



Our Ref: 3838/GA/20170724

24 July 2017

Tertius Greyling
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Department of Planning and Environment
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Dear Tertius

Re: Old Northern Road Quarry DA 250-09-01 Mod 5 - Response to Submissions

I refer to your correspondence dated 12 April 2017 requesting the preparation of a Response to Submissions report detailing Dixon Sand's response to issues raised in submissions on the above modification application for Old Northern Road Quarry.

Dixon Sand understands that a total of six (6) submissions were received from Government agencies, with no submissions received from members of the public or public interest groups. The following response is provided to the issues raised by each of the submissions received.

1.0 Department of Primary Industries

The EA indicates the proposal will extend the life of the consent by a further 20 years from 2022 until 2042. It notes the proposed modification "will not result in any change to the existing approved impacts on surface or groundwater resources, with the exception of an extension of the duration of impact" (see Table 2, page 14). Given that the extension of operating timeframe is significant it is not clear that impacts will not compound and increase above those currently approved. The proponent should provide an assessment that clearly outlines the likely impacts resulting from the proposed extension.

In order to confirm that the proposed extension to the life of the consent for the Old Northern Road Quarry will not result in any impact on groundwater resources, a Groundwater Assessment has been prepared by Golder Associates. The assessment includes a summary of existing groundwater monitoring data and an analysis of this data in the context of the approved operations including those activities approved as part of MOD 3 and MOD 4. It also provides an assessment of the proposed modification against the NSW Aquifer Interference Policy (DPI, 2012). A summary of the findings of this assessment is provided below, with the complete assessment included as **Attachment 1**.

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Background

Dixon Sand operates the Old Northern Road Quarry in accordance with the existing consent which limits the depth of extraction to 2 metres above the wet weather groundwater elevation of the following groundwater sources:

- the regional Sydney Basin Central Groundwater Source (SBCGS), a deep regional hard rock aquifer which comprises the deeper Hawkesbury Sandstone Aquifer and underlies the current extraction areas on Lots 29 and 196 DP 752025, and Lots 1 and 2 DP 547255.
- the Maroota Tertiary Sands Groundwater Source (MTSGS), a shallow water table aquifer which comprises the Maroota Tertiary Sands and weathered Hawkesbury Sandstone in the eastern portion of Lots 1 and 2 DP 547255.

In addition, Dixon Sand has limited extraction to 2 metres above the perched water table within a 100 metre buffer of the mapped extent of the MTSGS, in order to prevent any incidental water take from the MTSGS. Monitoring is undertaken within the buffer zone to detect any unforeseen groundwater impacts on the MTSGS.

An extensive groundwater monitoring network has been established within and surrounding the Old Northern Road Quarry site which commenced in 2003. The network monitors the deep regional SBCGS and overlying perched water tables. Information gained from the monitoring network has been used to establish pit extraction depths, which remain 2 metres above the wet weather groundwater elevation.

Groundwater monitoring of the SBCGS and perched water adjacent to the MTSGS has shown no discernible response to extraction operations at the Old Northern Road Quarry, with groundwater levels in designated monitoring wells remaining stable, signifying no groundwater impacts have occurred as a result of the existing quarry operations.

Assessment against NSW Aquifer Interference Policy

As discussed above, the depth of extraction at the Old Northern Road Quarry is not permitted to extend within 2 metres of the wet weather groundwater level of the SBCGS or the perched water within the 100 metre buffer zone of the MTSGS. These measures have been put in place to avoid impacts to groundwater levels. Therefore, interference with the groundwater levels of these aquifers in the vicinity of the quarry is not predicted to occur. This conclusion has been confirmed for the operations to date by groundwater monitoring data and this monitoring program will continue to provide assurance of this outcome.

An assessment of the proposed modification against the minimal impact considerations for highly productive alluvial groundwater sources set out in Table 2 of the NSW Aquifer Interference Policy has been completed and is provided in **Attachment 1**. The assessment concludes that the proposed extension of consent life satisfies the minimal impact considerations and will not alter the risks to groundwater associated with the Old Northern Road Quarry. This is due to the continued implementation of the following existing groundwater management strategies which will remain in place over the extended life of the quarry:

- Groundwater impacts to the MTSGS will continue to be mitigated by the 100 m buffer zone which was put in place along the western boundary of the MTSGS as a consent condition under MOD 4. To prevent incidental water take from the MTSGS, extraction within the buffer zone is currently limited to a depth of 2 m above the perched water table. The monitoring of groundwater levels within the buffer zone is undertaken to detect unforeseen groundwater impacts to the MTSGS.

- Outside of the 100 m buffer zone, groundwater impacts to the SBCGS will continue to be mitigated by maintaining extraction depth to 2 metres above the wet weather groundwater elevation of the SBCGS.
- There is an extensive groundwater monitoring network on site and ongoing review of groundwater monitoring data will continue to be undertaken to ensure the pit floors remain at least 2 metres above the wet weather groundwater elevation, thereby mitigating any drawdown impact to the SBCGS and MTSGS. Groundwater levels have remained very stable since the granting of MOD 3 and 4 and therefore no changes to the approved extraction depths is required.
- A Trigger Action and Response Plan is in place to ensure ongoing compliance with the AIP.

