F I N A L R E P O R T

Cost Benefit Comparison of Griffith Quarry / Landfill Options

Prepared for

Griffith City Council

1 Benerembah Street
Griffith
NSW

7 April 2008

43177543

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Contents

Section 1 Introduction

URS Australia Pty Ltd (URS) was commissioned by Griffith City Council (Council) to prepare a Cost Benefit Comparison of alternative options for the development of a quarry and landfill within the Griffith Local Government Area (LGA). The purpose of the comparison is to identify the preferred site, taking into consideration financial, social and environmental considerations.

1.1.1 Background and Key Issues

Council is currently considering the expansion of the Tharbogang Quarry and Landfill to meet its future demand for road making material and disposal of waste in the Griffith LGA. The proposed expansion is constrained by the limits contained with the existing approvals and licences, and these need to be amended to meet future requirements. Council has invested considerable resources into the establishment of the current site and there is considerable quantity of material remaining to be excavated, thereby meeting the future demand for road gravel and landfill space.

As part of the proposed expansion Council is currently preparing a Development Application to the NSW Department of Planning under Part 3A of the *Environmental Planning and Assessment Act* 1979 as the project is considered a Major Project under the SEPP Major Projects (2005*).* Supporting the development application is an Environmental Assessment, which is currently being prepared. As part of the Environmental Assessment, Council must provide suitable justification for the project. Council has completed a report titled *Assessment of Options for Quarry and Landfill* within the Griffith LGA (January, 2007), which contained a qualitative analysis of several options. The study evaluated eight alternative sites including the Tharbogang quarry against technical, environmental and social criteria. The study essentially ruled out Barter Quarry, Dalton Road, Dare Road Quarries and Shaw Road as being not feasible for several reasons and not worth considering further. Two other sites namely, Tyson and Wambulgal, were considered suitable, however the Tharbogang option was considered favourable over these options, primarily for economic reasons. This study concluded the preferred option was the proposed expansion of the Tharbogang Quarry and Landfill.

To provide further justification for the project, Council appointed URS to undertake an independent Cost Benefit Analysis of the alternative feasible options for establishing a quarry/landfill within the Griffith LGA, drawing on the findings from the options assessment undertaken by Council. In particular the Cost Benefit Analysis needs to assess in further detail the Tyson and Wambulgal options, against the base case being Tharbogang. The following section outlines the approach undertaken in preparation of the Cost Benefit Comparison.

1.2 Methodology

Our methodology to assess the alternative options consists of the following key tasks:

Define Options: Clearly define each of the alternative options to enable the costs and impacts associated with developing and operating each alternative site as a quarry/landfill to be compared with the base case (Tharbogang).

Cost Options: Estimate the establishment and operating costs associated with each alternative option including the base case, Tharbogang option.

Financial Analysis: Based on the differential costs and revenues determined from the previous task, carry out a comparison of the alternative options. The analysis would take into consideration the difference in establishment costs and operating costs associated with each of the feasible options compared to the baseline option.

Options Analysis: The results of the financial analysis would form part of the options analysis undertaken during this task. The purpose of this analysis would be to take into consideration environmental and social impacts together with the findings of the financial analysis to determine a preferred option. This would be carried out using a qualitative assessment supported by GIS mapping data.

Section 2 Quarry / Landfill Options

2.1 Initial Options Assessment

The initial Assessment of Options carried out by Council (2007) compared eight alternative sites located within the Griffith Local Government Area (LGA) including Tharbogang, to determine the preferred option to be developed as a quarry and landfill. The sites evaluated included Barter, Wambulgal, Dalton Road, Milbrae, Dare Road, Tyson and Shaw Road and Tharbogang.

2.1.1 Quarry Site Assessment

The assessment of the preferred quarry site took into consideration the following criteria:

- Type of material;
- Proximity to city and/ or the end use localities;
- Extraction and processing costs;
- Volumes available and the life of the resource; and
- Environmental factors.

Based on the options assessment undertaken for the quarry site, the list of sites from most preferred to least is given below:

1. Tharbogang
2. Wambulgal
3. Barter
4. Dalton Road
5. Milbrae
6. Shaw Road
7. Dare Road
8. Tyson

2.1.2 Landfill Site Assessment

The assessment of the preferred landfill site took into consideration the following criteria:

- Groundwater impacts;
- Compatibility with Quarry operation;
- Cover material availability;
- Odour, noise and dust impacts;
- Residential Impacts; and
- Proximity to City Centre.

