23 DECEMBER 2013

Determination of Calga Sand Quarry Project, Calga
(MP06_0278)

1. DELEGATION TO THE COMMISSION

The project application lodged by Rocla Materials Pty Ltd (the Proponent) has been referred to the Planning Assessment Commission (the Commission) for determination under Ministerial delegation dated 14 September 2011. The delegation is authorised because more than 25 submissions in the nature of objections were received by the Department of Planning and Infrastructure (the Department).

The Commission constituted to determine the application consists of Ms Jan Murrell (chair), Mr David Furlong and Mr Brian Gilligan.

2. PROJECT APPLICATION

The Proponent proposes to expand the existing Calga Sand Quarry to Stages 4 (an extension of Stage 3) and 5. Stage 3 is currently in operation and operates under a Ministeral approval granted in 2005. The proposal seeks to:

- increase the production rate from a limit of 400,000 tonnes, so that up to 1 million tonnes of sand product can be produced per year;
- increase the extraction area by 36.2 ha (currently stage 3 has an extraction area of 7.2ha) ;
- extract between 8metres and 30metres below ground level;
- increase the hours of operation; and
- provide 102 ha of biodiversity offsets.

3. THE ASSESSMENT REPORT

The Director-General's Environmental Assessment Report ('the Assessment Report') considered the proposal, its statutory context, public and agencies submissions, and the Proponent's responses to submissions. The report identified the following key issues:

- Biodiversity (including offsets);
- Water resources;
- Noise and Air Quality;
- Aboriginal Heritage;
- Visual Amenity;
- Traffic and Transport; and
- Socio-economics.

The assessment report concludes that Stage 5 should not be approved and that the area for stage 5 should be included in the permanent biodiversity offset strategy. The removal of stage 5 would limit biodiversity impacts and would also reduce visual impacts and impacts to The Australia Walkabout Park to the east and Glenworth Valley to the west. The Department further recommended that the Proponent provide a natural final landform in the vicinity of the Aboriginal Women's site and rehabilitate approximately one third of the Stage 4 pit to native

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woodland. The Department acknowledged that the site has been identified as a regionally significant sand resource and a preferred location for extractive industries. The Department stated that it has recommended a comprehensive and precautionary suite of conditions to ensure that predicted residual impacts are effectively minimised or mitigated. The Department concluded that on balance the project's benefits sufficiently outweigh its residual costs and that the project should be approved.

4. MEETINGS AND SITE INSPECTIONS

On 5 November 2013 the female member of the Commission and the senior planner working on the project met on site with Aboriginal women and Elders to inspect the Aboriginal women's heritage site (the 'women's site') and other relics in the area.

On 18 November 2013, the Commission visited the site and held a meeting with the Proponent, followed by a meeting with Gosford City Council (Council), followed by the scheduled public meeting which was held in the Peats Ridge Public School Community Hall from 4.00pm until approximately 8.30pm. A brief summary of the issues raised at these meetings are provided below. Further detail regarding these meetings can be found in Attachment 2. Thirty-three people were registered to speak at the public meeting (see attachment 1) and thirty-two people presented.

4.1 Proponent

The Proponent raised the following issues during the site visit by the Commission:

1. Quality of the fill to be imported to mix with the sand products;
2. Air quality monitoring in particular monitoring of $PM_{2.5}$;
3. Timing of the completion of environmental management plans;
4. Current operating processes;
5. Justification for the proposed hours of operation; and
6. Aboriginal heritage.

4.2 Gosford City Council

Council raised the following matters:

1. Support stage 5 being deleted from the project application as recommended by the Department;
2. Uncertainty regarding the extent of the road dilapidation survey;
3. The importance of independent monitoring of ground water, surface water, noise and air quality;
4. The need for a community enquires telephone hotline;
5. Minimisation of visual impacts from stage 4 through a rehabilitation plan;
6. Applicability of the *Sydney Regional Environment Plan No.9 - Extractive Industry* (SREP 9) to the proposed site;
7. Suitability of hours of operation; and
8. Impacts to the Australia Walkabout Park.

4.3 Public Meeting

A detailed list of issues raised by the thirty two people who spoke at the public meeting at Peats Ridge Public School Community Hall on 18 November 2013 is attached (see Attachments 1 and 2).

