Appendix 3

Community Information Sheets

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Cooma Road Quarry - Continuation Project Community Information Sheet No.1

December 2011

Who is Holcim Australia?

Holcim (Australia) Pty Ltd (Holcim Australia) is one of the country's leading producers and suppliers of construction materials such as concrete and quarry products.

The company has been serving the Australian construction industry since 1901, originally under the well-known brands Readymix and Humes. Many of Australia's most iconic landmarks have been built using our products, such as Australia's Parliament House in Canberra and Sydney's M7 Motorway.

Today Holcim Australia has a network of over 200 concrete plants and 88 quarries, including the Cooma Road Quarry south of Queanbeyan in New South Wales. Holcim Australia provide high quality concrete and quarry products to a diverse range of customers. Quarry products include rail ballast, aggregates, gravels, road pavement materials, manufactured and natural sands. These basic materials are essential construction products that go into making concrete and help to build schools, hospitals, roads, bridges, airports and other infrastructure as well as commercial buildings – all necessary for our communities to function.

Holcim Australia focuses on community and environmental concerns both during and after its quarrying operations. The company is committed to developing and maintaining long-term relationships with all stakeholders by communicating openly, honestly and in a transparent manner.

Purpose of this Information Sheet

To meet current and predicted market demand for quarry materials in the Queanbeyan and Canberra regions, Holcim Australia has recently submitted an application to request DGRs seeking to continue quarry operations for another approximately 11 years at the existing Cooma Road Quarry. The purpose of this Community Information Sheet is to provide a general overview of the Cooma Road Quarry Continuation Project (the Project), including an outline of the existing operations, a description of the proposal, the associated planning and approvals process and importantly, how the local community can remain informed and involved in this process.

Cooma Road Quarry - Continuation Project

Community Information Sheet No.1

Cooma Road Quarry Operations

Cooma Road Quarry is located approximately 6 kilometres south of Queanbeyan and 11 kilometres south-east of Canberra, and has been operating at the current site since 1959. The current development consent for Cooma Road Quarry was granted on 26 October 1995 by Queanbeyan City Council. Cooma Road Quarry is a significant regional supplier of granite and dacite hard rock aggregates with a current maximum annual extraction limit of 1 million tonnes per annum (Mtpa).

What is Proposed?

The current development consent for the Cooma Road Quarry will expire in 2015, however, there will still be rock resources available for quarrying at the site. The proposed Project will involve extending the life of the quarry to allow for extraction of these remaining resources. Extending the life of the existing site is consistent with best practice utilisation and sustainability of natural resources.

The Project will provide important construction resources to support the planned future growth and development of the Canberra and Queanbeyan regions.

Approval will be sought for the following:

- extension of the previously approved extraction boundary;
- relocation of the existing workshop, truck parking and temporary stockpiles;
- addition of a mobile pug mill and mobile asphalt plant; and
- increasing the maximum annual extraction limit from 1 Mtpa to 1.5 Mtpa.

Cooma Road Quarry currently operates 6am to 6pm Monday to Saturday. Holcim Australia propose to increase the hours of operation from 6am to 10pm Monday to Friday and 6am to 6pm on Saturday in order to allow for increased flexibility to supply material for certain projects and to accommodate the increased extraction rate.

As part of Holcim Australia's commitment to improving sustainable development, approval will also be sought to enable the site to carry out concrete recycling for re-use as product. Strict control conditions will apply to the concrete recycling process including:

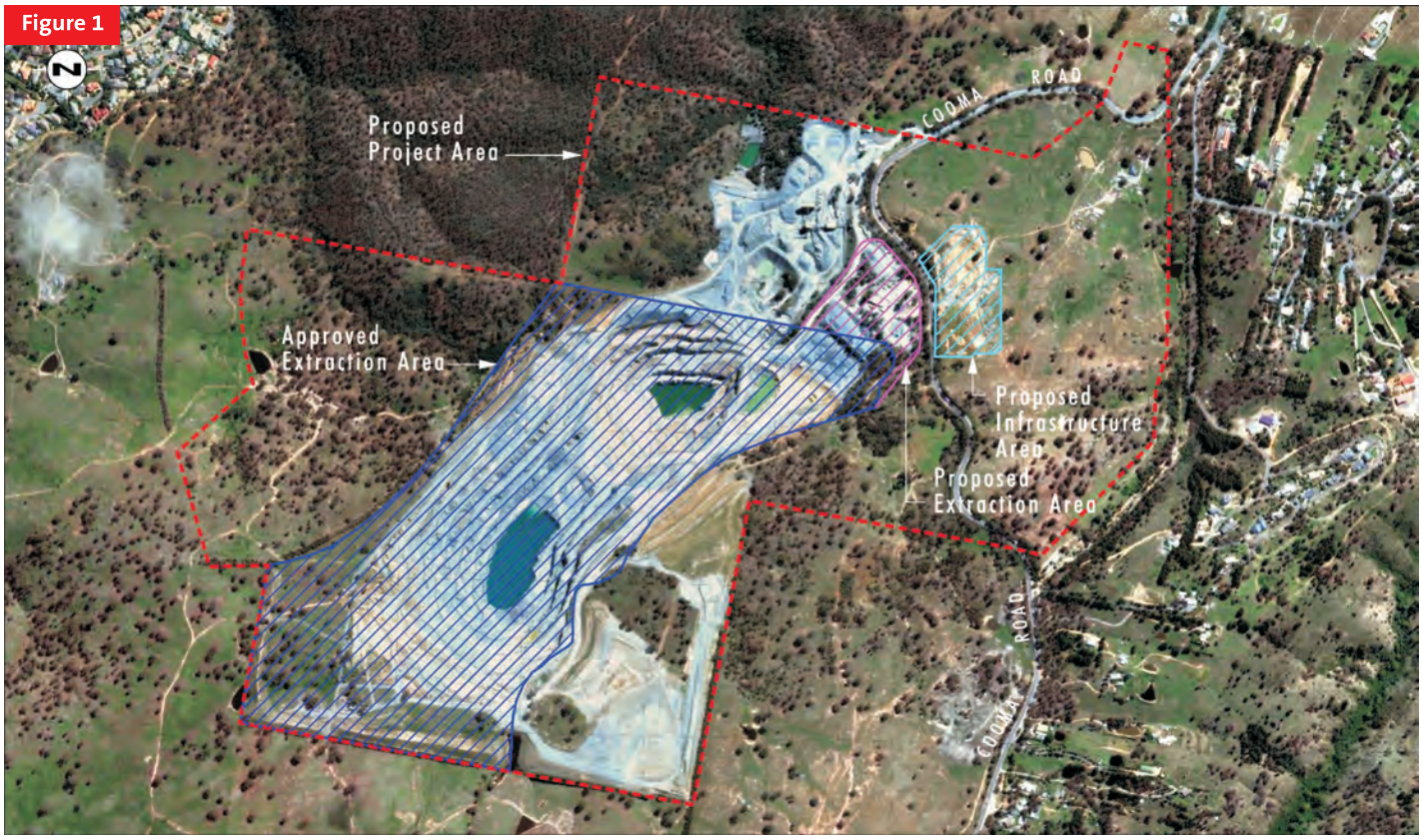
- the receipt of clean concrete from approved suppliers only;
- proof of origin of the concrete; and
- validation of returned concrete material to confirm it is free of general waste materials, wood, paper and metals.

The validated clean concrete material will be stored on site and recycled through the current on-site processing plant in accordance with all appropriate environmental management controls.

All other aspects of the quarry operations will remain unchanged.

Figure 1 shows the Cooma Road Quarry site layout including the proposed extraction area boundary and proposed new infrastructure area.

Figure 1



What planning and approvals will be required?

Approval under the *Environmental Planning and Assessment Act 1979* will be required for the Project. A development application will be submitted to the NSW Department of Planning and Infrastructure which will be supported by an Environmental Impact Statement (EIS).

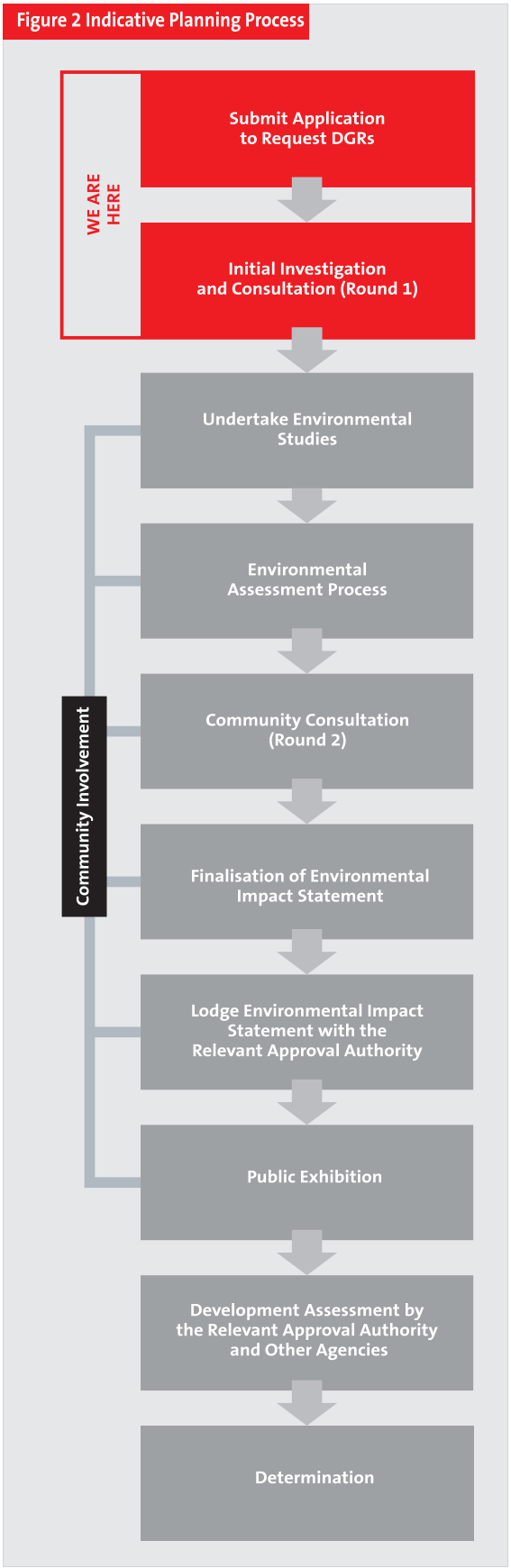
Umwelt (Australia) Pty Limited (Umwelt), an Environmental Consultant, has been engaged by Holcim Australia to assist with conducting environmental studies and preparation of the EIS. An outline of the indicative planning and approvals process is provided in Figure 2.

What will be assessed?

Comprehensive environmental assessments have been commenced to identify the potential environmental impacts of the Project and how best to manage these impacts. Potential impacts will be managed through detailed project and operational designs to avoid or minimise these impacts.

The EIS will address all potentially relevant environmental and community issues, with key focus areas including air quality, noise, water, traffic, greenhouse gas and energy, and rehabilitation and closure of the site.

Figure 2 Indicative Planning Process



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Community feedback and how you can be involved

Holcim Australia believes that ongoing communication with the community we live and work in is an important aspect of corporate social responsibility. The company is committed to engaging with local communities in a transparent and responsible way to ensure a positive, long-term partnership exists with communities. As a result, community input will be a key element of the Project to ensure that any community concerns are recognised and incorporated into project planning and considered in the EIS.

We would appreciate your feedback on the proposal and any issues you would like considered in the EIS. We invite you to provide feedback by completing the enclosed feedback form and returning it in the envelope provided. Alternatively, if you would like to meet with representatives from Holcim Australia and Umwelt to discuss the Project further, please contact Rachel Heath (Holcim Australia) or Kirsty Davies (Umwelt) on the contact numbers provided.
Holcim Australia will provide the community with further information on the results of the studies being undertaken as part of the EIS via a subsequent information sheet.

There will be further opportunity for the community to provide comments during the public exhibition phase of the EIS process. We will provide details on this closer to lodgement of the EIS in 2012.

Once again, we encourage your involvement and look forward to working with you throughout this process.

Further Information

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Kirsty Davies

EIS Project Manager
Umwelt (Australia) Pty Limited
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Cooma Road Quarry Community Feedback Form

Comments/Questions .....

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Name ..... Address .....

Telephone ..... Email .....

Preferred method for ongoing consultation: Mail [ ] Email [ ] Telephone [ ] In person [ ]

NB. Your contact details will only be used for the purpose of providing you with information about this project.

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Cooma Road Quarry - Continued Operations Project Community Information Sheet No.2

August 2012

Cooma Road Quarry - Continued Operations Project

Community Information Sheet No.2

Who is Holcim Australia?

Holcim (Australia) Pty Ltd (Holcim Australia) is one of the country's leading producers and suppliers of construction materials such as concrete and quarry products.

The company has been serving the Australian construction industry since 1901, originally under the well-known brands Readymix and Humes. Today Holcim Australia has a network of over 200 concrete plants and 88 quarries, including Cooma Road Quarry, south of Queanbeyan.

Holcim Australia provides high quality concrete and aggregate products to a diverse range of customers. These basic products are essential building materials for roads, bridges, schools, hospitals, airports, commercial buildings and other infrastructure.

Purpose of this Information Sheet

To meet current and predicted market demand for quarry materials in the Queanbeyan and Canberra regions, Holcim Australia intends to seek approval to continue operating Cooma Road Quarry beyond the expiration of the existing site development consent in October 2015.

This is the second community information sheet prepared in relation to the Comma Road Quarry Continued Operations Project (the Project). It provides a general Project update, outlines the community feedback on the Project from consultation undertaken to date and presents the key findings of detailed environmental studies undertaken for the Project.

Also provided are details of the planning and approvals process and information on how the local community can continue to be involved in this process.

Cooma Road Quarry Continued Operations Project

Cooma Road Quarry has been operating since 1959 and is a significant regional supplier of granite and dacite hard rock aggregates used in construction. The current development consent for Cooma Road Quarry will expire in October 2015, however there will still be rock resources available for quarrying at the site. Holcim Australia proposes to extend the life of the quarry and extend the existing quarry pit to allow for extraction of these remaining resources.

The Project also involves:

- extension of the approved extraction boundary to the north (refer to Figure 1);
- increasing the maximum annual production limit from 1 Mtpa to 1.5 Mtpa to meet predicted increases in peak demand for construction materials associated with the future growth and development of the region;
- allowance to receive quarry materials from other Holcim sites for crushing and screening (as required) and then sale. Total product (including from both material quarried from the site and from materials imported to the site) will be maintained within the total production limit of 1.5 Mtpa;
- relocation of the existing workshop, truck parking and temporary stockpiles;
- addition of a mobile pug mill; and
- recycling of clean concrete on site for re-use as product.