Section 2 Quarry / Landfill Options

Based on the options assessment undertaken for the landfill site, the list of sites from most preferred to least is given below:

1. Tharbogang
2. Tyson
3. Dalton Road
4. Barter
5. Shaw Road
6. Wambulgal
7. Dare Road
8. Milbrae

The assessment noted that the score difference between the various sites for the landfill options was not significant. The major factor was compatibility with the quarry operation, from this aspect Tharbogang was the preferred site, given it currently includes an operating landfill.

Overall, the study concluded that Tharbogang was the preferred site for the quarry/landfill operation taking into consideration all the criteria. However, the study did identify Wambulgal and Tyson sites as possible options which could be considered further. The location of these sites is given in **Figure 1**. A brief description of each of these sites is given below.

2.2 Tharbogang Quarry

The Tharbogang site, which is owned and managed by Council, is located approximately 8kms northwest of the Griffith city centre. The site is located within Lot 202 and consists of both a landfill serving the Griffith LGA and a quarry that exploits pebbly sandstones and thin conglomerates (Mailman Gap Conglomerate Member) to provide road base material for the surrounding area. Council plans to expand the current quarrying operation within Lot 202. In addition to Lot 202, Council purchased Lot 201 (234 hectares) from the Crown with the intention of developing the site as a potential quarry and landfill or some other development in the future. Lot 201 is situated next to the northwest side of the existing landfill and quarry site (Lot 202), and is currently zoned 1(f) Rural Forestry, 7(v) environmental protection – Scenic and 1(b) Rural Agricultural Protection). Approximately 65ha of Lot 201 is currently zoned as 1(f) Rural Forestry and it is this area that has been investigated (Coffey, 2007) for suitable road base materials. The layout of the Tharbogang site is given in **Figure 2**.

2.2.1 Geology and Preliminary Resource Estimate

The 1:250000 Narrandera Geological Map indicates the site geology comprises a succession of Upper Devonian sandstones, siltstones and conglomerates that belong to the Cocoparra Group. The Ranking Formation and Wonboyne Formation, both part of the Cocoparra Group are represented at the Tharbogang site by the Mailman Gap Conglomerate Member and Jimberoo Member respectively (Coffey, 2007). The Mailman Gap Conglomerate Member consists of coarse pebbly sandstone and thin conglomerates. The underlying Jimberoo Member comprises coarse to medium grained red and white sandstones, often interbedded with red siltstones, with several beds of coarse grit towards the top of the member.

The road base materials are obtained from the Mailman Gap Conglomerate Member which meet the dry strength requirements for dense grade sub-base (DGS) 20 and DGS40 as per RTA QA Specification 3051 (Coffey, 2007). The underlying Jimberoo Member rock does not meet the requirements for dense graded base (DGB) or sub-base (DGS) materials (Coffey, 2007). The preliminary recoverable resource as estimated by Coffey, 2008 is given in Table 2.1.

Section 2 Quarry / Landfill Options

Table 2-1 Tharbogang Quarry Preliminary Recoverable Resource Estimate (Coffey, 2008)

Pit ID	Estimated Surface Area (m^2)	Estimated recoverable in-situ volume (m^3)	Resource Tonnage (tonnes)[1]
101	97,897	1,374,419	3,573,489
102	86,613	1,306,750	3,397,550
203	182,864	2,614,949	6,798,867
303	132,108	1,769,291	4,600,157
Total (Lot 202 & 201)	**499,482**	**7,065,409**	**18,370,063**

Notes 1: Based on a Specific Gravity (SG) of 2.6 (Coffeys, 2008)

2.3 Wambulgal Quarry

This site is located east of Irrigation way, and just outside the eastern boundary of the LGA and some 20 kilometres east of the Griffith city centre. The site is bounded by the main Leeton – Griffith road on the west, and by grazing land on all other sides. The site is located on private land and would therefore need to be acquired. The site is rectangular in shape with an area of approximately 79 hectares. The site was approved in 1995 under the provisions of SEPP 37 for an annual average production capacity of 5,000m^3 and maximum extraction rate of 39,000m^3. The layout of the site is shown in Figure 3.