The key issues raised at the public meeting were:

1. In view of the scale of the proposal, the project should be assessed as a separate quarry proposal rather than an expansion of the existing quarry;
2. The impacts on ground water, consideration of the water sharing plan and water licence requirements;
3. Impacts on Aboriginal heritage and culture, in particular, the erosion of the landscape context for significant Aboriginal heritage sites ;
4. Dust and health impacts associated with the quarry operations;
5. Noise impacts associated with truck movements and the proposed hours of operation;
6. Impacts on flora and fauna, groundwater dependent ecosystems and the inadequacy of biodiversity offsets proposed;
7. Inadequate assessment processes, particularly for noise, groundwater, air quality and flora and fauna impacts;
8. Socio economic impacts including impacts on local tourism in particular the impacts on the Australia Walkabout Park and Glenworth Valley;
9. Potential land use conflicts and sterilization of the land for agricultural activities; and
10. Insufficient justification for the sand quarry expansion to proceed.

Issues raised at the public meeting are further detailed in attachment 2. These issues were congruent with those raised previously in written submissions to the Department.

5. COMMISSION'S CONSIDERATION

The Commission has carefully considered the Department's Assessment Report, documents provided, written submissions and views expressed at the public meeting and in meetings with the Proponent and Council, as well as knowledge gained from the site visit. Key considerations for the Commission were:

Aboriginal Heritage

The Commission notes that the Department recommends (the Supplementary Heritage Assessment and Preferred Project Report proposes) a revised buffer based on the "line of sight' from the quarry operations to the 'women's site' to minimise visual impacts from the quarry. The Department also recommends one third of the Stage 4 pit should be rehabilitated to a state that is similar to its natural landform with native woodland after extraction to further reduce the impacts on the 'women's site'. The Proponent has stated that a dedicated access track to the 'women's site' will be constructed immediately (across Rocla owned land) to provide long term unrestricted access for local knowledge holders and visitors.

The Commission acknowledges that Aboriginal women's heritage sites are rare and of high importance. The Commission accepts the Department's recommendation and the Proponent's commitment to the protection of the site. However, with respect to the Department's recommended buffer to the 'women's site' the Commission is of the opinion the Proponent should consider increasing the buffer to accommodate the edge effect on vegetation given the shape and lineal extent of potential exposure to quarry activities. The recommended conditions have been amended to reflect this requirement.

The Commission is also of the view that the Landscape Plan should be updated to ensure that it is consistent with protection of the 'women's site' having regard to the buffer zone and reflects the requirement to rehabilitate the area identified in Stage 4.

The Commission is satisfied that the Department's recommended measures and conditions, which include maintaining and managing reasonable access for Aboriginal stakeholders to cultural heritage items on site and the additional requirements imposed by the Commission will assist in minimising the overall impact from the project on Aboriginal heritage.

Water

Many community members raised concern regarding water resources, licence allocations, the adequacy of the groundwater modelling and surface water impacts.

Water Resources and Licence Allocations

The availability of water resources was a key concern to the community, given its importance for sustaining land use activities which contribute to the local economy. The Commission notes that the site is located in zone 7 of the Kulnura Mangrove Mountain Groundwater Resource and that 1,637ML of water are able to be extracted from this zone under the Water Sharing Plan. Currently the total water access licences issued by the NSW Office of Water (NOW) for zone 7 is 950ML. It is predicated that the project would require a maximum of 74ML of water per year (with the average being 23ML/year).

The Commission accepts the conclusion in the assessment report that the appropriate water resources are available and that the project is unlikely to have a significant impact on water availability and water sharing in the area. The Commission agrees with the Department and NOW that the Proponent must obtain the appropriate water licence prior to the commencement of extraction. It also notes that the Department has recommended a condition that no extraction is to commence at the site until the appropriate water licence has been obtained from the NOW.

Groundwater

The community raised concern regarding the adequacy of the groundwater modelling. The Commission notes that the Department engaged an independent groundwater specialist Dr Frans Kalf to undertake an independent review of the Proponent's groundwater modelling and impacts. Following this review the Proponent provided additional groundwater modelling which was conducted by Dr Noel Merrick, Heritage Computing.

The Commission discussed the community's concerns with the Department and it was agreed that Dr Kalf's comments be sought on the additional material. Subsequently Dr Kalf advised by letter dated 20 December 2013 that "overall the Heritage Computing report is quite detailed and more extensive than conducted previously and the calibrations and predictions are considered to be plausible" (see attachment 3).