Since the Community Information Sheet 1 (CIS 1) was prepared in December 2011, there have been some changes to the Project driven by the outcomes of community consultation, environmental studies and changes in business need. These changes include:

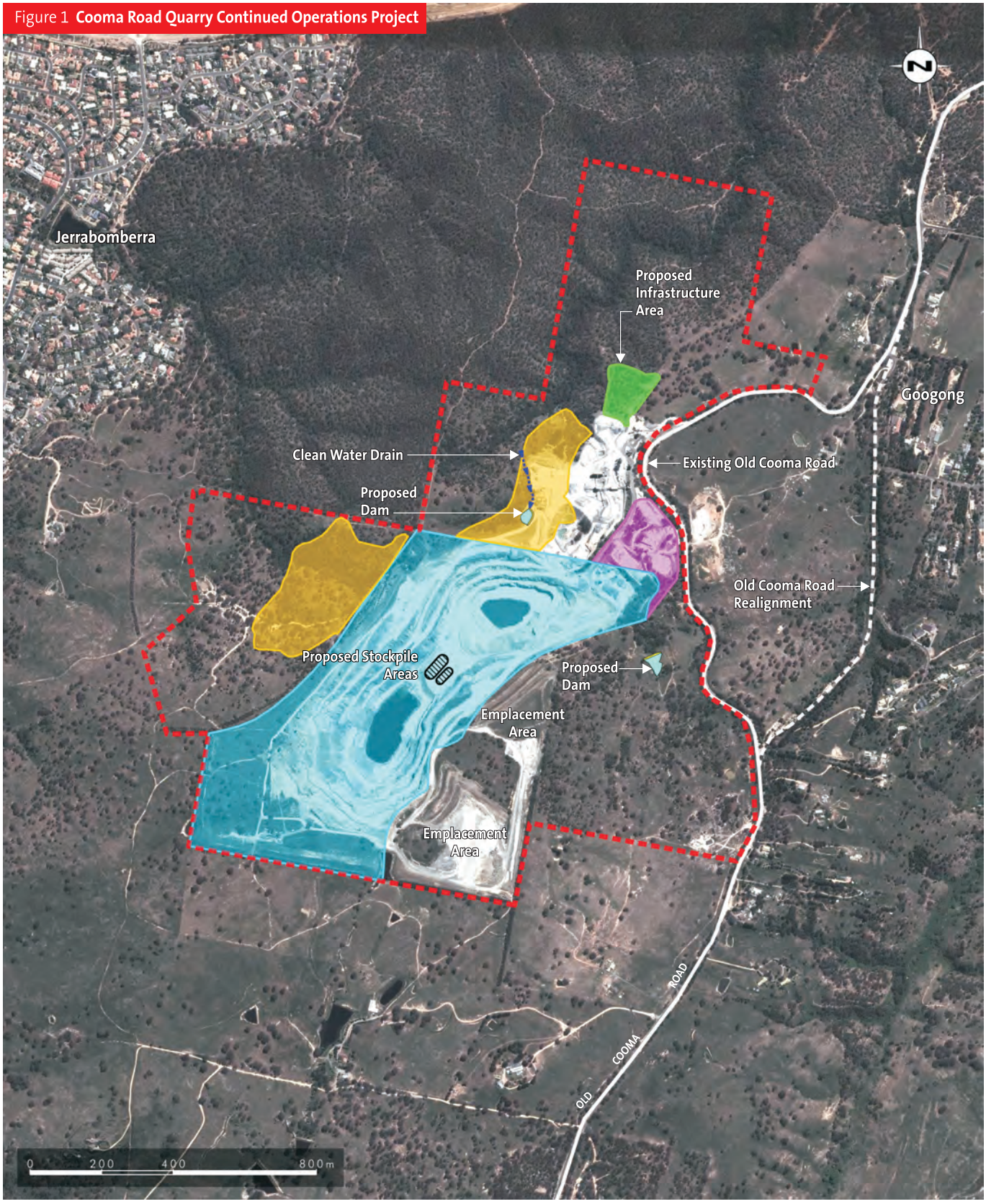
- the proposed infrastructure area has been moved from the eastern side of Old Cooma Road to the western side of Old Cooma Road, to an area previously approved for the construction of quarry infrastructure (refer to Figure 1);
- the proposal to receive quarry materials from other sites for crushing and screening. It is noted that there will be no change in the proposed maximum number of truck movements associated with this aspect of the Project; and
- an increase in the Project life to 20 years.

Cooma Road Quarry currently has approval to operate from 6am to 6pm Monday to Saturday, with general maintenance permitted until 10pm and truck movements associated with delivery vehicles returning to site permitted until 8pm.

Holcim Australia proposes to increase the hours of operation for certain activities from 6am to 10pm Monday to Friday and 6am to 6pm on Saturday in order to allow for increased flexibility to supply material for projects and to accommodate the increased production rate.

The activities undertaken during these extended operating hours will be limited and will not include blasting, primary crushing, hauling rock from the pit, truck loading or trucks departing the site. The 8pm curfew for empty trucks returning to the site will remain 8pm.

Figure 1 **Cooma Road Quarry Continued Operations Project**



Legend

- Proposed Project Area
- Existing Approved Extraction Area
- Proposed Additional Extraction Area
- Existing Approved Disturbance Area - Workshop
- Existing Approved Disturbance Area - Overburden Emplacement
- Proposed Dam
- Clean Water Drain

Benefits of the Project

The Queanbeyan and Canberra region is forecast to experience significant growth over the next 15 years, with population expected to increase by 25%. This is reflected locally by the planned construction of the new townships of Googong and Tralee.

There are limited sources of quarry material within the region to support this growth and the Project will make a significant contribution to the local and regional economies through the ongoing supply of cost effective, high quality construction materials to support ongoing development of the community.

The Project will also provide for the continued employment of the existing 33 quarry staff and drivers, plus employment of up to 10 additional staff, with flow on effects to the local and regional economy.

Community Feedback on CIS 1

The key issues raised by the community following distribution of the Community Information Sheet 1 included:

- traffic, particularly in relation to frequency of truck movements, noise, road safety including for cyclists, road condition and maintenance;
- air quality and potential increases in dust emissions;
- proposed changes to the operating hours;
- blasting and vibration;
- surface and groundwater impacts, including the sourcing of water, potential downstream impacts and water quality; and
- potential endemic flora impacts and offsetting.

Thank you to all those residents who have taken the time to contact us and provide feedback on this Project. These issues have been assessed as part of the detailed environmental studies undertaken for the Project and, where appropriate, specific management measures have been proposed to minimise potential environmental and community impacts.

Environmental Studies Findings

The detailed environmental studies to be included in the Environmental Impact Statement (EIS) for the Project are now largely complete. An overview of the key findings of these studies is provided below.

Traffic

An increased production capacity will enable an increase in heavy vehicles when required to meet peaks in demand. This increase has been assessed and is expected to be readily accommodated by the existing road network. The changes to the road network planned by Council will further increase road capacity and further reduce any potential impacts, including for cyclists with the addition of an off road cycle path planned as part of the Old Cooma Road duplication.

When compared to existing conditions, there will be minimal to no change in the operating conditions of local intersections due to the additional traffic from the Project. Most importantly, the Project is not expected to have a negative impact on road safety. Holcim Australia is committed to zero harm through its Zero4Life initiative, which aims to eliminate all preventable vehicular incidents. This is supported by Holcim Australia's driver safety training which is provided to quarry staff.

Water Resources

An assessment of the potential surface water impacts of the Project has been undertaken and found that the Project will have a minimal impact on the surface water of the surrounding region.

The existing site water management system will be altered to improve the management of disturbed and undisturbed catchment runoff. Holcim Australia will also continue to monitor the water quality of any water discharged from the site to Barracks Creek in accordance with its existing Environment Protection Licence.

Cooma Road Quarry has negligible interaction with groundwater and the Project is not anticipated to adversely affect local or regional groundwater aquifers or groundwater users.

Visual

Cooma Road Quarry is largely shielded from view from most directions due to the surrounding topography. This will not change as a result of the Project. The pit will remain isolated from view and additional tree planting will be undertaken around the proposed infrastructure area to assist in shielding it from public view.

Noise

An assessment of the noise impacts of the Project has been undertaken, with particular focus on activities proposed during the evenings.

To improve the environmental performance of the existing quarry and proposed Project, Holcim Australia has committed to implement a range of noise control measures including:

- reducing noise levels from the existing primary crushing plant;
- the management of mobile plant and stockpiles to minimise the number of machines running in exposed locations at any one point in time;
- the construction of an earth-berm beside the proposed infrastructure area and use of stockpiles to act as noise barriers; and
- not running the secondary crushing plant during the evenings (between 6.00pm and 10.00pm) under potentially adverse weather conditions.

These measures will result in a reduction in the levels of noise being generated by the Quarry compared to the existing situation.

Holcim Australia will engage an appropriately qualified acoustic engineer to undertake annual noise monitoring to confirm the operational noise levels of the Project and provide feedback on the effectiveness of noise controls.

Air Quality

An assessment of the Project's potential impact on local air quality has been undertaken. The assessment found that the Project will comply with the relevant air quality criteria at all nearby residences.

Holcim Australia will continue to monitor dust levels on a monthly basis and will continue to implement a range of dust controls on site, including:

- enclosure of the primary and secondary crushing plants and screening transfer points;
- dust collection during drilling operations;
- watering of unsealed roads, working areas and stockpiles;
- water sprays on conveyors;
- dust extraction system within the secondary crushing plant;
- minimising areas of disturbance at any one time; and
- truck wheel wash facility.

Archaeology & Heritage

A survey of proposed disturbance areas has found that no Aboriginal archaeological sites will be impacted by the Project.

Moses Morley's Lime Kiln is located to the south of Cooma Road Quarry pit and is a historic heritage site of local significance. The site will not be physically impacted by the Project, however Holcim Australia will implement a range of management and monitoring strategies to manage potential indirect impacts from vibration, and ensure the conservation of this locally important site.

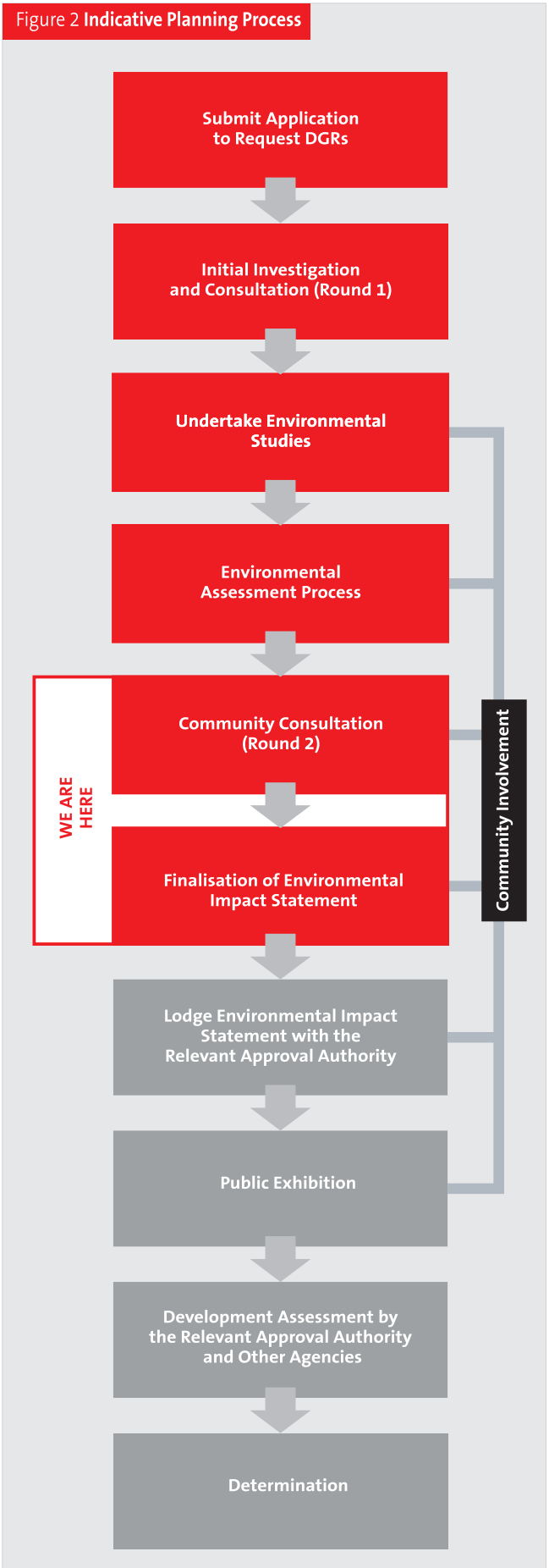
Ecology

The Project has been designed to avoid clearing of vegetation and will be located almost entirely on land that is previously disturbed or approved for disturbance under the existing Cooma Road Quarry development consent.

The ecological impacts of the Project have been assessed and found to be minimal.

Existing management measures for weed and feral animal control will continue to be implemented on an as needs basis.

Figure 2 **Indicative Planning Process**



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Where to from here?

Approval Process

The EIS for the Project is currently being finalised and will be lodged with the NSW Department of Planning and Infrastructure in the coming weeks. The EIS will include any further feedback from the community on the results of the environmental studies. Once lodged, the EIS will be assessed for adequacy and then placed on public exhibition. The Department will consider any submissions received during the public exhibition period in their assessment prior to the Project being determined.

Community Involvement

Holcim Australia believes that ongoing communication with the community we live and work in is an important aspect of corporate social responsibility. The company is committed to engaging with local communities in a transparent and responsible way to ensure a positive, long-term partnership exists with communities.

Community input has been a key element in the scope of the EIS and ultimate design of the Project. Now that the results of the environmental studies are available, we invite you to provide feedback by emailing us or completing the enclosed feedback form and returning it in the envelope provided.

Alternately, if you would like to meet with representatives from Holcim Australia and Umwelt to discuss the Project further, please contact Rachel Heath (Holcim Australia) or Kirsty Davies (Umwelt) on the contact numbers provided.

Further Information

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Kirsty Davies

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Phone: (02) 4950 5322

Holcim

Cooma Road Quarry Community Feedback Form

Comments/Questions .....

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Name ..... Address .....

Telephone ..... Email .....

Preferred method for ongoing consultation: Mail [ ] Email [ ] Telephone [ ] In person [ ]

NB. Your contact details will only be used for the purpose of providing you with information about this project.

Appendix 4

Groundwater Assessment

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

8 August 2012

Umwelt (Australia) Pty Limited
PO Box 838,
12/20 The Boulevarde
Toronto NSW 2283

Attention: Kirsty Davies

Dear Kirsty,

RE: Groundwater Assessment Cooma Road Quarry

Groundwater Assessment Cooma Road Quarry

As per our letter GEOTNEWS21034AA, below is Coffey's Ground Water Assessment, Cooma Road Quarry.

1. Introduction

Coffey Geotechnics has been engaged by Umwelt (Australia) Pty Limited (Umwelt) to assess the groundwater conditions at Cooma Road Quarry in Queanbeyan, NSW. The groundwater assessment is one of the Water Resource components of the Environmental Impact Statement (EIS) required by the Director-Generals Requirements (DGRs) under the Environmental Planning and Assessment Act 1979 (EP&A Act). The EIS is being prepared on behalf of the quarry operator, Holcim (Australia) Pty Limited (Holcim Australia), who is seeking to continue operations at Cooma Road Quarry.

The quarry has been in operation since 1959 and has an excavation footprint of approximately 25 ha. Two rock types are being quarried: (rhyo)dacite and Googong granite. The two rock masses are separated by an East-West trending Yarrabomberra shear zone. In the southern part of the quarry is the Dacite Pit, which occasionally holds water. In the northern part of the quarry is the Granite Pit, which typically holds water at or below the lowest bench. The benches are up to 10m high with a total of 7 benches in the highest (southern) portion of the excavation. Between the two pits is a 150 wide "nose", two benches high, that enables haul transport between and around the pits.

2. Surface Water Features

In order to quantify groundwater movement through or underneath the site, it is important to understand the interaction with surface water features, and establish whether they interact with the groundwater by means of recharge or discharge. For a surface water body such as pond, lake or stream to be

permanent, its water balance needs to be positive which means that precipitation minus evaporation must be matched, or exceeded by groundwater discharge. Based on data from the nearest climatic station at Canberra Airport (Bureau of Meteorology Site number 070014), the quarry is subject to about 31% more evaporation than precipitation. Only during occasionally wet periods will precipitation exceed evaporation (for example during March 2012), but a surplus rainfall condition will typically not persist for longer than a few months. On average, the site receives 595 mm annually (long-term average of three nearest rain gauges: Googong (Station 70347, Fernleigh Drive), Queanbeyan (Station 70072, Bowling Club), and Tuggeranong (Station 70339, Isabella Plains). The annual potential evaporation measured at Canberra Airport is 1126 mm (Appendix A and B). This means the site is in an area of precipitation deficit. For streams and quarry pits to continuously hold water, they must continuously be receiving groundwater in order to maintain their water level. No evidence that surface run-on is occurring at the quarry has been observed. A small unnamed stream at the southern rim of the quarry is dammed off and acts as a stock pond to the upstream property. To establish a relationship between the stock pond, water levels in the pit lakes, the two downstream sedimentation ponds, and the outfall below the site's water management dam, all site surface water features have been surveyed for elevation. Surveying was performed on 8 June 2012 by Leach-Steger, registered land surveyors. The survey results are shown in Figure 1.