Past quarrying of near surface materials, particularly in the crest and southern slopes, has modified some areas of the site. The vegetation comprises generally grasses, small shrubs and isolated mature trees.

2.3.1 Geology and Preliminary Resource Estimate

The 1:250000 Narrandera Geological Map indicates the site is underlain by regionally folded sedimentary rock of the Cocoparra Group of Upper Devonian age, largely obscured by residual or alluvial deposits with sandstone, pebbly sandstone and siltstone. Geological mapping of the site (Douglas, 1991) indicated scattered to continuous exposure of the Mailman Gap Conglomerate Member characterised by interbedded fine to coarse grained, siliceous conglomerate and pebbly sandstone similar to that found at the Tharbogang site. The site is also underlain by the Jimberoo Member comprising of light grey, very low to medium strength, fine to medium grained quartzose to lithic sandstone.

The Douglas Report (1991) concluded that on the basis of materials testing carried out, the interbedded conglomerate and pebbly sandstone of the Mailman Gap Conglomerate Member forms the most favourable quarrying target for the supply of (at least) sub-base materials. The estimated resource of this material at the Wambulgal site, based on a 500m buffer, is 312,000 m^3 (bulked yield) (Douglas,1991).

2.4 Tyson Road

Tyson quarry is located at the junction of Dickie Road and Nelson Road approximately 8 kilometres east of the village of Tabbita and 23 kilometres north-west of the Griffith city centre. This quarry was also approved in 1995 under the provisions of SEPP 37 for an annual average production capacity of 5,000m^3 and maximum extraction rate of 39,000m^3. The site is approximately 211 hectares in area. The location of the site is shown in Figure 1, while the layout is given in Figure 4**.** The site is privately owned and would need to be acquired by Council. A 5.5 kilometre section of Nelson Road which provides access to the site would need to be upgraded to a heavy vehicle standard, if the site were established as the primary quarry site for Griffith.

Section 2 Quarry / Landfill Options

2.4.1 Geology and Preliminary Resource Estimate

No in-situ testing of the material at the Tyson site has been carried out in the past, however a review of the 1:250000 Narrandera Geological Map, indicates that the geology is similar to that of the Tharbogang site consisting of the Mailman Gap Conglomerate Member underlain by the Jimberoo Member. No geological investigations have been carried out on the Tyson site and therefore an accurate recoverable resource estimate is not available for the Tyson site. The Statement of Environmental Effects (SEE) prepared for several quarries located in Griffith including Tyson (GCC, 1995) noted that "the life of the quarry based on average production is considered to be 10 years". The average annual production was estimated at 6,000m^3 in the SEE, giving a total recoverable resource estimate of 60,000m^3. Given the total area of the site (211 hectares) this is considered a very low estimate of the recoverable resource. Recent investigations by GHD (GHD, 2007) identified an area of approximately 61 hectares of the Tyson site which would potentially be disturbed due to quarry activities. Based on this area, and assuming an excavation depth of 1.5m a more realistic estimate of the recoverable resource would be around 1,000,000m^3,

2.5 Summary of Resource Estimates for Alternative Sites

Table 2-2 Summary of Resource Estimates

Site	Tharbogang	Wambulgal	Tyson
Recoverable Resource Estimate (m^3)	7,065,000m^3	312,000 m^3	1,000,000 m^3
Life of Quarry (assume annual requirement is approximately 200,000 tonnes per year or 77,000m^3 per year in Year 1 growing at 3% per annum, as provided by Griffith City Council)	47 years (Till 2055 based on starting in 2009)	4 years (Till 2012 based on starting in 2009)	12 years (Till 2020 based on starting in 2009)

As shown in the above table the Tharbogang quarry has a considerably longer life than both Wambulgal and Tyson sites. To provide a viable alternative to the Tharbogang site over the next 16 years, both sites would need to be utilised. Therefore, in carrying out the options assessment the impacts associated with both Wambulgal and Tyson need to be compared with the base case i.e. expansion of Tharbogang.

Section 3 Financial Analysis

The financial analysis takes into consideration factors for which a financial value can be estimated in particular capital and operating costs. The benefits of the project, namely the provision of crushed rock and an area for the disposal of waste is similar for each of the sites and therefore is not considered in the assessment of alternative sites. The evaluation of the alternative sites is based on a time period of 16 years from 2008, assuming Wambulgal would be used till 2012, followed by the Tyson site till 2020.