The Commission supports the Department's recommendation that continuous groundwater monitoring must be conducted and regular reporting is required to verify the results of the modelling report to ensure impacts to groundwater are minimised.

Surface Water
The Commission concurs with the Department that best practice mitigation measures should be implemented to manage water on site including the diversion of clean run-on water and the treatment of dirty water to further reduce the impacts.

Conclusion
The Commission is satisfied that surface and groundwater issues have been adequately addressed in the assessment report and recommended conditions of approval.

Biodiversity Offsets
The community and the Office of Environment and Heritage (OEH) raised concern regarding the adequacy of the biodiversity offsets.

The Commission notes that the proposal includes the removal of 37ha of native vegetation with an 88ha offset proposed. Part of the proposed offset includes Stage 5 as an 'interim' offset until such time it is ready for quarrying. Prior to the commencement of Stage 5 the Proponent proposes to identify an alternative offset to replace the Stage 5 'interim' offset.

The OEH stated that it does not support the inclusion of Stage 5 as part of the offset area and that the proposed offset areas should be greater. Council also supports the removal of Stage 5 from the project application. The Commission notes that the government policy on offsets is under review and transition arrangements between current and future policy may have implications for any future proposal that might be brought forward to extract sand from the Stage 5 area. In the circumstances the Commission agrees with the Department that this approach lacks certainty and does not support the 'interim offset'.

The Commission considers that the removal of Stage 5 from the project is warranted to limit biodiversity impacts, as well as groundwater impacts, and potential noise, health and visual impacts on the Australia Walkabout Park. The Commission concludes that the biodiversity offset strategy should be prepared in consultation with the OEH for the Director-General's approval and should be implemented as part of the overall Landscape Management Plan.

Noise
A number of the community members raised noise impacts as an issue. The three key issues which relate to noise are: noise impacts from the quarry operations and truck movements, hours of operation and loading operations.

Quarry Operations and Truck Movements
The Commission understands that with the mitigation measures put in place (as set out in the assessment report) that the predicted operational noise levels and noise generated by truck movements would comply with the applicable noise criteria at all off site residences including the Australia Walkabout Park. The Commission is satisfied that with the removal of Stage 5, the requirement of attended noise monitoring and the implementation of noise mitigation measures that the noise impacts can be adequately managed.

Hours of Operation
The Proponent seeks to extend the hours of operation to meet customer demands and avoid peak hour traffic times when delivering to construction sites in Sydney. The Commission notes

that the assessment report found that the predicted noise levels from operation and transportation are expected to meet the relevant criteria and a condition requiring monitoring is imposed. The Commission is of the opinion that the recommendation to extend the hours of operation is reasonable.

Loading
Council requested that loading be defined and assessed as a separate activity to extraction and processing. The Department advised that the inclusion of loading as part of the extraction and processing activities is in line with the *Industrial Noise Policy* and providing for a separate definition and assessment would be inconsistent and not appropriate. The Commission concurs with the Department's advice.

Conclusion
Given that the predicted noise levels would meet the relevant criteria during operation and transportation the Commission is satisfied that operational noise is expected to comply with the relevant noise criteria and any residual impacts can be adequately managed through the implementation of mitigation measures, including ongoing monitoring.

Traffic and Transport
The Commission notes that the project would result in a maximum of additional 30 truck movements per hour in a busy period and that there is reasonable access from the site to the arterial road network. The Council raised concern regarding road dilapidation and maintenance. The Commission discussed the issue with the Department, as there is no section 94 contribution plan in place the Department does not believe a maintenance levy would be reasonable. The Commission agrees with the Department's position.

Other Issues
The Commission notes that whilst the *Sydney Regional Environmental Plan No.9 – Extractive Industry* (SREP 9) does not apply to all lots within the project site, the sand resource on the site has been identified as regionally significant. The Department advised that although Lot 1 is not included in SREP 9 from a strategic perspective the objectives of SREP 9 should apply. While the Commission agrees with this approach it notes that the *Sydney Regional Environmental Plan 8 – Central Coast Plateau Areas* also applies to site.

Council and the community raised concern that no community enquiries hotline is proposed. To address this concern the Commission has imposed a condition which requires a 24 hour community telephone hotline and complaints register to be established. The complaints register is to be included in the annual review.

