VOLUME 1

ENVIRONMENTAL ASSESSMENT

SECTION 75W MODIFICATION (4)

DA 250-09-01

DIXON SAND (PENRITH) PTY LTD

OLD NORTHERN ROAD

MAROOTA

25 October 2013

Prepared by:
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STATEMENT OF VALIDITY

Submission of Environmental Assessment

Prepared under Section 75W of the Environmental Planning and Assessment Act 1979

Environmental Assessment prepared by

Name:	Neil Richard Kennan
Qualifications:	B.A., Dip. Urb. & Reg. Plan., Dip. Cart., Ord 4. Certified Practising Planner
Address:	PO Box 212 CONCORD NSW 2137
In respect of:	Section 75W Modification No.4 of Development Consent No.250-09-01

Applicant and Land Details

Applicant name:	Dixon Sand (Penrith) Pty Ltd
Applicant address:	PO Box 148 PENRITH NSW 2751
Land to be developed:	Lots 1 & 2, DP 547255 Old Northern Road MAROOTA NSW 2756

Environmental Assessment	An Environmental Assessment is attached

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Statement of Validity

I certify that I have prepared the contents of this Environmental Assessment in accordance with the Director-General's Requirements and that, to the best of my knowledge, the information contained in the Environmental Assessment is neither false nor misleading.

Signature: 

Name: Neil Kennan

Date: 25 October 2013

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Assessment has been prepared on behalf of Dixon Sand (Penrith) Pty Ltd (**Dixon Sand**) in support of an application to modify Development Consent No.250-09-01 pursuant to Section 75W of the Environmental Planning and Assessment Act 1979.

The objectives of the proposed modification are:

(a) To provide graded sand and gravel products suitable for use in the construction industry and specialty markets.

(b) To realise the economic potential and maximise the efficient recovery of natural resources on the Site.

(c) To successfully rehabilitate the extracted areas of the Site into an integrated, continuous agricultural landform plus an area of re-established native vegetation.

THE SITE

The land to which Development Consent No.250-09-01 relates is:

Lots 196 and 29, DP 572025 and Lots 1 and 2, DP 547255
Old Northern Road
MAROOTA

The Site is located on the western side of Old Northern Road, approximately 600 metres north of the intersection of Old Northern Road with Wisemans Ferry Road.

Access to the Site is via a sealed Crown Road from Old Northern Road.

The Site is within The Hills Shire Council local government area. The Site is zoned RU1 pursuant to The Hills Local Environmental Plan 2012.

The Site has been extensively disturbed by the extraction of sand for over 25 years.

Maroota Public School is located on Lot 78, DP 752025.

DEVELOPMENT CONSENT NO.250-09-01

Development Consent No.250-09-01 (**the Consent**) was issued by the Land and Environment Court on 24 May 2004 (refer *Diamond v Minister for Planning New South Wales and Another (No 2) [2004] NSWLEC 254*) for:

The operation of an extractive industry on Lots 1 and 2 DP 547255; the continued use of the existing central processing plant on Lot 196, DP 752025; and water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025 ....

THE PROPOSED MODIFICATION

Dixon Sand seeks the approval of the Minister for Planning and Infrastructure to modify the Consent to permit further extraction on Lots 1 and 2, DP 547255, Old Northern Road, Maroota (**the Site**). The section of the Site which is proposed for extraction is that which is currently excluded from the Consent due to:

- previously identified Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations and buffer areas to those populations.
- an area of shallow groundwater.

The excluded areas were identified in the south western section of the Site as shown on Figure 2.1 of the Environmental Impact Statement submitted with the Development Application for extraction of Lots 1 and 2, DP 547255. A copy of Figure 2.1 is provided as **Figure 1.3** of this Environmental Assessment.

There is also an extensive buffer area around the Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations. The buffer area is now also proposed to be extracted.

It is also proposed to clarify the position of the wet weather groundwater table on the Site for the purpose of clarifying the depth of the approved extraction.

IMPACT OF THE PROPOSED MODIFICATION

Groundwater

The proposed modification seeks to clarify the depth of extraction on the Site such that there would be no impact to the regional groundwater table.

The proposed modification would provide certainty with regard to the depth of extraction which could occur which is no closer than 2 metres above the wet weather groundwater level. To determine the wet weather high groundwater level on the Site, RPS Aquaterra has prepared a report titled *Groundwater Assessment for Dixon Sands Operations, Lot 1 and 2 DP 547255, Maroota NSW* (**the RPS Aquaterra Report** refer **Appendix 3**).

The objectives of the Aquaterra Report were to:

- Review existing hydrogeological studies with reference to the location of the Site and the surrounding area.

- Install two deep monitoring piezometers on the Site to refine the conceptual model of the area that was developed following previous assessments.

- Determine the lateral extent of the perched aquifer in order to ascertain the significance of the system and provide regulators with sufficient satisfactory information to make informed decisions in relation to the modification of the current consent condition on the Site.

- Determine the wet weather groundwater level beneath the Site such that the target depth of extraction can be clearly determined.

- Identify and assess the potential impacts of the proposed amendment to other groundwater users in the area.

The RPS Aquaterra investigations conclude:

- Lots 1 and Lot 2, DP 547255 and the remainder of the Dixon Sand land, is underlain by a series of shallow and limited extent zones of non water-bearing unconsolidated horizons of weathered clays, sandstones and shales. These low permeability layers permit temporary storage of groundwater at various shallow depths. These temporary perched storages have limited resource value because, like the Maroota Sand, they are discontinuous and of limited extent and low storage.

- Based on the inferred groundwater contouring the "wet weather high groundwater level" would be at a minimum elevation of about 171 metres AHD towards the east and 151 metres AHD in the west of the Site. Sand extraction on Lots 1 and 2, DP 547255 could, therefore, occur to an elevation of 173 metres AHD in the east grading to 153 metres AHD in the west, leaving a 2 metre distance of separation and, therefore, limiting potential interference with the regional water table.

- The total or partial removal of the shallow perched groundwater zones is unlikely to have any major impacts to the local hydrogeological regime, or to the regional aquifer system, other than potentially increasing the rate of rainfall recharge to the regional aquifer system. This potential increase in recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury sandstone.

- There are nine registered groundwater abstraction bores within approximately 1km of the Site. All of the bores listed were terminated at depths well below the extent of the low permeability layers. As such, none of these production bores would significantly rely on or abstract from groundwater stored above these layers and would, therefore, not be significantly impacted by an extension of the quarrying activity.

- Continued observations from the borehole network would be required to monitor general

groundwater behaviour as part of the ongoing operations licensing requirements.

Flora and Fauna Impact

Vegetation and Habitat Removal

The primary impact resulting from the proposed modification is the loss of vegetation and associated habitat. All vegetation present within the proposed modification area will be removed.

The total footprint of the proposed modification is approximately 4.35 ha, of which 3.68 ha comprises native vegetation communities. The remaining area supports exotic grassland (0.62 ha) and cleared land (0.05 ha).

The native vegetation communities present are well represented and well conserved in the wider locality. Removal of this vegetation under the proposed modification will not, therefore, result in a significant reduction in any of these vegetation communities in the locality.

No EECs listed under the EPBC Act and/or the TSC Act will be removed under the proposed modification.

Loss of Specific Habitat Features

In addition to the clearance of broad habitats within the proposed modification area, a number of specific habitat features will be removed. These include feed trees for various fauna, bushrock and hollow-bearing trees. These features provide suitable forage, shelter and breeding habitat for a range of native fauna, including threatened species. The primary areas of fauna habitat occur within the woodland and heath communities. The exotic grassland and cleared areas of the proposed modification area provide only limited habitat value.

The following key threatening processes are applicable to the habitat to be removed:

- Clearing of native vegetation;
- Loss of hollow-bearing trees;
- Bushrock removal, and
- Removal of dead wood and dead trees.

Some of the important habitat features will be removed, however, the proposed modification area is relatively small and provides limited habitat features when compared to larger, more intact examples of habitat within the locality. Further, the resulting fragmentation and isolation of these habitat features would impact many of the fauna that would otherwise utilise these habitat features.

Other Impacts to Vegetation Communities and Habitat

i. Habitat fragmentation

Habitat fragmentation is the process whereby habitat loss results in the division of large, continuous habitats into small, isolated habitat fragments. The area between the fragments is typically man-made and largely uninhabitable by the species which previously existed in the area. The ecological impacts of habitat fragmentation include:

- Changes in the number of species in fragments;
- Changes to the composition of faunal assemblages, and
- Changes to ecological processes in fragments such as food chains, predator-prey interactions, plant-animal pollination and dispersal associations.

Fragmentation of a community can also result in the isolation of vegetation patches both locally and regionally. Isolation of patches can decrease the amount of genetic exchange between remaining patches of vegetation by severing the small-scale potential genetic transfer mechanisms such as seed dispersal by ants and reproductive root suckering.

The site consists of land which has been approved for sand extraction, and which will soon be extensively disturbed. Under the approval for the Site, the surrounding areas will first be extracted, and then rehabilitated to a final landscape of farming land, with no requirement for the replacement of trees. Accordingly, under the existing approval, the proposed modification area would comprise an island of vegetation in first a extracted landscape, and then a farming landscape. As a result, removal of vegetation within the proposed modification area is not considered to significantly exacerbate habitat fragmentation.

ii. Edge effects

Edge effects are impacts occurring at an interface between natural environments and disturbed or developed land. The following are types of edge effects which can occur:

- Abiotic effects, involving changes in the environmental conditions which result from proximity to a structurally dissimilar matrix;
- Direct biological effects, which involve changes in the abundance and distribution of species caused directly by the physical conditions near the edge; and
- Indirect biological effects which involve changes in species interactions, such a predation, competition, herbivory and biotic pollination and seed dispersal.

Under the existing approval, the edges of the retained vegetation communities within the proposed modification area will be impacted by microclimate changes (e.g. increased sunlight, air temperature and soil temperature). Alteration of the microclimates within each vegetation community is likely to result in changes in species composition, including increased weed invasion, which in turn can lead to changes in community structure. Some species will be more

susceptible to these changes than others. Edge effects can also result from the increase in noise and artificial light from the approved quarry extension.

Under the existing approval, utilisation of the edge habitat by edge specialists is likely to increase. This has subsequent implications for the interaction between existing species at the edge. Other edge effects can include increased susceptibility to infection, such as infection of native plants by the fungus *Phytophthora cinnamoni*.

Edge effects will occur at the interface between the approved extraction area and the proposed modification area. These edge effects can potentially have an adverse impact on the vegetation and associated habitat of the proposed modification area. Impacts from edge effects can reduce the quality and integrity of the retained communities. Numerous edges will be created around the proposed modification area as a result of the approved extraction. It is primarily where edges are created between the approved quarrying of the Site and intact vegetation within the proposed modification area that impacts will occur.

Habitat within the proposed modification area does not lie at the edge of any vegetation which will remain under the existing approval, however, the removal of vegetation with the proposed modification area has the potential to increase edge effects to vegetation occurring along the southern boundary.

iii. Alteration of hydrological regime

Extraction under the existing approval will result in significant alteration to hydrology necessary for vegetation and habitat survival within the proposed modification area.

Removal of the vegetation within the proposed modification area will not result in any significant changes to hydrology additional to those which would already occur under the approved extraction.

iv. Increased erosion and sedimentation

Erosion is already occurring at the interface between the existing extraction and the Site, particularly along the western boundary of the proposed modification area. Under the existing approval, an extension of extraction into the remainder of the Site will result in increased erosion along all sides of the proposed modification area. The removal of vegetation from the proposed modification area would not result in any significant erosion or sedimentation on adjoining lands additional to those impacts already occurring under the existing approval.

v. Weeds and feral animals

Alterations to habitat conditions often favour introduced and/or hardy native plant and animal species which can proliferate in disturbed conditions. Such species have potential to impact upon the original local native plant and animal species. Weeds such as exotic grasses and other introduced plants have potential to out compete regenerating native plant species.

Feral animals such as foxes, rabbits and some species of birds can also breed in the more open areas following clearance of forest and woodland. They can cause problems for native fauna

species by preying upon them or by competing with them for food and resources.

Weed and feral animal species are already present within the site, including the proposed modification area. Under the existing approval, an extension of extraction activities into the remainder of the Site will result in increased competition from weeds and feral animals on vegetation within the proposed modification area. Removal of vegetation from within the proposed modification area will not result in any weed and feral animal impacts on adjacent lands additional to those already likely to occur under the existing approval. One threatened flora species was recorded within the proposed modification area during the current surveys.

One additional species is known to occur based on previous studies within the proposed modification area.

The following sections outline impacts to the threatened flora species within the proposed modification area.

Melaleuca deanei

Melaleuca *deanei* (Deane's Paperbark) is listed as Vulnerable under both the TSC Act and EPBC Act. This species was recorded at one location within the proposed modification area.

Removal of the known occurrence of 18 clumps of *Melaleuca deanei* is not considered likely to result in the extinction of the species in the locality. Within the locality, *Melaleuca deanei* is conserved within Marramarra National Park and Dharug National Park, and occurs in other bushland areas in the locality (e.g. near Wisemans Ferry).

Approximately 1.15 ha of suitable habitat, comprising *Angophora costata - Corymbia gummifera* Woodland is proposed to be cleared from the proposed modification area. The loss of this vegetation would result in a very small decrease in the amount of suitable habitat available to this species. The habitat to be removed within the proposed modification area is not considered important for the long-term survival of the species. Sufficient potential habitat will be rehabilitated within the proposed modification area and other parts of the site on completion of extraction activities.

Tetratheca glandulosa

Tetratheca glandulosa is listed as Vulnerable under both the TSC Act and EPBC Act. This species was not recorded within the proposed modification area during current surveys, however, *Tetratheca glandulosa* was recorded within the proposed modification area during surveys by Gunninah Environmental Consultants (Fanning et al. 1998) and Trevor Hawkeswood (2010).

Approximately 40 to 50 individual *Tetratheca glandulosa* were detected within the proposed modification area (Fanning et al. 1998), however, only five specimens were recorded within this area by Trevor Hawkeswood in 2010. As suggested by T. Hawkeswood (2010), this may be a result of changes in condition of vegetation between the times of the two surveys, resulting in a decline of *Tetratheca glandulosa* within the proposed modification area due to competition with other species.

Despite the absence of records, it is likely that *Tetratheca glandulosa* persists within the proposed modification area, albeit at significantly reduced abundance. *Tetratheca glandulosa* is conserved within Marramarra National Park and Dharug National Park, and Atlas of NSW Wildlife records indicate that this species is well represented in the locality.

Given the abundant records for this species in the locality, removal of *Tetratheca glandulosa* within the proposed modification area is not considered likely to result in the extinction of the species in the locality.

Although not clearly defined in previous surveys, it is likely that woodland supporting *Corymbia gummifera* would provide habitat for *Tetratheca glandulosa* within the proposed modification area. Approximately 1.15 ha of suitable habitat, comprising *Angophora costata - Corymbia gummifera* Woodland is proposed to be cleared from the proposed modification area. The loss of this vegetation would result in a very small decrease in the amount of suitable habitat available to *Tetratheca glandulosa*. The habitat to be removed within the proposed modification area is not considered important for the long term survival of the species. Sufficient potential habitat will be rehabilitated within the proposed modification area and other parts of the site on completion of quarrying activities.

Impacts to Threatened Fauna Species

Five threatened fauna species have been recorded within the proposed modification area during the current surveys. The following sections outline impacts to the threatened fauna species known within the proposed modification area. Mitigation and compensatory measures to address impacts to threatened fauna are provided in **Part 4**, including provisions for ongoing management.

Glossy Black-cockatoo

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is listed as Vulnerable under the TSC Act. Evidence of feeding by Glossy Black-cockatoo was recorded during current surveys indicating that the proposed modification area and surrounding site currently provide forage habitat for this species, however, habitat assessment indicates that the proposed modification area does not provide suitable breeding habitat for the Glossy Black-cockatoo.

The Glossy Black-cockatoo has been recorded from Marramarra National Park, Dharug National Park, Parr State Conservation Area and Berowra Valley National Park. Forage and breeding habitat for this species is well conserved in the locality within these protected lands.

All woodland and heath vegetation within the proposed modification area supports *Allocasuarina littoralis* which is a preferred feed tree species for the Glossy Black-cockatoo.

Approximately 1.82 ha of woodland and 1.86 ha of heath providing forage habitat for the Glossy Black-cockatoo will be removed under the proposed modification. Given the extent of high quality forage and breeding habitat for this species in conservation areas in the locality, the removal of a small area of forage habitat from within the proposed modification area is not considered important for the long-term survival of the Glossy Black-cockatoo.

Larger areas of forage habitat will be rehabilitated within the proposed modification area and other areas of the site on completion of extraction.

Microchiropteran Bats

The following threatened microchiropteran bats (microbats) were recorded within or adjacent to the proposed modification area during the current surveys:

- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- East-coast Freetail-bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat (*Miniopterus australis*), and
- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*).

The Large-eared Pied Bat is listed as Vulnerable under both the EPBC Act and the TSC Act. All other threatened species recorded are listed as Vulnerable under the TSC Act. All vegetation communities within the proposed modification area provide suitable forage habitat for threatened microbats. It should be noted that three of the four threatened species recorded are cave-roosting species. As the Site does not provide suitable roosting habitat for these species, it is highly likely that these bats travel to the proposed modification area to forage from other areas in the locality. The proposed modification area provides suitable roost habitat for the East-coast Freetail-bat, which is known to roost in tree hollows. There is no suitable breeding habitat for any threatened microbats within the proposed modification area.

The four threatened microbats recorded within the proposed modification area have been recorded from conservation areas in the locality, including Marramarra National Park, Dharug National Park, Parr State Conservation Area, Berowra Valley National Park and Cattai National Park. These conservation areas provide extensive forage, roosting and breeding habitat for all of the species recorded within the proposed modification area.

Approximately 4.3 ha of suitable forage habitat for threatened microbats (including 1.82 ha of woodland providing suitable roosting habitat for the East-coast Freetail-bat) will be removed under the proposed modification. There is extensive forage, roosting and breeding habitat for these species in the locality, much of this conserved in protected lands. It is, therefore, unlikely that the small area of habitat within the proposed modification area is important for the long-term survival of any threatened microbats.

Wildlife Corridors

The wildlife corridor values of the proposed modification area are limited due to historical disturbance, clearing and extraction in the surrounding lands. The proposed modification area currently forms a component of a corridor from south-west to north-east passing through the Site. This corridor is not large enough to provide significant habitat for threatened species, but may be utilised by mobile species such as birds and bats between larger areas of intact habitat. Wildlife corridor values for small terrestrial and arboreal species are limited due to clearing, extraction and roads in surrounding lands which provide substantial barriers to these species.

Under the existing approval, the wildlife corridor values of the proposed modification area will be significantly reduced as all connecting habitat to the north and east will be removed. Further, the current intent is to rehabilitate these lands to farmland, which will substantially limit corridor values for flora and fauna in the long term.

The proposed modification will remove approximately 4.3 ha of habitat which currently provides limited wildlife corridor values, mostly for birds and bats. More substantial wildlife corridors exist within the locality to the north and south of the Site, connecting large areas of bushland in the west to Marramarra National Park in the east. These important wildlife areas will not be significantly impacted by clearing of vegetation within the proposed modification area.

Acoustic Impact

The approved extraction of the Site is subject to conditions of consent relating to acoustic impact and the monitoring of that impact.

Dixon Sand, as part of its fulfilment of the conditions of consent for its Maroota operations, has prepared annual environment site audits. Those audits, which can be seen on the Dixon Sand web site, clearly show that sand extraction on all of the Dixon Sand sites at Maroota are operating within the acoustic criteria contained in the conditions of consent. The audit reports note that no complaints have been received relating to acoustic impacts from the Dixon Sand operations at Maroota.

Traffic Impact

Dixon Sand, as part of its annual environmental reporting, has monitored the number of trucks entering and leaving the Site. There has been no exceedance of the approved truck numbers. The annual environmental monitoring reports clearly state that a minor number of complaints have been made with regard to the conduct of truck drivers in the Maroota area with the number of complaints ranging from zero in some years to 4 in one year. In all cases, complaints related to trucks speeding. In all cases, Dixon Sand has reprimanded the driver concerned and reiterated the truck management plan which applies to trucks entering and leaving the Site.

Air Quality

Conditions of Development Consent No.250-09-01 relate to air quality impact and provide for the performance criteria to be adopted for extraction of the Site.

A review of the annual environmental monitoring reports for the Dixon Sand extractive industry operations at Maroota reveals that, generally, dust emissions from the extractive industry have been within the criteria referred to in conditions of consent.

Heritage

It is unlikely that heritage items or archaeological sites would be encountered should the modification be approved. Notwithstanding, Condition 3.52 would ensure that appropriate measures are employed to ensure the integrity of any such items of heritage or archaeological sites.

Waste

Conditions of Development Consent No.250-09-01 relate to waste management on the Site.

The proposed modification would be subject to those conditions.

Rehabilitation

Condition 1.15 of the Consent deals with the payment of a bond to the Director-General ... *to ensure completion of the rehabilitation and landscaping works at the site.*

Condition 6.3(e) requires the preparation of a *Rehabilitation and Landscape Plan* which forms part of the Site Environmental Management Plan.

The Rehabilitation and Final Landscape component of the Site Environmental Management Plan has as its objective:

> *To ensure rehabilitation works are implemented progressively to enhance the scenic and environmental quality of the site, increase habitat for threatened species, and utilises areas suitable for agricultural pursuits.*

The Site Environmental Management Plan contains, as its Figure EP15.2, a plan of the approved final landform for Lots 196 and 29, DP 752025 and Lots 1 and 2, DP 547255.

Dixon Sand, as part of the review process for its s.75W modification (3) application, ascertained that a more appropriate and suitable final landform could be achieved compared to that which was originally approved. As a result, the s.75W modification (3) application, which has been approved by the Department of Planning and Infrastructure, the Consent has been modified such that the final landform shown in **Figure 2.3** is substituted for that which was originally approved.

With the removal of the "exclusion area" and the "area of shallow groundwater" from the Consent as proposed in this modification application, a further refinement of the final landform is proposed as detailed in **Figure 2.3** of this Environmental Assessment, a copy of which is reproduced below.

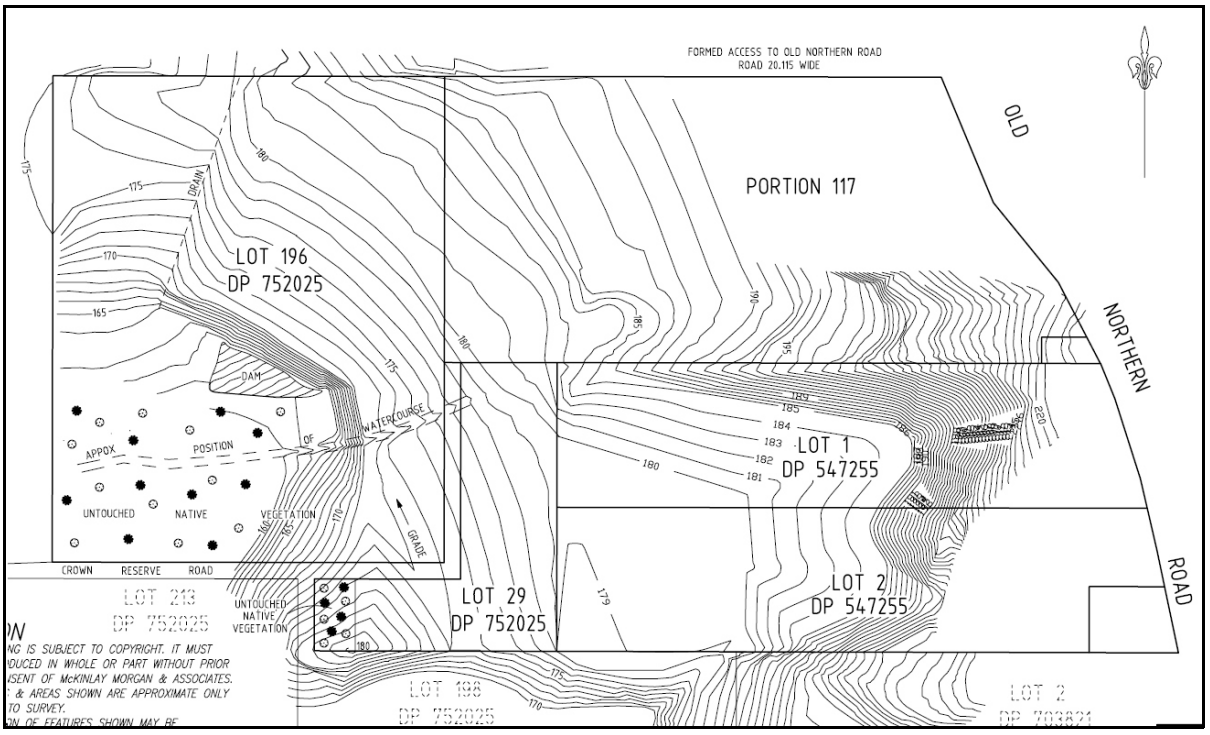

Figure 2.3: Proposed final landform contours over Lots 29 and 196, DP 750025 and Lots 1 and 2, DP 547255 as requested in modification application (4).

Rehabilitation will include the re-establishment of an area of native vegetation to compensate for the loss of native vegetation from the "exclusion area".

Social and Economic Impact

Conditions of the Consent provide the environmental monitoring conditions under which the existing development on the Site operates including conditions which relate to *Community Information, Consultation and Involvement*. **Those conditions would not alter as a result of the proposed modification**.

The proposed modification would not result in any additional employment, and the existing market for product would remain. No economic impact, other than the economic use of a valuable sand resource, is expected to result from the proposed modification.

CONCLUSION

Dixon Sand seeks the approval of the Minister for Planning and Infrastructure to modify Development Consent No.250-09-01 to permit further extraction on Lots 1 and 2, DP 547255, Old Northern Road, Maroota in a previously identified "exclusion area" and in a previously defined "area of shallow groundwater".

This Environmental Assessment has concluded that, with the proposed modification to Development Consent No.250-09-01, there would be no impact to the environment of the Site and its environs over and above that which was identified in the assessment of Development Application No.250-09-01.

The proposed modification would ensure that a valuable resource is utilised and ensure than the Site would be rehabilitated to be consistent with the agricultural landscape of the area and also to ensure that a section of the Site is re-established with native vegetation.

Part One
INTRODUCTION

1.1 Introduction

Dixon Sand (Penrith) Pty Ltd (**Dixon Sand**) has development consent to:

- extract sand on Lots 1 and 2, DP 547255 and Lot 29, DP 752025, and
- extract and process sand on Lot 196, DP 752025, Old Northern Road, Maroota.

Extraction commenced on Lots 29 and 196, DP 752025 in the early 1980s, with Dixon Sand operating that extraction from 1992 to December 1998.

The continued approval for extraction on Lots 196 and 29, DP 752025 (Development Consent No.796/00/HE) was granted on 7 July 2000 by the Land and Environment Court of NSW. Of relevance were conditions 3.1 and 3.5 which stated:

> ***3.1 Life of Consent***
>
> *Consent for the purposes of extraction of material and rehabilitation is limited to a period of ten (10) years effective from the endorsed date of this consent (operational consent is twenty-eight (28) days after consent is issued, i.e. consent lapses on 22 March 2010).*
>
> *The continuation of extraction on the site is subject to review on an annual basis, in accordance with Part 6 of this consent.*
>
> ***3.5 Extraction Depth***
>
> *(a) The extraction depth is to be in accordance with details provided in the Environmental Impact Statement and supporting details, except as amended by these conditions of consent.*
>
> *(b) Extraction is not to occur within 2m of the wet weather high groundwater level, or otherwise to the requirements of the Department of Land & Water Conservation.*
>
> *(c) Extraction should not exceed 15.24m from original ground level, as this would encroach onto Crown land title.*

The limit on the depth of extraction to 15.24 metres from the original ground level was imposed due to the resource below that level being in the ownership of the Crown as per the title to that part of the site.

In 2005, the Land and Environment Court of NSW granted Development Consent No. 250-09-01 for the expansion of extraction into Lots 1 & 2, DP 547255 to the east of Lots 29 & 196, DP 752025. Development Consent No.250-09-01 was for:

> *The operation of an extractive industry on Lots 1 and 2 DP 547255; the continued use of the existing central processing plant on Lot 196, DP 752025; and water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025 ....*

Relevantly, condition 1.5 of Consent No.250-09-01 stated:

> ***Period of Approval***
>
> *1.5 This consent provides approval for sand extraction on Lots 1 and 2, DP 547255, until 24 May 2022 and for the:*
>
> *a) continued use of processing facilities, haul roads, water management, weighbridge, offices, and associated infrastructure on site;*
>
> *b) transport of extracted sand and concrete product to the site, and sand product from the site; and*
>
> *c) decommissioning of equipment, rehabilitation and revegetation of the site,*
>
> *for a period of twenty-five (25) years from the commencement of the development consent for the Haerses Road quarry (DA 165-7-2005).*
>
> *Extraction on Lots 29 and 196 DP 752025 shall not occur beyond the period of approval under development consent 796/00/HE.*

As indicated above, pursuant to Development Consent No.796/00/HE, consent for the purposes of extraction and rehabilitation on Lots 29 & 196, DP 752025 ceased on 22 March 2010, however, Development Consent No.250-09-01 permits:

(a) development for the purposes of an extractive industry on Lots 1 and 2, DP 547255;

(b) the continued use of the existing central processing plant on Lot 196, DP 752025; and

(c) water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025.

The extractive resource on Lots 29 & 196, DP 752025 has not been exhausted. As such, Dixon Sand, by a Modification to Development Consent No.250-09-01, sought approval for the continued extraction on Lots 29 & 196, DP 752025. As part of the modification

application, Dixon Sand advised that the following situation applies with regard to extraction of material from Lots 29 and 196:

Lot 29 There is additional material available for extraction as previously approved by Development Consent No.796/00/HE, however, there is no need to extract below the previously approved depth of 15.24 metres below the original ground level.

Lot 196 There is additional material available for extraction as per Development Consent No.796/00/HE, however, the topography of this part of the site is such that a significant amount of material is available below the previously approved depth of 15.24 metres below the original ground level.

Dixon Sand determined that the most appropriate course of action would be to:

(a) amend Development Consent No.250-09-01 to include extraction on Lots 29 & 196, DP 752025, and

(b) surrender Development Consent No.796/00/HE issued by the Land and Environment Court on 7 July 2000.

The adoption of the above strategy would see the continued extraction of Lots 29 & 196, DP 752025 being encompassed in Development Consent No.250-09-01, i.e. a single integrated consent, thus having the Minister for Planning and Infrastructure as the consent authority for all activity within Lots 1 & 2, DP 547255 and Lots 29 & 196, DP 752025.

The above Modification to Development Consent No.250-09-01 was approved by the Minister for Planning and Infrastructure in 2012. Subsequently, Development Consent No.796/00/HE was surrendered in 2013.

This Environmental Assessment has been prepared on behalf of Dixon Sand in support of an application to further modify Development Consent No.250-09-01 (**the Consent**) pursuant to Section 75W of the Environmental Planning and Assessment Act 1979. The section of the Site which is proposed for the further extraction is that which is currently excluded from the Consent due to:

- previously identified Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations and buffer areas to those populations.

- an area of shallow groundwater.

As detailed in this Environmental Assessment, the area previously thought to be Shale/Sandstone Transition Forest and contain *Tetratheca glandulosa* populations has been incorrectly identified, and it has also be established that the regional groundwater level is below that adopted in Development Consent No.250-09-1.

1.2 The Site

The land to which the Consent relates is:

Lots 29 & 196, DP 752025 and Lots 1 & 2, DP 547255
Old Northern Road
MAROOTA

The above land is owned by:

- The Dixon family in the case of Lot 1, DP 547255;
- the Taouk family in the case of Lot 2, DP 547255;
- the Estate of the late C Gouskos in the case of Lot 29, DP 752025, and
- Manaldo Pty Ltd in the case of Lot 196, DP 752025.

The land is located on the western side of Old Northern Road, approximately 600 metres north of the intersection of Old Northern Road with Wisemans Ferry Road.

Access to the land is via a sealed Crown Road from Old Northern Road.

The land is within The Hills Shire Council local government area and is zoned RU1 Primary Production pursuant to The Hills Local Environmental Plan 2012.

The land has been extensively disturbed by the extraction of sand.

Maroota Public School is located on Lot 78, DP 752025.

For the purposes of this s.75W modification application, that part of the above land to which the modification specifically relates (**the Site**) is Lots 1 & 2, DP 547255. **Figure 1.1** shows the Site location. **Figure 1.2** shows the Site in more detail.

