Hornsby Shire Council

Hornsby Quarry Rehabilitation Environmental Impact Statement

VOLUME 1 – MAIN REPORT

February 2019

Prepared under the *Environmental Planning and Assessment Act 1979*

Environmental Impact State prepared by	**Names**	David Gamble	Anna Montgomery
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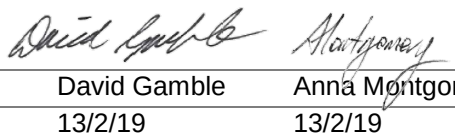
	Address	GHD Pty Ltd Level 15, 133 Castlereagh Street Sydney NSW 2000	
	In respect of	Hornsby Quarry Rehabilitation Project	
Development Application	Applicant name:	Hornsby Shire Council	
	Applicant address	296 Peats Ferry Road (formerly Pacific Highway) Hornsby NSW 2077	
	Land to be developed	The project is to be carried out on land as shown in the Environmental Impact Statement	
	Lot no, DP/MPS, vol/fol etc	• Lots A, B, C, D and E in Deposited Plan (DP) 318676 • Lot 1 DP 926103 • Lot 1 DP 926449 • Lot 1 DP 114323 • Lots 1 and 2 in DP 169188 • Lot 7306 DP 1157797 • Lot 1 DP 859646 • Lot 1 DP 926449 • Lot 13 DP 734459 • Lot 114 DP 749606 • Lot 213 DP 713249 • Summers Avenue, Hornsby partly formed • Old Mans Valley Trail	
Environmental Impact Statement	An Environmental Impact Statement is attached		
Certificate	I certify that I have prepared the contents of this Environmental Impact Statement and to the best of my knowledge: • It is in accordance with the requirements of Part 4; • It contains all available information that is relevant to the Environmental Impact Statement of the development; and • That the information contained in the Environmental Impact Statement is neither false nor misleading.		
	Signatures		
	Names	David Gamble	Anna Montgomery
	Date	13/2/19	13/2/19

Executive summary

INTRODUCTION

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services (Roads and Maritime), to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has been undertaken at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). This Environmental Impact Statement (EIS) has been prepared in accordance with the provisions of the EP&A Act.

It addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the Secretary's Environmental Assessment Requirements (SEAR No 1167) dated 6 September 2017.

SITE LOCATION

The project is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north west of the Sydney central business district.

The site can be defined as:

- Lots A, B, C, D and E in Deposited Plan (DP) 318676
- Lot 1 DP 926103
- Lot 1 DP 926449
- Lot 1 DP 114323
- Lots 1 and 2 in DP 169188
- Lot 7306 DP 1157797
- Lot 1 DP 859646
- Lot 1 DP 926449

- Lot 13 DP 734459
- Lot 114 DP 749606
- Lot 213 DP 713249
- Summers Avenue, Hornsby partly formed
- Old Mans Valley Trail

PROJECT OVERVIEW

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform generally in accordance with Option 1 in the Clouston Associates (2014) Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands (p. 88).

Approximately 500,000 m^3 of spoil is expected to be generated onsite from earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from a proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take two years to complete.

THE PROPONENT

The proponent is Hornsby Shire Council.

CONSULTATION

In accordance with the SEARs, consultation activities were undertaken to provide details of the project and seek input from relevant stakeholders.

A wide range of activities and tools were used to engage with government agencies, stakeholders and the community during development of the EIS. This included:

- Information distribution (letter and newsletter) to nearby neighbours and opportunity for face-to-face meetings
- Letters to key government agencies
- Email blast to 40,000 residents
- Letters and emails to stakeholders
- Dedicated project website (hornsbypark.com.au)
- Community Deliberative Forum and stakeholder meeting presentations
- Information boards at Hornsby Mall community ‘swing by’

- Social media posts, media release
- Presentations to Hornsby Shire Council
- Reconvene the Community Deliberative Forum
- Stakeholder meeting with Environmental and Bushwalking Stakeholder groups
- Community 'swing by' in the Mall

The key issues raise during consultation are addressed in the EIS.

ENVIRONMENTAL ASSESSMENT

Noise and vibration

Three scenarios containing worst case location of plant and equipment with expected throughput rates were modelled. Noise levels are predicted to exceed the construction noise management levels (NMLs) at most of the sensitive receivers within the study area during recommended standard hours. Noise levels are not predicted to exceed the highly noise affected criteria at any residential receivers.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works will be temporary during the construction period and would not represent a continuous impact on the community and surrounding environment due to changes in activities and plant used. The predicted noise levels are generally considered conservative and would likely only be experienced for limited periods during construction. Potential impacts would be reduced through the introduction of feasible and reasonable mitigation measures which have been identified in the EIS.

Safe working distances for vibration activities have been identified for structural damage to standard/heritage structures and for human comfort. No adverse structural damage impacts to buildings are anticipated as a result of the project. One building within Hornsby TAFE has been identified within the safe working distance for human comfort. Mitigation measures have been recommended to reduce potential construction vibration impacts.

Traffic noise levels resulting from construction vehicle movements are predicted to meet the Road Noise Policy (DECCW, 2011) noise criteria when assessed at residences adjacent to Bridge Road, Peats Ferry Road, Dural Street and Quarry Road.

Three scenarios containing worst case location of plant and equipment with expected throughput rates were modelled to account for likely particulate matter dispersion impacts. Predicted particulate matter concentrations were assessed against criteria provided in the EPA (2016) Approved Methods.

No particulate matter criteria exceedances were predicted. Based on assumptions as outlined in the assessment, the predicted particulate matter emission from the reshaping and rehabilitation of the quarry are expected to comply with the relevant criteria when assessed in accordance with the Approved Methods (EPA, 2016). The application of standard dust mitigation measures outlined in this report will assist to minimise potential particulate matter impacts.

Soils and water

A risk assessment was undertaken to assess the water related risks of the project such that a subsequent impact assessment could be undertaken. The primary risks identified were with relation to impacts on groundwater levels and availability, non-compliance with water licencing requirements, impact on the quality of external groundwater and impact on the quality or quantity of water in downstream surface water systems due to dewatering activities.

Impact assessment was undertaken finding that the water related impacts of the project are not anticipated to be significant. This is on the basis of:

- A water balance and groundwater flow assessment identifying that groundwater pumping would be significantly less than current licence entitlements, with the pump out requirement predicted to be less than under historic dewatering activities.
- The water quality of water discharged from the void is anticipated to be generally similar to that of the receiving environment. This is supported by existing void water quality monitoring data, assessment of the impacts of emplacing material undertaken for the NorthConnex project, and water balance results showing no increasing accumulation of concentrations of water quality constituents.
- The flow direction of groundwater being inwards to the void, mitigating the risk of discharging lower quality water to the groundwater system (noting that this lower quality water is not anticipated).
- Dewatering rates are anticipated to be less than under historical dewatering activities and therefore not result in geomorphological or waterway formation impacts.

Biodiversity

The majority of the site has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the site is a mixture of remnant, regrowth, revegetation and rehabilitation. Two native plant community types are present at the site:

- Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (BGHF), a critically endangered ecological community (CEEC) listed under the TSC Act. This form of the community does not meet the condition criteria for inclusion as the EPBC Act-listed community.
- Blackbutt Gully Forest (HN648) (not a threatened community).

The project would remove 0.74 ha of Blue Gum High Forest, 1.76 ha of Blackbutt Gully Forest and 3.39 ha of exotic grassland. Mapping of biodiversity values, in particular threatened ecological communities, early in the project has allowed some avoidance of impacts in the detail design phase. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest. A number of iterations of the proposal design have been made, each one further minimising impacts on native vegetation and fauna habitat. This has allowed impacts on biodiversity values to be substantially reduced.

The site generally has patches of good fauna habitat values, due to moderate habitat complexity, allowing for a moderate diversity of fauna species. Species recorded included species that require large tracts of native vegetation to persist, as well as generalist species able to utilise disturbed urban areas. Threatened species recorded at the site during recent and previous surveys include the Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (possible identification based on anabat analysis).

The project would remove up 2.50 hectares of canopied native vegetation and 3.39 hectares of exotic grassland vegetation within the project site. This habitat is highly modified and subject to disturbance including edge effects and noise from the surrounding urban environment. Up to five hollow-bearing trees would be removed. These have small hollows and would not provide breeding habitat for forest owls or cockatoos, but may provide roosting habitat for microchiropteran bats.

An assessment of significance pursuant to s5A of the EP&A Act has been prepared for Blue Gum High Forest. The project is highly unlikely to have a significant adverse effect on the local occurrence of Blue Gum High Forest as:

- The project has been designed specifically to avoid impacts on good quality patches and to minimise impacts on poor quality patches.
- While up to 0.74 ha of poor condition will be removed, extensive, better condition areas of this community will be retained within the wider Hornsby Quarry site outside of the project footprint.
- The vegetation to be impacted comprises the highly modified and degraded, poor condition edges of larger tracts of vegetation, and the project will not substantially increase existing levels of fragmentation and isolation from other areas of habitat

Landscaping works following completion of the project will focus on revegetating areas of Blue Gum High Forest, and will improve the condition of the community at the site in the long-term.

An assessment of significance pursuant to s5A of the EP&A Act has been prepared for the Powerful Owl. Given the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, and lack of impact on breeding habitat, the project is unlikely to result in a significant impact on this species. Similarly, due to the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, the project is unlikely to have a significant impact on the Varied Sittella or hollow-roosting microchiropteran bats.

Given that the project would not have a significant impact on any threatened biota, a Species Impact Statement is not required. Given that the project would impact native vegetation, offsets are proposed in accordance with Council's Green Offsets Code. As there would be no significant impacts on threatened biota, no calculation of offsets in accordance with the Biobanking Assessment Methodology has been provided. As the project is unlikely to have a significant impact on any MNES, no referral is considered necessary and no offset is required for threatened biota listed under the EPBC Act.

A range of mitigation measures have also been proposed to ameliorate potential impacts of the project on habitat throughout the study area, as well as areas downstream of the proposed works. These include provision of no-go zones to protect native vegetation, fauna management protocols, site-specific erosion and sedimentation management strategies and revegetation following construction. The future rehabilitation of the project site, including replantings using species sourced from Blue Gum High Forest and the use of salvaged fauna habitat features, would improve biodiversity values at the site in the long-term.

Aboriginal heritage

During the early stages of the design process, an Aboriginal heritage due diligence assessment of the project was prepared by Artefact Heritage in accordance with the OEH (2010) 'Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales'. The due diligence assessment identified two portions of the investigation area as archaeologically sensitive and recommended further investigation in consultation with the Metropolitan Local Aboriginal Land Council (LALC) be undertaken.

Artefact Heritage subsequently undertook an Aboriginal Archaeological Survey Report (ASR) to assess and identify any Aboriginal sites or areas of archaeological potential that might be impacted by the project. The ASR was undertaken in accordance with the 'Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales' (the Code of Practice) (DECCW, 2010).

The ASR was attended by representatives of Artefact Heritage, the Metropolitan LALC and Council. The survey did not result in the identification of any Aboriginal sites or areas of PAD.

The ASR concluded that the project is unlikely to impact any intact archaeological remains and therefore no further archaeological investigation or mitigation is required. However an unexpected finds policy would be implemented in the event of Aboriginal archaeological deposits being identified during ground works and excavation.

Non-Aboriginal heritage

The project has been developed as far as possible to minimise direct impact on heritage items.

The project would not result in any direct physical impact to the State listed Old Man's Valley Cemetery (SHR 01764), or locally listed items within the site including the 'Old Man's Valley Cemetery, including Higgins' Family Cemetery, sandstone receptacle, cool room and site of Higgins homestead on which the Higgins Family Memorial is located' heritage item (LEP A55), 'Hornsby Park—Lone Pine and sandstone steps' heritage item (LEP 513) and 'Sandstone steps' heritage item (LEP 537). Neutral to negligible impacts are anticipated for heritage items located adjacent to the site.

The majority of areas identified as having archaeological potential would be avoided in the project.

Two areas of archaeological potential have been identified within the extent of works. There is some chance archaeological remains associated with the Higgins family occupation of the site may be impacted in one of these areas to the north, which is partially within the earthworks extent. Mitigation and management measures have been identified to address potential impacts.

There is potential for indirect physical impact by way of vibration during the proposed works to heritage items in the vicinity. This particularly relates to the headstones located within the Old Man's Valley Cemetery.

The project would result in visual changes to the 'Diatreme Hornsby Quarry and surrounding vegetation' heritage item and its setting. The project would therefore result in direct impacts across much of the locally listed curtilage of the 'Diatreme Hornsby Quarry and surrounding vegetation' heritage item.

It is noted that preservation of the exposed diatreme and reinstatement of surrounding vegetation in the site generally as part of the future parkland development would assist in mitigating any potential physical and visual impacts and, as such, the project is considered acceptable from a heritage perspective.

In addition, at present the diatreme and heritage items including Old Man's Valley Cemetery and Diatreme are inaccessible to the public due to safety risks. The project would address the safety risks and enable a public park to be created in the future. The project, by improving safety and accessibility of the site, would potentially result in enhanced community visitation and engagement with the heritage items located within this historic precinct, and provide opportunities for greater understanding of their significant values and associations.

Traffic and transport

For the purpose of the traffic assessment, it was estimated that there would be 30 veh/h entering the project site in the AM peak and 30 veh/h leaving the project site in the PM peak for a worst-case, conservative scenario. In reality, workers would likely be arriving to the site prior to the road network peak. There would also be a fuel truck and approximately 26 heavy plant and equipment deliveries during off-peak hours.

The traffic assessment found that construction traffic generated during both AM and PM peak periods are not likely to be significantly different to that of the existing situation (level of service B; intersection experiences acceptable delays and has available capacity).

The proposed site access is adjacent to Roper Lane and directly provided from Bridge Road, linking to Peats Ferry Road. In accordance with Section 3.2.2 of the *Austroads Guide to Road Design Part 4A: Un-signalised and Signalised Intersections*, both the approach sight distance and safe intersection sight distance were satisfactory in both directions.

The impacts on the public transport services operating in proximity to the subject site as a result of the low volumes of vehicle movements associated with the construction phase, are expected to be insignificant.

Land resources

Erosion

While the erosion potential of many areas of the site is high, the 'inwards draining' nature of the site reduces sedimentation risks dramatically and water quality risks from erosion and sedimentation are anticipated to be manageable through the development of a construction phase soil and water management plan (including consideration of erosion and sediment control) and water quality monitoring program.

Acid sulphate soils

Acid sulfate soils are not expected to occur at the site.

Contamination

A number of areas of potential contamination have been identified as still being present on the site with some having potential to be disturbed as a result of the project. However the majority of the site has very little potential for contamination. Further investigation would be undertaken prior to any works in the immediate vicinity of the former workshop and office building areas to identify appropriate management measures and procedures to manage contamination during construction.

Landform (topography) and geotechnical stability

The project includes extensive earthworks and changes to the landform (topography of the site). The reshaping works would create a landform that is generally in accordance with Option 1 in the Clouston Associates (2014) Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands (p. 88). The landform has been designed to be suitable for future development of a parkland with the flexibility to host a range of recreational activities. The future parkland design would be subject to a separate approval and developed in consultation with the community.

In response to the identified geotechnical challenges, a series of Factor of Safety and risk-based assessments were undertaken. These found:

- Further detailed assessment of the southern quarry wall global stability shows that the stability is acceptable. Therefore, no access constraints or design response are proposed to address the global stability of the southern quarry wall. The existing quarry access road arrangements can be maintained and monitored to keep the factor of safety within acceptable limits. Details can be found in Section 2 of this report.
- The Southern Access Track at the crest of the southern quarry wall has localised instability issues associated with residual soils and fill material eroding and 'slipping off' the rock profile beneath. A robust structural solution (raked mini-pile wall including capping beam

with edge protection) is suggested. It is envisaged that this will enable the existing southern access track to continue to be used for maintenance and pedestrian access in the long term. Details of the concept level proposed solution are contained in Section 6 of this report.

- Northern Spoil Mound stability issues are proposed to be addressed by a combination of proactive engineering measures to improve stability (regrading to a shallower angle, slope reinforcement and drainage measures) with a continuance of long term monitoring and maintenance preferred in some areas.
- Throughout the site a combined approach is proposed to address the localised effects of erosion and small scale slope failures in soil and rock slopes A 'tool box' of measures is proposed including:
  - Toe exclusion zones to prevent park users from exposure to rock-fall and small-scale soil slope failure hazards.
  - Preventative measures such as rock bolts, face mesh, catch fences, catch ditches, facing 'skin' walls (e.g. gabions secured to exposed rock faces) and maintained erosion protection on soil slopes (vegetation erosion protection envisaged in most areas).
  - Monitoring and maintenance as required, in all areas.

The future parkland layout proposes widening, re-alignment and extension of access roads to improve access into the quarry space. This generates several new retaining / deck structures and new cuttings of differing heights and curved geometries.

Some of the proposed new retaining structures will be founded over deep (up to 55 m) fill material and in some areas founded within a few metres of dolerite bedrock at the edges of the park. This situation creates the potential for high differential settlement within the same structure and between adjacent structures.

The structures will need to be carefully designed to minimise the potential for high differential settlements.

Waste management

The following wastes may be generated during the project:

- Vegetation from clearing activities
- Top soil and spoil from earthworks/excavations
- General waste from site personnel (such as food scraps, aluminium cans, glass bottles, plastic and paper containers, paper, cardboard and other office wastes)
- Wastewater and sewage from site office/compounds and amenities

The management of wastes generated during the project would be in accordance with relevant NSW legislation and the principles of the waste management hierarchy set out in the NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (EPA, 2014a).

The project has been designed so that top soil or spoil from earthworks activities would be reused on site. Top soil would be retained for use on other parts of the site as part of proposed rehabilitation and regeneration programs/activities. Vegetation removed would also be mulched on site and blended with retained top soil or directly reused as part of rehabilitation works.

Visual

The visual assessment considered impacts on six groups of potential receptors, including residential receptors, users of nearby educational and recreational facilities and visitors to

recreational biking and walking trails. All receptor groups were determined to have a sensitivity of moderate or high. This was largely due to the quality of natural views and landscapes and the type of outlooks.

The magnitude of impacts on each identified receptor group was determined to be moderate or less, largely due to the location, topography and surrounding vegetation screening which would limit the potential visual impacts or due to the intermittent nature of visitors/users of facilities/trails.

It is noted that following completion of the project, Council intends to develop the site for future community use as a parkland. This future development would improve the visual and landscape aspects of the site and have an overall beneficial visual impact on existing visual receivers.

Works would also be limited to standard work hours only. Therefore, there would be no visual impacts during night time hours as a result of lighting or other activities.

Socio-economic

Social impacts

The site has been closed to the public for a long time. However the project would provide a landform suitable for future development into a community parkland and make the site safe for the community. While this project does not include the parkland development, it is a critical step in the process of opening the site up to the public for recreational use. Potential future social benefits of the change in land use from quarry to community park include improvements to house prices, mental and physical well being from leisure and recreation activities and nature experience, tourism, social cohesion/identify.

It is also noted that by improving safety and accessibility of the site, the project would ultimately allow for enhanced community visitation and engagement with the heritage items located within the site, and provide opportunities for greater understanding of their significant values and associations.

These positive long-term social benefits of development of the future parkland need to be considered against the potential short-term social and amenity impacts of the construction associated with the project

The project is expected to require the direct employment of up to 30 full time equivalent staff on site during the construction works. There would also be indirect employment benefits related to detailed design, investigations, procurement and tendering.

The project has potential to result in amenity impacts (noise and visual) to residents and businesses located in close proximity to the site. The potential negative impacts during construction would be temporary and would be significantly reduced by the implementation of appropriate design features and stringent environmental management controls guided by the Construction Environmental Management Plan.

Economic impacts

The estimated capital investment value of the project is $28 million dollars. The project would also directly employ up to 30 full time equivalent personnel during construction. This would provide a one off boost to the Hornsby economy in terms of local output, employment, wages and salaries and value added.

There would also be economic flow on benefits of the construction spend including flow on industrial effects in terms of local purchases of goods and services and flow on consumption effects.

The project would allow the development of a parkland for community use in the future. The parkland would result in additional tourist visits to the Hornsby region once the park has opened. These benefits would be permanent due to ongoing future parkland visitation.

Rehabilitation

Council is proposing to undertake extensive bush regeneration work across the site. In addition to this, general landscaping is proposed as part of the future parkland development (which will be subject to a separate approval). The bush regeneration measures proposed as part of this project include:

- Retainment of top soil and manufacture of soils
- Tree planting and reestablishment of Blue Gum High Forest

All topsoil from the proposed earthworks would be retained on site for reuse in the bush regeneration work. To supplement the retained topsoils, it is proposed to 'manufacture' soils that replicate the natural soils of the area from proposed areas of cut and by blending it with mulch or compost generated onsite from cleared vegetation (green waste).

There is potential for approximately 32,000 m^2 of the site to be subject to targeted bush regeneration (placement of retained and manufactured soils and tree planting) as part of the project.

In addition to the proposed bush regeneration works for this project, as part of the future parkland development, approximately 89,300 m^2 is expected to be landscaped and approximately 16,000 m^2 is expected to be turfed for sportsfield(s).

The State Government recently provided funding for the preparation and development of the site into a parkland. Council has also set aside additional funding to ensure the rehabilitation elements of the project can be undertaken.

Other issues

Human health

Air quality goals for PM_{10}, and advisory goal for $PM_{2.5}$, have been established by NEPC (NEPC 2002, 2003) that are based on the protection of human health and well-being. The assessment of impacts from any development also requires consideration of air quality goals/guidelines that are outlined in the Approved Methods (EPA, 2016). The guidelines are primarily derived from the NEPC, with the exception of an annual average PM_{10} guideline which is derived from older goals adopted by the EPA (EPA, 1998).

The air quality assessment undertaken for the EIS found that the project is not expected to exceed the air quality goals identified in accordance with the Approval Methods (EPA, 2016) at any nearby private receptors.

While the project is not expected to exceed air quality goals, a number of mitigation measures are also proposed to further reduce the potential exposure associated with the project.

Therefore the project is not expected to result in any significant air quality impact or significant air quality health risk.

The construction noise guidelines applicable to the project (ICNG) has considered the health effects of noise and the relevant guidance from the World Health Organisation and the Environmental Health Council of Australia in determining appropriate noise management levels (criteria).

Noise levels that do not comply with these guidelines/criteria may have the potential to have negative health outcomes for the community adjacent to the project. The ICNG requires feasible

and reasonable management measures to be implemented to minimise impacts. Where this process is followed, and where project works are only expected to occur for a short period of time (as is the case with the project) no adverse health effects are expected to occur in the community.

The noise and vibration impact assessment predicts noise levels would exceed the construction noise management levels at most of the sensitive receivers within the study area during recommended standard hours. Noise levels are not predicted to exceed the highly noise affected criteria at any residential receivers. Potential impacts would be reduced through the introduction of a number of feasible and reasonable mitigation measures.

The noise and vibration impact assessment identified safe working distances for vibration activities for structural damage to standard/heritage structures and for human comfort. No adverse structural damage impacts to buildings are anticipated as a result of the project. One building within Hornsby TAFE has been identified within the safe working distance for human comfort. Mitigation measures have been recommended to reduce potential construction vibration impacts.

Where the proposed noise and vibration management and mitigation measures are adopted, no adverse health impacts are expected in the local community.

Hazard and risk

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development (the project) should be considered a 'potentially hazardous industry' or a 'potentially offensive industry' and a PHA is required.

The results of the Dangerous Goods storage and transport screening indicate that the project would not result in any of the thresholds being exceeded. As a result, the project is not considered to be a 'potentially hazardous industry' and a PHA is not required.

To demonstrate that potential hazards have been identified and control measures are in place, a hazard identification process has been completed. The hazard identification process did not identify any significant hazards with the potential for offsite impact that would not be suitably controlled.

JUSTIFICATION AND CONCLUSIONS

The project is considered justified because:

- It is consistent with strategic land use planning for the site
- It provides a number of benefits
- It would not have any significant long term negative environmental or social impacts
- It is in the public interest and the site is suitable for the project
- It is consistent with the objects of the EP&A Act
- It is consistent with the principles of ecologically sustainable development
- The consequences of not proceeding with the project are not considered to be acceptable.

This EIS has been prepared in accordance with the provisions of the EP&A Act. It addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the SEARs).

Detailed environmental investigations have been undertaken to assess the potential environmental impacts of the project. These included specialist assessments of noise and vibration, air quality, soils and water, biodiversity, heritage, traffic and transport, land resource,

waste management, visual amenity and socio-economics. The EIS has documented the potential environmental impacts, considering both negative and positive impacts (and benefits).

Many of the potential issues identified in the initial risk assessment of the project would be effectively managed/eliminated through careful design features. To manage other issues, and in some cases eliminate them completely, the EIS chapters outline a range of mitigation measures that would be implemented during the project construction. The EIS has demonstrated that the project would not have a significant impact on the community or environment, with implementation of the proposed mitigation measures.

