771	207 635	2 128 804
13	01-Apr-21	31-Mar-22	82 255	901 026	213 864	2 342 669
14	01-Apr-22	31-Mar-23	84 723	985 749	220 280	2 562 949
15	01-Apr-23	31-Mar-24	87 265	1 073 014	226 888	2 789 837
16	01-Apr-24	31-Mar-25	89 883	1 162 897	233 695	3 023 532
17	01-Apr-25	31-Mar-26	92 579	1 255 476	240 706	3 264 238
18	01-Apr-26	31-Mar-27	95 357	1 350 833	247 927	3 512 165
19	01-Apr-27	31-Mar-28	98 217	1 449 050	255 365	3 767 530
20	01-Apr-28	31-Mar-29	101 164	1 550 214	263 026	4 030 556
21	01-Apr-29	31-Mar-30	104 199	1 654 413	270 917	4 301 473
22	01-Apr-30	31-Mar-31	107 325	1 761 737	279 044	4 580 517
23	01-Apr-31	31-Mar-32	110 544	1 872 282	287 416	4 867 933
24	01-Apr-32	31-Mar-33	113 861	1 986 143	296 038	5 163 971
25	01-Apr-33	31-Mar-34	117 277	2 103 419	304 919	5 468 890
26	01-Apr-34	31-Mar-35	120 795	2 224 214	314 067	5 782 956
27	01-Apr-35	31-Mar-36	124 419	2 348 633	323 489	6 106 445
28	01-Apr-36	31-Mar-37	128 151	2 476 784	333 193	6 439 638
29	01-Apr-37	31-Mar-38	131 996	2 608 780	343 189	6 782 828
30	01-Apr-38	31-Mar-39	135 956	2 744 736	353 485	7 136 312
31	01-Apr-39	31-Mar-40	140 034	2 884 770	364 089	7 500 402
32	01-Apr-40	31-Mar-41	144 235	3 029 005	375 012	7 875 414
33	01-Apr-41	31-Mar-42	148 562	3 177 568	386 262	8 261 676
34	01-Apr-42	31-Mar-43	153 019	3 330 587	397 850	8 659 526
35	01-Apr-43	31-Mar-44	157 610	3 488 197	409 786	9 069 312
36	01-Apr-44	31-Mar-45	162 338	3 650 535	422 079	9 491 392
37	01-Apr-45	31-Mar-46	167 208	3 817 744	434 742	9 926 133
38	01-Apr-46	31-Mar-47	172 225	3 989 968	447 784	10 373 917
39	01-Apr-47	31-Mar-48	177 391	4 167 360	461 218	10 835 135
40	01-Apr-48	31-Mar-49	182 713	4 350 073	475 054	11 310 189
41	01-Apr-49	31-Mar-50	188 194	4 538 267	489 306	11 799 495
42	01-Apr-50	31-Mar-51	193 840	4 732 107	503 985	12 303 479
43	01-Apr-51	31-Mar-52	199 656	4 931 763	519 104	12 822 584
44	01-Apr-52	31-Mar-53	205 645	5 137 408	534 678	13 357 261
45	01-Apr-53	31-Mar-54	211 815	5 349 223	550 718	13 907 979
46	01-Apr-54	31-Mar-55	218 169	5 567 392	567 239	14 475 219
47	01-Apr-55	31-Mar-56	224 714	5 792 106	584 257	15 059 475
48	01-Apr-56	31-Mar-57	231 455	6 023 561	601 784	15 661 259
49	01-Apr-57	31-Mar-58	238 399	6 261 960	619 838	16 281 097
50	01-Apr-58	31-Mar-59	245 551	6 507 512	638 433	16 919 530

16.2 Production Schedule

Gantt chart next page

17 APPENDIX 6 LANDFILL REVEGETATION SPECIES

Landfill Revegetation

Scientific Name	Common Name
Species to be planted on lower slopes	
Shrubs	
Dodonaea viscosa ssp. cuneata	Wedge-leaf Hopbush
Enchylaena tomentosa	Ruby Saltbush
Eutaxia microphylla	Malle Bush-pea
Maireana microphylla	Eastern Cottonbush
Melichrus urcolatus	Urn Heath
Olearia pimeleoides	Showy Daisy-Bush
Groundcover	
Calostemma purpurea	Garland Lily
Arthropodium minus	Small Vanilla-lily
Dichopogon fimbriatus	Nodding Chocolate Lily
Tricoryne elatior	Yellow Rush-lily
Bulbine bulbosa	Bulbine Lily
Bulbine semibarbata	Leek Lily
Isolepis congrua	
Dianella longifolia	Pale Flax-lily
Cheilanthes sieberiana	Mulga Fern
Dianella longifolia	Pale Flax-lily
Vittadinia gracilis	Fuzzweed
Wahlenbergia stricta	Tall Bluebell
Convolvulus erubescens	Blushing Bindweed
Crassula sieberiana	Austral Stonecrop
Elatine gratioloides	Waterwort
Glycine clandestine	Twining Glycine
Erodium crinitum	Blue Heron's-bill
Goodenia pusilliflora	Small-flower Goodenia
Nicotiana suaveolens	Scented Tobacco
Stackhousia monogyna	Creamy Candles
Danthonia sp.	Wallaby Grass
Stipa scabra	Corkscrew grass
Tripogon loliiformis	Five-minute Grass
Bidens subalterans	Cobbler's Peg
Brachycome lineariloba	Hard-head Daisy
Bracteantha bracteata	Golden Everlasting
Calotis hispidula	Bogan Flea
Chrysocephalum apiculatum	Common Everlasting
Hyalosperma semisterile	Orange Sunray

Species to be planted on ridgeline and rock outcrops	
Shrubs	
Acacia paradoxa	Kangeroo Thorn
Cassinia laevis	Cough-bush
Correa glabra	Rock Correa
Ibbertia obusifolia	Hoary Guinea-flower
Indigofera australias	Hill Indigo
Melichrus urceolatus	Urn Heath
Groundcover	
Stipa scabra	Corkscrew grass
Tripogon loliiformis	Five-minute Grass
Calotis hispidula	Bogan Flea
Chrysocephalum apiculatum	Common Everlasting
Hyalosperma semisterile	Orange Sunray
Minuria leptophylla	Minnie Daisy
Monachather paradoxa	Bandicoot Grass
Stipa densiflora	Dense Speargrass
Stipa drummondii	
Thyridolepis mitchelliana	Mulga Grass
Hypoxis glabella	Tiny Star
Cynodon dactylon	Couch
Wahlenbergia stricta	Tall Bluebell
Erodium crinitum	Blue Heron's-bill
Goodenia pusilliflora	Small-flower Goodenia
Goodenia glabra	Smooth Goodenia
Cheilanthes sieberiana	Mulga Fern
Vittadinia gracilis	Fuzzweed
Abutilon otocarpum	Desert Chinese Lantern
Sida corrugata	Variable Sida
Sida cunninghamii	Ridge Sida
Chenopodium desertorum microphyllur	Small-leaf Goosefoot
Einadia nutans	Climbing saltbush

18 APPENDIX 7 RAINFALL AND RUNOFF CALCULATIONS

		Y	
$^{Y}i_{D}$		2	50
D	6m	67.22	153.9
	1h	21.00	47.0
	12	3.40	6.9
	72	0.88	1.7

G	0.12
F2	4.34
F50	15.27

$^{2}i_{6m} = F2x(^{2}i_{1})^{0.9}$

$^{50}i_{6m} = F50x(^{50}i_{1})^{0.6}$

		X	S
D	6m	1.77	0.20
	1h	1.27	0.20
	12	0.48	0.18
	72	-0.11	0.17

$X_D = \log_{10}(^{2}i_D/1.13)$

$S_D = 0.4869 \times \log_{10}(^{50}i_D \times 1.13/^{2}i_D)$

LPIII RAINFALL INTENSITIES
ARI = AVERAGE RECURRENCE INTERVAL (YR); DUR = DURATION (MIN,H)

$^{Y}i_{D}$			DUR	6m	1h	12h	72h
			X_D	1.77	1.27	0.48	-0.11
			S_D	0.20	0.20	0.18	0.17
ARI	$^{Y}K_N$	^{Y}K	^{Y}P				
2	0.00	-0.02	1.13	66.6	20.8	3.4	0.9
5	0.84	0.84	1.05	91.9	28.5	4.4	1.1
10	1.28	1.29	1	108.2	33.3	5.1	1.3
20	1.64	1.68	1	129.3	39.7	5.9	1.5
50	2.05	2.12	1	158.5	48.4	7.1	1.7
100	2.33	2.41	1	181.8	55.3	8.0	1.9

GRAPH DATA

	0.10	1	12	72
2	66.6	20.8	3.4	0.9
5	91.9	28.5	4.4	1.1
10	108.2	33.3	5.1	1.3
20	129.3	39.7	5.9	1.5
50	158.5	48.4	7.1	1.7
100	181.8	55.3	8.0	1.9

	1	12	72
1	21.0	3.4	0.9
50	47.0	6.9	1.7

Location 34.250 S 146.075 E Near Griffith Airport Issued 28 November 2007

Prepared by Hydrometeorology Advisory Service Melbourne
Commonwealth of Australia Bureau of Meteorology

List of Coefficients to Equations of the Form

$$\ln(i) = a + b \times \ln(T)^1 + c \times \ln(T)^2 + d \times \ln(T)^3 + e \times \ln(T)^4 + f \times \ln(T)^5 + g \times \ln(T)^6$$

T = Time in Hours
I = Intensity in millimetres per hour

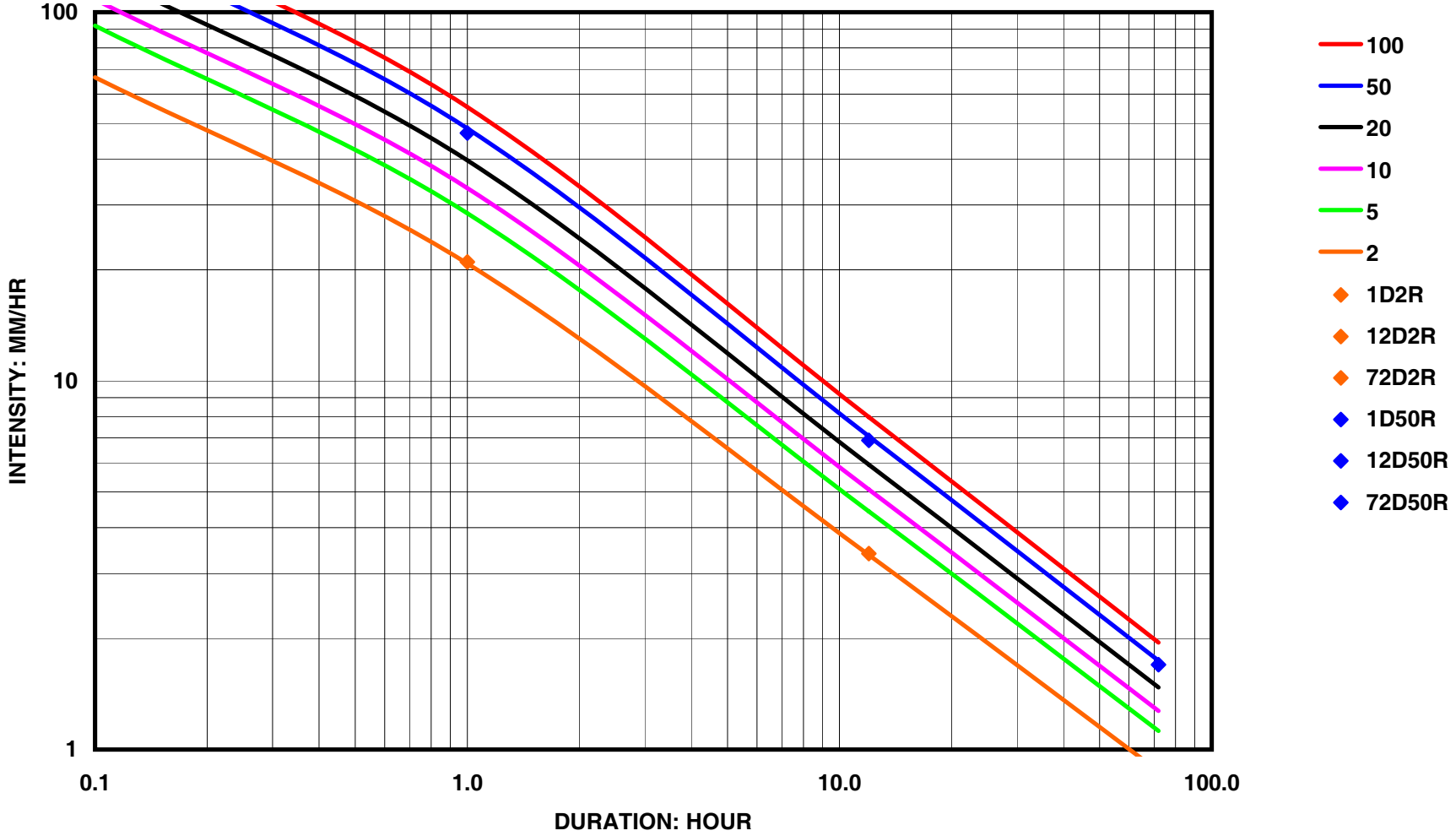
Return Period Years	a	b	c	d	e	f	g
1	2.7318	-0.6520	-0.0559	0.01077	0.001958	-0.0006037	-0.0000690
2	3.0093	-0.6544	-0.0577	0.00972	0.002344	-0.0004740	-0.0000283
5	3.3185	-0.6647	-0.0611	0.00993	0.002689	-0.0004817	-0.0000379
10	3.4747	-0.6698	-0.0632	0.00966	0.002941	-0.0004399	-0.0000521
20	3.6460	-0.6750	-0.0645	0.01007	0.002968	-0.0004844	-0.0000441
50	3.8415	-0.6800	-0.0663	0.01010	0.003167	-0.0004854	-0.0000497
100	3.9740	-0.6834	-0.0675	0.00999	0.003268	-0.0004730	-0.0000538