2.0 Office of Environment and Heritage

2.1 Original Submission

OEH has reviewed the documentation provided and notes that it is proposed to delete Condition 3.12 due to changes in staging of rehabilitation. OEH considers that Condition 3.12 should be replaced by a condition requiring rehabilitation be undertaken in accordance with the Rehabilitation and Landscape Plan required by Condition 6.3.

While it is noted that compliance with management plans is implicit within the consent due to the compliance monitoring, reporting, auditing and bond processes established by the consent, Dixon Sand has no objection to a condition which specifically requires rehabilitation to be undertaken in accordance with an approved Rehabilitation and Landscape Plan.

2.2 Supplementary Submission

OEH supports DPE's suggestion that the Biodiversity Offset Strategy Conditions 3.49-3.51 be amended to incorporate the NVC Rehabilitation Offset. Therefore OEH recommends that DPE amend the consent as part of the current modification application to:

- *include requirements and completion criteria (with a time frame) for the NVC Rehabilitation Offset.*
- *ensure that a conservation bond applies to the implementation and completion of the NVC Rehabilitation Offset, e.g. as part of Condition 3.49C.*

In responding to the OEH supplementary submission, Dixon Sand wishes to note that the issues raised by the OEH supplementary submission relate essentially to its satisfaction with the draft Rehabilitation and Landscape Plan recently submitted to OEH which is a matter related to the existing operations and to the currently approved rehabilitation and offsetting strategy for the Old Northern Road Quarry. As noted in the modification application, no changes to the approved quarrying footprint or activities, or to the currently approved offsets or rehabilitation strategy are proposed as part of the modification. The matters raised in the OEH supplementary submission have no relevance to the modification application submitted.

Although not relevant to the proposed modification, Dixon Sand has provided the following background and responses to the recommendation of OEH that Conditions 3.49 to 3.51 be amended to incorporate the Native Vegetation Corridor (NVC) Rehabilitation Offset.

Background

The NVC was proposed as part of MOD 4 as an impact mitigation measure to ameliorate the loss of approximately 3.68 hectares of native vegetation proposed as part of that modification, which provided known habitat for two threatened plant species and five threatened fauna species. The NVC, along with a number of other measures, were accepted and approved as the impact mitigation measures for MOD 4 and are reflected in the existing consent. No changes to the approved biodiversity impacts or approved biodiversity impact mitigation measure are proposed as part of this modification.

The NVC is a rehabilitation corridor that will be established on land disturbed by the quarry. The intent of the NVC is to utilise rehabilitated land to create a link between remnant vegetation to the west of the quarry and vegetation retained within a 250 metre buffer zone to the east of quarry extraction area. Dixon Sand has committed to manage all rehabilitated areas for conservation, seeking to provide high quality habitat for native flora and fauna and recreate ecological function of native vegetation communities, through weed and feral animal control, additional planting with native species and monitoring. The NVC is to be managed in accordance with the Rehabilitation and Landscape Plan.

The framework for the implementation and management of the NVC is outlined in the existing consent, specifically:

- Condition 3.49 requires the establishment of the Rehabilitation Offset to the satisfaction of the Secretary.
- Condition 1.15A (b) requires the payment of an additional Rehabilitation Bond for rehabilitation works associated with the NVC Rehabilitation Offset.
- Condition 6.3 (e) requires the preparation of a Rehabilitation and Landscape Plan for the rehabilitation of the NVC Rehabilitation Offset.

The existing consent also provides for the establishment of a separate biodiversity offset, to offset the biodiversity impacts of the broader Old Northern Road Quarry. As required by the consent, the Haerses Road Biodiversity Offset Area has been established as an in perpetuity conservation area and is managed as such in accordance with a Biodiversity Management Plan.

Response to Recommended Changes to Conditions of Consent

Condition 3.49

Condition 3.49 establishes the NVC as a Rehabilitation Offset that is required to be implemented to the satisfaction of the Secretary. No change is considered warranted to this condition as a result of the modification which does not change any of the impacts which this condition was imposed to address.

Condition 3.49A

Condition 3.49A requires the protection of the Haerses Road Biodiversity Offset Area in perpetuity. This reflects the purpose of the Haerses Road Biodiversity Offset Area as an in perpetuity biodiversity offset for the biodiversity impacts of the broader Old Northern Road Quarry. As noted above, the offset has been established in accordance with the conditions.

The NVC Rehabilitation Offset is a rehabilitation offset that is not intended for or suited to in perpetuity conservation, however as committed by Dixon Sand in its MOD 4 Environmental Assessment, it will be managed for conservation in accordance with the Rehabilitation and Landscape Plan. Given the intent of the NVC Rehabilitation Offset, as the existing consent requirements are being met and as the modification does not change any of the approved impacts or rehabilitation activities, no changes to these existing conditions are warranted.