3.1 Capital Costs

The capital costs associated with each of the options include approvals, establishment (site security, gatehouse, office, weighbridge, access road etc) and machinery costs. The following table outlines each of the capital costs for the alternative sites which are likely to be different when compared with Tharbogang.

Table 3-1 Capital Development Costs

Capital Item	Site		
	Tharbogang	Wambulgal	Tyson
Incurred in Year (Approximate)	2008	2008	2012
Approvals including Environmental Assessment	$500,000	$400,000	$600,000
Site Security Fencing	$180,000	$160,000	$280,000
Transportable Building	Existing	$50,000	$50,000
Access Road works upgrade	$50,000 1.5km Access Road	$16,000 500m Access Road	$180,000 5.5km (Nelson Road)
Total Capital Cost	**$730,000**	**$626,000**	**$1,110,000**

As shown in the above table the combined establishment costs for both Wambulgal and Tyson are significantly higher when compared with the base case (Tharbogang). In particular much of the site infrastructure including fencing, gatehouse/weighbridge, workshop etc. is already in place at Tharbogang as it is currently an operating quarry/landfill and therefore the initial establishment costs are reduced.

3.2 Operating Costs

The operating costs for each of the sites include extraction, processing, equipment, labour and haulage. Apart from haulage the other operating costs are considered similar for each of the sites and therefore will not have a significant impact on the financial analysis. The haulage cost per tonne of gravel was provided by Council. These costs take into consideration labour costs, fuel consumption, and equipment depreciation.

Table 3-2 Estimated Haulage Costs

Operating Cost	Site		
	Tharbogang	Wambulgal	Tyson
Approx haulage distance	9.5km	19.2km	22km
2007/08 Haulage Cost per tonne of Gravel based on one-way trip	$3.82 per tonne	$6.84 per tonne	$7.75 per tonne
Haulage cost based on 200,000 tonnes per annum	$764,000	$1,368,000	$1,550,000

Section 3 Financial Analysis

As shown in the above table the haulage cost per annum is considerably greater for the alternative site compared with Tharbogang. It is also noted that due to the extra haulage distance the time taken for trucks to deliver their load and return to the quarry will increase leading to possible delays on projects requiring several loads delivered during a particular time period.

3.3 Annual Revenue

The annual revenue from each of the sites from the sale of rock is predicted to be similar given the type of material, and is not considered to be a differentiating factor with regard to selection of the preferred site. Therefore, annual revenue has not been included in our comparison of alternative options.

Section 4 Environmental and Social Impact Analysis

4.1 Introduction

The intangible aspects of the project for which a financial value cannot be accurately provided, are primarily the environmental and social impacts associated with the development. The following comparison of environmental impacts of the alternative sites was based on a qualitative assessment of the impacts for each of the alternative sites compared to Tharbogang. As both Wambulgal and Tyson would need to be used to provide a feasible alternative to Tharbogang, the combined impacts of both need to be considered, when selecting the preferred option. The assessment was based on previous studies carried out for each of the alternative sites, site inspections and review of GIS data provided by Council. Based on the assessment a score out of 10 was given for each of the sites, with a higher score indicating greater impact, and a low score indicating a low impact.

4.2 Flora and Fauna

The impacts on flora and fauna in particular threatened species and clearing of vegetation is a significant environmental impact that needs to be assessed. A flora fauna assessment of the alternative sites was completed by GHD (2007). The key findings of this study are summarised in the table below.

Table 4-1 Flora and Fauna Impacts (GHD, 2007)

Parameter	Site		
	Tharbogang	Wambulgal	Tyson
Removal of Vegetation consisting mostly of Inland Rocky Hills Woodland and Western Peneplain Woodland will be removed.	Approximately 60 ha	Approximately 36ha	Approximately 61 ha
Threatened Biota Impacts	Localised Extinction of at least one threatened fauna species (Grey-Crowned Babbler)	Localised Extinction of at least one threatened fauna species (Grey-Crowned Babbler) Potential displacement of one EPBC 1999 listed Migratory species (Rainbow Bee-eater) Localised extinction of the rare ROTPA listed plant Lomandra patens	Localised Extinction of at least four threatened bird species (Grey-Crowned Babbler, Speckled Warbler, Diamond Firetail, Hooded Robin)
		In addition 15 threatened birds (including migratory species listed under the EPBC Act); four threatened mammals, four threatened plants and one endangered population are likely to inhabit Tysons Pit, Wambulgal Quarry or both. These are likely to be impacted by quarry development at the two sites.	