Rainfall intensity in mm/Hour for variou durations and return periods

Duration	Return Period Years						
Hour	1	2	5	10	20	50	100
0.08	52.31	70.64	97.50	114.68	136.89	167.66	192.26
0.10	48.86	65.62	90.47	106.41	126.92	155.32	178.08
0.17	39.95	53.13	73.08	85.89	102.36	125.07	143.30
0.33	29.08	38.47	52.80	61.95	73.80	90.06	103.08
0.50	23.43	30.96	42.40	49.71	59.16	72.13	82.50
1	15.36	20.27	27.62	32.29	38.32	46.60	53.20
2	9.55	12.57	16.98	19.76	23.36	28.28	32.20
3	7.13	9.36	12.56	14.57	17.17	20.73	23.54
6	4.28	5.60	7.43	8.57	10.05	12.07	13.65
12	2.54	3.37	4.44	5.09	5.94	7.10	8.00
24	1.45	2.04	2.68	3.07	3.57	4.26	4.79
48	0.72	1.21	1.59	1.82	2.11	2.52	2.82
72	0.42	0.86	1.12	1.28	1.49	1.77	1.98

coffey mining

THARBOGANG QUARRY AND LANDFILL
145º 41' 00" East Longitude, 41º 35' 00" South Latitude
RAINFALL CHARACTERISTICS



Catchment area	Ha	125			
100 Year rainfall event duration	hr	0.1	1	12	72
100 Year rainfall event intensity	mm/hr	181.8	55.3	8.0	1.9
Rainfall	m	0.02	0.06	0.10	0.14
Total volume	m^3	22,722	69,142	119,732	175,470
Flowrate	m^3/hr	227,220	69,142	9,978	2,437

Assuming sufficient soil mulch is provided to absorb all rainfall from worst case storm event with no runoff:

Saturated soil mulch water capacity	%w/w	10
Soil mulch water content at start of ever	%w/w	5
Effective soil mulch capacity	%w/w	5
Worst case storm event rainfall	m/m^2	0.14
Soil mulch dry density	t/m^3	1.8
Requisite soil mulch mass	t/m^2	2.67
Requisite soil mulch volume	m/m^2	1.48

THARBOGANG QUARRY & WASTE MANAGEMENT CENTRE

LANDFILL OPERATIONS PLAN

December 2008

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TABLE OF CONTENTS

1 Introduction

Tharbogang Quarry and Waste Management Centre is a combined quarry and waste management facility servicing the Griffith City Council local government area. At the time of writing, Griffith City Council is proposing to extend the quarry and landfill into new areas on the site. This site operations plan focuses on the waste management activities on the site, following the commencement of landfilling in the new cell.

The primary objective of this site operations plan is to manage the Tharbogang waste management centre and landfill to achieve the following objectives:

- Prevent, detect, and remediate water and air pollution;
- Contribute to the maintenance of the quality of the incoming solid waste;
- Minimise landfill volumes while maximising recycling and recovery;
- Maintain the operational status of the landfill and associated waste management functions within the centre;
- Keep accurate records of waste received into and recyclables dispatched from the centre;
- Prevent unauthorised entry into the centre.

The plan specifically provides for the existing, transitional, and future routine cyclic waste management, recycling and landfill operations, and emergency response to events associated with compaction and storage of waste on the Tharbogang Waste Management Centre greater site, whether permanent or temporarily, as part of achieving environmental license compliant operations.

The plan is intended to be a practical document to assist council staff and employees in the operation of the facility, both as existing today and as proposed in a future mature steady state facility.

It has been prepared to comply with guidelines published by the NSW Environment Protection Authority[1], Council planning requirements, and accepted leading industry practices.

This plan will eventually form an integral component of a Landfill Environmental Management Plan (LEMP). The LEMP will be prepared following the completion of all related site environmental monitoring, operational and management plans.

1.1 Abbreviations

Abbreviations utilised in this plan include the following:

- DECC: The Department of Conservation and Climate Change;
- TWMC: Tharbogang Waste Management Centre;
- WOM: Waste Operations Manager;
- W&QO: Weighbridge & Quarry Operations;

[1] The responsibilities of the NSW Environment Protection Authority are now undertaken by the NSW Department of Environment and Climate Change.

- LO: Landfill Operator;

1.2 Site Location

The Tharbogang landfill facility is located approximately 7 km to the north-west of the Griffith City area. It is accessed via Hillside Drive off the Kidman Way, which is main road west to the towns of Goolgowi and Hillston.

1.3 Hours of Operation

The times of operation of the landfill are 8.00 AM to 5.00 PM daily, with exception of Christmas Day, Good Friday, and New Year's Day when the facility is closed. Outside of these hours the facility is securely locked at all times and security patrols by contractors undertaken at regular intervals.

1.4 Site Description

The facility comprises Lots PT201 and PT202 on DP 756035 and totals approximately 365 ha in area.

1.5 Existing Operations

The existing site operates as parallel quarry and landfill operations, with the primary shared facility being the weighbridge.

The landfill site is primarily operated as a landfill with limited recycling of material. All inbound vehicles are intercepted at the weighbridge facility, the nature of the load established, and if needed the gross mass weighed.

All vehicles proceed to the operating landfill where users are directed by operational staff to points of recycling for metals, lead-acid batteries, green waste, and recoverable concrete.

Users then tip directly onto a controlled area of the working landfill face. The face is compacted and reshaped daily.

Users with asbestos products or dead animals are directed to disposal pits located on the flatter areas to the north of the current landfill where waste is deposited and covered daily.

Users that disposed a load with a weight of one tonne or more, then proceed back to the weighbridge, are reweighed, and pay the prescribed fee for the waste deposited.

The site accommodates the kerbside collection vehicle washing bay and bin storage and repair facilities.

The current plant fleet includes:

- A 25 tonne Cat wheeled compactor;
- A 20 tonne Liehberr traxcavator;
- A 24 tone tipper truck, that can be adapted as a water carter for dust suppression and a fire fighting truck.

- A tractor with front end bucket loader with rear linkage machinery capabilities;
- Two utilities.

Landfill operation staff currently total four, being two weighbridge and quarry operations staff, and a bin repairer/relief operator. The landfill works on a rotating shift that sees that two landfill operators and a weighbridge and quarry operations operator work nine days on and five days off. The bin repairer/relief operator works a standard five day week.

1.6 Permitted Wastes for Recovery and Disposal at Centre

Currently accepted wastes are as follows:

- Putrescible waste;
- Greenwaste;
- Ferrous and non-ferrous metals including whitegoods;
- Waste lubricating oil, to on-site storage for collection and transport to a recycling facility;
- Inert bulky wastes such as furniture, carpet, bedding, shredded tyres,
- Asbestos waste that has been packaged in accordance with State Guidelines;
- Dead animals.

1.7 Prohibited Wastes

Wastes that are currently specifically excluded are as detailed in Attachment B.

2 Waste Management Context

2.1 Existing Waste Management System

There is limited quantitative information available regarding the waste generation and waste management in the Griffith Local Government Area.

It appears that waste generation is dominated by the following waste streams:

- Agricultural and food processing wastes, including waste from wineries.
- Building and demolition wastes
- Garden wastes
- Commercial and domestic wastes from urban areas

Landfills are provided at Tharbogang and Yenda for use by all residents on a user-pays basis, a weekly kerbside waste collection service to urban and selected adjacent rural and village properties, and an annual bulky waste kerbside collection service for urban areas.

Council operates a large skip/bin waste commercial waste collection service, and has operated in parallel with other commercial collection operators. Council has acknowledged and encouraged a private recycling service. The recycling service specialises in single stream recycling such as reject glass bottles.

Council records of solid waste received at Tharbogang landfill are as presented in Attachment E. The data indicates that the majority of wastes from the agricultural and building and demolition sectors are not being delivered to the facility. These wastes probably are being reprocessed or recycled by private operations.

Liquid waste from grease arrestors is accepted at the Yenda landfill. Other non-sewer liquid wastes are exported from the Griffith Local Government Area for treatment and disposal.

Council currently does not operate a kerbside recyclable collection service. Recycling is currently limited to acceptance of specified recyclable material at a commercial depot within Griffith, and at the Tharbogang landfill and Yenda transfer station.

2.2 Future Waste Management Opportunities

Griffith City Council recognises that in the future waste management will need to place a stronger emphasis on systems to encourage the avoidance, reuse and recycling of waste over disposal by landfill.

Council recognises that the relative isolation of Griffith from more concentrated population centres and limited recyclable quantities makes economic recycling of many recoverable materials marginal.

Council is currently evaluating options for the provision of a fortnightly kerbside recyclables collection service, and for the implementation of a waste transfer and sorting station within the Tharbogang waste management centre.

It is acknowledged that the waste streams will vary as and when fortnightly kerbside recycling, efficient bulky waste collection, public education in waste management and recycling, and possible options for regional green waste recovery and composting are fully implemented.

Kerbside collection of recyclable materials, combined with transfer station interception of the waste streams of the vast majority of landfill users, is expected to have a significant reduction impact on the net input rate of solid waste into the landfill cells. The most probable impact of recycling and waste minimisation initiatives by mass and type of waste is as follows:

Year	Forecast Population Served	With kerbside recycling (t/a)			No kerbside recycling
		Municipal Waste	Commercial & Industrial Waste	Total	
2008	24,763				
2010	25,763	10,000	6,600	16,600	23,000
2015	28,444	11,000	7,300	18,300	25,400
2020	31,405	12,200	8,100	20,300	28,100
2025	34,674	13,400	8,900	22,300	31,000
2030	38,282	14,800	9,800	24,600	34,200

As of February, 2008, Council is not aware of any development that would result in the growth rate of the total solid waste loading being subjected to accelerated or stepped change in the growth rate of the solid waste stream.

Council recognises that advancing and emerging technologies in green waste composting and waste treatment and processing strategies may progressively reduce or eliminate the volume of various waste streams. This operational plan is intended to address the known existing and probable technological opportunities within the next 5 – 10 years.

Council proposes to undertake audit procedures on the performance of the kerbside putrescible and foreshadowed kerbside recyclables collection services. Cyclic auditing of waste composition will enable the success of waste minimisation strategies to be monitored and public education programs better targeted.