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Glossary and abbreviations

Term	Definition
2016 Planning Approval	The approval granted to Roads and Maritime Services to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry
AHIMS	Aboriginal Heritage Information System
Approved Methods	'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (EPA, 2016)
ARD	Archaeological Research Design
ASR	Aboriginal Archaeological Survey Report
ASRIS	Australian Soils Resource Information System
AUSRIVAS	Australian River Assessment System
BBAM	Biobanking Assessment Methodology (OEH, 2014)
BTEX	Benzene/ toluene/ ethylbenzene/ xylenes
CEEC	Critically endangered ecological community
CLM Act	*Contaminated Lands Management Act 1997*
Council	Hornsby Shire Council
DA	Development application
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
DEE	Commonwealth Department of the Environment and Energy
Dilution factor	A factor representing the potential accumulation of concentrations above the concentration in incoming groundwater.
DP	Deposited Plan
DPE	Department of Planning and the Environment
DPI	Department of Primary Industries
EETM	Emissions Estimation Technique Manual
EIS	Environmental Impact Statement
ENM	Excavated natural material
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
Extent of works	Refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. This can be considered the proposed disturbance footprint. It incorporates site access and internal roads/tracks.
FM Act	*Fisheries Management Act 1994*
GDE	Groundwater dependent ecosystem
GHD	GHD Pty Ltd
Heritage Act	*Heritage Act 1977*
HIPAP	Hazardous Industry Planning Advisory Paper

Term	Definition
ICNG	Interim Construction Noise Guidelines
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
km	kilometres
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90 per cent of the measurement period.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
L_{Amax}	The maximum A-weighted sound pressure level occurring in a specified time period.
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local government area
LoS	Level of Service
MNES	Matters of national environmental significance
NCA	Noise catchment area
NML	Noise management level
NPI	Noise Policy for Industry
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OCP	Organochlorine pesticides
OEH	Office of Environment and Heritage
OPP	Organophosphate pesticides
PAD	Potential archaeological deposit
PAH	Polycyclic aromatic hydrocarbons
PAR	Photographic Archival Recording
PCB	Polychlorinated biphenyls
PCT	Plant community type
PHA	Preliminary hazard analysis
PMST	Protected Matters Search Tool
PNTL	Project noise trigger level
POEO Act	*Protection of the Environment and Operations Act 1997*
POM	Plan of Management
Rating background level	The overall single-figure background noise level representing each assessment period (day/evening/night) over the whole monitoring period.
REHV	Regional environmental health values
RNP	Road Noise Policy
Roads and Maritime	Roads and Maritime Services
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SESL	Sydney Environmental Soil Laboratory
SHR	State Heritage Register
SISD	Safe Intersection Sight Distance
SoHI	Statement of Heritage Impact
TEC	Threatened ecological communities

Term	Definition
The Blue Book	Landcom. (2005). Managing Urban Stormwater, Soils and Construction 'The Blue Book' Vol 1.
The detwatering licence	Bore licence 10BL602742
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
TPH	Total petroleum hydrocarbons
TSC Act	*Threatened Species Conservation Act 1995*
VDV	Vibration dose value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
VENM	Virgin excavated natural material
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).
WM Act	*Water Management Act 2000*
WSP	Water Sharing Plan

1. Introduction

1.1 Overview

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services (Roads and Maritime), to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has been undertaken at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). This Environmental Impact Statement (EIS) has been prepared in accordance with the provisions of the EP&A Act.

It addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the Secretary's Environmental Assessment Requirements (SEAR No 1167) dated 6 September 2017 (provided in Appendix A).

1.2 Project overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform suitable for future development into a community parkland.

1.3 The proponent

The proponent is Hornsby Shire Council.

Hornsby Shire is a local government area in the northern region of Sydney that manages the area of land called Hornsby Shire Council, an area of approximately 500 square kilometres (km^2) extending from Brooklyn in the north, to Wisemans Ferry and Glenorie/Dural in the west, Wahroonga and Ku-ring-gai Chase National Park in the east and the M2 motorway in the south.

Hornsby Shire was incorporated in March 1906 and after the May 2016 proclamation administers the Shire on behalf of an estimated resident population of 151,000 residents and ratepayers.

1.4 Overview of the planning and approvals requirements

The project is development for the purpose of recreational area, which is permissible with consent requiring submission of a new development application (DA) to Council.

The project involves processing of materials for recycling and reuse and therefore is considered to trigger designated development provisions for crushing grinding and separating works, requiring an EIS to be prepared to support the DA.

If the project has a capital investment value of more than $5 million, it is also defined as regional development under Clause 4 of Schedule 4A of the EP&A Act. The development will therefore be notified and assessed by Hornsby Shire Council (using an independent planning consultant), however the consent authority is the Sydney North Planning Panel.

1.5 Purpose and structure of this environmental impact statement

This EIS supports an application for development approval from the Sydney North Planning Panel under Part 4 of the EP&A Act. It has been prepared in accordance with the EP&A Act and the SEARs.

The EIS provides:

- Information on the project, including need and alternatives considered
- An assessment of the potential key environmental impacts of the project as identified by the SEARs
- Council's commitments in terms of measures to minimise and manage potential environmental impacts.

The EIS is structured as follows:

Volume 1 – Environmental impact statement (main report)

Volume 1 includes:

- An introduction to the EIS (Chapter 1)
- Information on the statutory framework (Chapter 2)
- A summary of the consultation that occurred during the assessment process (Chapter 3)
- A description of the site including location, land ownership, land use, environmental setting and historical context (Chapter 4)
- An overview of strategic planning drivers, the project need and context and alternatives considered (Chapter 5)
- A description of the project including an overview of the proposed works, plans, proposed construction method and staging/timing and overview of future rehabilitation and use of the site (Chapter 6)
- Identification and prioritisation of environmental issues (Chapter 7)
- The results of the assessment of key environmental issues (Chapters 8 to 19)

- Proposed environmental management and a compilation of proposed mitigation measures (Chapter 20)
- The conclusions and justification for undertaking the project including an evaluation of the project with regard to social, economic and environmental considerations and the results of the environmental impact assessment (Chapter 21)
- References (Chapter 23)

Volume 2 and 3 – Appendices

Volume 2 and 3 contain the specialist technical/background reports prepared as part of the environmental impact assessment process, supporting correspondence and consultation information:

Volume 2:

- Appendix A – Secretary's Environmental Assessment Requirements
- Appendix B – Consultation material
- Appendix C – Noise and vibration assessment
- Appendix D – Air quality assessment
- Appendix E – Water assessment
- Appendix F – Biodiversity assessment

Volume 3:

- Appendix G – Aboriginal survey report
- Appendix H – Statement of heritage impacts
- Appendix I – Traffic assessment
- Appendix J – Geotechnical assessment
- Appendix K – Soil profile investigation

1.6 SEARs

The SEARs and location of where each requirement is addressed in the EIS is provided in the following table.

Table 1.1 Secretary's Environmental Assessment Requirements

Requirement	Reference
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In particular, the EIS must include:	
• an executive summary;	Page i
• a comprehensive description of the development, including: – a detailed site description and brief history of previous quarrying and fill emplacement on the site, including a current survey plan; – the layout of the proposed works and components (including any existing infrastructure that would be used for the development); – an assessment of the potential impacts of the development, as well as any cumulative impacts, including the measures that would be used to minimise, manage or offset these impacts; – a detailed rehabilitation plan for the site; – any likely interactions between the development and any existing/approved developments and land uses in the area, paying	 Chapter 4 Chapter 6 Chapters 7 to 20 Chapter 4 Chapters 7 to 20

Requirement	Reference
particular attention to construction impacts on nearby residential development; – a list of any other approvals that must be obtained before the development may commence; – the permissibility of the development, including identification of the land use zoning of the site; – identification of sensitive receivers likely to be affected by the development using clear maps/plans, including key landform areas, such as conservation areas and waterways;	Chapter 2 Chapter 2 Chapter 4
• a conclusion justifying why the development should be approved, taking into consideration: – alternatives; – the suitability of the site; – the biophysical, economic and social impacts of the project, having regard to the principles of ecologically sustainable development; and – whether the project is consistent with the objects of the *Environmental Planning and Assessment Act 1979*; and	Chapter 21
• a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	front of document
In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers and any surrounding landowners that may be impacted by the development. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Chapter 3
The EIS must assess the potential impacts of the proposal at all stages of the development, including the construction, rehabilitation and final land use of the development.	
The EIS must address the following specific issues: • **Noise** – including a quantitative assessment of potential: – construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* and *NSW Industrial Noise Policy* respectively; – reasonable and feasible mitigation measures to minimise noise emissions; and – monitoring and management measures;	Chapter 8
• **Blasting & Vibration** – – proposed hours, frequency, methods and impacts; and – an assessment of the likely blasting and vibration impacts of the development, having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features;	No longer required (no blasting proposed)
• **Air** – including an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities;	Chapter 9
• **Water** – including: – an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; – identification of any licensing requirements or other approvals required under the *Water Act 1912* and/or *Water Management Act 2000*; – demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and	Chapter 10

Requirement	Reference
reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) – a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan; – an assessment of activities, including but not limited to watercourse reestablishment, that could cause erosion or sedimentation, and the proposed measures to prevent or control these impacts; – an assessment of any likely flooding impacts of the development; an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and – a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts;	
• **Biodiversity** – including: – accurate predictions of any vegetation clearing on site; – a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems; – a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant; and – an assessment of whether a Species Impact Statement is required;	Chapter 11
Heritage – including: – an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and – identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1;	Chapter 12
• **Traffic &Transport** – including: – accurate predictions of the road traffic generated during construction of the development, including a description of the types of vehicles likely to be used; – an assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads; – a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development; – evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and – a description of access roads, specifically in relation to nearby Crown roads and fire trails;	Chapter 13
• **Land Resources**– including an assessment of: – potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); and – potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms;	Chapter 14

Requirement	Reference
• **Waste** – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams;	Chapter 15
• **Visual** – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, including with respect to any new landforms;	Chapter 16
• **Social & Economic** – an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project; and	Chapter 17
• **Rehabilitation** – including: – a detailed description of the proposed rehabilitation measures that would be undertaken throughout the development; – a detailed rehabilitation strategy, including justification for the proposed final landform and consideration of the objectives of any relevant strategic land use plans or policies; and – the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy. – a description of the biosecurity measures to prevent the introduction of weeds and pests.	Chapter 18 and Chapter 5

2. Statutory framework

2.1 Environmental Planning and Assessment Act 1979

2.1.1 Overview

All development in NSW is assessed in accordance with the provisions of EP&A Act and the Environmental Planning and Assessment Regulation (EP&A Regulation). The EP&A Act institutes a system for environmental planning and assessment, including approvals and environmental impact assessment requirements for proposed developments. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils.

The EP&A Act contains three parts that impose requirements for planning approval. These are generally as follows:

- Part 4, which provides for the assessment and approval of 'development' that requires development consent from the local council, a regional planning panel or the NSW government for development which is classed as State Significant Development (SSD).
- Part 5 (Division 5.1), which provides for the environmental assessment of 'activities' that do not require approval or development consent under Part 4.
- Part 5 (Division 5.2), which provides for control of State Significant Infrastructure (SSI) including critical SSI.

The need or otherwise for development consent is set out in environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

2.1.2 Hornsby LEP 2013

The site is on land within Zone RE1 Public Recreation under the Hornsby Local Environment Plan 2013 (Hornsby LEP). Rehabilitation of the quarry site is considered to meet the objectives of the zone which include:

- To enable land to be used for public open space or recreational purposes.
- To provide a range of recreational settings and activities and compatible land uses.
- To protect and enhance the natural environment for recreational purposes.
- To protect and maintain areas of bushland that have ecological value.

The Hornsby LEP outlines a range of development types permitted either with or without consent within the RE1 Zone and those that are prohibited under the LEP.

Development permitted without consent in the RE1 land zone is restricted to '*Environmental protection works'*.

Developments permitted with consent in the RE1 land zone includes '*Building identification signs; Business identification signs; Camping grounds; Car parks; Caravan parks; Cemeteries; Child care centres; Community facilities; Emergency services facilities; Environmental facilities; Flood mitigation works; Kiosks; Public administration buildings; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Respite day care centres; Roads; Water reticulation systems'.*

All other development is prohibited development and cannot be undertaken at the site in accordance with the Hornsby LEP.

The purpose of the development is to stabilise the quarry and rehabilitate the site to develop the final landform for the use of the site as a parkland.

The definition of a recreational area in accordance with the dictionary in the Hornsby LEP means a place used for outdoor recreation that is normally open to the public, and includes:

(a) a children's playground, or

(b) an area used for community sporting activities, or

(c) a public park, reserve or garden or the like,

and any ancillary buildings, but does not include a recreation facility (indoor), recreation facility (major) or recreation facility (outdoor).

Development of the site as parkland falls within the definition of a recreational area, which is permissible with consent within Zone RE1. Development consent is therefore required for the proposed works under the Hornsby LEP.

Clause 6.2 of the Hornsby LEP includes additional local provisions in regards to undertaking earthworks and states:

(1) The objective of this clause is to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

(2) Development consent is required for earthworks unless:

(a) the earthworks are exempt development under this Plan or another applicable environmental planning instrument, or

(b) the earthworks are ancillary to development that is permitted without consent under this Plan or to development for which development consent has been given.

(3) Before granting development consent for earthworks (or for development involving ancillary earthworks), the consent authority must consider the following matters:

(a) the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,

(b) the effect of the development on the likely future use or redevelopment of the land,

(c) the quality of the fill or the soil to be excavated, or both,

(d) the effect of the development on the existing and likely amenity of adjoining properties,

(e) the source of any fill material and the destination of any excavated material,

(f) the likelihood of disturbing relics,

(g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,

(h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Development consent is required for the proposed development and the considerations included in Clause 6.2(3) of the Hornsby LEP have been taken into consideration during preparation of this EIS.

2.1.3 State Environmental Planning Policy Mining, Petroleum and Extractive Industries 2007 (Mining SEPP)

The aims of this policy are, in recognition of the importance to NSW of mining, petroleum production and extractive industries:

(a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State,

(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and

(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

While the project will meet the aims of the Mining SEPP, there are no identified pathways to provide for the permissibility of an extractive industry at the site.

Clause 6 of the Mining SEPP allows for rehabilitation of abandoned mine sites, by or on behalf of a public authority without consent. The materials previously extracted from the site are not minerals as defined under the *Mining Act 1992* and therefore the site is defined as a quarry rather than a mine and this clause is not applicable to the project. Development consent for the project would still be required in accordance with the provisions in the Hornsby LEP.

2.1.4 State Environmental Planning Policy (Infrastructure) 2007

'State Environmental Planning Policy (Infrastructure) 2007' (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW and allows for a range of developments to be permitted with and without consent.

Division 12 of the Infrastructure SEPP includes definitions and consent requirements for parks and public reserves. In accordance with Clause 65 (3):

Development for any of the following purposes may be carried out by or on behalf of a council without consent on a public reserve under the control of or vested in the council:

(a) roads, cycleways, single storey car parks, ticketing facilities and viewing platforms,

(b) outdoor recreational facilities, including playing fields, but not including grandstands,

(c) information facilities such as visitors' centres and information boards,

(d) lighting, if light spill and artificial sky glow is minimised in accordance with AS/NZS 1158: 2007, Lighting for Roads and Public Spaces,

(e) landscaping, including irrigation schemes (whether they use recycled or other water),

(f) amenity facilities,

(g) maintenance depots,

(h) environmental management works.

The project involves stabilisation of the quarry and rehabilitation of the site to develop the final landform for the use of the site as a parkland and is not considered to meet the definition of any categories of development which can be undertaken without consent under the Infrastructure SEPP.

2.1.5 State Environmental Planning Policy No. 55 – Remediation of Land

The aims and objectives of 'State Environmental Planning Policy No. 55' (SEPP 55) are to provide a state-wide planning approach to contaminated land remediation and to promote the remediation of contaminated land to reduce risk of harm.

SEPP 55 restricts consent authorities from issuing development consent on land that may be contaminated, unless the consent authority is satisfied that the land in question is suitable for development, or would be suitable if the appropriate remediation was undertaken.

The site was operated as a breccia hard rock quarry by private business from the early 1900s and ceased in the late 1990s. Parsons Brinkerhoff (2004) identified some areas of the site with potential contamination.

The majority of historic fill material is expected to be overburden won from within the site, with very little potential for contamination. The fill placed by NorthConnex consists of VENM and ENM generated solely from tunnelling activtites and would also have very low potential for contamination. The former workshop and office building area west of the quarry void has also been identified as a potential contamination source that may be disturbed as part of the project. Further investigation would be undertaken during detailed design in the immediate vicinity of the former workshop and office building areas to identify appropriate management measures and procedures to manage contamination or hazardous materials if required.

Consideration of potential contamination sources for the project is outlined in Section 14.2.2. Consideration of potential impacts of the project on potential contamination sources is outlined in Section 14.3.1.

2.1.6 Statutory pathway

The project is development for the purpose of recreational area, which is permissible with consent requiring submission of a new DA to Council under Part 4 of the EP&A Act.

The project involves processing of materials for recycling and reuse and therefore is considered to trigger designated development provisions for crushing grinding and separating works, requiring an EIS to be prepared to support the DA. Clause 16 of Schedule 3 in the EP&A Regulation defines designated development as including:

16 Crushing, grinding or separating works

(1) Crushing, grinding or separating works, being works that process materials (such as sand, gravel, rock or minerals) or materials for recycling or reuse (such as slag, road base, concrete, bricks, tiles, bituminous material, metal or timber) by crushing, grinding or separating into different sizes:

(a) that have an intended processing capacity of more than 150 tonnes per day or 30,000 tonnes per year, or

(b) that are located:

(i) within 40 metres of a natural waterbody or wetland, or

(ii) within 250 metres of a residential zone or dwelling not associated with the development.

(2) This clause does not apply to development specifically referred to elsewhere in this Schedule.

Since the project has a capital investment value of more than $5 million, it is also defined as regional development under Clause 4 of Schedule 4A of the EP&A Act. The project will

therefore be notified and assessed by Council, however the consent authority is the Sydney North Planning Panel.

A development which requires additional licences and approvals under a range of applicable NSW legislation (e.g. an Environment Protection Licence (EPL) under the *Protection of the Environment and Operations Act 1997* (PoEO Act)) will also be considered to be integrated development. Prior to granting development consent for the project, the consent authority must obtain general terms of approval from each relevant approval body administering the relevant legislation.

2.1.7 Protection of the Environment Operations Act 1997

The objectives of the PoEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecological sustainable development.

The PoEO Act provides for an integrated system of licensing and contains a core list of activities requiring an EPL from the Environmental Protection Authority (EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the PoEO Act.

'Crushing, Grinding or Separating' is defined as an activity that requires an EPL when the operations exceed 150 tonnes per day or 30,000 tonnes per year.

The project will involve processing of more than 150 tonnes per day or 30,000 tonnes per year of hard rock and soil materials to achieve the stabilisation and rehabilitation of the site for the purpose of development of a future parkland. The project therefore triggers the need for an EPL under the PoEO Act.

2.1.8 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide a formal means for the protection and enhancement of the environmental qualities of waterways and their catchments.

Part 3 of the WM Act specifies approval requirements for water use, water management works approvals and activity approvals. There are two kinds of activity approvals including controlled activity approvals and aquifer interference approvals.

An aquifer interference approval may be required for any works that involve:

(a) the penetration of an aquifer;

(b) the interference with water in an aquifer;

(c) the obstruction of the flow of water in an aquifer;

(d) the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations;

(e) the disposal of water from an aquifer as referred to in paragraph (d).

The project may require the ongoing dewatering of the quarry void throughout construction which is defined as an aquifer interference activity. It is understood that a groundwater licence has previously been issued to Council based upon an assessment of impacts associated with the removal of water from the aquifer. Chapter 10 includes a review of existing licence provisions and consideration of suitability for management of any ongoing water take following the completion of filling as part of NorthConnex project.

2.1.9 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the NPW Act, an Aboriginal object is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

It is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the NPW Act provides a series of defences against the offences listed in Section 86 which includes if the harm was authorised by and conducted in accordance with the requirements of an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act.

The potential for impacts upon Aboriginal cultural heritage has been considered in Section 12.1. There have been no registered sites previously recorded or identified during previous investigations at the site and there is considered to be a low probability of discovery of any previously unidentified objects at the site.

2.1.10 Heritage Act 1977

The purpose of the *Heritage Act 1977* (Heritage Act) is to protect and conserve non-indigenous cultural heritage, including listed heritage items, sites, and relics.

Potential non-indigenous cultural heritage impacts have been considered in Section 12.2.

2.1.11 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations, and ecological communities of animals and plants.

Note that the TSC Act was repealed on August 25 2017, and replaced with the *Biodiversity Conservation Act 2016* (BC Act). Since the SEARs for this project were requested prior to the change in legislation, the project is being assessed under the TSC Act under the transitional arrangements. Following liaison with OEH and DEP, the approach detailed in the SEARs and OEH requirements were confirmed by DPE, which provided exemption from assessing the project in accordance with the Biodiersity Asssesment Method and BC Act.

Further details on this are provided in Appendix F and correspondence with OEH and DPE on this matter is included in Appendix B.

Chapter 11 identifies threatened biota in the site, as well as strategies for the management and mitigation of impacts.

2.2 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage environmental values considered to be of national environmental significance.

The EPBC Act requires approval from the Commonwealth Minister for the Environment and Resources for actions that may have a significant impact on listed matters of national environmental significance (MNES).

The project is considered an “action” which is broadly defined under the EPBC Act to include a project, development, undertaking, activity or series of activities. It is the responsibility of the applicant proposing to undertake an action to initially consider whether the proposal is likely to have a significant impact on any MNES. If the applicant considers there is potential for significant impacts upon any matters protected under the EPBC Act, then a referral is required to be submitted to the Minister for the Environment. Developments considered likely to result in significant impacts are defined as “controlled actions” and require assessment and approval under the EPBC Act.

Consideration of potential impacts upon listed threatened species and communities and any other MNES potentially impacted by the project have been undertaken as part of the EIS. All of the mapped condition classes of the Blue Gum Diatreme Forest have been previously assessed as forming part of the EPBC Act-listed Critically Endangered Ecological Community (CEEC) due to the presence of key diagnostic species and EPBC Act condition criteria.

The biodiversity assessment (Chapter 11) has concluded that a referral is not required to be submitted to the Minister for the Environment.

3. Stakeholder and community engagement

3.1 Consultation with government agencies

3.1.1 Engagement activities

Letters were sent to relevant government agencies requesting comment on issues that should be addressed in the EIS. Agencies consulted included:

- NSW Environment Protection Authority (EPA)
- Office of Environment and Heritage (OEH)
- NSW Rural Fire Service (RFS)
- Roads and Maritime Services
- Department of Primary Industries – Agriculture (DPI – Agriculture)
- Department of Primary Industries – Fisheries NSW (DPI – Fisheries)
- Department of Primary Industries – Water (DPI – Water)

In addition GHD engaged with OEH and DPE to seek confirmation of the assessment method for the biodiversity assessment. The results of the engagement are provided in Section 3.1.2.

3.1.2 Engagement outcomes

Responses were received from:

- NSW Environment Protection Authority
- Office of Environment and Heritage
- DPE

No other responses were received. However the SEARs documented the agency requirements for the EIS.

A summary of the responses/issues identified in government agency consultation and where each is addressed in the EIS is shown in Table 3.1. Further details are provided in Appendix B.

Table 3.1 Summary of government agency engagement outcomes

Agency/stakeholder	Issues/points raised	Response/where addressed in EIS
NSW Environment Protection Authority	A detailed map of the proposed project location including topography and landscape identifying the sensitive receptors, natural water bodies, wetlands, environmentally protected areas and location of ground water monitoring bores in the surrounding environment	The EIS documents and maps these details in various chapters and specialist reports. Refer to Chapter Figure 4.2, Figure 4.3, Figure 10.1, Figure 8.1 and Figure 9.1.
	Justification of the site suitability for the project including soil analysis reports before commencement of any rehabilitation works	The suitability of the site is discussed in Section 22.1.5. Sydney Environmental Soil Laboratory (SESL) has been engaged to assist in the development of an appropriate profile for soils to

Agency/stakeholder	Issues/points raised	Response/where addressed in EIS
		be used for rehabilitation/bush regeneration. The report is attached as Appendix K.
	Detailed assessments of the potential impacts of the rehabilitation works to all sensitive receptors and the receiving environment including air, water, land, vegetation, noise, wastes and flora & fauna	The EIS includes detailed assessments of air (Chapter 9), water (Chapter 10), land (Chapter 14), vegetation (Chapter 11), noise (Chapter 8) and flora and fauna (Chapter 11).
	Detailed information on the mitigation measures proposed to manage the above impacts to attain the required environmental goals and/or guidelines.	Chapter 20 provides a summary of the proposed mitigation measures
Office of Environment and Heritage	Confirmation that the EARs for biodiversity issued on 6 September 2018 remain appropriate for the development	A biodiversity assessment has been undertaken in accordance with the EARs. Refer Chapter 11 and Appendix F.
	OEH has no further need to be involved in the assessment of this project unless it is determined that an SIS is required	The biodiversity assessment determined that an SIS is not required. Refer Chapter 11 and Appendix F.
Department of Planning and Environment	SEARs	Refer Table 1.1
	Confirmation that the Department determines that substantial environmental assessment had commenced prior to 25 August 2017 and that the environmental assessment may continue in accordance with the BBAM.	A biodiversity assessment has been undertaken in accordance with the BBAM (as per the SEARs). Refer Chapter 11 and Appendix F.

3.2 Consultation with the community and local residents

3.2.1 Engagement activities

During preparation of the EIS a variety of engagement activities were undertaken by GHD and Elton Consulting on behalf of Council. This included:

Communication channels:

- Email blast to 40,000 residents
- Letters and emails to stakeholders
- Project website updated
- Community Deliberative Forum & Stakeholder meeting presentations
- Information boards at Hornsby Mall community ‘swing by’
- Social media posts, media release

Engagement Activities:

- Presentation to Hornsby Shire Council
- Reconvene the Community Deliberative Forum

- Stakeholder meeting with Environmental and Bushwalking Stakeholder groups
- Community ‘swing by’ in the Mall

Councillor briefing

A briefing/presentation to Councillors was made on the project and EIS. Details were as follows:

- Hornsby Shire Council Chambers
- Wednesday 3 October, 6 pm – 7 pm
- 5 Councillors in attendance

Community deliberative forum

The Community Deliberative Forum session consisted of a presentation where attendees were encouraged to ask questions throughout, followed by an open discussion plus a dedicated questions and answer session. Details were as follows:

- Hornsby Shire Council Chambers
- Saturday 27 October, 11 am – 1 pm
- 6 CDF members in attendance
- 3 Councillors in attendance

Stakeholder briefing – environmental and bushwalking groups

A briefing was held with local environmental and bushwalking groups. Details were as follows:

- Hornsby Shire Council Chambers
- Tuesday 30 October, 6:30 pm – 7:30 pm
- 6 participants in attendance
- 3 Councillors in attendance

Hornsby Mall “swing-by” session

To engage and inform as many Hornsby residents as possible about the EIS, an informal ‘swing by’ session was held in the mall. The session was attended by three members of the Council project team, and two Elton Consulting staff who actively spoke to people explaining the EIS process. A number of AO presentation boards were on easels displaying information about the project and acted as a cue for further questions and discussion with team members. Copies of these boards are included in Appendix B.

The session was promoted to residents through Councils communications channels, including:

- Email to 40,000 residents
- Social media posts
- Messaging on the Hornsby Station Footbridge digital display

Consultation with neighbours

A letter with an accompanying fact sheet was distributed to immediate neighbours on 18 September 2018. The letter provided an email address and telephone number for residents to call with any questions or comments, and it also offered two days (17 and 22 October 2018 from 9 am to 5 pm) when they could come to Council and discuss the EIS a meeting with the EIS project team.

Two residents requested a meeting, however one resident of Dural Street rang the telephone line and a member of GHD's Consultation team spoke to the resident twice.

3.2.2 Engagement outcomes

A summary of the issues and points raised during community and residents engagement activities and a response or where the issue is addressed in the EIS is provided in Table 3.2.