The Commission has made minor administrative amendments to the timing of the preparation of the environmental management plans.

COMMISSION'S DETERMINATION
The Commission has carefully considered the Department's Assessment Report and recommendations, including the recommended conditions. The Commission has also carefully considered the issues raised in both public and agency submissions on the application.

The Commission sought clarification from the Department on specific aspects of the project. The Commission is now satisfied that the impacts of the project can be adequately minimised, managed and contained and has amended the conditions recommended by the Department to strengthen the management measures. Consequently, the Commission has determined to approve the project, subject to these amended conditions.

Member of the Commission

Member of the Commission

Member of the Commission

Attachment 1

Speakers

Planning Assessment Commission Public Meeting

Calga Sand Quarry
(MP06_0278)

Date & Time: Monday , 18 November 2013, 4pm

Place: Peats Ridge Public School Community Hall

1. Gosford City Council - Danielle Dickinson, Director Environment and Planning
2. Darkinjung Local Aboriginal Land Council - Sean Gordon, CEO
3. Mangrove Mountain and Districts Community Group - Margaret Pontifex, Secretary
4. Annette Wilby
5. Angela Hellyer
6. Calga Peats Ridge Community Group - Maggie Dupille and Graeme Ausburn
7. Our Land, Our Water, Our Future - Paul Burton
8. Walk About Wildlife Conservation Foundation – Tassin Benard spoke on behalf of Andrew Smith
9. Save the Sacred Land at Kariong - Jake Cassar
10. Guringai Tribal Link Aboriginal Corporation - Tracey Howie
11. Central Coast Tourism - Robyne Abernethy
12. Community Environment Network - Michael Conroy
13. Mingaletta Aboriginal Group - Barbara Crew
14. Anita Selwyn
15. Catherine Barnard
16. Gerald Barnard
17. Sharon Hodgetts
18. Peter Campbell spoke on behalf of Ian Sim
19. Carrie Hardie
20. Alan Vandenberg
21. Leif Gratton-Wilson
22. Karen Anderson
23. Adrienne Ausburn
24. Kath Schilling
25. Annette Wilby spoke on behalf of Debbie Chancellor
26. Terri Thomson
27. Robert Pankhurst
28. Neil Berecry-Brown
29. Simone Glover
30. John Hancock
31. Sharon Hodgetts spoke on behalf of Annie Ross
32. Goolaveen Darkinyo

Attachment 2
Public Meeting

On 18 November 2013, the Commission held a public meeting at the Peats Ridge Public School Community Hall. The issues raised at the meeting are outlined below:

Water Impacts

- Groundwater quality monitoring should be conducted independently;
- Impacts to the groundwater and the aquifer. The aquifer will not recharge;
- The project does not comply with the Water Sharing Plan;
- The removal of sandstone will impact on the groundwater and cause draw down;
- The groundwater modelling is inadequate;
- Loss of groundwater will affect agriculture;
- A water licence must be obtained for the project;
- The groundwater to be extracted has not been quantified;
- The Proponent does not currently hold sufficient water licences; and
- The project will result in significant impacts to the local water supply.

Aboriginal Heritage Impacts

- Destruction of aboriginal sites and landscape is not acceptable;
- Aboriginal culture will be lost;
- Significant Aboriginal men and women's site;
- Currently limited access to the Aboriginal women's site;
- The area is spiritually significant to Aboriginal people;
- Less than 2% of sites are Aboriginal women's sites. The site must be protected for Aboriginal female ancestors;
- Potential for other Aboriginal heritage items to be present at the site;
- Not all the Aboriginal sites have been registered;
- Irreversible damage to Aboriginal heritage;
- Aboriginal sites have already been destroyed at Peats Ridge; and
- The cultural landscape is highly important to the Aboriginal people.

Air Quality

- Dust and health impacts associated with the quarry operations;
- Air quality monitoring should be conducted independently;
- The air quality monitoring is inadequate as no local air quality monitoring has occurred; and
- Dust impacts on Australia Walkabout Park.