2.3 Rationale for Ongoing Landfill Operations

The relative isolation of Griffith and consequent transportation costs eliminate any cost-effective joint waste operations that might permit total waste stream recycling, and significantly reduce the economic viability of recognised recyclable material streams due to the cost of transport to regional or metropolitan resource recovery centres.

Council has determined that a combination of resource recovery, recycling and landfilling of residue waste is the most practicable, cost-effective option for Griffith.

It is proposed to utilise quarried areas for future landfill space as the use of a disturbed excavation area will minimise the potential environmental impact of landfilling wastes which cannot be economically recovered or recycled.

The proposed waste management centre will feature a sawtooth layout transfer station to which will service almost all waste delivered using light vehicles. This transfer station will provide waste type-specific bulk waste bins. By reducing direct access to the landfill and tipping face, risks to users is reduced, and waste recovery is maximised. Heavy vehicles, including kerbside waste collection vehicles, will continue to dispose of waste at the tipping face. The reduced traffic at the tipping face means the size of the face is reduced which should reduce problems with wind-blown litter and vermin.

A further possible strategy is to facilitate a resource recovery facility to encourage reuse and minimise inert wastes proceeding to landfill.

2.4 Functional Operation of Tharbogang Waste Management Centre

Waste operations have primary objectives of optimising waste recovery consistent with cost-effectiveness of distance to national recycling industry end-point users.

Key features of the waste management centre are proposed to include:

- General public and minor commercial user access is to be confined to the transfer station and other specific resource reuse and recovery storage sites. The transfer station is to provide bulk waste bin disposal for builders' inert waste, concrete and rubble waste, green waste, putrescible waste, scrap steel, glass, plastic, and cardboard, and waste oil;
- Direct access to the primary landfill cell will be limited to bulk kerbside waste collection and authorised large commercial collection vehicles;
- Direct access to the inert cell to be confined to internal bin transfers and large inert waste loads conveyed by large capacity commercial vehicles;
- All vehicles are to be identified, waste loads weighed and inspected by CCTV in and out of site, and waste data recorded to permit identification of responsible waste transporters.

The waste management centre will share weighbridge operations and plant with the quarrying operation.

2.5 Transitional Management from the Existing to Proposed Landfills

2.5.1 Overview

The Tharbogang waste management centre and quarry must continue in operation during the transition from the existing site operations and facilities to the proposed future site facilities and operational plan.

2.5.2 Commissioning Sequence

The proposed key transition date is the commissioning of the new fully lined landfill cell incorporating the putrescible, inert, asbestos, and dead animal cells, together with the functional commissioning of the transfer station and bulk bin operation between the station and the relevant landfill cell or resource recovery stockpile.

Both the cell and the transfer station must be commissioned together as the lined cell is to be designed with no provision for access by the majority of users. The transfer station could lead but not lag the lined cell commissioning unless the access to the cell is constructed to meet public health and safety standards. Such access standards to add significant unnecessary capital expenditure.

A feature of the transfer station will be operator or transponder activated boom gate access for authorised vehicles to the primary and inert landfill cells. The boom gate ensures all other users are directed to the transfer station for disposal of sorted wastes to bulk bins.

2.5.3 Associated Facilities

The lined cell construction will require the parallel construction and commissioning of:

- Leachate, underdrain, surface water capture/diversion, storage and recycling systems, together with uncontaminated storm water drainage and diversion systems;
- Litter fences;
- Access roads;
- Relocated resources stockpile and reprocessing sites adjacent to the transfer station.

2.5.4 New Landfill Cell Location

Given that extensive available air space for landfill purposes will not be an issue within the foreseeable future, there is no proposal to utilise the space between the engineered landfill cell and the existing landfill mass. If appropriate, the area could be used for inert waste landfilling.

The new engineered, lined cell will be located adjacent to but not abutting the existing landfill. The separation will enable the environmental monitoring of the new landfill cell to be distinguished from the existing landfill cell.

This approach enables the engineered cell, water and leachate management systems, and access roads constructed without any interruption to the existing landfill operations.

2.5.5 Existing Landfill Transitional Operation, Closure, Capping and Remediation

The existing landfill is to be operated for the transitional period such as to achieve an optimum completed landfill profile at the point of closure.

Closure and remediation of the existing landfill is to commence immediately following the commissioning of the new engineered, lined landfill cell. Prompt closure is intended to:

- Limit rain water accessions into the landfill mass that could exacerbate existing leachate surcharging;
- Minimise the risk of fire occurring in the mixed media landfill mass.

2.5.6 Future Support Facilities

The weighbridge platform may be duplicated to provide dedicated entry and exit weighbridges if, in the future, traffic levels demand such an upgrade.

The possible introduction of kerbside recycling may result in the mixed waste recyclables and resource recovery centre being located adjacent to the transfer station.

3 Waste Management Operations

3.1 Future Centre Staff Plan

Centre staffing will consist of the following positions:

3.1.1 Shared staff

- Waste Operations Manager;
- Weighbridge operator;

3.1.2 Dedicated waste management staff

- Team leaders (2);
- Landfill operators (2);
- Bin repairer and relief operator.

3.2 Accepted Wastes

The acceptance of wastes for disposal at the landfill is governed by the Department of Environment and Climate Change's *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (Department of Environment and Climate Change, 2004).

The landfill will only accept wastes which, under the Guidelines:

- Conform to the definitions of Inert Waste or Solid Waste, or
- Has been classified as Inert Waste or Solid Waste, or
- Is asbestos.

In addition the transfer station will accept the following for transfer to a reprocessing facility:

- Waste oil
- Lead-acid batteries.
- 'Triple-rinsed' pesticide and herbicide containers conforming to 'DrumMuster' requirements.

Where waste does not fall into the standard definitions of Inert Waste, Solid Waste or asbestos, the waste will only be accepted under the written approval of Griffith City Council's Waste Operations Manager, once the disposer has satisfied Council that the waste proposed for disposal is classified as Inert Waste or Solid Waste. This generally will require randomised sampling and testing of the waste, or demonstration that the waste conforms to the requirements of a DECC Immobilisation Approval.

Asbestos waste will only be accepted if:

- The waste is packaged and treated in accordance with Guideline requirements, and
- Adequate notice is given to Waste Management Centre staff to allow them to cover the waste.

3.2.1 Prohibited Wastes and Management Protocols

All wastes that do not conform to acceptance requirements are prohibited.
In particular, the following wastes are explicitly prohibited from disposal in the landfill:

- Clinical waste
- Pesticide and herbicide containers which have not been 'triple rinsed'.
- Liquids and 'non-spadeable' solids

The weighbridge operator will ask each user for a description of the waste being deposited. Where a user identifies that part or all of the waste consists of prohibited wastes, the operator will advise the user that such waste/s are prohibited from disposal at the Tharbogang complex under their Environment Protection licence. The operator will provide the user with a council information sheet that provides service provider contact details who are licensed to accept and permanently dispose of prohibited wastes. Griffith City Council retains the right to refuse any load of waste without providing a reason.

CCTV and digital still images of the user vehicle and the details of the identified prohibited waste are to be retained on the weighbridge data capture system for up to 2 years for possible investigations by DECC.

Plant and transfer station operators are to routinely check for visible and detectable signs of illegal dumping of prohibited wastes either on the operating landfill site or within transfer station bulk bins. This will be aided by CCTV cameras stationed at the transfer station.

Where operators detect waste considered a possible prohibited waste, the site is to be taped off, and the waste supervisor notified prior to waste sampling, recovery and treatment activities being undertaken as per Attachment B.

3.2.2 Gatehouse Procedures

Entry to the centre is gained via a sealed access road off Hillside Drive. Areas for disposal of recyclable materials are available at the transfer station within the complex. Landfill staff will periodically supervise the transfer station platform and provide appropriate recycling and disposal advice.

At the weighbridge the weighbridge operator will register the vehicle into the database, and will inspect, categorise, and weigh the vehicle (including load).

The vehicle will then be directed to the appropriate place, (other than for heavy vehicles, the transfer station) for unloading under supervision.

After unloading, the vehicle will be re-weighed on departure through the weighbridge, the charge calculated and payment made. Vehicles that regularly visit the landfill may be permitted to bypass this second operation and be billed based on previously recorded tare weights.

An updated list of charges will be issued at the time any changes are made to the schedule.

The weighbridge facility is to be staffed at all times that the facility is open for business to general customers. Out-of-hours kerbside waste collection vehicles may visit the facility, provided that the weighbridge is provided with equipment to automatically identify and weigh in vehicles.

The weighbridge shall be cleaned and maintained (in so far as possible) by the weighbridge operators according to the manufacturer's instructions. Other maintenance tasks beyond the capabilities of council employees are to be programmed and implemented by certified external service providers.

3.3 Waste Storage Sites

There are interim and permanent waste storage sites within the TWMC.

Interim storage sites include the transfer station, green waste, scrap steel, batteries, gas cylinders, waste oil, and cardboard storage sites or enclosures.

Permanent sites consist of all landfill cells including the primary landfill cell, the inert landfill cell, and the original landfill cell complex in which all wastes were interred, whether capped or not.

Operational plans for the transitional waste sites are to be developed with each downstream user or service provider to optimise material quality and minimise contamination.

3.3.1 Permanent Waste Storage Cells

The Tharbogang waste management centre is to feature the following purpose-specific waste cells:

- Putrescible waste cell;
- Inert landfill cell;
- Dead animal disposal zone, within the putrescible waste cell;
- Hazardous waste Asbestos disposal zone, within the putrescible waste cell.

3.3.1.1 Putrescible Waste Cell

The future putrescible landfill cell at the Tharbogang Waste Management Centre is to be operated on the principles of an enhanced stabilisation process. The cell will be operated to optimise waste reduction by utilising the accelerated breakdown or decomposition of the waste under enhanced stabilisation operating conditions. Waste that is readily biodegradable such as domestic household and garden waste is placed in the cell and moderately compacted. This type of waste generally has a higher moisture content and the leachate produced (as the waste decomposes) can be recycled back into the cell to accelerate the decomposition process.

The anticipated decomposition cycle time to a stable, inert state is estimated at 30 years as compared with up to 50 - 75 years for a conventional, high compaction,

mixed media landfill.

The landfill gas produced by the decomposition process is to be harvested and flared to reduce potential odours, and minimize greenhouse gas emissions and negative environmental impacts. Subject to economic viability, the flare could be replaced with an electricity generating plant in the future.

The landfill is to be operated without the use of internal clay cover material that would inhibit the stabilisation process and reduce landfill gas harvesting.

The waste is placed in layers of 0.5 metres thickness by 50 metres width, and compacted to densities to optimize the enhanced stabilisation process. The operating layer may be constructed with a slope to enhance the efficiency of the number of passes required to achieve the correct compaction rate of 650 kg/cubic metre.

The operating face is covered with mulched green waste at the conclusion of daily operations. The daily waste placement is to be spatially located and the data logged in the landfill management system weekly.

The compactor operator is to be responsible for the notifying the waste supervisor of the requirements for the supply, and stockpiling of daily requirements of green waste cover material.

The primary cell will be considered fully utilized when the approved maximum height and vertical profile is reached.

The primary cell will, on completion, be capped with clay, and possibly a membrane liner to ensure gas emissions are minimized, clay capping volumes reduced, and rainwater accessions into the waste mass minimised

3.3.1.2 Inert Landfill Cell

Waste that is not readily biodegradable such as residual builders waste, treated timber, furniture, plastic, carpet, and foam will be separated where possible and placed in a separate cell referred to as the inert cell.

This material is mostly biologically inert material and is relatively dry, porous and difficult to compact making it more prone to the spread of fire. The material does not generate leachate as with the biological composition process of the putrescible cell. However, in the event of fire, the stored mix of plastics, treated timber, foam, tyres and other waste within the cell can generate polluted wastewater.

Inert waste therefore can be used in a more flexible manner than putrescible waste. Inert waste will be deposited in areas adjacent to the putrescible waste cell. The inert waste and putrescible waste cells are to be separated by clay walls with a minimum thickness of one metre.