Table 3.2 Summary of community and residents engagement outcomes

Engagement type	Issues/points raised	Response/where addressed in EIS
Councillor briefing	The types of engineering interventions that would be used	Chapter 6 describes the proposed earthworks design. Section 14.3.2 and Appendix J describe the proposed geotechnical engineering solutions and additional investigations that would be undertaken during detailed design.
	Requested to see the Communications and Engagement strategy	N/A – this was provided to Councillors
	Types of activities could be enjoyed at each of the Park's location	N/A – details of the parkland will form part of a separate project and be subject to a separate approval
Community Deliberative Forum	Filling of the quarry – type of fill, when it will be finished, visibility of the diatreme	Chapter 6 describes the proposed earthworks and timeframe for the project. Fill will be won from within the site. The diatreme will remain exposed above the filling already approved under the 2016 Planning Approval.
	Accessible path – general support, proposed route	Noted. This is an issue for the future parkland but the proposed landform design will support a future accessible path as part of the future parkland.
	Impact on CEEC and offset program	Chapter 11 considers the potential impact on CEEC and offsets.
	General support of work undertaken as part of the EIS Interested in next steps of park design Importance of communication through Social media Suggestion to include Hornsby South Public School in future engagement General comments around long term nature of the project and funding	Noted. Feedback on future engagement will be taken on board as part of ongoing engagement activities for the project and the future parkland.
Stakeholder meeting with Environmental and Bushwalking Stakeholder groups	Local and global stability and geotechnical investigations	Section 14.3.2 and Appendix J describe the geotechnical investigations undertaken as part of the EIS.
	Removal of Blue Gum High Forest and offsets.	Chapter 11 considers the potential impact on Blue Gum High Forest and offsets.
	Interested and supportive in the accessible pathway and how it	Noted. This is an issue for the future parkland but the proposed

Engagement type	Issues/points raised	Response/where addressed in EIS
	will link with other pathways, and look outs	landform design will support a future accessible path as part of the future parkland as well as other pathways and possible look outs.
	Duration of earthworks and diatreme wall	Chapter 6 describes the proposed earthworks and timeframe for the project. The diatreme will remain exposed above the filling already approved under the 2016 Planning Approval.
	Funding of the future parkland	This is an issue for the future parkland but the State Government's $50 million funding will contribute.
	Car parking and car access to the future parkland	Noted. This is an issue for the future parkland but the proposed landform design will support car access to the site. Details of car parking will be developed as part of the parkland design.
Community 'swing by' in the Mall	The overwhelming majority of people engaged were very supportive of the proposed EIS, and excited about the future of the park. Of the 220 people actively engaged, less than 5 people expressed a negative reaction. These were not about the EIS itself, but rather the site's vexed history.	Noted.
Consultation with neighbours	Potential impacts of noise, lights and parking at the future park and gates restricting access after dark	Noted. These are issues for the future parkland. Potential noise associated with this project has been assessed in the EIS (refer Chapter 8).
	Visual changes	Chapter 16 considers the potential visual impacts of the project and Chapter 12 provides an assessment of potential heritage impacts.
	Vegetation and environment, bush regeneration	Chapter 11 describes the potential impacts on vegetation and Chapter 18 describes the proposed bush regetation.
	Safety including risk of fire to future park visitors and therefore limiting use of the park to passive recreation and unstable north and south sides of quarry.	Fire risks for future park visitors is an issue for the future parkland. Chapter 14 considers geotechnical stability.
	Dust and air pollution	Air quality is assessed in Chapter 9.
	Heavy vehicle movements	Traffic is assessed in Chapter 13.

4. Description of the site

4.1 Location

The project is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north west of the Sydney central business district.

The site can be defined as:

- Lots A, B, C, D and E in Deposited Plan (DP) 318676
- Lot 1 DP 926103
- Lot 1 DP 926449
- Lot 1 DP 114323
- Lots 1 and 2 in DP 169188
- Lot 7306 DP 1157797
- Lot 1 DP 859646
- Lot 1 DP 926449
- Lot 13 DP 734459
- Lot 114 DP 749606
- Lot 213 DP 713249
- Summers Avenue, Hornsby partly formed
- Old Mans Valley Trail

Figure 4.1 shows the location of the site.

4.2 Surrounding land uses

Land use and existing development in the areas surrounding the site are predominantly suburban residential, with commercial and light industrial land uses along Peats Ferry Road.

Residential areas are located to the south of the site and on the southern side of Quarry Road. Residential development also occurs to the north of the site, off Fern Tree Close and Manor Road and to the east on Bridge Road and Peats Ferry Road, as shown on Figure 4.1.

Other surrounding land uses include the Mt Wilga Private Hospital to the north and the Hornsby Town Centre to the east, Hornsby TAFE, the Hornsby Aquatic and Leisure Centre, Hornsby Park, Hornsby Shire Council Chambers, police and Court precinct, various businesses along Peats Ferry Road and the Hornsby railway station.

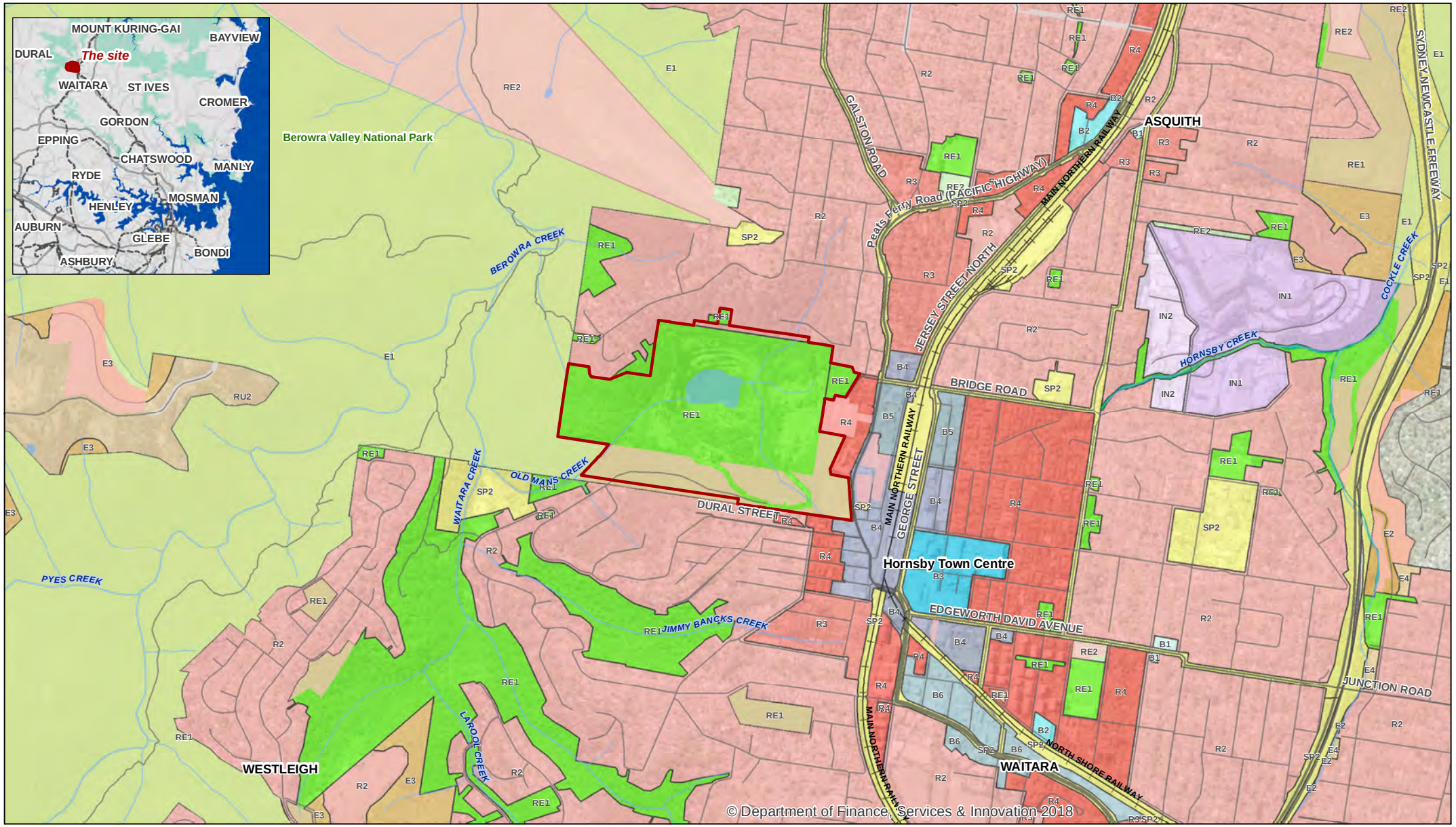
To the west of the site is an extensive bushland area known as Berowra Valley National Park, which is primarily managed by the NSW National Parks and Wildlife Service in conjunction with Council.

4.3 Land zoning

The site is zoned RE1 Public Recreation, as shown on Figure 4.1.

4.4 Land ownership

The majority of the site is owned by Council. Lot 7606, DP1157797 is Crown land.



Paper Size A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- The site
- Watercourses
- Parks and reserves

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Revision A
Date 09 Nov 2018

Site location, surrounding land uses and zoning

Figure 4.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

4.5 Access

The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road) from the north east. Dural Street links to Peats Ferry Road, an arterial road that connects with the state road network, including the Sydney-Newcastle Freeway.

Hornsby railway station is approximately 500 m to the east of the site. Rail access to the Hornsby Shire is provided by two rail lines which form part of the Sydney suburban rail network.

Local bus services operate in the Hornsby area serving surrounding suburbs with an important interchange at Hornsby railway station.

4.6 Environmental context

The site is characterised by dramatic topography and significant vegetation. The topography generally falls from the east to the west. The steeper parts of the site has many slopes that exceed a gradient of 25 percent.

The main feature of the site is the quarry, which covers an area of over 10 ha. The quarry pit is approximately 300 m wide and prior to the commencement of filling by NorthConnex was more than 100 m deep.

The quarry walls are benched and Council had been pumping water from the base of the quarry since late 2009 in order to keep the water level below RL 40 m AHD as recommended by geotechnical consultants for stability reasons. NorthConnex has undertaken filling of the void in accordance with the 2016 Planning Approval. This work also included dewatering of the quarry void prior to filling however, pumping has now ceased. The extent of filling from NorthConnex is expected to reach approximately RL 55 m AHD once completed.

The site and surrounds are densely vegetated with the exception of the areas of the site historically used for quarry operations (including the quarry void, access roads and former processing areas) and currently associated with the NorthConnex filling operations.

Infrastructure established onsite associated with the NorthConnex project includes a stockpile area and site compound (including site shed with staff amenities) at Old Mans Valley, two surface spoil conveyors, noise mounds around the stockpiling areas, temporary sedimentation basins and security fencing. Internal access roads within the stockpile area and the access track between Old Mans Valley and Bridge Road have been sealed for use by trucks manoeuvring and turning.

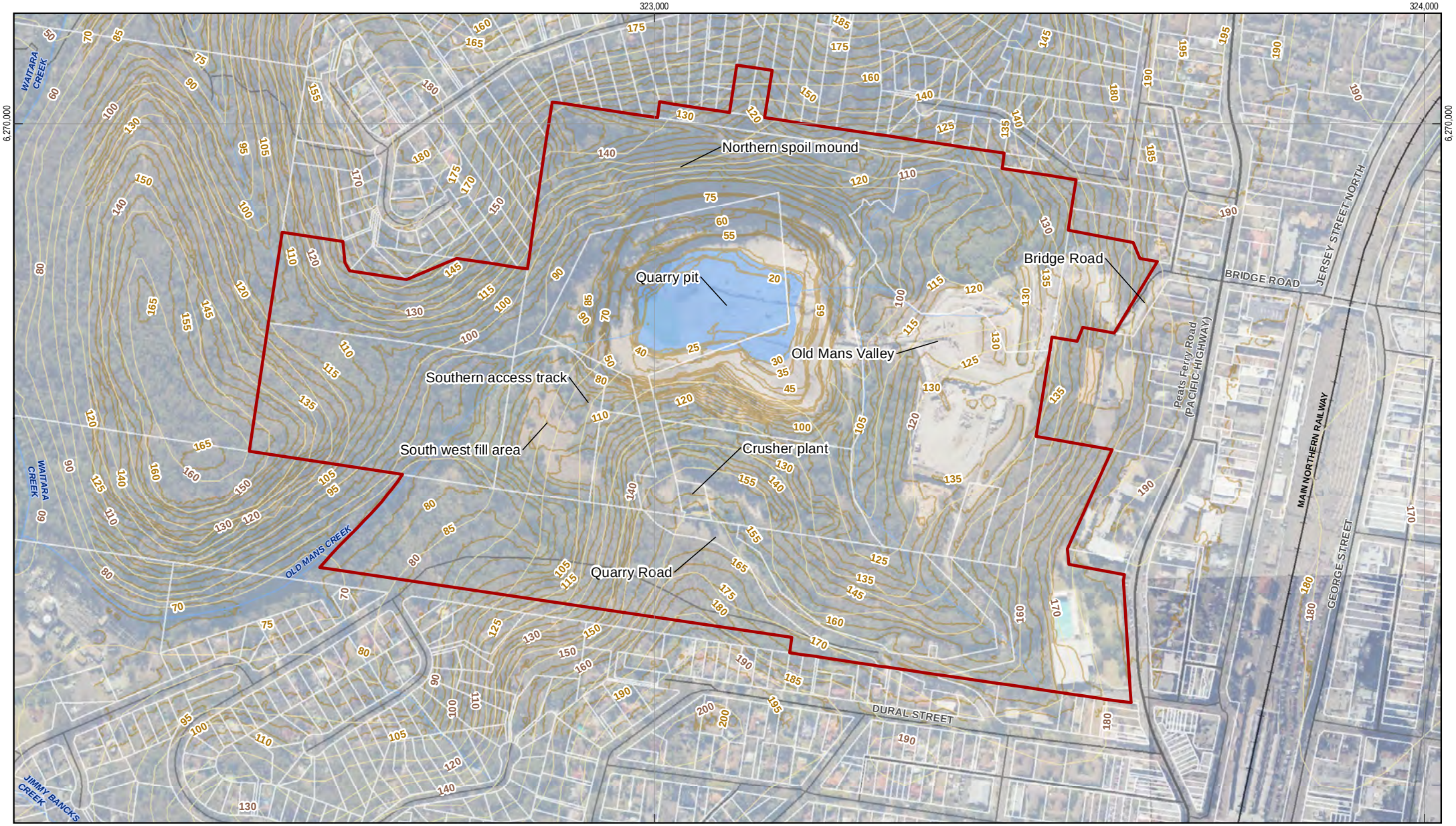
Facilities associated with past quarrying operations also remain on site including crushing and screening plant, pumps, pipeline and an extensive network of security fencing and gates. A number of other unsealed roads also provide access around the site.

The site is known to contain two items of heritage significance: the volcanic diatreme within the Hornsby Quarry and the Higgins Family Cemetery which is of regional significance because it contains the graves of members of the early families that settled in the Hornsby area.

The site is located within Old Mans Creek catchment. Old Mans Creek has three minor tributaries which converge upstream of the quarry. Downstream of the site, Old Mans Creek forms part of the Berowra Creek system, ultimately draining into the Hawkesbury-Nepean River.

Figure 4.2 provides shows an existing survey plan of the site and key features.

Further detail on the existing environmental characteristics of the site are provided in the relevant assessment chapters.



Paper Size A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The site
- Contours
- Watercourses
- Lots (2015)

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Existing site layout

Figure 4.2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

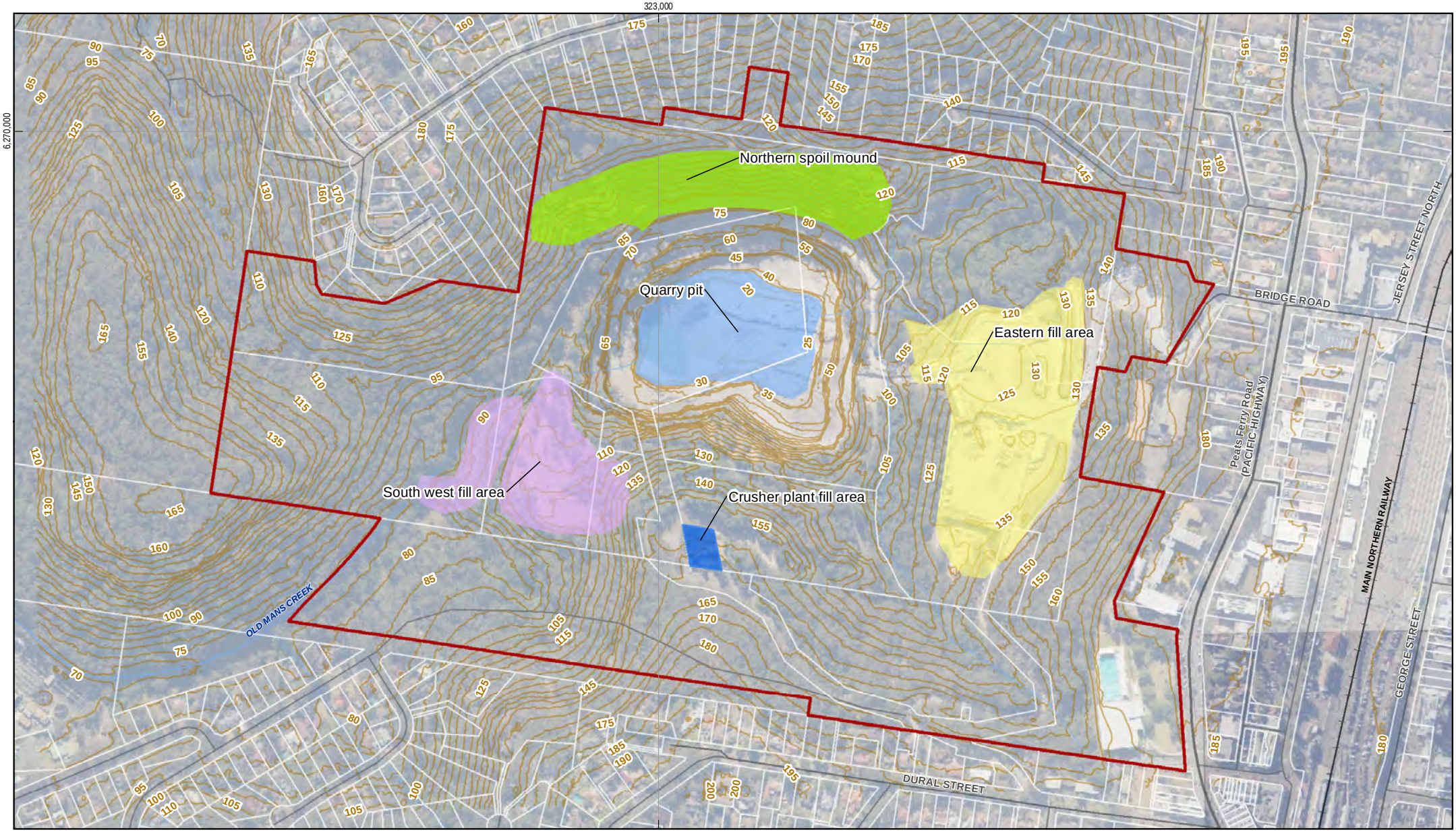
Data source: Sixmaps imagery, NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

4.7 Historical context and fill

The site was operated as a hard rock quarry since the early 1900s, and was most recently owned by CSR/Readymix which mined it for road base and aggregates. Mining ceased in the late 1990s and Council acquired the site in October 2002.

There are four main areas where fill has been placed over the period of quarrying, as shown on Figure 4.3. These include the eastern fill area, the southwestern fill area, the crusher plant fill area and the northern fill area:

- The eastern fill area consists of non-engineered fill. Fill thicknesses vary up to a maximum of about ten metres in this area.
- The crusher plant fill area consists of approximately 1.2 m of well graded, medium density engineered fill above approximately one metre of non-engineered clayey sandy gravel fill.
- The south western fill area consist of non-engineered sandy gravels with some boulders and cobbles up to one metre in size and non-engineered clayey gravely sands interspersed with boulders and man-made items. The depth of fill is up to 20 m.
- The northern spoil mound on the northern slope includes an approximately five metre high mound, constructed using what is assumed to be non-engineered fill. The northern spoil mound has a gradient of 35 degrees with the depth of fill being 15 m or more. Parts of this area are considered to be undrained and potentially unstable.



Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The site
- Eastern fill area
- Northern spoil mound
- South western fill area
- Crusher plant fill area
- Lots
- Contours
- Watercourses

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Revision A
Date 20 Nov 2018

Historical fill areas

Figure 4.3

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Sixmaps imagery, NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

5. Strategic project justification

5.1 Project need and context

5.1.1 Investigations for future use

Hornsby Quarry has presented a safety risk since operations ceased in the late 1990s and the site has therefore been closed to the public since that time.

Since Council acquired the site in 2002, it has commissioned various investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. These included:

Parsons Brinkerhoff (2004), Hornsby Quarry and Environs Land Capability Study and Master Plan, Volume 1 - Technical Investigations

The land capability study was undertaken to identify key issues that would need to be considered when planning for the future rehabilitation and management of Hornsby Quarry and Old Mans Valley. Technical investigations completed as part of the study identified issues, opportunities and constraints which informed the master planning for the site including consultation activities with the community and key stakeholders.

Pells Sullivan Meynink Pty Ltd (2007), Geotechnical and hydrogeological constraints relevant to the land use options within Hornsby Quarry

The investigations explored the geotechnical and hydrological constraints to the future development of the Hornsby Quarry. It described a key risk to the development of the quarry and public safety being the instability of the quarry walls. Three options to stabilise the walls were presented: backfilling, a combination of backfilling and cutting of the quarry walls, and mechanical treatments. The most cost effective solution identified, other than the do-nothing option, was to cut back the existing batters and backfill the quarry.

GHD (2009), Review of options for filling Hornsby Quarry

The discussion paper provided an overview of potential sources and quantities of solid waste and virgin excavated natural material (VENM) generated in Sydney and an evaluation of solid waste and VENM emplacement options at the Hornsby Quarry site. Emplacement of VENM was recommended as the preferred option from a technical, environmental, financial and operational perspective. The report stated that filling of the site would likely occur over a long period of time, with the timing dependent on the supply of VENM and filling rate.

Cardno (2013), Hornsby Quarry land filling preliminary impact assessment

The assessment was undertaken for a number of filling options and aimed to provide Council with an evaluation of the environmental, social and economic impacts expected during the filling of Hornsby Quarry. The economic assessment suggested that the works could result in a cost neutral outcome if VENM was made available to the site, and that alternatively, costs could be up to $200 million if this material was to be purchased by Council.

Clouston Associates (2014), Recreation potential study for Hornsby Quarry and Old Mans Valley

The study highlighted the need to fill and stabilise the quarry to halt environmental degradation and threat to public safety and presented a number of future land use options for the site that would enhance the existing environment. The study concluded that a number of landform options resulting in desirable outcomes were possible at the site, but stated that complex fill and

construction scenarios would be involved. The preferred option recommended by the study was for the use of the quarry as an adventure recreation site.

Hornsby Shire Council (2015) Hornsby Park Plan of Management (including Hornsby Quarry and Old Mans Valley)

The Plan of Management (POM) defines the existing and future use and development proposed for the Hornsby Park. It defines development allowed in Hornsby Park including asset maintenance, landscaping, provision of community facilities, parking, access roads and buildings, provision of ancillary facilities and deposition of NorthConnex spoil in the quarry void. The POM is supported by a masterplan and recommendations for the staged implementation of proposals for various parkland developments.

Through these studies and plans, Council has identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region, and
- develop the site into a community parkland.

More specifically, Council has identified that the site requires rehabilitation by partial filling and stabilisation of specific areas before it can be safely opened to the public as a community parkland.

5.1.2 NorthConnex project

In January 2016 the Department of Planning and the Environment (DPE) issued the 2016 Planning Approval which allowed the placement of up to 1.5 million m^3 of spoil into the Hornsby Quarry from the construction of the NorthConnex Tunnel. The NorthConnex project will link the M1 Pacific Motorway at Wahroonga to the Hills M2 Motorway at the Pennant Hills Road interchange at Carlingford.

The key features of the 2016 Planning Approval include:

- Hauling spoil from the NorthConnex tunnelling sites to Hornsby Quarry using the existing predominantly state road network
- Widening and sealing of the quarry access road (Bridge Road and track) to facilitate all weather access
- Dewatering of the quarry void to a suitable level that allows working within the void
- Creating a stockpile area at Old Mans Valley, where the spoil would be unloaded from trucks and handled with dozers
- Establishment of a compound site at Old Mans Valley stockpile area, security fencing and signage
- Constructing and operating a conveyor to take the spoil from Old Mans Valley stockpile to the rim of the quarry void
- Spreading and grading of the spoil on the quarry floor
- Site demobilisation and rehabilitation of the compound site, stockpile areas and the conveyor corridor in consultation with Council.

The 2016 Planning Approval in effect protects about 50% of the heritage listed eastern face of the quarry void by limiting the extent of fill from the NorthConnex project to 55 m AHD at this face.

The site is currently controlled and operated by NorthConnex and filling works have commenced and are well progressed, with completion expected by the early 2019.

Once filling under the 2016 Planning Approval is completed, the site will be handed back to Council. The completion of filling works by NorthConnex is the first step towards preparing the site for rehabilitation and ultimately developing the site for public recreation in the future. This is discussed further in Section 5.1.3.

5.1.3 Future community parkland

After the handover, stabilisation works and earthworks generally within the site (this project) are proposed in order to:

- rehabilitate the site
- make the site safe, and
- create a final landform suitable for development into a major parkland.

Council's intention is that the final created landform will be developed into a major parkland generally in accordance with the adopted Plan of Management for Hornsby Park (POM): Hornsby Shire Council (2015) 'Hornsby Park Plan of Management (including Hornsby Quarry and Old Mans Valley)'.

Future development of the parkland including landscaping and installation of recreational facilities is a separate project and will be subject to a separate approval process. Community consultation is currently being undertaken to inform the design of the parkland. The new Hornsby Park is expected to be opened to the public in 2023.

5.2 Strategic planning and policy framework

5.2.1 NSW 2021 – A Plan to Make NSW Number One

NSW 2021 was released in September 2011 and is the NSW Government's strategic plan for the future. NSW 2021 is a 10 year plan for change in NSW, and it aims to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability and strengthen local environments and communities.