Noise

- Acceptability of the hours of operation. It was requested that the proposed hours of operation be reduced;
- Noise quality monitoring should be conducted independently;
- Noise impacts to neighbouring residents caused by truck movements is not acceptable;
- Noise and vibration impacts from truck movements have not been adequately assessed;

- Each sensitive receiver should have been assessed for noise and vibration;
- Noise impacts to Australia Walkabout Park; and
- Bunding of quarry walls will not reduce the noise impacts to Australia Walkabout Park.

Flora and fauna

- Hanging swamps are groundwater dependent and will be affected by the loss of groundwater
- Endangered Ecological Communities and biodiversity offsets have not been adequately assessed and addressed; and
- A greater biodiversity offset area is required.

Roads and Transport

- Compliance and monitoring of truck movements;

Socio Economic Impacts

- Impacts on the Australia Walkabout Wildlife Park, Glenworth Valley and the local eco tourism industry; and
- Loss of tourism will impact on local businesses.

Other issues

- Council support the deletion of Stage 5;
- The need for a 24hour community enquiries hotline;
- Project will result in land use conflicts and sterilise the land;
- Insufficient studies conducted on sand quarries;
- Poor justification for the project. The need for further sand quarries is not justified;
- The sand will be used for coal seam gas extraction;
- Part 3A projects should not be accepted. The project should have been determined by Gosford City Council;
- The zones and Local Environment Plan have not been considered;
- Proximity of the project to Australia Walkabout Park will be approximately 700m; and
- Inappropriate management of resources – sand vs water.

Attachment 3
Groundwater Review – Kalf and Associates

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20 December 2013

Calga Sand Quarry Southern Extension Project
KA Review Comments related to Heritage Computing Groundwater Assessment Model

Background

The Department of Planning and Infrastructure (DoPI) on the 17 December 2013 requested that Dr F. Kalf of KA review the findings of the modelling report prepared by Heritage Computing (HC) for the proposed southern extension of the Calga Sand Quarry.

A hydrogeological investigation and reporting of the area was conducted by GeoTerra (2009) and a subsequent modelling study completed to determine the impact of the Calga sand quarry extension (Stages 4 and 5) on the groundwater system by Golders consultants (report contained in the GeoTerra 2009).

KA (2013) conducted a review of the Geoterra/Golders Calga hydrogeology and modelling using references cited at the end of this report. The KA (2013) report concluded that the hydrogeological aspects presented were of a reasonable standard but that the modelling contained a number of omissions that made it difficult to be precise about the veracity of the results presented and their interpretation. KA (2013) subsequently recommended that the modelling and reporting be either improved or redone. Subsequently the modelling work was conducted by Heritage Computing Pty Ltd (HC 2013) which is the subject of this review.

Because of time constraints and also issues found in the HC report that required additional time to resolve, this report by Dr F. Kalf will be less detailed than normally conducted by KA. Hence no check list is provided for the assessment using the new Water Commission Groundwater Modelling Guidelines. However this report does provide a summary of the objectives of the modelling work, and an overall assessment of the suitability and plausibility of that work conducted and results presented by HC based on the Dr Kalf's working experience. In addition this report makes comments on the issues raised in the first KA report (KA 2013) and how the new modelling results change or otherwise the conclusions made in that first review.

Some issues and errors were found in the report and were discussed with Dr Merrick and mostly resolved. Any outstanding ones are commented on in the body of this review and in footnotes[1].

[1] Figures 1, 2 and 3 for example were excessively compressed and it was difficult to decipher bore notation. Also the topographic map underlays were progressively shifted in a general northerly direction in Figures 4 and

Review

Overall the HC report is quite detailed and more extensive than conducted previously and the calibration and predictions are considered to be plausible.

Conceptual Model

The conceptual model in Figures 6 and 7 are considered valid.

Model Software and Extent

The modelling software used for this project by HC is MODFLOW-SURFACT (MS) which is entirely suitable for this kind of modelling assessment. The modelling area selected for this project is however considered excessive given the relatively small size of the mine site and surrounds compared to the 1200 sq kilometres covered by the model. But this is largely due to the use of a previous calibrated model of the region prepared (with assistance of his supervisor Dr Merrick) by Dr M. Alkhatib for his Ph.D. degree who was the primary HC modelling consultant for this project. For this project the grid/cell array used in the previous regional model was increased in resolution in and around the mine site using a 50m cell size extending out to 500m elsewhere.