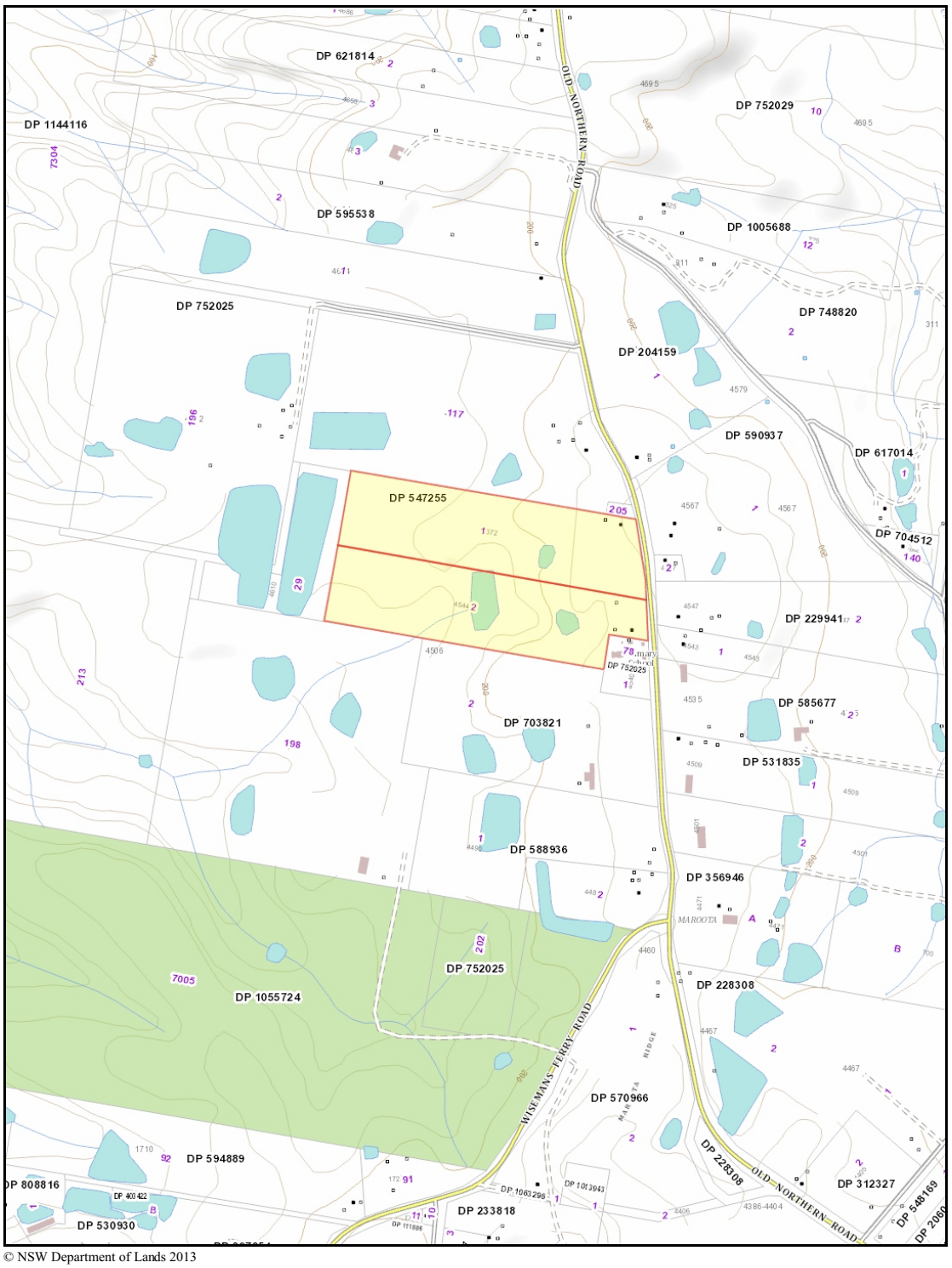

Figure 1.1: Site Location Map

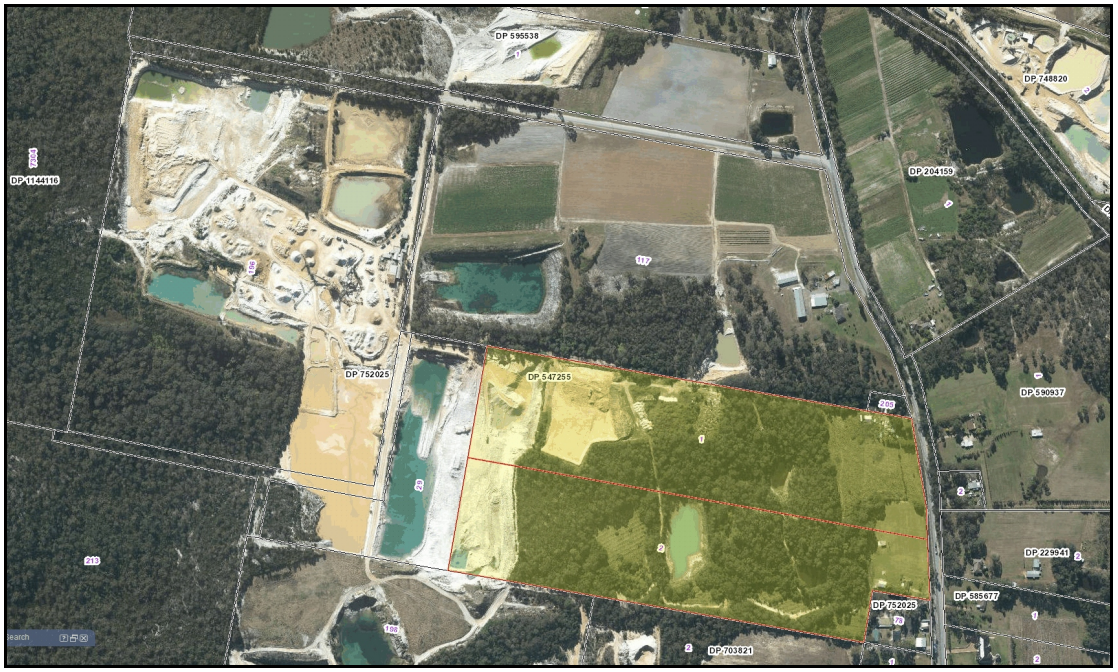

Figure 1.2: Aerial photograph indicating the location of the Dixon Sand extraction to which the Consent relates (Lots 196 & 29, DP 752025 and Lots 1 & 2, DP 547255) with Lots 1 & 2, DP 547255, which are the subject of Modification 4, highlighted.

1.3 Statement of the Proposal

Dixon Sand seeks the approval of the Minister for Planning and Infrastructure to further modify the Consent to permit further extraction on the Site. The section of the Site which is proposed for the further extraction is that which is currently excluded from the Consent due to:

- previously identified Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations and buffer areas to those populations.
- an area of shallow groundwater.

The excluded areas were identified in the south western section of the Site as shown on Figure 2.1 of the Environmental Impact Statement submitted with the Development Application for extraction of Lots 1 and 2, DP 547255. A copy of Figure 2.1 of the Environmental Impact Statement is provided as **Figure 1.3**.

Figure 1.3 also shows the extensive buffer area around the Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations.

As part of this modification, it is also proposed to clarify the position of the wet weather groundwater table on the Site for the purpose of clarifying the depth of the approved extraction.

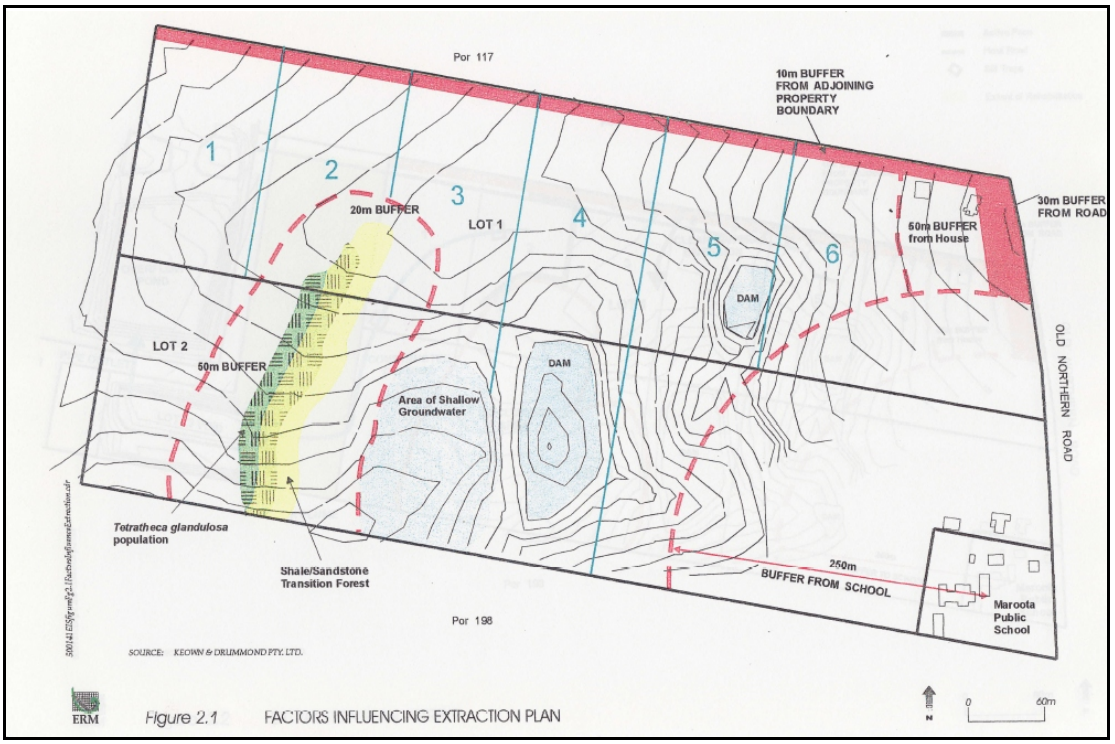

Figure 1.3: Figure 2.1 of the Environmental Impact Statement for extraction of the Site which shows in the south western corner the then identified Shale/Sandstone Transition Forest and a *Tetratheca glandulosa* population plus the buffer zones around that area, and the area of shallow groundwater, all of which are the subject of this modification application. This figure also shows (blue lines and numbers) the location of the approved 6 stages of extraction of the Site. Stages 1-4 would be extended to accommodate the additional extraction area as part this modification.

The objectives of the proposed modification are:

(a) To provide graded sand and gravel products suitable for use in the construction industry and specialty markets.

(b) To realise the economic potential and maximise the efficient recovery of natural resources on the Site.

(c) To successfully rehabilitate the extracted areas of the Site into an integrated, continuous agricultural landform together with a section of re-established land which is consistent with the vegetation of the proposed modification area.

1.4 Background to the Proposed Modification

1.4.1 Development Consent No.250-09-01 (the Consent)

As detailed above, the Consent was issued by the Land and Environment Court on 24

May 2004 (refer *Diamond v Minister for Planning New South Wales and Another (No 2) [2004] NSWLEC 254)* for:

> *The operation of an extractive industry on Lots 1 and 2 DP 547255; the continued use of the existing central processing plant on Lot 196, DP 752025; and water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025 ....*

Three modifications to the Consent have been approved. A copy of the Consent, as modified, is at **Appendix 1**.

Conditions of the Consent operate to protect both flora and fauna on the Site and the impact of extraction on the groundwater of the Site as follows.

1.4.2 Flora and Fauna

The protection of the flora and fauna species identified as being worthy of retention is reflected in conditions of the modified Consent, those conditions being:

- Condition 3.1(d)
- Conditions 3.49 - 3.51
- Conditions 4.9 & 4.10
- Condition 6.3(e)(iii).

Condition 3.1(d)

Setbacks and Buffer Zones

3.1 Prior to commencement of operations on Lots 1 and 2, DP 547255, the Applicant shall engage a registered surveyor to mark out buffer zones and setbacks generally in accordance with the provisions of Baulkham Hills Development Control Plan 500 relating to extractive activities at the date of this consent. In this regard, a buffer zone shall be established which excludes areas from extraction between the quarry and nearby landuses or sensitive environmental areas. The boundary of the buffer zone(s) shall be located:

a) Not less than 250m from the boundary of Maroota Public School (Lot 18 DP 752025);

b) Not less than 10m from the boundary of Lot 117 DP 752025;

c) Not less than 50m from the existing house on Lot 1 DP 547255;

d) In accordance with condition 3.50 around the threatened species conservation area;

e) At the edge of the area of shallow groundwater indicated on Fig 2.1 of the EIS;

(f) Not less than 50m from the Kunzea rupestris plant species on Lot 29 DP 752025; and

(g) Not less than 10m from the western boundary of Lot 196 DP 752025.

A survey plan of the buffer zone and setback boundary shall be submitted to the Director-General for approval at least one month prior to the commencement of operations on Lots 1 and 2, DP 547255. Once approved, the surveyed boundary and buffer zone shall be fenced to prevent vehicles and unauthorized persons entering the area(s). No works or operations on Lots 1 and 2, DP 547255 shall occur on the site until the approved boundary has been fenced.

Conditions 3.49-3.51

Impacts on Flora and Fauna

3.49 Prior to commencement of operations on Lots 1 and 2, DP 547255, the Applicant shall engage a suitably qualified and experienced ecologist to identify all threatened plant species on the site and clearly mark vegetation to be conserved, generally in accordance with the proposed conservation areas in documents listed in condition 1.2. The Applicant shall then define a buffer zone(s) around threatened species conservation areas as follows:

a) A 50 metre buffer around the populations of Tetratheca glandulosa and shale sandstone transitional forest; and,

b) A reduced buffer of 20 m on the northern point of the conservation area.

The boundary of the conservation area shall be surveyed and fenced in accordance with condition 3.1. Fencing around the threatened species conservation area shall be sufficient to ensure excavation operations, truck movements, overburden dumping, dust generation, and weed infestation due to quarry operations do not adversely affect flora and fauna. No works or operations on Lots 1 and 2, DP 547255 shall occur on the site until the approved conservation area boundary has been fenced.

3.50 The Applicant shall ensure that all natural bushland directly adjoining the site and bushland to be conserved within the development site, is not damaged or disturbed by its operations.

3.51 Native bush regeneration and habitat reconstruction techniques shall be used to rehabilitate the threatened species conservation area, extraction areas, tailings ponds, and disturbed areas, and stabilize environmental bunds on the site in accordance with the SEMP. Bush regeneration shall include a specific program to translocate, propagate, and revegetate threatened plant species on the site including Tetratheca glandulosa. Shale/sandstone transition forest, Darwinia Fascicularis susp. oligantha, and Kunzea rupestris. The specialised techniques shall be carried out under the direction of a qualified Plant Ecologist and shall include the re-use of stored topsoil that has not been contaminated with exotic grasses or weed species and the collection and propagation of species from the site.

Conditions 4.9 and 4.10

Flora and Fauna Monitoring

4.9 The Applicant shall prepare and implement a Flora and Fauna Monitoring Program to monitor the effects of the development on flora and fauna including known populations of Tetratheca Glandulosa, Shale-Sandstone Transitional Forest, Darwinia fascicularis subsp. oligantha, and Kunzea Rupestris on the site. The Program shall also monitor the success of revegetation works on the site. The Program shall be developed in consultation with OEH and Council. The Program shall include annual surveys for threatened species during quarry operations, and include monitoring of the threatened species conservation area. The Applicant shall include the Flora and Fauna Monitoring Program in the SEMP (condition 6.1(i)).

4.10 The Flora and Fauna Monitoring Program shall begin before commencement of operations on the quarry site and continue until at least two years beyond the period of approval in condition 1.5.

Condition 6.3(e)(iii)

e) A Rehabilitation and Landscape Plan to detail the proposed final landuse and landform for the site and measures to be undertaken to create that landform and vegetation cover. The Plan shall address the requirements of the Director- General, Council, OEH, the EPA and DRE. The Plan shall include, but not necessarily be limited to:

i. ....;

ii. ....;

iii. a specific program to translocate, propagate, and revegetate and monitor threatened plant species on the site including Tetratheca glandulosa, Shale/sandstone transition forest, Darwinia

Fascicularis susp.oligantha, and Kunzea rupestris;

1.4.3 Groundwater

In addition to reference to the shallow groundwater area in the above flora and fauna conditions, Condition 3.25 of the Consent states:

> *3.25 The Applicant shall ensure that no extraction or excavation works occur within two (2) metres of the highest recorded wet weather groundwater level.*

1.4.4 Environment Protection Licence

The existing extraction on the Site is undertaken in accordance with Environment Protection Licence No.3916.

1.4.5 Existing Environmental Management and Monitoring

Dixon Sand has developed a comprehensive environmental management and monitoring program which is contained in the *Dixon Sand Maroota Quarry Lots 1, 2, 29 & 196, 4610 Old Northern Road, Site Environmental Management Plan*. Dixon Sand also prepares an Annual Environmental Monitoring Report. Copies of the Site Environmental Management Plan and the Annual Environmental Monitoring Reports are available on the Dixon Sand web site (www.dixonsand.com.au).

1.5 The Proposed Modification

The Consent, as modified, permits:

(a) development for the purposes of an extractive industry on:

- Lots 196 and 29, DP 752025, and
- Lots 1 and 2, DP 547255;

(b) the continued use of the existing central processing plant on Lot 196, DP 752025, and

(c) water management and rehabilitation operations over Lots 1 and 2, DP 547255,

and Lots 29 and 196, DP 752025.

The proposed modification would amend the Consent as follows:

1.5.1 Flora Exclusion Area

The area which was identified in the Environmental Impact Statement which accompanied the development application for extraction of the Site, identified certain areas which contain flora species which were, at that time, determined as warranting protection, those areas being Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations. The areas of the Site which were affected are shown on **Figure 1.3** above.

In recent times, Dixon Sand has commissioned Cumberland Ecology to undertake an investigation of the areas excluded from extraction to determine if those areas are, indeed, worthy of exclusion from extraction. The Cumberland Ecology report is titled *Advice Regarding the Presence of Shale Sandstone Transition Forest in the Extraction Exclusion Area at Dixon Sand Quarry, Part Lots 1 & 2, DP 547255, Old Northern Road, Maroota*, dated 30 June 2011. A copy of the Cumberland Ecology report is at **Appendix 2**.

The Cumberland Ecology report provides an analysis and discussion relating to the presence of Shale-Sandstone Transition Forest (**SSTF**) within the current extraction exclusion area. SSTF is an Endangered Ecological Community listed under the Threatened Species Conservation Act 1995 (**TSC Act**) and the Environment Protection and Biodiversity Conservation Act 1999 (**EPBC Act**).

The presence of SSTF was first claimed to have been detected in the extraction exclusion area during ecological studies conducted for the Environmental Impact Statement for the initial extraction proposal for Lots 1 and 2, DP 547255.

The Cumberland Ecology report concludes:

- The vegetation on the Site is not SSTF as listed under the Final Determination of the TSC Act.

- The vegetation on the Site lacks the typical geology and soils to support SSTF, and the species present on the Site are typical of sandstone vegetation rather than SSTF. In particular, the typical tree species which dominate this community are essentially absent from the Site.

- The vegetation on the Site:

  (i) Does not conform to the Final Determination for SSTF;

  (ii) Does not conform to or pass the test prescribed in Tozer et al. (2010) for SSTF;

(iii) Does not occur on geology suitable for the development of SSTF, and

(iv) Conforms best to non-listed sandstone dominated vegetation.

- The vegetation on the Site is Coastal Sandstone Ridgetop Woodland as described in Tozer et al. (2010).

- The zone to protect the Site on the basis that it is SSTF is flawed and unwarranted. Furthermore, the vegetation is now relatively isolated from other occurrences of native vegetation by surrounding quarrying. The long term viability of such vegetation would be difficult to maintain and the maintenance of such vegetation would not provide a substantial positive conservation outcome.

Based on the findings of the Cumberland Ecology report, it is proposed that the 'exclusion area' and associated buffers identified in the Consent be removed to allow extraction of sand from this section of the Site.

1.5.2 Groundwater Depth

Because extraction of sand on the Site should not occur within 2 metres of the wet weather groundwater level on the Site, as part of the preparation of the Environmental Impact Statement for the development application to extract sand from the Site, sampling was undertaken to determine the level of the groundwater table below the then surface level. As a result, condition 3.25 of the Consent states:

> *3.25 The Applicant shall ensure that no extraction or excavation works occur within two (2) metres of the highest recorded wet weather groundwater level.*

The actual level to which extraction can occur in accordance with condition 3.25 is unclear, especially with regard to the area noted in **Figure 1.3** as *Area of Shallow Groundwater*.

In order to provide greater certainty with regard to the level of groundwater on the Site, Dixon Sand commissioned RPS Aquaterra to undertake additional work on the Site to better determine the level of groundwater on the Site. RPS Aquaterra prepared a report titled *Groundwater Assessment for Dixon Sands Operations, Lot 1 and 2 DP 547255, Maroota NSW*, dated 17 August 2012 (**the RPS Aquaterra Report)**, a copy of which is at **Appendix 3**. The objectives of the RPS Aquaterra Report were to:

- Review existing hydrogeological studies with reference to the location of Lots 1 and 2, DP 547255 and the surrounding area.

- Install two deep monitoring piezometers on Lots 1 and 2, DP 547255 to refine the conceptual model of the area which was developed following previous assessments.

- Determine the lateral extent of the perched aquifer in order to ascertain the significance of the system and to provide regulators with sufficient information to make informed decisions in relation to the modification of the Consent.

- Determine the wet weather groundwater level beneath Lots 1 and 2, DP 547255 such that the target depth of extraction can be clearly determined.

- Identify and assess the potential impacts of the proposed amendment to other groundwater users in the area.

The conclusions drawn by RPS Aquaterra are:

- Lots 1 and Lot 2, DP 547255 and the remainder of the Dixon Sand extraction area is underlain by a series of shallow and limited extent zones of non water-bearing unconsolidated horizons of weathered clays, sandstones and shales. These low permeability layers permit temporary storage of groundwater at various shallow depths. These temporary perched storages have limited resource value because, like the Maroota Sand, they are discontinuous and of limited extent and low storage.

- Based on the inferred groundwater contouring the *"wet weather high groundwater level"* would be at a minimum elevation of about 171 metres AHD towards the east and 151 metres AHD in the west. Therefore, sand extraction on Lots 1 and 2, DP 547255 could occur to an elevation of 173 metres AHD in the east grading to 153 metres AHD in the west, therefore, leaving a 2 metre distance of separation which would limit potential interference with the regional water table.

- The total or partial removal of the shallow perched groundwater zones is unlikely to have any major impacts to the local hydrogeological regime, or to the regional aquifer system, other than potentially increasing the rate of rainfall recharge to the regional aquifer system. This potential increase in recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury Sandstone.

- There are nine registered groundwater abstraction bores within approximately 1 kilometre of Lots 1 and Lot 2, DP 547255. All of the bores listed were terminated at depths well below the extent of the low permeability layers, therefore, none of these production bores would significantly rely on or abstract from groundwater stored above these layers and would, therefore, not be significantly impacted by an extension of the quarrying activity.

- Continued observations from the borehole network will be required to monitor general groundwater behaviour as part of the ongoing licensing requirements.

Based on the information provided in the RPS Aquaterra Report, there is clear evidence:

(a) of the wet weather groundwater level on the Site to allow for the revision of

condition 3.25 of the Consent to provide for a depth to which extraction could occur without having any impact on the regional groundwater table, and

(b) to allow the removal of the exclusion area which relates to the area of shallow groundwater.

Subsequent to the preparation of the RPS Aquaterra Report, Dixon Sand has commissioned a further groundwater report from Australian Groundwater Technologies (**AGT**) titled *Groundwater Assessment for Dixon Sands Operation on Lot 1 and 2 - Groundwater Monitoring and Management* (the **AGT Report**), dated 1 February 2013, a copy of which is at **Appendix 4**. The scope of work of the AGT Report is:

- A description of the existing environment, using sufficient baseline data.
- A detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts.
- A statement of commitments, outlining all the proposed environmental management and monitoring measures.
- A description of the measures which would be implemented to avoid, minimise, (and if necessary), offset the potential impacts of the proposed modification, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment.
- A detailed assessment of potential impacts on the quality and quantity of existing surface and groundwater resources in accordance with the NSW Aquifer Interference Policy (**AIP**).

1.6 Need for an Environmental Assessment

Pursuant to **Schedule 3** of the Environmental Planning and Assessment Regulation 2000, the proposed development is Designated Development being *Extractive industry*.

Before being repealed, Section 75A of Part 3A of the Environmental Planning and Assessment Act 1979 (the **Act**) defined a *project* as:

> ***project** means development that is declared under section 75B to be a project to which this Part applies.*

The then sub-section 75B (1) (a) of the Act stated:

> ***Projects to which Part applies***
>
> *(1)* ***General***

This Part applies to the carrying out of development that is declared under this section to be a project to which this Part applies:

(a) by a State environmental planning policy, or

Sub-clause 6 (1) of the then State Environmental Planning Policy (Major Development) 2005 stated:

Identification of Part 3A projects

(1) Development that, in the opinion of the Minister, is development of a kind:

(a) that is described in Schedule 1 or 2, or

(b) that is described in Schedule 3 as a project to which Part 3A of the Act applies, or

(c) to the extent that it is not otherwise described in Schedules 1–3, that is described in Schedule 5,

is declared to be a project to which Part 3A of the Act applies.

Schedule 1 of the then State Environmental Planning Policy (Major Development) 2005 contained the following definition:

Extractive Industries

(1) Development for the purpose of extractive industry that:

(a) extracts more than 200,000 tonnes of extractive materials per year, or

(b) extracts from a total resource (the subject of the development application (or other relevant application under the Act)) of more than 5 million tonnes, or

(c) extracts from an environmentally sensitive area of State significance.

(1A) Subclause (1) (c) does not apply to extraction:

(a) by a public authority in maintenance dredging of a tidal waterway, or

(b) in maintenance dredging of oyster lease areas, or adjacent areas, in Wallis Lake.

(2) Development for the purpose of extractive industry related works (including processing plants, water management systems, or facilities for storage, loading or transporting any construction material or waste material) that:

(a) is ancillary to or an extension of another Part 3A project, or

(b) has a capital investment value of more than $30 million.

The approved and proposed modified development would extract more than 200,000 tonnes per annum of sandstone material and, as such, is a *Part 3A project* for the purposes of the then State Environmental Planning Policy (Major Development) 2005.

The NSW Department of Planning and Infrastructure has advised that the then Section 75W of the Act can be utilised to give effect to the proposed modification.

1.7 Local Government, Government and Statutory Authority Consultation

In the preparation of this Environmental Assessment, consultation was undertaken with:

- The Hills Shire Council.
- The NSW Office of Environment and Heritage.
- NSW Office of Water.
- NSW Department of Industry and Investment.
- NSW Department of Resources and Energy.
- NSW Roads and Maritime Services.
- The Maroota Public School.

Copies of the responses received are provided as **Appendix 5**.

A 19 December 2012 letter was sent to the Maroota Public School as part of the consultation process. No reply has been forthcoming. Notwithstanding, as required by the conditions 5.3-5.7 of the Consent, continued consultation has been undertaken with the Maroota Public School during the life of the extraction process such that the school is aware of the operations being undertaken on the Site.

The **Hills Shire Council**, by letter dated 21 March 2012, indicated that the following issues should be addressed:

1. The submission of full details describing the proposal.

2. *The submission of full details in the EA confirming the proposal's relationship with the existing extractive industry operations upon the site.*

3. *The preparation of a comprehensive review of the proposal in terms of impact upon the local groundwater resources having regard to the findings of the Maroota Groundwater Study. This will require consultation with the NSW Office of Water. The submission must confirm that the extractive industry operation will be restricted in depth to ensure a 2 metre freeboard above the high (wet weather) groundwater level, at any part of the site.*

4. *The submission of plans and supporting written evidence showing the proposed final landform configuration and end use of land having regard to the existing approvals in place and ensuring that the additional area of extraction is rehabilitated in a consistent manner with the existing approvals. Specific details are to be provided regarding rehabilitation and landscape works upon cessation of extractive operation on the site.*

5. *The submission of a comprehensive staging plan and an associated rehabilitation staging program for the additional area of extraction.*

6. *The submission of full details regarding the proposal's compliance with the requirements of Council's Development Control Plan Part D Section 6 - Extractive Industries and the provisions of Sydney Regional Environmental Plan No.9 - Extractive Industry (Amendment No.2), Sydney Regional Environmental Plan No.20 - Hawkesbury - Nepean River & Baulkham Hills Local Environmental Plan 2005, and other relevant legislation, including the Section 91 "Integrated Development" provisions of the NSW EP & A Act, 1979 if relevant.*

7. *The EA is required to identify the maximum yearly extraction rate and the life of the extraction (based on resource within the quarry) and also the subsequent timeframe for the completion of rehabilitation works upon the site.*

8. *The submission of a detailed traffic impact assessment report addressing the maximum number of truck movements associated with the operation, if an increased* [sic] *in truck movements is proposed.*

9. *Given that the original proposal identified the site as containing Shale Sandstone Transition Forest and the current investigations identify an alternative species, it is considered appropriate for an independent person to carry out further review and an 8 part test. This matter should be reviewed by you in consultation with the Department of Planning and Infrastructure.*

The **Office of Environment and Heritage**, by letter dated 28 February 2012, indicated:

Development Consent DA No. 250-09-01, for Lots 1 & 2 DP 547255, originally suggested setbacks and buffer zones:

a) around threatened species conservation area; and

b) at the edge of the area of shallow groundwater indicated on Fig 2.1 in the Environmental Impact Statement (EIS) submitted with the DA;

based on the exclusion zones propose in the EIS considering significance of the portion of land and the shallow depth of groundwater table particularly after wet weathers [sic] *in other areas of land, respectively.*

OEH has reviewed your current modification application, pursuant to section 75W of the Environment [sic] *Planning and Assessment Act (EP&A Act), for extraction of materials from these areas, and has agreed to provide its approval for extraction of materials from the areas with the following conditions. That the proponent -*

a) must carefully and rigorously consider impacts of the proposed extraction of threatened species, populations, ecological communities and their habitats; and

b) have enough evidence from drilling in the area to suggest that the regional wet weather watertable will not be affected by going to extra depth of extraction and the extraction will be limited to two metres above the wet weather groundwater table as per DA 250-09-01.

Aboriginal Heritage

An assessment of Aboriginal Cultural Heritage will be required as part of the Environmental Assessment (EA) preparation, if applicable. Should any Aboriginal object or Aboriginal place be found and is likely to be impacted upon by the proposal, the proponent must apply for a Section 90 approval under the National Parks and Wildlife Act 1974 (NP&W Act) from the Chief Executive of the OEH.

The **Department of Resources & Energy**, by letter dated 15 February 2012, indicated:

This is a response from the NSW Trade & Investment - Mineral Resources Branch.

The key issues that need to be addressed in the EA are the size and quality of the resource to be extracted in the modified proposal. The proponent must be able to demonstrate that the size and quality of the resource have been adequately assessed and provide details of methods used to assess that resource.

DTIRIS - Mineral Resources Branch has reviewed the subject Environmental Assessment and is satisfied that sufficient information has been provided to

demonstrate the presence of a substantial resource of sand and sandstone. The community is likely to benefit from the exploitation of that resource, provided that appropriate operational and environmental standards can be satisfied.

DTIRIS - Mineral Resources Branch collects data on the quantity and value of construction materials produced annually throughout the State. ... In order to assist in the collection of construction material product data, it is requested that the proponent makes a commitment to provide annual production data to DTIRIS - Mineral Resources Branch.

1.8 Structure of the Environmental Assessment

Part 2 of the Environmental Assessment describes the modifications which would be required to Development Consent No.250-09-01 if approval is granted. **Part 3** details the net impact of the proposed modification to Development Consent No.250-09-01. **Part 4** contains a draft Statement of Commitments and **Part 5** is the conclusion to the Environmental Assessment.

1.9 Project Team

Nexus Environmental Planning	Project Management and Planning
RPS Aquaterra	Groundwater Impact
Australian Groundwater Technologies	Groundwater Monitoring & Management
Cumberland Ecology	Flora and Fauna Impact
McKinlay Morgan & Associates Pty Ltd	Volume calculations and rehabilitation plan amendments.
Archaeological & Heritage Management Solutions	Archaeological Assessment.