The project would facilitate rehabilitation and preparation of the site for future public recreation purposes as a parkland. This is consistent with Goal 27 of NSW 2021, which aims to recognise the need to enhance the cultural, creative, sporting and recreation opportunities to strengthen communities and support healthy lifestyles.

5.2.2 A Plan for Growing Sydney

A Plan for Growing Sydney was released in December 2014 and is the NSW Government's 20-year plan for guiding land use planning decisions in the Sydney Metropolitan Area. It sets four goals to be achieved, that Sydney will be:

- A competitive economy with world-class services and transport
- A city of housing choice with homes that meet our needs and lifestyles
- A great place to live with communities that are strong, healthy and well connected
- A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

The project is an important step towards development of the site in the future as a community parkland. The project is therefore an important contributor to delivering this vision and meeting the aims of A Plan for Growing Sydney.

5.2.3 Hornsby Shire Community Strategic Plan 2013 – 2023

The Hornsby Shire Community Strategic Plan 2013 – 2023 was adopted on 19 June 2013 and is Council's guiding document for future development and enhancement of its communities. The project supports a number of the goals identified within this plan.

Relevant goals and strategies include:

- Provide infrastructure and services that serves current and future community needs, including active and passive recreational facilities
- Provide infrastructure and services that are socially and environmentally responsive to community needs

The project will allow Council to proceed with the future development of a unique community parkland for recreational purposes. This would assist in facilitating the above goals and strategies identified in the community strategic plan.

5.3 Alternatives considered and justification of the preferred option

5.3.1 Design alternatives

Development of the proposed concept design surface and associated earthworks has been an iterative process that has been based on significant geotechnical, community engagement, land use planning and constructability assessments. The design has developed and has changed as further investigations were undertaken and as additional constraints and considerations were identified.

Initial conceptual design

The initial conceptual design for the site proposed extensive cutting back of the northern and southern quarry faces well back towards the northern site boundary and across a large area to the south and south west. Figure 5.1 shows this initial conceptual design in plan view.

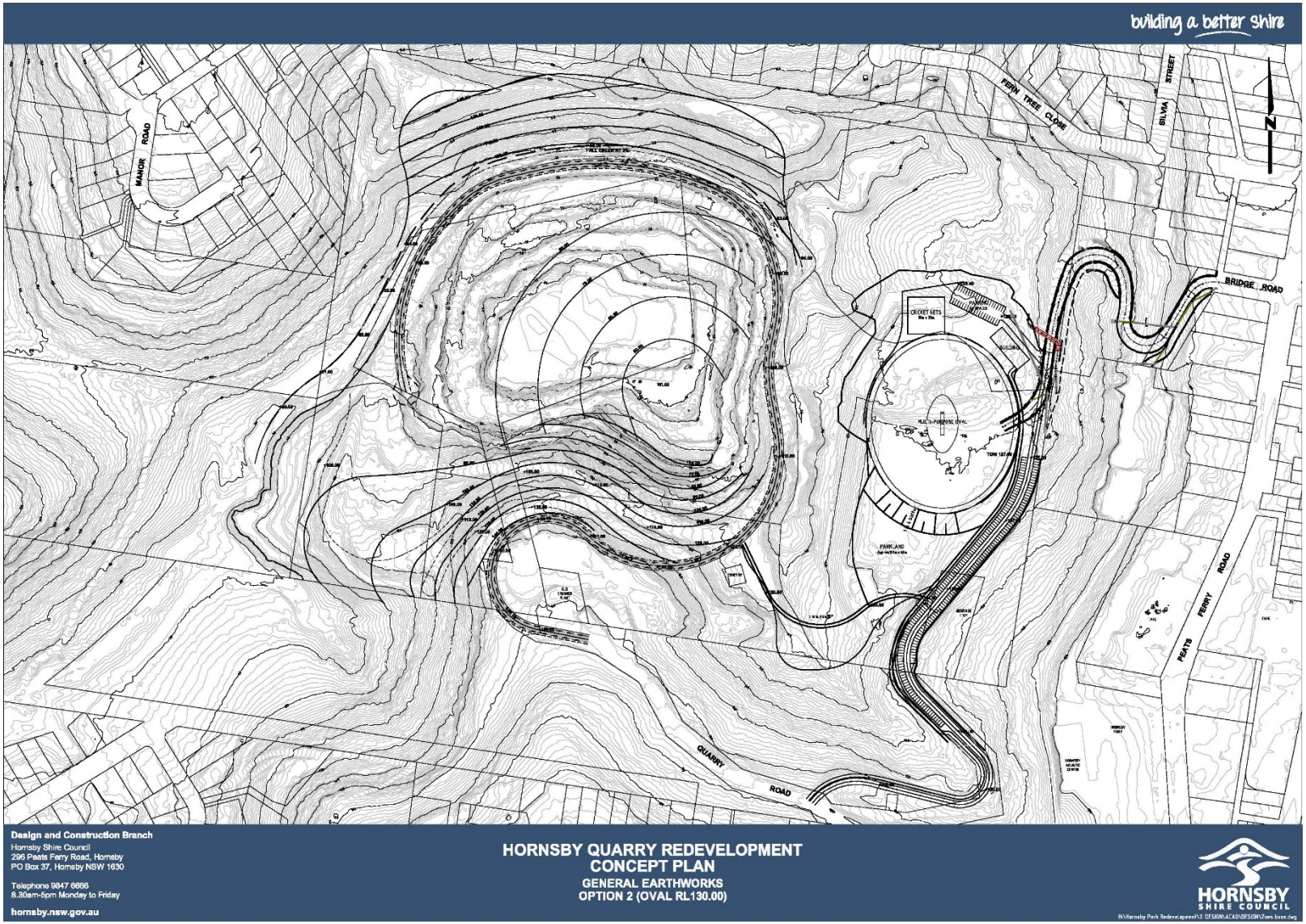


Figure 5.1 Initial conceptual plan

This design was based on stabilising the existing quarry faces by significantly cutting back the northern and southern quarry walls and surrounding areas, so they would have lesser slopes than they do currently. An early high-level constructability assessment of this approach was undertaken which considered the geological challenges of the site.

This assessment identified that extensive blasting and earthmoving would be needed to remove this amount of material and that the design presented some significant geotechnical and logistical challenges, which could lead to potentially unfeasibly high construction costs.

The extent of blasting and other associated crushing and earthworks activities that would potentially be required with this design was also identified to have a high potential noise and vibration impacts on nearby sensitive receivers.

Following the preliminary constructability and geotechnical reviews of the initial conceptual design, in consultation with GHD's geotechnical engineers, Council adopted a revised approach to the design with much more limited cut back of the quarry walls and a more targeted approach to addressing the safety concerns of the site, while also aiming to generate a landform suitable for the future parkland. This is discussed below.

Revised conceptual design

A revised conceptual design was prepared which focussed on works to the northern spoil mound to address instability issues, cut of material from the southwest fill area, reshaping the void, works on the southern access to the site and preparation of an expansive flat area in Old Mans Valley. The design is shown in Figure 5.2.

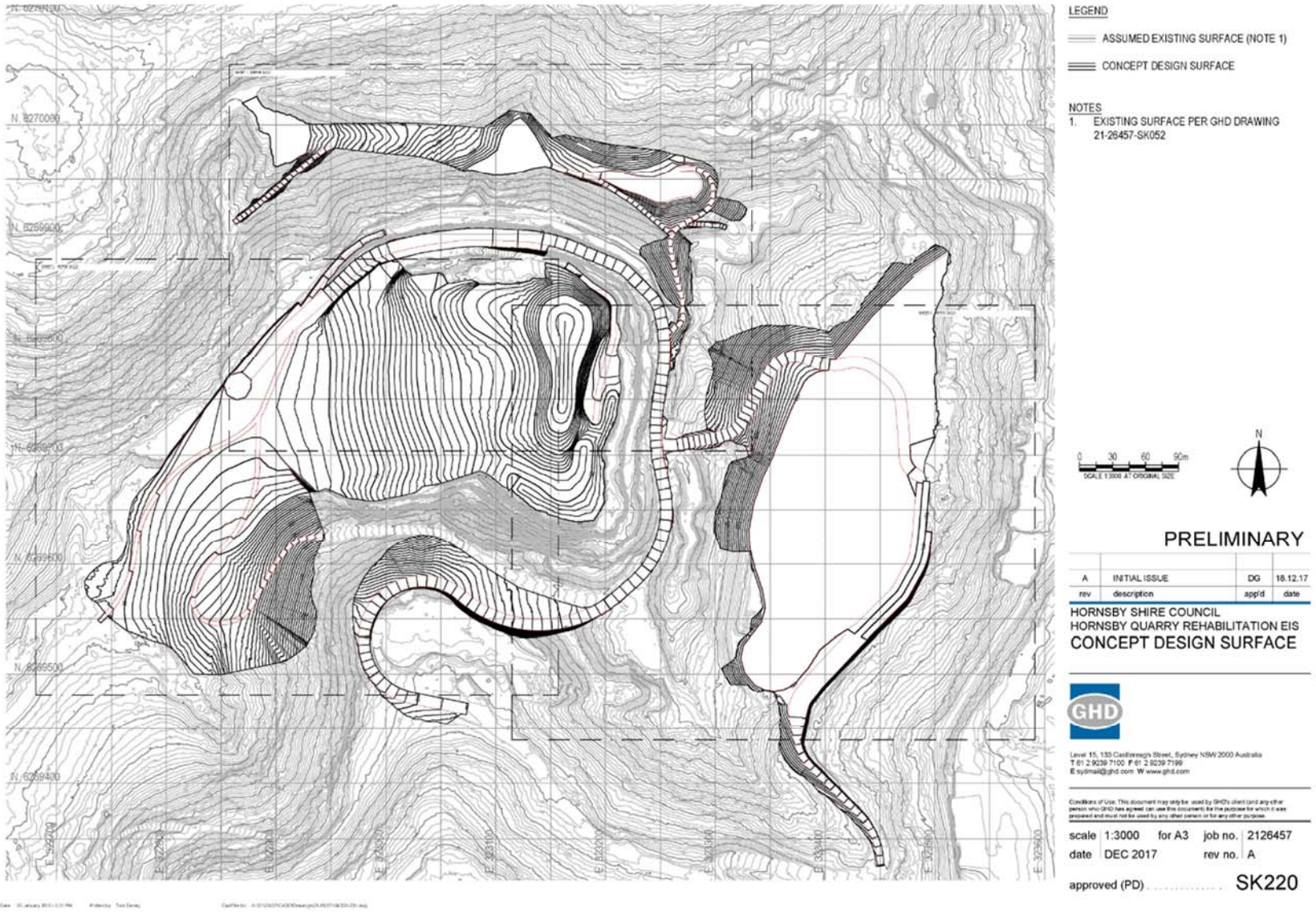


Figure 5.2 Revised conceptual plan

This approach addressed safety concerns through:

- earthworks on the northern spoil mound to flatten it
- identification of appropriate exclusion zones and
- application of targeted engineered stabilisation solutions on specific areas of the quarry walls.

The design surface was developed to enable future parkland access, circulation and functionality, while removing the need for extensive cutting back of the north and south quarry walls.

A high-level constructability assessment was undertaken on the revised conceptual design. This indicated that the majority of the works could be undertaken predominantly through conventional earthworks methods, with minimal need for blasting. This would reduce the potential for offsite noise and vibration impacts over the previous design.

An initial biodiversity assessment of the revised conceptual design was also undertaken. This identified that some areas of CEEC were required to be removed. Stakeholder consultation with Council's Natural Resources Division and a review of the potential vegetation removal requirements and associated potential impacts highlighted the need to investigate the possibility of further refining the design.

Further geotechnical and constructability reviews undertaken by GHD also provided Council with additional information to develop more design options and refine the design for the proposed southern access as well as reduce the extent of works in vegetation identified as CEEC in and around the northern spoil mound.

The preferred conceptual design, as presented in Chapter 6 and briefly discussed below was then developed as a result of this further review and refinement.

Preferred conceptual design

The preferred concept design was further developed through an extended iterative process. The design has evolved over time as site information has become available, through consultation processes, through several rounds of constructability and geotechnical review work and through consideration of the environmental constraints (and in particular, biodiversity values) of the site.

The process has included development and review of several design options for various parts of the site (such as the southern access, quarry void, Old Mans Valley and the northern spoil mound) as part of the refinement. Significant work was undertaken to investigate options for the northern spoil mound in particular. Details are provided in Section 5.3.2.

The preferred conceptual design balances the need for a functional and suitable final landform for future land use as a community parkland, safety, the geological complexities and potential geotechnical issues, earthworks balance, the constructability and potential construction costs and the need to minimise potential impacts on vegetation and in particular areas of EEC.

Chapter 6 provides details of the preferred design.

5.3.2 Northern spoil mound options

Overview

CSR constructed the northern spoil mound between the quarry void and residences to the north on Manor Road during quarry operations over 30 years ago. The lower half of the mound comprises existing material and the upper portion comprises unwanted fill from the quarry operation. It is understood that this material was placed here initially as it was a convenient dumping location.

Construction methods used were typical for a mining environment and the fill was placed with minimal compaction. The low point to the north of the mound was drained via a corrugated steel pipe that has subsequently collapsed. Currently the area is not drained and after heavy rainfall there is a potential for a catastrophic failure.

Apart from the rectification works required for draining the trapped low point, there is also a section of spoil to the eastern end that is excessively steep and requires removal to prevent future failure once the park is opened to the public. Council developed a number of options and sub options to determine the best access route for vehicles and machinery to remove excess spoil, and the most feasible method of draining the low point.

The various options considered for the treatment of the northern spoil mound is outlined below. Some of the options were quickly dismissed and others were further developed and modelled using 3 dimensional software to better understand the areas of impact and likely quantities of cut and fill associated with each option.

The challenge was to determine the option that minimised impact on highly valued CEEC whilst solving the drainage and stability issues and considering the needs of the proposed future park.

Option 1 – Remove spoil by traversing site

Option 1 considered removing the spoil by having necessary equipment gain access to the impact area by traversing the natural surface and removing the impact area. Spoil removed would be spread over the open flat area on the north east corner of the mound. It became evident that the slopes on the mound are too steep for direct access and that a track was required to gain access.

Advice from GHD suggested that the maximum grade for standard construction equipment is 1 in 6 (~17% grade) and if tracked machines were used then a grade of up to 1 in 4 (25%) could be feasible.

Option 2 – Access track from RL90 Quarry Road

Once it was determined an access track would be required, a concept design was developed for a track to traverse along the lower ridge from the road around the quarry void at RL90 AHD and continue behind the fill area to the east.

A grade of 1 in 6 was used in this option and resulted in significant cut into the embankment, impacting many trees and CEEC. This option was considered not to be practical and further options were developed.

Option 3 - Access track from RL90 Quarry Road - 1:4

An option which was the same as Option 2, but with an access track at a grade of 1 in 4 was developed. This resulted in reduced volume of cut required compared to Option 2. Again the amount of cutting into the existing embankment and impact on CEEC was significant.

Option 4 - Western access track (off Rosemead Road)

Additional options from Rosemead Road were also considered. Option 4 was developed, which proposed a western access track that followed an existing walking trail starting at the end of Rosemead Road and a sewer easement across the western end and northern side of the quarry void.

The track alignment from near Rosemead Road has two steep sections - 1 in 3 (33%) for about 10 metres and 1 in 4 (25%) for about 50 metres. The remainder of the track alignment along the western end is less than 1 in 5 (20%). The proposed track along the northern side follows the ridge of the overburden/spoil mound. This alignment is relatively flat with some steeper short

sections in the order of 1 in 10 (10%). An access route to the entrapped low point on the northern side of the spoil mound would likely need to be at 1 in 4 (25%) gradient.

This option was considered because it followed an existing track, however there seemed to be a number of issues requiring further investigation. Therefore four sub-options were developed as described below:

Option 4A/1 – Western access track (off Rosemead road)

Option 4A/1 assumed an access track from Rosemead Road behind the spoil mound. The trapped low point was to be drained via a pipe (rather than overland).

Access for maintenance was determined as to be suitable for a 4WD, or via a walking trail.

This option was later dismissed. Advice was sought from a specialist contractor on the feasibility of boring a pipe of over one metre diameter. This was assessed as being extremely difficult due to issues with setting up, the top section of the boring being through uncompacted fill with large boulders and the difficulty in construction a headwall and apron in the trapped low point with limited access. In addition, piped options require long term maintenance to remove any blockages that would inevitably occur, which was not considered desirable.

Option 4A/2 – Western access track (off Rosemead road)

This option is the same as Option 4A/1, however the trapped low point was assumed to be drained via an overland flow path, rather than via a pipe.

Installation of an overland flow path down the very steep 1 in 1.5 (66%) southern face was identified as a significant challenge for this option.

Access for maintenance was determined as to be suitable for a 4WD or via a walking trail.

Option 4B – Western access track (off Rosemead road)

This option comprised a ‘low impact’ access track (steep grades) from Rosemead Road that would go behind the spoil mound. Drainage of the trapped low point was to be via overland stormwater drainage.

Access for construction and maintenance was determined to be limited to track machines or a walking trail.

This option was developed further and drafted into AutoCAD for more detailed analysis to determine more precise volumes of cut and fill and impact areas.

Option 4C – Western access track (off Rosemead road)

This option was a refinement of Option 4A/1 with low impact access track from Rosemead Road going behind the spoil mound and the trapped low point drained via a pipe.

Access for construction and maintenance was determined to be limited to track machines or a walking trail.

As discussed above, piped options were later dismissed as unviable.

Option 5 – Access track from RL90 quarry road (east)

This option was a refinement of Option 2 with access to the top of the spoil mound via the existing road around the quarry rim (RL90). The access road starts at the eastern end and traverses to the north west towards the trapped low point which would be removed with an overland flow path being created via the access track.

Access was determined to be via a shared track providing good maintenance access.

Option 5A – Access track from RL90 quarry road (east)

This option was a refinement of Option 5 developed further and drafted into AutoCAD for more detailed analysis to determine more precise volumes of cut and fill and impact areas. Access to the top of the spoil mound was via the existing road around the quarry rim (RL 90 m AHD) with the access road starting at the eastern end and traversing to the north west towards the trapped low point. This would be removed with an overland flow path being created via the access track.

A shared track would provide good maintenance access.

Option 6 – Access track from RL90 quarry road (east)

This option was an initial attempt to include Option 4B with Option 5. It was used to develop the options that follow.

Option 6A – Access track from RL90 quarry road (west)

This option was the opposite of Option 5A with access to the top of the spoil mound via the existing road around the quarry rim (RL90 m AHD) access road starting at the western end and traversing to the north east to the trapped low point. The mound was to be reduced in this area to allow for an overland stormwater flow path via the new access road.

A shared track would provide good maintenance access.

Option 6B – Access track from RL90 quarry road (east & west)

This option was a combination of Options 5A & 6A with access to the top of the spoil mound via the existing road around the quarry rim (RL90 m AHD) access road with access at both the eastern and western ends traversing up the slope to meet near the trapped low point. The mound is reduced in this area to allow for overland stormwater flow via the new access road.

A shared track would provide good maintenance access.

Options assessment

From the above 12 options developed, seven options were considered as feasible and were evaluated further using the following criteria:

- Base data such as road width and grade, volumes of cut and fill and areas of impact on the CEEC.
- Environment issues:
  - Impact on area of CEEC HN596 Moderate/good-poor and area of HN648 Moderate/good-poor and Low
  - Number of Blue Gum High Forest trees removed
  - Number of other trees removed
  - Habitat impact
  - Vegetation management areas (revegetate and restore)
- Park development implications:
  - Visual impact of loss of trees
  - Visual impact of earthworks and infrastructure
  - Improved accessibility
- Asset management:
  - Ease of maintenance
- Risk:

- During construction
- Long term embankment stability risk
- Construction financial risk

When assessed against the above criteria Option 5A (access road starting at the western end and traversing up to the north east) was identified as the preferred option. This option was found to:

- Have the least impact on the CEEC
- Allow the sparse areas of the western end of the spoil mound to be accessed to allow for soil placement to regenerate areas of CEEC, and
- Provide access to future park features to the east and western ends of the mound.

5.3.3 Do nothing option

The do nothing option is to not undertake any stabilising works or reshaping of the site. This would leave the site unsuitable for development into a parkland for community use. This option is not considered acceptable as the site would need to remain closed to the public indefinitely due to safety reasons and Council would have to forgo the development of an important community facility.

In this case, the community would not be able to benefit from the future parkland, which is envisaged to be a unique community space. In addition, the historic values of the site including for example the diatreme, Old Mans Valley Cemetery etc would remain inaccessible to the community.

6. Project description

6.1 Overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform as described in Section 6.2 and shown on Figure 6.2.

Approximately 500,000 m^3 of spoil is expected to be generated onsite from earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from a proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed be imported to the site for filling purposes nor would the excavated material be transported off the site.

The following sections describe the project in further detail.

6.2 Proposed works

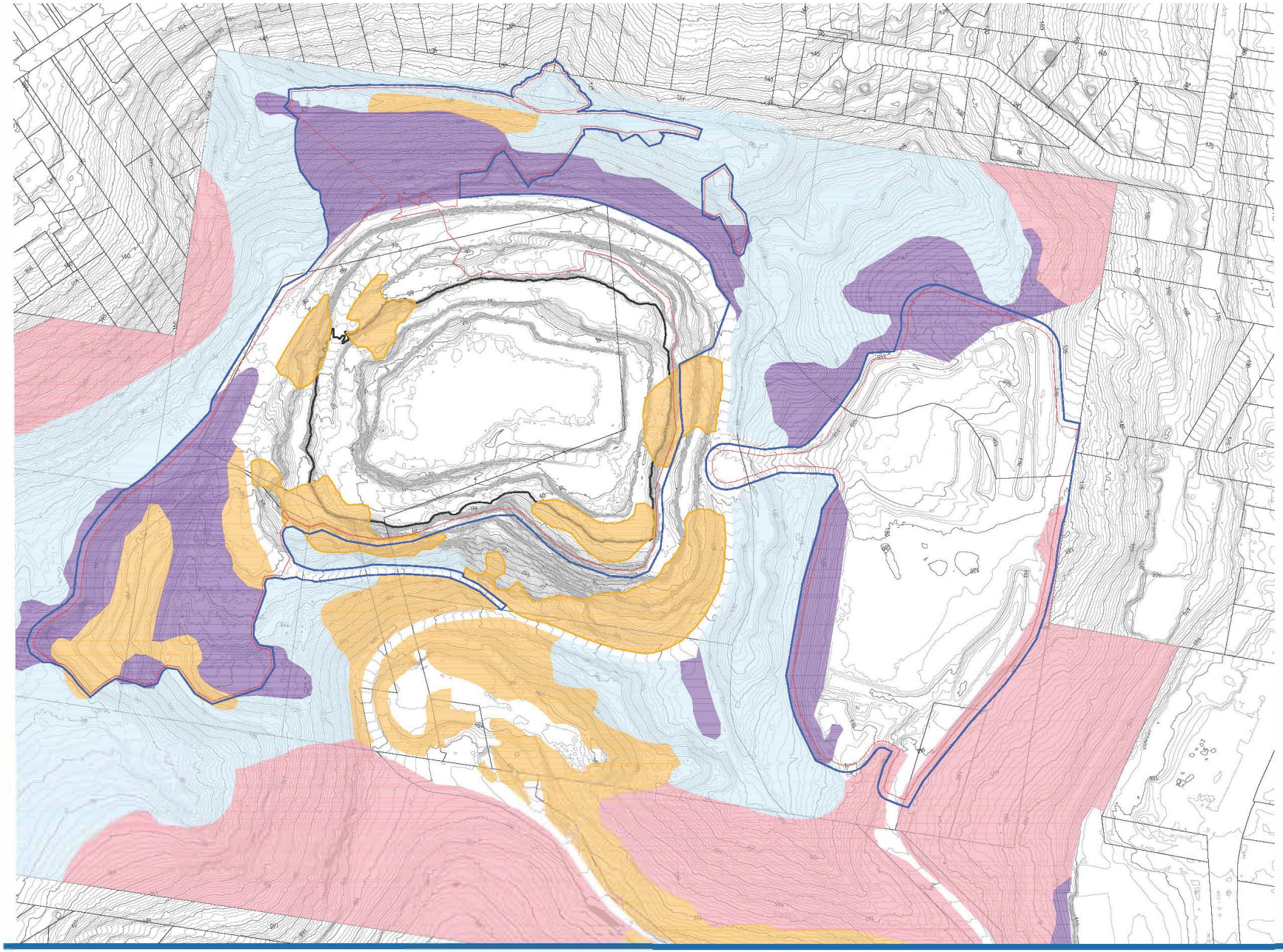
A conceptual design for the proposed reshaping and stabilisation works has been developed by Council. The design has been developed in parallel with the planning for the proposed future parkland. As discussed in Section 5.3.1, the conceptual design has been developed through an extended iterative process, taking into consideration the various requirements for the future parkland, site safety, geological and geotechnical challenges, constructability and environmental constraints.

Figure 6.1 shows the proposed extent of works on the site.

The ‘extent of works’ refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. This can be considered the proposed disturbance footprint. It incorporates site access and internal roads/tracks.

Figure 6.2 shows the proposed concept design surface including the extents of cut and fill.

The project includes geotechnical safety management measures, as discussed in Chapter 14 and rehabilitation works as discussed in Chapter 18.



LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- EXTENT OF WORKS

VEGETATION COMMUNITY

- SYDNEY BLUE GUM - BLACKBUTT SMOOTH-BARKED APPLE MOIST SHRUBBY OPEN FOREST (CEEC TSC Act) (MODERATE/GOOD - POOR)
- BLACKBUTT GULLY FOREST (POOR)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - HIGH)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - POOR)

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

GHD

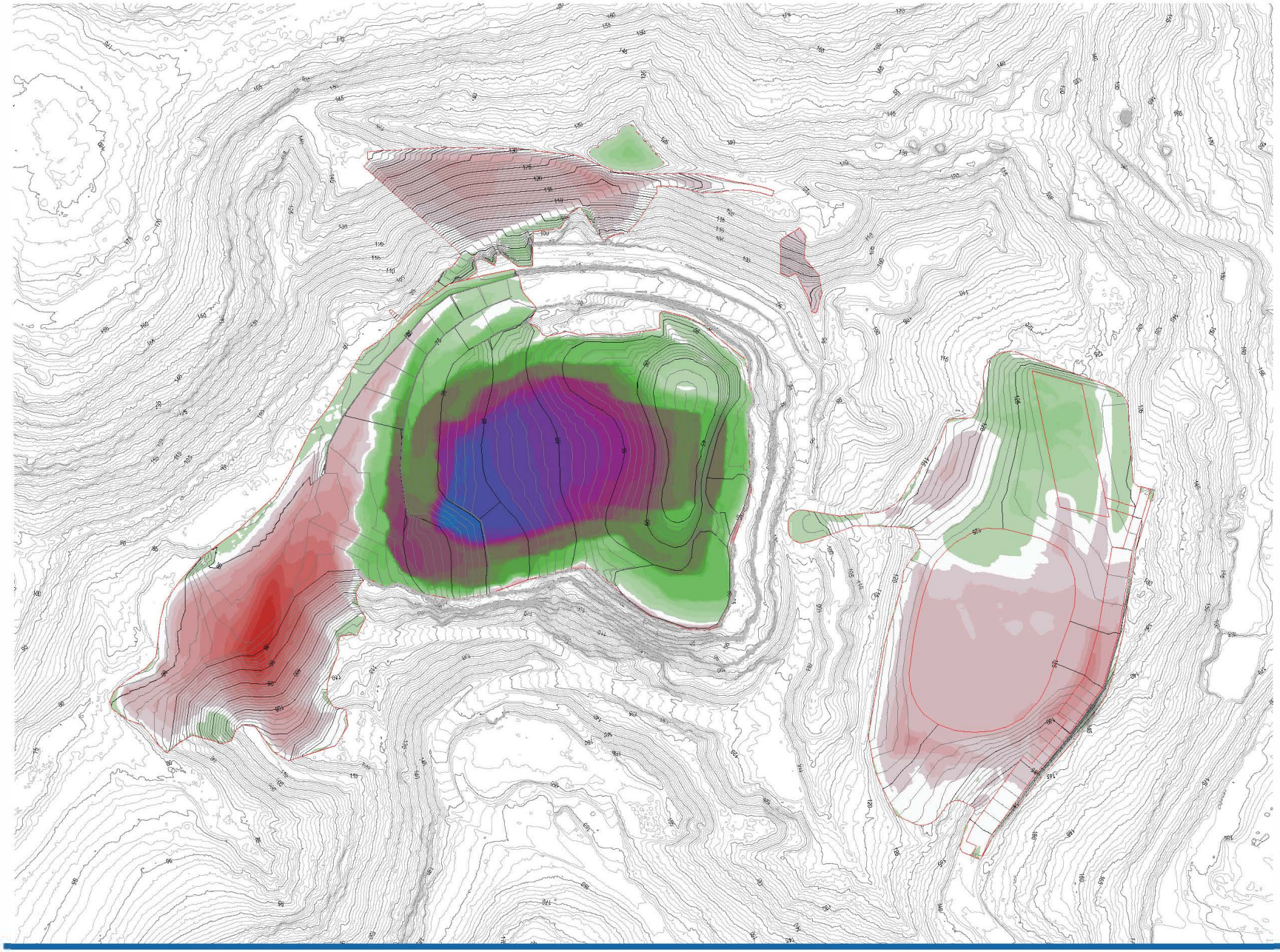
HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
EXTENT OF WORKS

Job Number 21-26457
Revision A
Date SEP 2018

Figure 6.1

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 November 2018 - 9:00 AM Plotted by: Radhidh Grewal CadFile No: G:\21\26457\CADD\Drawings\21-26457-FIG6.1.dwg



LEGEND

ASSUMED EXISTING SURFACE

PIT AREA DESIGN SURFACE

VOLUME CALCULATION BOUNDARY

CUT FILL DEPTH RANGE

25m CUT
22.5m
20m
17.5m
15m
12.5m
10m
7.5m
5m
2.5m
0
2.5m
5m
7.5m
10m
12.5m
15m
17.5m FILL

17.5m FILL
20m
22.5m
25m
27.5m
30m
32.5m
35m
37.5m
40m
42.5
45m
47.5m
50m
52.5m
55m
57.5m
60m FILL

VOLUMES

AREA	CUT (m³)	FILL (m³)
QUARRY VOID AND SW FILL AREA	273,000	1,346,600
OLD MANS VALLEY	176,300	32,700
NORTHERN SPOIL MOUND	63,800	6,400
TOTAL	513,900	1,385,700

NOTE: NorthConnex to place over 1 million m^3

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
CONCEPT DESIGN SURFACE

Job Number 21-26457
Revision A
Date SEP 2018

Figure 6.2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 November 2018 - 10:26 AM Plotted by: Rashnith Grewal

Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG6.2.dwg

Figure 6.3 indicates a preliminary layout for the park development, identifying key recreation areas and park features. The parkland development would be subject to a separate development application.

Figure 6.3 Proposed park recreation areas plan

6.3 Construction

6.3.1 Construction method

A combination of excavation techniques would be required to shift the material in accordance with the proposed design (as described in Section 6.2). The cut material would be won by mechanical excavation. No blasting is proposed.

Geotechnical safety management works would include installation/placement of gabion retaining walls or reinforced earth walls and facings, rock slope treatment and micro-piling.

The cut/fill operation can be undertaken in two different ways:

- Conventional load and haul with mid-size dump trucks; and
- Conveyor transfer.

The construction method would be determined by the construction contractor. For the purpose of the EIS it is assumed that a conventional load and haul operation would be undertaken, as this is the more likely scenario. For the purpose of impact assessment, this is also considered to be a conservative assumption. Similar equipment would be required for a conveyor transfer method, but fewer items of plant would be required for the load and haul to the conveyor feed hopper.

The expected plant and equipment to be used during construction is listed in Section 6.3.2.

6.3.2 Plant and equipment

Typical plant required to undertake the construction works by load and haul operation include:

- Excavators – with rippers or rock-breakers

- Rock saw
- Vibratory roller/compactor
- Bulldozers
- Loaders
- Articulated dump trucks
- Mobile screen
- Mobile crusher
- Fuel truck
- Off-road - water cart
- Tub grinder and mulcher

Proposed geotechnical safety management works would also be installed using the same equipment. However specific attachments may be used (such as drilling equipment applied to excavators for micro-piling, grab arms for placing gabion/facings etc) where required.

6.3.3 Construction workforce

The peak construction workforce is expected to be 25-30 including supervising personnel.

6.3.4 Traffic management and access

The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road) from the north east. It is expected that most construction vehicles would be accessing the site via Bridge Road.

It is possible that low loaders may need to bring in large plant and equipment via Quarry Road (due to the steepness of Bridge Road). These deliveries would only happen occasionally and would be scheduled outside of peak times.

No spoil material is expected to be delivered to the site or transported off the site.

Construction traffic would be managed through a construction traffic management plan that would form part of the construction environmental management plan for the works.

6.3.5 Hours of construction

The proposed works would be carried out during the following standard construction times:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

While no works are anticipated to occur outside of standard hours there may be circumstances where out-of-hours activities associated with the project are necessary. Activities which may be undertaken outside of standard daytime hours (in accordance with Section 2.3 of the Interim Construction Noise guidelines (ICNG) would include the following circumstances:

- The delivery of materials or oversized plant as required by the Police or other authorities for safety reasons.
- Where it is required to avoid the loss of lives, property and/or to prevent environmental harm in an emergency.

- Activities which are determined to comply with the relevant Noise Management Level (NML) at the most affected sensitive receiver, excluding activities associated with the transport and handling of spoil. Such activities may include refuelling of plant and equipment maintenance.
- Where agreement is reached with affected receivers.

6.4 Staging/timing

The project is expected to take approximately two years to complete. However the majority of key earthworks activities are expected to be completed in an approximate 60 week period.

6.5 Rehabilitation and future use

The project includes rehabilitation measures as discussed in Chapter 18.

Any temporary project facilities such as construction compounds and plant and equipment would be removed from site. Erosion and sediment controls would be kept in place until the site is stabilised and/or retained for future development works for the parkland.

The final rehabilitation and development of the site to recreational land use does not form part of this project and would be subject to a separate planning approval. The landform that would be created as part of this project has been designed to be suitable for this future development.

7. Identification and prioritisation of issues

7.1 Overview

The key project-related issues warranting detailed assessment in the EIS have been identified through:

- The existing environmental context and surrounding locality.
- The legislative framework applicable to the project.
- The preliminary environmental risk screening.
- The outcomes of consultation to undertaken with government agencies and other relevant stakeholders.
- Specialist studies completed as part of the preparation of the EIS.

The outcomes of the environmental risk screening and prioritisation, including the issues identified for further detailed assessment, are discussed in Section 7.3.

7.2 Risk analysis method

A preliminary environmental risk screening was undertaken to identify potential environmental impacts that may arise as a result of the proposed project.

The preliminary environmental risk screening was undertaken in the form of a preliminary, desktop-level risk assessment, to broadly assess the potential environmental risks that may arise as a result of the construction and operation of the project to identify key areas for the assessment.

The environmental risk analysis for the project involved:

- Identifying environmental aspects
- Identifying the source of potential risks associated with each of these aspects
- Identifying the potential impact associated with each risk
- Identifying priority issues for the EIS.

7.3 Assessment results

7.3.1 Risk screening

Table 7.1 provides the environmental risk analysis for the project. It includes:

- A summary of the potential key impacts/risks
- Consideration of the priority for the assessment
- A discussion regarding the findings of the preliminary risk screening.

Table 7.1 Preliminary environmental risk analysis results

Environmental aspect	Source of risk	Potential impact	Priority of assessment	Discussion
Traffic	Additional vehicles on the local road network during construction activities	Potential disruption to local road users	Low	The project is anticipated to result in only a minor increase in traffic due to construction personnel traveling to and from the site and some initial delivery of construction plant/equipment. No additional fill material will be imported or exported from the site as part of the project. The SEARs identified this as a key issue requiring assessment. Chapter 13 provides an assessment of the potential impacts of the project on the local road network.
Noise, vibration and blasting	Noise and vibration generated during / earthworks / earth moving and landform reshaping activities	Impacts on sensitive receivers in proximity to the project from noise	High	The proposed construction activities have the potential to generate noise. The SEARs identified noise, blasting and vibration as key issues requiring assessment. However the refinements to the project design since SEARs were issued have removed the need for blasting. Therefore blasting has not been assessed. Chapter 8 provides an assessment of the potential noise and vibration impacts of the project.
Hydrology and soils, flooding	Exposure of soils during earthworks and earth moving activities Spills or leaks of fuel and/or oils from construction plant and equipment Spills or leaks of other hazardous substances and dangerous goods from construction activities Groundwater levels and pumping	Erosion and sedimentation and associated impacts to waterways from earthworks Contamination of soils from accidental spills or leaks Changes to groundwater levels and groundwater system	Medium	The site is not located on flood prone land (according to Hornsby Shire Council flood planning maps). Although localised flooding may occur during high intensity rainfall events, these would be infrequent and short term in nature. The site contains one named watercourse, Old Mans Creek, which drains from the south west of the site to the west. There are also some smaller drainage lines within the site. However construction activities are not anticipated to significantly impact on any of the waterways. The project has potential for erosion and sedimentation during earthworks activities and therefore potential impacts to water quality. The SEARs identified water as a key issue requiring assessment.

Environmental aspect	Source of risk	Potential impact	Priority of assessment	Discussion
				Chapter 10 provides an assessment of soil, surface water and groundwater impacts.
Hazard and risk	Transport and use of chemicals, fuels and materials on site that are classed as hazardous substances or dangerous goods Occupational health and safety hazards such as dangers to construction workers	Impacts to the environment from spills of chemicals, fuels or other hazardous substances. Exposure of site personnel to hazards during construction activities	Medium	The project is designed to reshape and rehabilitate the quarry in order to create a safe final landform for future development of a community parkland. A risk screening has been undertaken in accordance with Department of Planning (2011) 'Applying SEPP 33: Hazardous and Offensive Development Application Guidelines)'. Section 6.3.1 contains a preliminary construction methodology which has been developed taking into consideration the safety risks associated with reshaping and rehabilitating the quarry. Section 19.2 also considers potential hazards and risks and Chapter 14 considers geotechnical risks.
Air quality	Dust generated during excavations, trucks traversing unsealed roadways and from exposed soils/surfaces	Offsite amenity impacts from dust	Medium	The project has potential to generate dust during construction – due to excavations and other earthworks etc. The SEARs identified this as a key issue requiring assessment. Chapter 9 includes an assessment of air quality with a focus on dust impacts due to construction activities. It includes mitigation measures to control dust and minimise the potential for off-site amenity impacts.
Non-Aboriginal heritage	Direct and indirect effects on non-Aboriginal heritage items located within the site or in proximity to the impact areas.	Construction activities impacting on heritage items	Medium	The site contains a number of identified items of non-Aboriginal heritage significance. The SEARs identified heritage as a key issue requiring assessment. Chapter 12 provides an assessment of non-Aboriginal heritage impacts.
Aboriginal heritage	Direct and indirect effects on Aboriginal heritage items located in proximity to the site	Impacts on Aboriginal artefacts or cultural heritage values	Low to medium	The site contains no known / registered Aboriginal heritage items or sites. However there are a number of registered sites in proximity to the site. The SEARs identified heritage as a key issue requiring assessment. Chapter 12 provides an assessment of Aboriginal heritage impacts.

Environmental aspect	Source of risk	Potential impact	Priority of assessment	Discussion
Biodiversity	Vegetation clearance due to construction activities and stabilising works	Clearance of native vegetation, loss of habitat, degradation of landscape Impacts on threatened species and communities	High	The project would remove some native vegetation, some of which is classified as CEEC. The removal of vegetation also has potential to impact on native fauna. The SEARs identified biodiversity as a key issue requiring assessment. Chapter 11 provides an assessment of biodiversity impacts of the project.
Visual amenity	Active construction areas Vegetation clearing as part of the reshaping works Lighting for the work areas	Changes to landscape character within the proposed works areas due to stabilisation works and landform reshaping	Low	Landscaping and development of the future community parkland forms part of a separate project and will be subject to separate assessment and approval. Views of the proposed works as part of this project, within the site and in the quarry pit, are expected to be very limited due to the topography and extensive existing vegetation screening around the site. The site will not be open to the public during the works. Therefore the potential for visual amenity impacts is considered minimal. Chapter 16 provides a basic assessment of visual impacts.
Health	Human health risks associated with air quality, noise, vibration and social impacts during construction	Human health impacts associated with offsite dust emissions, noise and vibration other social impacts	Low	The project has potential for some short term amenity impacts during construction. However the project design and mitigation/control measures will minimise these effects and the project is not expected to have significant impacts on air quality, noise or vibration. Therefore the effect on human health is expected to be minimal. Chapter 17.1 provides a basic assessment of human health impacts, which draws on the findings from each of the specialist studies for air quality and noise.
Social and economic and land resources	Amenity impacts due to construction activities	Social and property impacts due to noise, vibration, dust etc Overarching benefit as a critical pre-requisite for the development of a future	Low	The project has potential to result in some amenity impacts during construction. These impacts are not expected to be significant, and would be short-term in nature. The project forms part of an overall plan to develop a community parkland at the site, which would have significant

Environmental aspect	Source of risk	Potential impact	Priority of assessment	Discussion
		community parkland – local and wider region		socio-economic benefits for the local area and the wider local government area. The project is not expected to directly impact on any other property. Some current limitations associated with the NorthConnex filling on the existing land use of the site will remain in place during construction works. Chapter 17 considers potential socio-economic impacts of the project and Chapter 14 considers potential land resource impacts.
Waste	Waste handling and storage	Handling, storage, recovery and disposal of waste generated during construction	Low	Some construction waste is expected to be generated during the project, mostly from site personnel. Chapter 15 provides an assessment of waste management for the project (noting that no additional materials are proposed to be received at the site) including identification of waste streams, likely classifications and proposed measures for handling, transport, storage, recovery and disposal.

7.3.2 Priority assessments for the EIS

Based upon the results of the preliminary environmental analysis, the following broad qualitative risk ratings were assigned for each environmental attribute.

- High – noise and vibration and biodiversity
- Moderate – soils and water, non-Aboriginal heritage, air quality, hazard and risk
- Low – traffic, Aboriginal heritage, waste, health, visual amenity, socio-economic and land resources.

8. Noise and vibration

The information presented in this chapter is based on the findings of the noise and vibration assessment undertaken by GHD. The noise and vibration assessment report is included in Appendix C of this EIS.

8.1 Approach and methodology

The noise and vibration assessment was undertaken with consideration to the following guidelines:

- Noise Policy for Industry (NPI) (EPA, 2017)
- Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Road Noise Policy (RNP) (DECCW, 2011)
- Assessing Vibration: A Technical Guideline (DEC, 2006).

The assessment included:

- Initial desktop review to identify environmental noise and vibration sensitive receivers from aerial photography
- Use of previous background noise monitoring at four (4) noise receiver locations identified as being indicative of the local ambient noise environment.
- Establishment construction noise management levels and project specific noise trigger levels and vibration criteria for the operation of the quarry with consideration to the guidelines and standards mentioned below.
- Identification of the likely principal noise and vibration sources during the project.
- Noise modelling to predict construction noise levels at the nearest identified noise receivers to the quarry.
- Calculation of noise level at the nearest receptors due to noise generating equipment and plant movements at the site during the early and later stages of the project
- Identification of reasonable and feasible mitigation measures to reduce potential noise and vibration impacts at sensitive receivers
- Assessment of noise impacts from the increase in traffic movements on Bridge Road, Peats Ferry Road, Dural Street and Quarry Road. The potential noise impacts associated with the traffic movements were assessed with consideration of the Road Noise Policy (NSW DECCW, 2011).

8.2 Existing environment

The noise environment surrounding the site is dominated by the local road network, including Peats Ferry Road and other transport infrastructure such as Hornsby railway station and the Northern Railway Line.

8.2.1 Noise catchment areas and sensitive receivers

For the purpose of the noise impact assessment, the surrounding study area was divided into four representative noise catchment areas (NCAs) based on their similar acoustic environment. The NCAs are summarised in Table 8.1 and the extents are shown on Figure 8.1.

Table 8.1 Noise catchment areas

Sensitive receivers	Direction from the site	Residential planning zones within NCA
NCA1	North / Northwest	R2 – Low Density Residential
NCA2	Northeast / East / Southeast	R3 – Medium Density Residential
NCA3	South	R2 – Low Density Residential
NCA4	Southwest	R2 – Low Density Residential

Noise sensitive receivers are defined based upon the type of occupancy and the activities performed within the land parcel. The receivers are classified within the following categories:

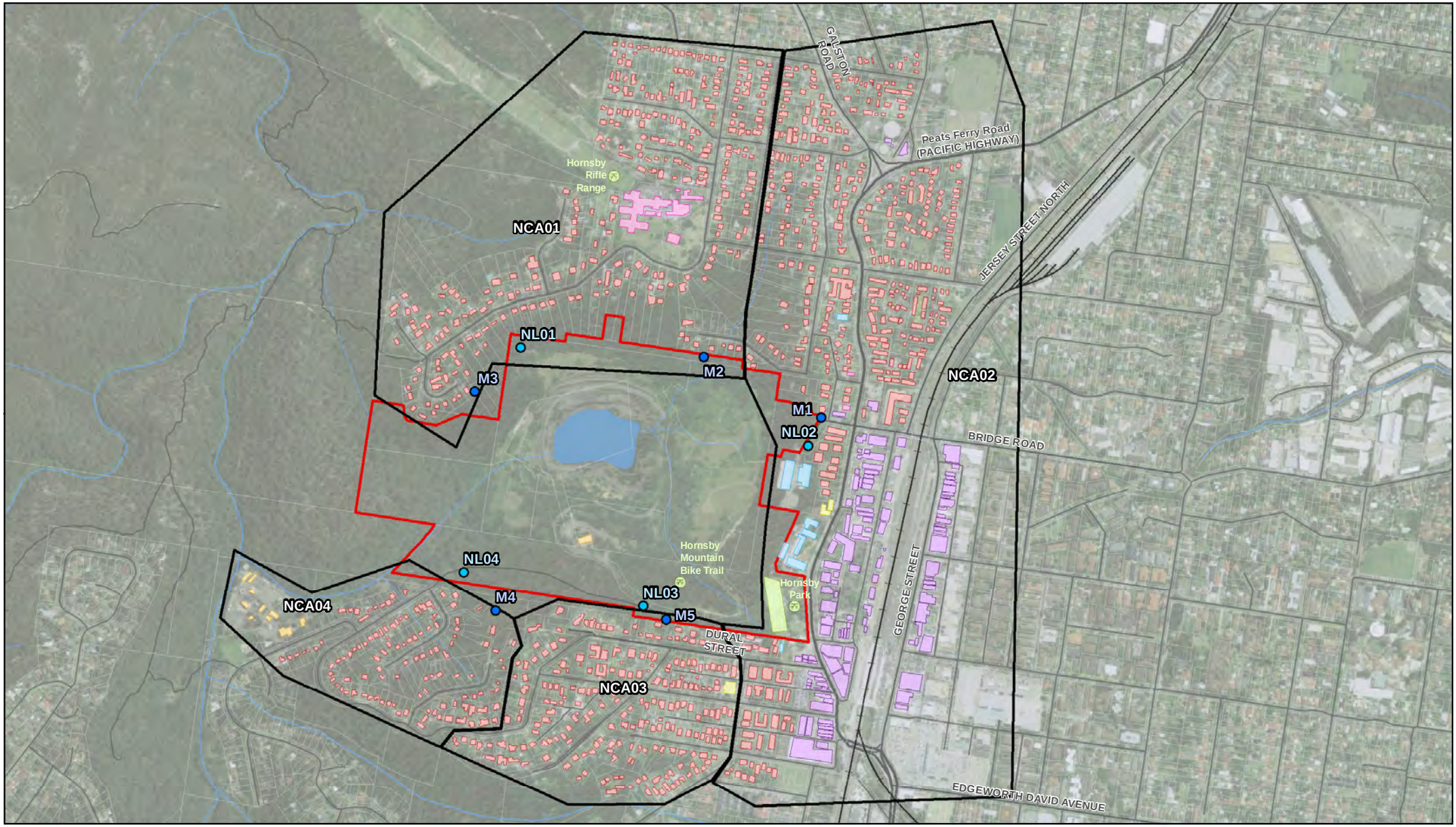
- residential premises
- educational institutions
- hospitals and medical facilities
- places of worship
- passive and active recreation areas
- commercial premises and industrial premises.

A summary of the number of sensitive receivers is presented in Table 8.2, with all sensitive receivers listed in Appendix C.

Table 8.2 Identified noise sensitive receivers

Sensitive receivers	Number of sensitive receiver buildings in study area
NCA01 - Residential	281
NCA02 - Residential	382
NCA03 - Residential	215
NCA04 - Residential	118
Residential (total)	998
Commercial	118
Industrial	11
Educational institute	9
Medical facility	9
Place of worship	4
Active recreation areas	4
Total no. of sensitive receivers	**1,151**

The noise sensitive receivers, the noise catchment areas and the background noise monitoring locations are presented in Figure 8.1.



Paper Size A4

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

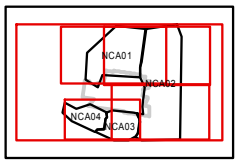
N

LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Medical Facility
- Residential
- Place of Worship



Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 08 Nov 2018

Site location, NCAs, noise monitoring locations and sensitive receivers - Overview

Figure 8.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

8.2.2 Noise monitoring

2018 unattended noise monitoring

Noise monitoring of the existing noise conditions at five sensitive receiver locations was undertaken to measure background and ambient noise levels during the 2016 Planning Approval (NorthConnex) filling works at the site. The dominant noise sources were due to earthmoving equipment within the quarry site, the screener transporting material from the spoil site to the quarry and heavy vehicle movements to and from the site.

Noise logging was conducted from Monday 17 September 2018 to Thursday 27 September 2018 in accordance with the NPI long-term monitoring method.

Table 8.3 provides a summary of the results of this noise monitoring.

Table 8.3 Summary of 2018 noise monitoring results, dBA

Location	Background noise descriptors $L_{A90(Period)}$			Ambient noise descriptors $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
M1 – Nr Bridge Rd / Roper Ln	46	38	31	63	47	47
M2 – 9 Fern Tree Close	42	34	31	52	47	43
M3 – 98 Manor Rd	42	36	31	52	45	42
M4 – 30 Lowanna Pl	36	30	29	49	46	43
M5 – Quarry Rd	40	34	30	51	46	47

2015 unattended noise monitoring

Unattended background noise monitoring was carried out at four locations as part of the 'Hornsby Quarry – Road Construction Spoil Management Project EIS' (AECOM, 2015). The background noise levels measured at the four noise monitoring locations surrounding the site provide the basis for the project noise trigger levels and construction noise management levels for each of the four NCAs.

Noise logger data results from Table 6-15 of AECOM (2015) are summarised in Table 8.4.

Table 8.4 Summary of 2015 noise monitoring results, dBA

Noise Catchment Area (NCA)	Noise Measurement Location (NL)	Background noise descriptors $L_{A90(Period)}$		
		Day	Evening	Night
NCA1	NL04	35[1]	34	31
NCA2	NL02	39	33	33
NCA3	NL03	37	37	32
NCA4	NL04	35[1]	34	31

Note: 1) Measured level is 34 dBA, however the minimum rating background noise level for the day (35 dBA) has been used in accordance with the Noise Policy for Industry (NPI)

The background noise levels presented in Table 8.4 have been used to determine the noise criteria for this assessment.

8.2.3 Construction noise criteria

Construction noise management levels

Construction noise management levels at sensitive residential receivers are provided in Table 8.5. The construction noise management levels during recommended standard hours represent a noise level that, if exceeded, would require management measures including:

- reasonable and feasible work practices
- contact with the residences to inform them of the nature or works to be carried out, the expected noise levels and durations and contact details.

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The noise affected construction noise management levels during recommended standard hours are not intended as a noise limit but rather a level where noise management is required and as such should not be included as a noise limit in the environmental protection license or consent condition.

Table 8.5 Residential construction noise management levels, dBA

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	Noise affected: RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • the proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours[1]	Noise affected: RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Notes:

1. It must be noted that no works are scheduled outside standard construction hours

Sleep disturbance

The NPI (EPA, 2017) recommends a detailed maximum noise level event assessment be undertaken where night-time noise levels from a development exceed the following levels when assessed externally at the nearest residential location:

- $L_{Aeq(15min)}$ 40 dBA or the prevailing RBL + 5 dBA (whichever is greater); and/or
- L_{AFmax} 52 dBA or the prevailing RBL + 15 dBA (whichever is greater)

Sleep disturbance is not anticipated from the project as construction works would not generate noise between 10:00 pm and 7:00 am.

Project noise management levels

A summary of the construction noise management levels are presented in Table 8.6.