Model layers

Model layering adopted is considered suitable with ten layers used to represent both the Hawkesbury Sandstone Formation and underlying Narrabeen Group hydrogeological units and as sub-divisions of these units for separating the soft, medium and hard sandstone, alluvium and siltstone/shale sequences and for achieving sufficient vertical resolution in the model.

Boundary conditions and model sections

Boundary conditions set for the model are suitable. Ephemeral streams have been set as drains using a method modification of the "River" package in MS to prevent outflow but to allow only inflow. Some major streams use the standard "River" package. Maximum evapotranspiration was set at 60mm per annum which is considered to have been underestimated although it is accepted that this would be balanced out to some extent by the values adopted for recharge to achieve calibration.

The hydrogeological model sections shown in Figure 10 are apparently and unfortunately shown to true vertical scale and over the entire large scale model rather than the immediate site area and surrounds and hence are of poor quality[2]. Consequently model layer detail, and conceptual understanding about the model set up of the quarry site area is lost.

Model parameters

The initial distribution and assignment of permeability[3] and storage parameters in the model are those that were used in the original Alkhatib regional model. Calibration however was subsequently used to refine these values using trial and error methods. Although sensitivity and uncertainty analyses are not covered specifically in the report, consideration of these aspects would be to some extent embedded in the calibration process.

Calibration

Both steady state calibration using bore water level measurements and transient analysis calibration was conducted. Bore hydrographs over the period January 2007 to December 2012 were used for transient calibration that included Calga quarry monitoring, private and

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5 in HC(2013) compared with Figure 1 in Geoterra (2009) report. However, bore position relative to site boundaries were not affected and hence these errors have had no affect on the model simulations conducted. Bore MW16 was also found to be duplicated in error in the bottom LH corner in HC report Figure 4.

[2] Dr Merrick agrees with this conclusion.

[3] Permeability is used herein as a substitute for the correct term hydraulic conductivity for convenience.

NOW registered bores. The start of the hydrograph period included a major recharge event that followed a long period of drought in the area that appreciably affected the watertable elevations in the region. As outlined in KA (2013) concerns and complaints by the community that the mine affected their bore yields and water levels can be attributed to the drought period that caused water levels to fall considerably.

Calibration statistics have been provided for both the steady state and the transient simulations in the HC report. Steady state calibration achieved a 5% RMS[4] which is well within the accepted 5 to 10% range and is a very good result. For the transient case the key statistic was 2.8% RMS[5], which again is a very good result. However some Group 3 bores show marked deviation and the cause for this could have been explained[6]. The results of the simulated drawdown at December 2012 are shown in Figure 20 in the HC report.

Predictions

Prediction of drawdowns for the period from December 2012 to December 2037 was simulated. In particular it included stage 3/3a to completion in December 2019; stage 4/1 extraction to the end of 2034 and stage 5 to the end of 2037. Rainfall was applied at long term average rates and is appropriate in order to determine influence that mining would have rather than its combination with either excess or deficits in rainfall.

The predicted inflows to the mining zones and the influence to baseflows presented are considered to be plausible. Inflows to stages 3, 4 and 5 respectively are expected to peak at 30, 300 and 70 kL/day respectively. Average baseflow at individual reaches would decrease from zero percent to 0.15 percent with combined creeks designated as A, B and C in the report by 39%.

Time and budget apparently prevented total heads and water table position sections being presented as suggested in the KA(2013) report review (*Merrick pers. comm.).* Although not critical to the outcome it would have assisted in displaying the relative watertable position over the mining site region.

Recovery of water table levels will occur over a period of about 30 years although the model was run for a total 200 year time period.

Potential Impacts

In general the GDE would not be affected appreciably except possibly GDE E54 along creek B as designated in the report but not if its groundwater is supplied by a perched saturated zone.

Figure 20 that shows the drawdown up to December 2012 indicates that mine drawdown in CP bores north of the mined zone is in the range 0.1m to just over 1m whilst in the CQ bores it is in the range 0.1m to 3m. Figure 23 shows the drawdowns in Stage 4 excavation and in the backfill silts/slurry in stage 3. Because of very low permeability in the stage 3 backfill (0.001 m/day permeability adopted) this impedes drawdown propagation across the northern area occupied by the CP and CQ bores yielding negligible drawdown influence. Only bores CQ3, CQ10 and CQ1 are affected.