Importantly, Dixon Sand does not own the land within the NVC and therefore is not able to make arrangements for its conservation in perpetuity.

Any amendment to condition 3.49A requiring the in perpetuity conservation of the NVC is considered unwarranted in the context of the nature of the offset as a rehabilitation corridor.

Condition 3.49B

Condition 3.49B requires the preparation and implementation of a Biodiversity Management Plan for the Haerses Road Biodiversity Offset Area. This is considered the appropriate mechanism for managing the Haerses Road Biodiversity Offset Area as an in perpetuity conservation area.

Condition 3.49B does not require the Biodiversity Management Plan to include the NVC Rehabilitation Offset as the NVC forms part of the overall rehabilitation strategy for the quarry site and is managed under the Rehabilitation and Landscape Plan required by Condition 6.39 (e). This existing management regime is considered appropriate and is not proposed to be changed.

Condition 3.49C

Condition 3.49C requires a Conservation Bond be lodged with the Department to ensure the implementation of the Biodiversity Management Plan. As the Biodiversity Management Plan relates to the Haerses Road Biodiversity Offset Area, the NVC Rehabilitation Offset is not included in the calculation of the Conservation Bond.

Rather, the NVC Rehabilitation Offset forms part of the overall rehabilitation strategy of the Old Northern Road Quarry and therefore the Rehabilitation Bond specified in Condition 1.15A (b) and which has been paid by Dixon Sand, covers the rehabilitation works associated with the NVC Rehabilitation Offset.

As an existing bond is in place for the NVC Rehabilitation Offset, including the NVC Rehabilitation Offset under the Conservation Bond is unnecessary.

Condition 3.50

Condition 3.50 is a general condition seeking to ensure that natural bushland adjoining the site or to be conserved within the site is not damaged or disturbed by the operation of the quarry. Given the general nature of this condition and as no change to disturbance footprint is proposed, no change to this condition is considered warranted.

Condition 3.51

Condition 3.51 requires the use of native bush regeneration and habitat reconstruction techniques during rehabilitation and regeneration both broadly within the Old Northern Road Quarry site and the Haerses Road Biodiversity Offset Area. It also requires a specific program to translocate, propagate and revegetate threatened plant species on the site.

OEH has advised that it no longer supports propagation of *Melaleuca deanei* for this purpose as 'there is a higher risk of failure associated with the translocations', and that the Rehabilitation and Landscape Plan should include a contingency measure in the event of failure of the translocation.

In order to comply with Condition 3.51 and the commitments made in the MOD 4 Environmental Assessment, Dixon Sand has invested in a threatened species propagation program for use in rehabilitation and regeneration works within the quarry. This program has seen the successful propagation of *Darwinia fascicularis subs. oloigantha* and *Melaleuca deanei*, with translocated specimens of *Darwinia* having survived in the rehabilitation area to date. Translocation of *Melaleuca deanei* is yet to occur due to impacts to this species not occurring for another 4-5 years, however Dixon Sand has commenced cuttings, propagation and planting in the NVC with success. Given impacts on this species will not occur for another 4-5 years, this provides Dixon Sand substantial time to obtain more cuttings and seed collection for propagation, and to test alternate approaches to propagation and translocation to maximise the potential for success. Progress of the propagation and translocation program will be reported during the annual survey in accordance with the Old Northern Road Quarry Fauna and Fauna Monitoring Program (Cumberland Ecology, June 2016).

While Dixon Sand is committed to continuing the existing propagation and translocation program in compliance with Condition 3.51, if OEH no longer support propagation and translocation of these threatened species, Dixon Sand has no objection to the deletion of this condition.

Recommendation to include requirements and completion criteria (with time frame) for the NVC Rehabilitation Offset

Dixon Sand notes that while there is currently no requirement under Condition 6.3 (e) to include completion criteria for the NVC Rehabilitation Offset in the Rehabilitation and Landscape Management Plan, completion criteria have been incorporated into the Flora and Fauna Monitoring Program (Cumberland Ecology, June 2016). The Flora and Fauna Monitoring Program was developed in consultation with OEH and approved by the DPE in November 2016. It identified vegetation monitoring sites, including those for threatened flora and fauna, and contains Key Performance Indicators. The Flora and Fauna Monitoring Program requires the Rehabilitation Offset (NVC) to be monitored annually for the duration of the development (2022) and for 2 years beyond this period.

Section 5.2 of the Rehabilitation and Landscape Management Plan makes reference to the NVC monitoring requirements contained in the Flora and Fauna Monitoring Program.

Recommendation to ensure that a conservation bond be applied to the implementation and completion of the NVC Rehabilitation Offset

As previously discussed, a Rehabilitation Bond applying the implementation of the NVC Rehabilitation Offset has already been paid, in accordance with Condition 1.15A (b).

3.0 Roads and Maritime Services

Further information is required showing that the access meets the required treatment as per AUSTROADS and the need for improvement (if required). The proponent should investigate the required access arrangement/intersection treatment in compliance with AUSTROADS Guide to Road Design Part 4A: Unsignalised and signalised intersections using the graph in Figure 4.9 which will give an indication of the type of right and left turn treatments required.