Table 8.6 Project construction noise management levels, dBA

Receiver type	Construction noise management levels, $L_{Aeq(15\ min)}$				
	Standard construction hours		Outside standard construction hours[1]		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential (NCA1)	45	75	40	39	36
Residential (NCA2)	49	75	44	38	38
Residential (NCA3)	47	75	42	42	37
Residential (NCA4)	45	75	40	39	36
Commercial	70 (external)				
Industrial	75 (external)				
Educational Facility	55 (external)[2] or 45 (internal)				
Hospitals / Medical	55 (external)[2] or 45 (internal)				
Place of Worship	55 (external)[2] or 45 (internal)				
Active Recreation	65 (external)				

Notes:

1. It must be noted that no works are scheduled outside standard construction hours
2. External noise management level is based on a 10 dB noise reduction through an open window

8.2.4 Operational noise criteria

The NPI provides guidance on the assessment of operational noise impacts. The guideline includes both intrusiveness and project amenity noise levels that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from industry near a receiver.

Construction activities are excluded from the NPI as they are temporary in nature. Section 1.5 of the NPI make specific reference to activities and facilities that are excluded from the policy, one of these being construction activities. Never-the-less, potential noise impacts have been assessed against the NPI criteria to adequately satisfy the acoustic requirements detailed within the SEARs 1167 (Appendix A).

Project noise trigger levels – residential receivers

For residential receivers, the project noise trigger levels are provided in Table 8.7. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness and project amenity noise level. Daytime project noise trigger levels (PNTLs) are most relevant as the construction works at the site are proposed during this time period.

Table 8.7 Project noise trigger levels – residential noise receivers, dBA

NCA	PNTL $L_{Aeq(15min)}$ at residential receivers		
	Intrusive $L_{Aeq(15min)}$ noise level (Day)	Project amenity $L_{Aeq(15min)}$ noise level (Day – Suburban Residential)	Project $L_{Aeq(15min)}$ noise trigger level (Day)
NCA01	40	53	**40**
NCA02	44	53	**44**
NCA03	42	53	**42**
NCA04	40	53	**40**

Notes:

- The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday & Public Holidays
- Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.
- To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes that the LAeq,15min is be equal to LAeq, period + 3 dBA
- The project noise trigger levels have been determined based on the background noise logging undertaken in 2015 by AECOM

Project noise trigger levels – non-residential receivers

For non-residential receivers, the project noise trigger levels are provided in Table 8.8.

Table 8.8 Project noise trigger levels – non-residential receivers

Type of receiver	Time of day	Non-residential receivers		
		Assessment Location (NPI)	NPI trigger level L_{Aeq}, dBA	Adopted external trigger level L_{Aeq}, dBA
Commercial premises	When in use	External	65	65
Educational facility	Noisiest 1-hour period when in use	Internal	35	55[1]
Hospitals / Medical	Noisiest 1-hour period when in use	External	50	50
Place of worship	When in use	Internal	40	50[1]
Industrial	When in use	External	70	70
Passive recreation	When in use	External	50	50
Active recreation	When in use	External	55	55

Notes:

1. External noise management level is based on a 20 dB noise reduction through a closed window

Modifying factor adjustment

The NPI requires that modifying factor adjustments are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. The modifying factor adjustments are detailed in Table 8.9.

Table 8.9 Modifying factor adjustments

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz • 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive • 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dBA[2]

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted $L_{eq,T}$ levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and: • Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels for the evening/night period • Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dBA and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted noise levels applies for the evening/night period and a dBA positive adjustment for the daytime period.	5 dBA[2]
Impulsive noise	A-weighted fast response and impulse response	If the difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB.	Apply the difference in measured noise levels as the correction up to a maximum of 5 dBA
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dBA.	5 dBA

Notes:

1. Where two or more modifying factors are present the maximum correction is limited to 10 dBA.

2. Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

Sleep disturbance

No significant noise associated with the project is anticipated during the night-time hours between 10:00 pm and 7:00 am. As such, an assessment of sleep disturbance is not required.

Construction traffic

The Road Noise Policy (RNP) (DECCW, 2011) provides traffic noise criteria for residential receivers in the vicinity of existing roads, shown in Table 8.10. The criteria is applied to operational and construction traffic on public roads to identify potential road traffic impacts and the requirement for reasonable and feasible mitigation measures.

The RNP application notes state that *"for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of or exceeds, the relevant day or night noise assessment criterion."*

If road traffic noise increases from the development are within 2 dBA of current levels then the objectives of the RNP are met and no specific mitigation measures are required.

Table 8.10 Road traffic noise criteria, $L_{Aeq(period)}$ dBA

Type of Development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on existing arterial/sub-arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on existing local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$

Quarry Road and Dural Street are classified as local roads and Peats Ferry Road and Bridge Street are classified as sub-arterial/collector roads.

8.2.5 Construction vibration criteria

A summary of the vibration screening criteria is provided in Table 8.11. The criteria are provided as a guide for determining potential human comfort or structural damage impacted buffer distances to determine if further detailed investigation is required. The levels provided in Table 8.11 are recommended screening criteria for the impact assessment.

Table 8.11 Summary of screening vibration criteria

Receiver type	Criteria type	Peak particle velocity screening criteria
Residential (standard structures)	Human comfort	1 mm/s
	Structural damage	15 mm/s[1]
Heritage structure	Structural damage	7.5 mm/s

Note:

1. The vibration screening criteria for heritage structures has been assumed to be half of the residential structural damage criteria and is considered conservative.

8.3 Assessment of potential impacts

8.3.1 Noise modelling

For the purpose of the noise modelling, four construction work regions within the site were identified as shown in Figure 8.2.

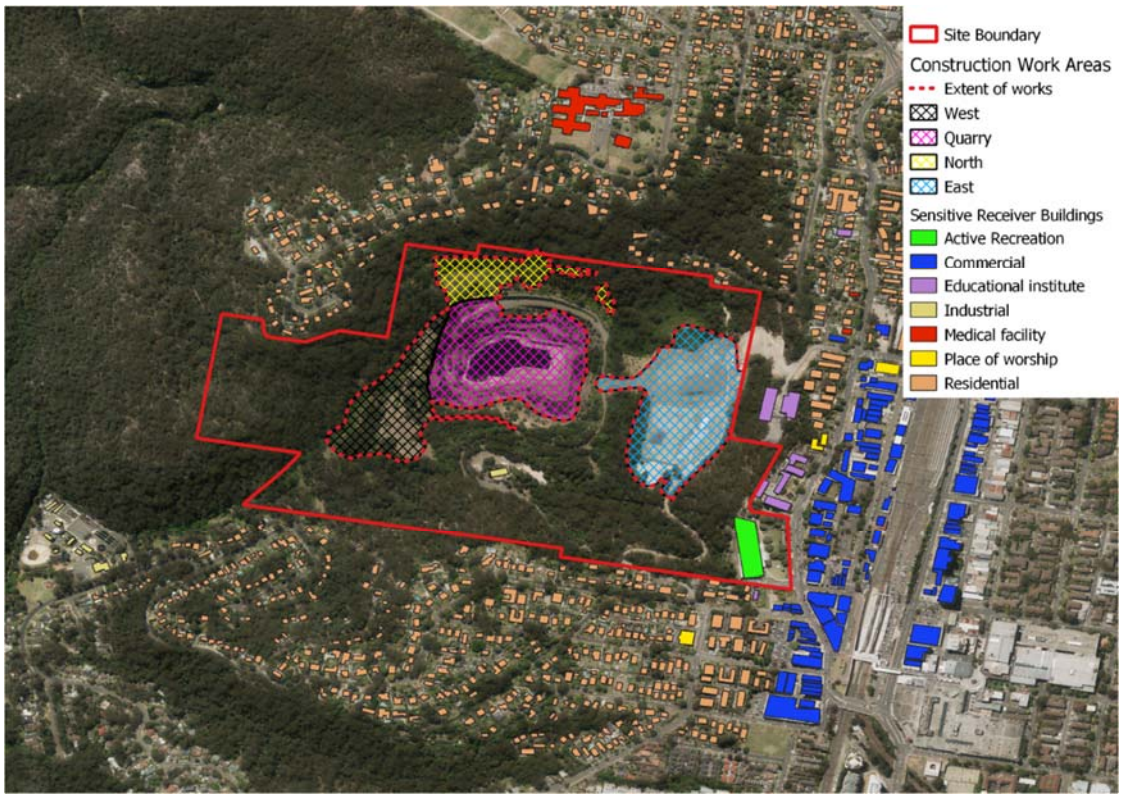

Figure 8.2 Construction work areas

Three scenarios which represent potential worst case situations were identified and assessed. Plant and equipment throughputs and locations are different for each scenario. The three modelled scenarios are:

Scenario 1

- West: Excavation and rock breaking/ripping/crushing works and rock sawing
- Quarry: Rock ripping, filling works, screening and excavation

Scenario 2

- North: Excavation works
- Quarry: Excavation, Rock breaking/sawing/crushing, filling and screening
- East: Excavation and filling

Scenario 3

- West: Excavation and rock sawing
- Quarry: Filling
- East: Rock ripping/sawing/crushing, filling, excavation and screening

In addition, two quarry topographies for each scenario has been modelled. One representing the existing topography of the quarry at the beginning of the construction works (sub-scenarios A and B) and the other representing the proposed topography of the quarry based on the final design (sub scenarios C and D).

The loudest construction activities, being ripping, rock breaking and crushing were assessed as separate scenarios (30 tonne excavator and ripper, 30 tonne excavator and breaker and the mobile crusher). Sub-scenarios A and C do not include the rock breaking activities, whereas sub-scenarios B and D include the rock-breaking activities.

It is noted that as a worst-case, the two noisiest items of equipment within each scenario have been modelled at the closest distance between the receiver and the relevant construction area. For the majority of the time, construction equipment will be at a further distance from the sensitive receiver.

As a result, 12 potential construction sub-scenarios have been modelled, as summarised in Table 8.12.

Table 8.12 Summary of modelled construction scenarios

Parameter	Construction scenario	Topography used in model	Rock breaking / ripping/ sawing / crushing
CS1A	1	Existing	×
CS1B	1	Existing	✓
CS1C	1	Final Design	×
CS1D	1	Final Design	✓
CS2A	2	Existing	×
CS2B	2	Existing	✓
CS2C	2	Final Design	×
CS2D	2	Final Design	✓
CS3A	3	Existing	×
CS3B	3	Existing	✓
CS3C	3	Final Design	×
CS3D	3	Final Design	✓

Complete modelling details and assumptions for all scenarios are provided in Appendix C.

8.3.2 Noise impacts

Interim Construction Noise Guideline (ICNG)

Where the predicted $L_{Aeq(15\ minute)}$ noise level is greater than the noise management levels, all feasible and reasonable work practices should be applied, however, it is unlikely that mitigation measures would reduce the predicted noise levels below the management levels. The magnitudes of construction noise levels are dependent on the duration of construction, the type of equipment, location of activities, the surrounding environment's background noise levels and the weather conditions during construction.

The predicted noise levels are generally conservative as the construction noise model predicts the worse-case 15 minute scenario and these levels may not represent the actual noise emission experienced by the community throughout the entire construction period.

Comparison of the predicted noise levels to all receivers within the study area against the noise management levels is presented in Appendix C.

The residential noise management levels are predicted to be exceeded at the majority of residences located within 800 m of the construction works at some stage during construction. CS3D is predicted to result in the highest number of exceedances of the noise management levels.

The predicted results at the worst-affected receivers during CS3D indicate that:

- R0109, R0110, R0407 and R0408 (NCA01) are predicted to receive noise levels 27 dBA above the noise management levels
- R0409 (NCA02) is predicted to receive noise levels 25 dBA above the noise management levels

- R0680 and R0834 (NCA03) are predicted to receive noise levels 21 dBA above the noise management levels
- R0299 and R1035 (NCA04) are predicted to receive noise levels 16 dBA above the noise management levels
- R0117 (Medical facility – Mount Wilga Private Hospital) is predicted to receive noise levels 2 dBA above the noise management levels
- R0106 (Educational institute – Hornsby TAFE) is predicted to receive noise levels 25 dBA above the noise management levels
- R0715 (Place of worship – St Peter's Anglican Church) is predicted to receive noise levels 16 dBA above the noise management levels
- R1151 (Active recreation – Hornsby Mountain Bike Trail) is predicted to receive noise levels 21 dBA above the noise management levels
- No other non-residential receivers are predicted to receive noise levels that exceed the noise management levels

All other construction scenarios are predicted to result in a lower amount of exceedances of the noise management levels. No exceedances of the highly noise affected criteria of 75 dBA have been predicted at any residential receivers.

It should be noted that the predicted noise levels is a maximum noise level from the closest potential distance from the receiver to the relevant construction activity. For the majority of the time, noise levels would be much lower than the predicted results as there would be a greater distance between the source and the receiver.

Mitigation measures to manage noise impacts have been recommended and are provided in Section 8.4.

Noise Policy for Industry (NPI)

Section 1.5 of the NPI provides a list of activities that are excluded from the policy and includes construction activities. As the construction works proposed at the site are not permanent and are temporary in nature, the ICNG should be considered a more suitable framework to assess potential noise impacts.

Never the less, the acoustic requirements detailed in the SEARS 1167 require the noise impacts be assessed against the NPI project noise trigger levels for sensitive receivers. A summary of the predicted noise levels against the sub-scenario with the greatest amount of exceedances is provided below. The predicted noise levels to sensitive receivers within the study area against the PNTLs are presented in Appendix C.

Predicted noise levels

The predicted results at the worst-affected receivers during CS3D indicate that:

- R0109, R0110, R0407 and R0408 (NCA01) are predicted to receive noise levels 32 dBA above the PNTL
- R0409 (NCA02) is predicted to receive noise levels 30 dBA above the PNTL
- R0680 and R0834 (NCA03) are predicted to receive noise levels 26 dBA above the PNTL
- R0299 and R1035 (NCA04) are predicted to receive noise levels 20 dBA above the PNTL
- R004 (Commercial – Service NSW Hornsby) is predicted to receive noise levels 4 dBA above the PNTL

- R0117 (Medical facility – Mount Wilga Private Hospital) is predicted to receive noise levels 7 dBA above the PNTL
- R0106 (Educational institute – Hornsby TAFE) is predicted to receive noise levels 25 dBA above the PNTL
- R0715 (Place of worship – St Peter's Anglican Church) is predicted to receive noise levels 16 dBA above the PNTL
- R1151 (Active recreation – Hornsby Mountain Bike Trail) is predicted to receive noise levels 30 dBA above the PNTL
- No industrial receivers are predicted to receive noise levels that exceed the PNTL

All other construction sub-scenarios are predicted to result in a lower amount of exceedances of the PNTLs.

Mitigation measures to manage noise impacts and reduce the severity of the exceedances above the PNTLs are provided in Section 8.4. However subsequent to the incorporation of these mitigation measures, the residual noise impact is predicted to still exceed the PTNLs at the nearest sensitive receivers.

Tonal noise assessment

Tonal noise characteristics are identified by assessing the predicted one-third octave noise levels. No modifications to the predicted operational noise levels are required as no tonal noise characteristics were identified at the nearest sensitive receivers.

Low frequency noise assessment

Low frequency noise impacts were assessed using the modelled A-weighted and C-weighted L_{eq} noise levels. The difference between the C-weighted and A-weighted levels at the nearest sensitive receivers during each assessment period did not result in any modification of the predicted noise results.

8.3.3 Construction traffic noise impacts

Construction activities would generate heavy vehicle movements associated with the transportation of construction machinery, equipment and materials to and from the site via Dural Street and Quarry Road at the start and end of the project. No other significant heavy vehicle movement are anticipated as no spoil is to be moved to or from the site.

For safety reasons, some heavy machinery/equipment may need to be delivered via Dural Street and Quarry Road during the night period. Light vehicle movements would be associated with the entry and exit for construction staff to and from the site via Bridge Road and Peats Ferry Road during the entire construction period.

The noise assessment found that the use of construction vehicles along Dural Street, Quarry Road, Peats Ferry Road and Bridge Street is predicted to comply with the acoustic requirements of the RNP.

8.3.4 Construction vibration impacts

Energy from construction equipment is transmitted into the ground and transformed into vibrations, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- the efficiency of the energy transfer mechanism of the equipment (i.e. impulsive; reciprocating, rolling or rotating equipment)

- the frequency content
- the impact medium stiffness
- the type of wave (surface or body)
- the ground type and topography.

Construction and demolition works have the potential to impact human comfort and / or cause structural damage to buildings. Potential vibration inducing activities identified during construction and demolition works include:

- rock breaking will generate impulsive vibration emissions
- bulk earthworks, vibratory rolling and compacting works will be a source of intermittent or continuous vibration.

Safe working buffer distances to comply with the human comfort, cosmetic damage and heritage structural damage criteria were taken from the Construction Noise and Vibration Guideline (RMS, 2010) and are provided in Table 8.13. Safe working buffer distances for heritage buildings were estimated by doubling the buffer distance for standard structures.

Table 8.13 Vibration safe working buffer distances, m

Activity	Human comfort	Structural damage	
		Heritage building/structure	Standard dwellings
Vibratory roller (>18 tonnes)	100 m	50 m	25 m
Vibratory roller (13-18 tonnes)	100 m	40 m	20 m
Vibratory roller (7-13 tonnes)	100 m	30 m	15 m
Vibratory roller (4-6 tonnes)	40 m	24 m	12 m
Vibratory roller (2-4 tonnes)	20 m	12 m	6 m
Vibratory roller (1-2 tonnes)	15 m	10 m	5 m
Large hydraulic hammer (1,600 kg, 18 to 34 tonne excavator)	73 m	44 m	22 m
Medium hydraulic hammer (900 kg, 12 to 18 tonne excavator)	23 m	14 m	7 m
Small hydraulic hammer 300 kg, 5 to 12 tonne excavator)	7 m	4 m	2 m

Note:

1. The safe working distance for heritage structures has been assumed to be double the safe working distance for standard dwellings

Vibratory rolling and compacting works (plant over 18 tonnes) haven been identified as the most vibration intensive activity associated with the construction works. Safe working buffer distances for human comfort (100 m) and structural damage to standard (25 m) and heritage buildings (50 m) due to rolling/compacting works are shown in Figure 8.3.

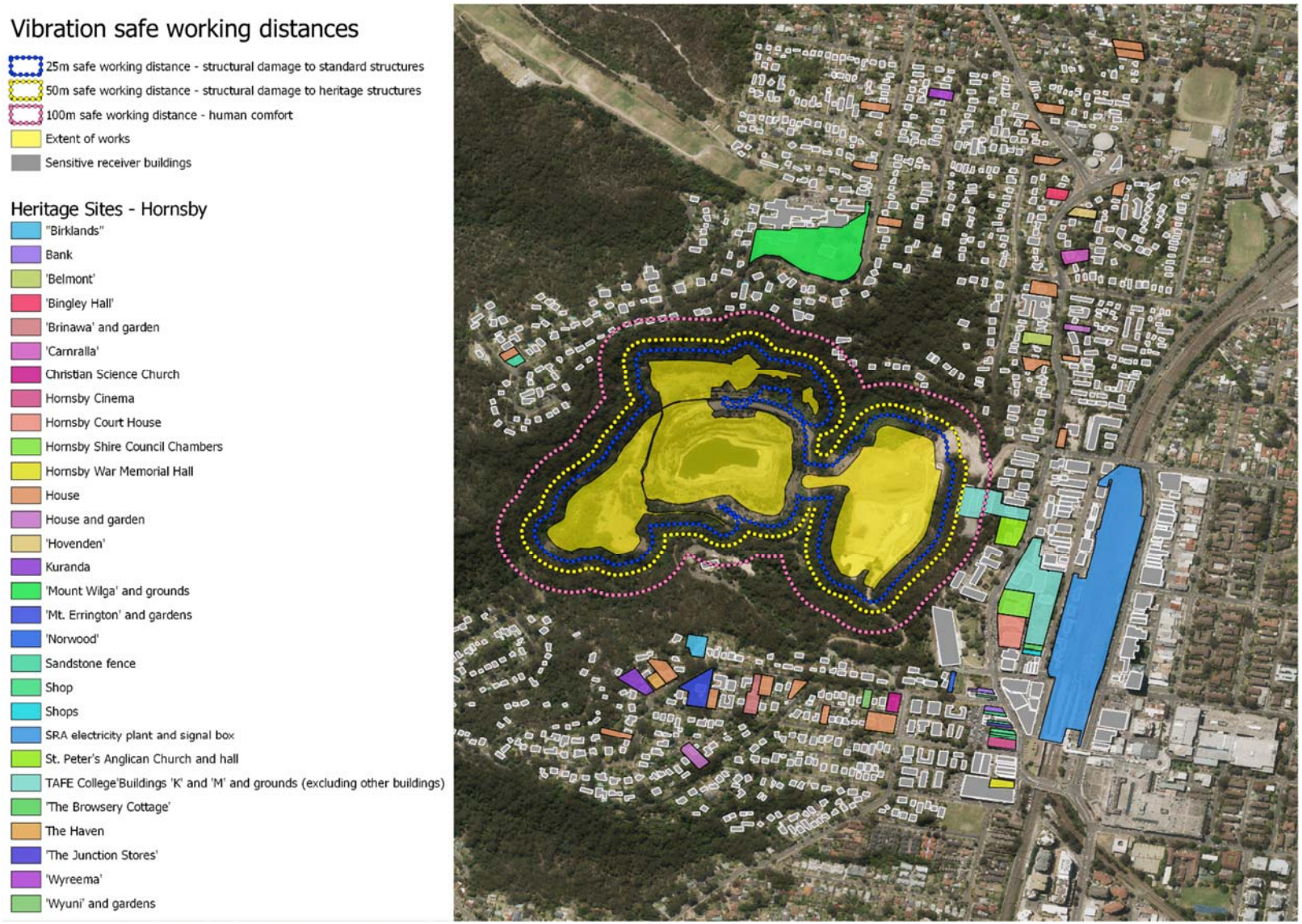

Figure 8.3 Vibration safe working distances

A review of the sensitive receivers within the safe working distances has been undertaken and the following has been found:

- The nearest residential receivers to the north of the site are within the safe working distances for human comfort. Rolling works within 100 m of residential dwellings have the potential to cause adverse vibration impacts to human comfort to the residences to the north. These impacts are temporary in nature and would likely only be experienced for limited periods during construction.
- Hornsby TAFE has been identified within 100 m of the eastern construction works and may result in adverse human comfort vibration impacts during rolling/compacting works. These impacts are temporary in nature and would likely only be experienced for limited periods during construction.
- No other sensitive receivers have been identified within the 100 m safe working distance for human comfort.
- No standard dwellings have been identified within 25 m of the construction work areas. As such, no adverse structural damage impacts to standard dwellings are anticipated.

One heritage structure has been identified within the 50 m structural damage buffer. This structure has been identified as the most western building of Hornsby TAFE. The building is only marginally within the calculated structural damage buffer zone. This building is not considered structurally unsound and as such, no adverse structural damage impacts are anticipated to this building as a result of rolling/compacting works along the eastern construction area.

Mitigation measures have been identified to reduce potential construction vibration impacts (Section 8.4.3).

8.4 Mitigation and management measures

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise levels are generally conservative and would only be experienced for limited periods during construction.

Impacts may be reduced through the introduction of feasible and reasonable mitigation measures, which have been identified below. However, these mitigation measures are unlikely to reduce noise levels below the construction noise management levels (ICNG) and the project noise trigger levels (NPI) at the nearest sensitive receivers.

8.4.1 Environmental management plan

The following measures would be incorporated into the Construction Environmental Management Plan as general work practice:

- All activities on site would be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 7:00 am to 1:00 pm on Saturday
- All personnel on site would be made aware of the potential for noise impacts and should aim to minimise impact or elevated noise levels, where possible.
- Regular identification of noisy activities and adoption of improvement techniques
- Minimise the need for vehicle reversing (for example, by arranging for one-way site traffic routes)

- Construction heavy vehicles utilising Dural Street and Quarry Road would be limited to one vehicle per hour during the night period
- Scheduling of respite periods for high noise activities including rock breaking, ripping and sawing
- A noise monitoring program would be carried out for the duration of the works in accordance with any approval and license conditions
- No swearing or unnecessary shouting or loud stereos/radios on site
- All employees, contractors and sub-contractors would receive an environmental induction. The induction would include:
  - all relevant project specific and standard noise and vibration mitigation measures
  - relevant licence and approval conditions
  - permissible hours of work
  - any limitations on high noise generating activities
  - location of nearest sensitive receivers
  - construction employee parking areas
  - designated loading/ unloading areas and procedures
  - construction traffic routes
  - site opening/closing times (including deliveries)
  - environmental incident procedures
- Notification detailing work activities, dates and hours, impacts and mitigation measures indication of work schedule, and contact phone number (for noise complaints and project information) would be made available for the community.

8.4.2 Noise mitigation strategies

The following mitigation measures are proposed to reduce noise at the source:

- Substitution:
  - Where reasonably practicable, noisy plant would be replaced by less noisy alternatives
- Modification of equipment:
  - All engine covers would be kept closed while equipment is operating.
  - Plant and vehicles would be kept properly serviced and fitted with appropriate mufflers and silencers, where applicable.
  - The use of exhaust brakes would be eliminated, where practical.
  - Where practical, plant operating on site would be fitted with broadband reversing alarms.
  - Acoustic enclosures would be provided for suitable equipment
- Use and siting of plant:
  - The offset distance between noisy plant and adjacent sensitive receivers would be maximised where practical
  - Plant used intermittently would be throttled down or shut off
  - Noise-emitting plant would be directed away from sensitive receivers, where possible
- Regular and effective maintenance:
  - Regular inspection and maintenance of equipment to ensure it is in good working order and checking the condition of mufflers

  - Machines found to produce excessive noise compared to industry best practice would be removed from the site or stood down until repairs or modifications can be made.
  - Ensure air lines on pneumatic equipment do not leak
  - Return of any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair.
- Alternative methods:
  - Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting. The suitability of alternative methods would be considered on a case-by-case basis.

The typical and maximum noise reductions due to these measures have been summarised in Table 8.14.

Table 8.14 Noise control measures

Control measure	Type of control	Typical reduction, dBA	Maximum reduction, dBA	Source
Silencers / mufflers / diffusers	Source	7 - 10	15	AS2436
Acoustic enclosures	Source	15 - 30	50	AS2436
Equipment substitution	Source	5-10	10	AS2436
Distance	Source / transmission path	6 per doubling of distance	6 per doubling of distance	AS2436

It is noted that noise barriers have been assessed and modelled (details provided in Appendix C) and shown to not be a reasonable and feasible mitigation option. In addition, noise control measures at the receiver are not suitable for construction noise as construction noise is temporary in nature and will not result in long-term noise impacts the community.