Part Two

DETAILS OF PROPOSED MODIFICATION

2.1 Introduction

As noted in **Part 1.4.1** of this Environmental Assessment, the Consent permits:

(a) development for the purposes of an extractive industry on Lots 1 and 2, DP 547255;

(b) the continued use of the existing central processing plant on Lot 196, DP 752025, and

(c) water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025.

The proposed modification would amend the Consent as follows:

Flora Exclusion Area

The Environmental Impact Statement which accompanied the development application for extraction of the Site, identified certain areas which contain flora species which were, at that time, determined as warranting protection, those areas being Shale/Sandstone Transition Forest and *Tetratheca glandulosa* populations. Consent conditions were imposed to ensure the protection of those areas.

It is proposed to remove this restriction on the extraction of sand from the "exclusion area", that area being shown on **Figure 1.3** of this Environmental Assessment.

Groundwater Table

Because extraction of sand on the Site should not occur within 2 metres of the wet weather groundwater level on the Site, as part of the preparation of the Environmental Impact Statement for the development application to extract sand from the Site, sampling was undertaken to determine the level of the groundwater table below the then surface level. As a result, condition 3.25 of the Consent states:

> *3.25 The Applicant shall ensure that no extraction or excavation works occur within two (2) metres of the highest recorded wet weather groundwater level.*

The actual level to which extraction can occur in accordance with condition 3.25 is unclear, especially with regard to the area noted in **Figure 1.3** of the Environmental Assessment as *Area of Shallow Groundwater*. Work undertaken as part of this modification application has determined a clear picture of the depth of the regional

groundwater table such that it is now possible to amend the Consent to reflect the actual depth of the regional groundwater table for the purpose of condition 3.25.

It is proposed to amended the Consent to provide more certainty with regard to the depth to which extraction can take place without impacting on the regional wet weather groundwater table.

2.2 Proposed Modification to Development Consent No.250-09-01

The proposed modification to the Consent would allow the additional extraction of sand from both Lots 1 and 2, DP 547255.

To achieve the proposed modification, a number of amendments would be required to the Consent.

Following are details of the proposed modifications to the Consent.

Page 1

Amend the definition of *Proposed Development* to add reference to Annexure "E" which would be the Environmental Assessment for s.75W modification (4).

Page 3

Insert in Condition 1.2 the following:

i) The Environmental Assessment titled "Environmental Assessment. Section 75W Modification (4). DA 250-09-01. Dixon Sand (Penrith) Pty Ltd), dated add final dated of EA prepared by Nexus Environmental Planning Pty Ltd forming Annexure "E" of this consent.

Page 6

Amend Condition 3.1 to delete conditions 3.1(d) and (e).

Page 8

Amend Condition 3.16 to make reference to the amended final landform plan contained in the Environmental Assessment (Annexure "E").

Page 9

Amend Condition 3.25 to read:

3.25 The Applicant shall ensure that no extraction or excavation works occur within two (2) metres of the highest recorded wet weather groundwater

level as identified in the Environmental Assessment (Annexure "E").

It is, however, considered a preferred option that Condition 3.25 be amended to make reference to the limits of extraction to elevation of 173 metres AHD in the east grading to 153 metres AHD in the west as recommended in **Part 1.5.2** of this Environmental Assessment.

Page 13

Delete condition 3.49 as it is no longer applicable.

Condition 3.51 reads:

3.51 Native bush regeneration and habitat reconstruction techniques shall be used to rehabilitate the threatened species conservation area, extraction areas, tailings ponds, and disturbed areas, and stabilize environmental bunds on the site in accordance with the SEMP. Bush regeneration shall include a specific program to translocate, propagate, and revegetate threatened plant species on the site including Tetratheca glandulosa. Shale/sandstone transition forest, Darwinia Fascicularis susp. oligantha, and Kunzea rupestris. The specialised techniques shall be carried out under the direction of a qualified Plant Ecologist and shall include the re-use of stored topsoil that has not been contaminated with exotic grasses or weed species and the collection and propagation of species from the site.

Amend Condition 3.51 to accommodate changes to the exclusion area as follows:

3.51 Native bush regeneration and habitat reconstruction techniques shall be used to rehabilitate the threatened species conservation area, extraction areas, tailings ponds, and disturbed areas, and stabilize environmental bunds on the site in accordance with the SEMP. Bush regeneration shall include a specific program to translocate, propagate, and revegetate threatened plant species on the site. The specialised techniques shall be carried out under the direction of a qualified Plant Ecologist and shall include the re-use of stored topsoil that has not been contaminated with exotic grasses or weed species and the collection and propagation of species from the site.

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Condition 4.9 reads:

4.9 The Applicant shall prepare and implement a Flora and Fauna Monitoring Program to monitor the effects of the development on flora and fauna including known populations of Tetratheca Glandulosa, Shale-Sandstone Transitional Forest, Darwinia fascicularis subsp. oligantha, and Kunzea Rupestris on the site. The Program shall also monitor the

success of revegetation works on the site. The Program shall be developed in consultation with OEH and Council. The Program shall include annual surveys for threatened species during quarry operations, and include monitoring of the threatened species conservation area. The Applicant shall include the Flora and Fauna Monitoring Program in the SEMP (condition 6.3(i)).

Amend Condition 4.9 to read:

4.9 The Applicant shall prepare and implement a Flora and Fauna Monitoring Program to monitor the effects of the development on flora and fauna on the site. The Program shall also monitor the success of revegetation works on the site. The Program shall be developed in consultation with OEH and Council. The Program shall include annual surveys for threatened species during quarry operations. The Applicant shall include the Flora and Fauna Monitoring Program in the SEMP (condition 6.3(i)).

Page 22

Amend Condition 6.3(e) to reflect the current modification application by deleting Condition 6.3(e)(iii) and (vi).

Page 23

Amend Condition 6.3(i)(xi) to delete reference to ... *the threatened species conservation area*.

2.3 Limits on Production

Conditions 1.6 and 1.7 of the Consent state:

1.6 The combined production of quarry products from the site (Lots 196 and 29 DP 752025, and Lots 1 and 2 DP 547255, Old Northern Road, Maroota) and from the Haerses Road sand quarry shall not exceed 495,000 tonnes per annum.

1.7 Processing of extracted sandstone on the site shall not exceed 1750 tonnes per day.

No modification is proposed to the above approved limits on production.

2.4 Traffic and Transport

Condition 3.30 of the Consent states:

> *3.30 Truck movements at the site, including those provided for under this consent and DA 165-7-2005, shall not exceed:*
>
> *a) a total of 180 per day (ie inbound combined with outbound);*
>
> *b) 40 between the hours of 6.00am and 7.00am (inbound combined with outbound); and*
>
> *c) 118 laden per day, of which no more than 28 may be inbound.*

No modification is proposed to the already approved truck movements to and from the Site.

2.5 Hours of Operation

Condition 3.42 of the Consent states:

> *3.42 Loading of trucks and truck movements at the site must only be carried out between 6am and 6pm Monday to Saturday, and at no time on Sundays and Public Holidays. All other activities at the premises must only be carried out between 7am and 6pm Monday to Saturday, and at no times on Sundays and Public Holidays.*

The above approved hours of operation would not be modified.

2.6 Rehabilitation

Condition 6.3(e) of the Consent requires the preparation of a Rehabilitation and Landscape Plan which forms part of the Site Environmental Management Plan.

The Rehabilitation and Final Landscape component of the Site Environmental Management Plan has as its objective:

> *To ensure rehabilitation works are implemented progressively to enhance the scenic and environmental quality of the site, increase habitat for threatened species, and utilises areas suitable for agricultural pursuits.*

The Site Environmental Management Plan contains, at its Figure EP15.2, a plan of the

originally approved final landform. An extract from that plan is at **Figure 2.1** below.

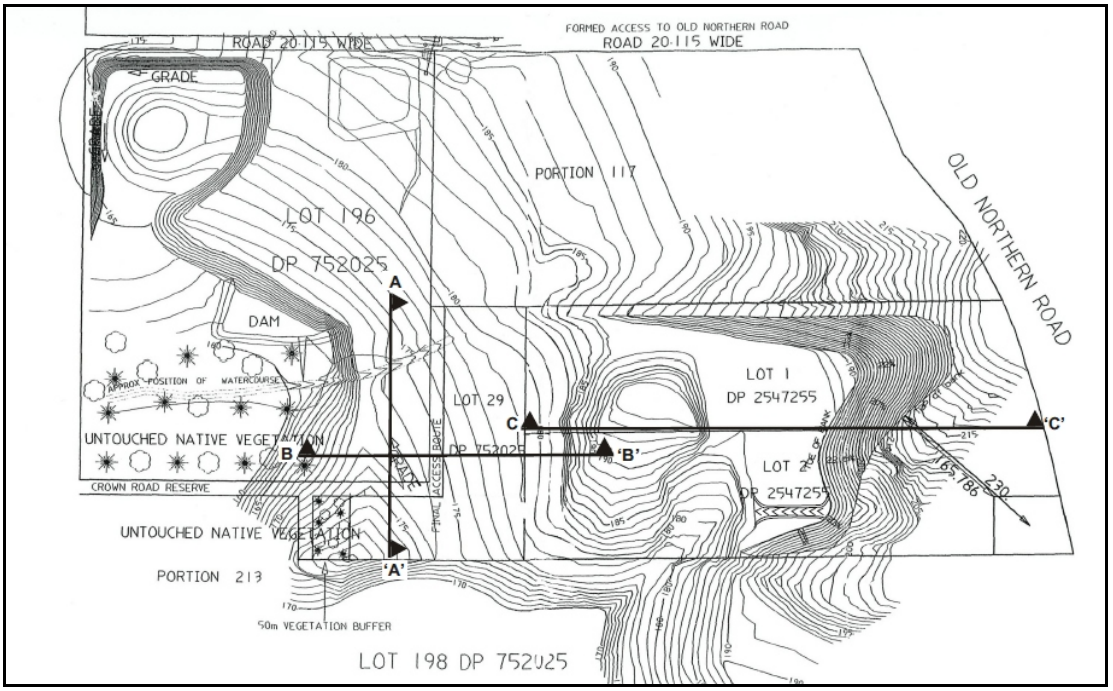

Figure 2.1: Extract from the originally approved final landform for Lots 196 and 29, DP 752025 and Lots 1 and 2, DP 547255 contained in the original Site Environmental Management Plan.

Dixon Sand, as part of the review process for its s.75W modification (3) application relating to extraction of the north western corner of Lot 196, DP 752025, ascertained that a more appropriate and suitable final landform could be achieved compared to that which was originally approved.

As a result, the s.75W modification (3) application, which has been approved, modified the Consent such that the final landform shown in **Figure 2.2** is substituted for that which was originally approved.

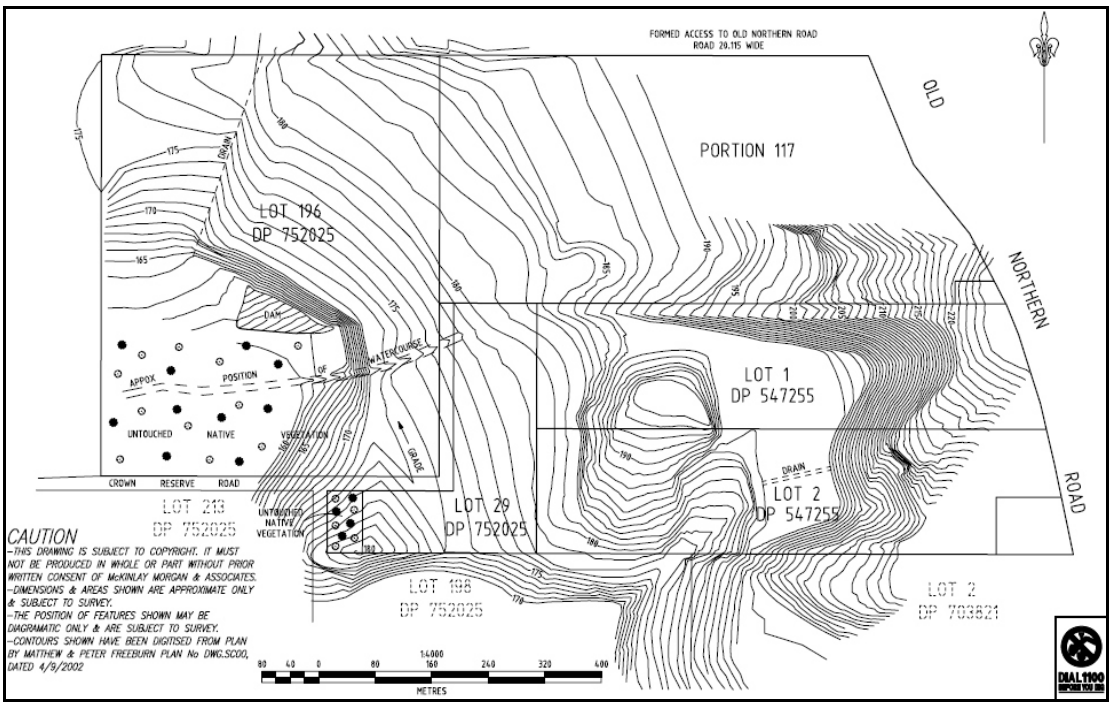

Figure 2.2: The modified final landform after the completion of extraction of Lots 196 & 29, DP 752025 and Lots 1 and 2, DP 547255 as approved in s.75W modification (3).

With the removal of the "exclusion area" and the "area of shallow groundwater" from the Consent as proposed in this modification application, a further refinement of the final landform is proposed as detailed in **Figure 2.3** below.

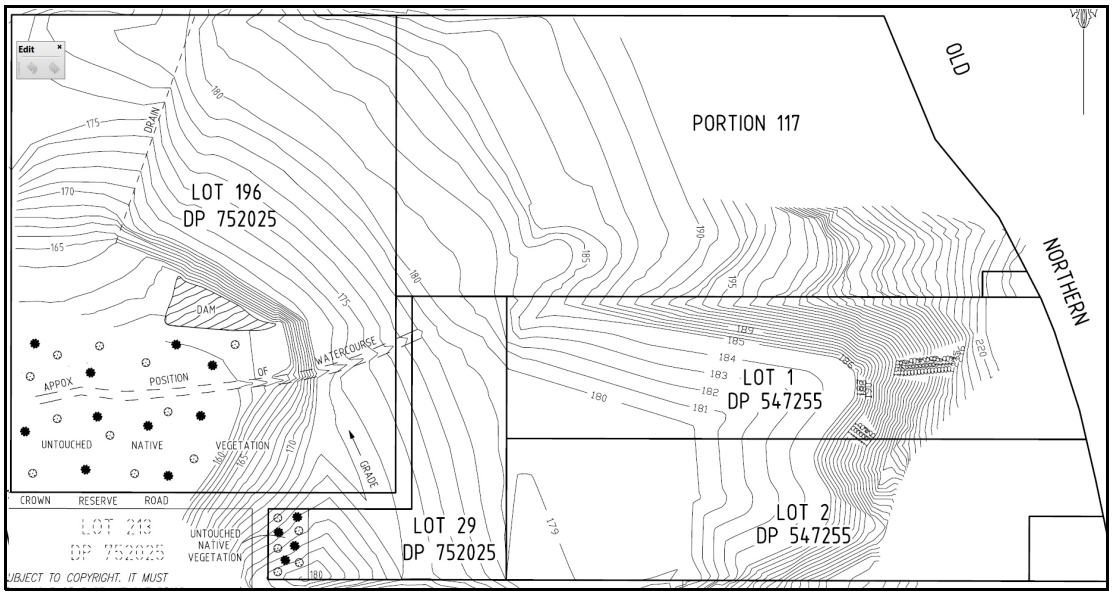

Figure 2.3: The proposed modified final landform after the completion of extraction of Lots 196 & 29, DP 752025 and Lots 1 and 2, DP 547255 as proposed in s.75W modification (4).

A copy of the modified final landform plan is at **Appendix 6**.

2.7 Additional Resource to be Extracted

Having regard to the conclusions of both Cumberland Ecology with regard to the flora "exclusion area" and RPS Aquaterra/AGT with regard to the regional groundwater table, Dixon Sand has commissioned a series of diagrams which depict the proposed amended extraction of the Site on the assumption that:

- the flora "exclusion area" is permitted to be extracted;
- the shallow groundwater "exclusion area" is permitted to be extracted, and
- extraction is permitted to within 2 metres of the regional groundwater table as determined by RPS Aquaterra/AGT.

The amended plans for the Site have been prepared by McKinlay Morgan & Associates Pty Ltd, Consulting Surveyors, and are:

1. A plan showing the natural surface contours over Lots 1 and 2, DP 547255 prior to any extraction.
2. A plan showing the now proposed final landform contours over Lots 29 and 196, DP 752025 and Lots 1 and 2, DP 547255.
3. A plan showing the base extraction level over Lots 1 and 2, DP 547255 after the proposed modification (4) to the Consent.
4. A plan showing the final landform over Lots 1 and 2, DP 547255 after the proposed modification (4).
5. A series of sections through the Site.

Copies of the McKinlay Morgan & Associates plans are at **Appendix 6**.

Extracts from the abovementioned plans 1 to 4 are provided as **Figures 2.4 to 2.7** respectively below.

Having regard to the plans prepared by McKinlay Morgan & Associates, if the proposed modification is approved, there would be an additional 4,330,000m^3 of material available for extraction from the Site.

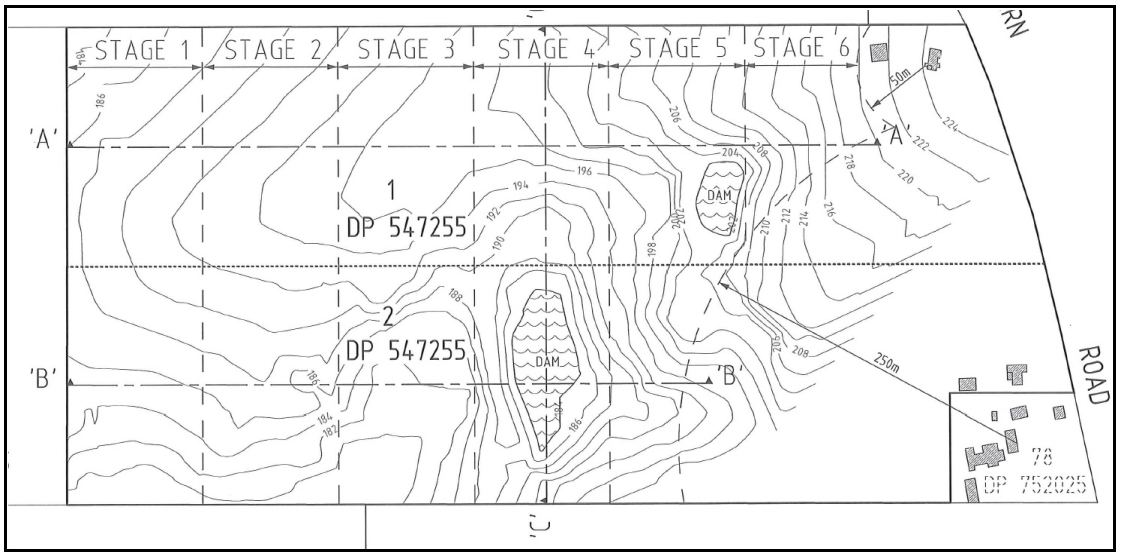

Figure 2.4: The natural surface contours over Lots 1 and 2, DP 547255 prior to any extraction of the Site.

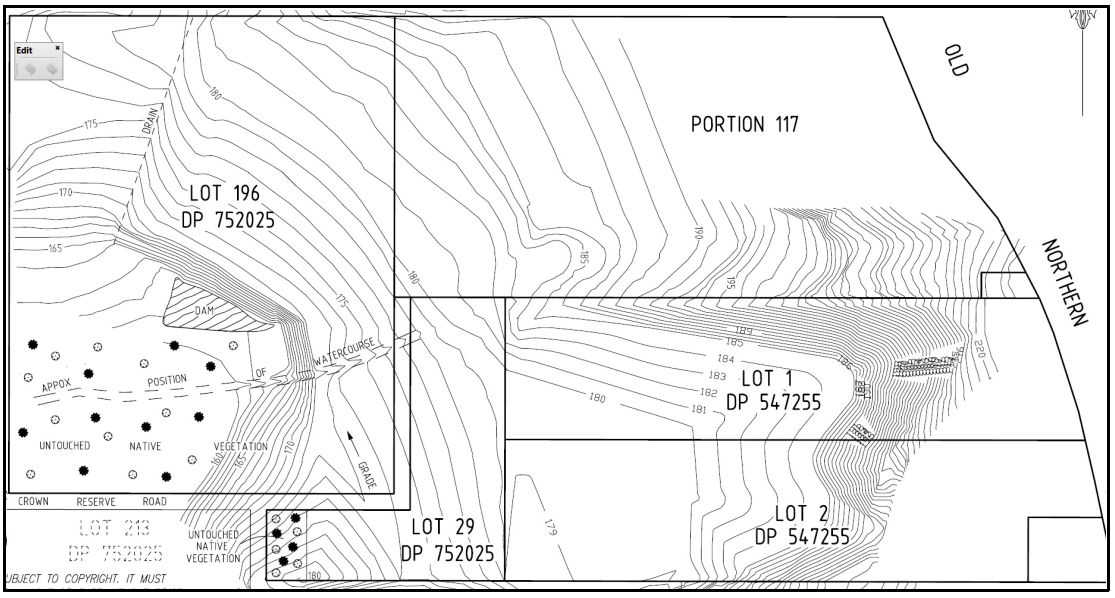

Figure 2.5: Proposed final landform contours over Lots 29 and 196, DP 752025 and Lots 1 and 2, DP 547255.

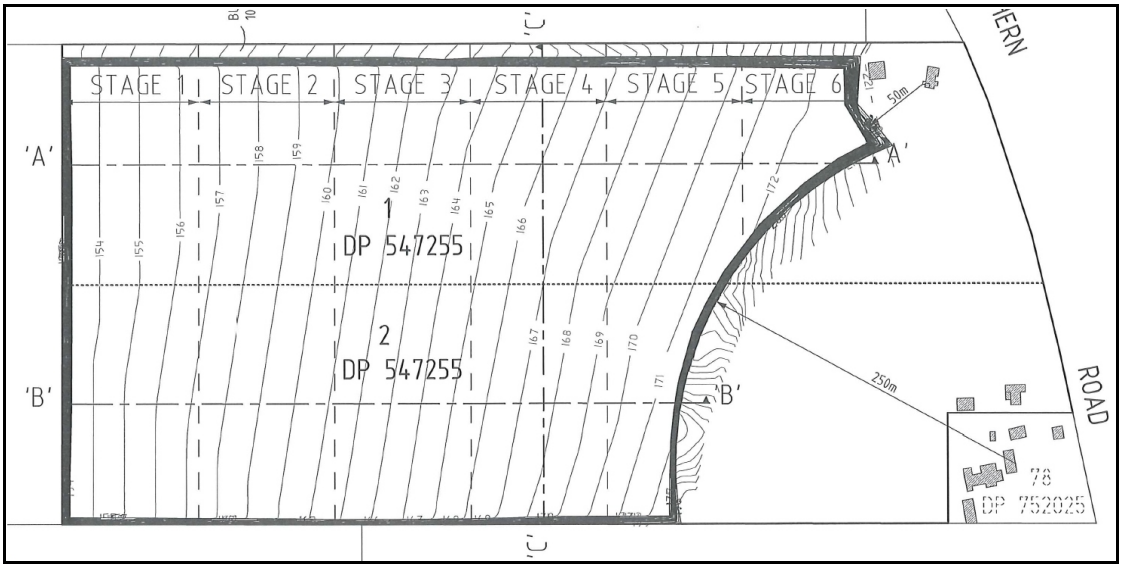

Figure 2.6: Plan showing the base extraction level over Lots 1 and 2, DP 547255 after the proposed Modification (4) to the Consent.

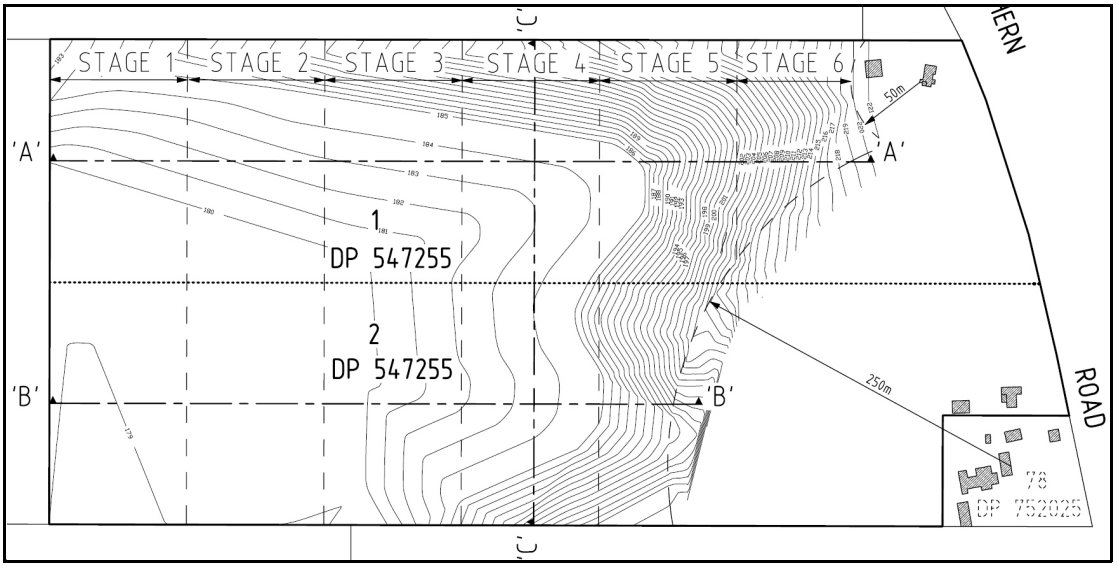

Figure 2.7: Plan showing the final landform over Lots 1 and 2, DP 547255 after the proposed Modification (4) to the Consent.

2.8 Rehabilitation Methodology

Figure 1.2 of this Environmental Assessment (reproduced as **Figure 2.8** below) is an extract from an aerial photograph of the Dixon Sand sand extraction activity at Old Northern Road, Maroota.

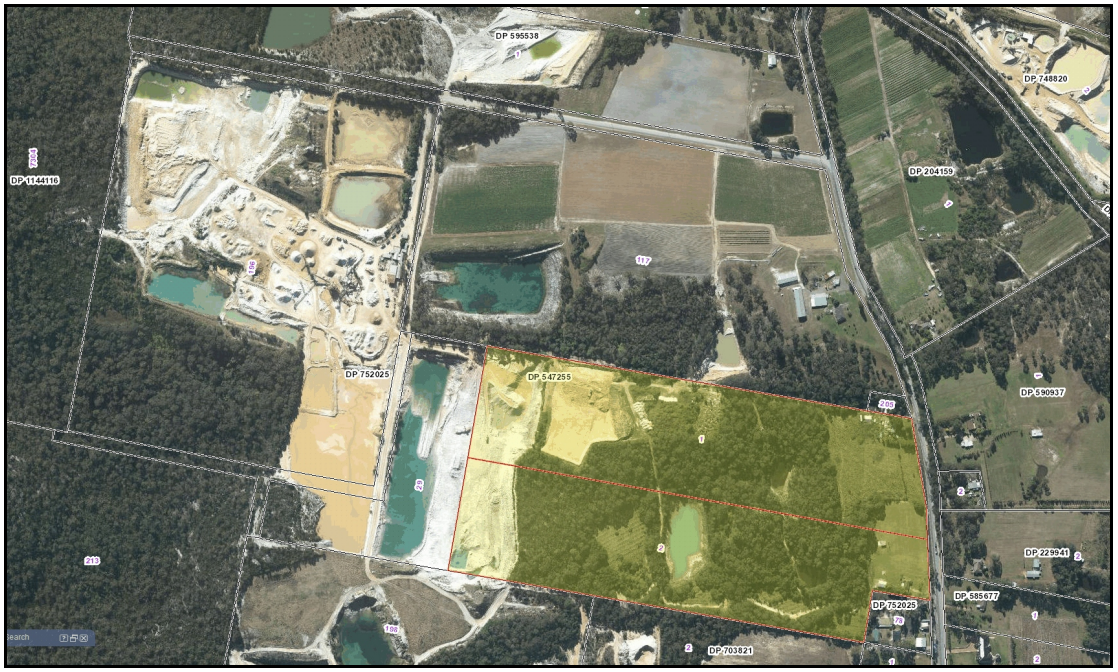

Figure 2.8: Aerial photograph indicating the location of the Dixon Sand extraction to which the Consent relates (Lots 196 & 29, DP 752025 and Lots 1 & 2, DP 547255) with Lots 1 & 2, DP 547255, which are the subject of Modification 4, highlighted.

The process of rehabilitation of the Dixon Sand extraction activity was described in the information submitted with the s.75W modification (3) application as follows:

1. *There is currently 5 to 6 years of tailings void (sedimentation ponds) located in the north eastern corner of Lot 196 DP 752025, and in the eastern side of Lot 29, DP 752025. These ponds are referred to in the Environmental Impact Statements for extraction of both Lot 1 & 2, DP 547255 and the Hearses Road Quarry. Perhaps the most succinct explanation of the rehabilitation is contained in Chapter 2.4.4 of the Haerses Road Quarry Environmental Impact Statement which states:*

   2.4.4 Processing

   The proposed operation will simply involve the removal and stockpiling of topsoil, and the excavation and transport of raw material from the site. A mobile screen will be available for use within each of the stages when required to remove clay balls and other waste from the product prior to transport. Approximately one quarter of the raw material will be sold directly from the site annually, while the majority of sand will be hauled by highway trucks to the existing processing plant on Lot 196. The front end loader will be fitted with a certified weigh cell for the direct sale of material from the Haerses Road site.

   All hauled material unloaded at the plant on Lot 196 will be

washed to remove silt and clay fines. The tailings generated will aid in the backfill of voids on Lots 196 and 29, which will be dewatered and rehabilitated when the approved topographic levels are reached. With an estimated washing loss of 15 percent, the total tailings volume produced (after settling) will be approximately 1 425 000 cubic metres, while the existing quarry on Lots 1 and 2 will produce 380 000 cubic metres of tailings in its lifetime. The amount of available airspace on Lots 196 and 29 is approximately 1 570 000 cubic metres, 235 000 cubic metres short of the required volume. Therefore, a belt press filter (or simialr) [sic] will be required for tailings generated during the final four years of quarrying at the Haerses Road site.

2. *The voids on both Lot 196 and Lot 29 will be progressively filled with tailings from the washing process until such time as they are filled to close to the final landform approved in the rehabilitation plan, and proposed to be amended in the subject s.75W Modification Application. Once that level has been reached, the voids would be dewatered and overburden and topsoil will be used to cap the voids.*

3. *Once the above Point 2 process has been completed, the extraction of Lot 196, if approved in the subject s.75W Modification Application, would have a void created and prepared ready for the depositing of tailings from the washing plant. Those tailings would be added to the void to assist in reaching the approved final landform level prior to capping and rehabilitation.*

4. *As with most extractive industries, the extraction, tailing deposition and rehabilitation would be undertaken progressively as the material is extracted from the north western section of Lot 196. This progressive process would continue until such time as the approved extraction is completed and Lot 196 rehabilitated to the now proposed final landform.*

5. *With regard to the impact the proposed rehabilitation process would have, the material which would be deposited into the voids is that which has been generated during the washing of clay and fines from the sand which has been won from the approved extraction processes. No imported material, other than water, is placed in the voids as part of the process. As such, as with the existing, approved operations, there would be no impact to the regional groundwater table as a result of this rehabilitation process. As the Department is aware, over the period of extraction of its resource in Maroota, Dixon Sand has provided significant data from the various bores on its land, that information having been gathered to provide some empirical evidence of the impact extraction has on the regional groundwater table. As the monitoring has demonstrated, there has been no appreciable impact to the groundwater table resulting from the approved and proposed rehabilitation process. As such, we are of the opinion that no additional environmental*

assessment of this process is required.

The final landform shown in **Figure 2.7** would be established in the essentially the same way as that described above and progressively as the extraction of the Site occurs. The rehabilitation would be generally as follows:

1. Figure 2.1 of the Environmental Impact Statement which accompanied the original development application, an extract from which is at **Figure 2.9**, shows the approved sequence of extraction, being Stage 1 to Stage 6.