All inert waste is to be initially deposited into a holding area adjacent to the inert cell in which the waste is stored for a minimum of 24 hours to observe any combusting material and to confine the fire event to a small volume of waste within a flat area on

which fire extinguishment is straightforward at minimum risk to adjacent landfill cells and adjacent properties.

Inert waste is to be pushed, placed, compacted, and immediately covered in the inert waste cell no greater than weekly, and with at least 24 hours quarantine and observation time.

The compactor operator is to be responsible for the notifying the Team Leader of the requirements for the supply, and stockpiling of weekly requirements of clay cover material.

The cell is to be operated with lifts of not greater than 2 metres depth and widths of up to 25 metres. Each layer is divided from the underlying and adjacent material by a minimum of 500 mm of clay cover material. The clay cover and separation, when combined with horizontal separation, a quarantine holding enclosure, immediate covering, and no direct access to the inert waste cell by users will minimize the risk of landfill fires.

3.3.1.3 Dead animal disposal zone

The dead animal burial areas are to be located within the putrescible waste cell. Dead animals are to be covered with lime after each load is dumped, and the zone covered with 300mm of clean fill daily to deny food mass to vermin.

3.3.1.4 Asbestos disposal zone

The asbestos disposal zone is to be constructed within defined, compacted clean fill sections of putrescible waste cell. The cell area is to be defined by survey with a depth of not greater than 1.5 metres into the clean, compacted fill. The area is to be signposted indicating that the site contains asbestos waste.

Once a zone is filled, the boundaries of the pit are to be spatially located, and the information recorded in the landfill management system. A new zone is to be created immediately to one side of the filled pit with a separation between trench faces to achieve trench stability.

On completion of a series of parallel zones, the site is to be filled with compacted clean fill to the approved profile for the total primary cell profile, and the filling cycle repeated.

A council employee is to accompany any authorized user with an approved load of asbestos waste to the disposal area, observe the depositing of the waste into the burial pit, immediately cover the waste with 300 millimetres of clean fill, and secure the pit area.

3.4 Interim waste storage

3.4.1 Garden organic wastes

Garden organic wastes are to be stored in piles in preparation for chipping. Garden organic wastes should be chipped at least quarterly.

Storage piles should be located within the landfill site to enable management of surface runoff, but need to be kept away from the tipping face in the event of fire.

3.4.2 Construction timber

Construction timber, other than copper chrome arsenate (CCA) treated timber, is suitable for cover material once chipped.

3.4.3 Steel

Steel is to be stored in piles suitable for compaction and loading onto scrap steel vehicles. The storage area is to be located in a free draining area, with vegetation controlled to discourage vermin and snakes.

Any gas bottles received for recycling are to have their valves removed prior to delivery to the landfill.

Refrigerators and other appliances containing chlorofluorocarbons are have the gas recovered in accordance with the Ozone Protection Act 1989, before transfer to a steel recycler.

3.4.4 Batteries

Batteries are to be stored in a covered, bunded area, to reduce the risk of pollution in the event of leaks or spills.

3.4.5 Paper

Paper will be deposited in mobile garbage bins, cages or bulk bins as demand requires. The risk associated with fires is controlled through the location of the paper recycling area in the transfer station.

3.4.6 Recyclable packaging

Recyclable packaging will be deposited in mobile garbage bins, cages or bulk bins as demand requires.

3.4.7 Mechanical lubricants

A standard design oil disposal facility will be provided adjacent to the transfer station.

3.5 Site Water Management

3.5.1 Introduction

This water operational component of the site operations plan specifically provides for the routine cyclic operation, and emergency response to events associated with water on the Tharbogang Waste Management Centre greater site as part of minimising environmental impacts. The primary objectives of the water management component are to :

- Ensure that potable water intended for human consumption is not compromised in any way that would threaten the health and safety of all site users, and of other users of the public water reticulation system;

- Optimise the use of all water within the waste management and landfill areas of the greater site;
- Prevent pollution of surface and groundwater by waste leachate;
- Detect any water pollution events, and;
- Remediate water pollution events;
- Conserve and appropriately store all forms of water to provide for the operational requirements of the landfill activities;
- Direct all available contaminated water into the putrescible landfill to optimise the stabilisation process.

3.5.2 Existing Water Source Situation

There are six sources of water on and in the greater TWMC property. These sources and their operational and environmental circumstances are presented in order of biological and chemical quality:

- **Potable Water**
  Potable water is the highest quality, most reliable water that is available on the site. The supply is provided by Council for human consumption and for maintaining emergency fire tanks in a full condition.

  The plan of potable water pipelines and storage tanks is as per the site plan in Attachment A.

- **Surface Drainage Water**
  Surface water upstream from the landfill site will be diverted away from the landfill site to prevent contamination. Surface water running off the landfill site, and upstream of leachate dams will be treated as potentially contaminated, and isolated for management by landfill application and evaporation.

  Council is responsible for ensuring that contaminated water is not discharged from the licensed site.

  The drainage alignments of surface drains is as per the site plan in Attachment A.

- **Groundwater**
  Groundwater other than landfill leachate is assumed to be minimal in volume given the topography and geology of the ridgeline.

  Groundwater coming in contact with the existing landfill will be considered potentially contaminated, and isolated for management by landfill application and evaporation.

  Some groundwater may pass under the future landfill cells. Any groundwater identified as passing under the cells will be separately managed in case a the landfill lining system fails and groundwater contamination occurs.

The available information on the existing groundwater interception trench, pumps and pipeline system is detailed in the site plan in Attachment A.

- **Potentially Contaminated Stormwater**
  Potentially contaminated surface stormwater derives from areas of the landfill site that may be exposed to contamination from landfill material or leachate. This stormwater must be diverted to site storage and reuse onsite and not be permitted to be discharged from the site.

  The drainage system and storage dam are as depicted in the plan in Attachment A.

- **Underdrain Water**
  Underdrain water, harvested from drains installed under future landfill cells, is intended to enable early detection of any failure of a cell liner and loss to the groundwater system, and to ensure that groundwater pressure does not compromise the landfill liner.

  This source of water will be potentially leachate-contaminated, and as such, must be managed as potentially contaminated.

  A concept underdrain system of pump stations, pipelines, storage, and pipeline connection to a storage dam to serve the future landfill cell is as depicted in the plan in Attachment A.

- **Landfill Leachate**
  Leachate-contaminated water is harvested from the pump well in the gully alignment below the existing landfill, and will be collected from the leachate drainage system within future landfill cells.

  Leachate is the lowest quality source of water on the site and must be managed such as to ensure containment and reuse into the primary landfill cell.

  An outline plan of the existing leachate system and a possible future system for new landfill cells is as depicted in the plan in Attachment A. The plan depicts pump stations, pipelines, storage tanks, and pipeline connection to storage dams.

3.6 Environmental Monitoring

Council will engage the services of environmental specialists to design, specify, and implement a site environmental monitoring plan.

The site environmental monitoring plan will be the higher order management plan to the site operational plan. All activities defined within this plan are to integrate and compliment the objectives and activities of the site environmental monitoring plan.

3.6.1 Known Site Water Risks, Operational Issues, and Responses

The current known issues, risks, and proposed responses to remediate/eliminate/resolve such matters are as follows:

- There may not be an operational backflow prevention device on the potable water supply in accordance with National and State plumbing regulations.

- Pipelines to convey various water sources are not accurately mapped or marked on site for location.

- Pipelines utilised for various water transfer purposes throughout the site are suspected as having no defined water quality usage colour coding, and is assumed to fail to comply with current Australian and State standards and regulations for colour coding of pipes that convey contaminated water.

  This issue is a major task given that it is assumed that every pipeline presently installed on site is not colour-coded to warn users of the quality of the water conveyed, and to forewarn of the dangers of cross-connection and consequent potential contamination.

  It may take some years before all pipelines are replaced with colour coded pipelines that meet current Australian standards.

- Existing water storages are not known to be the consequence of detailed engineering design to establish the volume required for effective containment under license conditions for peak weather events.

  Detailed design of future systems must be completed to establish the total potential volume of potentially contaminated water that must be retained and reused onsite.

  Equally, the potentially contaminated stormwater runoff system must be surveyed and be the subject of detailed design and implementation to ensure that the interception, pumped transfer, storage, and reuse system is adequate for known wet weather events.

  This total survey and design task is expected to take until December, 2008 to complete.

The above initiatives are to be included in the forward business and capital expenditure plans for the TWMC.

3.6.2 Water Quality Monitoring

A formal site water quality monitoring plan is form an integral component of a greater site environmental monitoring plan.

3.6.3 Landfill Fires

Whilst landfill fires are extremely undesirable and a matter of concern for Council and

the Department of Environment and Climate Change (which includes the former Environmental Protection Authority), it is not possible to fully eliminate the risk of fires occurring in landfills. The combustion of waste, in particular treated timber, plastic, rubber and foam, produces highly toxic fumes and smoke that are prohibited under the Protection of the Environment Act and the license for the site.

Landfill fires can be caused by a range of events including:

- **Lightning Strikes on Exposed Landfill Surfaces**
  Lightning strikes are random uncontrolled events. Risk minimisation strategies for lighting strikes include minimising the size of the tipping faces, and keeping as much waste as possible covered.

- **Self-Ignition of Highly Combustible Green Waste and Street Sweeper Waste**
  Green waste and street sweeper waste is easily combustible and can reach high temperatures through the decomposition process and can subsequently self-ignite. Highly combustible material should not be buried in confined pockets in the cells, but should be spread out in thin layers to minimise the risk of self-combustion.

- **Illegal Disposal of Chemicals**
  It is possible for dumped waste to contain various chemicals that if mixed together can ignite. Continued public education, reminder campaigns and increased waste inspection regimes are required to reduce this risk.

- **Dumping of Hot or Burning Material**
  Hot or burning material such as ashes, can be encountered in kerbside bins or bulky waste bins which are collected by a service provider and normally received directly into the cell. Such material can, if not detected, cause a landfill fire. As above, continued public education, and increased waste inspection regimes are required to reduce this risk.

3.7 Fire Response Procedure

The full sequence of fire response activities is as detailed in Attachment B.

3.7.1 Fire Mitigation Strategies

The following strategies are to be implemented to reduce the risk of fires occurring:

- Small commercial and all domestic waste being transported by users is to be diverted to the transfer station to enable the waste to be better monitored before it is disposed of into the landfill cell.
- A quarantine holding enclosure is to be established adjacent to the inert cell. All large loadings of inert waste are to be deposited into the enclosure, with no direct access being made available to authorized users to deposit inert waste directly into the inert cell. The holding enclosure contents are to be observed for not less than 24 hours before the material is to be pushed to the working face of the inert landfill, placed and compacted;

- Signs are to be installed along the entrance road to the site instructing that all loads are to be uncovered for inspection at the weighbridge and the transfer station.
- The weighbridge operators monitor the commercial waste closely utilising direct visual inspection and a network of strategically positioned closed circuit cameras. The cameras also act as a deterrent for illegal dumping and provide surveillance footage of the disposal areas should it be required.
- Street sweeper waste is diverted from the landfill cells and is stockpiled in a separate area adjacent to the green waste stockpile.
- The inert cell is to be operated in discrete vertical and horizontal cells with dividing layers of available clay cover material to isolate the volume of waste that can be subjected to a fire event.
- Ensure the capacity of the transfer station will maximise the diversion of commercial and domestic vehicles from having direct access to the landfill. The transfer station acts as a quarantine area for the waste.
- Undertake regular public education programs that include commercial carriers to re-acquaint them of their obligation to ensure illegal or non compliant wastes are not collected from customer sources.
- Further increase the inspection regime and take action against customers and commercial carriers detected dispossessing of illegal or non compliant wastes.
- Stockpile easily combustible material such as the green waste for mulching and reuse.

Whilst the above strategies will assist in reducing the risk of fires occurring it is not possible to fully eliminate the occurrence of fires from the landfill. Consideration also needs to given to strategies for the quick detection, containment and reducing the spread of fires should they occur.

This plan provides initial strategies for preventing the spread of fire within and beyond the site and includes an emergency response plan. The emergency response plan describes the responses to a fire event.