The GHD (2007) study concluded that the proposed development should be undertaken at the Tharbogang site. As noted in the GHD report, the premise for this decision is based upon two main reasons:

1. Confinement of the proposed activity to an already modified area; and

2. The potential impacts across a landscape as opposed to an individual site.

Section 4 Environmental and Social Impact Analysis

The GHD (2007) study concluded that the proposed development should be undertaken at the Tharbogang site. As noted in the GHD report, the premise for this decision is based upon two main reasons:

1. Confinement of the proposed activity to an already modified area; and

2. The potential impacts across a landscape as opposed to an individual site.

The GHD study states "Tysons Pit and Wambulgal Quarry are both located in different areas of the Griffith locality and have different flora and fauna values attributed to their size, connectivity and surrounding land uses. If the proposed activity was not to proceed at the Tharbogang site then the potential impacts would be spread to two other sites which have known significant flora and fauna values in addition to the existing operating Tharbogang landfill and quarry site. Effectively GCC would be reducing the flora and fauna values across three sites within the locality as opposed to increasing the impacts upon the flora and fauna values of one site" (namely Tharbogang).

4.3 Air, Noise and Vibration Impacts

Air, Noise and Vibration impacts are primarily a function of the proximity of the proposed activity to residential dwellings and number of dwellings. Quarry and landfill operations can cause noise from machinery movement and noise and vibration from blasting. Outlined in the table below is the estimated number of residences located within 1km of each of the site boundaries based on a site inspection and review of aerial photographs.

Table 4-2 Approximate Number of Residences within 1km buffer

Parameter	Site		
	Tharbogang	Wambulgal	Tyson
Number of Residences within 1km buffer of site boundary.	21	4	1

As noted in the above table the majority of residences are located within 1km of the existing Tharbogang Quarry site boundary. These residences are located primarily to the west of the site within the adjoining horticultural belt (refer to **Figure 2**). It is noted that extraction at both the Wambulgal and Tyson sites will primarily be from the highest points on the sites (i.e. the crest of the hills), thereby providing no natural barrier between the proposed operations and the residences. Tharbogang however, will involve extraction primarily from the eastern face and the crest located on the western boundary of the site will remain, thereby providing some protection for dwellings located further west of the site. This barrier will potentially (subject to detailed environmental impact assessment studies) reduce the air, noise and vibration impacts on these residences.

4.4 Traffic Impacts

Traffic impacts associated with the proposed activity are related to the number of vehicle movements generated by the operation, the type of vehicles used to transport material to and from the site, the haulage distance and number of residences located along the route taken. Given the annual tonnages of material and type of vehicles used for each of the sites are similar, the key differentiating factor between Tharbogang and the Wambulgal/Tyson sites would be the haulage distance and route travelled. It is understood the majority of roadworks for which gravel is required would occur towards to the north east of the Griffith city centre in the Collina area and industrial sites through out the area. Future development areas are located to the south and west of the city centre. The haulage distance given in the table below has been estimated based on the shortest road route from each of the quarries to the city centre.

Table 4-3 Estimated Haulage Distance

Parameter	Site		
	Tharbogang	Wambulgal	Tyson
Approx one-way haulage distance	9.5km	19.2km	22km

As shown in the above table the haulage distances from both the Wambulgal and Tyson sites are significantly greater when compared to Tharbogang. Taking into consideration that no detailed traffic impact assessment was carried out for this options study, given the greater haulage distance the potential traffic impacts from the Wambulgal and Tyson sites are considered greater than for the Tharbogang site.

4.5 Groundwater

The groundwater suitability for all three sites is classified as "low" based on GIS information provided by Council. The impacts on groundwater from the proposed quarry/landfill operations are considered similar for each of the sites, however by utilising both Wambulgal and Tyson the potential impacts are spread across two sites, compared to utilising only the Tharbogang site. Therefore when considering the impacts on groundwater, the preferred option would be to continue the quarry/landfill activities at the existing Tharbogang site.

4.6 Summary of Environmental and Social Issues

Based on the above preliminary assessment, a score out of 10 for each of the criteria was given for each site, with a higher score indicating increasing impact.