2.1 Elevations of Surface Waters

The elevations of the surface water features are sketched in Figure 2, plotting elevation versus northing coordinate. The highest elevated water body is a small dammed-off creek at the south rim of the pit. It's elevation is 74 metres above the nearest on-site water body, which is the Dacite Pit. Minimal seepage was evidenced in the pit wall, suggesting disconnected water systems. Any overflow during storm events is expended by in-pit storage. A review of figure 2 yields several relevant findings, the important one being that the water level in the Granite Pit constitutes a site-wide low. The level in the Granite Pit is over 20 metres lower than in the Dacite Pit, and is over 5 metres deeper than the level in the Barracks Creek as measured at the toe of the sedimentation dam ("northern outfall"). For reference, the elevation of the Googong Reservoir on the Queanbeyan River, which parallels the excavation some 2 kilometres to the East, is shown on the graph, and it too has a higher elevation than the Granite Pit. The figure also lends itself for calculations of gradients, or slopes, between the respective water features. The gradient between Dacite Pit and Granite Pit, for example, is 0.10 m/m. The gradient across the sedimentation dam (northern outfall) is 0.07 m/m. Steep gradients typify reduced or absence of permeability, commonly encountered in tight formations such as massive rock. Contouring of water table data has been refrained from, because contouring of water elevation data in an impervious system may create a false sense of flow (Freeze and Cherry, 1979).

3. REGIONAL GROUNDWATER ASSESSMENTS

The Cooma Road quarry lies in the upland area of the Queanbeyan/Molongo catchment. The uplands lie mainly on erosion-resistant, ancient, Silurian volcanic rocks and Palaeozoic granites. Groundwater flow in this catchment is from a local flow system found within Palaeozoic rocks or Mesozoic intrusives (Bureau of Rural Sciences 2000; Beale et al. 2004). Local groundwater flow systems "have recharge and discharge areas within a few kilometres of one another. They tend to occur within individual subcatchments, in areas of higher relief such as foothills to ranges" (Bureau of Rural Sciences 2000, page 4). Because of this relatively short flow path, Ife and Skelt (2004) noted that water management planning in the catchment needs to consider surface water and groundwater as a single resource. In their study, Ife and Skelt (2004) noted that virtually no data were available for groundwater quality in highland areas associated with these groundwater subsystems. The average groundwater salinity in the Queanbeyan/Molongo catchment is 350 mg/L, a relatively good quality for any consumptive uses (Australian National Resources Atlas, anra.gov.au). This compares well to the surface water quality below the Googong dam which ranges from 400 to 550 mg/L, and where the increase over a donor

stream (i.e. Queanbeyan River) is attributed to evaporation (Tomkins et al, 2009). Other data on groundwater quality for the area, including groundwater contamination, were minimal. Apart from local sand and granite rock quarries in the upland area, the subsurface geology is not known to contain any metallic ores that may adversely affect groundwater quality (Beale et al. 2004).

3.1 Groundwater Elevations

In the bedrock setting of the quarry, only one aquifer can be discerned which is the perched aquifer on top of the dacite plateau (Figure 4). This perched aquifer is associated with the stock ponds upstream of the quarry; it is thin and disconnected and consists of colluvium and weathered bedrock. Because the quarried rock is massive with little or no primary porosity, groundwater potential exists only as secondary porosity and permeability and is associated with structural features such as faults, joints, shear zones, boundaries between lithological units, and weathering zones along structural fractures in faults and fissures. For the purpose of groundwater assessment at the quarry site, three monitoring bores have been installed to verify the groundwater potential of the granite subsurface. The well locations are shown in Figure 1 and identified by labels P1, P2 and P3. The focus was on the Granite Pit, because it was evident from the preliminary surface water elevations that the Granite Pit was the deepest, and therefore most likely to be in hydraulic communication with regional groundwater. The temporary wells were drilled on 21 June 2012 using a rock percussion rig with a bore of 85 mm. The observation wells were constructed of 51 mm diameter PVC flush-threaded casing and a 1.5 metre screen set at a depth of 12 metres below grade. The depth was chosen such that the bore would penetrate to below the lowest bench of the Granite Pit. Figure 2 shows the well screen bottom elevations. Each well completion was equipped with a slip-on bottom cap and a surface plug. Approximately 50 cm stick-up was allowed on these completions and the top-of-casing (ToC) elevation was surveyed to provide a reference level for depth-to-water measurements. ToC elevations are shown in Figure 1, and reduced groundwater elevations for the three wells are shown in Figure 3.

3.2 Groundwater Trends

Depth-to-water measurements have been taken over a one month period at approximately weekly intervals to discern groundwater trends. The data that was collected through to 17 July 2012 is shown in Figure 3. Bores P1 and P3, which are located at opposite sides for the Granite Pit, show a parallel trend with P3 (northern shore) always being approximately 1.5 metres lower than P1 on the southern edge of the pit. Well P2, which is located near the 1st sedimentation pond, has a groundwater elevation that is 25 metres higher than the water level in the Granite Pit. Closer inspection of trend in Figure 3 also shows an opposite trend in P1 and P3, as compared to the trend of P2 during weeks 1 and 2 of record. Where P1 and P3 are falling at almost 1cm per day, P2 is rising at about the same rate. These groundwater trends suggest that the 1st sedimentation pond is hydraulically disconnected from the Granite Pit. The difference in water elevation between P2 and P1/P3 is over 26 metres, suggesting a very tight formation separating these two water bodies. Only the lowest water level as observed in the Granite pit is deemed to be the regional groundwater level, the “region” being 2000 metres swath of landscape bounded by the Jerrabomberra water divide to the west and the Queanbeyan River to the east.

The Granite Pit will respond to groundwater fluctuations that in turn will be dependent on the surface water balance between rainfall and evaporation on the pit-scale, because groundwater inflow is hampered by the tightness of the rock formation. The sedimentation pond likely responds to operational input and output; it has a sediment bed that is impervious enough to maintain its elevation and is able to discharge only through the designed culvert system into the 2nd sedimentation pond at the downstream dam.

3.3 In-Pit Groundwater Flow Quantification

The quarry operation occasionally uses the Granite Pit for taking process water, mainly for dust suppression. During the site visit, on 22 May 2012, the pump was not running and no pumping records are kept. The pump setup can be seen on site photo in Figure 4. Based on pump inspection (25 kW, 200 mm discharge line, over 100m of static head), it can be estimated that no more than 50 m^3/hr (14 L/s) can be extracted from Granite Pit. A portion of this extracted process water flow returns to the 1st sedimentation pond, where fines are settled out, while remainder is deemed lost to evaporation. By assuming idealized conditions of a circular pit with a known extraction and drawdown in an adjacent observation well, the horizontal transmissivity of the rock systems can be calculated (Bruggeman, 1999). For a 90 metre diameter pit to influence drawdown by 1.5 metres (maximum elevation difference between Granite Pit and P3), the hydraulic conductivity can be estimated at 0.17 m/d (Appendix C). In terms of aquifer properties, this conductivity is very low. When using the relationship to a well's specific capacity, expressed as flow rate Q, divided by drawdown, this fractured granite system would yield to a well only 0.34 m^3/d, or 0.004 L/s, which is not considered a productive aquifer (Driscoll, 1989). Hence the quarried mass does not comprise an aquifer; the groundwater levels in the perched aquifer, if flowing, are independent of the water levels in the pits.

Direction of groundwater flow is complicated at the site by the fact that the Dacite Pit, and the 1st sedimentation pond are perched above the Granite Pit water level. The 2nd sedimentation pond, which is held by a clay-core dam at the downstream end of the site, may also be perched above the regional water table. A perched groundwater condition occurs when the subsurface permeability is so low that vertical flow is impeded and unsaturated conditions may persist below the perched aquifer or water body (Freeze and Cherry, 1979). The gradient between the upstream (southern Pit rim) and downstream ends of the site is 0.07, with general flow direction to the north. This model gets distorted when consideration is given to the low water level in the Granite Pit. Based on triangulation of water elevations in the area, all flow directions suggest convergence of flow to the Pit. It has been observed that the Granite pit intercepts a shear zone, the geological contact between the Dacite Volcanics and the Googong Granite. The E-W orientation of this feature, however, does not point to an obvious discharge point that would be lower than the pit water level. Log descriptions of exploration bores drilled in this shear zone do not suggest major voids or fracture sets: structures are described as "veins", "veinlets" and "quarts-healed fissures", supporting the tightness of the rock formation and the low permeability. It is therefore postulated that the evaporation from the Granite Pit (approximately 2.0 m^3/d in June) and the quarry's extraction (1200 m^3/d, assuming uninterrupted pumping) accounts for the low level in the Granite Pit. In terms of elevation, water level in the Granite Pit is below the outfall at the head of Barracks Creek. It is therefore unlikely that groundwater is flowing to the south from the outfall back to the Pit. The estimated quantity of groundwater passing through the Granite Pit is quantified below and is relatively small. Water levels are controlled by coalescing rainfall water, and evaporation, with process water (50 m^3/hr, at most) cycling through it.

3.4 Regional Groundwater Flow Quantification

The overall regional groundwater gradient is 0.07 in a south to north direction and conforms in general terms to the topography. Application of simplified modelling assumptions of Darcy's flow through a cross section of 90 metres of the quarry (cross sectional width of the quarry within the granite pit at the level of the regional groundwater (i.e. east to west) perpendicular to the perceived groundwater slope) and a hydraulic conductivity of 0.17 m/d yields a flux of 161 m^3/d. The volume of water is equivalent to direct precipitation of 16.1 mm onto the site's footprint area (20 ha, i.e. approximately 2.7 per cent of annual rainfall). When no surface water inflow is assumed, as none is observed during no-rain periods, this fraction constitutes groundwater recharge. The proposed extension of the Granite Pit will not increase the depth of the quarry and is not likely to increase the groundwater inflows. Furthermore, based on the above pit throughput calculations, hydraulic communication with the regional aquifer is very limited or even non-existent. Upon eventual quarry exhaustion, the created void will be filled by a

combination of groundwater and surface water. The total volume of water that is expected to accumulate in the final void is 2.9 million m^3 (25 ha x 11.6 m head), assuming groundwater rise up to the outfall threshold elevation of 665 mRL. Re-establishing the groundwater level in the reclaimed pit with groundwater only will take over 49 years (2.9Mm^3/161.2m^3/d). It will take surface water only two years to fill in the same void, based on 103 ha catchment and 595 mm/yr of precipitation. Therefore, the infill quality issue of the re-establishing reservoir will be more a matter of surface water than groundwater and will depend predominantly on rainfall distribution. Given the fact that for groundwater to enter the void it has to travel through bedrock, it may pick up solutes by contacting fracture and conduit surfaces. Both host rock types, granite and dacite, are relatively stable with respect to groundwater, so there is no concern regarding the potential for the quarried material to affect groundwater quality.

4. Conclusion

The volume of groundwater affected by the Cooma Road Quarry is limited to the exposed water table in the Granite Pit (i.e. approximately 90 metres wide). Water level in this pit is deemed to be true regional groundwater, based on its depth and trends. However, communication of the Pit with the nearest aquifers is limited as evidenced by the high local groundwater gradients that are in the order of 0.07 to 0.10. Other water bodies at the quarry, including the Dacite Pit and sedimentation ponds are perched water bodies, artificially maintained and hydraulically isolated so that they coalesce rain water but do not communicate with the regional groundwater. The occurrence of stock ponds high above the pit level indicates a separate perched aquifer, which is not affected by the quarry. If there is any hydraulic connection of the Granite Pit, it may be facilitated by an East-West trending shear zone between the granite and the dacite rock masses, however its orientation is perpendicular to the prevalent north to south sloping topography and therewith associated groundwater gradient. Water level records and bail-down tests on three temporary bores installed to assess the groundwater at the quarry suggest the granite rock has a very low permeability (cm/day) and based on the width of the quarry and the low hydraulic transmissivity, the interaction of the Pit with regional groundwater is very limited. With a prospective well yield of less than 0.01 L/s, the rock mass has not been proven to be a viable aquifer. Based on a hydraulic conductivity of 0.17 m/d (2.0 10^{-6} m/s), the groundwater flow through the 90 m wide section of pit that intercepts regional groundwater can be estimated as no more than161 m^3/day, or 1.9 L/s. This is the maximum groundwater flow feeding the outfall at the toe of the 2nd sedimentation pond and the Barracks Creek. Atop of this generalised flow system is the Granite Pit with depressed water level that forms a hydraulic sink. For it to remain a sink, it must be sited within a rock mass that has a very low permeability. This confirms that the quarry site is in tight rock formations where no meaningful groundwater extractions can be attained. As the quarry does not affect a viable aquifer, the conclusion is that its extension does not pose a threat to any regional groundwater resource. The proposed extension of the Granite Pit will not increase the depth of the quarry and is not likely to increase the groundwater inflows. Upon reclamation, the void is expected to refill with local surface water recharge over a period of two years under average precipitation conditions. It is considered that any evaporative losses from the final void will be primarily related to surface water volumes and should be licensed under surface water provisions. As such it is considered that post recovery of the final void no groundwater take will occur on the quarry site.

For and on behalf of Coffey Geotechnics Pty Ltd

Vit Kuhnel

Principal Hydrogeologist

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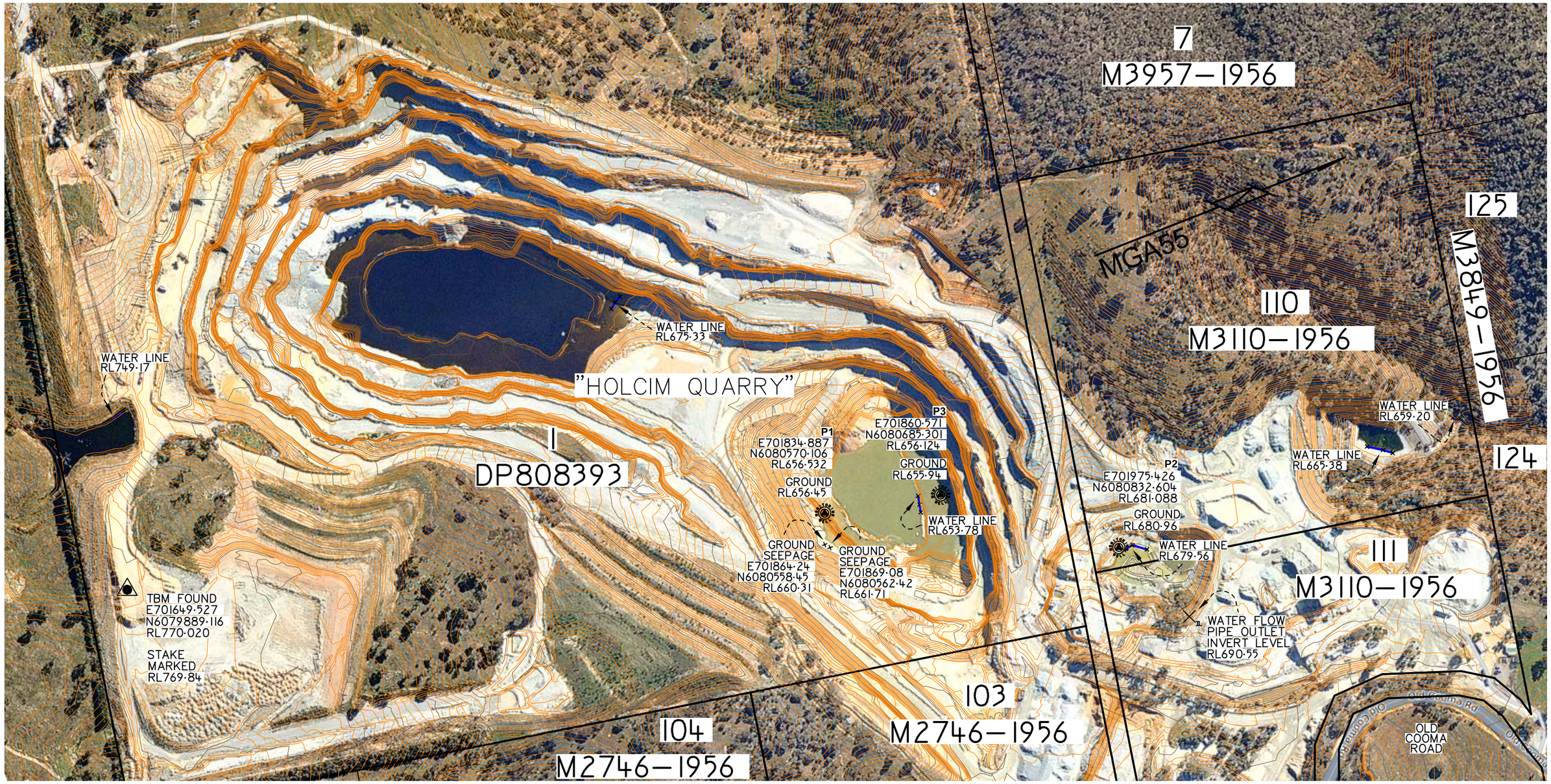
Figures



NOTES:

- INFORMATION ON THIS PLAN IS LIMITED TO THAT REQUESTED BY THE CLIENT, IS INTENDED FOR THE USE OF THE CLIENT AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.
- BOUNDARY INFORMATION SHOWN IS COMPILED FROM DP808393, DP1087429, M2746–1956 & M3110–1956. NO BOUNDARY INVESTIGATION / MARKING HAS BEEN UNDERTAKEN.
- BORE ELEVATIONS SHOWN REFER TO NORTHERN EDGE AT TOP OF PVC PIPE.
- UNDERGROUND SERVICES HAVE NOT BEEN LOCATED BY LEACH STEGER.
- GNSS METHODS HAVE BEEN USED IN THE DATA COLLECTION OF THIS SURVEY.
- DIMENSIONAL OR BOUNDARY INFORMATION SHOULD NOT BE EXTRACTED FROM DIGITAL ELEMENTS.
- CONTOURS SHOWN ARE PROVIDED AND SHOWN AS SURVEYED BY OTHERS.