SECA Solution has reviewed the design of the quarry access road intersection against Figure 4.9 of Austroads Guide to Road Design Part 4A. A copy of the technical design note prepared by SECA is provided as **Attachment 2**.

With consideration of future traffic growth along Old Northern Road, the intersection layout requirements have been assessed to warrant a type CHR (S) / AUL (S). All quarry traffic has an original/destination to the south, therefore there are no right turns into the quarry access road from the north and consequently the intersection requires a short left turn deceleration lane only. The existing left turn deceleration lane on Old Northern Road meets the design requirements outlined in Table 5.2 of Austroads Part 4A and is considered adequate for the future design year of 2042.

SECA concludes that the current site access layout is in accordance with current standards and can continue to operate in a safe and acceptable manner up to the future project design year of 2042.

4.0 Department of Planning and Environment – Division of Resources and Geoscience

In order to assist in the collection of construction material production data, the proponent should be required to provide annual production data for the subject site to the NSW Division of Resources and Mining as a condition of any new or amended development consent.

Dixon Sand currently provides annual production data to the Division of Resources and Geoscience as required by Condition 1.8 of the consent and will continue to do so.

5.0 NSW EPA

The EPA notes that no substantial changes are proposed that affect the scope or operation of the existing environment protection licence... Should the modification application be approved by the Department of Planning and Environment, the EPA will amend and update the licence if required to maintain consistency upon receiving advice of any substantial changes to the existing condition of consent.

Noted, no response required.

6.0 Heritage Council of NSW

The proposed modification to the conditions of consent have no bearing on historic heritage matters in relation to the Old Northern Road Quarry, therefore the Heritage Division have no additional comment in relation to these modifications.

Noted, no response required.

7.0 The Hills Shire Council

You are advised that no objection is raised in principle to the proposed modification subject to an assessment being undertaken of the increased impact of the proposed extractive industry operations on land owners and residents in the area, including the broader areas, given the increased time frame requested for extraction.

As outlined in the Environmental Assessment prepared for the proposed modification, no changes to the existing operations is proposed, including no change to production rates, product transport rates, disturbance area, extraction area, quarry plans or infrastructure. Therefore, no changes to the existing impacts of the quarry on the surrounding community will occur, with the exception of an increase in the duration of existing operations associated with the proposed change to the life of the consent. An assessment of the change of duration of the quarrying activity was provided along with the modification application.

Thank you for the opportunity to provide a response to these submissions, if you require any further information or wish to discuss this matter, please contact either David Dixon of Dixon Sand on 0414 330 490, or Gabrielle Allan of Umwelt on (02) 4950 5322.

Yours sincerely



Gabrielle Allan
Principal Environmental Consultant

Enc

Attachment 1 – *Groundwater Assessment – Modification no. 5* (Golder Associates, 2017)

Attachment 2 – *Technical Design Note* (SECA Solution, 2017)



ATTACHMENT 1



18 July 2017

DIXON SANDS (PENRITH) PTY LTD

Groundwater Assessment - Modification no.5

REPORT



Submitted to:
Dixon Sand (Penrith)

Report Number. 1780381-001-R-Rev1

Distribution:

1 e-copy - ATL GP Pty Ltd ATF ATL GP Unit Trust
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APPENDICES

APPENDIX A

Important Information



1.1.2 Site Description

The quarry site comprises four separate parcels of land identified as Lots 1 and 2 DP547255 and Lot 29 and Lot 196 DP 752025, at 4610 Old Northern Road, Maroota (Figure 1).

The majority of the northern, central and eastern parts of Lots 29 and 196 are being used for extraction operations. Lots 1 and 2 are two rectangular shaped lots running parallel to one another occupying an area of approximately 20ha.



2.0 HYDROGEOLOGICAL SETTING

Information collected during previous drilling campaigns, together with long term groundwater monitoring has resulted in a large amount of hydrogeological information. From this, a good understanding of the groundwater resources has been possible.

The aquifers identified across the Maroota area include the:

- Hawkesbury Sandstone, a regional fractured rock aquifer that forms part of the SBCGS. The unit is competent (lithified) with secondary fracturing the predominant mechanism for groundwater flow.
- Maroota Sands and upper weathered part of the Hawkesbury Sandstone (eluvial sands) constitute the water table aquifer of the MTSGS.

2.1 Maroota Tertiary Sands Groundwater Source

The extent of the MTSGS is shown on Figure 1 and was delineated by Etheridge, 1980. This report has been used by authorities to determine the extent of the Maroota Tertiary Sands, including the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 – Maroota Tertiary Sands Ground Water Source (NOW, 2011).