The above initiatives are to be included in the forward business and capital expenditure plans for the TWMC.

3.8 Routine Landfill Operations

3.8.1 Employee and Public Health and Safety

All activities within the centre are to be the subject of the Workcover Act and all Council OHS policy and procedures for ensuring a safe workplace for both the public and council employees alike.

3.8.2 Machine Performance Specification, Life Cycle, and Maintenance

Compactors in the primary cell are to be specified for compaction rates of not greater than 650 kg/m³ to ensure optimum stabilization activity.

While the compactor may not be optimum for compaction in the inert cell where maximum compaction rates are preferred for efficiency and fire control, the primary cell compaction is the much larger task by operating hours, and therefore determines the preferred compactor performance.

The wheeled compactor is only partially through its service life. Existing operational service issues associated with small gauge, high tensile steel wire wrapping around drive axles and damaging shaft seals will reduce once an inert waste cell is established, and steel recycling is extended to include all steel wire. The prime sources of thin gauge, high tensile steel wire are bedding mattresses.

The recommended daily checks of all earth-moving equipment used on-site will be the responsibility of the relevant operator.

The supplier's maintenance schedules will be made available to the operator to assist them in this regard. The operator will liaise with the workshop supervisor to co-ordinate services where the workshop is involved.

A logbook for each item of plant shall be kept and all details of machine checks shall be entered on a daily basis by the operator.

Plant and vehicle washing is to be conducted on the existing wash down bay which is to be upgraded to facilitate sediment capture and achieve compliant operation. Pre-treated wastewater from the wash down facility is to be pumped to the leachate storage lagoon for return to primary cell moisture control activities.

3.8.3 Fuels, Lubricants and Prescribed Chemicals

Fuels and lubricants to be utilised by landfill and waste management plant within the centre are to be stored in secured, compliant-bunded enclosures in accordance with relevant regulations.

Prescribed chemicals to be utilised within the centre for weed control and dust suppression are to be stored in compliant storage at separations from fuels, lubricants, and other flammables.

All fuels, lubricants, and chemicals are to be utilised in accordance with manufacturer's directions.

3.8.4 Vermin

Observation of vermin (rats, cats, foxes etc) is to be noted by staff. Should this become a problem then the Waste Operations Manager should be consulted and if necessary, contractors engaged to carry out an eradication campaign.

3.8.5 Monitoring Bores

Independent monitoring of surface waters and aquifers is to be carried out by independent contractors.

The surface condition of the piezometers are to be maintained by Council staff ensuring that the inner tubes, outer cases, concrete bases are kept in a satisfactory condition.

Slashing and maintenance of access tracks to all sites shall also be carried out periodically.

3.8.6 Roadways

The condition of the access road from the weighbridge to the tipping sites is to be monitored and appropriate maintenance including the application of dust suppressants carried out to minimise dust.

Road conditions shall be maintained such that the Council kerbside collection and authorised commercial and hazardous waste user vehicles to have safe access to the tipping face and burial pits at all times.

Extended periods of wet weather may mean that gravel will have to be imported and placed to maintain access. The compactor operator shall contact the Supervisor when he considers such treatment is needed.

Areas set aside for recycling and for green waste similarly have to be provided with a gravel base to allow all-weather access.

Slashing of the roadsides shall be carried out as needed.

3.8.7 Windborne Litter

Windborne litter is to be minimised by prompt compaction, and by strategic placement of litter fences within and surrounding the primary cell.

The landfill team leader is to ensure that the greater centre site and the approach road is inspected weekly for evidence of windborne litter. Litter is to be manually collected from around the site weekly and from adjoining properties not greater than a monthly cycle.

3.8.8 Grass, Tree and Shrub Plantation Development, Maintenance, and Renewal

The stability and competency of closed and active landfill banks and capping cover depends partially on eliminating water and wind erosion of the clay/soil surface. Landfill banks and caps generally feature slopes up to 33%, and readily erode to expose the buried landfill mass. Such exposures release landfill gases, and permit rainwater surcharging of the landfill leachate.

Establishing, maintaining, and renewing surface vegetation, and selected shrubs and trees specific to site and construction details minimises soil erosion, and enhances the visual appearance of the active and closed landfill cells. Grasses, shrubs and trees need to be carefully selected to avoid deep root systems that can penetrate the capping soil and become exposed to the compacted landfill waste material and gases. Such

exposure normally results in the tree dying and the root penetration becoming a site for rainwater penetration and landfill gas release.

Council will engage suitably qualified specialists to evaluate the existing and proposed landfill masses and surrounding centre sites before developing and presenting a landscape and vegetation plan for approval and implementation.

Maintenance of landfill mound areas should comprise weed control and where necessary, watering of shrubs and young trees. Watering should only need to occur during the first summer after planting.

Inspections for noxious weeds are to be carried out monthly and advice on control sought from Council's Weeds Inspector.

Staff should familiarise themselves with the appearance of the common noxious weeds in the area.

3.8.9 Complaints

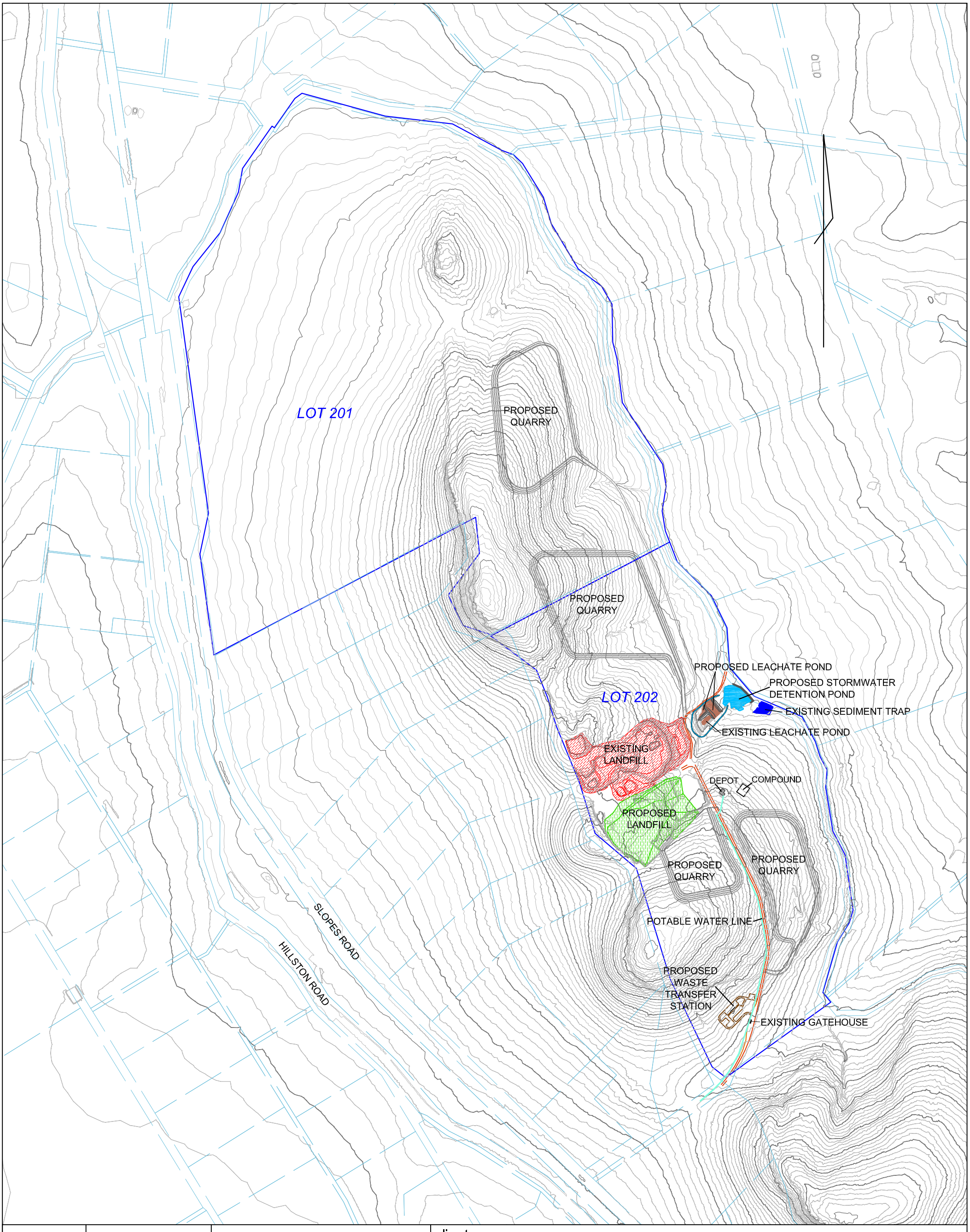
All complaints, no matter how trivial, are to be recorded in the operator's daily log noting names, time, details of complaint etc.

3.8.10 Facility Closure and Security

The Waste Operations manager is responsible to ensure that a competent team member locks the Hillside Drive gates at closing time each day.

The gatehouse/weighbridge relevant alarm systems shall be activated by the weighbridge operator on exit each day.

Attachment A: Site Plans



drawn	RJ
approved	MC
date	14 OCT 2008
scale	1 : 12 500
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY AND WASTE MANAGEMENT CENTRE
SITE OPERATIONS PLAN

title: LOCATION PLAN

project no:

FIGURE 1

LEACHATE FROM EXISTING LANDFILL TO BE DIRECTED INTO NEW LEACHATE POND

PROPOSED 2ND STAGE LEACHATE POND IF REQUIRED

PROPOSED LEACHATE POND

PROPOSED STORMWATER DETENTION POND

EXISTING LEACHATE POND

CUTOFF DRAIN

EXISTING SEDIMENT DAM

CELL 2

CELL 4

CELL 6

CELL 5

CELL 8

CELL 7

CELL 3

CELL 1

LEACHATE HOLDING TANK

WORKS DEPOT

WORKS COMPOUND

SUBSURFACE DRAINAGE COLLECTION SUMP

PROPOSED QUARRY

EXISTING SITE ACCESS ROAD

PROPOSED QUARRY

LEGEND

- POTABLE WATER LINE
- LEACHATE DRAINAGE LINES
- SUBSURFACE DRAINAGE
- LANDFILL FINISHED CONTOURS (1m INTERVAL)
- EXISTING LANDFILL
- HYDRANT, STOP VALVE

revision	description	drawn	approved	date

0 20 40 50 80 100 120

Horizontal Scale (metres)

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approved	
date	13 OCT 2008
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original size	A3

coffey mining

SPECIALISTS FROM BOARDROOM TO MINE FACE

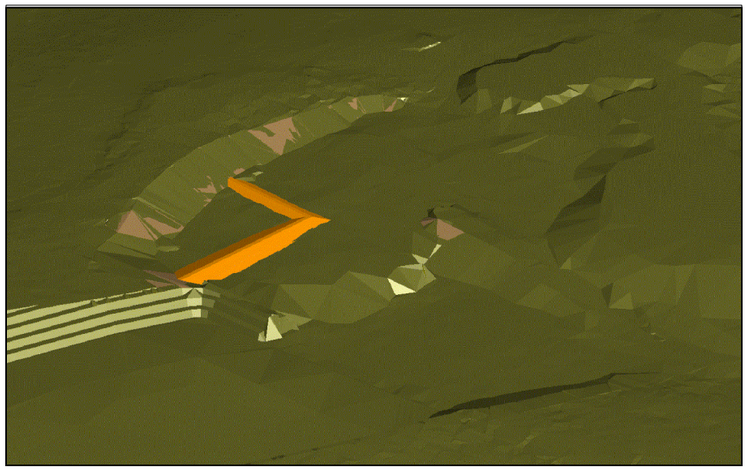
client: **GRIFFITH CITY COUNCIL**

project: **THARBOGANG QUARRY AND WASTE MANAGEMENT CENTRE SITE OPERATIONS PLAN**

title: **DETAILED SITE PLAN**

project no: **-**

FIGURE 2



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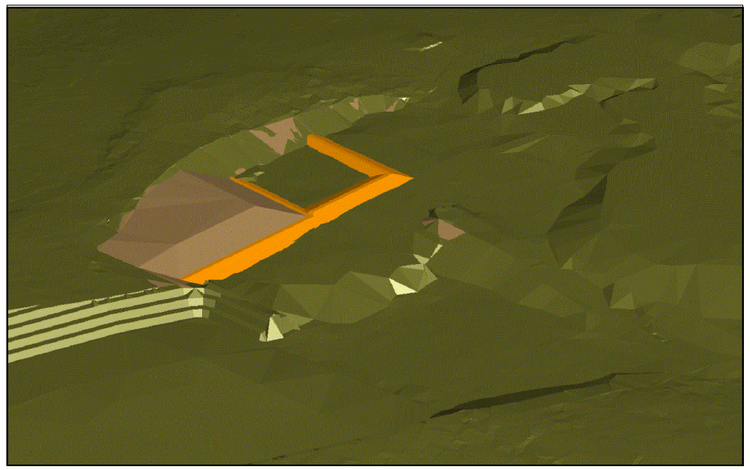