Table 4-4 Summary of Environmental and Social Impacts

Parameter	Site		
	Tharbogang	Wambulgal	Tyson
Flora/Fauna	5	6	7
Air/Noise/Vibration	6	4	5
Traffic	3	6	5
Groundwater	3	3	3
Overall Score	17	19	20

As shown in Table 4-4, compared to impacts arising from the Wambulgal and Tyson sites, the Tharbogang expansion is preferred from an environmental perspective. If the cumulative environmental impact of using both the Wambulgal and Tyson sites is considered, then it is clear the Tharbogang site is preferred. It is noted that this is based on a desktop qualitative assessment using information from previous studies and GIS data provided by Council. A more detailed environmental assessment would be carried out for the preferred site.

Section 5 Conclusion

5.1 Conclusion

Based on the financial and environmental assessment carried out, the preferred option for the location of future quarry and landfill in the Griffith LGA is the existing Tharbogang site and associated expansion. The Tharbogang site offers a recoverable quarry resource with a life of around 47 years compared with the combined resource estimate available from both Wambulgal and Tyson of only 16 years.

The costs associated with development and operation of the alternative sites (Wambulgal / Tyson) is greater than the Tharbogang option, in particular the haulage costs given the extra distance from the Griffith city centre compared to Tharbogang. Finally, by utilising the Tharbogang site, Council will be confining the environmental and social impacts to one site, on which the current quarry/landfill operations are taking place, compared to spreading the impacts across two sites if the alternative Wambulgal /Tyson option was chosen.

If the Tharbogang site was not selected, Council would need to identify and develop a new site within 16 years, following extraction of the resource from the Wambulgal and Tyson sites, which will require further assessment and development costs. Given the limited availability of suitable sites within the Griffith LGA it is likely that the Tharbogang site expansion would need to be reconsidered.

Section 6 References

Coffey 2007, *Geological Assessment Stage 2 Proposed Quarry Extension, Tharbogang Landfill, Griffith NSW,* Coffey Geotechnics prepared for Griffith City Council.

Coffey, 2008, *Tharbogang Quarry and Landfill Pit Designs*, emailed to Griffith City Council dated 10 Jan 08

Douglas, 1991, Report on Geological Investigation for Proposed Road and Aggregate Quarries, Griffith NSW, D.J Douglas & Partners Pty Ltd prepared for Griffith City Council.

GCC, 1995, *Statement of Environmental Effects for the quarries known as Dare Road, Wambulgal, Tyson and Shaw Road Quarries within the City of Griffith* prepared by Griffith City Council.

GCC, 2007 *Assessment of Options for Quarry and Landfill*, Griffith City Council (GCC)

GHD, 2007 *Report for Flora and Fauna Assessment of Alternative Quarry Sites*, GHD prepared for Griffith City Council.

Section 7 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Griffith City Council and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 4 September 2007.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between October 2007 and April 2008 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Figures

Tyson Road Site

Tharbogang Site

Griffith City Centre

Wumbulgal Site

Barren Box Swamp

HILLSTON RD

RANKINS SPRINGS RD

BURLEY GRIFFIN WY

Mirrool Ck

DARLINGTON POINT RD

LEETON GRIFFITH RD

STURT HWY

Legend:

- Griffith LGA Boundary
- Potential Sites
- Main Roads
- Site Access from Griffith City Centre

N

0 5 10 kilometers

SOURCE: Griffith City Council and MapInfo StreetPro Data.
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Drawn: BH	Approved: CL	Date: 04/02/2008
Job No: **43177543**	File: 43177543.005.wor	

Client: CLIENT NAME

Project: PROJECT TITLE

Title: **SITE LOCATION**

Figure: **1**

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Legend:

- Griffith LGA Boundary
- Potential Site Boundary
- 1km Site Buffer
- Remnant Vegetation

N

Drawn: BH	Approved: CL	Date: 07/04/2008
Job No: **43177543**	File: 43177543.004.wor	