The MTSGS is a sandy formation of limited areal extent as is mapped adjacent to Lot 1 and Lot 2 development areas (Figure 1). In these areas there is some evidence of a thin horizon of unsaturated tertiary sand approximately 0.9 m deep, which represents the feather edge or pinched out part of the Maroota Tertiary Sands. Nevertheless, underlying the Tertiary sands, small groundwater zones have developed above horizons of weathered clays, sandstones and shales within the Hawkesbury Sandstone. These zones form localised perched aquifer systems which also constitute the MTSGS.

The groundwater elevation of the MTSGS has been inferred by groundwater levels measured at site monitoring bores BH8 and MW2, which target zones of perched water in the Hawkesbury Sandstone next to the western boundary of the MTSGS (Figure 1).

2.2 Sydney Basin Central Groundwater Source

The Hawkesbury Sandstone of the SBCGS is generally a low permeable rock, due to the fine grained clayey matrix (largely kaolinite and illite) and large degree of grain cementation resulting from the development of secondary minerals in the interstitial spaces, such as secondary silica and siderite (iron carbonate). Although the rock has very little primary permeability, fracturing and jointing, where open and interconnected, provides secondary permeability and storativity.

Throughout the region different perched water tables are intersected during drilling in the Hawkesbury Sandstone, due to the different degree of fracturing and the presence of confining layers (such as the shale lenses) within the rock mass (DWLC, 2001) and this was also apparent from the drilling undertaken on site.

Site monitoring bores completed to depths of between 15 and 35 m (MW1 to 5), have groundwater levels in the range of 173 to 202 mAHD. By contrast, site monitoring bores completed at greater depth, >60 m (such as BH1, BH6, BH7 and BH9) have groundwater levels in the range 106-165 mAHD. Groundwater levels monitored in these deeper bores represent the regional groundwater elevation of the SBCGS.

Most of the bores in the area are in elevated locations along the Maroota Ridge which represents a surface drainage divide and groundwater divide (RPS Aquaterra, 2012). Groundwater flow directions are away from the main axis of the groundwater divide, which coincide with the main topographic divides.

Long term groundwater level monitoring beneath the site shows regional groundwater levels range from 165 mA HD in the east to 106 m AHD in the west, with a long term variation of approximately 1 m.

2.2.1 Groundwater Dependent Ecosystems

Groundwater assessments undertaken to support previous modifications for MOD 3 (Aquaterra, 2010) and MOD 4 (RPS Aquaterra, 2012) did not identify Groundwater Dependent Ecosystems (GDE's) associated with the SBCGS or MTSGS.



GROUNDWATER ASSESSMENT - MODIFICATION NO.5

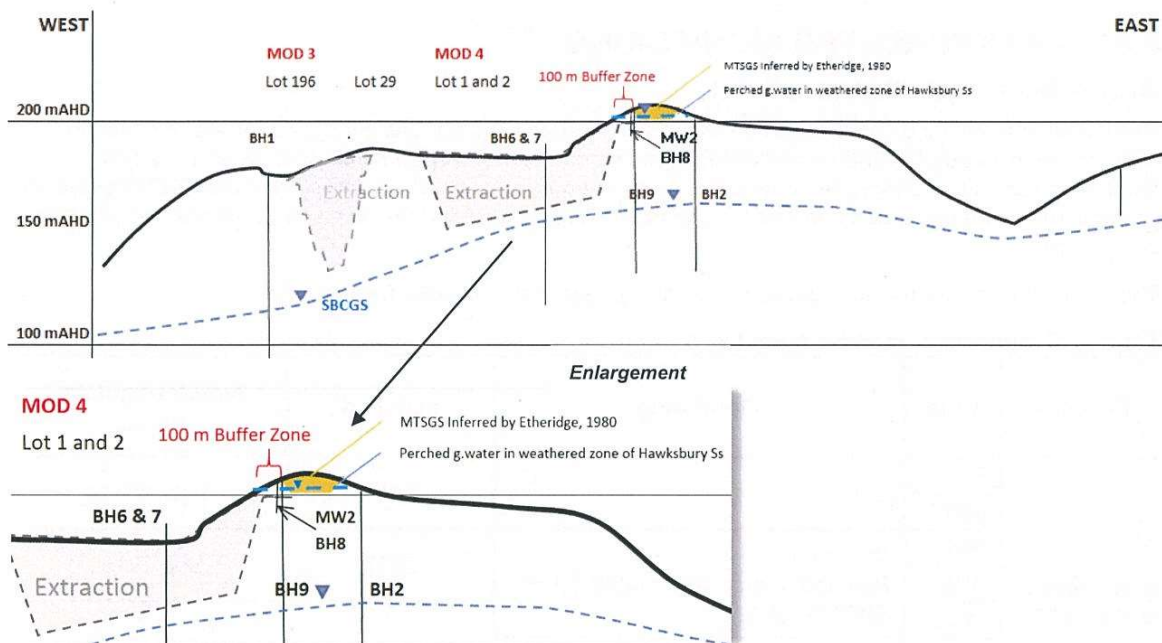


Figure 2: Cross section



Groundwater levels

Long term groundwater monitoring of the deep SBCGS and upper perched zones of the SBCGS have shown no discernible response to extraction. Hydrographs are presented on Figure 3 for the following three areas.