Figure 27 shows the drawdowns in the backfilled stage 3, partial backfilled stage 4 and no-fill in stage 5. Again because of silt/slurry backfill there is negligible drawdown in the CP and CQ bores with the exception of CQ3, CQ10 and CQ1.

[4] RMS: Root Mean Square. The report indicates 4% RMS but this is the Scaled RMS as noted in Table 5.
[5] 2.2% RMS in the text is noted as the SRMS in Table 8
[6] Dr Merrick agrees with this comment.

Community Concerns

The comments provided by the community that relate specifically to the mining influence on groundwater levels and hence groundwater yields in bores were assessed in a preliminary manner in KA (2013). It is worthwhile to briefly indicate whether these issues have any more relevance than when first assessed by KA. The issues are presented below as they were outlined in KA (2013).

a) Bore yields [surrounding the mine] have been *"seriously depleted"* as a result of the existing mine influence and such influence has *"disrupted"* the flow of groundwater in the Australian Walkabout Wildlife Park bore for example. AWWP (2013) claim that their bore had been affected and that it could only be pumped for 3 hours before it needed to recover. They stated they did not want the bore tested.

b) The owner of the Kashouli bore in 2004 indicated that the quarry had caused the bore to *"dry up".*

c) Monitoring bores (DWE) within 10km of the mine showed falling water levels during the period 2002 to 2006. These falling water levels need to be taken into account in any impact created by the mine.

d) Difficulty of establishing practical available drawdown in landholders' bores *"because they do not take into consideration the position of pumps or aquifers".*

e) The consultant groundwater assessment that the drawdown effect from the quarry would be limited to 100 metres from the edge of the quarry is false and misleading.

f) "*In 2008 a sudden SWL* [standing water level] *drop (approx 5m) occurred in one of NOW's monitoring bores 2 km N of the current* [mining] *operations"* (CPRCG -Water submission Part B).

g) CPRCG (Water submission Part A) refers to *"State of the Art Modelling"* and that there was deliberate selection of the *"best case"* of the final [ground]water inflow that was 161ML per year (referred to in GeoTerra (2009) page 1-76) rather than in the other 'sensitivity case' at 616ML[7] per year based on the model results.

The following are the KA responses based on the current set of modelling results:

a) The drawdowns that could be attributed to the mining to December 2012 are shown in Figure 20 in the HC (2013) report. The figure indicates that mine drawdown in CP bores north of the mined zone is in the range 0.1m to just over 1m whilst in the CQ bores it is in the range 0.1m to 3m. The overriding impact on these bores has been without doubt the drought conditions imposed on the water levels in this region before the 2007 recharge of the groundwater system. With regard to the AWWP (Australian Walkabout Wildlife Park) bore[8], which is located about 1 km from the existing quarry, the results show that this bore would not have been affected by the current mining drawdown influence. The drop in yield can be attributed to the drought conditions coupled perhaps with some silting/clogging due to over pumping during the drought period with a much lower water level. This bore will also not be affected at the end of Stage 4 mining. If Stage 5 were to proceed then based on the bore's best known position the drawdown at the end of mining would be in the range 0.1 to

[7] Actually 1,700 m^3/day or 621.3 ML/year. (Golders report page 8)

[8] There is no acknowledgement of this bore in the HC report and apparently in the Dundon report (Merrick pers. Comm.). This bore is apparently situated adjacent to a turnoff road from Flynns Road before the turnoff road leads into a parking area. The bore is situated about 370m linear distance from bore MW7 (based on Google map distance determined by KA).

0.5m and certainly less than 2m.

b) It is evident that mine drawdown created would not have been sufficient to cause the bore to *"dry up"*. Drought conditions would have been the main cause.

c) A hydrograph analysis by Williams (2010) has shown that water level decline during the 1999 to 2007 drought was up to 7m in the region. This has been the main cause of bore problems experienced in the mine region and not mine created drawdown.

d) Again the drought conditions are the main cause for the falling watertable and not mine drawdown. There is however merit in the comment as indicated in the KA (2013) review.

e) The latest modelling results indicate that mine drawdown up to December 2012 of up to one metre lies at most 125m from the edge of mine pit with drawdown of between 1m rapidly decreasing to 0.1m extending out up to 500m from the pit. During and at the end of Stage 4 the drawdown will decrease progressively within the area occupied by bores CP and CQ located north of the pit because of the low permeability of the backfill to negligible influence with the exception of CQ3, CQ10 and CQ1.