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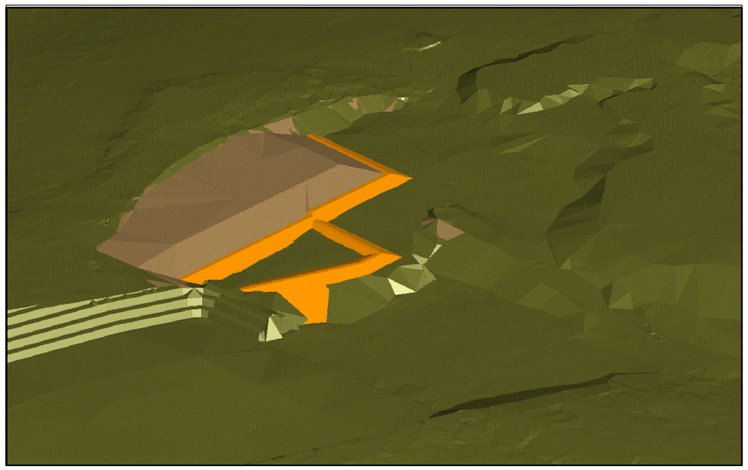

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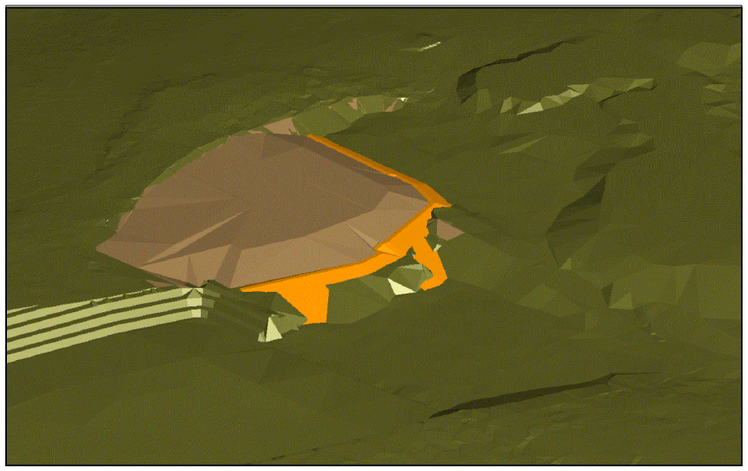

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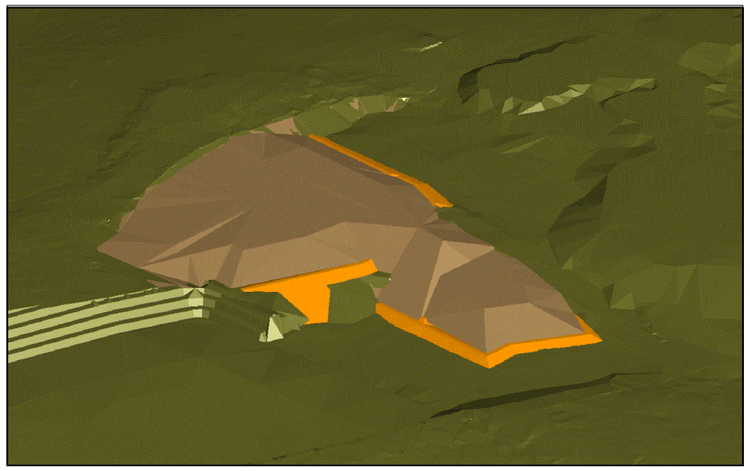

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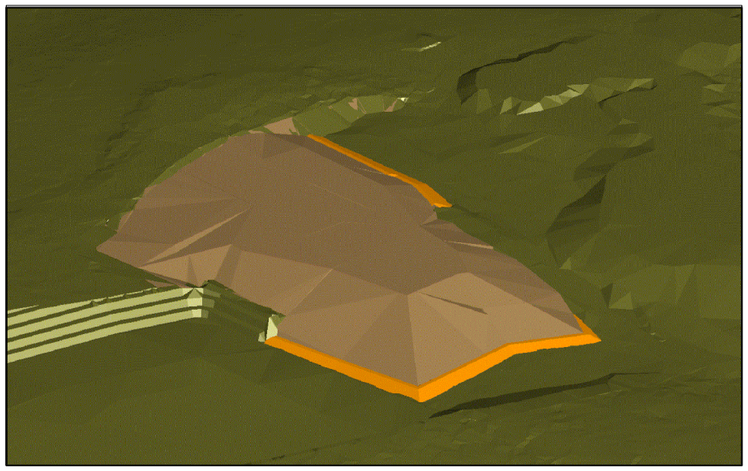

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revision	description	drawn	approved	date

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approved	
date	6 AUG 2008
scale	-
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

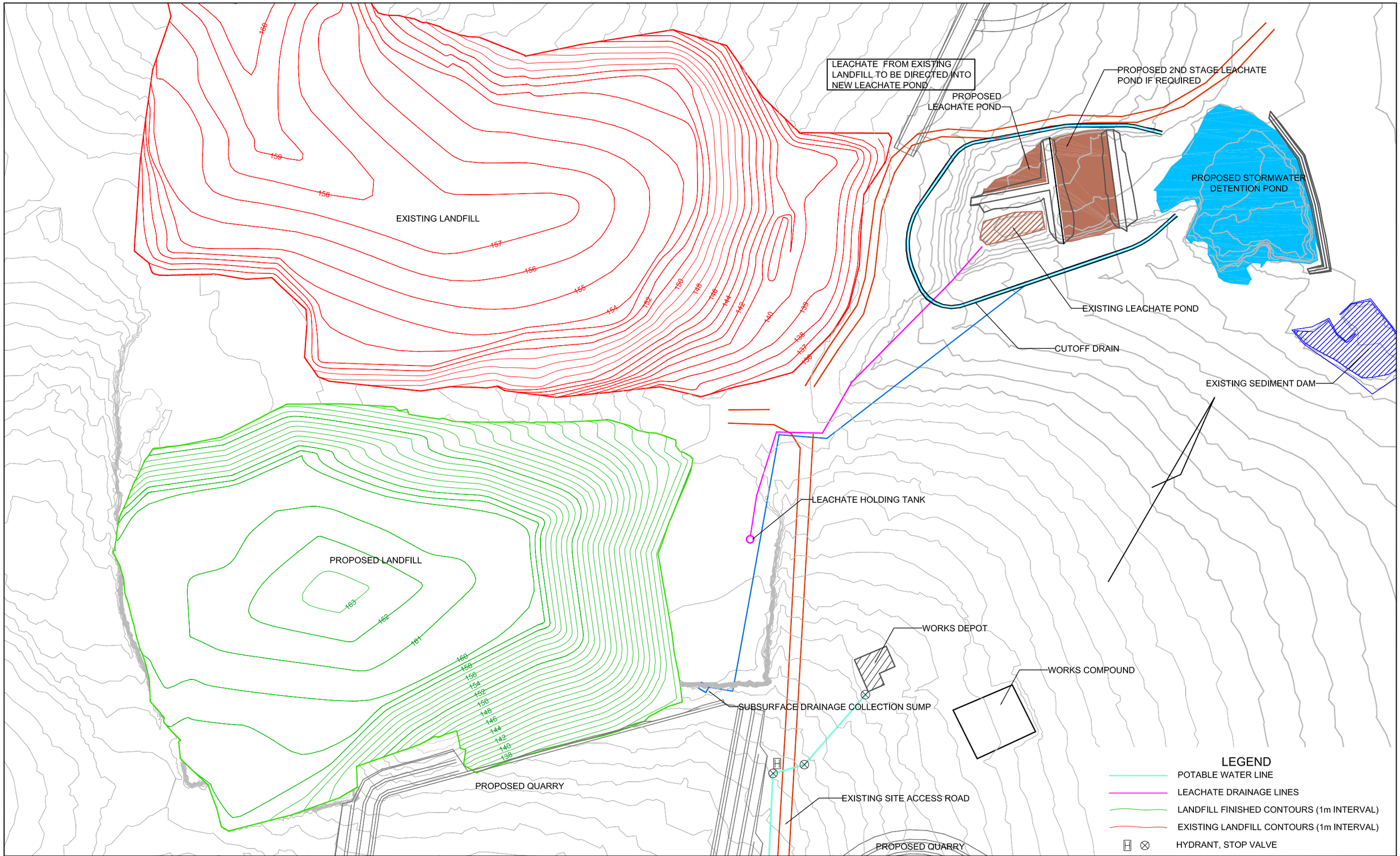
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY AND WASTE MANAGEMENT CENTRE SITE OPERATIONS PLAN

title: CONCEPTUAL LANDFILL STAGING

project no: -

FIGURE 3



revision	description	drawn	approved	date

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Horizontal Scale (metres)

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coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