8.4.3 Vibration mitigation measures

Where vibratory rolling or compacting works undertaken within 100 m of the most western building of the Hornsby TAFE, the occupants of this building would be notified of the expected impacts. Should complaints be received, vibration monitoring would be undertaken to determine the extent of the vibration impact and to guide mitigation measures, which may include the use of smaller equipment when the TAFE is in use.

Where practical, rolling works near the TAFE would be undertaken during their holiday break period to minimise potential vibration impacts.

9. Air quality

The information presented in this chapter is based on the findings of the air quality assessment undertaken by GHD. The air quality assessment report is included in Appendix D of this EIS.

9.1 Approach and methodology

The air quality assessment included:

- Desktop review of site plans, aerial photographs and topographic maps to gain an understanding of the existing environment in terms of local terrain, existing/proposed operations and sensitive receptors within the study area.
- Review of available ambient air quality monitoring data, to gain an understanding of existing air quality in the vicinity of the site. Ambient dust levels were sourced from data recorded from the Office of Environment and Heritage (OEH) ambient monitoring station located in Lindfield.
- Identification of the applicable air quality criteria with consideration to the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (EPA, 2016) (the 'Approved Methods').
- Meteorological modelling to gain an understanding of the local wind climate and use as input for conducting atmospheric dispersion modelling.
- Preparation of an emission inventory for the project to identify significant sources of dust emission and estimate the emissions rates. Emission rates were estimated using emission factors published in the 'National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining V 3.1' (2012) and the 'National Pollutant Inventory Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.1' (2014).
- Dust modelling using the regulatory atmospheric dispersion model CALPUFF for use in areas with complex terrain based on proposed rehabilitation scenarios.
- Development of in principle mitigation and management measures to reduce potential dust impacts.

The air quality impact assessment focused on the potential impact from particulate (dust) emissions, in particular; total suspended particulates (TSP), fine particulates less than 10 micrometres in equivalent aerodynamic diameter (PM_{10}) and dust deposition.

9.2 Existing environment

9.2.1 Ambient air quality

The nearest OEH ambient air quality monitoring station to the site with sufficient data is the Lindfield station, which is approximately 11 km southeast of the site. Background PM_{10} measurements for the modelled year were taken from the Lindfield OEH monitoring site. Historical air quality data is limited, so daily background TSP and $PM_{2.5}$ data has been scaled off PM_{10} measurements. The adopted annual background TSP, PM_{10} and $PM_{2.5}$ concentrations are presented in Table 9.1.

Table 9.1 Background ambient levels for TSP, PM_{10} and $PM_{2.5}$

Pollutant	Assumed ambient concentration ($\mu g/m^3$)
$PM_{2.5}$ (Annual average)	5.4
PM_{10} (Annual average)	14.4
TSP (Annual average)	28.8

9.2.2 Sensitive receptors

The location of the nearest identified sensitive receptors to the site are presented in Table 9.2 with the address and receptor type. The Approved Methods (EPA, 2016) defines sensitive receptors as locations where people are likely to work or reside and may include a dwelling, school, hospital, office or recreation area.

Table 9.2 Sensitive receptor location

ID	X Coordinate (m)	Y Coordinate (m)	Address	Description
R01	322765	6269885	98 Manor Rd	Residential
R02	322962	6270094	43 Manor Rd	Residential
R03	323305	6270043	17 Fern Tree Cl	Residential
R04	323473	6269945	1A Fern Tree Cl	Residential
R05	323646	6269831	1 Bridge Rd	Residential
R06	323651	6269577	207 Peats Ferry Rd	St Peters Anglican Church Hornsby
R07	323514	6269385	203 Peats Ferry Rd	Hornsby Aquatic and Leisure centre
R08	323295	6269291	24A Quarry Rd	Residential
R09	323041	6269331	52 Dural St	Residential
R10	322728	6269374	3 Lockinvar Pl	Residential

The location of the site and surrounding receptors is provided in Figure 9.1.

Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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The Site

Sensitive Receptors

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 08 Nov 2018

Air quality sensitive receptors

Figure 9.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

9.2.3 Air quality criteria

Table 9.3 summarises the project specific air quality assessment criteria using the Approved Methods.

Table 9.3 Air quality assessment criteria

Pollutant	Averaging period	Concentration (µg/m^3)
Total suspended particulates (TSP)	Annual	90
PM_{10}	24 hours	50
	Annual	25
$PM_{2.5}$	24 hours	25
	Annual	8
Dust deposition	Annual	2 g/m^2/month*

** Maximum Increment. Maximum cumulative impact of 4 g/m^2/month.*

9.3 Assessment of potential impacts

9.3.1 Emissions

The air quality assessment focuses on dust and particulate matter, as they are the primary emissions to air from the project, with potential for off-site impacts.

Emissions factors were taken from the 'National Pollutant Inventory Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.1' (2014) and the 'National Pollutant Inventory Emission estimation Technique Manual for Mining Version 3.1' (2012). The techniques used to estimate emissions from operations are based primarily on activity rate (e.g. tonnes per hour).

The project would involve the handling and transfer of compacted and loose fill, weathered sandstone and hard rock. This material would be moved by various plant and equipment to fill in the quarry void and other parts of the site.

Expected plant and equipment throughputs have been calculated based on the expected total amount of material moved during the entire project and the predicted duration each piece of plant and equipment would be active on site.

9.3.2 Scenarios

The project construction has been assessed over three scenarios which represent potential worst case situations. Plant and equipment throughputs and location are different for each scenario. The three modelled scenarios are:

Scenario 1

- West: Excavation, rock breaking/ripping/crushing works and rock sawing
- Quarry: Rock ripping, filling works, screening and excavation

Scenario 2

- North: Excavation works
- Quarry: Excavation, Rock breaking/sawing/crushing, filling and screening
- East: Excavation and filling

Scenario 3

- West: Excavation and rock sawing
- Quarry: Filling

- East: Rock ripping/sawing/crushing, filling, excavation and screening

Complete emissions inventory details and assumptions for all scenarios are provided in Appendix D.

9.3.3 Dispersion modelling

An analysis of meteorology from the years from 2013 to 2017 was conducted to select a period considered to be most representative of 'normal' conditions. The analysis shows that the year 2013 is the most representative year based on a review of temperature, humidity, wind speed and wind direction. 2013 was also identified as not being excessively wet or dry.

Meteorological modelling was then undertaken for the selected year using the TAPM prognostic model and CALMET simulation in accordance with the Approved Methods.

Atmospheric dispersion modelling was then carried out using the CALPUFF dispersion model to predict ground-level concentrations of modelled pollutants downwind of the project.

The TSP, PM_{10} and $PM_{2.5}$ impacts were assessed at nearby sensitive receptors for each scenario (scenario 1, scenario 2 and scenario 3).

A summary of the predicted particulate concentrations are presented in this section. No exceedances of criteria are predicted.

Predicted TSP

Table 9.4 presents the incremental and cumulative annual TSP concentrations (bolded) for each receptor. There are no predicted exceedances of the annually averaged criterion (90 µg/m^3).

Table 9.4 Incremental and cumulative annual TSP concentrations (µg/m^3)

	Scenario 1		Scenario 2		Scenario 3	
Receptor	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	6.4	**35.1**	4.4	**33.1**	1.3	**30.0**
R02	3.3	**32.0**	4.3	**33.0**	1.6	**30.3**
R03	1.5	**30.2**	2.0	**30.7**	1.9	**30.6**
R04	1.0	**29.7**	1.1	**29.8**	2.7	**31.4**
R05	0.4	**29.1**	0.4	**29.1**	1.4	**30.1**
R06	0.3	**29.0**	0.3	**29.0**	1.2	**29.9**
R07	0.4	**29.1**	0.4	**29.1**	1.1	**29.8**
R08	0.6	**29.3**	0.4	**29.1**	0.7	**29.4**
R09	1.4	**30.1**	1.0	**29.7**	1.2	**29.9**
R10	3.3	**32.0**	1.6	**30.3**	1.3	**30.0**

Predicted PM_{10}

PM_{10} concentrations are assessed against a 24 hour averaged criterion of 50 µg/m^3 and an annual averaged criterion of 25 µg/m^3.

The maximum daily incremental 24 hour PM_{10} concentrations predicted from each scenario are shown in Table 9.5. This shows that there were no exceedences of the 24 hour averaged criterion of 50 µg/m^3 at any of the receptors, for any of the scenarios.

Table 9.5 Maximum predicted incremental 24 hour PM_{10} concentration for each scenario, µg/m^3

Receptor	Scenario 1	Scenario 2	Scenario 3
R01	25.7	23.6	15.3
R02	14.2	21.6	9.9
R03	8.5	7.5	5.6
R04	4.3	4.2	8.2
R05	2.3	1.9	5.9
R06	1.5	1.5	4.4
R07	2.2	1.8	4.5
R08	2.6	2.1	2.3
R09	5.2	3.6	2.6
R10	9.9	6.0	5.0

The most affected receptor from all three scenarios was identified to be receptor R01, which is located to the north west of the site.

A contemporaneous assessment during the worst case scenario (scenario 1) for receptor R01 is presented in Table 9.6. A contemporaneous assessment adds historical background concentrations to the predicted incremental concentrations to quantify the expected cumulative impacts.

The contemporaneous assessment showed that no criteria exceedances are predicted even with historically high background PM_{10} concentrations at Receptor R01.

Table 9.6 PM_{10} 24 hour contemporaneous assessment for the worst case affected receptor R01 during the worst case Scenario 1 (µg/m^3)

Date	PM_{10} Background	Date	PM_{10} Incremental	Date	PM_{10} Cumulative
08/11/2013	45.3	27/06/2013	25.7	08/11/2013	45.3
21/10/2013	38.9	08/06/2013	25.6	08/06/2013	41.2
29/10/2013	38.8	28/06/2013	21.9	27/06/2013	40.1
22/10/2013	36.0	07/05/2013	19.6	29/10/2013	39.6
29/12/2013	33.5	22/05/2013	16.7	21/10/2013	38.9
23/12/2013	31.1	17/04/2013	16.2	22/10/2013	36.2
09/01/2013	31.0	10/05/2013	14.9	10/05/2013	36.0
25/08/2013	31.0	12/02/2013	14.2	14/03/2013	36.0
21/12/2013	29.3	03/03/2013	13.9	29/12/2013	35.2

The measured annual background for 2013 was 14.4 µg/m^3. The incremental and cumulative annual PM_{10} concentration (bolded) are shown in Table 9.7. No criteria exceedances are predicted and the incremental concentrations are significantly lower than the assessment criteria of 25 µg/m^3.

Table 9.7 Predicted incremental and cumulative annual PM_{10} concentrations (µg/m^3)

Receptor	Scenario 1		Scenario 2		Scenario 3	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	1.9	**16.2**	1.3	**15.6**	0.4	**14.7**
R02	0.9	**15.3**	1.2	**15.6**	0.5	**14.8**
R03	0.4	**14.8**	0.6	**14.9**	0.6	**14.9**
R04	0.3	**14.6**	0.3	**14.7**	0.8	**15.1**

Receptor	Scenario 1		Scenario 2		Scenario 3	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R05	0.1	**14.5**	0.1	**14.5**	0.4	**14.8**
R06	0.1	**14.4**	0.1	**14.4**	0.3	**14.7**
R07	0.1	**14.5**	0.1	**14.5**	0.3	**14.6**
R08	0.2	**14.5**	0.1	**14.5**	0.2	**14.5**
R09	0.4	**14.8**	0.3	**14.6**	0.3	**14.7**
R10	0.9	**15.3**	0.4	**14.8**	0.4	**14.7**

Predicted $PM_{2.5}$

$PM_{2.5}$ concentrations are assessed against a daily averaged criterion of 25 µg/m^3 and an annually average criterion of 8 µg/m^3.

The maximum daily incremental 24 hour $PM_{2.5}$ concentrations predicted from each scenario are presented in Table 9.8. No incremental criteria exceedances are predicted.

Table 9.8 Maximum predicted incremental 24 hour $PM_{2.5}$ concentrations for each scenario (µg/m^3)

Receptor	Scenario 1	Scenario 2	Scenario 3
R01	4.2	4.3	2.3
R02	2.5	4.3	1.6
R03	1.5	1.4	1.3
R04	1.0	1.2	2.3
R05	0.6	0.7	1.9
R06	0.4	0.5	1.2
R07	0.6	0.5	1.1
R08	0.6	0.4	0.6
R09	0.9	0.6	0.6
R10	1.6	1.0	0.8

The most affected receptor from all three scenarios was identified to be receptor R01 located to the north west of the site. A contemporaneous assessment during the worst case scenario (scenario 1) for receptor R01 is presented in Table 9.9.

Table 9.9 $PM_{2.5}$ 24 hour contemporaneous assessment for the worst case affected receptor during the worst case Scenario 1 (µg/m^3)

Date	$PM_{2.5}$ Background	Date	$PM_{2.5}$ Incremental	Date	$PM_{2.5}$ Cumulative
02/11/2013	23.8	08/06/2013	4.2	02/11/2013	23.8
08/11/2013	17.0	27/06/2013	3.8	08/11/2013	17.0
21/10/2013	14.6	28/06/2013	3.4	29/10/2013	14.8
29/10/2013	14.6	07/05/2013	3.3	21/10/2013	14.6
22/10/2013	13.5	22/05/2013	2.8	22/10/2013	13.5
29/12/2013	12.6	17/04/2013	2.5	29/12/2013	12.9
23/12/2013	11.7	12/02/2013	2.4	09/01/2013	12.1
09/01/2013	11.6	03/03/2013	2.4	25/08/2013	12.0
25/08/2013	11.6	10/05/2013	2.2	14/03/2013	11.7

The adopted annual $PM_{2.5}$ background for 2013 was 5.4 µg/m^3. The incremental and cumulative annual (bolded) $PM_{2.5}$ concentration are shown in Table 9.10. No criteria exceedances are

predicted and the incremental concentrations are significantly lower than the assessment criteria of 8 µg/m^3.

Table 9.10 Predicted incremental and cumulative annual $PM_{2.5}$ concentrations (µg/m^3)

Receptor	Scenario 1		Scenario 2		Scenario 3	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	0.3	**5.7**	0.2	**5.6**	0.1	**5.4**
R02	0.2	**5.5**	0.2	**5.6**	0.1	**5.4**
R03	0.1	**5.4**	0.1	**5.5**	0.1	**5.5**
R04	0.1	**5.4**	0.1	**5.4**	0.1	**5.5**
R05	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R06	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R07	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R08	0.0	**5.4**	0.0	**5.4**	0.0	**5.4**
R09	0.1	**5.4**	0.1	**5.4**	0.1	**5.4**
R10	0.2	**5.5**	0.1	**5.4**	0.1	**5.4**

9.4 Mitigation and management measures

While the project is not expected to exceed air quality goals at nearby private receptors, the following mitigation measures are proposed:

- Where appropriate, material would be watered prior to it being loaded for on-site haulage
- The size of storage piles would be minimised where possible
- Cleared areas of land would be limited where practicable and only cleared when necessary to reduce fugitive dust emissions
- On-site traffic would be controlled by designating specific routes for haulage and access and limiting vehicle speeds to below 25 km/h
- All trucks hauling material on the way to the site would be covered and a reasonable amount of vertical space would be maintained between the top of the load and top of the trailer
- Operations conducted in areas of low moisture content material would be suspended during high wind speed events or water sprays would be used
- Rock saws would be equipped with in built wet control systems that reduce dust generation to negligible levels. These wet control systems would be used during all rock sawing activities.

10. Water

The information presented in this chapter is based on the findings of the water assessment undertaken by GHD. The water assessment report is included in Appendix E of this EIS.

10.1 Approach and methodology

A water impact assessment was undertaken to identify the potential impacts of the project and address the requirements of the SEARs, as well as key agency requirements, in relation to water.

The assessment included:

- Conceptualisation of the surface and groundwater conditions for the project and identification of potential water related risks
- Development of a daily time step water balance model to represent likely inflows and outflows to the system. This included rainfall, runoff, evaporation, groundwater inflows and dewatering.
- Establishment of groundwater inflow for the water balance model through review of previous assessments, completion of additional analytical calculations and calibration of the water balance to recent observed water levels in the void.
- Assessment of identified potential risks using the results of the water balance including:
  - The abstraction of groundwater through inflow into the quarry void and potential consequences regarding the dewatering licence.
  - Potential impacts due to dewatering to the natural waterway with groundwater, leachate and disturbed runoff that may contain elevated concentrations of substances.
  - The risk of impacting groundwater quality due to exposure or contamination in the void.
  - Potential impacts to the formation of downstream waterways through affecting the patterns of sediment mobilisation and deposition.
- Development of management and mitigation measures

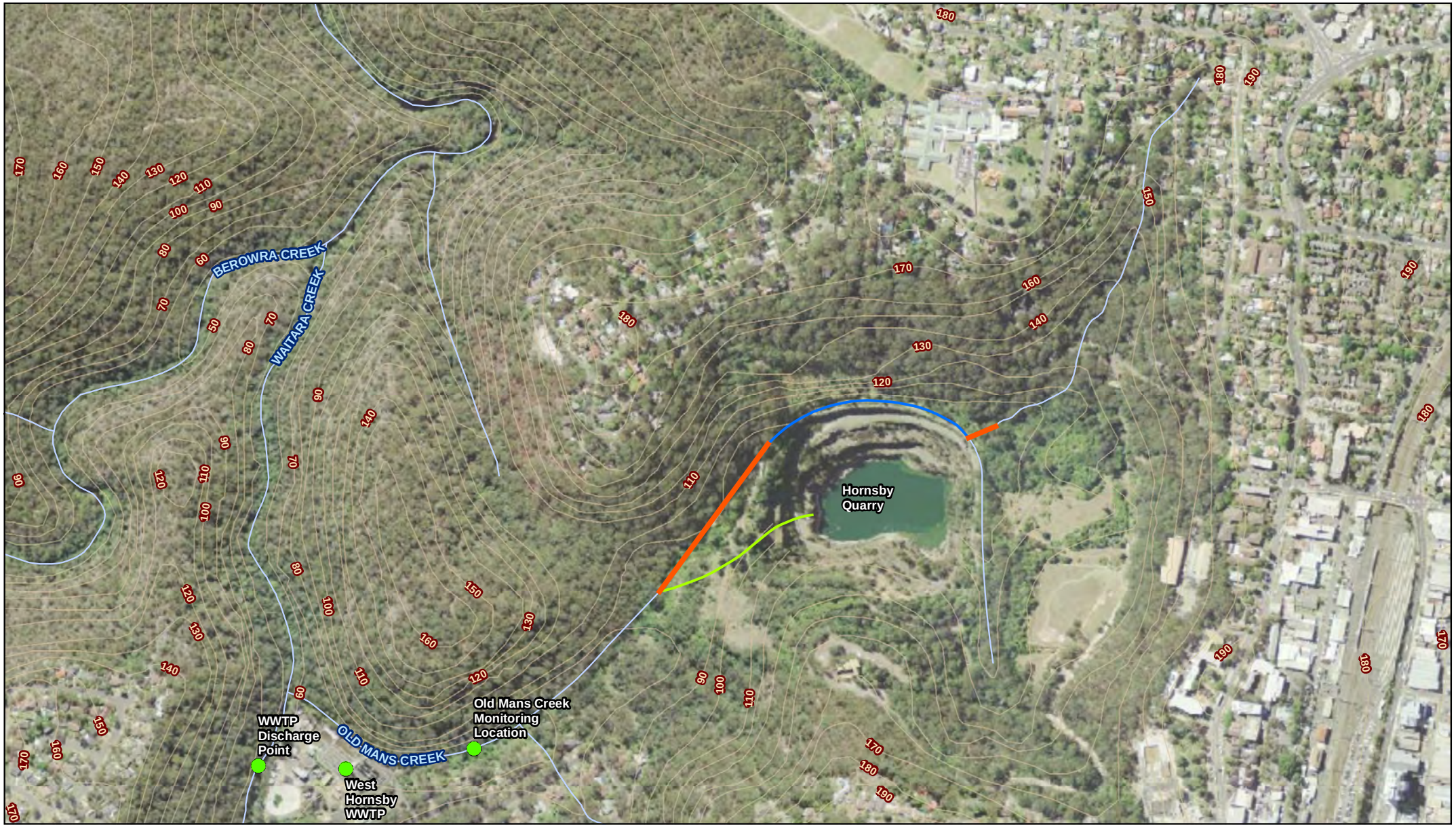
10.2 Existing environment

10.2.1 Surface water

The quarry is located in Old Mans Valley. This valley collects runoff from the east including urban areas within the suburb of Hornsby as well as vegetated areas surrounding the quarry site. Upstream flows through the valley have been diverted around the quarry via constructed channels and culverts, resulting in the quarry only receiving surface runoff from the immediate vicinity.

Downstream of the quarry site Old Mans Creek flows in a westerly direction, flowing into Waitara Creek. Waitara Creek in turn flows into Berowra Creek which flows into the Hawkesbury River, discharging into the ocean at Broken Bay. The Hornsby West Wastewater Treatment Plant discharges treated effluent into Waitara Creek a short distance upstream of the confluence with Old Mans Creek.

Figure 10.1 shows the surface water systems at and surrounding the site, including the diversion of flows around the quarry void.



Service Layer Credits: © Department of Finance, Services

Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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LEGEND

- Diversion Culverts
- Diversion Channels
- Dewatering Pumping Line
- Watercourse
- Contours (10m)

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number	21-26457
Revision	A
Date	20 Nov 2018

Surface Water Environment

Figure 10.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012. Created by:jwatson2

10.2.2 Groundwater

Two groundwater systems occur at the quarry void: a shallow perched water system and a deeper system located within the fresh breccia and surrounding Hawkesbury Sandstone.

Groundwater is present within secondary structural features such as joints, fractures and bedding planes. Water flows into the quarry void due to the elevated surrounding groundwater levels compared to the levels within the pit. Historically this groundwater inflow resulted in filling of the base of the void with water, which was subsequently pumped out.

Following the commencement of emplacement works under the 2016 Planning Approval, this groundwater inflow is anticipated to result in the "filling up" of void spaces in the emplaced material without significant observed standing water until the voids of the emplaced material have been filled.

10.2.3 Current void water management

As the base of the void is located below the surrounding groundwater levels, inflow into the void continuously occurs. Since 2009, Council has undertaken dewatering under bore licence 10BL602742 ('the dewatering licence') under the *Water Management Act 2000* (WM Act). This license is understood to allow for up to 370 ML/year of dewatering and requires that the volumes of dewatering be recorded. On average, between 2010 and 2014, Council has dewatered approximately 200 ML/year.

NorthConnex has undertaken management of water in the void since the commencement of works under the 2016 Planning Approval. This has involved dewatering the void below the level previously maintained by Council to allow emplacement of material.

10.2.4 Water quality

Water quality data is available for two key locations relevant to the quarry:

- Monthly physio-chemical measurements from the discharges of water from the quarry void taken by Council between 2010 and 2014 (prior to the works undertaken under the 2016 Planning Approval). This monitoring was undertaken in accordance with the requirements of the dewatering licence.
- Monitoring in Old Mans Creek, downstream of the site undertaken as documented in the Hornsby Shire Council (2013) 'Water Quality Monitoring Program Annual Report 2012-2013' and (2014) 'Water Quality Monitoring Program, Annual Report 2013-2014'.

Council has also undertaken analysis of water quality data for non-impacted reference sites for over 15 years and developed regional environmental health values (REHVs) based generally on the 95th percentile values at these sites (Hornsby Shire Council, undated).

The ANZECC (2000) 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality' forms the central technical reference of the National Water Quality Management Strategy adopted by federal and state governments and based on this document REHVs are considered to be an appropriate representation of natural background conditions, against which the existing and future level of impact in the catchment can be assessed.

Table 10.1 shows the sampling results for the two key locations described above for key analytes. The REHV trigger values are also provided in the table.

Table 10.1 Water quality sampling results

			Old Mans Creek (Hornsby Council Site 115)					Quarry dewatering (monitored as per dewatering licence 10BL602742)				
Parameter	Unit	REHV	Number of samples	Mean	Minimum	80th Percentile*	Maximum	Number of samples	Mean	Minimum	80th Percentile	Maximum
Electrical conductivity	ms/cm	0.32	19	0.45	0.12	0.5	0.82	63	0.84	0.71	0.879	0.92
Turbidity	NTU	8.1	19	1.84	0	2.98	10.5	64	0.9	-0.2	1.58	7
Dissolved oxygen	% saturation	75-118	19	89.8	60.3	83.5 (20th) 97.6 (80th)	106.2	64	99.92	59	93.6 (20th) 111.9 (80th)	128.8
pH	pH	4.8-7	19	6.52	4.65	6.22 (20th) 6.94 (80th)	8.28	63	8.24	7.15	8.06 (20th) 8.47 (80th)	8.68
Suspended solids	mg/L	7	19	2.95	1	6.75	17	60	1	1	2	6
Ammonium nitrogen	mg/L	0.02	19	0.026	0.01	0.045	0.17	61	0.008	0.005	0.005	0.04
Oxidised nitrogen	mg/L	0.05	19	0.025	0.01	0.040	0.12	61	0.011	0.005	0.01	0.06
Total nitrogen	mg/L	0.32	19	0.22	0.08	0.26	0.54	61	0.21	0.16	0.24	0.29
Total phosphorus	mg/L	0.01	19	0.021	0	0.025	0.05	61	0.009	0.004	0.011	0.026
Faecal coliforms	CFU/100 ml	Median < 150 80th% < 600	19	2969	6	749	51000	61	11	1	17	36

* 80th Percentile values provided in Hornsby Shire Council (2013) and Hornsby Shire Council (2014) for respective years of monitoring. Overall 80th percentile approximated based on average of 80th percentile for each monitoring years

It can be seen that for the majority of analytes, the REHVs are exceeded when considering the maximum monitored values. This is to be expected with the REHVs based on the 95th percentile values for two unimpacted reference sites (Hornsby Shire Council, undated).

Therefore, even the maximum values observed in a non-impacted location would be expected to exceed the REHVs. Therefore, comparing against the 80th percentile values (the highest percentile presented in the creek monitoring data) is considered to be more appropriate in assessing existing impacts than comparison with natural conditions.

- Comparison of the water quality data with the REHVs indicates that:
- For the 80th percentile results in Old Mans Creek and the dewatering discharge compared to the REHVs there are several exceedances, however, the existing water quality of both of these is generally similar to an unimpacted or slightly disturbed catchment.
- The pH of the dewatering is elevated compared to natural catchments, however this does not appear to be affecting the downstream creek such that pH levels are outside those expected for a natural catchment of this nature.
- On some occasions, elevated faecal contamination has been observed in the creek potentially due to point sources such as sewage overflows.