Client

GRIFFITH CITY COUNCIL

Project

QUARRY/LANDFILL CBA

Title

THARBOGANG SITE CHARACTERISTICS

Figure: **2**

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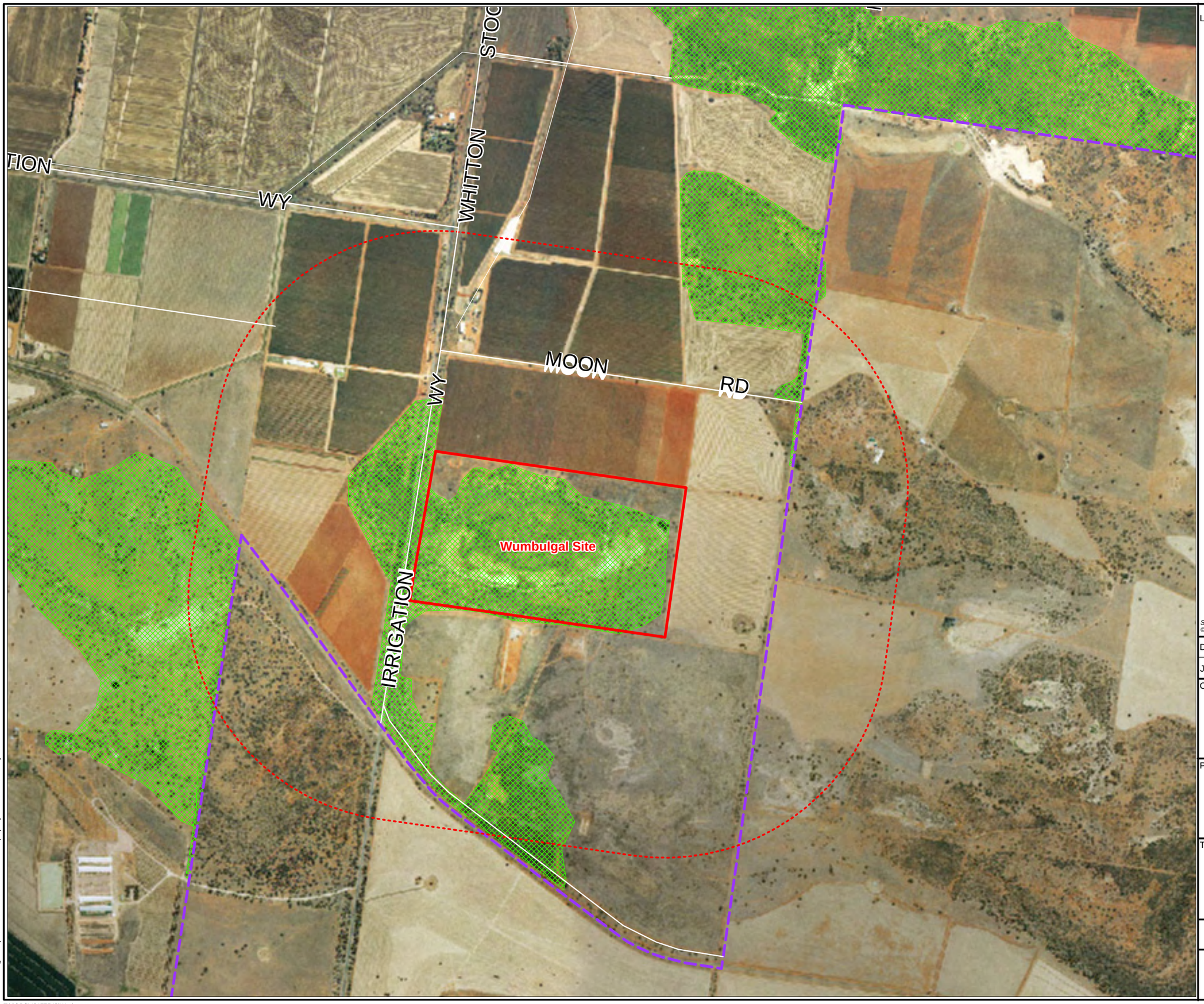

Legend:

- Griffith LGA Boundary
- Potential Site Boundary
- 1km Site Buffer
- Remnant Vegetation

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GRIFFITH CITY COUNCIL

Project

QUARRY/LANDFILL CBA

Title

WUMBULGAL
SITE CHARACTERISTICS

Figure: **3**

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Legend:

- Griffith LGA Boundary
- Potential Site Boundary
- 1km Site Buffer
- Remnant Vegetation

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SOURCE: Griffith City Council and MapInfo StreetPro Data.
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Project

QUARRY/LANDFILL CBA

Title

TYSONS ROAD
SITE CHARACTERISTICS

Figure: **4**

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