f) This is presumed to be Bore GW080167. This sudden drop in water level has nothing to do with mine influence. Williams (2010) has noted logger malfunction or logger interference as a possible cause which is consistent with the very sudden rapid water level response. KA is in agreement with view expressed by Williams.

g) As noted in the previous review (KA 2013*), 'the 'sensitivity case' modelled by Golders was considered to be unrealistic because of the excessive recharge applied to the model -That simulation yielded a total mine inflow of 1,700 m^3/day (621 ML/year). Hence the choice made by the GeoTerra consultant of 161 ML/year inflow was deliberate not because it was the "best case" (i.e. lowest value) but because it was more realistic."* However the recent modelling work based on transient simulation that takes into account storage of the system rather than steady state used previously has indicated inflows to stages 3, 4 and 5 respectively are expected to peak at 30, 300 and 70 kL/day respectively, that is, about 11, 110 and 26 ML/year.

Comment

The new set of modelling results clearly indicate that both drawdowns created and inflows into the simulated pit extensions are much less than the results presented using the previous modelling of the Calga Sand Quarry mine southern extension. The reason that the earlier model would very likely not be representative was highlighted in the previous KA (2013) report. The report indicated: *"Use of steady state condition for* [calibrating and] *predicting drawdown is severe, ...where effectively the storage of the groundwater system is set to zero. However, under these conditions, rainfall recharge can often then become the proxy forcing parameter for obtaining a satisfactory calibration due to the lack of buffering by formation storage*.....[and] *necessitated the application of very much higher recharge values to achieve what was described as an "acceptable" calibration based purely on achieving a small error of fit".* That is, as a consequence of eliminating storage from the simulated groundwater system required increased recharge and as a result much greater pit inflows, and without storage buffering led to much greater extent and magnitude of mine induced drawdowns.

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References

Australian Walkabout Wildlife Park (AWWP) 2013. *Submission - Section 4.0 Groundwater. Feb.*

Aquaterra 2008 *Calga Sand Quarry 2008 Annual Groundwater performance Review. Report ref: S4B/B4/600/006b. Sept. Report prepared for Rocla Pty Ltd.* [Report is contained in the GeoTerra 2009 document referenced below.]

Corkery & Co 2012. *Final response to Government Agency submissions and non-confidential public submissions.*

Corkery & Co 2009 *Calga Quarry Environmental Assessment - Executive Summary. Report No 664/01*

Corkery & Co 2009 *Calga Quarry Environmental Assessment. Section 2 Project Description. report No 664/01*

Corkery & Co 2009 *Calga Quarry Environmental Assessment. Environmental Setting.*

Corkery & Co 2012. *response to Government Agency submissions and non-confidential public submissions. Report No 664/04. Attachment 1 Results of Kashouli Pumping Test December 2005*

Community submissions from Sharp, Carlier & Sawkins, Wilby, Hellyer, Orban

Calga Peats Ridge Community Group Inc (CPRCG) 2013 *Submission 1 . Water- Part A 14 February.*

Calga Peats Ridge Community Group Inc (CPRCG) 2013 *Water Submission Part B. NOW Monitoring bores.14 February.*

GeoTerra 2009. *Calga Sand Quarry Southern Extension - groundwater Assessment. Special Consultant Compendium part 1. Oct. This report contains the Golder Modelling report and an Appendix B that deals with an Annual performance review by Aquaterra in December 2007 that contains bore hydrographs compared to absolute rainfall.*

Heritage Computing 2013. *Calga Quarry Southern Extension groundwater modelling. July 2013. Report HC2013/12. Prepared for Rocla Materials Pty Ltd.*

Kalf and Associates Pty Ltd (KA) 2013. *Calga Sand Quarry Project -KA Review Comments related to Groundwater. 4 March. Report prepared for DoPI.*

NSW Office of Water (NOW) 2010. Memorandum Meeting Notes F. Hancock. 12 February [Document is attached to the CPRCG Submission 1 - Water Part A referenced above]

Williams 2010. *Kulnura - Mangrove Mt Groundwater Sources. Groundwater Management Area 605 Hydrograph Summary. Oct.* [Document contained with CPRCG Water Submission Part B. referenced above]