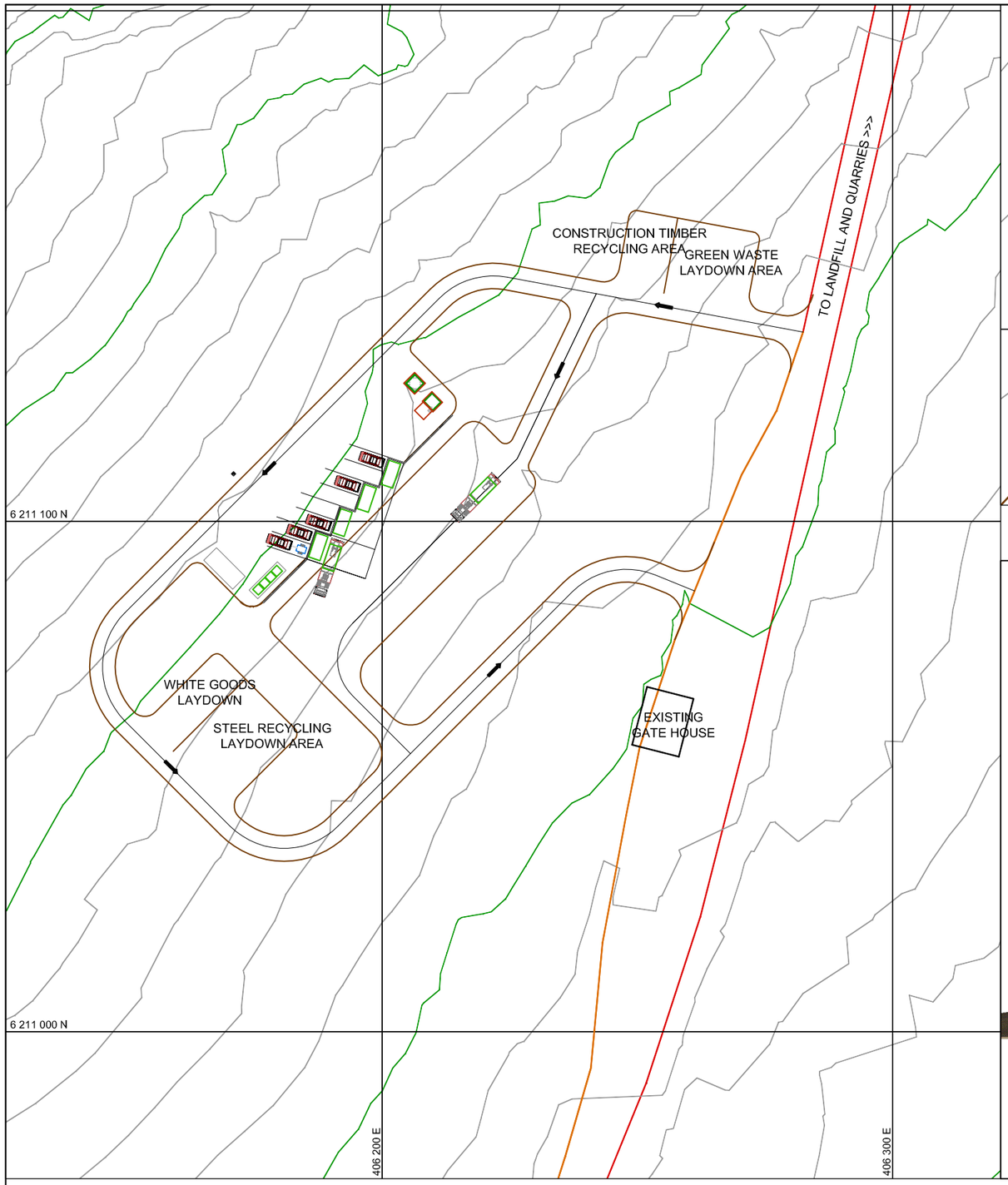
client: GRIFFITH CITY COUNCIL

project: THARBOGANG QUARRY AND WASTE MANAGEMENT CENTRE SITE OPERATIONS PLAN

title: PROPOSED FINISHED PROFILE

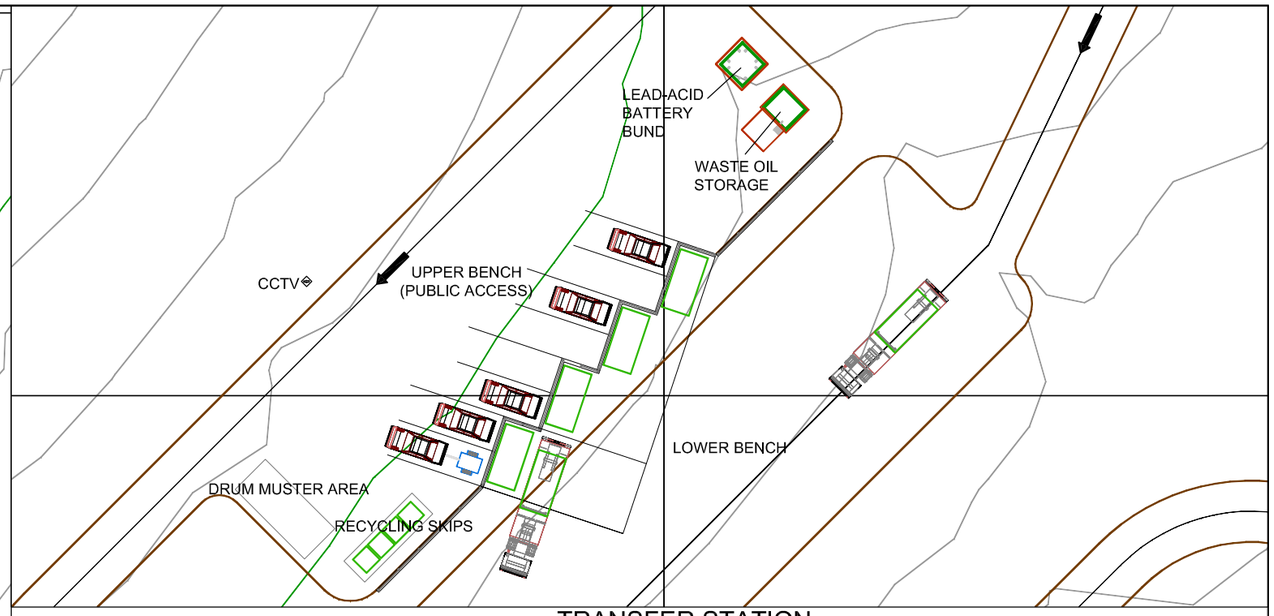
project no: -

FIGURE 4



TRANSFER STATION LOCATION PLAN

SCALE 1:1000



TRANSFER STATION

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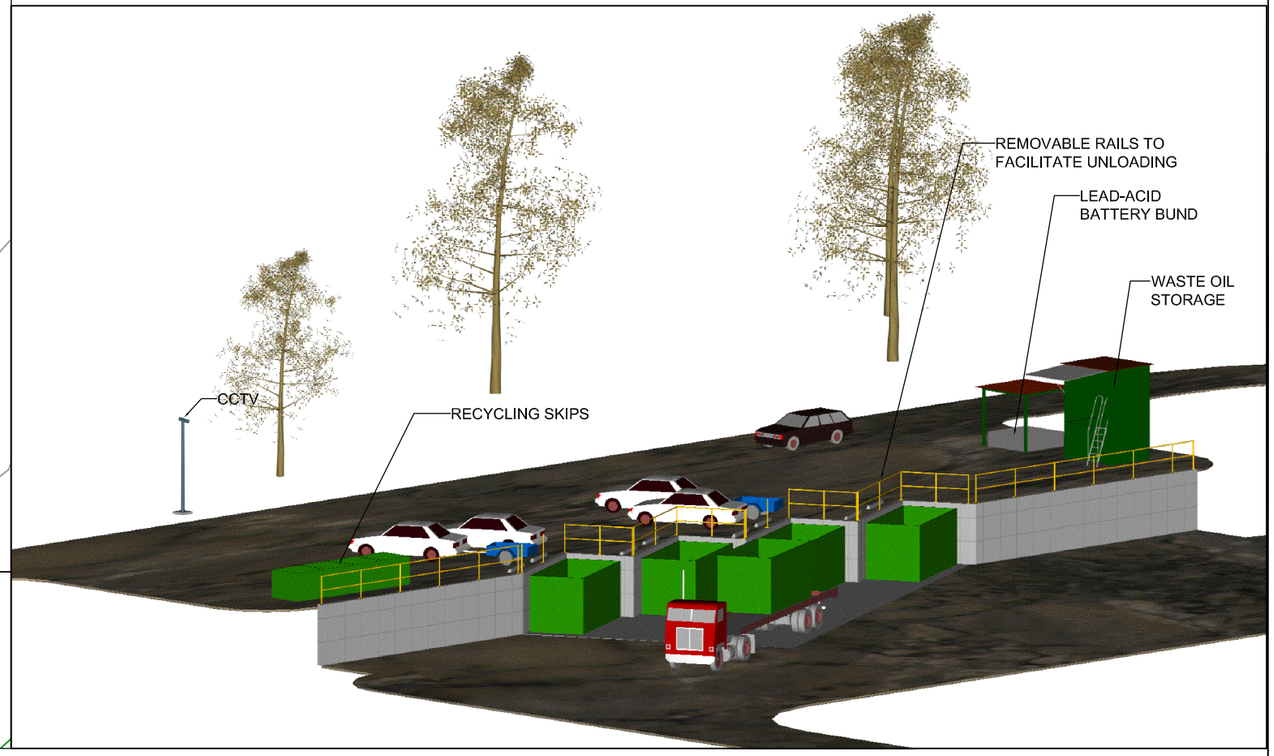

ISOMETRIC VIEW OF TRANSFER STATION CONCEPT

revision	description	drawn	approved	date

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approved	
date	21 OCT 2008
scale	AS SHOWN
original size	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

client: **GRIFFITH CITY COUNCIL**

project: THARBOGANG QUARRY AND WASTE MANAGEMENT CENTRE
SITE OPERATIONS PLAN

title: **WASTE TRANSFER STATION CONCEPT**

project no: **-**

FIGURE 5

Attachment B: Substances Excluded from Landfill and Response and Remediation Procedures

Excluded Substances
The following substances are excluded from the proposed landfill unless specifically approved by Council and DECC:

i. liquid wastes
ii. radioactive wastes
iii. any explosive or flammable material, including material derived from grease, oil, tar, petroleum, shale or coal.
iv. Any sludge or refuse material (unless it can be shown to be harmless) from any:
    a. Tanning or leather processing plant
    b. Petroleum or petrochemical plant
    c. Chemical plant
    d. Paint manufacturing plant
    e. Metal treatment plant
    f. Vegetable oil or mineral oil plant
    g. Pharmaceutical or drug manufacturing plant
v. Any material containing
    - arsenic
    - cadmium
    - cyanide
    - lead
    - mercury
    - selenium
    - sulphide

vi. any toxic inorganic material including any soluble salt of the following:
    - barium
    - borun
    - chromium
    - copper
    - manganese
    - silver
    - zinc

vii. any toxic organic material including any pesticide or herbicide, in particular any containing:
    - chlorinate hydrocarbons
    - fluorinated hydrocarbons
    - organophosphates
    - carbamates or thiocarbamates
    - phenols

viii. any soluble acid or alkali or acidic or basic compound unless it can be shown that it may be beneficial to the operation of the depot.

Response and Remediation Procedures
This plan calls for all prohibited wastes to be detected and diverted at the weighbridge initial inspection and querying of the user as to the contents of the waste being disposed.

In reality, many users will suspect that declaring prohibited wastes will result in approved disposal at their cost and inconvenience. Many will attempt to illegally dump such wastes.

Prohibited wastes are likely to appear at three locations:

- The bulk waste bins of the transfer station where the majority of smaller commercial and all private users will deposit pre-sorted wastes;
- The working face of the primary landfill where council kerbside collection and large authorised commercial vehicles will deposit waste, and;
- Other sites outside the waste management centre, particularly the verges of the approach access road.

Centre employees will have few opportunities to evaluate such prohibited materials as many containers containing prohibited materials may be unlabeled or obscured, or the material may have been spilt onto other material surfaces.

Suspect materials may only be able to be categorised into:

- Liquid or solid; no liquids are approved for disposal;
- Any readily detectable odour, whether pungent or otherwise;
- The colour of the material;
- Any visible chemical reaction of surrounding material to the prohibited substance;
- The volume of the material observed, whether small or substantial.

If a centre employee detects what he/she believes to be a suspect prohibited material, he/she is to immediately:

- Notify the Quarry and Waste Operations Manager, and other adjacent centre staff;
- Cordon off the immediate area or bulk bin;
- Signpost the area with potential hazard warning signs;
- If detectable or pungent fumes or dust is discharging, notify the gatehouse to stop any further user entry, advise all users on site to immediately leave the area, secure the site to further entry, and notify the NSW Fire Service who have responsibility for hazardous materials situations;
- If the material is a liquid of a small volume and appears inert, utilise the spills absorption and clean-up kits containing the granular absorbent material. The kits are to be stored on the transfer station, at the weighbridge, and adjacent to the primary landfill cell.

Attachment C: General Site Rules

Griffith City Council has developed these rules for all operations and maintenance works and projects. It is important that all personnel are familiar with, and work within these rules when working on Council projects.

General safety and safe work practices include:

- No one shall come to work under the influence of alcohol or other drugs.
- Practical jokes or bullying will not be permitted.
- Each **i**njury or illness MUST be reported to the Waste Operations Manager and first aid officer immediately and then to OH&S Coordinator. This applies to all incidents & accidents, including near misses.
- Formal investigation and reporting of Incidents **must** be carried out as soon as possible.
- The centre shall be locked at the end of each day – ensure if you are the last to leave that padlocks are engaged.

General housekeeping and cleaning rules include:

- It is the responsibility of all personnel on site to keep their work area clean and tidy to promote safety and efficiency;
- All tools and equipment are to be locked away at the end of the day;
- Materials must be kept stacked in designated areas;
- Place all rubbish in the bins provided.