- The hydrographs for monitoring bores on Lot 196, near to the North West pit revealed stable groundwater levels within the upper perched zone of the SBCGS (MW1) and deeper regional SBCGS (BH1).
- The hydrographs for monitoring bores on Lot 1 and 2 indicated stable groundwater levels within upper perched zones of the SBCGS (MW2 to MW5) and the deeper regional SBCGS (BH6 and BH7).
- The hydrographs for monitoring bores positioned within the 100 m buffer zone on Lot 1 and 2 indicated stable groundwater levels in the upper perched zone of the Hawkesbury Sandstone (MW2 and BH8), signifying no impact to the MTSGS from current operations. Likewise, stable groundwater levels were observed in the deeper SBCGS (BH7).

Visual inspections of the pit walls have also been conducted and no groundwater seepages have been observed.



4.1 Groundwater Quality

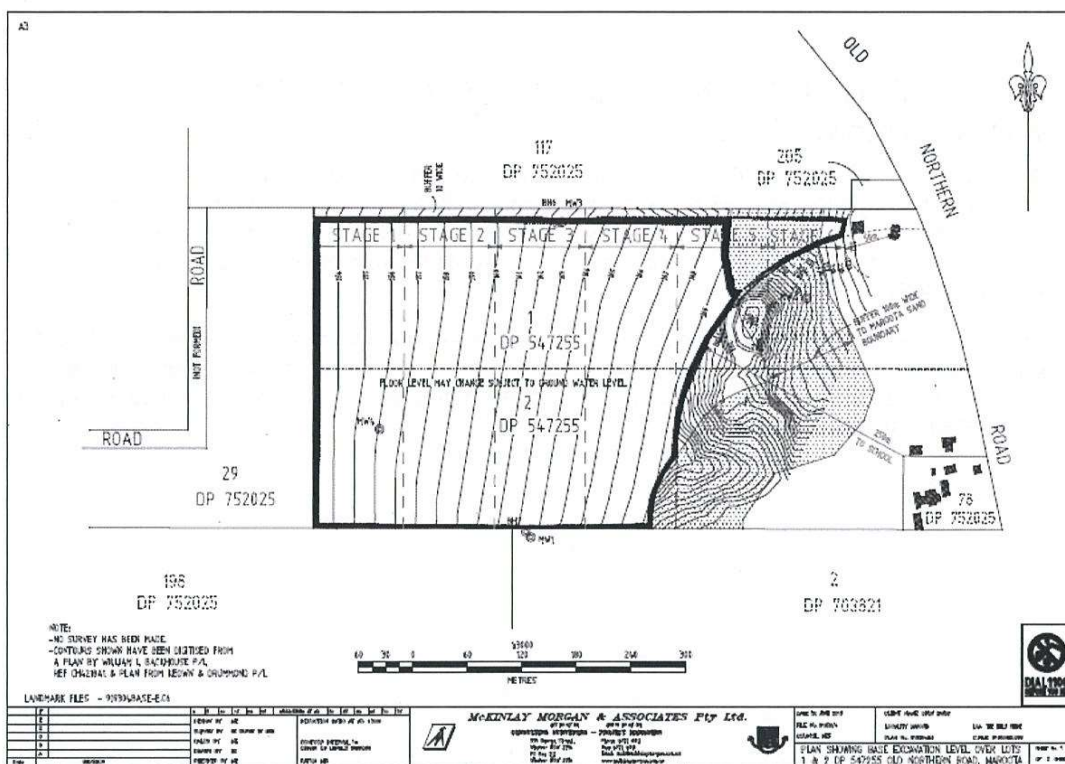
In accordance with the current development consent conditions, groundwater samples have been collected from each bore for analysis of the following parameters: Electrical Conductivity (EC), pH, Totals Suspended Solids (TSS) and Turbidity. A summary of the natural variation of groundwater quality is provided below:

- Groundwater salinity of the deep and shallow groundwater systems of SBCGS is very low, ranging from 120 to 560 $\mu\text{S}/\text{cm}$ (66 to 307 mg/L).
- pH ranges from 3.8 to 7.8, with deeper bores revealing higher average pH values (6.4) in comparison to the shallower bores (4.8).
- Turbidity is generally less than 20 NTU and TSS is generally less than 30 mg/L.

As the groundwater salinity is $<1,500$ mg/L, the aquifers are classified as a highly productive groundwater source under the criteria of the AIP.