LEGEND

BORE – MONITORING WELL
BOUNDARY – SUBJECT
WATER LINE 08/06/12

COORDINATE SYSTEM - MGA55 / AHD71

NAME	EASTING	NORTHING	HEIGHT	DESCRIPTION
BORE - P1	701834.887	6080570.106	656.532	BORE - MONITORING
BORE- P2	701975.426	6080832.604	681.088	BORE - MONITORING
BORE - P3	701860.571	6080685.301	656.124	BORE - MONITORING

		SURVEY	DRAWN	CHECK	APPROVED	ZONE	SURVEY	ISSUE
ORIGINAL ISSUE		JS	JS	JS	JS		08/06/12	12/06/12
AMENDMENTS	A	JS	JS	JS	JS			13/06/12
	B							
	C							
	D							
	E							

Notes:

12/06/12

Surveyor Registered Under the ACT Surveyors Act 2007

Prepared By:
LEACH·STEGER
REGISTERED LAND SURVEYORS
PO Box 58
WODEN ACT 2606
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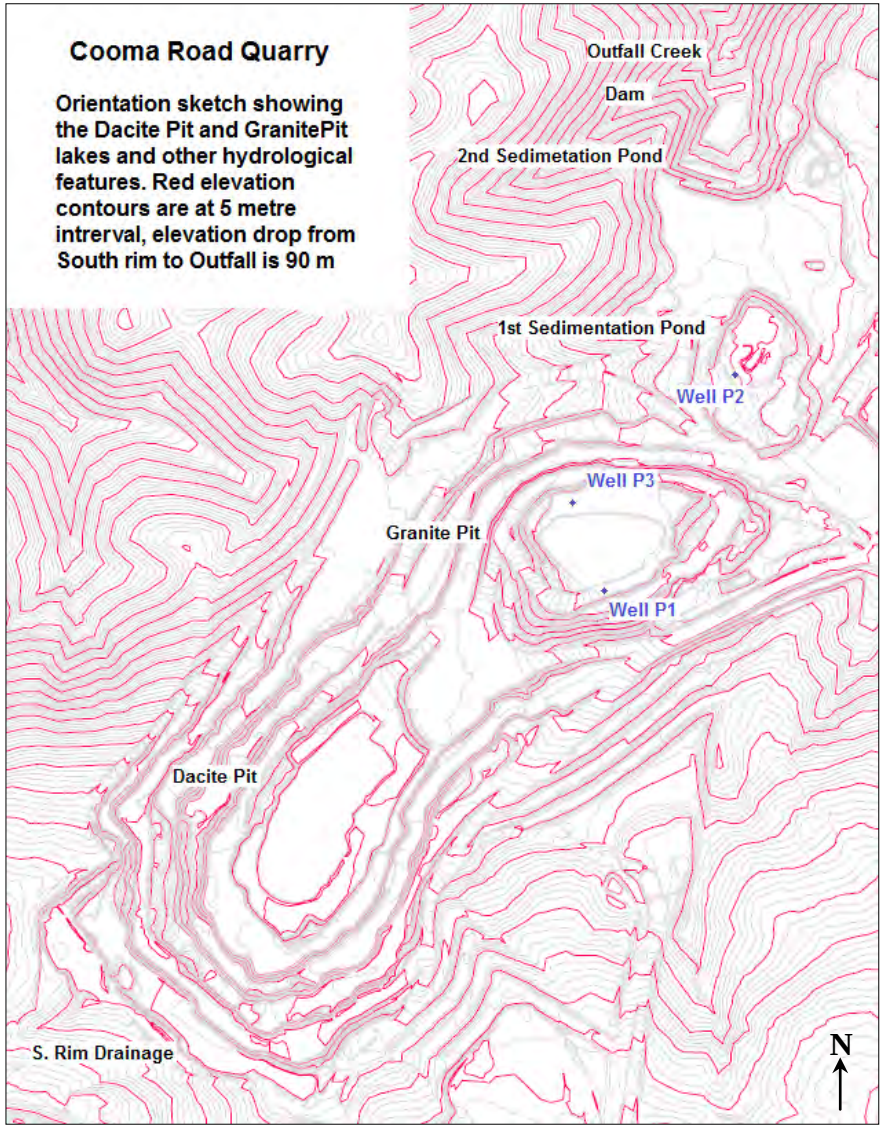
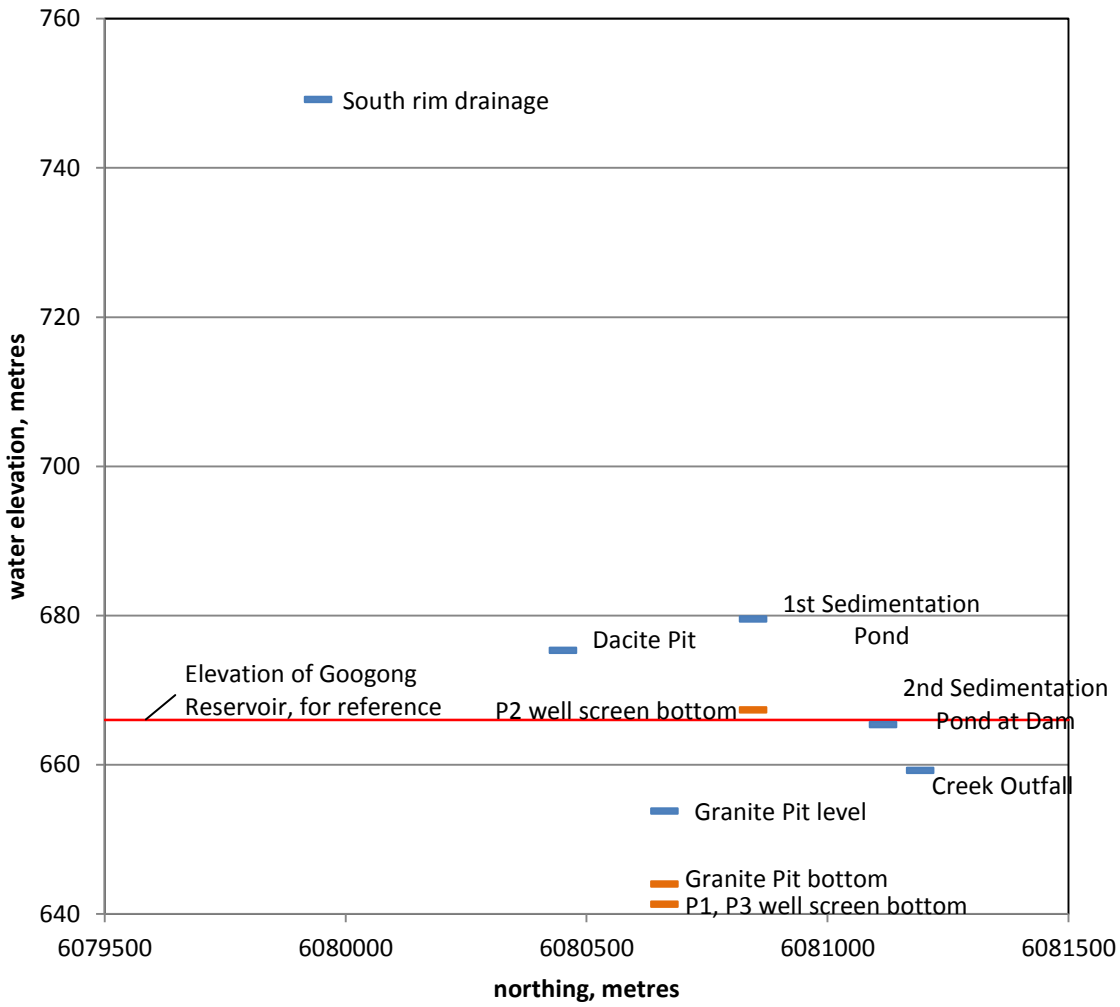
Client:
coffey geotechnics
SPECIALISTS MANAGING THE EARTH
47 DOGGETT STREET
NEWSTEAD QLD 4006

Horizontal Datum: MGA55
Vertical Datum:
MARK: PM55163
LEVEL: RL649.815
SYSTEM: AHD71
Contour Interval: 0.20m

Title: **MONITORING WELLS**
LGA: Q'BYAN LOT: 1
PARISH: GOOGONG PLAN: DP808393
COUNTY: MURRAY

Job: 12047
Scale (meters): 1:4000 (0 20 40 80 120)
Sheet: 1 of 1
Size: A3
Drawing: 12047_001_RevA.dwg





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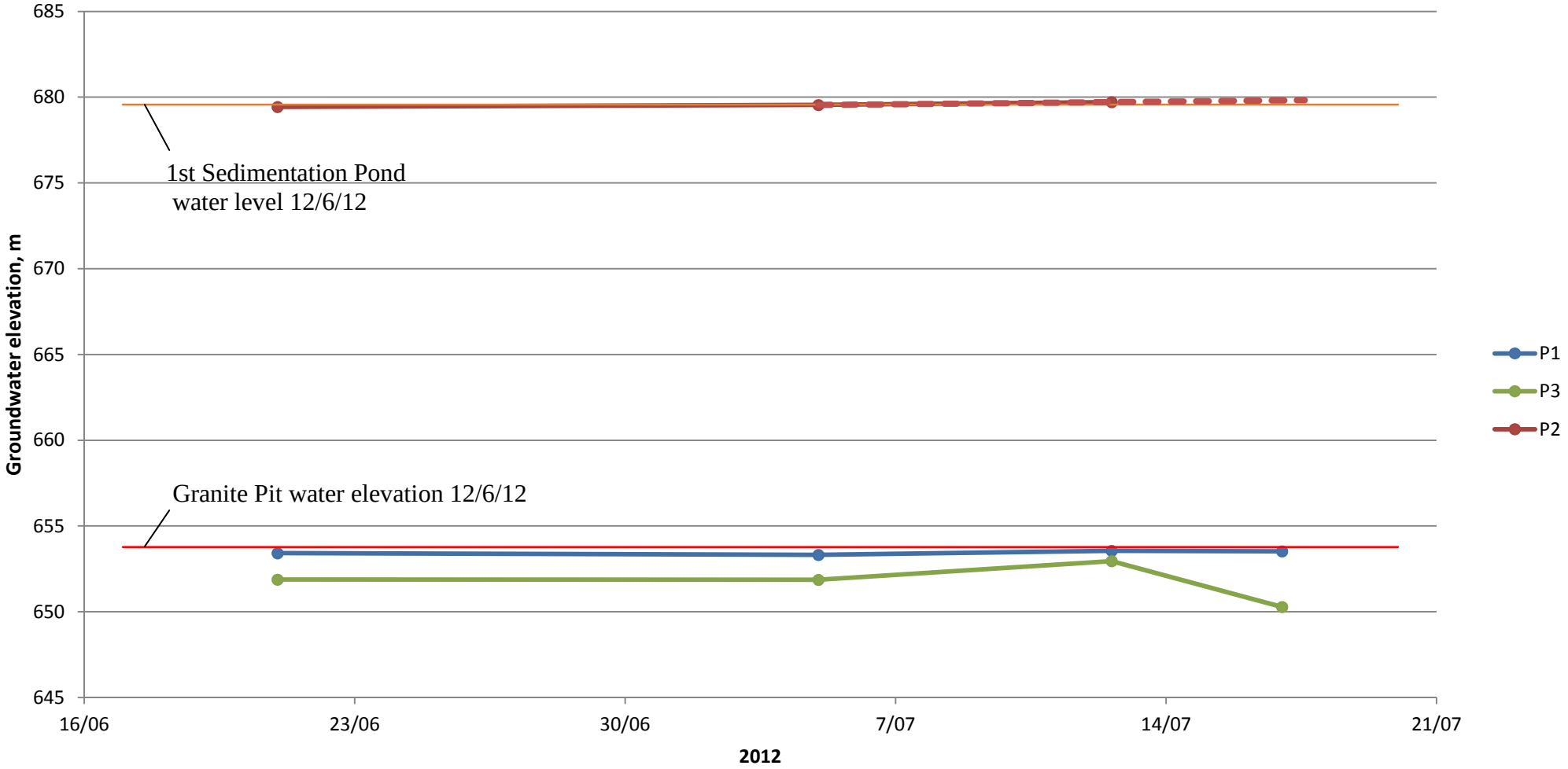
approved	VK
date	23/07/2012
scale	-
original size	A4

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client:	Umwelt (Australia)
project:	Cooma Road Quarry
title:	Surface water elevation
project no: GEOTNEWS21034AA	figure no: FIGURE 2

Cooma Rd Quarry hydrographs and trends



drawn	**JZ**
approved	**VK**
date	**23/07/2012**
scale	**-**
original size	**A4**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