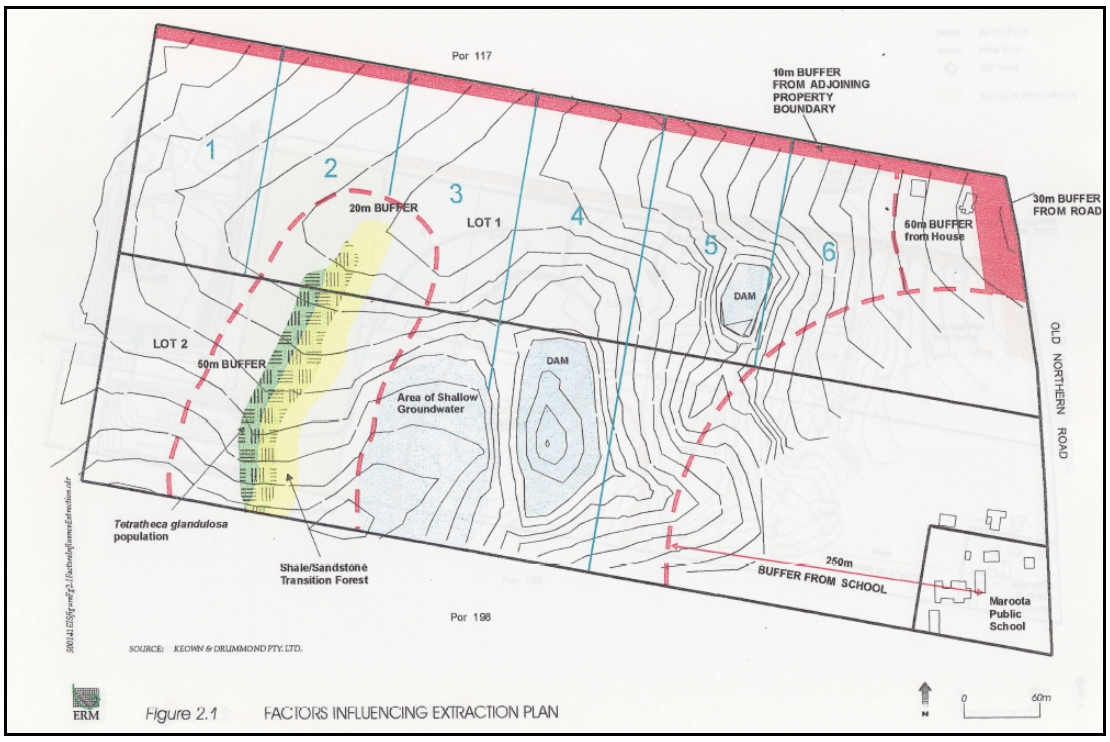

Figure 2.9: Figure 2.1 of the Environmental Impact Statement for extraction of the Site which shows in the south western corner the then identified Shale/Sandstone Transition Forest and a *Tetratheca glandulosa* population plus the buffer zones around that area, and the area of shallow groundwater, all of which are the subject of this modification application. This figure also shows (blue lines and numbers) the location of the approved 6 stages of extraction of the Site.

2. On the assumption that the s.75W modification (4) application is approved, extraction would continue as per the approved sequence from Stage 1 to Stage 6, however, Stages 1 to 4 would be extended to the southern boundary of Lot 2 to incorporate the "excluded area" and the "area of shallow groundwater".

3. The overall extraction would vary from that which is approved in that the depth of extraction would be greater than that which was approved in the original approval.

4. Material would be extracted from the Site and transferred to the processing plant on Lot 196. Material would be washed to remove all silt and clay fines which

would be transferred to the existing tailing ponds on Lot 196 and/or Lot 29.

5. As part of the extraction of each stage, a bund wall would be constructed between each stage using clay overburden, interburden, and oversize material from the processing plant screens (rock spoil). The bund walls would be constructed to the final landform level to create a tailings pond similar to the existing tailings ponds.

6. Once the new tailings pond is constructed, it would be filled with tailings from the process plant as per the existing operation. As each tailing pond is filled, it is decommissioned for a period of 12 to 18 months to allow settlement and consolidation of the fill material.

7. Once settlement has occurred to a desired level, the tailing pond is capped by way of topping the area with spoil rock sourced from the extraction area. The rock is slowly spread over the tailing pond to a depth of approximately 2-3 metres to create a solid landform. This landform is then rehabilitated with required vegetation and fenced off to prevent access.

8. The above process continues easterly until such time as the extraction is completed and the total site rehabilitated. In order to allow the above process to be successfully implemented, it is necessary to have three stages of the extraction underway at any one time. For example, Stage 1 and Stage 2 would be extracted to the maximum depth to allow for the construction of the bund walls between Stage 1 and Stage 2 to create the initial tailing pond in the Stage 1 extraction area. This would result in extraction being undertaken in Stage 3 while the bund wall is constructed and filling of the Stage 1 void was undertaken.

The void between the maximum extraction level sought in s.75W modification (4) application and the proposed final landform is approximately 5 million cubic metres. The void would be backfilled using material sourced entirely from the Dixon Sand extraction activities, generally as follows:

- 72% consisting of tailings from the tailing ponds located in the extraction area. The raw material is typically 18% clay and silt. The clay and silt swells to approximately 4 times its volume when saturated during the washing process.

- 11% consisting of overburden material which comprises clay, ironstone, coffee rock or other suitable materials which are encountered during the extraction process.

- 5% consisting of surface clay material. It has been estimated that approximately 200,000 m^3 of clay suitable for backfilling is located on Lot 1.

- 12% of spoil rock which consists of oversize rock from the screening operation at the processing plant. Approximately 50% of the material won during the extraction process is spoil rock (unbroken sandstone rock) which is usually crushed to create a sand product, however, much of this material is retained on site for use in the rehabilitation process if required. As such, if there is a shortfall

of other rehabilitation materials, spoil rock is utilised to ensure that the rehabilitation material is sourced solely from the extraction site.

Part Three

IMPACT OF THE PROPOSED MODIFICATION

3.1 Local Planning

3.1.1 The Hills Local Environmental Plan 2012

The Site is zoned RU1 Primary Production pursuant to The Hills Local Environmental Plan 2012 (**LEP 2012**). An extract from the LEP 2012 Map is at **Figure 3.1**.

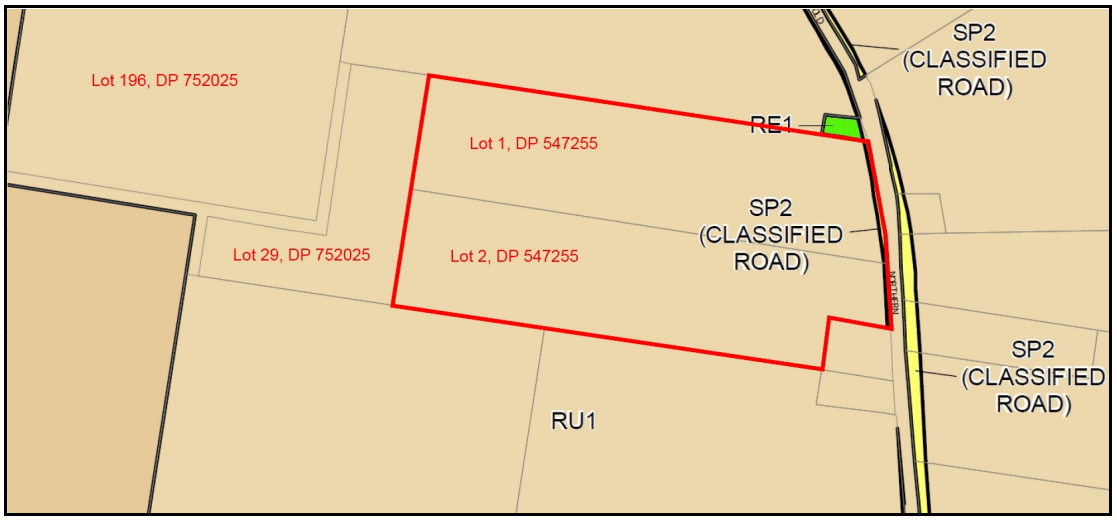

Figure 3.1: Extract from The Hills Local Environmental Plan 2012 Map.

Extractive industries are permitted, with consent, in the RU1 Primary Production zone.

Sub-clause 2.3(2) of LEP 2012 states:

> *(2) The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.*

Although the subject modification application is not a development application, the objectives of the RU1 Primary Production zone are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*

- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

- *To facilitate the economic extraction of materials from land and the subsequent rehabilitation of that land.*

The Site is currently subject to the Consent for extraction of sand resources for the Sydney market. The proposed modification would be consistent with the above objectives of the zone in that a valuable resource would be extracted and the final landform following extraction would be that which would facilitate sustainable primary production and the establishment of an area of native vegetation similar to that which is located on the Site.

3.1.2 The Hills Development Control Plan 2011

Part B, Section 1, Appendix B of The Hills Development Control Plan 2011 **(DCP 2011)** relates to extractive industry and has as its principal objectives:

(i) To consider the social, economic and environmental issues in the assessment and management of extractive industries; implement the objectives of international and nationally recognised environmental standards;

(ii) To encourage community participation in all phases of extractive industry development;

(iii) To provide sound technical parameters to facilitate the orderly development of extractive resources within environmentally sensitive regions;

(iv) To conserve the biological and cultural diversity and quality of the Baulkham Hills Shire; and

(v) To implement the requirements of the Environmental Planning & Assessment Act 1979 and other relevant environmental statutes.

The approved extractive industry on the Site has been conducted in accordance with the principal objectives of DCP 2011 and is continually monitored to ensure that those objectives are met. The proposed modification would continue extraction of the Site within the principal objectives of DCP 2011.

Section B1.2 of Part B, Section 1, Appendix B of DCP 2011 relates to extractive industry in the Maroota area and has as its objectives:

(i) To facilitate and ensure extraction occurs in a controlled and environmentally acceptable manner.

(ii) To facilitate Community participation and encourage local employment.

(iii) To maintain and upgrade the safety and efficiency of the existing external road networks.

(iv) To protect and maintain the safety and amenity of the Maroota Public School and residences not associated with extraction.

(v) To conserve the biological and cultural diversity of Maroota.

(vi) To conserve and protect the integrity pattern and quality of the Maroota ground water regime.

The proposed modification would be undertaken in accordance with the existing conditions of the Consent which have been designed to ensure:

(a) that extraction of the Site is undertaken in an environmentally responsible manner, and

(b) that community consultation is undertaken to address concerns raised by both the general public and the community of the Maroota Public School.

Comprehensive environmental monitoring programs are in place to provide both the public and the relevant authorities with data which are used to ensure that the extraction of the Site is undertaken in an environmentally responsible manner. Those monitoring programs would encompass the proposed additional extraction on the Site to ensure the integrity of the environment of the Site and its surroundings.

Part 3.5 of this Environmental Assessment details how the proposed additional extraction of sand would be monitored such that there would be no adverse impact to groundwater.

The proposed modification would:

(a) Maintain and not alter the existing approved access to the Site from Old Northern Road.

(b) Maintain the approved sequence of extraction of the Site, albeit with inclusion of the "exclusion area" and the "area of shallow groundwater", and an increased depth of extraction as detailed in the RPS Aquaterra Report (**Appendix 3**).

(c) Ensure that the approved rehabilitation plan, as proposed to be modified as part of this application, is implemented to provide a finished landform which would be in keeping with the rural character of the area, re-establish areas of native vegetation, and provide a platform for agricultural pursuits.

(d) Maintain the approved buffers to adjoining development and native species as per conditions of the modified consent.

(e) Maintain approved internal access ways.

(f) Maintain approved and existing community consultation programs which include consultation with the local community.

Section 2.6 of Part B, Section 1, Appendix B of DCP 2011 relates to flora and fauna.

Appendix 2 of the Environmental Assessment (30 June 2011 letter report from Cumberland Ecology) contains a detailed assessment of the "exclusion area" with regard to the status of flora previously identified as significant and concludes:

- The vegetation on the Site is not SSTF as listed under the Final Determination of the Threatened Species Conservation Act 1995.

- The vegetation on the Site lacks the typical geology and soils to support SSTF, and the species present on the Site are typical of sandstone vegetation rather than SSTF. In particular, the typical tree species which dominate this community are essentially absent from the Site.

- The vegetation on the Site:

  (i) Does not conform to the Final Determination for SSTF;

  (ii) Does not conform to or pass the test prescribed in Tozer et al. (2010) for SSTF;

  (iii) Does not occur on geology suitable for the development of SSTF, and

  (iv) Conforms best to non-listed sandstone dominated vegetation.

- The vegetation on the Site is Coastal Sandstone Ridgetop Woodland as described in Tozer et al. (2010).

- The zone to protect the Site on the basis that it is SSTF is flawed and unwarranted. Furthermore, the vegetation is now relatively isolated from other occurrences of native vegetation by surrounding quarrying. The long term viability of such vegetation would be difficult to maintain and the maintenance of such vegetation would not provide a substantial positive conservation outcome.

In addition to the above, a detailed assessment of the impact the proposed modification would have on the flora and fauna of the area has been undertaken by Cumberland Ecology in a report titled *Dixon Sands Maroota. Flora and Fauna Impact Assessment*, dated May 2013, a copy of which is at **Appendix 7**. This aspect of the development is discussed in more detail in **Part 3.6** of the Environmental Assessment.

3.2 Regional Planning

3.2.1 Sydney Regional Environmental Plan No.9 - Extractive Industry (No.2 - 1995)

The Site is located within the area to which Sydney Regional Environmental Plan No.9 - Extractive Industry (No.2 - 1995) (**SREP 9)** applies.

The Consent was issued having regard to SREP 9 with the conclusion that the then proposed development was consistent with the aims of SREP 9.

The proposed modification would expand the previously approved lateral extent of extraction on the Site, however, it would not result in any adverse impacts to the environment which would offend the aims of SREP 9.

Clause 7 of SREP 9 states that a person may, with consent, carry out extractive industry on land specified in Schedule 1 or 2 of SREP 9. In this regard, the consent authority:

> *... must not grant such a consent unless:*
>
> *(a) it has considered the effect of the development on flood behaviour, the water quality, quantity and hydrodynamics of any watercourse or underground waters and also the effect of flood behaviour on the development and operations associated with the development in the vicinity, and*
>
> *(b) it has considered a rehabilitation plan prepared in accordance with the Guidelines for Rehabilitation Plans in the Extractive Industry Report, and*
>
> *(c) it is satisfied that, while the development is being carried out, noise and vibration levels will generally be in accordance with the guidelines in the State Pollution Control Commission Environmental Noise Manual (1985 edition) available at the offices of the Environment Protection Authority and the councils of the areas specified in Schedule 4, and*
>
> *(d) it is satisfied that rehabilitation measures will be carried out in accordance with the guidelines in the Urban Erosion and Sediment Control Handbook (1992) prepared by the Department of Conservation and Land Management and available at the offices of the Department of Land and Water Conservation.*

The previously approved extraction of resources from the Site has been the subject of thorough environmental assessment procedures and, indeed, has been the subject of consideration by the Land and Environment Court. The general conclusion has been that the extraction activity which has been and is being undertaken on the Site has been and is being undertaken within the environmental parameters which govern environmentally responsible extractive activities.

The approved extraction on the Site is subject to a comprehensive rehabilitation and management regime which is implemented as part of the extraction of the Site. The proposed modification would be undertaken in accordance with that approved management and rehabilitation regime, albeit with modification to the final landform plan as provided for in this modification application (refer **Figures 2.3 and 2.7** and **Appendix 6**).

Detailed assessment of the approved extraction with regard to acoustic impact was undertaken as part of the original approval process which has resulted in appropriate conditions of consent which require continued monitoring of the acoustic impact of the development. The proposed modification would not alter the process of extraction which has been and is being undertaken on the Site and would be subject to the existing conditions of consent and the on going monitoring regime which operates on the Site (refer **Part 3.7** of this Environmental Assessment).

The proposed modification would extend the life of the previously approved extraction on the Site and also provide certainty with regard to the depth of extraction which could occur which is no closer than 2 metres above the wet weather groundwater level.

Clause 11 of SREP 9 states:

> ***Special requirements for extractive industry at Maroota***
>
> *(1) This clause applies to land described in Schedule 2.*
>
> *(2) The council must not grant consent to the carrying out of development for the purpose of extractive industry on land to which this clause applies unless the council is satisfied that the proposed development:*
>
> *(a) is unlikely to have a significant adverse impact on the Maroota groundwater resource or on other groundwater users in the region, and*
>
> *(b) will conserve the environmentally sensitive and significant areas and features of the Maroota locality, including the environment of threatened species, populations and ecological communities, and*
>
> *(c) will involve controlled and limited access points to main roads, and*
>
> *(d) will result in a final landform capable of supporting sustainable agricultural production or other post-extraction land uses compatible with the established character and the landscape and natural quality of the Maroota locality.*

The proposed modification seeks to extend the previously approved extraction of sand resources into both the "exclusion area" and the "area of shallow groundwater" which,

as concluded by RPS Aquaterra, would not impact the groundwater of the area. The modification does, however, seek to clarify the depth of the approved extraction to ensure that no extraction occurs within 2 metres of the regional groundwater table.

The proposed modification would increase the previously approved lateral extent of extraction and, as detailed in the Cumberland Ecology Report (refer **Part 3.6** and **Appendix 7**), no impact is expected to the flora and fauna of the area or any environmentally sensitive areas.

The proposed modification would not alter the approved access to the Site and would not involve any amendment to the approved number of truck movements to and from the Site.

An approved rehabilitation plan has been established for the Site which has as its aim to rehabilitate the Site such that it can be utilised mainly for agricultural purposes. No amendment to the approved rehabilitation process is proposed as part of this modification application other than to modify the final rehabilitated landform to that which is detailed in **Figures 2.3 and 2.7** and to re-establish a section of native vegetation on the Site.

3.2.2 Sydney Regional Environmental Plan No. 20 Hawkesbury-Nepean River (No. 2 - 1997)

Sydney Regional Environmental Plan No. 20 Hawkesbury-Nepean River (No. 2 - 1997) (**SREP 20**) applies to The Hills Shire local government area.

The aim of SREP 20 is:

> *to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.*

Clause 6 of SREP 20 identifies specific planning policies and recommended strategies for development. Those specific strategies applicable to extractive industries are reproduced below with comments.

(1) Total catchment management:

(b) Consider the impact of the development concerned on the catchment.

(c) Consider the cumulative environmental impact of development proposals on the catchment.

Comment: The impact of the extraction of resources from the Site on the hydrology and ecology of the area was considered at the time of the assessment of the original development applications. The proposed modification would

not result in additional impacts.

(2) Environmentally sensitive areas

(b) Minimise adverse impacts on water quality, aquatic habitats, riverine vegetation and bank stability.

Comment: The existing extraction incorporates approved erosion, sediment and stormwater controls to divert clean runoff away from disturbed areas, and dirty runoff into sediment basins and ponds. The proposed modification would not affect these controls.

(c) Minimise direct and indirect adverse impacts on land reserved or dedicated under the National Parks and Wildlife Act 1974 or the Forestry Act 1916 and conservation area sub-catchments in order to protect water quality and biodiversity.

Comment: The proposed modification would not have adverse impact on these areas.

(d) Protect wetlands (including upland wetlands) from future development and from the impacts of land use within their catchments.

Comment: The proposed modification would not impact the quality or amount of surface or ground water leaving the Site nor would it affect the integrity of wetland areas in the catchment.

(e) Consider the need to include buffer zones (such as adequate fire radiation zones) for proposals on land adjacent to land reserved or dedicated under the National Parks and Wildlife Act 1974 or the Forestry Act 1916.

Comment: The proposed modification would not impact on these areas.

(g) Consideration should be given to the impact of the development concerned on the water table and the formation of acid sulphate soils.

Comment: The proposed modification, with existing conditions in place requiring extraction not to proceed closer than 2 metres above the wet weather high groundwater level, would not affect the water table or potential acid sulphate soils.

(3) Water quality:

(a) Quantify, and assess the likely impact of, any predicted increase in pollutant loads on receiving waters.

Comment: The approved erosion, sediment and stormwater controls would be maintained and the proposed modification would not result in an increase in any pollutants leaving the Site.

(f) Consider the need for an Erosion and Sediment Control Plan (to be in place at the commencement of development) where the development concerned involves the disturbance of soil.

Comment: An erosion and sediment control plan has been approved for the Site. The proposed modification would not affect that approved plan.

(4) Water quantity:

(b) Ensure the amount of stormwater run-off from a site and the rate at which it leaves the site does not significantly increase as a result of development. Encourage on-site stormwater retention, infiltration and (if appropriate) reuse.

Comment: The proposed modification would not increase the amount of stormwater runoff leaving the Site.

(d) Consider the impact of development on the level and quality of the water table.

Comment: The proposed modification would allow more certainty with regard to the level of the regional groundwater table on the Site, would ensure that extraction did not occur within 2 metres of the wet weather high groundwater level, and would not result in any significant impacts to the water table.

(5) Cultural heritage:

(b) Protect Aboriginal sites and places of significance.

Comment: The proposed modification would not impact on any protected Aboriginal sites or places of significance (refer **Part 3.10**).

(c) Consider an Aboriginal site survey where predictive models or current knowledge indicate the potential for Aboriginal sites and the development concerned would involve significant site disturbance.

Comment: The archaeological assessment carried out for the original development applications (refer **Appendix 8**) did not identify any Aboriginal archaeological sites or areas of potential archaeological deposits. This conclusion is supported by a recently updated Archaeological Assessment of the Site (refer **Appendix 9**). The proposed modification would not allow disturbance of any land which has not already been disturbed as part

of the previous approvals for extraction or covered by previous archaeological surveys.

(6) Flora and fauna:

(a) Conserve and, where appropriate, enhance flora and fauna communities, particularly threatened species, populations and ecological communities, aquatic habitats, wetland flora, rare flora and fauna, riverine flora, flora with heritage value, habitats for indigenous and migratory species of fauna, and existing or potential fauna corridors.

Comment: The proposed modification seeks approval to extract that area of the Site which was previously identified as a flora "exclusion area". It is clear from the Cumberland Ecology report (refer **Part 3.6** and **Appendix 7**), that the area previously identified as in need of preservation is no longer considered to be of such significance. As such, threatened species, populations or ecological communities, or existing conservation areas on the Site would not be affected.

(c) Minimise adverse environmental impacts, protect existing habitat and, where appropriate, restore habitat values by the use of management practices.

Comment: The proposed modification would not increase any environmental impact to existing habitats. The approved rehabilitation plan, as modified as per **Figures 2.3 and 2.7** of this Environmental Assessment, would ensure that appropriate rehabilitation of the Site is undertaken as extraction ceases.

(e) Consider the range of flora and fauna inhabiting the site of the development concerned and the surrounding land, including threatened species and migratory species, and the impact of the proposal on the survival of threatened species, populations and ecological communities, both in the short and longer terms.

Comment: As discussed in detail in **Part 3.6** and **Appendix 7**, the proposed modification would not impact threatened or migratory species, populations or ecological communities of the area or impact their long term survival.

(f) Consider the need to provide and manage buffers, adequate fire radiation zones and building setbacks from significant flora and fauna habitat areas.

Comment: The proposed modification would alter existing approved buffers and setbacks as detailed in the Cumberland Ecology Report and the body of this Environmental Assessment.

3.3 State Environmental Planning Legislation

3.3.1 State Environmental Planning Policy No.55 - Remediation of Land

State Environmental Planning Policy No.55 - Remediation of Land (**SEPP 55**) aims:

> *.... to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.*

The Site was subject to assessment for contamination as part of the original development application process. As such, further assessment pursuant to SEPP 55 is not warranted.

3.3.2 State Environmental Planning Policy No.44 - Koala Habitat Protection

State Environmental Planning Policy No.44 - Koala Habitat Protection (**SEPP 44**) applies in The Hills Shire local government area.

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation which provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

An assessment pursuant to SEPP 44 has been undertaken as part of the original development application process. The proposed modification is such that no additional assessment is required pursuant to SEPP 44.

3.3.3 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (**SEPP Infrastructure**) has as its aim:

> *... to facilitate the effective delivery of infrastructure across the State by:*
>
> *(a) improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and*
>
> *(b) providing greater flexibility in the location of infrastructure and service facilities, and*
>
> *(c) allowing for the efficient development, redevelopment or disposal of surplus government owned land, and*

(d) identifying the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development), and

(e) identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development, and

(f) providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing.

The existing extractive industry on the Site has access to Old Northern Road. The assessment of the impact that access would have on the function of Old Northern Road was canvassed in the assessment of the original development application. The proposed modification would not affect the operation of the existing, approved, access to the Site.

3.3.4 Protection of the Environment Operations Act 1997

Section 43 of the Protection of the Environment Operations Act 1997 (**POEO Act**) requires an Environment Protection Licence to be obtained from the NSW Office of Environment and Heritage (**OEH**) for the carrying out of *scheduled development works* which would enable a *scheduled activity* to be carried out.

The existing extractive industry on the Site operates within Environment Protection Licence No.3916. The proposed modification would fall within the existing Environment Protection Licence and no modification would be required to that licence.

3.4 Commonwealth Legislation

The **Commonwealth Environment Protection and Biodiversity Conservation Act 1999** (**EPBC Act**) came into force from 16 July 2000. The EPBC Act requires actions which are likely to have a significant impact on matters of National Environmental Significance or which have a significant impact on Commonwealth land to be referred to the Commonwealth Minister for the Environment for approval.

The Site is not listed as a national heritage place and the proposed modification would not impact on any national heritage places.

The proposed modification would not impact on any threatened species and communities.

No National Environmental Significance matters would be impacted by the proposed modification. As such, the proposed modification has not been referred to the Commonwealth Minister for the Environment and approval pursuant to the EPBC Act

is not required.

3.5 Groundwater

The proposed modification seeks to clarify the depth of extraction on the Site such that there would be no impact to the regional groundwater table.

The proposed modification would provide certainty with regard to the depth of extraction which could occur which is no closer than 2 metres above the wet weather groundwater level.

To determine the wet weather high groundwater level on the Site, RPS Aquaterra has prepared a report titled *Groundwater Assessment for Dixon Sands Operations, Lot 1 and 2 DP 547255, Maroota NSW* (**the RPS Aquaterra Report** refer **Appendix 3**).

The key technical issues pertinent to Lots 1 and 2, DP 547255 are:

- The total depth of extraction which will be permitted on Lots 1 and 2 will be limited by the depth of the regional water table *"to a depth not exceeding 2 metres above the highest recorded wet weather groundwater level"* which, until recently has not been well defined.

- The current depth of extraction permitted on Lots 1 and 2 was based on the information obtained from shallow monitoring bores which have been monitoring localised perched aquifers and not the regional aquifer system in the Sydney Basin Central Groundwater source.

- Information obtained from a recent drilling program carried out in areas surrounding Lots 1 and 2 indicated that the regional water table is in fact between 35 metres and 60 metres below ground level.

The objectives of the RPS Aquaterra Report were to:

- Review existing hydrogeological studies with reference to the location of Lots 1 and 2, DP 547255 and the surrounding area.

- Install two deep monitoring piezometers on Lots 1 and 2, DP 547255 to refine the conceptual model of the area which was developed following previous assessments.

- Determine the lateral extent of the perched aquifer in order to ascertain the significance of the system and provide regulators with sufficient satisfactory information to make informed decisions in relation to the modification of the current consent condition on Lots 1 and 2, DP 547255.

- Determine the wet weather groundwater level beneath Lots 1 and 2, DP 547255

such that the target depth of extraction can be clearly determined.

- Identify and assess the potential impacts of the proposed modification to other groundwater users in the area.

3.5.1 Previous Studies

The RPS Aquaterra report states:

> *The hydrogeological system underlying Lots 1 and 2 has been previously assessed by ERM (2005) and more recently by E3 (2010). However, due to the limited amount of site specific groundwater data available, the regional hydrogeological system was not well understood and any potential impacts to groundwater as a result of the proposed extension would have limited site specific emphasis.*
>
> *In order to address the gaps in the site specific data four monitoring bores were established on Lots 1 and 2 by ERM in 2005, MW1, MW2, MW3 and MW4 .... and MW5 located on adjacent Lot 196. These monitoring bores were terminated at relatively shallow depths (ranging from 15.5 to 33.8m). An assessment of groundwater data recorded from the monitoring network has indicated the presence of a shallow 'perched' groundwater table of limited lateral extent, sitting above combinations of shallow confining clay sequences, shale lenses and bands of ironstone. These zones commonly permit the formation of shallow 'perched' aquifer systems well above the deeper regional groundwater level of the Hawkesbury Sandstone. These groundwater bodies generally have limited resource value due to limited extent and storage (DLWC, 2001).*
>
> *Shallow 'perched' aquifers were also identified in logs of boreholes drilled in the greater Maroota area by Farley and Lewers Ltd (1978) which also reported the presence of shallow clay lenses of limited lateral extent.*
>
> *An assessment carried out by E3 (2010) concluded that perched groundwater was only present during and shortly after wet periods and that observations from monitoring bores (MW1 to MW4) indicated that the water tables monitored on Lots 1 and 2 were not representative of the depth of water-bearing strata or saturated depth of the regional aquifer system.*
>
> *For this reason the 'wet-weather' regional groundwater level of the area could not be established from observations recorded from the existing monitoring bore network. In November 2010, Aquaterra Pty Ltd (now RPS Aquaterra) was commissioned to refine the conceptual hydrogeological model of the area, and determine with greater accuracy the depth of the regional groundwater system. This assessment included a review of information obtained from existing licensed bores and the drilling of 3 deep groundwater monitoring bores on nearby allotments .... BH1 was installed on the western boundary of Lot 196 DP752025,*

and BH2 and BH3 were drilled to the east, on Lot 196 DP204159. All three monitoring bores were drilled along an east to west transect, and were completed within the Hawkesbury Sandstone aquifer. The depth of the regional groundwater level was reported to range from 35m in the east to about 60m in the west.

The study also confirmed that the site (and the surrounding area) is underlain by a shallow, narrow, non water bearing, and unconsolidated horizon of weathered clays, sandstones and shales that are likely to be part of the Eluvial Sand unit that grades rapidly to the massive sandstones of the Hawkesbury Sandstone. The weathered clays and shale bands permit the intermittent formation of shallow 'perched' water tables, which are of limited extent and act as temporary storage of groundwater prior to release, by either seepage at topographic lows or by leakage to the deeper underlying aquifers.

3.5.2 Hydrogeology

The geological formations present in the Maroota area have variable hydrogeological characteristics. The high degree of lithological variability (i.e. sands, clays, ironstone, shale and sandstone) and permeability contrasts often result in the establishment of localised perched water tables in both the Maroota Sand and in the Hawkesbury Sandstone and, possibly within the latter, at the base of the weathered profile above fresher sandstone beneath.

Under these conditions, two separate aquifers in the vicinity of the Site can be identified, although the extent of their hydraulic separation or, conversely, interconnection, is sometimes uncertain.

These aquifer units are the:

- the Maroota Sands, gazetted as *"The Maroota Tertiary Sands Groundwater Source"*, and
- The fresh Hawkesbury Sandstone, gazetted as *"The Sydney Basin Central Groundwater Source"*.

3.5.2.1 The Maroota Tertiary Sands Groundwater Source

The Maroota Tertiary Groundwater Source is a sandy formation of limited areal extent which has been mapped adjacent to Lots 1 and 2. While there is some evidence of a thin horizon of sands to the east of Lots 1 and 2, the actual groundwater source itself does not underlie Lots 1 and 2 as identified in the Water Sharing Plan for the Greater Metropolitan Region Groundwater Source 2011 report.

To the east of Lots 1 and 2, the thin unsaturated sands (approximately 0.9 metres thick),

represent the feather edge or pinched out part of the Maroota sands matrix and do not represent the saturated Maroota Tertiary Groundwater Source. An independent report to investigate the extent of the Maroota Sand in the vicinity of the Site was commissioned by VGT Pty Ltd in August 2012. This report is attached as Appendix C to the RPS Aquaterra Report. The VGT Pty Ltd report concluded that the Water Sharing Plan for the Greater Metropolitan Region Groundwater Source 2011 (**WSP**) report incorrectly identifies that Lots 1 and 2 are underlain by the Maroota Tertiary Groundwater Source. This conclusion is confirmed by site specific and regional drilling data in the area as shown on Figure 2 of the RPS Aquaterra Report, an extract from which is at **Figure 3.2**.