Personal Protective Equipment (PPE)

- Wear clothing that is suitable for the job. Do not wear clothing that may become tangled in moving machinery.
- In areas designated as requiring a specific form of PPE/C, (e.g. Hard Hat, Ear Protection, Eye Protection etc.) the item must be worn.
- Wear gloves when handling materials or substances that could cause harm to your skin. (Check MSDS) Avoid wearing gloves near moving machinery.
- Use dust masks or respirators as appropriate in dusty or fume-filled conditions.
- Your employer has an obligation to provide you with any personal protective equipment necessary for your safety. You have an obligation to properly use the protection provided

Clothing Policy

- Clothing requirements for Council Staff are specified in GCC policy "Personal Protective Clothing for Employees Working Outdoors."
    - Council Outdoor Staff will be provided with, and are expected to correctly use:
        - Steel capped safety boots
        - A broad brimmed hat or appropriate headgear with flap of fabric to protect back of neck and ears
        - Sunglasses
        - A Workcover approved reflective safety vest (or approved "Fluoro" top in daylight).
            - Loose fitting shirt with long sleeves & collar <u>and</u> Long trousers or long skirt
            - <u>Or</u> Long overalls

    - Sunscreen Broad Spectrum SPF 30+
- Subcontractors and their staff must comply with these requirements when subcontracting to GCC. They will be excluded from the site at their own cost for failing to comply.
- Visitors to the worksite (including managers, inspectors, public authority representatives, commercial representatives, members of the public and others) are expected to comply with these requirements. Those who do not comply will have their access restricted to times and/or locations with minimal exposure to risk, at the discretion of the Waste Operations Manager.

Hazardous Materials

- A Register of Hazardous Materials (not including hazardous waste) brought onto site and their corresponding Material Safety Data Sheets (MSDS) is kept at the weighbridge;
- The Register of Hazardous Materials is to indicate the location of materials either for storage or during use.
- In the event of accidental release or exposure of an employee, these sheets are to be referred to for emergency information.

Traffic and Access

- Access ways must be kept clear and unrestricted at all times.
- Use designated walkways wherever possible when travelling to and from your job site
- Beware of mobile plant and motor vehicles around the centre site.
- Only authorised personnel are allowed to enter and move around the centre site. Should some other person enter the site instruct them to go the weighbridge.

Emergency Procedures

- Emergencies shall be responded to in accordance with the Council system procedure for incident management;
- First Aid facilities are identified by a white cross on a green background, First Aid officers have this logo printed on their safety vests.
- Incidents & accidents (including near misses) involving plant, equipment, vehicles or materials must be reported to the supervisor immediately. Formal investigation and reporting of ALL incidents and accidents must be carried out as soon as possible.

Plant and Equipment

- No person will drive or operate any vehicle or other equipment unless they have been properly trained and authorised to do so. The appropriate licence or certificate of competency is required where applicable.
- Plant Pre-start checks must be done on a daily basis or when taking a vehicle or other equipment over from another operator.
- No person is to travel on the rear of a truck or utility, or other plant unless in an approved seat.
- Vehicles and equipment should when possible be parked on level ground with park brake on.

Electrical safety

- Overhead/underground utilities that have the potential to cause a hazard shall be identified prior to commencement of work. Employees and subcontractors shall be notified through toolbox talks if they are working in an identified area.
- Only qualified personnel shall be used as a safety observer and plant operator if the machinery is to go within the restrictions outlined in WorkCover Exemption 5099.
- All electrical work on the site shall be conducted in accordance with Code of Practice: Electrical Practices for Construction Work.

Training

- All personnel, including subcontractors, working on site, must have attended general construction work health and safety induction training before starting work or have written exemption from their divisional manager or principal, denoting appropriate experience.
- All personnel including subcontractors, inspectors, and visitors must attend a centre site induction before commencing work on the site. This is to include work activity briefings, where available, and identification of hazards for works to be conducted on site.
- During the centre site induction all personnel will receive a copy of these rules.

Routine Landfill Operations

Putrescible Waste Cell

Frequency	Task	Outcome Measure	Record ?	By Who ?
Daily	Operate the placement of material in discrete layers of not greater than 0.5 metres depth by 50 metres width with target compaction of 650 kg/cubic metre. Close the cell and cover with chipped green waste immediately following close of business each day. Spatially locate the day site boundaries prior to finishing.	Achieve optimum compaction for bio-digestion; Maintain heavy vehicle access; Minimise fire risk; Record location of daily waste input for subsequent tracking purposes	Download from GPS.	L.O.
Weekly	Determine waste moisture content on a number of sites; apply recycled leachate water or potentially contaminated stormwater to adjust. Conduct centre site inspection for windborne litter.	Optimise enhanced stabilization process. Utilise leachate within lined landfill cell. Minimise amenity loss from litter.	Minimise storage of leachate for optimum wet weather event storage. Log	L.O. TL
Quarterly	Conduct visual assessment of waste composition delivered to landfill working face to provide feedback to optimise public education program	Minimise landfill waste volumes.	Written report with digital images to QWOM.	L.O.
Annually	Assess volume filled by survey for DECC reporting requirements.		DECC reporting requirements.	WOM/ TL

Inert landfill Cell

Frequency	Task	Outcome Measure	Record ?	By Who ?
Daily	Observe and record on CCTV vision any unusual events or observations of the holding enclosure.	Record of inspection available for any subsequent prosecution events.	CCTV.	L.O.
Weekly	Inspect the contents of the holding enclosure, confirm no combusting material, then push, place and compact the material into the operating face of the inert landfill cell. Cover the waste. Spatially locate the deposit.	No fires in the inert landfill cell.	Log	L.O.
Weekly	Check the leachate well and pump to the leachate system if required.			

Asbestos & Dead Animal Zones

Frequency	Task	Outcome Measure	Record ?	By Who ?
On demand	Inspect incoming material; confirm that the asbestos waste conforms to requirements; open a new section of the defined burial zone, observe the material being deposited, immediately cover with minimum of 300 mm of clay cover.	Minimise site OHS risks. Comply with DECC regulations & industry guidelines.	Daily weighbridge log.	L.O.
On completion of the defined zone.	Spatially locate the zone following final closure and placement of cover material.			

Closed Waste Cells

Frequency	Task	Outcome Measure	Record ?	By Who ?
Weekly	Check the leachate well and pump to the leachate system if required.	Leachate is recovered and discharged to the active leachate management system.	Log.	TL
Annually	Inspect the cap for erosion and formation of sink holes. Repair as required then reseed to establish cover material.	Minimise rainwater ingress and gas emissions.	Log.	T.L.

Routine Water Operations

Potable Water

Frequency	Task	Outcome Measure	Record	By Who
Daily	None.			
Weekly	Check fire fighting storage tanks.	Tanks are full.	Yes.	TL
Monthly	None.			
Annually	Ensure that the backflow prevention device has been checked and certified as required by Australian Standards.	Prevention of backflow to public potable water mains.	Yes.	TL

Contaminated Surface Drainage Water

Frequency	Task	Outcome Measure	Record	By Who
Daily	When raining, ensure all run off, has a clear run to the storage areas for reuse.	Visual check all drainage and pipelines, leading to the storage areas.	Yes	LO
Weekly	Testing for any contaminations and the capacity of the storage area.	Take a visual reading of depth indicator, plus do a conductivity reading for entering to a spreadsheet.	Yes	LO
Annually	Ensure contaminated surface run- off and drainage system works.	Check all pipelines, open drains leading to storage areas. Check banks on storage area for any failures. Maintain pump and motor.	Yes	TL

Underdrain Water

Frequency	Task	Outcome Measure	Record	By Who
Daily				
Weekly	Ensure water is harvested from drainage system installed under lined landfill cells. Ensure early detection of any contamination to the groundwater system, and ensure that groundwater pressure does not compromise the landfill liner.	Maintain pumps and wells. Monitor hour and flow meters, take conductivity reading for entering on a spreadsheet	Yes	TL
Annually	Monitor the system	Check and maintain pumps and meters	Yes	TL

Leachate Water

Frequency	Task	Outcome Measure	Record	By Who
Daily				
Weekly	Ensure leachate is drained, through drainage system installed on top of clay and plastic liner. Ensure all leachate reaches the clay lined ponds. Try to ensure the clay and plastic liners are not damaged in any way.	Check all pipelines, pits leading to storage ponds. Check and mow banks on storage ponds for any failures. Maintain pump and motor. Take depth reading on ponds and record on spreadsheet.	Yes	LO
Monthly	Inspect ports and risers on collection system for blockages, gas levels	Leachate system is efficiently draining the cell of leachate.		
Annually	Monitor the system	Check and maintain pumps and meters.	Yes	LO

Landfill gas

Frequency	Task	Outcome Measure	Record	By Who
Daily	Inspect gas release ports and gas flaring system	System is functional	Yes	LO
Weekly	Measure methane levels	Explosive gases below	Yes	LO

	at ports using gas detection equipment.	limits		
Annually	Measure methane levels in enclosed structures.	Explosive gases below limits	Yes	LO

Attachment D: Fire Response Procedure

The following procedure is to be followed in the event of fire within the Tharbogang Landfill and waste management centre:

- In the event the fire is detected in the primary cell and is considered small in size, the plant operator is to smother the fire with garbage or fill. The operator then utilises available fire fighting facilities to wet-down the smothered fire with the assistance of another team member;
- Before attempting to fight any significant fire, operators are to fit the face-masks stored in the compactor and the weighbridge building.
- The weighbridge supervisor is to call the Rural Fire Service on (phone 000 and report a fire at the Tharbogang Landfill, Hillside Drive, Tharbogang).
- If the fire is of a size where it cannot be quickly smothered or is outside the cell, then the following procedure is to apply:
- The Rural Fire Service is to be called by the weighbridge supervisor (phone 000 and report the fire at the landfill in Hillside Drive, Tharbogang). If the weighbridge supervisor is required to fight the fire then the fire brigade should be called before any attempt is made to put out the fire.
- The staff at the centre are to attempt to put out the fire using the available plant, staying upwind of the fire as much as possible, as the smoke may be harmful to health (see 2. above).
- Once the Rural Fire Service arrives, the brigade will coordinate the fire-fighting and centre staff are to assist as directed by them.
- Note: extra masks for Rural Fire Service staff use are stored within the weighbridge office and should be made available on request.
- As soon as possible or once the fire is declared under control by the Rural Fire Captain, supervisory staff are to be called as follows:
    - Team Leader Landfill Operations
    - Waste Operations Manager

In the event of the fire being discovered when the centre is shut, team members are to be called in the following order:

1. Team Leader Landfill Operations
2. Waste Operations Manager

Attachment E: Existing Council Records of Waste Volumes Received into Tharbogang Waste Management Centre

The following is a summary of waste by type as recorded by Griffith City Council's weighbridge. It should be noted that minimum charge loads are not weighed; instead these loads are recorded with an assumed mass of 300kg.

Table: Waste by Type by Year (tonnes)

Year	Mixed waste	Recycled waste (including concrete)	Specialist waste (including asbestos)
2002	17375	3395	112
2003	15540	2243	138
2004	16898	3303	633
2005	17690	3628	177
2006	17500	2262	386
2007	17745	1611	196

Most of the recycled waste consists of bricks and concrete which is broken up as part of the quarrying operation.

Heavy vehicles[2] represent under half of the visits to Tharbogang landfill, yet deliver over 85% of the waste disposed at the landfill. This means a light vehicle transfer station will only need to capture 3000 tonnes of waste per year, yet will substantially reduce the number of vehicles at the landfill face.

Table: Waste deliveries by Vehicle Type (number of vehicles)

Year	Number of heavy vehicles	Number of light vehicles	% heavy vehicles	% light vehicles
2002	4697	8205	36%	64%
2003	3690	7910	32%	68%
2004	4258	8608	33%	67%
2005	4344	7081	38%	62%
2006	4163	5607	43%	57%
2007	3902	4834	45%	55%

Table: Waste disposal by Vehicle Type (tonnes)

Year	Disposal by heavy vehicles	Disposal by light vehicles	% disposed by heavy vehicles	% disposed by light vehicles
2002	20610	4650	82%	18%
2003	17649	3899	82%	18%
2004	20509	4074	83%	17%
2005	21204	3872	85%	15%
2006	19903	2932	87%	13%
2007	19298	2940	87%	13%

[2] Tare exceeding 2.5 tonnes