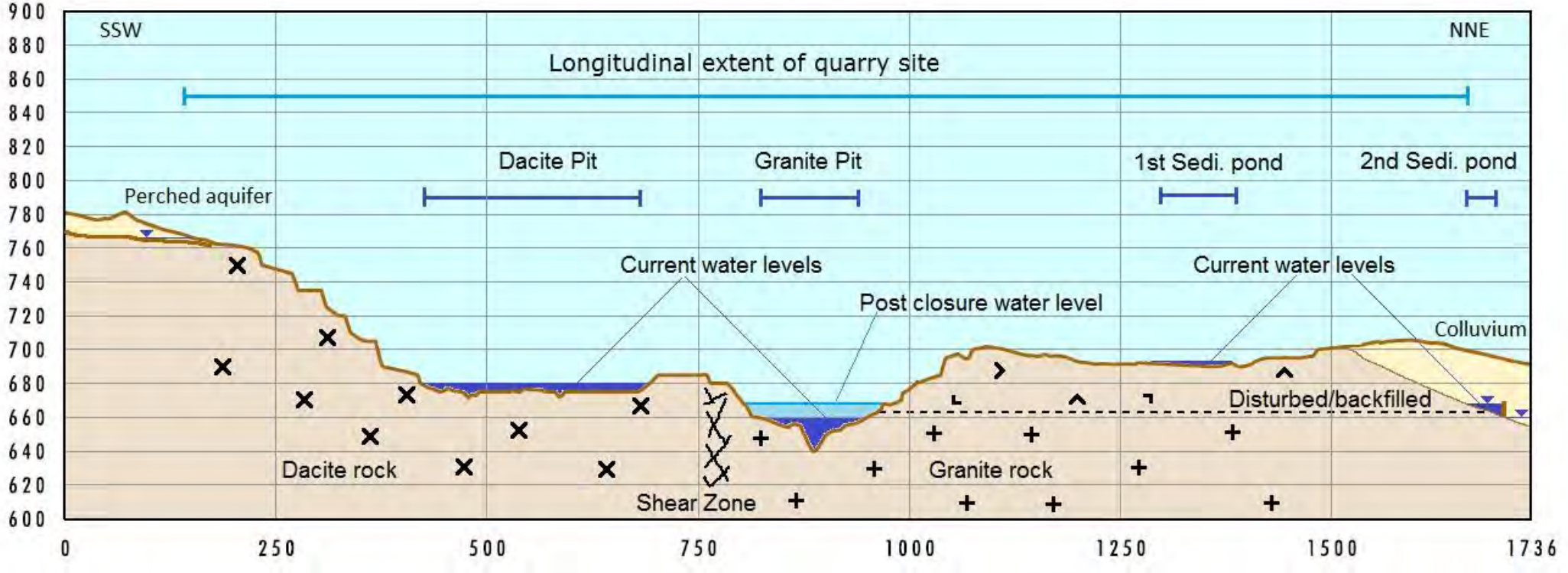
client: **Umwelt (Australia)**

project: **Cooma Road Quarry**

title: **Surface elevation**

project no: **GEOTNEWS21034AA**

figure no: **FIGURE 3**



0 150 300 600m

Horizontal Scale 1:12 500

0 75 150 300m

Vertical Scale 1:6250

drawn	**JZ**
approved	**VK**
date	**23/07/2012**
scale	**-**
original size	**A4**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: **Umwelt (Australia)**

project: **Cooma Road Quarry**

title: **Sketch of geological cross-section and water bodies at the Cooma Road quarry site**

project no: **GEOTNEWS21034AA**

figure no: **FIGURE 4**

a Granite Lake with pump in the back ground

b Well P3 on bench 2 at the Granite Pit

drawn	**JZ**	coffey geotechnics SPECIALISTS MANAGING THE EARTH	client: **Umwelt (Australia)**	
approved	**VK**		project: **Cooma Road Quarry**	
date	**23/07/2012**		title: **Site photos**	
scale	**-**		project no: **GEOTNEWS21034AA**	figure no: **FIGURE 5ab**
original size	**A4**			

c Bench 3 rock face, dry, in Dacite Pit, southern edge

d Minimal traces of groundwater flow, fresh cut, Dacite Pit

drawn	**JZ**
approved	**VK**
date	**23/07/2012**
scale	**-**
original size	**A4**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: **Umwelt (Australia)**

project: **Cooma Road Quarry**

title: **Site photos**

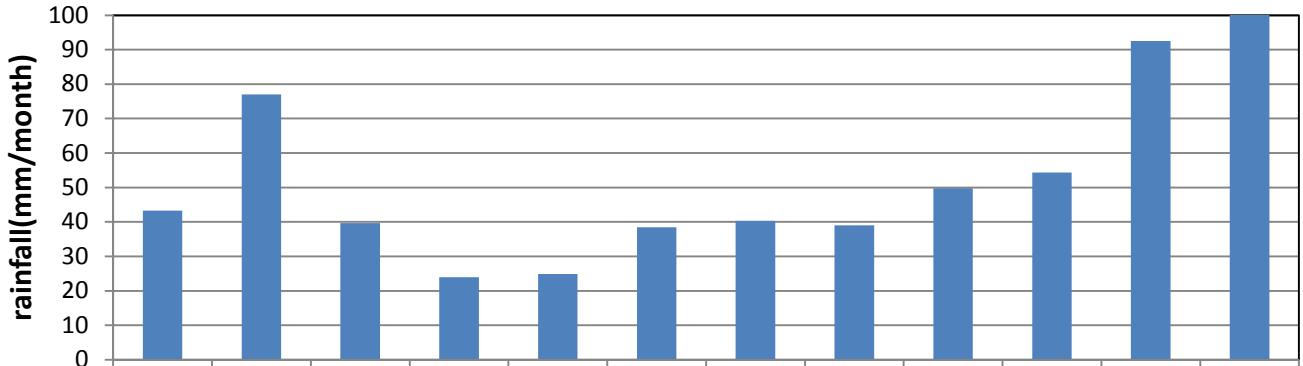
project no: **GEOTNEWS21034AA**

figure no: **FIGURE 5cd**

Appendix A

Monthly Average Rainfall of 3 Nearest Stations

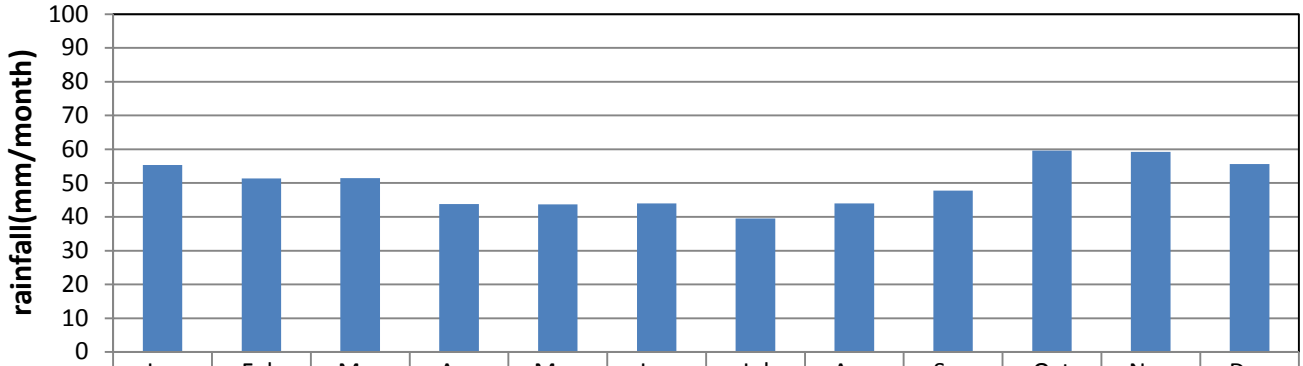
Monthly Average Rainfall in Googong (8y)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	43.3	77.0	39.6	24.0	24.9	38.4	40.3	39.1	49.8	54.4	92.6	100.2

Month

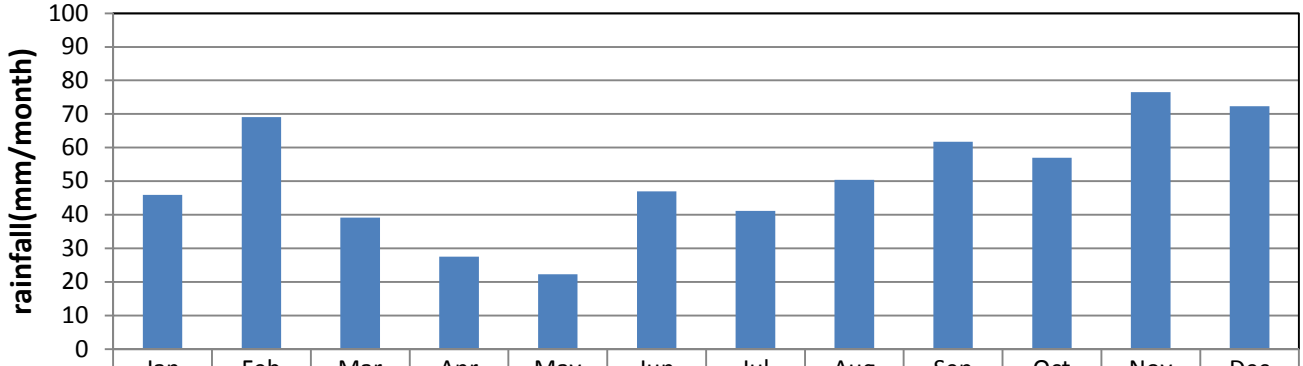
Monthly Average Rainfall in Queanbeyan Bowling Club （42y）



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	55.3	51.4	51.5	43.8	43.7	44	39.5	44	47.8	59.6	59.2	55.6

Month

Monthly Average Rainfall in Tuggeranong (Isabella Plains) AWS （16y）



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	46.0	69.1	39.2	27.5	22.3	47.0	41.2	50.4	61.7	57.0	76.5	72.3

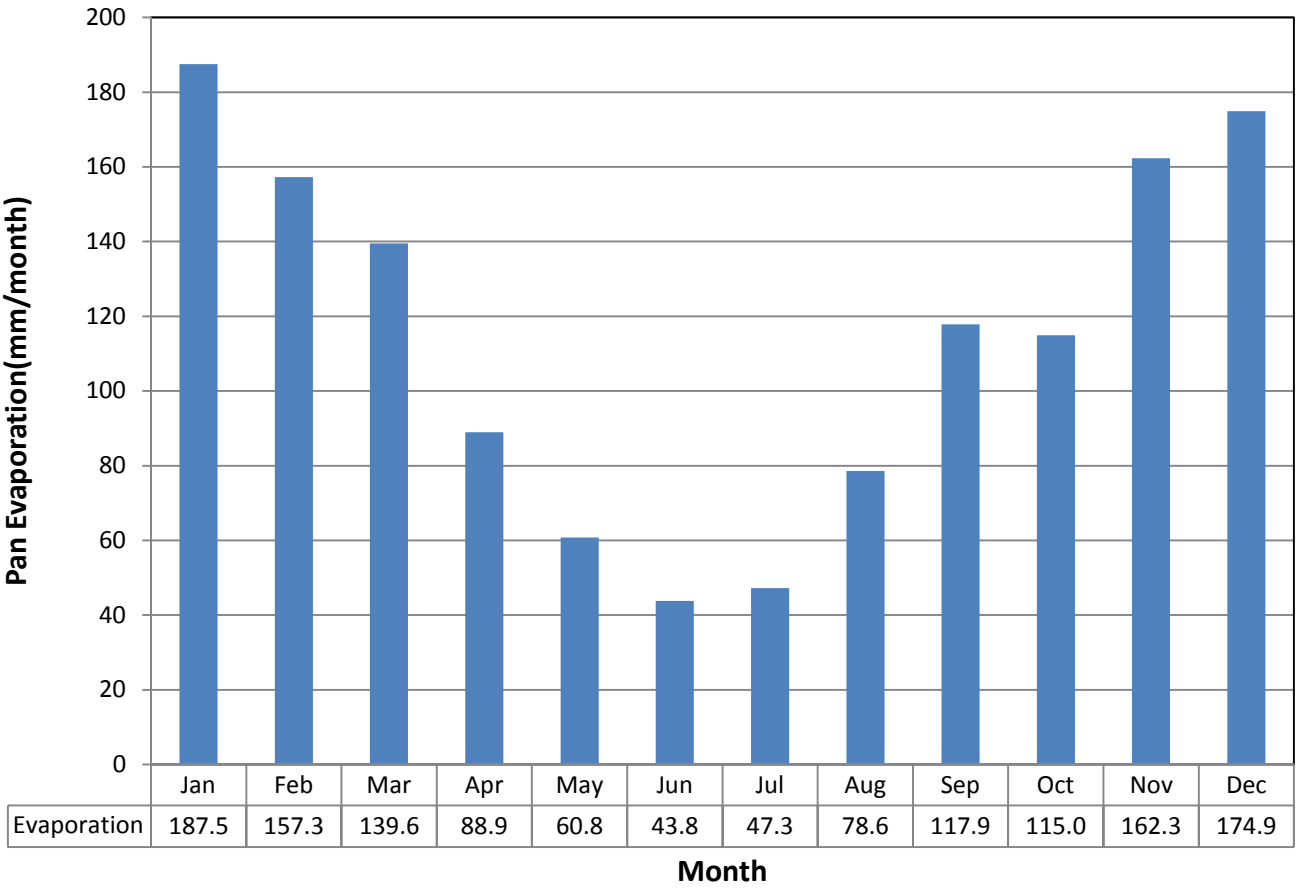
Month

drawn	JZ	coffey geotechnics SPECIALISTS MANAGING THE EARTH	client:	Umwelt (Australia)
approved	VK		project:	Cooma Road Quarry
date	30/07/2012		title:	Monthly average rainfall of 3 nearest stations
scale	-		project no: GEOTLCOV23000AA	figure no: Appendix A
original size	A4			

Appendix B

Monthly Average Pan Evaporation

Monthly Average Pan Evaporation in CANBERRA AIRPORT （4y）



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evaporation	187.5	157.3	139.6	88.9	60.8	43.8	47.3	78.6	117.9	115.0	162.3	174.9

drawn	**JZ**	coffey geotechnics SPECIALISTS MANAGING THE EARTH	client:	**Umwelt (Australia)**
approved	**VK**		project:	**Cooma Road Quarry**
date	**30/07/2012**		title:	**Monthly average pan evaporation**
scale	**-**			
original size	**A4**		project no: **GEOTLCOV23000AA**	figure no: **Appendix B**

Appendix C

Derivation of Aquifer Transmissivity

G.A. Bruggeman, 1999. Analytical solution of geohydrological problems
Equation 227.14, p.180
Drawdown in an observation well in a radial flow field around a circular pit with radius R and a constant withdrawal Q.

$$s(r) = \frac{Q}{2\pi kD}\frac{\lambda}{R}\frac{K_0(\frac{r}{\lambda})}{K_1(\frac{R}{\lambda})}$$

Where s(r) is the drawdown observed at distance r from the pit's centre, and
Parameter λ is defined as:

$$\lambda = \sqrt{kD\ c}$$

With:
s(r) is the drawdown, m
Q is extraction rate, m^3/d
kD is aquifer transmissivity, m^2/d
r is the distance of observation well from pit centre, m
R is radius of pit, m
c is resistivity of bottom layer, d (assumed 1000 days for tight formations)
K_0 and K_1 are second type Bessel functions, of the 0 and 1st order, respectively

drawn	**JZ**	coffey geotechnics SPECIALISTS MANAGING THE EARTH	client: **Umwelt (Australia)**	
approved	**VK**		project: **Cooma Road Quarry**	
date	**30/07/2012**		title: **Derivation of aquifer transmissivity**	
scale	**-**		project no: **GEOTLCOV23000AA**	figure no: **Appendix C**
original size	**A4**			

Appendix 5

Ecological Assessment Supporting Information

Appendix 5 – Ecological Assessment Supporting Information

1.0 Overview

This document provides supporting information for the ecological impact assessment contained in the main text of the EIS.

2.0 Literature Review

A review of previous studies of the Cooma Road Quarry was conducted to provide background for the current study and to compare the current findings with species previously recorded on site. Although the studies reviewed in the following sections were carried out at the site, they may not be directly relevant to the additional disturbance footprint. Information has been included however, to provide a full understanding of the locality and to provide context to broader considerations in the assessment.

Databases

Searches of matters of conservation significance under NSW and Commonwealth legislation were targeted in database searches of the NSW Wildlife Atlas[1] and the EPBC Protected Matters Search Tool[2] on 21 July 2012. A total of 10 threatened flora species and 31 species of fauna including vertebrates, invertebrates and nationally threatened fish were returned in the searches. The following list summarises the results of the database searches, the results and relevance of these searches is elaborated on further in the Assessment section.

- Amphibians (3).
- Birds (17).
- Insects (1).
- Mammals (4).
- Fish (2).
- Reptiles (4).
- Plants (10).
- Communities (3).

These species and communities are considered further in **Section 3.0**.

Crawford (1993)

Crawford (1993) was engaged by Camp Scott & Furphy to undertake a survey of flora and fauna of the then CSR Cooma Road Quarry and analyse the likely impacts of the proposed development on the flora and fauna. As a consequence of that study, Crawford (1993) defined the vegetation of the Cooma Road Quarry as predominately of the yellow box – red gum (*E. melliodora – E. blakelyi*) and red stringy bark – scribbly gum (*E. macrorhyncha – E. rossii*) 'alliance', although the report states that a history of clearing across the site made it difficult to divide the vegetation into communities.

[1] http://www.bionet.nsw.gov.au/
[2] http://www.environment.gov.au/epbc/pmst/index.html

Yellow box – red gum woodland was recorded on the gentler slopes with deeper soils. The dominant canopy species included mealy bundy (*E. nortonii*), yellow box, red box (*E. polyanthemos*), red stringybark, a small patch of broad-leaf peppermint (*E. dives*), occasional red gums and drooping she-oak (*Allocasuarina verticillata*) and apple box (*E. bridgesiana*). Virtually no regeneration of eucalypts was observed. On the steeper, better drained slopes with skeletal soils, the red stringybark – scribbly gum 'alliance' was recorded. The description of vegetation communities is on a broad scale and it is difficult to ascertain the exact location in which the surveys were conducted in order to compare to the current study.