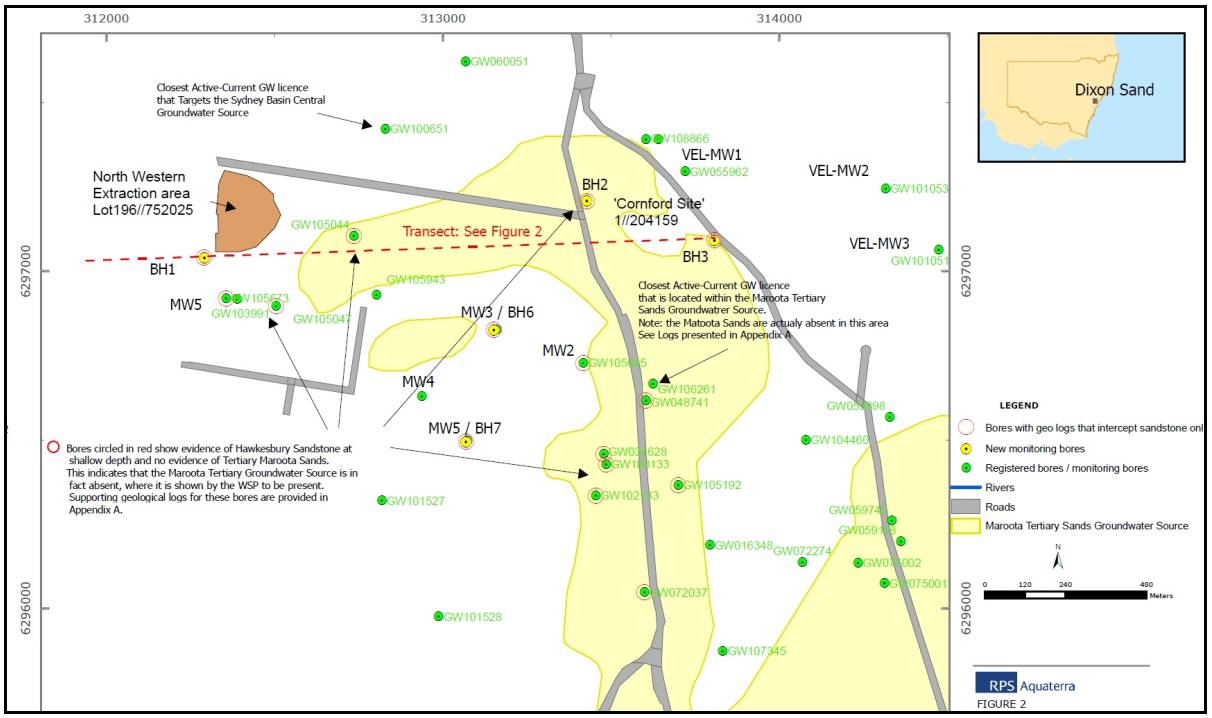

Figure 3.2: Figure 2 of the RPS Aquaterra Report showing the location of bores in the Maroota area.

The correct hydrogeology underlying Lots 1 and 2 consists primarily of unsaturated Hawkesbury Sandstone, with some small thin deposits of sand to the east.

Regionally, the Maroota Tertiary Groundwater Source was deposited mainly in two palaeochannels located to the east of Lots 1 and 2 which have been eroded into the exposed surface of the Hawkesbury Sandstone.

Away from the palaeochannels, the presence of considerable clay and cemented layers gives rise to localised perched water tables. From a resource viewpoint, the perched water table aquifers have limited value due to their small extent and limited storage. These water bodies are found at variable elevations and depend upon rainfall infiltration for their persistence. The Maroota Sand, where it occurs below the water table such as in the deeper sections of the palaeochannels, constitutes a substantially unconfined water table aquifer open to direct rainfall infiltration.

3.5.2.2 Weathered Profile of the Underlying Hawkesbury Sandstone

Small aquifer zones have developed in the eluvial sand, which comprises the leached and weathered profile of the Hawkesbury Sandstone. These zones often form perched aquifer systems above the deeper regional water level of the Hawkesbury Sandstone. In the majority of cases, these perched aquifer systems have limited resource value because, like the Maroota Sand, they have small extent and storage. They act as temporary storage of groundwater prior to release to streams or leakage to underlying aquifers. Dams and large diameter wells constructed into this material can provide a source of farm water supplies, but generally the permeability is too low to yield significant supplies to small diameter boreholes.

3.5.2.3 Hawkesbury Sandstone

The Hawkesbury Sandstone is generally an impermeable rock, due to the fine grained clayey matrix (generally 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.

A review (by RPS Aquaterra) of the bore records held by the NSW Office of Water, for the Maroota area (including observation bores established during the Stage 2 Maroota Groundwater Study), showed that different 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. Three nested bores (GW075000/1,2,3) located approximately 2.6km to the south of Lots 1 and 2 are approximately 22 metres, 43.5 metres and 110 metres deep, with corresponding groundwater levels of 14.4 metres (Maroota Sand), 27.7 metres (Hawkesbury Sandstone) and 29 metres (Hawkesbury Sandstone) below ground level respectively. The water level at 14.4 metres is interpreted to be a localised perched aquifer, while the two deeper levels at 27.7 metres and 29.0 metres are considered to represent the regional groundwater aquifer system. The slightly lower level for the deep bore indicates a downward head gradient and is indicative of the variable and layered nature of the aquifer system.

Most of the bores in the area are in elevated locations along the Maroota Ridge which represents a surface drainage divide and a likely groundwater divide.

Groundwater gradients measured in recent investigations in closely spaced bores are variable and steep in places due to the low permeability of the rock mass. Groundwater flow directions are expected to be generally to the northwest, east and south, away from the main axis of the groundwater divides, which coincide with the main topographic divides.

3.5.3 Site Investigations

Three deep monitoring bores (BH1, BH2 and BH3) were originally drilled along an east to west transect and completed within the Hawkesbury Sandstone Aquifer. BH1 was located on the western boundary of the north western extraction area (Lot 196, DP 752025) and BH2 and BH3 were located on Lot 1, DP204159.

Two additional groundwater monitoring bores (BH6 and BH7) were installed following a subsequent drilling program in the vicinity of Lots 1 and 2, DP547255. Both monitoring bores were drilled to 60 metres in an attempt to establish the wet weather groundwater level of the regional aquifer underlying Lots 1 and 2.

BH6 was drilled along the northern boundary of Lot 1, and BH7 was drilled along the southern boundary of Lot 2, with both being completed within the Hawkesbury Sandstone. Both monitoring bores were drilled in close proximity to existing shallow monitoring bores (MW1 and MW3). This was done to demonstrate the degree of separation between the perched localised system and the deeper region aquifer identified in previous drilling. The location of the bores is shown on **Figure 3.2**.

3.5.4 Hydrogeological Assessment

3.5.4.1 Maroota Tertiary Sands Groundwater Source

Evidence based on the bore logs and the monitoring wells located on Lots 1 and 2 shows that the Maroota Tertiary Sands Groundwater Source does not underlie these areas. Information from the logs indicate that Lot 1 and Lot 2 and the remainder of the Dixon Sand extraction area is underlain by a shallow and narrow non water bearing and unconsolidated horizon of weathered clays, sandstones and shales, which are likely to be part of the Eluvial Sand unit which grades rapidly to massive sandstones of the Hawkesbury Sandstone.

Geological logs obtained from a large number of boreholes which have been drilled further to the east and south east of Lots 1 and 2 do not show any evidence of the Maroota Tertiary Sands Groundwater Source where it is indicated in the WSP, suggesting that the extent of this source is incorrect and the boundary is probably much further south than the WSP indicates.

Furthermore, the independent report investigating the lateral extent of the Maroota Tertiary Sands Groundwater Source prepared by VGT Pty Ltd also concludes that Lots 1 and 2 are not underlain by the groundwater source. The VGT Pty Ltd report identifies a small area to the east of Lots 1 and 2 where a shallow (0.9 metre deep) unsaturated sand unit is present at ground surface. This horizon may represent the thin "feather edge" of the Maroota Tertiary Sands where it pinches out between the underlying sandstone and

the ground surface.

3.5.4.2 Sydney Basin Central Groundwater Source

Shallow perched water tables have been found to exist above semi confining layers such as clay lenses, shale or ironstone bands throughout the area. These shallow groundwater lenses are commonly referred to as "perched" aquifers and are defined as an aquifer which forms in the otherwise generally unsaturated zone above the regional aquifer in the saturated zone. The use of the term "perched" aquifer in this case can be misleading as it suggests that the perched aquifer could be of significant importance hydrogeologically and from a potential resource perspective. The perched groundwater identified in this area is reported to have limited resource value because of its isolated nature, limited extent and low storage capacity.

MW1, MW2 and MW3 located on Lots 1 and 2 revealed perched water tables at approximately 6 metres to 19 metres below ground level (177 metres AHD). Perched groundwater was also found to exist above thin clay bands at depths of 14 metres to 18 metres during the drilling of BH6 and BH7. It was reported by Aquaterra in 2010 that the groundwater levels in MW1 and MW4 did not respond greatly to significant rainfall (i.e. 53mm events). This suggests that the perched aquifers are not extensive and act as temporary storage of groundwater followed by rapid release to the deeper underlying aquifers.

3.5.5 Potential Impacts

3.5.5.1 Maroota Tertiary Sands Groundwater Source

Groundwater Dependent Ecosystems

Lots 1 and 2 are not underlain by, and do not intersect with the Maroota Tertiary Sands Groundwater Source, therefore, any Groundwater Dependent Ecosystem (**GDE**) present in the area which is fed with discharge from this groundwater source will not be impacted by the proposed modification.

The thin sands (approx. 0.9 metre deep) present at the eastern edge of Lots 1 and 2 are unsaturated and, therefore, do not contribute groundwater to any GDEs in the area. Similarly, the removal of this thin horizon of unsaturated sand will not have any impact on any GDEs in the area.

Local groundwater users

As Lots 1 and 2 are not underlain by Maroota Tertiary Sands Groundwater Source, there

will be no impacts to any users abstracting groundwater from this source in the region.

A review of the database has indicated that there are nine registered groundwater abstraction bores within approximately 1 km of Lots 1 and 2. All of the bores listed were terminated at depths well below the extent of the low permeability layers observed in the site investigation drilling and from the borehole log review, therefore, none of these production bores would significantly rely on or abstract from groundwater stored above these layers and would, therefore, not be significantly impacted by an extension of the extraction activity.

3.5.5.2 Sydney Basin Central Groundwater Source

The total or partial removal of the shallow horizons which contain some perched groundwater zones is unlikely to have any measurable impacts to the local or regional hydrogeological regime, other than potentially increasing the rate of local rainfall recharge (due to the partial removal of low permeability layers) to the regional aquifer system. The shallow groundwater system will recharge the deeper aquifer via gradual drainage, however, this level of recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury Sandstone. These mechanisms would include mass infiltration via complex networks of structurally controlled fracturing (secondary porosity) at a more regional level throughout the sandstone unit.

Groundwater Dependent Ecosystems

The proposed modification comprises the extension of pits into the unsaturated zone overlying the Sydney Basin Central Groundwater Source. No impact to any wetlands or GDEs in the area is expected to occur and, therefore, will not intersect the flow path or hydraulic gradient of the aquifer. No impact on discharge to any local wetland can therefore occur.

Local Groundwater Users

The impact of the extended quarrying is expected to have minimal impact to existing users in the immediate vicinity.

3.5.6 Compliance with the Water Sharing Plan Rules

The Sydney Basin Central Groundwater Source is the only gazetted groundwater source underlying Lots 1 and 2. The depth of the development will not extend to the depth of the groundwater level in this aquifer and no impacts are expected, however, for clarity, all of the rules and requirements of the Water Sharing Plan for Sydney Basin Central Groundwater source are presented in Table 7.1 of the RPS Aquaterra Report along with reasons why none of the rules are being impacted.

An independent geological investigation by VGT Pty Ltd and site specific drilling data have shown that the Tertiary Sands Groundwater Source is absent from Lots 1 and 2, however, for completeness, and because it is the next nearest gazetted groundwater source, reasons why the development does not impact on the rules for this aquifer are presented in Table 7.2 of the RPS Aquaterra Report.

3.5.7 Conclusion

The RPS Aquaterra investigations conclude:

- Lot 1, Lot 2 and the remainder of the Dixon Sand extraction operation is underlain by unsaturated Hawkesbury Sandstone which contains some shallow perched groundwater lenses of limited extent. These temporary perched storages have no significant resource value as they are discontinuous and of limited extent and low storage. They, therefore, do not contribute to the regional hydrogeological regime.

- The only gazetted aquifer underlying the development area is the Sydney Basin Central Groundwater Source which will not be intersected by the modified development of Lots 1 and 2.

- The maximum wet weather regional groundwater table level in this aquifer is estimated to be about 171 metres AHD in the east and 151 metres AHD in the west, therefore, sand extraction of Lots 1 and 2 could extend to a depth of 173 metres AHD in the east grading to 153 metres AHD in the west.

- As the extraction of Lots 1 and 2 will extend to a maximum depth of 2 metres above the highest wet weather groundwater level in the Sydney Basin Central Groundwater source, no interception of this aquifer will occur.

- An independent report commissioned by VGT Pty Ltd concludes that Lots 1 and 2 are not underlain by the Maroota Tertiary Sands Groundwater Source ..... This fact is confirmed by drilling data in the vicinity of Lots 1 and 2 ....

- The proposed modification is considered to be in accordance with the provisions of the Water Sharing Plan for the Metropolitan Region Groundwater Source. Rationale for this is presented in the rules summary sheet in Tables 7.1 and 7.2 (of the RPS Aquaterra Report).

- There are no wetlands or GDEs present in the area which could be impacted, as neither groundwater source will be intercepted by the extraction of Lots 1 and 2 which remains in unsaturated geology. Therefore, no discharges to or from GDEs would be affected.

- The total or partial removal of the shallow perched groundwater zones is unlikely to have any major impacts to the local hydrogeological regime, or to the regional aquifer system, other than potentially locally increasing the rate of rainfall

recharge to the regional water table in the vicinity of the extraction, however, this potential increase in recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury Sandstone.

- There are nine registered groundwater abstraction bores within approximately 1 km of Lots 1 and 2. None of these production bores abstract groundwater from the perched groundwater lenses located in the area, and, therefore, would not be impacted by deepening of the quarry on Lots 1 and 2.

A statement of commitments relating to groundwater is provided in **Part 4.3** of this Environmental Assessment.

3.6 Flora and Fauna

3.6.1 Literature review

A review of ecological literature relevant to the proposed modification area was undertaken as part of the Cumberland Ecology flora and fauna assessment (refer **Appendix 7**) to determine the ecological values associated with the proposed modification area. Key documents reviewed include:

- Cumberland Ecology (2011). Letter - *Advice regarding the presence of Shale Sandstone Transition Forest in the extraction exclusion area at Dixon Sand Quarry, Part Lots 1 & 2, DP 547255, Old Northern Road, Maroota* (refer **Appendix 2**).

- Hawkeswood, T. J. (2010). *Flora and Fauna Survey and Assessment of parts of Lots 1 & 2, DP 547255, 4610 Wisemans Ferry Road, Maroota, New South Wales.* T.J. Hawkeswood Scientific Consulting, Richmond, NSW; and

- Fanning et al. (1998). *Proposed Sand Extraction. Old Northern Road, Maroota. Flora and Fauna Constraints. Draft report.* Gunninah Environmental Consultants, Crows Nest, NSW.

The information collected during the literature review guided the field surveys undertaken for the flora and fauna assessment. Information within the literature reviewed was also utilised in determining the likelihood of threatened species occurring within the proposed modification area and assessing the potential impacts of the proposed modification.

3.6.2 Database Analysis

Database analysis was conducted for the locality using the Office of Environment and

Heritage Atlas of NSW Wildlife Database and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities EPBC Protected Matters Search Tool. The Atlas of NSW Wildlife Database search facility was used to generate records of threatened flora and fauna species and populations listed under the TSC Act within the locality of the proposed modification area.

The Protected Matters Search Tool generated a list of potentially occurring Matters of National Environmental Significance listed under the EPBC Act within the locality of the proposed modification area. The lists generated from these databases were used to assist in designing surveys for threatened species considered likely to occur within the proposed modification area. The abundance, distribution and age of records generated within the search area also provided supplementary information for the assessment of likelihood of occurrence of those threatened species within the proposed modification area.

3.6.3 Flora Survey

Cumberland Ecology conducted flora surveys within the proposed modification area on 20 February 2013 and 26 February 2013. These flora surveys included vegetation mapping, quadrat sampling and threatened species searches, which are described in detail as follows.

Vegetation Mapping

Several vegetation mapping studies have been undertaken across the proposed modification area and surrounds, including broad scale mapping of The Hills Shire Local Government Area. The vegetation within the proposed modification area was ground-truthed to examine and verify the extent and condition of different vegetation communities. Records were made of proposed boundaries using a hand-held Global Positioning System (**GPS**) and mark-up of aerial photographs.

The resultant information was synthesised using Geographical Information Systems (**GIS**) to create a spatial database which was used to interpret and interpolate the data to produce a vegetation map of the proposed modification area.

Vegetation Sampling

Vegetation sampling conducted within the proposed modification area included:

- Quadrat sampling (20m x 20m) to obtain information on species composition and community structure, and
- Random meander surveys to detect additional flora species not recorded during quadrat sampling.

A total of four quadrats were sampled during the flora survey period. The locations of flora quadrats were recorded using a GPS and are shown in Figure 2.1 of the Cumberland

Ecology report at **Appendix 7** which is reproduced below as **Figure 3.3**.

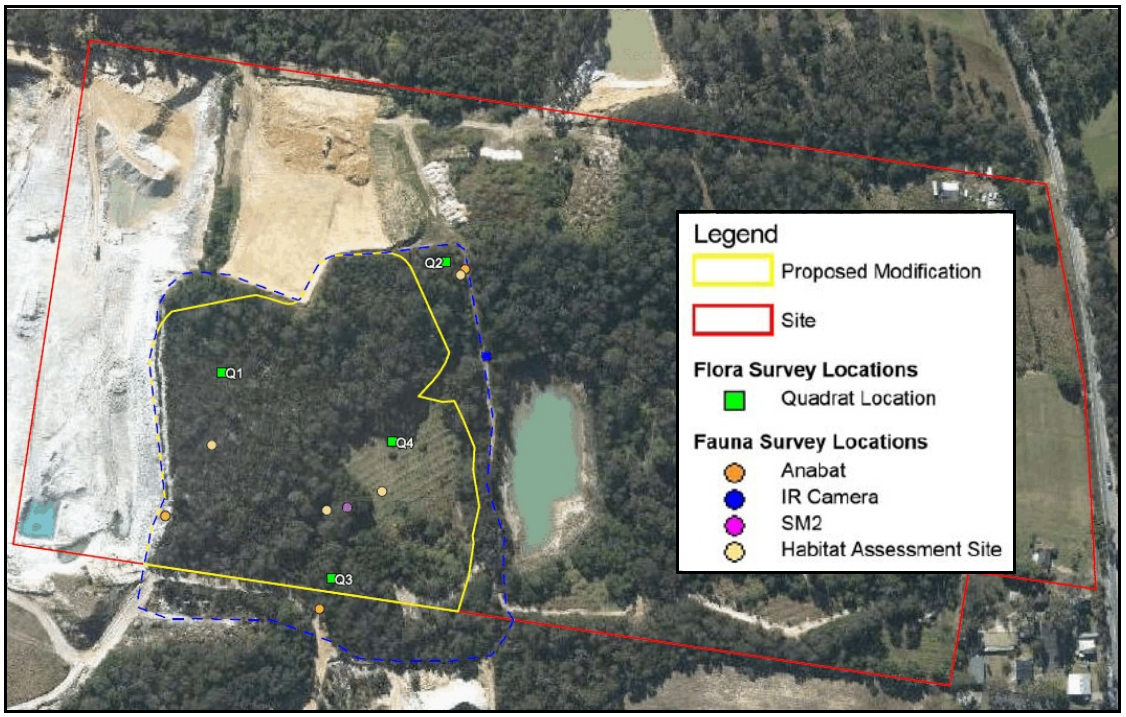

Figure 3.3: Flora and Fauna Survey Locations

The locations of these quadrats were stratified so that sampling was conducted in all of the major vegetation types discernable across the proposed modification area. The process of quadrat sampling included the following:

- Identifying and recording all vascular flora species present in each strata within the plot or directly adjacent to the plot;
- Assigning a cover-abundance value to each species recorded within the plot, using a modified Braun-Blanquet scoring system (Braun-Blanquet 1927), to reflect their relative cover and abundance in the plot;
- Recording details about vegetation structure such as percentage foliage cover and height of each strata, and
- Taking photographs of the quadrat to provide a record of vegetation condition and appearance.

Random meanders were undertaken throughout the proposed modification area in conjunction with vegetation mapping surveys in order to maximise the census of vascular plant species. Additional species not recorded during quadrat sampling were noted during the random meanders to assist in the compilation of a species list for the proposed modification area.

All vascular plants recorded or collected were identified using keys and nomenclature

provided in Harden (Harden 1990-1993). Recent name changes to plant names have been incorporated, and the names are derived from PlantNET (Botanic Gardens Trust 2013). Specimens which required further investigation were sampled in the field, given a voucher number, pressed and then lodged for identification with the National Herbarium of NSW at the Royal Botanic Gardens, Sydney.

Threatened Species Searches

Threatened flora surveys were undertaken across the proposed modification area. These surveys were initially undertaken as part of the vegetation mapping ground-truthing and quadrat surveys. Targeted searches were also conducted within suitable habitat for several potentially occurring species including *Melaleuca deanei, Darwinia fascicularis* subsp. *oligantha* and *Tetratheca glandulosa*. Patches of observed threatened flora species were traversed and the boundaries of each patch were recorded using a GPS. Following delineation of each patch, an estimate was made of the number of individuals present.

3.6.4 Fauna Survey

Cumberland Ecology conducted fauna surveys across the proposed modification area from 25 February 2013 to 1 March 2013. These fauna surveys were conducted, where appropriate, in accordance with the survey guidelines provided in the OEH Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW) 2004). The fauna surveys included a general fauna habitat assessment, ultrasonic bat call detection, infrared camera survey and incidental observations. All survey methods utilised within the ecological assessment are described in detail as follows. The location of all fauna survey sites are shown in Figure 2.1 of the Cumberland Ecology Report at **Appendix 7**, and extract from which is reproduced as **Figure 3.3**.

General Habitat Assessment

Key areas of investigation were delineated on an aerial photograph and targeted for general habitat assessments. The general habitat assessment included a traverse of the modification area and the recording of notes on habitat. Notes were taken on the presence of suitable nesting, roosting and foraging habitat features suitable for threatened species known from the locality. Features noted include hollow-bearing trees, termite mounds, bush rock and soaks. The general habitat assessment provided assistance in the determination of targeted fauna survey types and locations.

Microchiropteran Bat Survey

Surveys for microchiropteran bats were undertaken using "Anabat" units to record ultrasonic bat calls. A total of three locations were surveyed for four nights.

Anabat units were positioned in suitable habitat, such as along tracks and near edges of vegetation. Anabat units were set to activate before dusk each evening and switch off

after dawn.

Ultrasonic calls collected from the Anabat units were subsequently identified.

Scientific naming of microchiropteran bats within this assessment follows Churchill (2008).

Infrared Camera Survey

One infrared camera was deployed for four nights targeting medium to large mammals along an existing track. Images recorded during this period were then reviewed to determine which fauna species were present.

Incidental fauna observations

Any incidental vertebrate fauna species which was observed, heard calling or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list.

3.6.5 Vegetation Communities

The proposed modification area supports a vegetation cover of heath, woodland and grassland communities which reflects topography, geology, drainage and disturbance history.

The Hills Shire Council has mapped the vegetation communities in the proposed modification area as Map Unit 11 - Shale/Sandstone Transition Forest (High Sandstone Influence) and Map Unit 21 - New Unclassified 2005 (Baulkham Hills Shire Council 2008).

Cumberland Ecology has subsequently identified the following communities within the proposed modification area, which have been mapped by the dominant species present:

- *Banksia ericifolia - Leptospermum trinervium* Heath;
- *Angophora costata - Corymbia gummifera* Woodland;
- *Eucalyptus punctata - Acacia parramattensis* Woodland, and
- *Cynodon dactylon - Axonopus fissifolius* Exotic Grassland.

The distribution of these communities within the proposed modification area is shown in Figure 3.1 of the Cumberland Ecology Report at **Appendix 7** an extract from which is reproduced below as **Figure 3.4**. The area occupied by each of the communities is shown in **Table 3.1**.

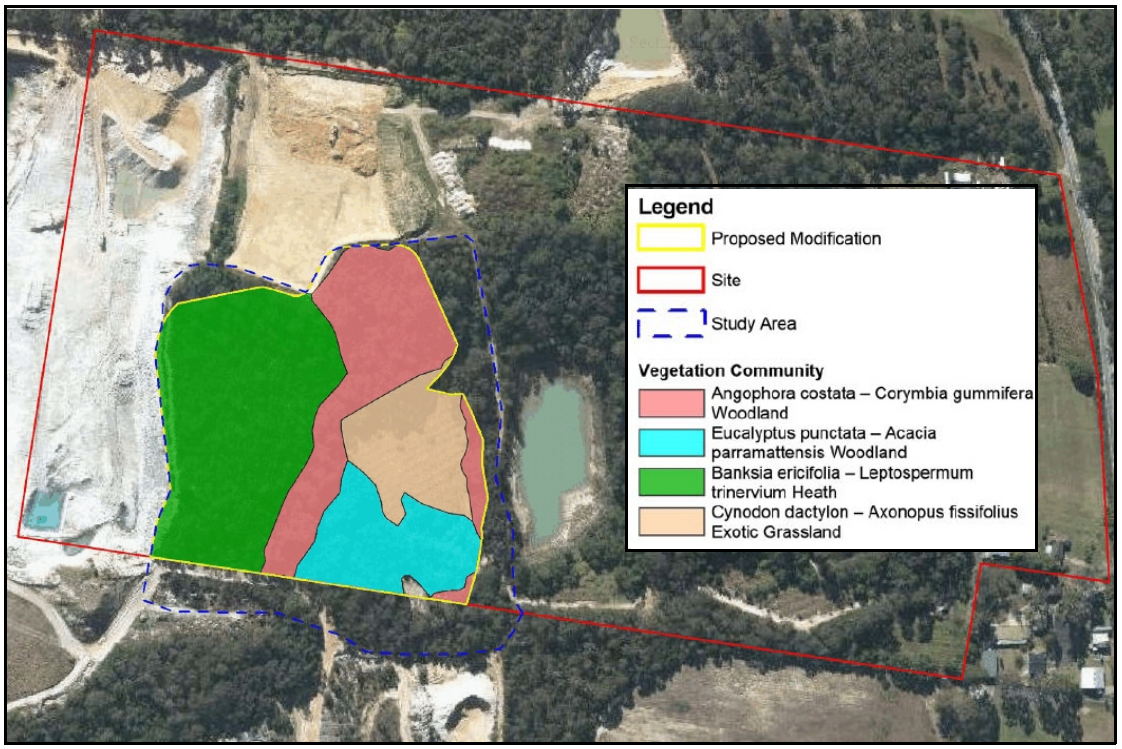

Figure 3.4: Vegetation Communities

Table 3.1: Area of each vegetation community recorded within the proposed modification area.

VEGETATION COMMUNITY	AREA (HA)
Banksia ericifolia - Leptospermum trinervium Heath	1.86
Angophora costata - Corymbia gummifera Woodland	1.15
Eucalyptus punctata - Acacia parramattensis Woodland	0.67
Cynodon dactylon - Axonopus fissifolius Exotic Grassland	0.62
Cleared land	0.05
Total	**4.35**

Shale/Sandstone Transition Forest EEC is known from the locality and has been mapped within the proposed modification area by Fanning et al. (1998) and The Hills Shire Council (2008). Recent detailed investigations by Hawkeswood (2010) and Cumberland Ecology (2011) have determined that Shale/Sandstone Transition Forest EEC is not present within the proposed modification area. Cumberland Ecology (2011) determined that the vegetation within the proposed modification area does not conform to Shale/Sandstone Transition Forest EEC for the following reasons:

- Does not conform to the Final Determination for Shale/Sandstone Transition Forest;

- Does not conform to or pass the test prescribed in Tozer et al. (2010) (REF) for

Shale/Sandstone Transition Forest;

- Does not occur on geology suitable for the development of Shale/Sandstone Transition Forest, and

- Conforms best to non-listed sandstone dominated vegetation.

As such, Shale/Sandstone Transition Forest is not considered to occur within the proposed modification area.

3.6.6 Flora

General Species

Over 150 flora species have been recorded during surveys undertaken. The dominant plant families encountered have consistently been represented by the Myrtaceae, Fabaceae, Poaceae and Proteaceae families. The floral assemblage across the proposed modification area is largely typical of dry sclerophyll sandstone vegetation.

Approximately 15% of the flora species recorded are exotic species. These occurred predominately within the area previously used as an orchard, along tracks and adjacent to cleared areas. A total species list is provided in Appendix B of the Cumberland Ecology Report at **Appendix 7**.

Threatened Species

A number of threatened flora species are known to occur in the locality of the Site. Comprehensive vegetation surveys have been conducted within the proposed modification area over a number of years and during different seasons. It is, therefore, likely that sufficient survey effort has been conducted to detect any threatened flora species which may be present within the proposed modification area. The likelihood of occurrence of threatened flora species within the proposed modification area is outlined in Appendix C of the Cumberland Ecology Report at **Appendix 7**.

The following threatened species have been recorded within the proposed modification area:

- *Melaleuca deanei* (Deane's Melaleuca) - Vulnerable under the EPBC Act and TSC Act, and

- *Tetratheca glandulosa* - Vulnerable under the EPBC Act and TSC Act.

The location of threatened species detected during the most recent surveys is shown in Figure 3.2 of the Cumberland Ecology Report at **Appendix 7**, an extract from which is provided below as **Figure 3.5**.

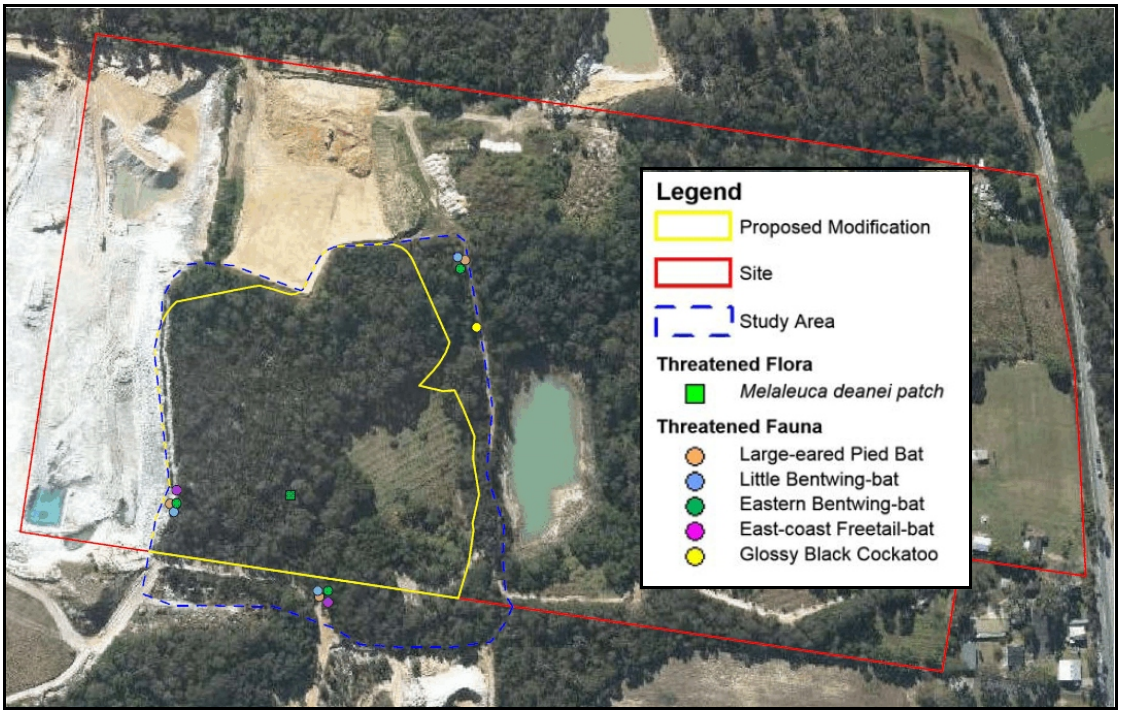

Figure 3.5: Location of Threatened Species

A discussion of the species and their occurrence within the proposed modification area is provided below.

i. Melaleuca deanei

Melaleuca deanei (Deane's Melaleuca) is listed as Vulnerable under both the TSC Act and EPBC Act.