GROUNDWATER ASSESSMENT - MODIFICATION NO.5





GROUNDWATER ASSESSMENT - MODIFICATION NO.5

Table 2: Minimal impact considerations for aquifer interference activities – Alluvial water source

Highly Productive Groundwater Sources - Alluvial Water Sources

AIP requirement - Water Table	Summary of impact and monitoring	AIP requirement - Water Quality	Summary of impact and monitoring
<p>1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or</p> <p>(b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan.</p> <p>A maximum of a 2 m decline cumulatively at any water supply work.</p> <p>2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or</p> <p>(b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies (c) will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site.</p> <p>If more than 2 m decline cumulatively at any water supply work, then make good provisions should apply.</p>	<p>Summary of Impact: No groundwater impacts to the MTSGS are expected from the proposed modification as</p> <ul style="list-style-type: none"> The extraction depth will continue to be maintained at least 2m above the wet weather elevation of perched groundwater within 100 m of the mapped extent of the MTSGS. Monitoring to date indicates that groundwater levels in relevant bores remain stable despite ongoing extraction activities. <p>Also, no groundwater dependent ecosystems have been identified in the area (Aquaterra, 2010 and RPS Aquaterra, 2012).</p> <p>Mitigation Measure: A 100 m buffer zone from the western boundary of the MTSGS has been created (Figure 1 and 4). Extraction within this buffer zone is currently limited to 2 m above the wet weather elevations as determined by perched aquifer monitoring bores MW2 and BH8, positioned within the buffer area.</p> <p>The buffer acts to mitigate seepage from the MTSGS and was approved under MOD 4.</p> <p>Monitoring: Groundwater level monitoring is being conducted within the buffer zone. Stable groundwater levels within the perched zone at MW2 and BH8 are inferred to signify no impact to the MTSGS.</p> <p>The monitoring program also includes visual inspections of the pit walls. In the event seepage is detected in the pit the groundwater monitoring data will be reviewed to determine the source of the water. If the source is determined to be from the MTSGS, remedial actions will be undertaken in accordance with the response outlined in the site TARP.</p>	<p>1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.</p> <p>2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.</p>	<p>Summary of impact: No groundwater quality related impacts have occurred from existing quarry operations and none are expected to occur as a result of the proposed modification.</p> <p>There are no GDE or water supply works identified in the greater area that could be impacted.</p> <p>Mitigation Measure: Quarrying will be maintained 2 m above the wet weather level. There are no water quality impacts as a result of the project.</p> <p>Monitoring: Existing monitoring bores will be maintained on to detect any unforeseen groundwater quality impacts for the duration of consent life.</p>



7.0 CONCLUSION

Dixon Sand operates under an existing consent which allows for extraction to a depth of 2 m above the *wet weather groundwater elevation* of the regional SBCGS and 2 m above perched groundwater elevation within 100 m of the MTSGS. This depth is defined by groundwater level monitoring which has been conducted on site since 2003. These controls are in place to avoid impacts on groundwater.

Groundwater monitoring of the SBCGS and perched water adjacent to the MTSGS has shown no discernible response to extraction; groundwater levels in designated monitoring wells have remained stable, signifying no groundwater impacts have occurred as a result of the existing quarry.

Dixon Sand is seeking minor modifications to the consent condition (under Modification No.5), including an extension to the life of the consent by a further 20 years. No other changes to the existing approved operations are proposed, including no change to extraction depth, extraction area, disturbance area, quarry plan or infrastructure.

The modification for extension of consent life required reassessment against Section 3.2.1 of the AIP, which includes the concept of ensuring “no more than minimal harm” for the granting of approvals. The proposed modification will satisfy this requirement of the AIP as the situation in terms of groundwater risks will not alter by extending the quarry life. This is due the following existing groundwater management strategies which will remain in place over the extended life of the quarry.

- Groundwater impacts to the MTSGS will continue to be mitigated by the 100 m buffer zone which was put in place along the western boundary of the MTSGS as a consent condition under MOD 4. To prevent incidental water take from the MTSGS, extraction within the buffer zone is currently limited to a depth of 2 m above the perched water table, measured at MW2 and BH8 (near the western boundary of MTSGS). The monitoring of groundwater levels at these bores is required to detect unforeseen groundwater impacts to the MTSGS.
- Outside of the 100 m buffer zone, groundwater impacts to the SBCGS will continue to be mitigate by maintaining extraction depth to 2 m above the *wet weather groundwater elevation* of the SBCGS.
- There is a an extensive groundwater monitoring network on site and ongoing review of groundwater monitoring data will continue to be undertaken to ensure the pit floors remain at least 2 m above the *wet weather groundwater elevation*, thereby mitigating any drawdown impact to the SBCGS and MTSGS. Groundwater levels have remained very stable since the granting of MODs 3 and 4 and therefore no changes to the approved extraction depths is required.
- A Trigger Action and Response Plan is in place to ensure ongoing compliance with the AIP.



9.0 REFERENCES

AGT, 2013. Groundwater Assessment for Dixon Sand Operation on Lot 1 and 2 - Groundwater Monitoring and Management Prepared for Dixon Sand (Penrith) Pty Ltd.

Aquaterra, 2010. Groundwater Assessment for Dixon Sand Operations Lot 196 DP 752025 Maroota NSW – Aquaterra 19 November 2010.

DPI, 2012. NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities. September 2012. ISBN 978 1 74256 338 1.

DWLC, 2001. NSW Department of Land and Water Conservation (2001) Maroota Groundwater Study Technical Status Report.