Crawford recorded the shrub layer as containing a mixture of native and exotic flora and the ground layer was dominated by annual pasture grasses and weeds. Low densities of native perennial grasses – wallaby grasses (*Austrodanthonia* spp.), spear grasses (*Austrostipa* spp.) and redleg grass (*Bothriochloa macra*) were found and only the occasional rare patches of kangaroo grass (*Themeda australis)* and tussock grass (*Poa labillardieri*).

Native herbs that were commonly recorded included those tolerant of a history of pasture improvement and grazing.

Red stringybark – scribbly gum forest was recorded on the steeper, drier slopes with skeletal soils. On the north western facing slopes scribbly gum and brittle gum (*E. mannifera)* were the dominant trees in the upper canopy with a shrub layer dominated by the native peas - *Bossiaea buxifolia*, *Dillwynia sericea* and *Pultanea* spp., and the heaths – *Leucopogon* sp. and *Stryphelia triflora* and the wattles – *Acacia genistifolia* and *A. ulicifolia* and the red-anther wallaby grass (*Joycea pallida*). The ground layer consisted mostly of native species with lower weeds than the woodland.

On the south eastern facing slopes the dominant trees were red stringybark, mealy bundy, brittle gum and red box. The sparse shrub layer consists of daisy bush (*Cassinia quinquefaria*), silver wattle (*Acacia dealbata*) and burgan (*Kunzea ericoides*) and an open grassy ground layer consisting of snow grass (*Poa sieberiana*); forest senecio (*Senecio tenuiflorus*) and *a*ustral bugle (*Ajuga australis*).

No threatened species were recorded on the site during the 1993 survey although a search for button wrinklewort *(Rutidosis leptorrhynchoides*), small purple-pea (*Swainsona recta*) and austral toadflax (*Thesium australe*) was undertaken. A rarely recorded plant – zornia (*Zornia dyctiocarpa* var. *dyctiocarpa*) was recorded in woodland east of the two dams in the Western paddock.

CMPS & F Environmental (1994)

CMPS & F Environmental (1994) in the EIS for Cooma Road Quarry, based their assessment on the work undertaken by Crawford (1993) and accordingly defined the vegetation of the study area into two broad categories; yellow box – red gum woodland on the gentler slopes with deeper soils and consisting of scattered trees and cleared pasture. The dominant trees being mealy bundy, yellow box, red box and red stringybark and patches of broad-leaved peppermint, Blakely's red gum, drooping she-oak and apple box. The EIS was also in agreement with Crawford (1993) that the trees present perhaps did not represent the likely original community but rather the remnants of selective clearing for firewood and fence posts.

Red stringybark - scribbly gum open forest was also recorded on the north eastern side of the quarry where skeletal soils occur on steeper, drier slopes of the site. On the slopes with north and west aspects brittle gum and scribbly gum were dominant, while the slopes with a South Easterly aspect were dominated by mealy bundy, brittle gum and red box. The open forest in the north and west of the Quarry is much denser than that of the South eastern side.

Crawford (2007)

In the 2007 survey, Crawford again listed yellow box – red gum woodland as the most widespread vegetation community on the site. Red box woodland was considered a subset of the larger community. The 2007 report recorded 'scattered patches of quite healthy regeneration of the eucalypt species, yellow box, red gum, red box and apple box. Patchy regeneration of drooping she-oak *Allocasuarina verticillata* and Australian blackthorn *Bursaria spinosa* ssp. *lasiophylla* was also noted.

The quality of the tree and shrub layers of the woodland was found to have improved since earlier surveys, but the ground layer had degraded with a higher prevalence of weed species and more bare soil between grassy tussocks and other plants. Nevertheless the status of the woodland at the Quarry was recorded to be 'at least as good as it was in 2001'.

The yellow box – red gum alliance recorded in Crawford (2007) is now referred to as white box – yellow box – Blakely's red gum grassy woodland and derived native grassland ecological community (*E. albens - E. melliodora - E. blakelyi* grassy woodland).

Crawford (2007) made no attempt to survey thoroughly for fauna, focussing instead on recording suitable habitat for rare and threatened species.

The report states that no rare or threatened species, or habitat considered suitable was discovered on site.

Species targeted included:

- striped legless-lizard (*Delma impar*);
- pink-tailed worm-lizard (*Aprasia parapulchella*);
- grassland earless dragon (*Tympanocryptis pinguicolla*);
- wingless grasshopper (*Keyacris scurra*); and
- golden sunmoth (*Synemon plana*).

Birds listed by the Canberra Ornithologist's Society (COG) as 'woodland Species of Concern' that were recorded on site included diamond firetail (*Stagonopleura guttata*) and hooded robin (*Melanodryas cucullata cucullata*) both listed as vulnerable under the TSC Act, with the latter also listed as vulnerable under the NC Act in the ACT. Peregrine falcon (although not listed under legislation) was also observed flying overhead.

The south-eastern form or subspecies of hooded robin was recorded on the upper slopes of the north-western paddock, above the locked gate. The population status appeared the same as in 1993 and 2001. Three other bird species recorded during the survey included buff-rumped thornbill, brown-headed honeyeater and house sparrow.

Geoff Butler & Assoc. (2009)

Geoff Butler and Associates (2009) assessed the south eastern division of the Old Cooma Road Quarry site.

The report findings are consistent with EcoLogical Australia (2011) and Crawford (1993) that the area consists of primarily yellow box/red gum woodland on the lower lying land.

The dominant trees recorded in the 2009 survey were yellow box, red box and apple box in the northern end of the subject site. Although they are in agreement with Crawford (1993) that areas of box-gum woodland are degraded with no regeneration and shrub and ground layers are dominated by introduced weeds and pasture, overall the site is assessed as having moderate conservation value. The report does not mention the regeneration of eucalypt species described by Crawford (2007).

Although Geoff Butler and Associates (2009) did not survey for fauna, they considered the area of yellow box woodland in the north eastern corner of the study area to support the best fauna habitat within the area assessed. The report states that the area has potential to support 17 woodland species listed as threatened under the NSW *Threatened Species Conservation Act 1995*. The report states that although Crawford (2007) suggested the habitat not suitable for pink-tailed worm-lizard, it has since been found on adjacent land and should be considered present until further surveys conducted.

Eco Logical Australia (2011)

Eco Logical Australia (ELA) prepared a Preliminary Biodiversity Assessment of the Old Cooma Road Quarry proposed expansion area in 2011.

Four separate vegetation communities were identified, including red box woodland, yellow box – red box woodland, inland scribbly gum - stringybark gully forest and apple box woodland.

The report states that due to time constraints and the brevity of the survey, further definition of vegetation communities and detailed survey is required to adequately delineate vegetation community boundaries. The red box woodland described may be part of the box gum woodland CEEC listed under State (TSC Act) and Commonwealth (EPBC Act) legislation.

The red box woodland community described in this report is located on a small hill to the north of the existing quarry operation. The community is dominated by red box with a mixed native and exotic pasture under storey. ELA define the condition of the community as moderate, but recommend further surveys as it may constitute a component of box-gum woodland and may provide habitat for a range of threatened fauna species.

An area of remnant yellow box/red gum woodland is described on the slopes both within and surrounding the existing quarry. The community is described as 'dominated by yellow box and red box along with scribbly gum and apple box. The community broadly conforms to the white box – yellow box – Blakely's red gum woodland (EEC) listed under the TSC Act and some areas may also conform to the white box - yellow box - Blakely's red gum grassy woodland and derived native grassland (CEEC) listed under the EPBC Act' (Eco Logical Australia 2011). The community ranges from areas in poor condition with a patchy upper canopy and weedy under storey to areas in good condition with all structural layers present.

In the rocky gully to the north of the quarry and in small areas around the existing quarry, areas of Inland scribbly gum - red stringybark forest were identified with occasional red box. Regenerating burgan (*Kunzea ericoides*) shrub thickets were dominant in areas around the west of the existing quarry. Two populations of hoary sunray (*Leucochrysum albicans* var. *tricolor*) were observed within this community and the condition of the community as a whole was considered moderate to good.

A single patch of apple box woodland was identified in a gully to the east of the quarry. This community was dominated by apple box with areas of red stringybark and was considered in good to moderate condition.

ELA describe the vegetation communities within the study area as ranging from derived grassland to woodland and open forest. Reference is made to the two threatened woodland birds previously recorded by Crawford (1993), namely diamond firetail and hooded robin. It is suggested that suitable habitat is likely to exist at the site for other threatened woodland birds including brown treecreeper (*Climacteris picumnus*), speckled warbler (*Chthonicola sagittatus*) and swift parrot (*Lathamus discolor*).

ELA also concur with Crawford (2007) that the site may provide suitable habitat for threatened reptiles such as pink-tailed worm-lizard, striped legless-lizard and Rosenberg's monitor (*Varanus rosenbergi*).

3.0 Umwelt Field Survey (2012)

A survey was conducted over two days to verify the findings of previous investigations. This focussed on the areas that would potentially be affected by the proposed development and also covered broader areas that were surveyed to allow for flexibility in project design and to provide context to surrounding areas. Some of these areas discussed to provide context were identified during initial project planning as potentially impacted, however, subsequent changes to the Project resulted in no impacts proposed in these areas. The results of the survey are provided below.

The flora and fauna species recorded during the Umwelt surveys of the proposed additional disturbance area and surrounding woodland areas that are not proposed to be impacted are provided in **Sections 3.1** and **3.2** respectively.

Impact Area

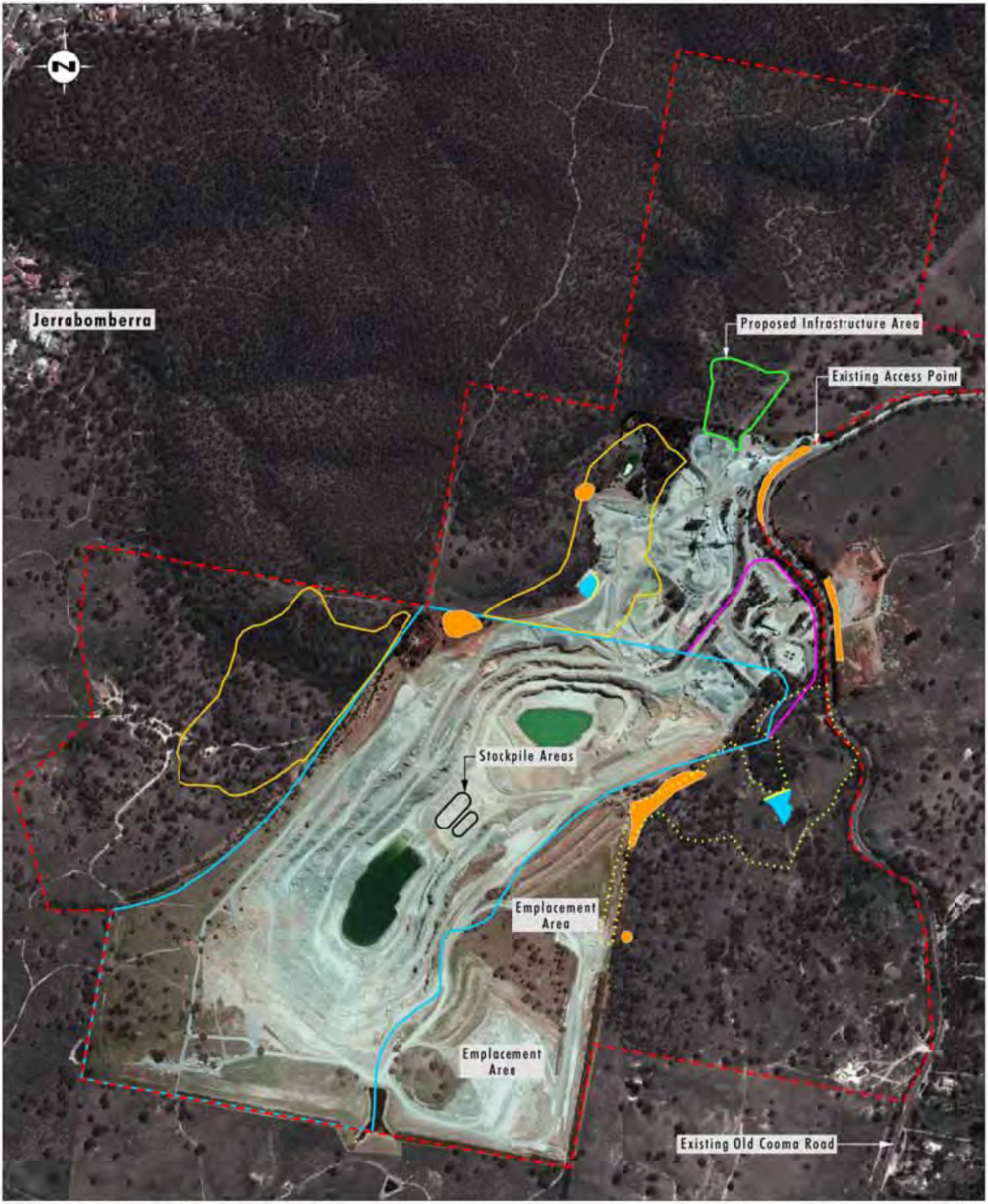
The additional impact area to be affected by the proposed Project is limited to the proposed Eastern Dam (refer to **Figure 1**). The proposed site of the dam and the surrounding area were surveyed. It is noted that impacts will be limited to the proposed Eastern Dam site however the surrounding area is also discussed below. The proposed additional impact area is largely disturbed, containing no trees and a ground layer of mostly exotic grasses. Small patches of degraded native pasture are also present and support several native species including purple wiregrass (*Aristida ramosa*), wallaby grasses (*Austrodanthonia* spp.), spear grasses (*Austrostipa* spp.) and redleg grass (*Bothriochloa macra*).

The vegetation present within the additional impact area is not consistent with any listed ecological community and supports only marginal habitat opportunities for fauna. During field surveys a mob of approximately 20 eastern grey kangaroo (*Macropus gigantea*) were observed foraging and moving through this area. Similarly to the kangaroos, other fauna potentially occurring in this area would mainly be moving through the area between proximate areas of habitat in addition to occasional and opportunistic foraging.

The affected area has poor habitat quality and is unlikely to represent an important feature in the area for locally occurring flora and fauna.

Survey of Surrounding Areas

The area surrounding the proposed Eastern Dam was also surveyed, however will not be impacted by the Project. The area is discussed below in two components, the area to the north of the proposed Eastern Dam and the area to the south of the proposed Eastern Dam (refer to **Figure 1**).



Legend

- Proposed Project Area
- Approved Extraction Area
- Proposed Additional Extraction Area
- Proposed Disturbance Area - Workshop
- Approved Disturbance Area - Overburden Emplacement
- Survey Area
- Dam
- Hoary Sunray Locations

FIGURE 1

Survey Area

File Name (A4): R01/2992_112.dgn
20121029 16.51

The area to the north of the proposed Eastern Dam contains a combination of remnant vegetation on native soil and other areas that have been subjected to filling and revegetation with pasture grasses. The filled and revegetated part of this area appears to be generally north of the main drainage line that would feed into the proposed Eastern Dam.

The site contains open woodland with a mixture of native grasses and forbs and introduced pasture weeds and exotic grasses in the ground layer. A low diversity of native grasses and forbs were recorded in the ground layer. This is likely to be an indication of substantial and prolonged disturbance such as by land filling in parts and grazing.

The upper canopy species includes the two co-dominant trees; red box and yellow box with a lower presence of Blakely's red gum, scribbly gum, red stringybark and apple box. In the drainage line below the proposed dam, there was also potentially broad-leaved peppermint, *E. dives*, although this area is outside of the survey site and area considered in this assessment. These findings are generally consistent with those of ELA (2011) and Butler (2009) who also surveyed in this immediate area. The previous studies named the tree alliances as 'yellow box/red box woodland' with a nearby area of 'apple box woodland' (not included in the current study). It is difficult to ascertain the original community type although the dominance of yellow box suggests it was likely to have been box–gum woodland prior to clearing.

The mid layer consists of predominately native shrubs including: black wattle, golden wattle (*Acacia pycnantha),* Australian blackthorn, dolly bush (*Cassinia aculeata*), cough-bush and burgan. Sweet briar (*Rosa rubiginosa*) and a small patch of blackberry (*Rubus fruticosa*) were also recorded.