This species is a shrub to 3 metres high.

Melaleuca deanei is distributed from St. Albans in the north, to Nowra in the south and west to Faulconbridge. Within its extent, *Melaleuca deanei* is known from broad flat ridgetops, dry ridges and slopes and is strongly associated with sandy loam soils which are low in nutrients and sometimes containing ironstone.

As *Melaleuca deanei* is a clonal species, it has the ability to re-sprout from a swollen rootstock to produce coppiced growth and can also sucker from its rootstock.

This species was recorded at one location within the proposed modification area within *Angophora costata - Corymbia gummifera* Woodland. Due to the suckering nature of this species, obtaining counts of plants was difficult, so clumps of stems considered to represent one individual were recorded. A total of 18 clumps were recorded within the proposed modification area.

The Atlas of NSW Wildlife holds 1 record of *Melaleuca deanei* within the locality. *Melaleuca deanei* is conserved in the locality within Marramarra National Park and

Dharug National Park.

ii. Tetratheca glandulosa

Tetratheca glandulosa is listed as Vulnerable under both the TSC Act and EPBC Act. This species is a small spreading shrub to 20-50 cm high.

Tetratheca glandulosa is distributed from Sampons Pass (Yengo National Park) in the north to West Pymble (Lane Cover National Park) in the south and Ingleside (Pittwater LGA) in the east and East Kurrajong (Wollemi National Park) in the west.

It is associated with shale-sandstone transition habitat where shale-cappings occur over sandstone and it typically occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches.

This species was not recorded during current surveys, however, approximately 40 to 50 plants were recorded by Gunninah Environmental Consultants (Fanning et al. 1998) and 5 plants were recorded by Hawkeswood (2010).

The Atlas of NSW Wildlife holds 130 records of *Tetratheca glandulosa* within the locality. *Tetratheca glandulosa* is conserved in the locality within Marramarra National Park and Dharug National Park. Populations south of the Hawkesbury are considered to be adequately conserved in Berowra Valley National Park, Marramarra National Park and Kuring-gai Chase National Park.

3.6.7 Fauna

Fauna Habitat

The woodland, heath and grassland communities present within the proposed modification area provide a range of fauna habitats. Habitat features within these vegetation communities provide potential foraging, shelter and breeding opportunities for fauna. No permanent or ephemeral drainage lines (breeding habitat for amphibians) were recorded within the proposed modification area. Key habitat features recorded within the proposed modification area include:

- Fallen logs, debris and leaf litter - shelter habitat for amphibians, reptiles and terrestrial mammals;
- Hollow-bearing trees and stags - providing shelter and breeding habitat for a range of reptiles, birds, arboreal mammals and microchiropteran bats (microbats);
- Sandstone rock outcrops - shelter and breeding habitat for amphibians, reptiles and terrestrial mammals, and
- Nectar-producing trees and shrubs - foraging habitat for insects, blossom

dependant birds, arboreal mammals and megachiropteran bats (flying-foxes).

These key habitat features provide habitat for a range of fauna, including some species which are listed as threatened under the EPBC Act and/or the TSC Act.

i. Fallen logs, debris and leaf litter

Features such as fallen logs, debris and leaf litter has the potential to provide shelter for many of the common small to medium sized terrestrial fauna species known from the locality. These features are most abundant within the woodland communities, where structural complexity is highest, however, these features are limited within the proposed modification area due to the small area of woodland present.

ii. Hollow-bearing trees and stags

The mature living trees and stags within the proposed modification area provide a limited number of small to medium-sized hollows for fauna species dependant on this resource, such as microchiropteran bats. The woodland communities provide the greatest abundance and diversity of hollows within the proposed modification area, although only a small number of hollows were observed. The proposed modification area does not support suitable large hollows in tall mature trees which would provide roosting or nesting habitat for large gliders, large forest owls or Glossy Black-cockatoo (Calyptorhynchus lathami).

iii. Sandstone rock outcrops

Rocky outcrops are limited within the proposed modification area to small areas of exposed sandstone within heath. There are only small cracks, crevices and rocks present which provide shelter for small reptiles. There are no caves, large crevices or substantial areas of exfoliating rock which would provide suitable shelter and/or breeding habitat for microbats and threatened terrestrial mammals.

iv. Nectar-producing trees and shrubs

The vegetation within woodland and heath of the proposed modification area would provide suitable foraging habitat for a range of nectivorous birds, bats and arboreal mammals during blossom periods. It is expected that a number of nectar-dependant species would be attracted to the proposed modification area during the blossom periods of dominant trees and shrubs.

General Fauna Species

Over 40 vertebrate fauna species have been recorded within or immediately adjacent to the proposed modification area during the current surveys, with the majority of species being native. A total list of fauna species recorded during the current surveys is provided in Appendix D of the Cumberland Ecology Report at **Appendix 7**.

i. Amphibians

The proposed modification area does not support permanent or ephemeral water which would provide suitable breeding habitat for amphibians. There are currently small dams adjacent to the proposed modification area which provide breeding habitat for a range of common amphibians.

Five common frog species were recorded during the current surveys.

ii. Reptiles

A range of habitat features suitable for common reptiles occurs throughout the proposed modification area. A total of three reptile species were recorded within the study area, although additional common species are predicted to occur.

iii. Birds

The vegetation communities within the proposed modification area support a number of common bird species. Over 20 bird species were recorded during the current surveys, and the results of habitat assessment and previous surveys indicate that a number of additional common birds are likely to occur. A variety of small to medium sized birds including finches, honeyeaters and lorikeets utilise the nesting and foraging habitat with the heath, woodland and grassland vegetation. No threatened birds were observed within the study area during the current surveys. Chewed cones of *Allocasuarina littoralis* indicate the presence of foraging Glossy Black-cockatoo within the proposed modification area.

iv. Mammals

The proposed modification area supports a limited range of terrestrial or arboreal mammal species, with only three species being recorded during the current surveys. One of these, the European Rabbit (*Oryctogalus cuniculus*), is an introduced species. Previous surveys indicate that several additional common terrestrial and arboreal mammals are likely to occur within the proposed modification area.

The study area supports a diversity of microchiropteran bats (microbats), with ten species being positively identified from ultrasonic calls. Calls which could not be identified to species indicate that a small number of additional microbats occupy the study area. A number of microbats recorded are listed as Vulnerable under the EPBC Act and/or the TSC Act.

Threatened Fauna Species

The current condition of habitat within the proposed modification area is a significant determining factor in the likelihood of occurrence of many of the threatened fauna species known to occur in the locality. The proposed modification area has been historically disturbed and remains relatively isolated from larger, more intact habitats in the wider locality as a result of surrounding clearing and quarrying. Habitat values of the proposed modification area are, therefore, limited to more mobile species such as birds and bats.

Other threatened fauna, particularly smaller terrestrial or arboreal species, are less likely to occur within the proposed modification area as these species are less able to re-colonise isolated habitats. The likelihood of occurrence of threatened fauna known to occur in the locality of the proposed modification area is outlined in Appendix E of the Cumberland Ecology Report at **Appendix 7**.

The following threatened species have been recorded within the study area:

- Glossy Black-cockatoo (*Calyptorhynchus lathami*) - Vulnerable under the TSC Act;
- Large-eared Pied Bat (*Chalinolobus dwyeri*) - Vulnerable under the EPBC Act and the TSC Act;
- East-coast Freetail-bat (*Mormopterus norfolkensis*) - Vulnerable under the TSC Act;
- Little Bentwing-bat (*Miniopterus australis*) - Vulnerable under the TSC Act, and
- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) - Vulnerable under the TSC Act.

The locations these species are shown in **Figure 3.5**. A discussion of these species and their occurrence within the study area is provided below.

i. Glossy Black-cockatoo

The Glossy Black-cockatoo is listed as Vulnerable under the TSC Act. It is a dusky brown to black cockatoo, about 50cm in length with a massive bill. The Glossy Black-cockatoo is distributed from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. Within its extent, it inhabits open forest and woodlands in which stands of she-oak species occur, particularly *Allocasuarina littoralis* (Black She-oak), *Allocasuarina torulosa* (Forest Oak) and *Allocasuarina verticillata* (Drooping She-oak).

The Glossy Black-cockatoo also requires large hollow-bearing eucalypts for nest sites. The proposed modification area provides suitable forage habitat for the Glossy Black-cockatoo. A preferred feed tree for this species, *Allocasuarina littoralis*, is present in all woodland and heath communities within the proposed modification area. There are no large hollow trees within the proposed modification area which would provide suitable nesting habitat for the Glossy Black-cockatoo. It is, therefore, likely that this species would only occasionally visit the proposed modification area to forage as part of a much larger range.

The Glossy Black-cockatoo has been recorded in most conservation areas in the locality, including Marramarra National Park, Dharug National Park, Parr State Conservation Area and Berowra Valley National Park. These conservation areas provide large areas of intact forage and breeding habitat for this species in the locality.

ii. Microchiropteran Bats

A total of four threatened microchiropteran bats (microbats) were recorded within or adjacent to the proposed modification area during the current surveys. These are Large-eared Pied Bat, East-coast Freetail-bat, Little Bentwing-bat and Eastern Bentwing-bat. The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. This species roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Hirundo ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. This species is found in well timbered areas containing gullies.

The East-coast Freetail-bat occurs from southern Queensland to southern NSW, in dry sclerophyll forest and woodland. It roosts in tree hollows and sometimes under bark or in man-made structures.

The Little Bentwing-bat is distributed along the east coast of Australia from Cape York in Queensland to Wollongong in NSW. This species inhabits moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.

The Eastern Bentwing-bat occurs along the east and north west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man-made structures. It forages above the canopy in forested areas. This species also can potentially roost in some rock crevices and overhangs. The Eastern Bentwing-bat forms maternity colonies in caves and populations usually centre on such caves. All vegetation communities within the proposed modification area and surrounding lands provide suitable forage habitat for these species.

Three of the threatened microbats recorded are cave-dependant species. There are no caves or culverts within the proposed modification area, so these species are highly unlikely to roost or breed here. Only one species, the East-coast Freetail-bat, is not dependant on caves for roosting or breeding habitat. Although suitable roosting hollows are present within the proposed modification area for the East-coast Freetail-bat, these are relatively scarce. It is, therefore, likely that all threatened microbats travel from suitable roosting habitat elsewhere in the locality to forage within the proposed modification area and adjacent lands.

All four of the threatened microbats recorded are known to occur in conservation areas of the locality, including Marramarra National Park, Dharug National Park, Parr State Conservation Area, Berowra Valley National Park and Cattai National Park.

These conservation areas provide large areas of intact forage and breeding habitat for threatened microbat species in the locality.

Wildlife Corridors

Wildlife corridors are generally areas of habitat which connect reserves or blocks of disjunct habitat. Wildlife corridors allow wildlife to disperse and provide for gene flow between populations or sub-populations. Wildlife corridors are of varying relevance to fauna, and are of greatest relevance to ground dwelling species which cannot fly. Highly mobile birds and bats can fly between patches of habitat, over human developments and clearings. Notwithstanding that, retention of corridors or stepping stone patches of habitat can also greatly aid in the conservation of such mobile species.

Desktop analysis of aerial photography and field investigations indicate that the proposed modification area forms part of a corridor of vegetation connecting vegetated areas within the eastern portion of the Site to extensive areas of vegetation to the west of the Site.

Areas to the east of the Site, beyond properties along Old Northern Road, are largely conserved within Marramarra National Park.

Within the wildlife corridor on the Site, there are several barriers to movement. These include the existing sand quarry and associated clearing for tracks to the south, north and west of the proposed modification area. The corridor is further impacted to the east of the Site by agricultural land and Old Northern Road. These features are likely to impede movement of many smaller terrestrial and arboreal fauna species through this corridor.

The proposed modification area and surrounding lands are likely to provide wildlife corridor values primarily for highly mobile species (e.g. birds and bats) or common and adaptable species (e.g. wallabies, possums, feral mammals). The maintenance or creation of wildlife corridors has become an important planning consideration as landscapes are developed. If due consideration is given, provisions can be made to retain and/or enhance wildlife corridors present within the proposed modification area and surrounding land and to retain viability of habitats.

3.6.8 General Impacts of the Proposed Modification

Vegetation and Habitat Removal

The primary impact resulting from the proposed modification is the loss of vegetation and associated habitat. All vegetation present within the proposed modification area will be removed.

The total footprint of the proposed modification is approximately 4.35 ha, of which 3.68 ha comprises native vegetation communities. The remaining area supports exotic grassland (0.62 ha) and cleared land (0.05 ha).

The native vegetation communities present are well represented and well conserved in the wider locality. Removal of this vegetation under the proposed modification will not, therefore, result in a significant reduction in any of these vegetation communities in the

locality.

No EECs listed under the EPBC Act and/or the TSC Act will be removed under the proposed modification.

Loss of Specific Habitat Features

In addition to the clearance of broad habitats within the proposed modification area, a number of specific habitat features will be removed. These include feed trees for various fauna, bushrock and hollow-bearing trees. These features provide suitable forage, shelter and breeding habitat for a range of native fauna, including threatened species. The primary areas of fauna habitat occur within the woodland and heath communities. The exotic grassland and cleared areas of the proposed modification area provide only limited habitat value.

The following key threatening processes are applicable to the habitat to be removed:

- Clearing of native vegetation;
- Loss of hollow-bearing trees;
- Bushrock removal, and
- Removal of dead wood and dead trees.

Some of the important habitat features will be removed, however, the proposed modification area is relatively small and provides limited habitat features when compared to larger, more intact examples of habitat within the locality. Further, the resulting fragmentation and isolation of these habitat features would impact many of the fauna that would otherwise utilise these habitat features.

Other Impacts to Vegetation Communities and Habitat

i. Habitat fragmentation

Habitat fragmentation is the process whereby habitat loss results in the division of large, continuous habitats into small, isolated habitat fragments. The area between the fragments is typically man-made and largely uninhabitable by the species which previously existed in the area. The ecological impacts of habitat fragmentation include:

- Changes in the number of species in fragments;
- Changes to the composition of faunal assemblages, and
- Changes to ecological processes in fragments such as food chains, predator-prey interactions, plant-animal pollination and dispersal associations.

Fragmentation of a community can also result in the isolation of vegetation patches both

locally and regionally. Isolation of patches can decrease the amount of genetic exchange between remaining patches of vegetation by severing the small-scale potential genetic transfer mechanisms such as seed dispersal by ants and reproductive root suckering.

The Site consists of land which has been approved for sand extraction, and which will soon be extensively disturbed. Under the approval for the Site, the surrounding areas will first be extracted, and then rehabilitated to a final landscape of farming land, with no requirement for the replacement of trees. Accordingly, under the existing approval, the proposed modification area would comprise an island of vegetation in first a extracted landscape, and then a farming landscape. As a result, removal of vegetation within the proposed modification area is not considered to significantly exacerbate habitat fragmentation.

ii. Edge effects

Edge effects are impacts occurring at an interface between natural environments and disturbed or developed land. The following are types of edge effects which can occur:

- Abiotic effects, involving changes in the environmental conditions which result from proximity to a structurally dissimilar matrix;

- Direct biological effects, which involve changes in the abundance and distribution of species caused directly by the physical conditions near the edge, and

- Indirect biological effects which involve changes in species interactions, such a predation, competition, herbivory and biotic pollination and seed dispersal.

Under the existing approval, the edges of the retained vegetation communities within the proposed modification area will be impacted by microclimate changes (e.g. increased sunlight, air temperature and soil temperature). Alteration of the microclimates within each vegetation community is likely to result in changes in species composition, including increased weed invasion, which in turn can lead to changes in community structure. Some species will be more susceptible to these changes than others. Edge effects can also result from the increase in noise and artificial light from the approved quarry extension.

Under the existing approval, utilisation of the edge habitat by edge specialists is likely to increase. This has subsequent implications for the interaction between existing species at the edge. Other edge effects can include increased susceptibility to infection, such as infection of native plants by the fungus *Phytophthora cinnamoni*.

Edge effects will occur at the interface between the approved extraction area and the proposed modification area. These edge effects can potentially have an adverse impact on the vegetation and associated habitat of the proposed modification area. Impacts from edge effects can reduce the quality and integrity of the retained communities. Numerous edges will be created around the proposed modification area as a result of the approved extraction. It is primarily where edges are created between the approved quarrying of the Site and intact vegetation within the proposed modification area that impacts will occur.

Habitat within the proposed modification area does not lie at the edge of any vegetation which will remain under the existing approval, however, the removal of vegetation with the proposed modification area has the potential to increase edge effects to vegetation occurring along the southern boundary.

iii. Alteration of hydrological regime

Extraction under the existing approval will result in significant alteration to hydrology necessary for vegetation and habitat survival within the proposed modification area.

Removal of the vegetation within the proposed modification area will not result in any significant changes to hydrology additional to those which would already occur under the approved extraction.

iv. Increased erosion and sedimentation

Erosion is already occurring at the interface between the existing extraction and the Site, particularly along the western boundary of the proposed modification area. Under the existing approval, an extension of extraction into the remainder of the Site will result in increased erosion along all sides of the proposed modification area. The removal of vegetation from the proposed modification area would not result in any significant erosion or sedimentation on adjoining lands additional to those impacts already occurring under the existing approval.

v. Weeds and feral animals

Alterations to habitat conditions often favour introduced and/or hardy native plant and animal species which can proliferate in disturbed conditions. Such species have potential to impact upon the original local native plant and animal species. Weeds such as exotic grasses and other introduced plants have potential to out compete regenerating native plant species.

Feral animals such as foxes, rabbits and some species of birds can also breed in the more open areas following clearance of forest and woodland. They can cause problems for native fauna species by preying upon them or by competing with them for food and resources.

Weed and feral animal species are already present within the Site, including the proposed modification area. Under the existing approval, an extension of extraction activities into the remainder of the Site will result in increased competition from weeds and feral animals on vegetation within the proposed modification area. Removal of vegetation from within the proposed modification area will not result in any weed and feral animal impacts on adjacent lands additional to those already likely to occur under the existing approval. One threatened flora species was recorded within the proposed modification area during the current surveys.

One additional species is known to occur based on previous studies within the proposed modification area.

The following sections outline impacts to the threatened flora species within the proposed modification area.

Melaleuca deanei

Melaleuca *deanei* (Deane's Paperbark) is listed as Vulnerable under both the TSC Act and EPBC Act. This species was recorded at one location within the proposed modification area.

Removal of the known occurrence of 18 clumps of *Melaleuca deanei* is not considered likely to result in the extinction of the species in the locality. Within the locality, *Melaleuca deanei* is conserved within Marramarra National Park and Dharug National Park, and occurs in other bushland areas in the locality (e.g. near Wisemans Ferry).

Approximately 1.15 ha of suitable habitat, comprising *Angophora costata - Corymbia gummifera* Woodland is proposed to be cleared from the proposed modification area. The loss of this vegetation would result in a very small decrease in the amount of suitable habitat available to this species. The habitat to be removed within the proposed modification area is not considered important for the long-term survival of the species. Sufficient potential habitat will be rehabilitated within the proposed modification area and other parts of the Site on completion of extraction activities.

Tetratheca glandulosa

Tetratheca glandulosa is listed as Vulnerable under both the TSC Act and EPBC Act. This species was not recorded within the proposed modification area during current surveys, however, *Tetratheca glandulosa* was recorded within the proposed modification area during surveys by Gunninah Environmental Consultants (Fanning et al. 1998) and Trevor Hawkeswood (2010).

Approximately 40 to 50 individual *Tetratheca glandulosa* were detected within the proposed modification area (Fanning et al. 1998), however, only five specimens were recorded within this area by Trevor Hawkeswood in 2010. As suggested by T. Hawkeswood (2010), this may be a result of changes in condition of vegetation between the times of the two surveys, resulting in a decline of *Tetratheca glandulosa* within the proposed modification area due to competition with other species.

Despite the absence of records, it is likely that *Tetratheca glandulosa* persists within the proposed modification area, albeit at significantly reduced abundance. *Tetratheca glandulosa* is conserved within Marramarra National Park and Dharug National Park, and Atlas of NSW Wildlife records indicate that this species is well represented in the locality.

Given the abundant records for this species in the locality, removal of *Tetratheca glandulosa* within the proposed modification area is not considered likely to result in the extinction of the species in the locality.

Although not clearly defined in previous surveys, it is likely that woodland supporting *Corymbia gummifera* would provide habitat for *Tetratheca glandulosa* within the

proposed modification area. Approximately 1.15 ha of suitable habitat, comprising *Angophora costata - Corymbia gummifera* Woodland is proposed to be cleared from the proposed modification area. The loss of this vegetation would result in a very small decrease in the amount of suitable habitat available to *Tetratheca glandulosa*. The habitat to be removed within the proposed modification area is not considered important for the long term survival of the species. Sufficient potential habitat will be rehabilitated within the proposed modification area and other parts of the Site on completion of quarrying activities.

3.6.9 Impacts to Threatened Fauna Species

Five threatened fauna species have been recorded within the proposed modification area during the current surveys. The following sections outline impacts to the threatened fauna species known within the proposed modification area. Mitigation and compensatory measures to address impacts to threatened fauna are provided, including provisions for ongoing management.

Glossy Black-cockatoo

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is listed as Vulnerable under the TSC Act. Evidence of feeding by Glossy Black-cockatoo was recorded during current surveys indicating that the proposed modification area and surrounding site currently provide forage habitat for this species, however, habitat assessment indicates that the proposed modification area does not provide suitable breeding habitat for the Glossy Black-cockatoo.

The Glossy Black-cockatoo has been recorded from Marramarra National Park, Dharug National Park, Parr State Conservation Area and Berowra Valley National Park. Forage and breeding habitat for this species is well conserved in the locality within these protected lands.

All woodland and heath vegetation within the proposed modification area supports *Allocasuarina littoralis* which is a preferred feed tree species for the Glossy Black-cockatoo.

Approximately 1.82 ha of woodland and 1.86 ha of heath providing forage habitat for the Glossy Black-cockatoo will be removed under the proposed modification. Given the extent of high quality forage and breeding habitat for this species in conservation areas in the locality, the removal of a small area of forage habitat from within the proposed modification area is not considered important for the long-term survival of the Glossy Black-cockatoo.

Larger areas of forage habitat will be rehabilitated within the proposed modification area and other areas of the Site on completion of extraction.

Microchiropteran Bats

The following threatened microchiropteran bats (microbats) were recorded within or adjacent to the proposed modification area during the current surveys:

- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- East-coast Freetail-bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat (*Miniopterus australis*), and
- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*).

The Large-eared Pied Bat is listed as Vulnerable under both the EPBC Act and the TSC Act. All other threatened species recorded are listed as Vulnerable under the TSC Act. All vegetation communities within the proposed modification area provide suitable forage habitat for threatened microbats. It should be noted that three of the four threatened species recorded are cave-roosting species. As the Site does not provide suitable roosting habitat for these species, it is highly likely that these bats travel to the proposed modification area to forage from other areas in the locality. The proposed modification area provides suitable roost habitat for the East-coast Freetail-bat, which is known to roost in tree hollows. There is no suitable breeding habitat for any threatened microbats within the proposed modification area.

The four threatened microbats recorded within the proposed modification area have been recorded from conservation areas in the locality, including Marramarra National Park, Dharug National Park, Parr State Conservation Area, Berowra Valley National Park and Cattai National Park. These conservation areas provide extensive forage, roosting and breeding habitat for all of the species recorded within the proposed modification area.

Approximately 4.3 ha of suitable forage habitat for threatened microbats (including 1.82 ha of woodland providing suitable roosting habitat for the East-coast Freetail-bat) will be removed under the proposed modification. There is extensive forage, roosting and breeding habitat for these species in the locality, much of this conserved in protected lands. It is, therefore, unlikely that the small area of habitat within the proposed modification area is important for the long-term survival of any threatened microbats.

Wildlife Corridors

The wildlife corridor values of the proposed modification area are limited due to historical disturbance, clearing and extraction in the surrounding lands. The proposed modification area currently forms a component of a corridor from south-west to north-east passing through the Site. This corridor is not large enough to provide significant habitat for threatened species, but may be utilised by mobile species such as birds and bats between larger areas of intact habitat. Wildlife corridor values for small terrestrial and arboreal species are limited due to clearing, extraction and roads in surrounding lands which provide substantial barriers to these species.

Under the existing approval, the wildlife corridor values of the proposed modification area will be significantly reduced as all connecting habitat to the north and east will be removed. Further, the current intent is to rehabilitate these lands to farmland, which will substantially limit corridor values for flora and fauna in the long term.

The proposed modification will remove approximately 4.3 ha of habitat which currently provides limited wildlife corridor values, mostly for birds and bats. More substantial wildlife corridors exist within the locality to the north and south of the Site, connecting large areas of bushland in the west to Marramarra National Park in the east. These important wildlife areas will not be significantly impacted by clearing of vegetation within the proposed modification area.

3.6.10 Measures to Mitigate Impacts

Minimising Vegetation and Habitat Loss

In order to minimise clearing impacts and unnecessary disturbance to native vegetation which occurs outside of the proposed modification area, the following procedures will be implemented:

- The limits of clearing will be delineated during the construction process and marked clearly on plans and on the ground;
- Native vegetation to the south of the identified clearing areas will not be disturbed, and
- Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

Staged Clearing

Under the approved extraction plan for the Site, clearing and extraction will be completed in stages. Within this approved extraction plan, it is proposed that clearing of vegetation in proximity to *Melaleuca deanei* should be avoided until Stage 2. This will aim to avoid individuals of *Melaleuca deanei* as long as possible. The aim of this approach is to enable cuttings and seed to be collected from individuals in the proposed modification area to be planted in the rehabilitated areas post extraction.

Immediately prior to clearing of the second stage, all *Melaleuca deanei* within the proposed modification area will be carefully removed and translocated to existing rehabilitated lands within the extraction lease area.

Translocation of Topsoil

Topsoil from the proposed modification area will be removed to a depth of between 50 and 100 mm and stockpiled for use in rehabilitation. This is a well recognised method for

conducting post-extraction rehabilitation. The topsoil contains native seeds, rhizomes and bacteria and has been shown to be highly effective at remediating disturbed sites if it is applied as soon as possible after being removed. Topsoil removed from the proposed modification area may contain viable seed of *Tetratheca glandulosa* which could germinate in rehabilitated areas.

Pre-clearing Surveys

Prior to any clearing of vegetation in the proposed modification area, pre-clearing protocols will be followed to avoid injuring native fauna, including:

- Preparation of an inventory of trees and hollows to be removed, prior to clearing;
- Checking hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands;
- Nest boxes or salvaged tree hollows will be provided in nearby woodland or stored for re-use when the area is rehabilitated to compensate for the hollows to be removed due to vegetation clearance, and the numbers will be directly proportional to the number of hollows removed, and
- If present, boulders and large logs will be placed in nearby areas of retained vegetation to allow their continued use as fauna habitat, or for re-use in rehabilitation.

A fauna ecologist will be on hand at all times to supervise clearing and to rescue any animals still remaining in the clearing area following the pre-clearance surveys. The fauna ecologist will handle any animals injured during the process and will determine whether veterinary help is needed.

Rehabilitation

A plan showing the proposed final landform for the Site after rehabilitation has been prepared by McKinlay Morgan Surveyors (**Figures 2.3 and 2.7 and Appendix 6**). All areas disturbed by extraction activities in the proposed modification area will be rehabilitated after extraction. It is understood that the already approved extraction areas will be rehabilitated to a farming landscape, however, in recognition of the biodiversity values in the proposed modification area, it is proposed to be rehabilitated with the objective of recreating and establishing a self-sustaining landscape which resembles the original vegetation communities and is able to support a diverse range of viable flora and fauna populations, including those threatened species recorded from the proposed modification area.

In order to further enhance biodiversity in the Site, it is proposed that additional strategic areas in the Site be rehabilitated to woodland, instead of the previously proposed

farmland.

These areas are those which are in the approved extraction areas to the east and north of the proposed modification area but which currently contain native vegetation and link to existing native vegetation outside of the Site to the north which will not be disturbed by the project. The rehabilitation of these areas to contain woodland communities will recreate vegetated corridors in the landscape which will facilitate fauna movement, and genetic flow between populations. It will provide connectivity between the areas of remnant vegetation in and near the Site and the large areas of intact vegetation to the east.

Rehabilitation Corridor

Figure 3.6 shows the location of a proposed rehabilitation corridor.

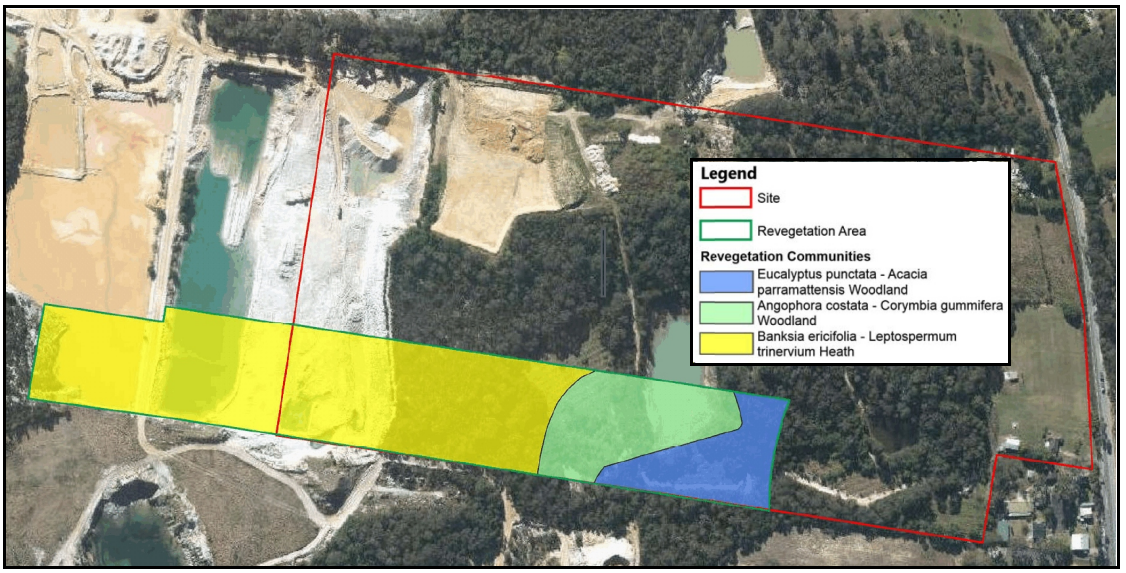

Figure 3.6: Rehabilitation Corridor.

The rehabilitation corridor occurs partially outside the Site, but is part of a broader rehabilitation strategy for the quarry. The corridor will create 6.83 ha of full-structured vegetation, approximately 100 metres in width and approximately 650 metres in an east-west direction.

The corridor will create a link between the remnant native vegetation to the west of the Site and the vegetation retained within the 250 metres buffer to the Maroota Public School. This vegetation has connectivity to vegetation to the east of the Site, and more broadly to Marramarra National Park. The corridor has previously been identified as being restored to agricultural land, therefore, the proposed revegetation and restoration of this area is a positive outcome for biodiversity within the Site and the locality. The vegetated corridor will be created using stockpiled topsoil from the clearing of other areas, with the topsoil being stored in accordance with guidelines to ensure the viability of the seed within the soil in the long term. Revegetation will be a staged process, with areas rehabilitated following extraction of sand. Vegetation communities currently existing on the Site will be replicated through the use of stored topsoil from the original communities.

Where topsoil is not available to be translocated, such as in previously cleared areas, common species from the vegetation community will be planted. An analysis of vegetation communities adjacent to the Site and the underlying geology have been used to determine the vegetation communties to be restored. The vegetation communities to be restored will include:

- *Banksia ericifolia – Leptospermum trinervium* Heath (4.66 ha);
- *Angophora costata – Corymbia gummifera* Woodland *(1.19 ha)*, and
- *Eucalyptus punctata – Acacia parramattensis* Woodland (0.98 ha).

Areas which currently exist as exotic vegetation will be restored to their likely previous native vegetation community. In particular, the area of exotic orchard will be restored to fully structured Eucalyptus punctata woodland. The revegetation will be designed to replicate natural vegetation structure. Further analysis of vegetation communities to be restored will be detailed within the Rehabilitation Management Plan.

Local provenance native plant species will be utilised in rehabilitation where possible and seed will be collected from native vegetation in the study area to ensure genetic diversity is maintained. In particular, seed and cuttings will be taken of *Melaleuca deanei* prior to clearing for future propagation and planting in the proposed modification area.

The rehabilitation will be undertaken in two stages:

- replacement of topsoil and natural regeneration of native species, and
- targeted planting of native species which have not germinated and targeted planting of *Melaleuca deanei*.