Etheridge, 1980. Geological Investigation and Resource Assessment of the Maroota Tertiary Alluvial Deposit" dated August 1980.

NOW, 2011. Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources – Background document, July, 2011.

RPS Aquaterra, 2012. Groundwater Assessment for Dixon Sand Operation, Lot 1 and 2 DP547255, Maroota NSW. Prepared for Dixon Sand, July 2012.



APPENDIX A

Important Information

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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ATTACHMENT 2

Technical Design Note

Project: P0760 Umwelt Dixon Sand Quarry

Subject: Access design review

Date: 24th May 2017

Attention: Gabrielle Allan

Further to your recent email, we have reviewed the comments provide by the RMS with regard to the access layout and the requirements of the access layout against Austroads requirements. The requirement for the access arrangement has been reviewed against Figure 4.9 of Austroads Guide to Road Design Part 4A to determine the requirements for the left and right hand turns into the side road.

When reviewing the access, it is important to note that all trucks have an origin / destination to the south, requiring a left turn into the site and a right turn out. Trucks do not turn left out of the site nor right in.

From our assessment work, the future two-way traffic flow along Old Northern Road for 2042 are projected to be in the order of 3,700 vehicles per day giving 370 vehicles during the morning and afternoon peak hours. Traffic flows for the quarry site will remain at 180 per day total, giving 90 inbound and 90 outbound per day as per the current consent. Allowing for 15 trucks entering and exiting the site in one hour, the intersection layout requirements have been assessed to warrant a type CHR (S) / AUL (S). Given there are no right turns for the site this shows that the intersection will require a short left turn deceleration lane only.

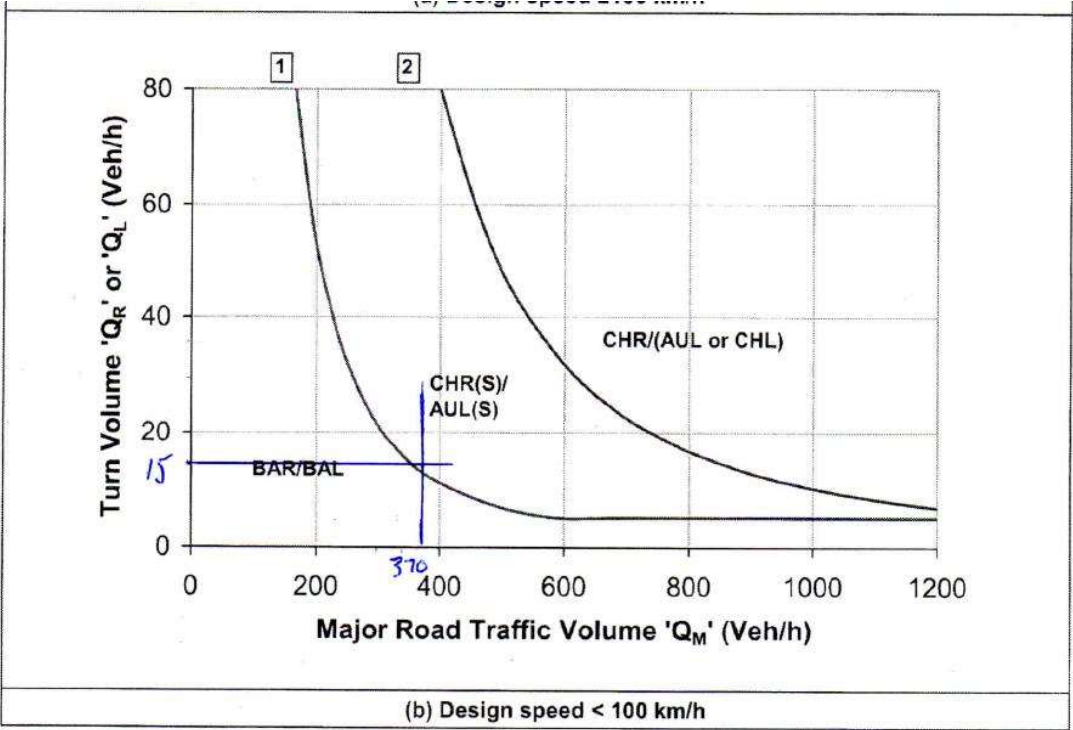
The current access arrangements for the site access on Old Northern Road provides a short left turn lane which is approximately 100 m long. Based on Table 5.2 of Austroads Part 4a the deceleration lane length required for the 80 km/h speed zone is 95 metres for an exit speed of 20 km/h. Therefore, the current left turn lane is adequate for the future design year of 2042.

Based on the above it can be seen that the current site access layout is in accordance with current standards and can continue to operate in a safe and acceptable manner up to the future project design year of 2042.

Aerial view of current site access on Old Northern Road



Figure 4.9 from Austroads Part 4a with projected traffic flows at site access on Old Northern Road (370 2-way movements including site truck movements and 15 vehicles per hour entering and exiting the site)



Source: Arndt and Troutbeck (2006)

Figure 4.9: Warrants for turn treatments on the major road at unsignalised intersections