The ground layer contains a mixture of both native and exotic forbs and grasses. A history of grazing and clearing has resulted in an extensively altered landscape. Nevertheless the area still retains some features of conservation value, in what was likely to have been originally box gum grassy woodland with apple box also present in parts. Across the area, 10 native grasses were recorded, 23 native forbs, and 14 other native creepers, shrubs, trees and mistletoes. Of these native species, 11 of the 'important' species associated with box-gum woodland CEEC are also present. Of the recorded species in the ground layer 26 were exotic weed species.

It is unlikely that the area now meets the criteria of Box Gum Grassy woodland (EEC) listed under the EPBC and TSC Acts, as despite the co-dominance of yellow box in parts, the ground layer is significantly degraded and dominated by weed species. A large section of the area has been cleared and filled. As a drainage line runs through this area, it is likely to have contained a continuation of the apple box community described by Butler (2009) present at the base of the slope in a gully.

The area to the south of the proposed Eastern Dam supports a diversity of eucalypts including yellow box, red box, apple box, red stringybark, scribbly gum and the occasional Blakely's red gum. A single bundy/long-leaved box (*E. goniocalyx*) was also recorded. In contrast to this Crawford (2003) recorded mealy bundy (*E. nortonii*) with no mention of long-leaved box. Otherwise the findings of the survey in this area are generally consistent to those described by Crawford (2003) and Butler (2009) who recorded yellow box – red gum on the gentler slopes. ELA (2011), however define the woodland as yellow box – red box woodland with no mention of the red gum component. It is likely the site was originally yellow box – red gum grassy woodland, although perhaps due to a history of selective clearing (Crawford 1993) the canopy is now dominated by residual species of the former community, not favoured by the early timber-getters.

The mid storey contains a diversity of native shrubs including wattles: currawang, black wattle and *g*olden wattle (*Acacia pycnantha*); various heath species: twin-flower beard-heath, peach heath (*Lissanthe strigosa)* and urn heath; various peas: showy parrot-pea (*Dillwynia sericea*) and hoary guinea flower (*Hibbertia obtusifolia)* and other natives such *as* Australian blackthorn, burgan and bitter cryptandra.

Drooping mistletoe (*Amyema pendula*) was present in eucalypts across the site, along with another mistletoe *A. cambageii* in a drooping she-oak (*Casuarina verticillata*).

The ground layer contained a large diversity of native forbs and grasses with a selection of weeds associated with grazing and disturbance.

A diversity of native grasses was recorded including: purple wiregrass (*Aristida ramosa*), wallaby grasses (*Austrodanthonia* spp.), spear grasses (*Austrostipa* spp.), redleg grass (*Bothriochloa macra*), plume grass (*Dichelachne* sp.), wheat grass (*Elymus scaber*), red-anther wallaby grass (*Joycea pallida*), tussock (*Poa sieberiana*) and kangaroo grass (*Themeda australis*).

A total of 29 native forbs were recorded, including hoary sunray (*Leucochrysum albicans* ssp. *albicans)* which was discovered scattered across several locations on the western edge of the surveyed area (refer to **Figure 5.8** in the main text of the EIS). These occurrences of hoary sunray were not previously identified in any of the earlier surveys.

It is likely that most of the areas supporting a tree canopy within this area meet the criteria of box gum woodland (EEC) listed under the EPBC Act and TSC Act. It is noted that the Project does not involve any impact on this area.

3.1 Flora Species List

The following list was developed from surveys of the study area covering both the area of impact and surrounds. It includes all species of vascular plants observed within the study area during fieldwork completed by Umwelt. Although substantial, the list will not be comprehensive, because not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only.

The following abbreviations are used in the list:

subsp. subspecies;

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler *et al*. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2012), the online plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources. **Table 3.1** lists all flora species observed during the site inspections.

Table 3.1 – Flora Species List

Family/Subfamily	Scientific Name	Common Name
Filicopsida (Ferns)		
Adiantaceae	*Cheilanthes distans*	bristly cloak fern
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)		
Lomandraceae	*Lomandra bracteata*	short-flowered mat-rush
Lomandraceae	*Lomandra filiformis*	Wattle mat-rush
Lomandraceae	*Lomandra* sp.	Mat rush
Orchidaceae	*Diuris* sp.	Buttercup doubletail
Poaceae	*Aira* sp.	Hairgrass
Poaceae	*Aristida ramosa*	Purple wiregrass
Poaceae	*Austrodanthonia spp.*	Wallaby grass
Poaceae	*Austrostipa bigeniculata*	Tall speargrass
Poaceae	*Austrostipa scabra*	Corkscrew speargrass
Poaceae	*Bothriochloa macra*	Redleg grass
Poaceae	*Dichelachne* sp.	Plume grass
Poaceae	*Elymus scaber*	Wheat grass
Poaceae	*Joycea pallida*	Redanther Wallaby Grass
Poaceae	*Nassella trichotoma*	Serrated tussock
Poaceae	*Poa sieberi*	Poa tussock
Poaceae	*Themeda australis*	Kangaroo grass
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)		
Apiaceae	*Hydrocotyle laxiflora*	Stinking pennywort
Asteraceae	*Brachyscome ridgida*	Leafy daisy
Asteraceae	*Chrysocephalum apiculatum*	Common everlasting
Asteraceae	*Conyza bonariensis*	Flaxleaf fleabane
Asteraceae	*Cymbonotus lawsonianus*	Bear's ear
Asteraceae	*Euchiton sphaericus*	Common cudweed
Asteraceae	*Hypochaeris glabra*	Smooth cat's ear
Asteraceae	*Hypochaeris radicata*	Flat weed
Asteraceae	*Leucochrysum albicans* subsp. *albicans*	Hoary sunray
Asteraceae	*Microseris lanceolata*	Yam daisy
Asteraceae	*Onopordum acanthium* subsp. *acanthium*	Scotch thistle
Asteraceae	*Senecio quadridentatus*	Cotton fireweed
Asteraceae	*Silybum marinum*	Milk thistle
Asteraceae	*Sonchus asper*	Prickly sow-thistle
Asteraceae	*Tolpis umbellata*	Tolpis
Asteraceae	*Vittadinia cuneata*	Fuzzweed
Asteraceae	*Vittadinia muelleri*	Mueller's fuzzweed
Asteraceae	*Xerochrysum viscosum*	Sticky everlasting
Brassicaceae	*Hirschfeldia incana*	Hairy mustard
Campanulaceae	*Wahlenbergia gloriosa*	Royal bluebell
Campanulaceae	*Wahlenbergia* sp.	Bluebell sp
Casuarinaceae	*Allocasuarina Verticillata*	Drooping sheoak

Table 3.1 – Flora Species List (cont.)

Family/Subfamily	Scientific Name	Common Name
Casuarinaceae	*Amyema cambagii*	Sheoak mistletoe
Clusiaceae	*Hypericum perforatum*	St John's wort
Dilleniaceae	*Hibbertia obtusifolia*	Hoary guinea flower
Ericaceae	*Leucopogon fletcheri*	Twin flower beard heath
Ericaceae	*Lissanthe strigosa*	Peach heath
Ericaceae	*Melichrus urceolatus*	Urn heath
Ericaceae	*Monotoca scoparia*	Prickly broom heath
Euphorbiaceae	*Chamaesyce drummondii*	Caustic weed
Fabaceae	*Acacia doratoxylon*	Currawang
Fabaceae	*Acacia genistifolia*	Early Wattle
Fabaceae	*Acacia mearnsii*	Black wattle
Fabaceae	*Acacia pycnantha*	Golden wattle
Fabaceae	*Desmodium varians*	Slender tick-trefoil
Fabaceae	*Dillwynia sericea.*	Showy parrot-pea
Fabaceae	*Glycine clandestina*	Twining glycine
Fabaceae	*Glycine tabacina*	Variable glycine
Fabaceae	*Indigofera australis*	Austral indigo
Fabaceae	*Trifolium arvense*	Hare's foot clover
Fabaceae	*Trifolium* sp.	Clover
Fabaceae	*Ulex europaeus*	Gorse
Gentianaceae	*Centaurium erythraea*	Common centaury
Geraniaceae	*Geranium solanderi*	Native geranium
Goodeniaceae	*Goodenia hederaceae*	Ivy Goodenia
Haloragaceae	*Haloragis heterophylla*	Rough raspwort
Loranthaceae	*Amyema pendula*	Drooping mistletoe
Myrtaceae	*Eucalyptus blakelyii*	Red gum
Myrtaceae	*Eucalyptus bridgesiana*	Apple box
Myrtaceae	*Eucalyptus goniocalix*	Long- leafed box
Myrtaceae	*Eucalyptus macrorhyncha*	Red stringybark
Myrtaceae	*Eucalyptus melliodora*	Yellow box
Myrtaceae	*Eucalyptus polyanthemos*	Red box
Myrtaceae	*Eucalyptus rossii*	Scribbly bark
Myrtaceae	*Kunzea ericoides*	Burgan
Onagraceae	*Epilobium billardierianum*	Smooth willow herb
Pittosporaceae	*Bursaria spinosa* subsp. *lasiophylla*	Native blackthorn
Plantaginaceae	*Plantago lanceolata*	Plantain
Polygonaceae	*Acetosella vulgaris*	Sorrel
Ranunculaceae	*Ranunculus lappaceus*	Common buttercup
Rhamnaceae	*Cryptandra amara*	Bitter cryptandra
Rosaceae	*Acaena agnipila*	Sheep's burr
Rosaceae	*Rosa rubiginosa*	Sweet briar
Salicaceae	*Salix babylonica*	Weeping willow
Scrophulariaceae	*Verbascum thapsus*	Great mullein
Solanaceae	*Solanum nigrum*	Deadly nightshade
Thymelaeaceae	*Pimelia* sp.	Rice-flower

3.2 Fauna Species List

The following list was developed from field surveys of the study area covering both the area of impact and surrounds. It includes all species of vertebrate fauna recorded within the study area during fieldwork undertaken by Umwelt.

Birds recorded were identified using descriptions in Slater *et al.* (2003) and the scientific and common name nomenclature of Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan *et al.* (2004) and Wilson & Swan (2010) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Van Dyke and Strahan (2008), Churchill (2008) and Menkhorst & Knight (2011) and the scientific and common name nomenclature of Van Dyke and Strahan (2008). **Table 3.2** lists all fauna observed or heard during the site inspections.

Table 3.2 – Fauna Species List

Scientific Name	Common Name	Conservation Status	
		TSC Act	EPBC Act
REPTILES			
Scincidae			
Morethia boulengeri	south-eastern Morethia skink		
BIRDS			
Accipitridae			
Aquila audax	wedge-tailed eagle		MIG
Psittacidae			
Platycercus elegans	crimson rosella		
Platycercus eximius	eastern rosella		
Maluridae			
Malurus cyaneus	superb fairy-wren		
Acanthizidae			
Smicrornis brevirostris	weebill		
Acanthiza chrysorrhoa	yellow-rumped thornbill		
Pardalotidae			
Pardalotus punctatus	spotted pardalote		
Pardalotus striatus	striated pardalote		
Meliphagidae			
Lichenostomus leucotis	white-eared honeyeater		
Melithreptus brevirostris	brown-headed honeyeater		
Anthochaera carunculata	red wattlebird		
Pachycephalidae			
Colluricincla harmonica	grey shrike-thrush		
Artamidae			
Gymnorhina tibicen	Australian magpie		
Corvidae			
Corvus coronoides	Australian raven		
Nectariniidae			
Dicaeum hirundinaceum	mistletoebird		
MAMMALS			
Macropodidae			
Macropus giganteus	Eastern grey kangaroo		

TSC = *Threatened Species Conservation Act 1995*

EPBC = *Environment Protection and Biodiversity Conservation Act 1999*

3.3 Summary

The reports considered in this literature reviewed have provided an overview of the area and background to the current study. The scope of works of ELA, Geoff Butler and Associates and Crawford were more extensive than the current study and identify further areas of conservation value found around the periphery of the study area. It should be noted that the two main vegetation types found in each of the reports were alliances and constituents of yellow box/Blakely's red gum community and red stringybark/scribbly gum community. As a result of a history of selective clearing (as suggested by Crawford, 1993) the remnant trees perhaps constitute only part of what might have originally been box-gum woodland.

4.0 Assessments

The following **Tables 4.2** and **4.3** present a preliminary assessment all threatened species identified in the database searches with respect to their potential to occur on the site. For each of the tables, a source for referenced material is provided and corresponds to the following references as listed in **Table 4.1**. The 'locality' was defined by an area of 10 kilometres around Cooma Road Quarry. Within this area, all threatened species and communities known or predicted to occur have been considered in addition to other potential species of conservation significance where relevant.

Table 4.1 – References for cited material in Table 4.2 and Table 4.3

ID	URL	Name
1	www.environment.gov.au/sprat	Australian Government Species Profile and Threats Database
2	www.environment.nsw.gov.au/threatenedspecies/	OEH Threatened Species Profile Database

In addition to the species considered three endangered ecological communities are known to occur in the vicinity of the affected area, these are as follows:

1. The nationally listed (EPBC Act) endangered ecological community known as 'natural temperate grassland of the southern tablelands of NSW and the Australian Capital Territory' occurring in areas peripheral to the quarry site. Based on the findings of field surveys, this community is not considered to be present or even potentially affected by indirect impacts of the proposed works.

2. The nationally listed (EPBC Act) critically endangered ecological community known as 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' occurs in areas peripheral to the proposed works.

3. The state listed (TSC Act) endangered ecological community known as 'white box yellow box Blakely's red gum woodland' is generally consistent with the nationally listed community and is also known to occur in areas peripheral to the proposed works.

Table 4.2 – Threatened Flora

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat Requirements
			TSC	EPBC		
Asteraceae	*Calotis glandulosa*	Mauve Burr-daisy	-	V	Unlikely due to habitat quality.	Occurs in montane and subalpine *Poa* sp. dominated grasslands, Snowgum woodland and dry sclerophyll woodland at high altitude in the Australian Alps (1).
	Leucochrysum albicans var. *tricolor*	Hoary sunray	-	E	Present elsewhere in lands peripheral to the quarry. Absent from the impact area and unlikely to occur based on habitat quality.	In NSW and ACT, Hoary Sunray occurs in grasslands, grassy areas in woodlands and dry open forests, and modified habitats, on a variety of soil types including clays, clay loams, stony and gravely soil, on grazed and ungrazed land (1).
	Rutidosis leptorrhynchoides	Button Wrinklewort	E1	E	Possible in peripheral lands but unlikely within the impact area due to habitat quality.	In the ACT and NSW, Button Wrinklewort occurs in box-gum woodland, secondary grassland derived from box-gum woodland or in natural temperate grassland; and often in the ecotone between the two communities (1).
Brassicaceae	*Lepidium ginninderrense*	Ginninderra peppercress	-	V	Nil, habitat absent.	Natural temperate grassland dominated by *Austrodanthonia* spp. The only known population is at Belconnen Naval Station (1).
Fabaceae (Faboideae)	*Swainsona recta*	Small Purple-pea	E1	E	Possible in peripheral lands but unlikely within the impact area due to habitat quality.	Occurs in open woodland dominated by *Themeda australis*, *Poa* sp. Or *Austrostipa* sp. Overstorey dominated by Box-gum associated species, *E. nortonii*, *E. dives*, *E. microcarpa* or *Calitris endlicheri.*
	Swainsona sericea	Silky Swainson-pea	V	-	Possible in peripheral lands but unlikely within the impact area due to habitat quality.	Occurs in a wide range of grassland and woodland habitats from Natural temperate grasslands, to Riverine communities, sandhills to rocky outcrops (2).
Geraniaceae	*Pellargonium* ssp. *Striatellum*	Omeo stork's bill	-	E	Nil, habitat absent.	Occurs just above the riparian zone of irregularly filled water bodies or ephemeral lakes (1).
Orchidaceae	*Caladenia tessellata*	Thick Lip Spider Orchid	E1	-	Nil, habitat absent.	Favours low, dry sclerophyll woodland (for example open Kunzea woodland) with a heathy or sometimes grassy understorey on clay loams or sandy soils. More specifically, the population at Braidwood occurs in dry, low Brittle Gum (*Eucalyptus mannifera*), Inland Scribbly Gum (*E. rossii*) and *Allocasuarina* spp. woodland with a sparse understorey and stony soil (1).