Initially, topsoil removed from the proposed extraction areas will be stockpiled and then replaced after extraction is complete. Extraction will be undertaken to an approximate depth of 30 metres, and after extraction this will be in-filled to a depth of 5 metres below the current land level. The stockpiled topsoil will then be spread onto this surface to provide an appropriate growing medium to regrow native species and also to conserve the native seed bank of local ecological communities. It is expected that significant regrowth will occur from seeds stored within the seed bank of this topsoil which will improve the quality and diversity of native growth in rehabilitation areas and maximise the establishment of a diversity of native species, particularly the understorey species.

The second stage of rehabilitation will involve the targeted planting of particular species which may be missing in the native vegetation community. This will depend on the results of the natural germination of the seed bank, but it may include canopy tree species, understorey shrubs or grasses. In this stage of rehabilitation, efforts will be made to establish a viable population of *Melaleuca deanei* through planting seedlings propagated from cuttings or seed.

All rehabilitated areas will be managed for conservation to ensure that the ecological

function of native vegetation communities will be recreated and that rehabilitated areas will provide high quality habitat for native flora and fauna. This will include weed and feral animal control, additional planting with native species if required, and other management actions as required. For the recreation of the habitat values of the proposed modification area, the following measures will be implemented, if necessary:

- Use of locally occurring native shrubs, trees and groundcover plants for planting;
- Inclusion of logs, dead trees and stumps in strategic locations to enhance fauna habitat;
- Provision of vegetative links to bushland remaining in the study area, and
- Measures to manage weeds and feral animals.

Monitoring

A monitoring program will be developed to monitor the progress of the rehabilitated vegetation in the proposed modification area, including both vegetation monitoring and threatened species monitoring. This will provide data to determine the level of success of the rehabilitation measures and to track its progress.

i. Vegetation Monitoring

Vegetation monitoring sites will be established in rehabilitation areas and will be monitored in the long term to allow changes in species composition and structure over time to be quantified. Information will be used in adaptive management, in order to continually improve the outcomes of rehabilitation. Appropriate data management procedures will be implemented to ensure that all data is collected using appropriate techniques and suitably analysed to allow meaningful spatial and temporal comparisons to be made.

ii. Threatened Species Monitoring

Monitoring will also be undertaken on the species of threatened flora which will be established in the rehabilitation area, including *Melaleuca deanei*, in order to determine whether the rehabilitation has been successful in establishing viable populations of these species.

Threatened species monitoring will involve conducting targeted threatened species surveys annually in the rehabilitation areas in order to record the abundance and health of these species. This would focus on *Melaleuca deanei*, which is a priority for introduction. Key indicators for monitoring would be the abundance of individual threatened species.

iii. Weeds and Feral Animal Monitoring

A weed and feral animal monitoring program will also be established as part of the monitoring program. This will include monitoring for the presence and abundance of

exotic species recorded from the proposed modification area. The monitoring program will allow for early recognition of increases in the abundance or distribution of weed species and will enable appropriate action to be taken in a timely manner.

Preparation of a Rehabilitation Management Plan

In order to provide a comprehensive framework for the implementation of the proposed biodiversity impact mitigation and offset measures, a Rehabilitation Management Plan (**RMP**) will be prepared and implemented for the project prior to the commencement of removal of vegetation. The RMP will ensure that the project's conservation objectives are met and that impacts to biodiversity are adequately managed for the life of the project. The RMP will incorporate all of the impact mitigation measures as described above which are proposed to be undertaken for the project, and provide detailed specifications for their implementation. The RMP will include the following:

- A description and plan of rehabilitation measures (long and short term);
- Measures to protect local biodiversity values;
- Details of designated areas for rehabilitation and conservation;
- Specifications for pre-clearing surveys and fauna rescue or translocation protocols where practical;
- Vegetation clearing protocols limiting clearance or disturbance of native vegetation;
- Details of revegetation priorities and techniques;
- Control and ongoing management of environmental and noxious weeds;
- Control and ongoing management of feral animals;
- Details of monitoring methodology;
- Description of key performance indicators against which to measure progress, and
- Specification of appropriate review periods where progress is reviewed and the document updated as required.

The RMP will prescribe further information on the staged rehabilitation of the proposed modification area and how it will be returned to woodland and/or heath. This will include final landform design, and rehabilitation methodology.

The RMP is intended to be a working document which guides all facets of biodiversity management for the project, and will include clear objectives and actions. The RMP will specify what measures will be undertaken, how they will be undertaken, and will provide a time line to ensure that all activities are conducted according to the plan. The RMP will

include clear objectives, key performance objectives and management actions to ensure biodiversity values are protected and the proposed mitigation measures are implemented.

3.7 Acoustic Impact

The Environmental Impact Statement which accompanied the development application for extraction of Lots 1 and 2, DP 547255 contained an assessment of the potential impact of the then proposed extraction on the acoustic environment, and made recommendations with regard to mitigation of identified impacts. The following extracts have been taken from the Environmental Impact Statement:

> *The acoustic environment of residences near the site is generally agricultural, with little road traffic. This area is defined by the INP as "rural".*
>
> *The receptors nearest the site .... include:*
>
> - *houses along Old Northern Road (R1 to R5); and*
> - *Maroota Public School on Old Northern Road, school buildings and playground.*
>
> *Operational scenarios were considered for quarrying in strip 2 and 6 with the processing plant at full capacity. It was assumed that when extraction is taking place in Lots 1 and 2, no extraction is carried out on Portions 29 or Lot 196. All extraction plant were modelled at ground level with a three metre bund positioned adjacent to the excavation.*
>
> *Noise levels calculated for strip 2 during calm weather were below criteria at all residential and school receivers. Levels at several residential receivers exceeded recommended criteria during adverse weather conditions. Ceasing extraction in Lots 1 and 2 during wind speeds greater than 2 metres per second from 236 to 304 degrees results in receivers meeting criteria with the exception of R1 which is 3 dB greater than the relevant criterion.*
>
> *Worst case noise levels were calculated for the proposed quarry with equipment placed at ground level in strip 6. A five metre bund was added to the model along the northern edge of strip 6 between the quarry and Residence 1 to reduce received noise levels. Noise levels calculated during calm weather exceeded the relevant criterion by 3 levels. Noise levels calculated during calm weather exceed the relevant criteria by 3 dB(A) at R1, however, levels calculated for all other receptors are below the criteria.*
>
> *Noise levels calculated for strip 6 during adverse weather conditions exceeded recommended criteria. Further modelling was undertaken which showed ceasing extraction operations in strip 6 during wind speeds greater than 2 metres per second from 214 to 326 degrees would reduce noise levels to below the relevant*

criteria. The exception is R1 that would still exceed by 6dB.

In summary, initial modelling with quarry plant at ground level predicted numerous exceedances in adverse weather. Additional calculations with winds from the south west to north west removed, resulted in more acceptable noise emissions. To meet these new calculations, quarrying at ground level would need to cease when these winds are blowing. It is expected that quarrying at lower levels would be able to continue during these winds due to increased topographic shielding with depth.

Given that traffic movements from the site will not increase as a result of this proposal, traffic noise has not been assessed."

The Consent recognised the above assessment and provided conditions of consent which would ensure that the acoustic integrity of the Maroota area would be maintained during the life of the extraction.

The proposed modification to the Consent seeks to extract the previously identified "exclusion area" and "area of shallow groundwater" and to add certainty to the depth of extraction. The Consent, as modified, at its:

- conditions 3.35 - 3.48,
- conditions 4.5 - 4.6A, and
- condition 6.3(c)

provides comprehensive acoustic impact conditions and requirements for continued monitoring of extraction. Environmental management of acoustic impact is provided for in the Site Environmental Management Plan.

Because the proposed additional extraction area is further away from all sensitive receivers than the majority of the area already approved for extraction, and the modification does not propose any increase in the intensity of quarrying operations, the acoustic impacts from additional extraction would be less than that assessed for the original development.

Notwithstanding, the proposed modification would bring any additional extraction on the Site under the umbrella of the existing acoustic impact conditions to ensure that the continued extraction of the Site is undertaken such that an acceptable acoustic environment is maintained.

Dixon Sand, as part of its fulfilment of the conditions of consent for its Maroota operations, has prepared annual environment site audits. Those audits, which can be seen on the Dixon Sand website, clearly show that sand extraction on all of the Dixon Sand sites at Maroota are operating within the acoustic criteria contained in the above conditions of consent. Indeed, the audit reports note that no complaints have been received relating to acoustic impacts from the Dixon Sand operations at Maroota.

3.8 Traffic Impacts

Truck movements generated by all Dixon Sand extraction activity in the Maroota area are governed by condition 3.30 of the Consent, as modified, which states:

> *3.30 Truck movements at the site, including those provided for under this consent and DA 165-7-2005, shall not exceed:*
>
> *a) a total of 180 per day (ie inbound combined with outbound);*
>
> *b) 40 between the hours of 6.00am and 7.00am (inbound combined with outbound); and*
>
> *c) 118 laden per day, of which no more than 28 may be inbound.*

No modification is proposed to the already approved truck movements to and from the Site.

In addition to the above, conditions 3.30A - 3.35C of the Consent, as modified, relate to truck and transport impacts and state:

> *3.30A The Applicant shall:*
>
> *a) keep daily records of the amount of sand transported from the site;*
>
> *b) keep daily records of all traffic movements in and out of the site (including records of movements approved under condition 3.30; and*
>
> *c) include detailed reports on these records in the AEMR.*
>
> *3.31 deleted.*
>
> *3.32 The Applicant is to ensure that the Old Northern Road pavement in the vicinity of the intersection with the Crown Access Road is regularly maintained and kept free of sand, clay and soil at all times. All costs of these works are to be borne by the Applicant.*
>
> *3.33 The Applicant shall advise its drivers and its clients not to arrive at the site prior to 5.45am on any day. Certified (under company seal) weighbridge dockets and a log book or equivalent computer records are to be kept to verify the arrival and departure times of vehicles. Copies of these records shall be summarized in the AEMR.*
>
> *3.35A The Applicant shall ensure all new truck drivers are provided with Site Induction for Drivers outlining site requirements, including the requirements of the Transport Code of Conduct referred to in condition*

6.3 of this consent, and expected driver behaviour such as all speed limits (including school zone speed limits around Maroota Public School or other such speed limits as may be imposed from time to time), and not using exhaust brakes, especially during morning periods.

3.35B The Applicant shall liaise with representatives of Maroota Public School as required, but no less than annually, to discuss the effectiveness of traffic management procedures.

3.35C The Applicant shall impose a 20 km/hr speed limit on internal haul roads and shall ensure that all vehicles using internal haul roads do not exceed this speed limit.

These conditions would apply to any modification and are not proposed to be modified.

Dixon Sand, as part of its annual environmental reporting, has monitored the number of trucks entering and leaving the Site. There has been no exceedance of the approved truck numbers.

The annual environmental monitoring reports also clearly state that a minor number of complaints have been made with regard to the conduct of truck drivers in the Maroota area with the number of complaints ranging from zero in some years to 4 in one year. In all cases, complaints related to trucks speeding. In all cases, Dixon Sand has reprimanded the driver concerned and reiterated the truck management plan which applies to trucks entering and leaving the Site.

3.9 Air Quality

The Environmental Impact Statement which accompanied the original development application contained an assessment of the potential impact the then proposed extraction would have with regard to air quality, and made recommendations with regard to mitigation of identified impacts. The following extracts have been taken from the Environmental Impact Statement:

Sensitive receptors near the site include houses and a school, all to the east and north-east.

Predicted concentrations at discrete receptor locations (ie Residences and the nearby school) are below the nominated criteria for all pollutants and averaging times modelled.

Air quality modelling was undertaken and determined that dust deposition will not exceed EPA criteria under conditions modelled. All discrete receptors will have a maximum increase of less than 2 g/m/month dust deposition. Depositional dust monitoring is currently undertaken around the existing site and will be continued for the proposed operation.

Total suspended solids PM_{10} concentrations from the proposed are predicted to be lower than the relevant criteria at the nearest houses.

Current dust controls will continue to be used, including water sprays of haul roads, stockpiles and disturbed areas, minimal exposure of active extractions areas, vehicle speed reduction and progressing rehabilitation.

Because the proposed additional extraction area is further away from all sensitive receivers than the majority of the area already approved for extraction, and the modification does not propose any increase in the intensity of quarrying operations, the impact from additional extraction on air quality would be less than that assessed for the original development.

The Consent recognised the above assessment and provided conditions of consent which would ensure that the integrity of the air quality of the Maroota area would be maintained during the life of the extraction on Lots 1 and 2, DP 547255.

The Consent, as modified, at its:

- conditions 3.2 - 3.8,
- conditions 4.3 - 4.4, and
- condition 6.3(a)

provides comprehensive air quality impact conditions and requirements for continued monitoring of extraction. Environmental management of air quality impact is provided for in the Site Environmental Management Plan.

The proposed modification would bring any extraction of the "exclusion area" and the "area of shallow groundwater" under the umbrella of these air quality impact conditions to ensure that the continued extraction of the Site is undertaken such that an acceptable air quality is maintained.

A review of the annual environmental monitoring reports for the Dixon Sand extractive industry operations at Maroota reveals that, generally, dust emissions from the extractive industry have been within the criteria referred to in conditions of consent. In this regard, the following information is provided from those environmental monitoring reports.

2003 - 2005 All dust gauges located on the Dixon Sand sites recorded dust emissions below the criteria.

2005-2006 Some minor exceedance of the dust criteria. The environmental monitoring report indicates that the non compliance is as result of new operations in the locality other then those operated by Dixon Sand combined with unusually high winds and temperatures at time of recording the non compliance.

2006-2007 Two non compliant readings were recorded in this period which were stated as minor breaches of the criteria.

2007-2010 During this period, all dust gauges recorded readings below the criteria except for dust gauge D1. This gauge is located close to the front gate of the Site and the high levels have been a result of sand being deposited in the gauge.

3.10 Heritage

The Environmental Impact Statement which accompanied the original development application contained an assessment of the potential impact the then proposed extraction would have with regard to heritage matters, and made recommendations with regard to mitigation of identified impacts. No Aboriginal archaeological sites or areas of potential archaeological deposit were identified. A copy of the Survey for Aboriginal Archaeological Sites is included as **Appendix 8**.

Condition 3.52 of the Consent, as modified, states:

> *3.52 If, during the course of any activities conducted under this consent, the Applicant becomes aware of any heritage or archaeological sites not previously identified, all work likely to affect the site shall cease immediately. The Applicant shall then consult with relevant authorities and decide on an appropriate course of action prior to recommencement of work. The relevant authorities may include DECC, the NSW Heritage Office, and the relevant local Aboriginal community. Any necessary permits or consents shall be obtained and complied with prior to recommencement of work.*

The proposed modification seeks approval to extract material on land which was part of the above survey. Notwithstanding, Dixon Sand has commissioned an updated survey of the modification area (refer **Appendix 9**). The conclusions of the updated archaeological assessment are:

> *The current assessment includes a review of the environmental, archaeological and Aboriginal historic context for the subject area and surrounding region. This indicates that:*
>
> - *The subject area contains no known Aboriginal archaeological sites or sites of Aboriginal historic or other cultural significance; and*
> - *That any previously undetected Aboriginal sites would be likely to be associated with areas of sandstone that are overhanging (where rock shelters may occur), exposed in significant platforms (where engraved art may occur), or associated with reliable water (where grinding grooves may occur).*

It is therefore recommended that:

- *There should be no constraint to the proposed activity on the basis of Aboriginal cultural heritage; and*

- *That there should be no requirement for further Aboriginal cultural heritage assessment for DoPI to assess the application for modification to Development Consent No. 250-09-01 for sand extraction at Lots 1 & 2 DP 547255, Old Northern Road, Maroota.*

3.11 Waste

Conditions 3.53 - 3.55 of the Consent state:

3.52 The Applicant shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing or disposal, or any waste generated at the site to be disposed of at the site, except as expressly permitted by a licence under the Protection of the Environment Operations Act 1997. This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the site if it requires an Environment Protection Licence under the Protection of the Environment Operations Act 1997.

3.53 All liquid and non-liquid wastes generated at the development shall be assessed, classified and managed in accordance with the EPA Environmental Guidelines Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA, 1999).

3.54 Any waste generated at the development shall only be transported to an EPA - approved waste management facility for treatment, recycling and/or disposal, where relevant.

The proposed modification would be subject to the above conditions of the Consent.

The Site Environmental Management Plan contains details of the waste management practices on the Site, the objective of which is:

To minimise waste generated, maximise reuse and recycling and ensure wastes are managed effectively to minimise impact on the environment.

The following procedures have been adopted which relate to all extractive activities undertaken by Dixon Sand at Maroota:

1. Maintain separate receptacles for paper, aluminium, glass, plastic and general domestic waste.

2. *Recyclables (paper, aluminium, glass and plastic) to be collected by Council and other types (oil, steel and paper) by contractors.*

3. *Pick-up of non-recyclable domestic waste from office, amenity and workshops by Council.*

4. *No building wastes or putrescible material to be disposed on site.*

5. *No waste generated outside site to be stored, treated, processed, or disposed on site except as permitted by a licence.*

6. *Maintain on-site sewage treatment and disposal in an 'enviro-cycle' type plant.*

7. *Waste oil and grease to be collected and stored on Lot 196 in bund 110% size of the volume of largest tank and removed by a licensed waste oil recycling contractor. No refuelling of equipment to be undertaken on Lots 1 & 2.*

8. *Encouragement of employees to adopt waste-reducing practices.*

9. *Processing plant tailings (fine clays and silts) to be disposed to tailings dams on Lots 29 & 196, to be capped and rehabilitated when at capacity.*

No change to the above waste management practices would evolve as a result of the proposed modification.

3.12 Rehabilitation

Condition 1.15 of the Consent deals with the payment of a bond to the Director-General *... to ensure completion of the rehabilitation and landscaping works at the site.*

Condition 6.3 (e) requires the preparation of a *Rehabilitation and Landscape Plan* which forms part of the Site Environmental Management Plan.

The Rehabilitation and Final Landscape component of the Site Environmental Management Plan has as its objective:

> *To ensure rehabilitation works are implemented progressively to enhance the scenic and environmental quality of the site, increase habitat for threatened species, and utilises areas suitable for agricultural pursuits.*

The following procedures have been adopted in the Rehabilitation and Final Landscape component of the Site Environmental Management Plan:

1. *Progressively rehabilitate extraction precincts on Lots 29 and 196 within*

3 months of completion of extraction in accordance with the schedule outlined in the Rehabilitation Strategy (DLWC, 2000) .....

2. *Progressively rehabilitate buffer areas on lots 1 and 2 (refer to DLWC, 2000 for detail). Retain mature vegetation in designated buffer zones and plant 30m buffer to Old Northern Road upon commencement of strip 1 extraction.*

3. *Rehabilitation works to be supervised by Environmental Officer.*

4. *Carry out rehabilitation and habitat construction works in the conservation area and its buffer zones on lots 1 and 2 upon commencement of strip 1 extraction.*

5. *Undertake rehabilitation and final landform works within 250m of Maroota PS in school holiday periods only.*

6. *Soils used in rehabilitation to be tested to determine fertiliser requirements etc prior to rehabilitation in each precinct on lots 29 and 196.*

7. *Initial cover cropping of lots 29 and 196 with cereals. Once crop has browned off it is to be slashed to create mulch layer, then second seed application with required fertilisers and soil ameliorants (recommended seed mix refer to DLWC, 2000).*

8. *Minimise extraction-related activities to not more than 2 strips (plus one undergoing rehabilitation) on lots 1 and 2 at any one time.*

9. *Transfer topsoil and brush material from adjacent strips prior to excavation.*

10. *Establish native vegetation areas using brush matting and/or tube stock propagated from local seed and other vegetation (orchards) in accordance with the Rehabilitation Strategy (DLWC, 2000) and Plan (Dixon Sand (Penrith) Pty Ltd, 2004b).*

11. *Remove felled trees, logs and rocks from strips and stockpile or lay during rehabilitation to provide fauna habitat.*

12. *Revegetate final batters and slopes as soon as land forming is completed.*

13. *Stockpiles to be kept to less than 3m high, left for less than 12months and revegetated with non-invasive, sterile species.*

14. *Retain erosion and sediment controls as per EP10 until works complete.*

15. *Remove problem weeds or prevented from spreading; notify local council*

if noxious weeds found.

16. *Carry out required rabbit control methods as required per annual inspection during winter months.*

17. *Rehabilitate Lots 1 & 2 with native plants to Class 4 agricultural land (utilising cover crops when necessary).*

18. *Restore the creek line through Lot 2 and precinct 4 of Lots 29 and 196 once extraction is completed in consultation with DLWC (see DLWC, 2000; Dixon Sand (Penrith) Pty Ltd, 2004b).*

19. *Establish a riparian zone 20 metres wide along the entire length of the reconstructed ephemeral waterway & revegetate with local native species.*

As detailed in **Part 2.6** of this Environmental Assessment, the Site Environmental Management Plan contains, as its Figure EP15.2, a plan of the approved final landform for Lots 196 and 29, DP 752025 and Lots 1 and 2, DP 547255.

As a result of modification (3) to the Consent, which has been approved, the final landform has been modified. With the removal of the "exclusion area" and the "area of shallow groundwater" from the Consent as proposed in this modification application, a further refinement of the final landform is proposed as detailed in **Figure 3.7**.

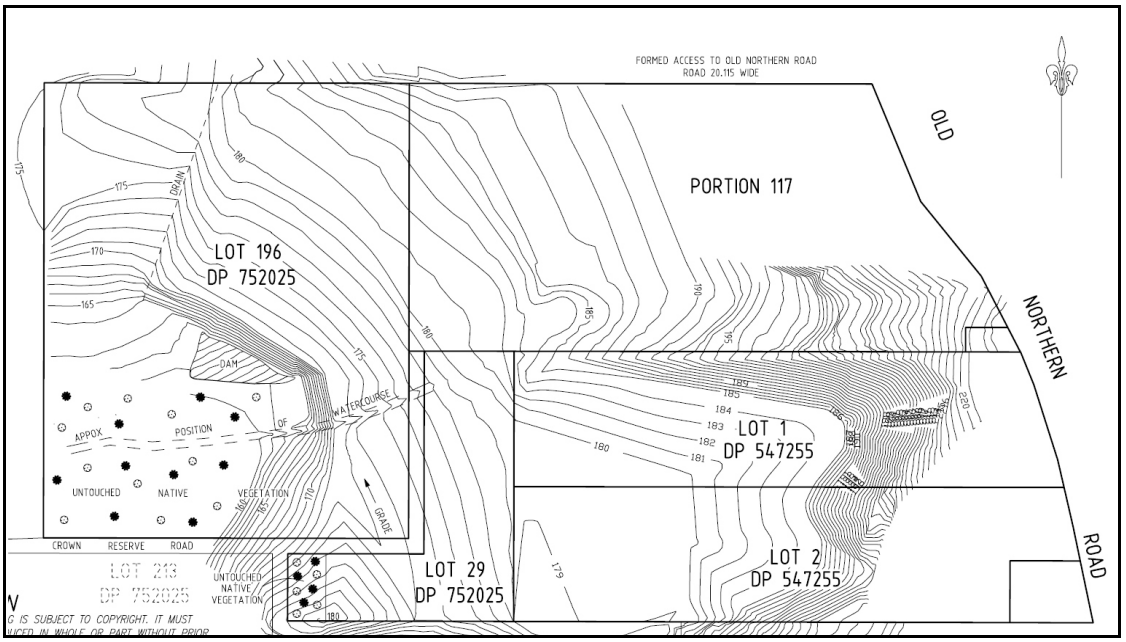

Figure 3.7: Final Landform after rehabilitation.

3.13 Social and Economic Impact

Conditions 4.1 - 4.12 of the Consent provide the environmental monitoring conditions under which the existing development on the Site operates.

Conditions 5.1 - 5.7 of the Consent relate to *Community Information, Consultation and Involvement*. Those conditions would not alter as a result of the proposed modification.

The proposed modification would not result in any additional employment, and the existing market for product would remain. No economic impact, other than the economic use of a valuable sand resource, is expected to result from the proposed modification.

3.14 Impact on Land Resources

The Site is bounded to the west and south by existing sand quarry areas, with extensive areas of unreserved vegetation occurring further west. Immediately to the east of the Site are private land holdings which are primarily used for agriculture. Marramarra National Park adjoins these private land holdings further to the east.

There are a number of conservation areas surrounding the Site, including:

- Marramarra National Park - located approximately 1km to the east;
- Dharug National Park - located approximately 6km to the north-east;
- Parr State Conservation Area - located approximately 6km to the north-west;
- Muogamara Nature Reserve - located approximately 17km to the south-east;
- Berowra Valley National Park - located approximately 19km to the south-east, and
- Cattai National Park - located approximately 13 km to the south-west.

The Hawkesbury River winds from the south west, around the Maroota area at Wisemans Ferry to the north before meandering toward the south-east.

The Site consists of two different soil landscapes. The most widespread soil landscape is "Sydney Town" with the "Colo Heights" soil landscape occurring less frequently. Both are erosional soil landscapes characterised by undulating and rolling hills on Hawkesbury Sandstone.

The Hawkesbury area contains rugged rock outcropping and benches with narrow crests and ridges and rugged to rolling hills. The Maroota area is located on a relatively flat ridge. The Site is located on the western side of this ridge, and is relatively flat with some sections sloping gradually to the west. The topography of the Site has been modified, particularly in the western and northern areas, but also where dams have been formed.

The proposed modification area slopes from north to south, with the lowest area lying in the south eastern corner of the proposed modification area.

No major watercourses occur within the Site. A dam occurs to the east of the proposed modification area and drains to the south west. The quality of the water within this dam is poor as a result of runoff from the upslope land use and surrounding sand quarrying.

It is proposed to modify the approved extraction area to the south of approved Stage 2, 3 and 4. Although the landform would alter as a result of the proposed increased extraction, it has been demonstrated in this Environmental Assessment that the impact to the land resources would be limited and acceptable.

3.15 Risk Assessment

The proposed modification to the approved extraction involves a number of potential environmental issues. Each of the issues has been addressed and, where appropriate, management and mitigation options have been developed.

Each of the potential environmental issues was ranked as being low, moderate, high or critical risk, the risk rating allocated being dependant upon the probability of the impact occurring and the potential consequences should the impact materialise.

Table 3.2 summaries the findings of the risk assessment which indicate that, in the absence of controls and mitigation measures, several aspects of the proposed modification pose a moderate to high risk to the environment. No critical risks were identified.

Aspects of the proposed modification which have been identified as having a moderate to high environmental impact risk ranking have been the primary focus of the Environmental Assessment with appropriate mitigation measures identified. Aspects which were identified as having a low risk were also assessed, however, mitigation measures were considered either of lesser importance or unwarranted.

Ratings in **Table 3.2** were determined based on the following criteria:

Critical Recurring event during the life time of the operation.

High An event which may occur frequently during the life time of the operation.

Moderate An event which may occur during the life time of the operation.

Low An event which is unlikely to occur during the life time of the operation.

Table 3.2: Environmental Risk Rating

Critical	High	Moderate	Low
None	Groundwater	Air Quality	Aboriginal Heritage
	Ecology (Biodiversity)	Noise	Traffic
			Hazardous Materials

Each of the issues identified are discussed in more detail below.

Groundwater

There is a potential risk that the proposed extraction would impact the regional groundwater resource. The resultant impact would be that groundwater would flow into the extraction pit and that the use of the groundwater resource by other users dependant upon that groundwater would be adversely impacted.

A groundwater assessment was undertaken by RPS Aquaterra to determine the elevation of the wet weather groundwater level, such that the depth of extraction can be established. The report also addressed the potential groundwater related impacts of the development. The RPS Aquaterra investigations conclude:

- Lot 1, Lot 2 and the remainder of the Dixon Sand extraction operation is underlain by unsaturated Hawkesbury Sandstone which contains some shallow perched groundwater lenses of limited extent. These temporary perched storages have no significant resource value as they are discontinuous and of limited extent and low storage. They, therefore, do not contribute to the regional hydrogeological regime.

- The only gazetted aquifer underlying the development area is the Sydney Basin Central Groundwater Source which will not be intersected by the extraction of Lots 1 and 2.

- The maximum "wet weather" regional groundwater table level in this aquifer is estimated to be about 171 metres AHD in the east and 151 metres AHD in the west, therefore, sand extraction in Lots 1 and 2 could extend to a depth of 173 metres AHD in the east grading to 153 metres AHD in the west.

- As the extraction of Lot 1 and 2 will extend to a maximum depth of 2 metres above the highest wet weather groundwater level in the Sydney Basin Central Groundwater source, no interception of this aquifer will occur.

- An independent report commissioned by VGT Pty Ltd concludes that Lot 1 and 2 are not underlain by the Maroota Tertiary Sands Groundwater Source ..... This fact is confirmed by drilling data in the vicinity of Lots 1 and 2 ....

- The proposed modification is considered to be in accordance with the provisions of the Water Sharing Plan for the Metropolitan Region Groundwater Source.

- There are no wetlands or Groundwater Dependent Ecosystems (**GDE**) present in the area which could be impacted, as neither groundwater source will be intercepted by the extraction at Lots 1 and 2 which remains in unsaturated geology. Therefore, no discharges to or from GDEs would be affected.

- The total or partial removal of the shallow perched groundwater zones is unlikely to have any major impacts to the local hydrogeological regime, or to the regional aquifer system, other than potentially locally increasing the rate of rainfall recharge to the regional water table in the vicinity of the extraction, however, this potential increase in recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury Sandstone.

- There are nine registered groundwater abstraction bores within approximately 1 km of Lots 1 and 2. None of these production bores abstract groundwater from the perched groundwater lenses located in the area, and, therefore, would not be impacted by deepening of the quarry in Lots 1 and 2.

Ecology (Biodiversity)

The proposed modification would require the removal of existing vegetation and would have the potential to impact endangered flora and also to impact the habitat of endangered fauna.

Cumberland Ecology has undertaken an assessment of the Site to describe the ecological values of the proposed modification area and to assess the impacts on flora and fauna, particularly threatened species, populations and communities as listed under the New South Wales Threatened Species Conservation Act 1995.

The assessment found that there are large areas of nearby known habitats for all of the impacted communities, threatened flora and threatened fauna within the locality. It is recognised that the proposed modification area will have a small impact on the habitat for these communities and species, however, the combined mitigation and compensatory measures to be implemented are likely to sufficiently ameliorate these impacts to the extent that no threatened species are likely to become extinct as a result of the proposed modification.

Air Quality

There is potential for the proposed additional extraction to impact on the air quality of the locality.

The Environmental Impact Statement which accompanied the original development application contained an assessment of the potential impact the then proposed extraction would have with regard to air quality, and made recommendations with regard to mitigation of identified impacts.

Because the proposed additional extraction area is further away from all sensitive receivers than the majority of the area already approved for extraction, and the

modification does not propose any increase in the intensity of quarrying operations, the impact from additional extraction on air quality would be less than that assessed for the original development.

The Consent recognised the above assessment and provided conditions of consent which would ensure that the integrity of the air quality of the Maroota area would be maintained during the life of the extraction on Lots 1 and 2, DP 547255.

The Consent, as modified, at its:

- conditions 3.2 - 3.8,
- conditions 4.3 - 4.4, and
- condition 6.3(a)

provides comprehensive air quality impact conditions and requirements for continued monitoring of extraction. Environmental management of air quality impact is provided for in the Site Environmental Management Plan.

The proposed modification would bring any extraction of the "exclusion area" and the "area of shallow groundwater" under the umbrella of these air quality impact conditions to ensure that the continued extraction of the Site is undertaken such that an acceptable air quality is maintained.

Noise

The Environmental Impact Statement which accompanied the development application for extraction of Lots 1 and 2, DP 547255 contained an assessment of the potential impact of the then proposed extraction on the acoustic environment, and made recommendations with regard to mitigation of identified impacts.

The Consent recognised the above assessment and provided conditions of consent which would ensure that the acoustic integrity of the Maroota area would be maintained during the life of the extraction.

Because the proposed additional extraction area is further away from all sensitive receivers than the majority of the area already approved for extraction, and the modification does not propose any increase in the intensity of quarrying operations, the acoustic impacts from additional extraction would be less than that assessed for the original development.

The proposed modification to the Consent seeks to extract the previously identified "exclusion area" and "area of shallow groundwater" and to add certainty to the depth of extraction. The Consent, as modified, at its:

- conditions 3.35 - 3.48,

- conditions 4.5 - 4.6A, and
- condition 6.3(c)

provides comprehensive acoustic impact conditions and requirements for continued monitoring of extraction. Environmental management of acoustic impact is provided for in the Site Environmental Management Plan.