Table 4.2 – Threatened Flora (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat Requirements
			TSC	EPBC		
Rhamnaceae	*Pomaderris pallida*	Pale Pomaderris	V	V	Nil, habitat absent.	This species is found at numerous small sites along the plateau edge and very steep upper slopes and cliffs of river valleys at 480-600 m asl. The ACT sites are only on the eastern banks of the rivers, with an aspect ranging from north-westerly through westerly to southerly. The soils are shallow pale brown sandy loams over granite rock; large exposed granite boulders may be present. The species grows in near pure stands in a shrub community surrounded by Eucalyptus or Callitris woodland, or in open forest with shrubs such as *Bursaria spinosa* (1).
Santalaceae	*Thesium australe*	Austral toad flax	V	V	Possible in peripheral lands but unlikely within the impact area due to habitat quality and history of disturbance.	Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion provides important habitat for the species. The community is located between 700 and 1500 m and characterised by native grasses and forbs and dominant upper canopy of *E. viminalis*, *E. dalrympleana*, *E. stellulata* and *E. pauciflora* (2).

Table 4.3 – Threatened Fauna

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
AMPHIBIANS						
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	V	Nil, habitat not present.	In NSW the species is found in a wide range of slow-flowing and still waterbodies. Also found in disturbed sites such as abandoned mines and quarries. Breeding habitat includes slow, to still ephemeral water bodies, with aquatic plants and no predatory species such as mosquito fish (*Gambusia holbrooki*). Terrestrial habitat includes grassy areas close to water sources (1).
Hylidae	*Litoria castanea*	Yellow spotted tree frog	CE	E	Nil, habitat not present.	Similar habitat to *Litoria aurea* and *L. raniformis* which includes permanent ponds, swamps, lagoons, farm dams and the still backwaters of rivers usually with tall reeds present . The species is also found in ponds or slow moving streams with overhanging grassy banks in the absence of reed beds. May overwinter in the hollow centres of rotting logs and in the earth surrounding the roots of uprooted trees (1).
Hylidae	*Litoria raniformis*	Southern Bell Frog	E1	V	Nil, habitat not present.	This species is found mostly amongst emergent vegetation including *Typha* sp. (bullrush), *Phragmites* sp. (reeds) and *Eleocharis* sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams (1).
BIRDS						
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V		Possible, occasional foraging.	Wide range of Eucalypt dominated woodlands with a grassy understorey, particularly on rocky ridges or in gullies (1).
Accipitridae	*Circus assimilis*	Spotted Harrier	V		Possible, occasional foraging.	Grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (2).

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		Possible, occasional foraging.	Occurs within open eucalypt forest, woodland or open woodland with large numbers of available prey. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used. The species requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring (2).
Ardeidae	*Botaurus poiciloptilis*	Australasian bittern	E1	E	Nil, habitat absent.	The species occurs in three regions: south-eastern Australia from the Queensland border to south-east South Australia, south-west Western Australia and Tasmania. These regions are inferred to support three subpopulations. Australasian Bitterns in NSW form a part of the south-eastern subpopulation and are found in the better-watered landscapes in the east and south of the state (2.)
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		Nil, habitat absent.	The species occurs in a variety of forest and woodland habitats and occasionally in more open areas in south-eastern New South Wales and Victoria. Birds have been observed nesting in hollows in large, old trees. The species shows strong nest site fidelity (2).
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V		Nil, habitat absent	An insectivorous bird that occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups. Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (2).
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V		Possible, occasional foraging	Eucalypt woodlands, forests and mallee where there is a grassy understorey. Firetails build bottle-shaped nests in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (2).

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
Megapodidae	*Leipoa occelata*	Mallee fowl	E1	V	Nil, habitat absent	The Malleefowl usually occurs in semi-arid and arid zones of temperate Australia in mallee vegetation dominated by multi-stemmed trees and shrubs. The species can also occur elsewhere in Australia in shrublands and low Eucalyptus woodlands, native pine Callitris woodlands and acacia shrublands (1)
Meliphagidae	*Anthochaera phrygia*	Regent honeyeater	E1	E	Nil, habitat absent	Inhabits Eucalypt open forests and woodlands, predominantly box-ironbark types, but also Spotted Gum and Swamp Mahogany on the coast. The species also inhabits River She-oak forest with *Amyema cambagei* (Needle-leaf Mistletoe) (2).
Meliphagidae	*Epthianura albifrons*	White-fronted Chat	V		Unlikely, habitat is marginal	White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. The species is sensitive to human disturbance and is not found in built areas (2).
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		Nil, habitat absent	It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Varied Sittella feed on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree. Canopy, and often re-uses the same fork or tree in successive years (2).

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V		Possible, occasional foraging	The species occupies a wide range of Eucalypt woodlands, Acacia shrublands and open forests. In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. Home ranges are relatively large sometimes averaging 18 km. The species feeds on the ground by pouncing on insects, and forages in areas with a mix of bare ground, ground cover and litter (2).
Petroicidae	*Petroica boodang*	Scarlet Robin	V		Possible, occasional foraging	Occupies open forests and woodlands from the coast to the inland slopes . Breeds in drier Eucalypt forests and temperate woodlands, often on ridges and slopes within an open understorey of shrubs and grasses and sometimes in open areas. Requires abundant fallen timber and woody debris. In autumn and winter it migrates to more open grassy open woodlands or paddocks with scattered trees where it perches on low branches and feeds on insects among fallen wood (2).
Petroicidae	*Petroica phoenicea*	Flame Robin	V		Possible, occasional foraging	Similar to *Petroica boodang* (2).
Psittaculidae	*Lathamus discolor*	Swift parrot	E1	E	Nil, habitat absent	Swift Parrots occur in woodlands and forests of eastern Australia up to south east Queensland, where they feed on eucalypt nectar, pollen and associated insects. They return to Tasmania during the warmer months for breeding (2).
	Polytelis swainsonii	Superb parrot	V	V	Nil, habitat absent	The species mainly inhabits forests and woodlands dominated by eucalypts, especially River Red Gums (*Eucalyptus camaldulensis*) and box eucalypts such as Yellow Box (*Eucalyptus melliodora*) or Grey Box (*E. microcarpa*). The species also seasonally occurs in box-pine (*Callitris* spp.) and Boree (*Acacia pendula*) woodlands typically close to watercourses (1).
Rostratulidae	*Rostratula australis (benghalensis)*	Australian painted snipe	E1	V,M	Nil, habitat absent	The species inhabits shallow freshwater wetlands, vegetated ephemeral and permanent lakes and swamps, and inundated grasslands (2).

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
INSECTS						
Castniidae	*Synemon plana*	Golden Sun Moth	E1	CE	Nil, habitat absent	Grasslands including Natural Temperate Grasslands and Grassy Woodlands dominated by Wallaby grasses (*Danthonia* spp.). Species has also been recorded in degraded grasslands with exotic grasses including Chilean needle grass (*Nassella neesiana*). Species known to persist in small areas of high quality native habitat. Habitat quality appears more important than habitat size. Commonly found in lightly grazed paddocks that have had no pasture improvement of fertiliser application. Often found around verges of paddocks within remnant parcels of wallaby grass (1).
MAMMALS						
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	Nil, habitat absent	Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage. This subspecies is moderately arboreal and approximately 11% of travelling is done in trees (1).
Macropodidae	*Petrogale pencillata*	Brush-tailed Rock-wallaby	E1	V	Nil, habitat absent	Rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. Dense, arboreal vegetation below cliffs as a source of food and shelter and protection from predation. Vegetation types associated with Brush-tailed Rock-wallaby habitat, include dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest Within their home range, rock-wallabies habitually use the same refuges, sunning spots, feeding areas and pathways (1).

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Nil, habitat absent	Areas dominated (>50%) by the Primary food tree species - (such as Eucalyptus camaldulensis and *E. viminali*s) and secondary food tree species including (*E. blakelyi*, *E. melliodora* and *E. polyanthemos*. Leaves from other non-eucalypt species are sometimes also taken. Suitable shelter trees such as Cypress pine are often used. Vegetation on more fertile soils (higher nutrient in the leaves). Tertiary habitat which may not contain the food species but serves as a habitat buffer and habitat linkage (2).
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		Possible, occasional foraging	Requirements include an availability of foraging areas and proximity to suitable roosting caves, many of which are located near coastal cliffs. Foraging areas include forested areas, volcanic plains, wetlands and coastal vegetation including beaches (1).
FISH						
Percichthyidae	*Maccullochella peelii*	Murray Cod		V	Nil, habitat absent	Throughout the waterways of the Murray–Darling Basin ranging from clear, rocky streams to slow flowing turbid rivers and billabongs. Not found in cooler, upper reaches of the Murray and Murrumbidgee (1).
Percichthyidae	*Macquaria australasica*	Macquarie perch		E	Nil, habitat absent	Throughout the waterways of the Murray–Darling Basin . Bottom or mid-water in slow flowing streams, and some upland catchment water bodies with intact riparian vegetation (1).
REPTILES						
Agamidae	*Tympanocryptis pinguicolla*	Grassland earless dragon	E1	E	Nil, habitat absent	Natural Temperate Grassland dominated by Wallaby Grasses (*Danthonia* spp.), Spear grassess (*Stipa* spp.) and Kangaroo grass (Themeda australis) with a light grazing regime and that have not been degraded by fertilisers and pasture improvement. Optimal Inter tussock distance is also considered an important factor for foraging and protection. Availability of wolf spider and cooroboorama cricket burrows for shelter and protection from predation.

Table 4.3 – Threatened Fauna (cont.)

Family	Species Name	Common Name	Status		Potential Presence in Impact Area	Habitat requirements
			TSC	EPBC		
Pygopodidae	*Aprasia parapulchella*	Pink-tailed Legless Lizard	V	V	Nil, habitat absent	Lizards usually occur in open grassland habitats that have a substantial cover of small rocks . Preference is shown for sunny aspects, avoiding south facing slopes. The species is only found at sites with good numbers of invertebrates under rocks . Although usually in proximity of a native patch of Wallaby Grasses (*Danthonia* spp.), Spear grasses (*Stipa* spp.) and Kangaroo grass (*Themeda australis*) some specimens have been collected from grassland sites without any native grasses. Sometimes found on the edge of woodlands such as *Casuarina stricta*, *Callitris endlicheri* (Black cypress pine) and *E. macrorhyncha* (Red stringybark) (1).
	Delma impar	Striped legless lizard	V	V	Nil, habitat absent	Until recently, *D. impar* was thought to inhabit only native grasslands dominated by species such as *Stipa bigeniculata* (Spear Grass) and *Themeda triandra* (Kangaroo Grass). In recent years, surveys have revealed *D. impar* in many sites dominated by exotic grasses such as *Phalaris aquatica*, *Nasella trichotoma* and *Hypocharis radicata*). They have also been found in several secondary grassland sites (i.e. sites which were not historically grassland, but which have been cleared for grazing or agriculture). The presence of a relatively dense and continuous structure, rather than the floristic composition of the grasslands, may be important in influencing the persistence of *D. impar* (1).
Varanidae	*Varanus rosenbergi*	Rosenberg's Monitor	V		Possible	Occurs in a variety of habitats including: wet and dry sclerophyll forests, woodlands, heaths where it shelters in hollow logs, burrows, and rock crevices. Utilises termite mounds for nesting sites (2).

4.1 NSW TSC Act

Section 5A of the *Environment Planning and Assessment Act 1979* describes factors that must be taken into account in making a determination as to whether a proposal will result in a significant effect on threatened species, populations or ecological communities, or their habitats. The considerations under S.5A of the EP&A Act presented in the following assessments must be made for any potentially impacted species, populations or communities listed on the schedules of the *Threatened Species Conservation Act 1995*.

On the basis of the preliminary assessments in **Table 4.2** and **Table 4.3**, the relevant species are considered under S5A of the EP&A Act below. Given similar habitat requirements and the limited likelihood of any impact to a number of the species, they have been grouped for the purpose of the assessment.

Further to the species considered in the table below, the endangered ecological community 'white box yellow box Blakely's red gum woodland' is known to occur in areas peripheral to the area affected by the proposed action. While there will be no direct impact to this community, it is considered under S.5A of the EP&A Act with respect to potential indirect impacts.

Threatened Species and Communities

Listed species and communities potentially affected by the proposal are woodland birds that generally forage in the lower strata and are also substantially terrestrial in their habitat requirements. These species were considered to possibly occur within the affected area associated with foraging activities:

- button wrinklewort (Rutidosis leptorrhynchoides);
- small purple-pea (Swainsona recta);
- silky swainson-pea (Swainsona sericea);
- austral toad flax (Thesium australe)
- speckled warbler (Chthonicola sagittata);
- brown treecreeper (eastern subspecies) (Climacteris picumnus victoriae);
- diamond firetail (Stagonopleura guttata);
- white-fronted chat (Epthianura albifrons);
- hooded robin (south-eastern form) (Melanodryas cucullata cucullata);
- scarlet robin (Petroica boodang);
- flame robin (Petroica phoenicea); and
- white box yellow box Blakely's red gum woodland.

in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The proposal will not have an adverse impact on the life cycle of the listed species such that any viable local population would be placed at risk of extinction.

in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

This part is not relevant to threatened species or endangered communities.

in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

a. *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
b. *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

The proposal affects a small (approximately 0.2 hectares) and highly modified area that supports exotic pasture and degraded native pasture, none of the affected areas are consistent with the description of white box yellow box Blakely's red gum woodland. Accordingly the proposal is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence will be placed at risk of extinction.

It is also unlikely that the proposal would substantially or adversely affect the ecological composition of the local occurrence of white box yellow box Blakely's red gum woodland.

in relation to the habitat of a threatened species, population or ecological community:

a. *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
b. *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
c. *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

Potential habitat affected by the proposal is highly disturbed and retains few features that would encourage the area to be an important component of the habitat requirements of any of the list species whether in the short or long term. There is also unlikely to be any adverse indirect impacts that would result in a subsequent effect to other areas of proximate habitat for the listed species.

For flora species considered, none occur down-stream of the proposed dam and as such there are unlikely to be any indirect effects to those species through altered drainage patterns, water availability or other such effects. Similarly, it is unlikely that the proposal would result in any indirect impacts to peripheral areas of white box yellow box Blakely's red gum woodland.

The proposal will not result in the fragmentation or isolation of habitat for any of the listed species or communities.

As described above, the affected habitat affected by the proposal is of poor quality with respect to the listed species. The proposal will not directly affect any area of the local occurrence of white box yellow box Blakely's red gum woodland. In addition to the relatively small area affected, the importance of the affected habitat is considered to be low. Given this, the proposal is unlikely to affect any area of importance to any of the listed species or communities.
whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly), There are no areas of critical habitat on the Register of Critical Habitat relevant to the study area.
whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan, The proposal is not inconsistent with recovery actions identified for these species, primarily due to the absence of these species from the study area and low importance of the potential habitat.
whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process. The proposal does not contribute to any listed key threatening processes relevant to the listed species.
SUMMARY Consideration of the proposed impacts under Section 5A of the EP&A Act concluded there is unlikely to be any significant impacts to listed threatened species, population or communities as a consequence of the proposal. This assessment considered both the direct impacts of the proposal with respect to the area to be inundated and subject to construction in addition to the indirect effects that may potentially occur as a result of altered drainage patterns.

4.2 EPBC Act

The following definitions of 'significant' and 'likely' are presented in the significant impact guidelines published by the Commonwealth (DEWHA, 2009) with respect to assessment of matters of national environmental significance. These provide context to the assessments presented for the relevant species and communities.

What is a significant impact?

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance.

When is a significant impact likely?

To be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility.

If there is scientific uncertainty about the impacts of your action and potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.

The proposed action relates to impacts on a small (0.2 hectare) area of degraded habitat and will not impact any listed matter of national environmental significance such that a significant impact is likely.

4.3 Summary

Consideration of the proposal under Section 5A of the *Environment Planning and Assessment Act 1979* determined there was unlikely to be any significant impacts to species or communities listed in NSW. Species and communities in the locality listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were also considered however assessment was not conducted as it was determined that a 'significant' impact was not 'likely' with reference to definitions recommended by guidelines to the assessment process.

This assessment concludes that in the absence of suitable habitat for species and communities known to occur in the locality, no listed matter of state or national environmental significance would be significantly impacted.