The proposed modification would bring any additional extraction on the Site under the umbrella of these acoustic impact conditions to ensure that the continued extraction of the Site is undertaken such that an acceptable acoustic environment is maintained.

Dixon Sand, as part of its fulfilment of the conditions of consent for its Maroota operations, has prepared annual environment site audits. Those audits, which can be seen on the Dixon Sand website, clearly show that sand extraction on all of the Dixon Sand sites at Maroota are operating within the acoustic criteria contained in the above conditions of consent. Indeed, the audit reports note that no complaints have been received relating to acoustic impacts from the Dixon Sand operations at Maroota.

Aboriginal Heritage

The Environmental Impact Statement which accompanied the original development application contained an assessment of the potential impact the then proposed extraction would have with regard to heritage matters, and made recommendations with regard to mitigation of identified impacts. No Aboriginal archaeological sites or areas of potential archaeological deposit were identified. A copy of the Survey for Aboriginal Archaeological Sites is included as **Appendix 8**.

Condition 3.52 of the Consent, as modified, states:

> *3.52 If, during the course of any activities conducted under this consent, the Applicant becomes aware of any heritage or archaeological sites not previously identified, all work likely to affect the site shall cease immediately. The Applicant shall then consult with relevant authorities and decide on an appropriate course of action prior to recommencement of work. The relevant authorities may include DECC, the NSW Heritage Office, and the relevant local Aboriginal community. Any necessary permits or consents shall be obtained and complied with prior to recommencement of work.*

The proposed modification seeks approval to extract material on land which was part of the above survey. Notwithstanding, Dixon Sand has commissioned an updated survey of the modification area (refer **Appendix 9**). The conclusions of the updated archaeological assessment are:

> *The current assessment includes a review of the environmental, archaeological and Aboriginal historic context for the subject area and surrounding region. This indicates that:*

- *The subject area contains no known Aboriginal archaeological sites or sites of Aboriginal historic or other cultural significance; and*

- *That any previously undetected Aboriginal sites would be likely to be associated with areas of sandstone that are overhanging (where rock shelters may occur), exposed in significant platforms (where engraved art may occur), or associated with reliable water (where grinding grooves may occur).*

It is therefore recommended that:

- *There should be no constraint to the proposed activity on the basis of Aboriginal cultural heritage; and*

- *That there should be no requirement for further Aboriginal cultural heritage assessment for DoPI to assess the application for modification to Development Consent No. 250-09-01 for sand extraction at Lots 1 & 2 DP 547255, Old Northern Road, Maroota.*

Traffic

Truck movements generated by all Dixon Sand extraction activity in the Maroota area are governed by condition 3.30 of the Consent, as modified, which states:

3.30 Truck movements at the site, including those provided for under this consent and DA 165-7-2005, shall not exceed:

a) a total of 180 per day (ie inbound combined with outbound);

b) 40 between the hours of 6.00am and 7.00am (inbound combined with outbound); and

c) 118 laden per day, of which no more than 28 may be inbound.

No modification is proposed to the already approved truck movements to and from the Site.

Dixon Sand, as part of its annual environmental reporting, has monitored the number of trucks entering and leaving the Site. There has been no exceedance of the approved truck numbers.

The annual environmental monitoring reports also clearly state that a minor number of complaints have been made with regard to the conduct of truck drivers in the Maroota area with the number of complaints ranging from zero in some years to 4 in one year. In all cases, complaints related to trucks speeding. In all cases, Dixon Sand has reprimanded the driver concerned and reiterated the truck management plan which applies to trucks entering and leaving the Site.

Hazardous Materials

Refuelling of Plant and Equipment

The existing development operates with a number of internal combustion engine powered components (e.g. front end loaders, trucks etc) which requires periodical refuelling. All refuelling would be undertaken away from the proposed modification area in accordance with the approved environmental management plan for the Dixon Sand operation.

During the refuelling operation, there is a potential for fuel leaks and spills to occur from split or failed hoses, overfill of the truck/equipment or tanker/vehicle tank failure. Whilst the likelihood of these incidents would be low, heat radiation impact offsite could occur if the incident eventuated, therefore, there is potential for the adjacent bushland to be ignited resulting in a bushfire. A dedicated refuelling procedure has been established for mobile plant in accordance with the environmental management plan for the Dixon Sand operations.

Part Four

DRAFT STATEMENT OF COMMITMENTS

4.1 Introduction

This part of the Environmental Assessment provides a draft Statement of Commitments which outlines the measures which Dixon Sand would undertake in respect of the environmental management of the Site. Those commitments would be in addition to those which are currently in place as part of the conditions of consent which direct the existing extraction on the Site.

4.2 General

(a) The proposed modification would be undertaken in accordance with the Environmental Assessment prepared by Nexus Environmental Planning Pty Ltd, including Attachments.

(b) The continued extraction of material from Lots 1 and 2, DP 547255 would be undertaken in accordance with the modified conditions of Development Consent No.250-09-01.

4.3 Groundwater

The proposed modification seeks to provide certainty with regard to the depth of extraction such that extraction does not impact on the regional groundwater table as detailed in diagrams prepared by RPS Aquaterra and provided in **Appendix 3** of the Environmental Assessment.

Dixon Sand is committed to the continued monitoring of the borehole network to ensure that suitable data are obtained with regard to the behaviour of groundwater as per the current licensing requirements. The following commitments are made with regard to groundwater.

4.3.1 Groundwater Management Strategy

The strategy for groundwater management is to minimise groundwater inflows from the Sydney Basin Central Groundwater Source to the open cut and preservation of groundwater quality. It involves maintaining the depth of extraction to an elevation which is at least 2 metres above the "wet weather" elevation.

Aspects assessed to be at risk have been previously assessed by RPS Aquaterra (2012) and are presented in Table 4 of the Australian Groundwater Technologies Report (**Appendix 4**) along with mitigation measures for each. That Table is reproduced below as **Table 4.1**.

Table 4.1: Trigger Action Response Plan (TARP) - Table 4 of the Australian Groundwater Technologies Report (**Appendix 4**).

Impact	Observation	Strategy for Mitigation	Monitoring	Monitoring Action	Response
Groundwater level	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: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the water sharing plan.	Baseline GWL data has been used to ensure depth of mining remains above the Sydney Basin Central Groundwater Source. Regular review of monitoring data to ensure mining is maintained above the elevation of the regional water table.	BH 6 and BH7	**Water level**: Increase monitoring frequency to weekly to establish trend	Investigate potential contributing factors: • Confirm trends or anomalies by repeating water level sampling as required • Compare exceedance with climatic conditions • Engage a hydrogeologist to undertake a preliminary investigation and report on any identified changes. Where investigations determine that impacts are the result of Dixon Sands operations or may potentially impact on adjacent bores or surface water users, implement Section 4.2 of this report, which may include: Modify mine plan, increase or obtain groundwater licence to offset impact
Groundwater quality	Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Ensure all spillages are contained, diversion of dirty water into settling ponds, maintenance of machinery to be undertaken in work shop areas. Monitoring of pit sumps will be undertaken as a first line of defence to detect & control the risk of groundwater contamination	MW1 to 5, BH 6 and BH7	**Water Quality**: Repeat sampling of bore to confirm. If so obtain samples for comprehensive analysis from all bores	
Groundwater users	Reported decrease in yield or GWL outside of climatic variations. Reported decrease in water quality parameter outside of baseline variation	Baseline GWL data has been used to ensure depth of mining remains above the Sydney Basin Groundwater source. Regular review of monitoring data to ensure mining is maintained above the elevation of the regional water table.	BH1, 2, 3, 6 and 7	**Water level**: Increase monitoring frequency to weekly to establish trend	
Mine inflows	Observed seepages from pit wall	Regular review of monitoring data to ensure mining is maintained above the elevation of the regional water table. Monitoring of water quality in pit sumps will be undertaken as a first line of defence to control the risk of groundwater contamination	Pit seepages, BH1 to 3 BH6 and 7 and MW1 to 5	**Water level**: Increase monitoring of bores to weekly to establish trend. **Water quality:** obtain comprehensive analysis of seepages. **Volume:** weekly record of pit seepages	

These include both predicted and unpredicted impacts, and, as such, the groundwater monitoring program specifically deals with:

- A mechanism for ensuring the project is compliant with the rules of the Water Sharing Policy (**WSP**) and NSW Aquifer Interference Policy (**AIP**).

- Unforseen impacts on groundwater levels on neighbouring properties and on any

users of groundwater.

- Unforseen impacts of the development on groundwater quality such as around storages.

- Periodical monitoring for changes and local and regional impacts of the quarry on groundwater levels and quality during the project and on a reduced basis for at least five years post mining.

Information gained from the monitoring program has been used to determine the pit extraction depth, which will remain 2 metres above the "wet weather" groundwater level, thereby mitigating any draw down impact to the Sydney Basin Central Groundwater Source.

Ongoing groundwater monitoring serves to notify changes to the groundwater, quality or unforeseen discharges into the pit (interference with groundwater flow). Monitoring is necessary to indicate that an abnormal condition relating extraction has developed as well as compliance with the rules of the WSP and AIP.

A Trigger Action Response Plan (**TARP**) for groundwater will be developed to focus upon appropriate trigger and response actions for the management or mitigation of impacts to the natural environment as a result of extraction. An example is provided in **Table 4.1** but this will be refined following consultation with NSW Office of Water. To ensure compliance with the AIP, triggers will be developed based on the baseline groundwater data and the minimal impact considerations outlined for fractured rock aquifers in Table 1 of the AIP (reproduced in Table 5 of the Australian Groundwater Technologies Report at **Appendix 4**).

The baseline monitoring program which is in place will have established triggers, which will be used to indicate levels of impact and trigger an appropriate response. The fundamental means of determining the magnitude of any impact and the need for further monitoring and/or remedial actions is based upon the impact assessment criteria detailed in **Table 4.2**. The responses (actions) documented in the table are proposed to ensure the timely and adequate management of impacts outside of the established trigger levels.

The TARP has been designed to allow reference to identified risks of impact from extraction to environmental aspects identified within the mining area and surrounds. These may be either predicted or unpredicted.

Table 4.2: Table 3 of the Australian Groundwater Technologies report at **Appendix 4**.

Pre mining	Purpose	Weekly	Fortnightly	Monthly	Bi-annual
BH1, BH2, BH3, BH6, BH7, MW1–5	To obtain baseline, pre mining conditions for Lot 1 and 2 and surrounding area			Water level	
	Provide the foundation for establishing trigger values for investigation				Field Parameters EC,TSS, pH, Turbidity
	Obtain natural variation of regional groundwater level, such that depth of mining can be determined				
During mining					
BH1, BH2, BH3, BH6, BH7, MW1–5	Ensure mining is maintained above the regional groundwater level			Water level	
	Monitor any unforseen water quality impacts, ensuring that there is no change in overall beneficial use category >40 m from site				Field Parameters EC,TSS, pH, Turbidity
	Monitor unforseen regional impacts, ensure there are no WL/WQ impacts to neighbouring private bores				
	Ongoing compliance with the WSP and AIP	No pit seepages are expected, but undertake measurements in the unlikely event that measurable volumes occur		No pit seepages are expected, but take sample in the unlikely event that measurable volumes occur	
Post mining					
BH6, BH7, MW2–5	Monitoring of post mining water level and quality impacts and ensuring ongoing compliance with the WSP and AIP				Water level & Field Parameters

4.3.2 Dixon Sand Responsible Impacts Procedure

Where investigations detailed in the TARP determine that groundwater impacts are the result of Dixon Sand operations or may potentially impact on adjacent bores, the following procedure would be actioned:

- Inform landholders adjacent to streams and/or private bore owners, and the NSW Office of Water of preliminary investigation outcomes, as appropriate.

- Undertake a detailed investigation and assess possible mitigation measures in consultation with the landowner and the NSW Office of Water, as appropriate.

- If deemed necessary, prepare and implement a site mitigation/action plan to the satisfaction of DPI, in consultation with the landowner and the NSW Office of Water, as appropriate.

- Conduct a review of results from the follow up investigation.

- Further, the timing of the above includes, but is not limited to:

    - Results of preliminary investigation reported within one week of completion.

    - Commence preparation of detailed investigation including assessment of possible mitigation measures immediately.

    - Commence preparation of mitigation/action within one week of the need being identified.

4.3.3 Notification of Significant Impact

Where a significant, confirmed impact to the environment or private landowner has occurred according to the TARP, relevant agencies will be contacted immediately.

4.4 Rehabilitation

Conditions 1.15 and 1.15A of the Consent as modified have been formulated to require a bond for rehabilitation purposes.

Dixon Sand is committed to maintaining the bond detailed in conditions 1.15 and 1.15A which it considers is sufficient to cover the cost of rehabilitating the extraction areas and other likely disturbed areas in the event that, in the Director-General's opinion, Dixon Sands has failed to make satisfactory progress on the rehabilitation and landscaping of the Site.

4.5 Flora and Fauna

The proposed modification would result in the removal of vegetation which was previously the subject of an exclusion zone.

Cumberland Ecology has prepared a detailed assessment of the impact the removal of vegetation would have on the environment of flora and fauna (refer **Appendix 7**). Chapter 5 of that report details the mitigation and compensatory measures which would be established by Dixon Sand as follows.

4.5.1 Measures to Mitigate Impacts

Minimising Vegetation and Habitat Loss

In order to minimise clearing impacts and unnecessary disturbance to native vegetation which occurs outside of the proposed modification area, the following procedures will be implemented:

- The limits of clearing will be delineated during the construction process and marked clearly on plans and on the ground;
- Native vegetation to the south of the identified clearing areas will not be disturbed, and
- Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

Staged Clearing

Under the approved extraction plan for the Site, clearing and extraction will be completed in stages. Within this approved extraction plan, it is proposed that clearing of vegetation in proximity to *Melaleuca deanei* should be avoided until Stage 2. This will aim to avoid individuals of *Melaleuca deanei* as long as possible. The aim of this approach is to enable cuttings and seed to be collected from individuals in the proposed modification area to be planted in the rehabilitated areas post extraction.

Immediately prior to clearing of the second stage, all *Melaleuca deanei* within the proposed modification area will be carefully removed and translocated to existing rehabilitated lands within the extraction lease area.

Translocation of Topsoil

Topsoil from the proposed modification area will be removed to a depth of between 50 and 100 mm and stockpiled for use in rehabilitation. This is a well recognised method for conducting post-extraction rehabilitation. The topsoil contains native seeds, rhizomes

and bacteria and has been shown to be highly effective at remediating disturbed sites if it is applied as soon as possible after being removed. Topsoil removed from the proposed modification area may contain viable seed of *Tetratheca glandulosa* which could germinate in rehabilitated areas.

Pre-clearing Surveys

Prior to any clearing of vegetation in the proposed modification area, pre-clearing protocols will be followed to avoid injuring native fauna, including:

- Preparation of an inventory of trees and hollows to be removed, prior to clearing;
- Checking hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands;
- Nest boxes or salvaged tree hollows will be provided in nearby woodland or stored for re-use when the area is rehabilitated to compensate for the hollows to be removed due to vegetation clearance, and the numbers will be directly proportional to the number of hollows removed, and
- If present, boulders and large logs will be placed in nearby areas of retained vegetation to allow their continued use as fauna habitat, or for re-use in rehabilitation.

A fauna ecologist will be on hand at all times to supervise clearing and to rescue any animals still remaining in the clearing area following the pre-clearance surveys. The fauna ecologist will handle any animals injured during the process and will determine whether veterinary help is needed.

Rehabilitation

A plan showing the proposed final landform for the Site after rehabilitation has been prepared by McKinlay Morgan Surveyors (**Figures 2.3 and 2.7 and Appendix 6**). All areas disturbed by extraction activities in the proposed modification area will be rehabilitated after extraction. It is understood that the already approved extraction areas will be rehabilitated to a farming landscape, however, in recognition of the biodiversity values in the proposed modification area, it is proposed to be rehabilitated with the objective of recreating and establishing a self-sustaining landscape which resembles the original vegetation communities and is able to support a diverse range of viable flora and fauna populations, including those threatened species recorded from the proposed modification area.

In order to further enhance biodiversity in the Site, it is proposed that additional strategic areas in the Site be rehabilitated to woodland, instead of the previously proposed farmland.

These areas are those which are in the approved extraction areas to the east and north of the proposed modification area but which currently contain native vegetation and link to existing native vegetation outside of the Site to the north which will not be disturbed by the project. The rehabilitation of these areas to contain woodland communities will recreate vegetated corridors in the landscape which will facilitate fauna movement, and genetic flow between populations. It will provide connectivity between the areas of remnant vegetation in and near the Site and the large areas of intact vegetation to the east.

Rehabilitation Corridor

Figure 4.1 shows the location of a proposed rehabilitation corridor.

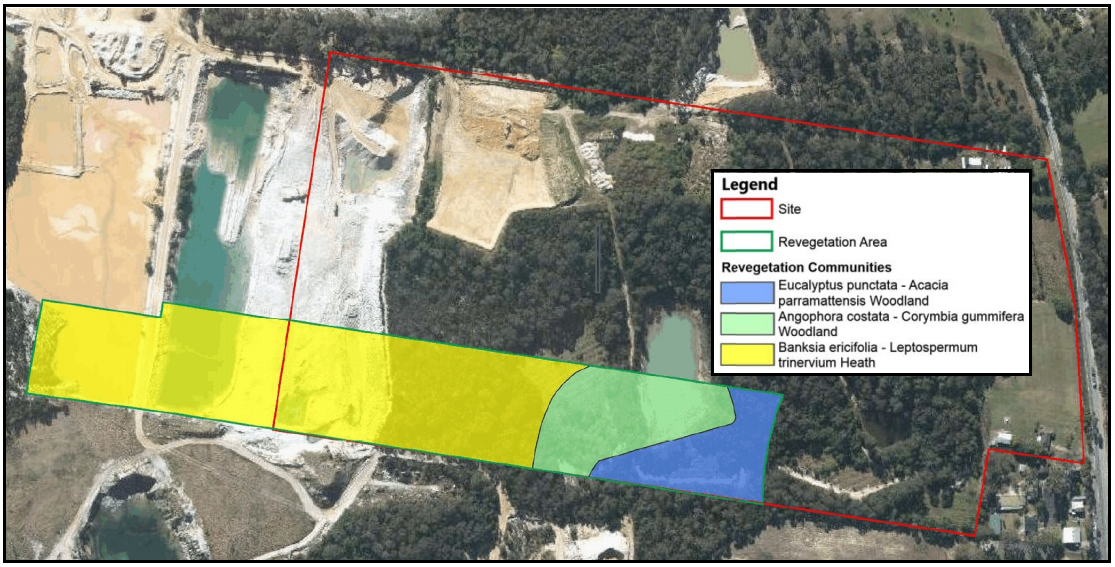

Figure 4.1: Rehabilitation Corridor.

The rehabilitation corridor occurs partially outside the Site, but is part of a broader rehabilitation strategy for the quarry. The corridor will create 6.83 ha of full-structured vegetation, approximately 100 metres in width and approximately 650 metres in an east-west direction.

The corridor will create a link between the remnant native vegetation to the west of the Site and the vegetation retained within the 250 metres buffer to the Maroota Public School. This vegetation has connectivity to vegetation to the east of the Site, and more broadly to Marramarra National Park. The corridor has previously been identified as being restored to agricultural land, therefore, the proposed revegetation and restoration of this area is a positive outcome for biodiversity within the Site and the locality. The vegetated corridor will be created using stockpiled topsoil from the clearing of other areas, with the topsoil being stored in accordance with guidelines to ensure the viability of the seed within the soil in the long term. Revegetation will be a staged process, with areas rehabilitated following extraction of sand. Vegetation communities currently existing on the Site will be replicated through the use of stored topsoil from the original communities. Where topsoil is not available to be translocated, such as in previously cleared areas, common species from the vegetation community will be planted. An

analysis of vegetation communities adjacent to the Site and the underlying geology have been used to determine the vegetation communities to be restored. The vegetation communities to be restored will include:

- *Banksia ericifolia – Leptospermum trinervium* Heath (4.66 ha);
- *Angophora costata – Corymbia gummifera* Woodland *(1.19 ha)*, and
- *Eucalyptus punctata – Acacia parramattensis* Woodland (0.98 ha).

Areas which currently exist as exotic vegetation will be restored to their likely previous native vegetation community. In particular, the area of exotic orchard will be restored to fully structured Eucalyptus punctata woodland. The revegetation will be designed to replicate natural vegetation structure. Further analysis of vegetation communities to be restored will be detailed within the Rehabilitation Management Plan.

Local provenance native plant species will be utilised in rehabilitation where possible and seed will be collected from native vegetation in the study area to ensure genetic diversity is maintained. In particular, seed and cuttings will be taken of *Melaleuca deanei* prior to clearing for future propagation and planting in the proposed modification area.

The rehabilitation will be undertaken in two stages:

- replacement of topsoil and natural regeneration of native species, and
- targeted planting of native species which have not germinated and targeted planting of *Melaleuca deanei.*

Initially, topsoil removed from the proposed extraction areas will be stockpiled and then replaced after extraction is complete. Extraction will be undertaken to an approximate depth of 30 metres, and after extraction this will be in-filled to a depth of 5 metres below the current land level. The stockpiled topsoil will then be spread onto this surface to provide an appropriate growing medium to regrow native species and also to conserve the native seed bank of local ecological communities. It is expected that significant regrowth will occur from seeds stored within the seed bank of this topsoil which will improve the quality and diversity of native growth in rehabilitation areas and maximise the establishment of a diversity of native species, particularly the understorey species.

The second stage of rehabilitation will involve the targeted planting of particular species which may be missing in the native vegetation community. This will depend on the results of the natural germination of the seed bank, but it may include canopy tree species, understorey shrubs or grasses. In this stage of rehabilitation, efforts will be made to establish a viable population of *Melaleuca deanei* through planting seedlings propagated from cuttings or seed.

All rehabilitated areas will be managed for conservation to ensure that the ecological function of native vegetation communities will be recreated and that rehabilitated areas will provide high quality habitat for native flora and fauna. This will include weed and

feral animal control, additional planting with native species if required, and other management actions as required. For the recreation of the habitat values of the proposed modification area, the following measures will be implemented, if necessary:

- Use of locally occurring native shrubs, trees and groundcover plants for planting;
- Inclusion of logs, dead trees and stumps in strategic locations to enhance fauna habitat;
- Provision of vegetative links to bushland remaining in the study area, and
- Measures to manage weeds and feral animals.

Monitoring

A monitoring program will be developed to monitor the progress of the rehabilitated vegetation in the proposed modification area, including both vegetation monitoring and threatened species monitoring. This will provide data to determine the level of success of the rehabilitation measures and to track its progress.

i. Vegetation Monitoring

Vegetation monitoring sites will be established in rehabilitation areas and will be monitored in the long term to allow changes in species composition and structure over time to be quantified. Information will be used in adaptive management, in order to continually improve the outcomes of rehabilitation. Appropriate data management procedures will be implemented to ensure that all data is collected using appropriate techniques and suitably analysed to allow meaningful spatial and temporal comparisons to be made.

ii. Threatened Species Monitoring

Monitoring will also be undertaken on the species of threatened flora which will be established in the rehabilitation area, including *Melaleuca deanei*, in order to determine whether the rehabilitation has been successful in establishing viable populations of these species.

Threatened species monitoring will involve conducting targeted threatened species surveys annually in the rehabilitation areas in order to record the abundance and health of these species. This would focus on *Melaleuca deanei*, which is a priority for introduction. Key indicators for monitoring would be the abundance of individual threatened species.

iii. Weeds and Feral Animal Monitoring

A weed and feral animal monitoring program will also be established as part of the monitoring program. This will include monitoring for the presence and abundance of exotic species recorded from the proposed modification area. The monitoring program

will allow for early recognition of increases in the abundance or distribution of weed species and will enable appropriate action to be taken in a timely manner.

Preparation of a Rehabilitation Management Plan

In order to provide a comprehensive framework for the implementation of the proposed biodiversity impact mitigation and offset measures, a Rehabilitation Management Plan (**RMP**) will be prepared and implemented for the project prior to the commencement of removal of vegetation. The RMP will ensure that the project's conservation objectives are met and that impacts to biodiversity are adequately managed for the life of the project. The RMP will incorporate all of the impact mitigation measures as described above which are proposed to be undertaken for the project, and provide detailed specifications for their implementation. The RMP will include the following:

- A description and plan of rehabilitation measures (long and short term);
- Measures to protect local biodiversity values;
- Details of designated areas for rehabilitation and conservation;
- Specifications for pre-clearing surveys and fauna rescue or translocation protocols where practical;
- Vegetation clearing protocols limiting clearance or disturbance of native vegetation;
- Details of revegetation priorities and techniques;
- Control and ongoing management of environmental and noxious weeds;
- Control and ongoing management of feral animals;
- Details of monitoring methodology;
- Description of key performance indicators against which to measure progress, and
- Specification of appropriate review periods where progress is reviewed and the document updated as required.

The RMP will prescribe further information on the staged rehabilitation of the proposed modification area and how it will be returned to woodland and/or heath. This will include final landform design, and rehabilitation methodology.

The RMP is intended to be a working document which guides all facets of biodiversity management for the project, and will include clear objectives and actions.

The RMP will specify what measures will be undertaken, how they will be undertaken, and will provide a time line to ensure that all activities are conducted according to the

plan. The RMP will include clear objectives, key performance objectives and management actions to ensure biodiversity values are protected and the proposed mitigation measures are implemented.

Part Five
CONCLUSION

5.1 Introduction

Dixon Sand seeks the approval of the Minister for Planning and Infrastructure to modify Development Consent No.250-09-01 to permit further extraction on Lots 1 and 2, DP 547255, Old Northern Road, Maroota.

Development Consent No.250-09-01, as modified, permits:

(a) development for the purposes of an extractive industry on Lots 1 and 2, DP 547255 and Lots 29 and 196, DP 752025.

(b) the continued use of the existing central processing plant on Lot 196, DP 752025.

(c) water management and rehabilitation operations over Lots 1 and 2, DP 547255, and Lots 29 and 196, DP 752025.

The original approval for extraction on Lots 1 and 2, DP 547255 contained conditions of consent which precluded extraction of sand in the areas noted as "exclusion area" and "area of shallow groundwater". The "exclusion area" was previously identified as containing Shale/Sandstone Transition Forest (**SSTF**) species and the "area of shallow groundwater" was believed to be an area where the regional groundwater was close to the existing land surface.

In recent times, Dixon Sand has commissioned Cumberland Ecology to investigate the "exclusion area" while RPS Aquaterra and Australian Groundwater Technologies have investigated the occurrence of the regional groundwater below Lots 1 and 2, DP 547255 and other extraction areas in the Maroota area.

The conclusion of the above reports are as follows.

5.2 Flora and Fauna

The Cumberland Ecology Report (refer **Appendix 2**) concludes:

- The vegetation on the Site is not SSTF as listed under the Final Determination of the Threatened Species Conservation Act 1995.

- The vegetation on the Site lacks the typical geology and soils to support SSTF, and the species present on the Site are typical of sandstone vegetation rather than SSTF. In particular, the typical tree species which dominate this community are

essentially absent from the Site.

- The vegetation on the Site:

  (i) Does not conform to the Final Determination for SSTF;

  (ii) Does not conform to or pass the test prescribed in Tozer et al. (2010) for SSTF;

  (iii) Does not occur on geology suitable for the development of SSTF, and

  (iv) Conforms best to non-listed sandstone dominated vegetation.

- The vegetation on the Site is Coastal Sandstone Ridgetop Woodland as described in Tozer et al. (2010).

- The zone to protect the Site on the basis that it is SSTF is flawed and unwarranted. Furthermore, the vegetation is now relatively isolated from other occurrences of native vegetation by surrounding quarrying. The long term viability of such vegetation would be difficult to maintain and the maintenance of such vegetation would not provide a substantial positive conservation outcome.

Following from the above conclusions, Cumberland Ecology has undertaken a comprehensive assessment of the impact the proposed removal of vegetation from the modification area would have on flora and fauna (refer **Appendix 7**). Cumberland Ecology has concluded:

> *The Proposed Modification would have a small impact on the biodiversity values in the locality. Clearing within the Proposed Modification area will result in the loss of 4.30 ha of vegetation, including 1.82 ha of woodland and 1.86 ha of heath.*
>
> *There are no EECs occurring within the Proposed Modification area. Two threatened flora species and five threatened fauna species were recorded within the Study Area during the current surveys. A small area of vegetation and associated habitat will be removed from the Proposed Modification area, resulting in some limited ecological impact in the locality. However, these impacts would not be significant as there are broad areas of similar biodiversity values in the locality, including within conservation reserves such as Marramarra National Park, Dharug National Park, Parr State Conservation Area and Berowra Valley National Park.*
>
> *Under the approved DA for the Site, vegetation and associated habitat within the Proposed Modification area will remain isolated and potential impacted by surrounding land uses. Further, the original intent to rehabilitate surrounding lands to farm land will leave habitat within the Proposed Modification area isolated in the long-term.*
>
> *In recognition of the potential ecological impacts of the Proposed Modification,*

a package of mitigation and compensatory measures is proposed to be implemented. Mitigation and compensatory measures will focus on the rehabilitation of land within the Proposed Modification area to restore native vegetation communities representative of those to be removed. Further, rehabilitation of woodland and/or heath in other areas of the Site is recommended to compensate for any loss of wildlife corridor values under the Proposed Modification area.

This assessment has found that there are large areas of nearby known habitats for all of the impacted communities, threatened flora and threatened fauna within the locality. It is recognised that the Proposed Modification will have a small impact on the habitat for these communities and species. However, the combined mitigation and compensatory measures to be implemented are likely to sufficiently ameliorate these impacts to the extent that no threatened species are likely to become extinct as a result of the Proposed Modification.

5.3 Groundwater

The conclusions drawn by RPS Aquaterra (refer **Appendix 3**) are:

- Lots 1 and 2, DP 547255 and the remainder of the Dixon Sand extraction area is underlain by a series of shallow and limited extent zones of non water-bearing unconsolidated horizons of weathered clays, sandstones and shales. These low permeability layers permit temporary storage of groundwater at various shallow depths. These temporary perched storages have limited resource value because, like the Maroota Sand, they are discontinuous and of limited extent and low storage.

- Based on the inferred groundwater contouring the "wet weather high groundwater level" would be at a minimum elevation of about 171 metres AHD towards the east and 151 metres AHD in the west. Therefore, sand extraction on Lots 1 and 2, DP 547255 could occur to an elevation of 173 metres AHD in the east grading to 153 metres AHD in the west, therefore, leaving a 2 metre distance of separation which would limit potential interference with the regional water table.

- The total or partial removal of the shallow perched groundwater zones is unlikely to have any major impacts to the local hydrogeological regime, or to the regional aquifer system, other than potentially increasing the rate of rainfall recharge to the regional aquifer system. This potential increase in recharge is negligible when compared to the larger scale recharge mechanisms associated with the Hawkesbury Sandstone.

- There are nine registered groundwater abstraction bores within approximately 1 kilometre of Lots 1 and Lot 2, DP 547255. All of the bores listed were terminated at depths well below the extent of the low permeability layers, therefore, none of these production bores would significantly rely on or abstract

from groundwater stored above these layers and would, therefore, not be significantly impacted by an extension of the quarrying activity.

- Continued observations from the borehole network will be required to monitor general groundwater behaviour as part of the ongoing operations licensing requirements.

Aquifer Interference Policy

As discussed in this Environmental Assessment, the depth of extraction will not extend to the depth of the groundwater level in this aquifer and the risk of aquifer interference will be mitigated through measures described under **Part 4.3.1**.

The outcomes from the RPS Aquaterra 2012 study show that the proposed modification is compliant with the rules of the AIP, however, for clarity all of the rules and requirements stipulated in the AIP (Table 1 and Section 3.2 of the AIP) have been summarised in the tables 5 & 6 of the Australian Groundwater Technologies report at **Appendix 4**.

5.4 Conclusion

This Environmental Assessment has concluded that, with the proposed modification to Development Consent No.250-09-01, there would be no impact to the environment of the Site and its environs over and above that which was identified in the assessment of Development Application No.250-09-01.

The proposed modification, with commitments in place as described in **Part 4**, would ensure that a valuable resource is utilised to its economic capacity and ensure that the Site would be rehabilitated to be consistent with the agricultural landscape of the area and to ensure that vegetation lost as part of the proposed modification is re-established on part of the Site.

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