There is potential for the water quality in the void to be altered (compared to the historically monitored dewatering) through seepage through the material placed under the 2016 Planning Approval. This potential impact would not be recognised through analysis of existing water quality data (as above) which is for the period before emplacement commenced. However, the EIS for the emplacement activities (AECOM, 2015) assessed the potential impact of the emplaced material on water quality noting “the project is unlikely to affect groundwater quality as the quarry would be filled with ENM and VENM and would not include contaminated material”.

On this basis, the water quality of historical dewatering is considered for this assessment to be an appropriate indicator of the existing water quality in the void at the commencement of this project.

10.3 Assessment of potential impacts

10.3.1 Water balance model

A daily time step water balance model was developed to represent likely inflows and outflows to the system using the GoldSIM software package. This included rainfall, runoff, evaporation, groundwater inflows and dewatering, as represented on Figure 4.1. The simulation was based on water level data obtained during a site inspection, available meteorological data, restrictions indicated in the dewatering license and the final landform at the end of the project.

The model was simulated for 92 different realisations of rainfall and evaporation, which allowed for assessment of the impact of the range of potential climatic conditions that could be experienced. The model was simulated for the period required to represent conditions during “filling up” of the void to the target water level (55 m AHD) and for one year after “filling up” was achieved.

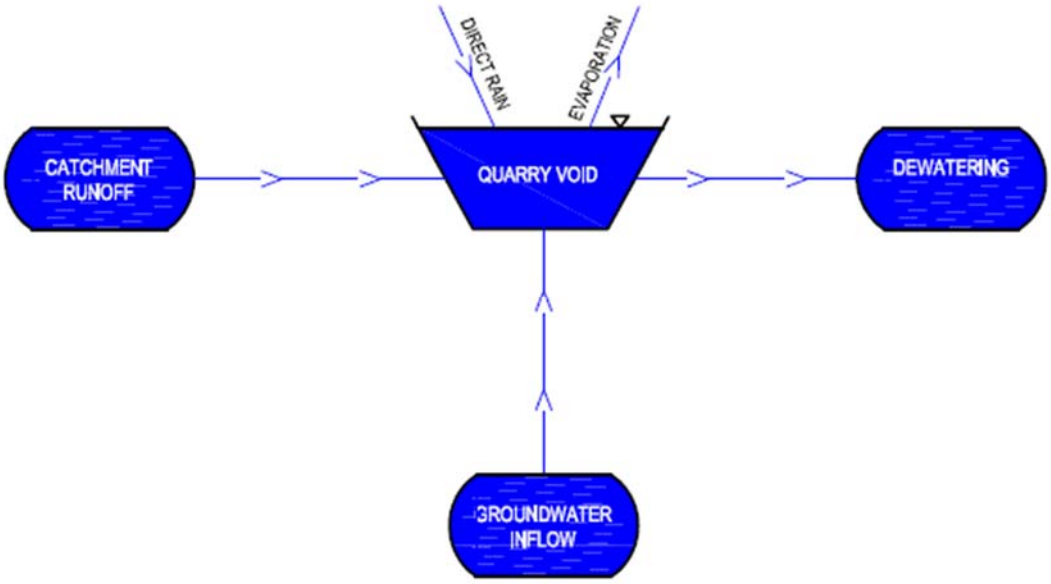


Figure 10.2 Water balance schematic

The estimation of groundwater inflow rates is a predominant/key input parameter for the water balance. Therefore, a multifaceted approach was adopted to assess groundwater inflows. The aim of the approach was to develop an appropriate relationship of pit water level vs inflow rate for input into the water balance. The assessment included the following works:

- An analytical assessment of inflows.
- Comparison against previous estimates outlined in Appendix M of the EIS completed for disposing of construction spoil into the quarry void (AECOM, 2015).
- Model calibration to recent observed water levels in the void.

Details of the assessment are provided in Appendix E. Based on the above considerations, the following groundwater inflow rates were adopted (Table 10.2).

Table 10.2 Groundwater inflow scenarios

Pit water level (m AHD)	Groundwater inflow 20% runoff (m^3/day)	Groundwater inflow 30% runoff (m^3/day)	Groundwater inflow 50% runoff (m^3/day)
8	114	91.2	68.4
10	114	91.2	68.4
20	111	88.8	66.6
30	107	85.6	64.2
40	100	80	60
50	91	72.8	54.6
60	80	64	48
70	66	52.8	39.6
80	50	40	30
90	31	24.8	18.6
92	0	0	0

Figure 10.3 shows the results of the water balance for the 30% runoff scenario. The range of results presented on each figure indicate the potential variation based on the climatic conditions that are experienced. Review of the figures indicates that:

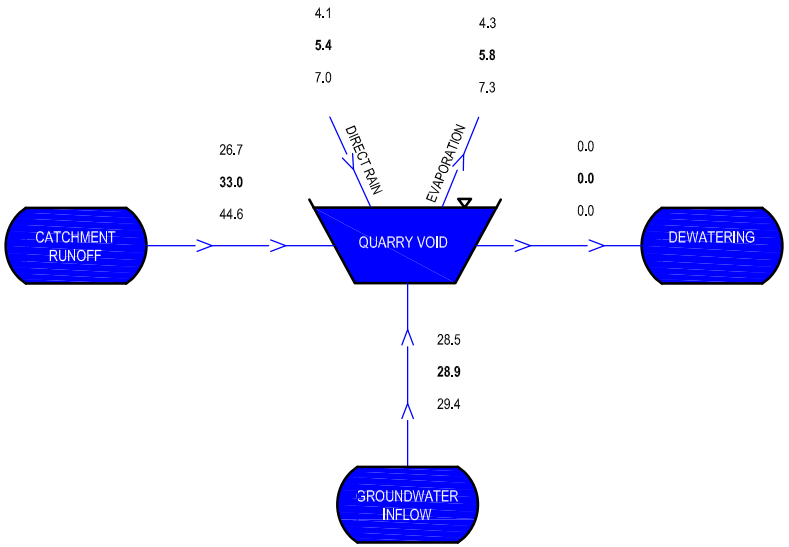
- Prior to reaching the target water level groundwater inflow is approximately 30 ML/year with minimal variation for climatic conditions.
- Catchment runoff is approximately 30 ML/year for average climatic conditions but is subject to greater variability with climatic conditions.
- Direct rain is a significantly smaller input and approximately offset by evaporation.
- After reaching the target water level the predicted range of the annual dewatering requirement is from 30 ML/year for the minimum climatic conditions to over 100 ML/year for the maximum climatic conditions. These results are all less than the volumetric allowance of Council's groundwater licence.
- After reaching the target water level groundwater inflow at approximately 25 ML/year is relatively smaller than the "filling up" stage due to the relatively higher water level.

Table 10.3 indicates the estimated time to reach the target water level for the three runoff scenarios. It can be seen that the predicted time to reach the target water levels varies from August 2021 to July 2025. There is more variation in the time to fill for the higher runoff scenario because for this scenario the calibrated groundwater inflows were relatively less due to the higher surface water contribution. As the groundwater inflows are less variable than rainfall derived surface flows, the higher ratio of groundwater reduces the range of prediction.

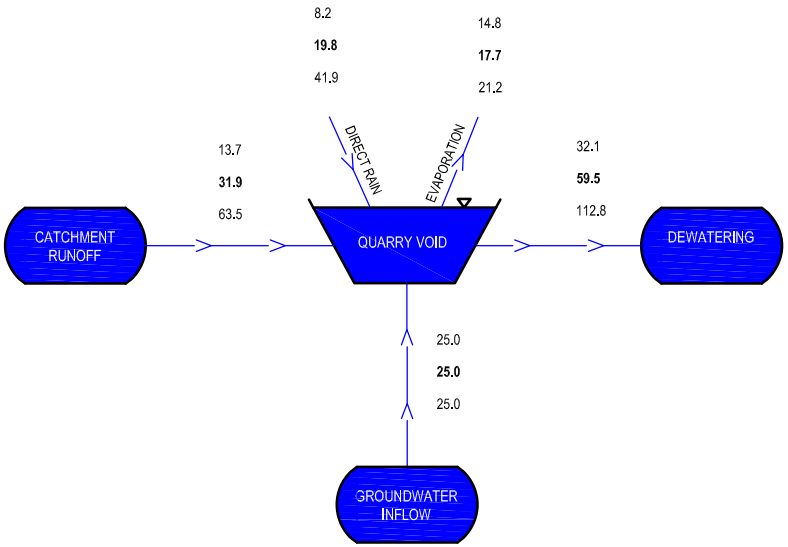
It should be noted that the terms "minimum" and "maximum" refer to the upper and lower range climatic conditions for a given set of other parameters, rather than guaranteed bounds after all other non-climatic factors are considered.

Table 10.3 Time to reach target water level

Climatic conditions	20% runoff	30% runoff	50% runoff
Minimum	2/12/2023	28/03/2023	2/08/2021
10th Percentile	12/03/2024	31/07/2023	29/04/2022
Mean	06/11/2024	28/05/2024	13/03/2023
90th Percentile	06/05/2025	22/01/2025	25/11/2023
Maximum	19/07/2025	4/05/2025	19/04/2024



PRIOR TO REACHING TARGET WATER LEVEL



AFTER REACHING TARGET WATER LEVEL

LEGEND

MINIMUM (ML/YR)
AVERAGE (ML/YR)
MAXIMUM (ML/YR)

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION

Water balance results - 30% runoff scenario

Job Number 21-26457
Revision B
Date JUN 2018

Figure 10.3

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 22 June 2018 - 3:54 PM Plotted by: Rod Towner Cad File No: N:\AU\Sydney\Projects\21\26457\Tech\Water\WaterBalance\Hornsby Water Cycle Schematic.dwg

Figure 10.4 indicates the dilution factor results for the final quarry lake after the target water level is reached for the 30% runoff scenario. This factor represents the potential accumulation of concentrations above the concentration in incoming groundwater. Final predicted concentrations equal the factor multiplied by the concentration of incoming flows

The results indicate the dilution factors expected are similar to 1 and less than or equal to 1.05 at all times, suggesting no significant ongoing accumulation and concentration.

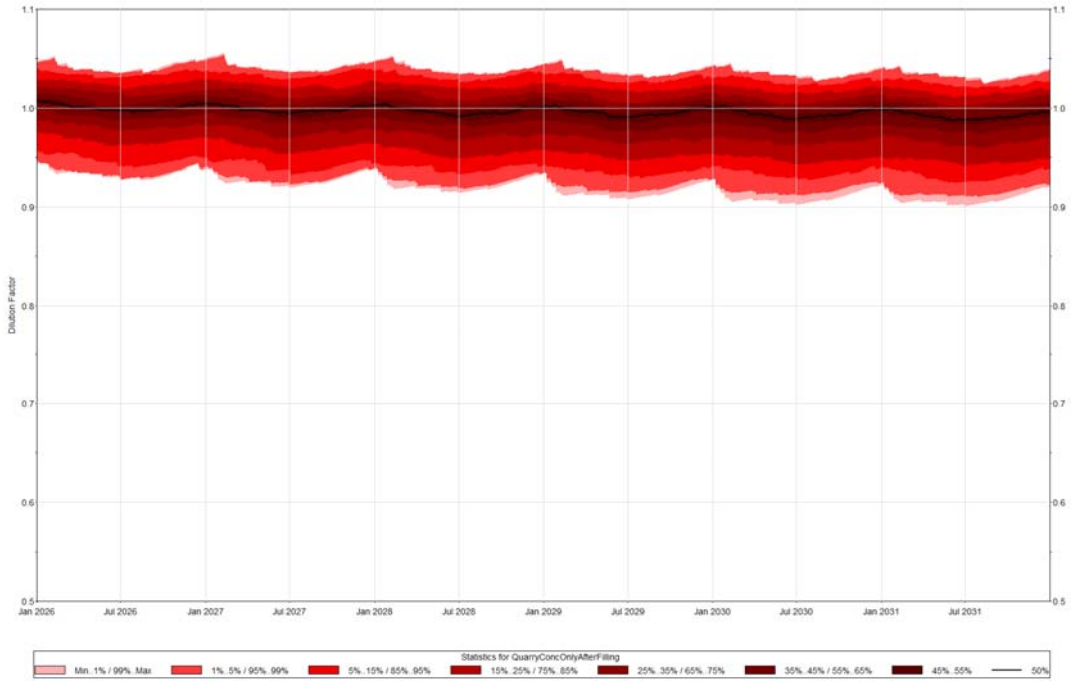


Figure 10.4 Water balance results – dilution factor

10.3.2 Groundwater quantity and water licensing

The results of the water balance (Section 10.3.1) indicate that the net flow of water to the surface water system is positive (that is more dewatering to the surface water system than capture of runoff), other than during the relatively brief period before reaching the target water level.

Therefore, the primary consideration in relation to water take and licencing is the abstraction of groundwater through inflow into the quarry void and the conveyance of this water to the surface water system (or evaporation), rather than return to the groundwater system. It can be noted from the water balance results that, whilst maintaining the target water level at 55 m AHD, the sum of evaporation and dewatering for the maximum year is approximately 130 ML/year. This is significantly less than the entitlement under the dewatering licence of 370 ML/year and is therefore not expected to result in groundwater impacts.

It should also be noted that maintaining the target water level at 55 m AHD results in less groundwater inflows than under historical activities before the works under the 2016 Planning Approval on the basis that the higher water level in the void reduces the hydraulic gradient from the surrounding aquifer and therefore reduces inflows.

10.3.3 Groundwater quality

The groundwater assessment (Table 10.2) showed that for all void water levels under the project (that is up to 55 m AHD) an inflow of groundwater into the void is predicted, not an outflow. Additionally, the quality of water in the void (current and future) is not dissimilar to

receiving environments (as discussed in Section 10.3.4). Therefore, the risk of impacting on surrounding groundwater quality conditions through the project would be minimal.

10.3.4 Surface water quality

The following potential pathways exist for potential impact on surface water quality by extracting water from the void (supplied by groundwater) and dewatering to the surface water system:

- Elevated concentrations of substances naturally in the groundwater system, in excess of the surface water system concentrations.
- Introduction of elevated concentrations through leaching of the material placed under the 2016 Planning Approval.
- Introduction of elevated concentrations through the activities associated with the project.
- Elevation of concentrations through ongoing accumulation in the void through processes such as evaporation.

In relation to elevated concentrations naturally in the groundwater system, water in the quarry was shown to be generally similar to the receiving creek. An exception to this is pH levels, which were shown to be consistently higher than the REHV trigger for all observations. However, as discussed in Section 10.2.4, it is likely that the discharges have not altered the pH above natural levels for similar environments. Furthermore, these impacts are expected to reduce for the project compared to historical conditions on the basis that the dewatering volume would be reduced.

AECOM (2015) completed assessment of the potential increase to concentrations caused by leaching through the emplaced material, and noted that “the project is unlikely to affect groundwater quality as the quarry would be filled with ENM and VENM and would not include contaminated material”. It is expected that the pore water extract from the fill material would be similar to that found within the natural shale and sandstone groundwater environment. The emplaced material would have greater contact with water in pore spaces, however, the water balance predicted no significant accumulation.

With regards to the introduction of elevated concentrations through activities associated with the project (earthworks activities), water quality risks are anticipated to be manageable through the development of a construction phase soil and water management plan (including consideration of erosion and sediment control) and water quality monitoring program. It is noted that the ‘inwards draining’ nature of the site reduces sedimentation risks dramatically.

It is also noted that (although not forming part of this project) vehicular access to the future parkland in proximity to the quarry lake during the parkland operational phase would be generally minimal, with primarily pedestrian activity occurring. Furthermore, the installation of impervious surfaces as part of the future parkland is expected to be minimal. Therefore, the water quality risks associated with the future parkland are expected to be small and primarily in relation to nutrients from parkland maintenance (fertilizers etc) as well as introduction of pathogens from human recreation in the quarry lake.

With regard to potential accumulation of concentrations in the void, the results of the water balance (Section 10.3.4) indicate a dilution factor of less than 1.05 at all times, indicating no significant accumulation.

Therefore, with implementation of appropriate mitigation measures, the project is not anticipated to result in significant impacts with respect to surface water quality.

10.3.5 Watercourse stability and morphology

The influence on sediment mobilisation and deposition is not expected to impact the formation of downstream waterways on the basis of the following:

- Downstream waterways are generally well vegetated, with defined stream patterns and outcrops of bedrock providing control on potential incisions.
- The flows from the site discharge point are expected to be minimal compared to the discharge from the wider catchment.
- The dewatering rates under the project would be less than historical dewatering, therefore impacts would be lessened over time.

10.4 Mitigation and management measures

The assessment has shown that the water related risks associated with the project are not anticipated to be significant. Therefore, management and mitigation measures have been developed with the purpose of confirming that the actual operation of the system is in accordance with the predictions of the assessment to confirm that impacts are not significant.

The following mitigation measures are proposed:

- A Soil and Water Management Plan would be developed prior to construction, in accordance with Landcom (2015) 'The Blue Book', including consideration of erosion and sediment control impacts.
- Measurement of pumped dewatering volumes when they occur using the existing flow measurement weir available to Council. Dateawould be stored in a central location and maintained for the duration of the project.
- Continuation of the current groundwater extraction licencing arrangements.
- Monitoring of the quality of the water in the void, at the location of extraction for dewatering. This monitoring would be undertaken every three months until two years after the target water level is reached, and every 6 months subsequent to that. It would include the following analytes:
  - pH
  - Total Dissolved Solids
  - Turbidity
  - Dissolved Oxygen
  - Total Suspended Solids
  - Ammonia
  - Oxidised Nitrogen
  - Total Nitrogen
  - Total Phosphorus
  - Faecal Coliforms
  - Enterococci
- Continuation of all other requirements of the groundwater licence not already covered in the above items.
- Procedures for the management of water quality with respect to human health and primary contact recreation have been developed, although these are considered separate to this assessment.

- Should one of the below be triggered an appropriate management plan would be developed and implemented within 6 months of the second occurrence:
  - Annual dewatering volume exceeds the maximum predicted rate of 112 ML/year in two consecutive years.
  - In an annual period, the following are observed for any monitored water quality analyte:
  - The 80th percentile monitored concentration over a two year period exceeds the REHV trigger value; and
  - The median concentration exceeds the median concentration for monitored historical discharges before commencement of the project.

11. Biodiversity

The information presented in this chapter is based on the findings of the biodiversity assessment undertaken by GHD. The biodiversity assessment report is included in Appendix F of this EIS.

11.1 Approach and methodology

This biodiversity assessment was prepared to describe the impacts of the project on biodiversity values with reference to the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004), NSW Guide to Surveying Threatened Plants (February 2016) and the Biobanking Assessment Methodology (BBAM) (OEH 2014a). This included:

- Desktop assessment (as described below)
- Field surveys (as described below)
- Identification of the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the TSC Act and *Fisheries Management Act 1994* (FM Act)
- Assessment of the potential for any matters of national environmental significance (MNES) listed under the EPBC Act to occur within the impact area and/or to be affected by the project
- Identification of the potential impacts of the project on biodiversity values including threatened biota and their habitats
- Development of mitigation and environmental management measures to avoid or minimise adverse impacts on threatened biota and biodiversity values
- Assessment of the likely significance of impacts on threatened biota listed under the TSC Act and EPBC Act that would be affected by the project
- Quantification of the biodiversity impacts of the project and to determine the biodiversity credits that would be required to offset these impacts, as calculated by the BBAM
- Outline measures to maintain and improve biodiversity values at the site.

Definitions

For the purpose of the biodiversity assessment the following definitions apply:

- The site – as previously defined (section 4).
- Impact area – the focus of the rehabilitation works, not including the area within the NorthConnex impact area.
- Locality – land within 10 km of the impact area.

11.1.1 Desktop assessment

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. Biodiversity resources pertaining to the impact area and locality (i.e. within a 10 km radius of the site) that were reviewed prior to conducting field investigations included:

- The Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST), for MNES (threatened and migratory biota) known or predicted to occur in the locality (DEE, 2017a).
- DEE online species profiles and threats database (DEE, 2017b).
- OEH Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the project (OEH, 2017a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2017b). This resource was used to identify the suite of threatened ecological communities (TECs) that could potentially be affected by the project and to inform habitat assessments.
- The NSW BioNet Vegetation Classification (OEH, 2017c) to identify plant community types (PCTs) known or likely to occur in the study area.
- Regional-scale vegetation mapping of the site (Tozer *et. al*., 2010; Smith and Smith, 2008).
- Mapping and descriptions of the NSW Mitchell landscapes (DECC 2008a, 2008b).
- DPI Threatened species distributions in NSW for indicative distributions of species listed under the FM Act that may occur in the locality (DPI, 2017a).
- Previous surveys and reporting conducted at the site (Parsons Brinkerhoff 2004, Ecological Australia 2015, Kleinfelder 2017).
- The list of species credit-type species identified by the BBAM Credit Calculator based on the initial credit calculations.
- Aerial photographs and satellite imagery of the study area.

11.1.2 Field surveys

A number of surveys have been conducted within the site over recent years for various projects. These have included:

- Detailed field surveys within part of the Hornsby Quarry land for NorthConnex by Ecological (2015) (much of which is encompassed by the impact area for this project, but has been excised from within the impact area boundary)
- Detailed vegetation mapping across the site by Kleinfelder (2017) (i.e. includes the impact area and additional areas).
- Current field surveys by GHD within the site to ground-truth previous mapping, assess impacts of the rehabilitation, and to calculate offset requirements in accordance with the BBAM.

Previous survey efforts

Ecological Australia (2015)

Ecological Australia undertook field surveys in accordance with the Framework for Biodiversity Assessment (OEH, 2014b) for use of Hornsby Quarry for the handling, management and reuse of spoil from the NorthConnex project. Surveys were conducted over five days, two days in December 2013, two days in December 2014 and one day in February 2015. In addition, a hollow-bearing tree survey was conducted over two days by AECOM in December 2013. Surveys comprised:

- Floristic surveys

- Biometric plots
- Targeted searches for *Genoplesium baueri*
- Fauna habitat assessment
- Anabat detectors
- Hollow-bearing tree survey
- Aquatic surveys.

Kleinfelder (2017)

Vegetation surveys were conducted by Kleinfelder across the site over four days in December 2016, and one day in January 2017. Surveys comprised:

- Vegetation mapping based on data collection at rapid data points and along walked transects
- 12 plot/transects with data collected in accordance with the BBAM
- Incidental fauna surveys.
- Quadrat and rapid data point locations are mapped on Figure 11.1.

Current survey effort

Surveys were undertaken by three GHD ecologists on 23 and 24 November 2017. Methods are described below.

Flora surveys

Flora surveys conducted within the study area and surrounds included:

- Site stratification
- Plot/transect surveys
- Targeted threatened flora surveys
- Identification of groundwater ecosystems

Site stratification

Pre-existing vegetation mapping (e.g. Tozer *et. al*., 2010; Smith and Smith, 2008) and vegetation mapping of the quarry surrounds (Ecological, 2015; Kleinfelder, 2017) were ground-truthed in the field via systematic walked transects across the entire impact area and by walking the boundary of vegetation units. Necessary adjustments were made by hand on aerial photographs of the study area. The site was divided into relatively homogenous or discrete zones for assessment based on observed vegetation structure, species composition, soil type, landscape position and condition. Native vegetation was divided into vegetation zones which represented a distinct PCT and broad condition state.

Plot/transect surveys

Plot and transect surveys were conducted in the impact area in accordance with the BBAM to confirm vegetation types, assess site condition and where required to calculate biodiversity credits. The site value was determined by assessing ten site condition attributes against benchmark values. Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect. Plots were used to sample potential vegetation zones (i.e. PCTs and broad condition classes) based on the initial site stratification. Seven plots were sampled within the impact area as shown on Figure 11.1. Plot data was compared with

Tozer (2010) diagnostic plant species lists using a modified version of a spreadsheet that has been provided to GHD by OEH in order to assign each vegetation type to the appropriate PCT.

Targeted threatened flora surveys

The suite of threatened plants potentially present was identified based on the desktop assessment results and results of previous surveys and the species credit-type species identified by the Credit Calculator (see Appendix F). Habitat for these species was identified based on OEH threatened species profiles and the experience and judgement of GHD ecologists. Areas of potential threatened plant habitat (i.e. near-intact native vegetation and areas with natural topsoil) were traversed on foot and inspected for threatened plants.

Identification of groundwater dependent ecosystems

The Australian Government Atlas of Groundwater Dependent Ecosystems was used to identify any previously mapped GDEs that occur in or near the study area. This atlas identifies GDEs reliant on surface groundwater (rivers, springs and wetlands) and subsurface groundwater (vegetation). The Atlas was reviewed to ascertain whether any GDEs are likely to occur in the study area.

The *Risk Assessment Guidelines for Groundwater Dependent Ecosystems – The Conceptual Framework* (Serov et. al., 2012) presents an approach to GDE identification, classification, ecological valuation, and ecological risk assessment for a given activity or potential impact on a groundwater source. This also details a series of steps to identify and infer the level of groundwater dependency and provides a summary of risk assessment guidelines for GDEs. This risk assessment has assigned probabilities of vegetation types in the Sydney Metro CMA being a GDE (Kuginis et al 2012). Vegetation types mapped in the impact area were cross-checked against this risk assessment, and their probability of being a GDE was assessed.

Fauna surveys

Fauna surveys conducted within the study area and surrounds included:

- Fauna habitat assessment
- Anabat surveys
- Hollow bearing trees
- Spotlighting and call playback
- Opportunistic fauna surveys
- Aquatic habitat assessment

Fauna habitat assessment

An assessment was made of the type and quality of habitats present in the impact area for native fauna. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The study area was searched for habitat features of particular relevance to threatened species, such as hollow-bearing trees, specific feed trees, termite mounds (breeding habitat for Rosenberg's Goanna), rock outcrops (potential den sites for the Spotted-tailed Quoll), and water bodies. Areas of planted trees that may provide habitat for fauna were inspected.

Searches for hollow-bearing trees were undertaken throughout the fauna habitat assessment and opportunistic fauna surveys. Positions of hollow-bearing trees were logged on a hand-held GPS, and details of tree species, height, diameter, and number, position and size of hollows recorded on a proforma.

Anabat surveys

Microbat ultrasonic echolocation call recordings (Anabat surveys) were undertaken at two locations in the study area on one evening. One anabat was placed on an access road near the quarry and the other in a cleared area. The anabats were deployed about one hour before sunset and collected the following morning. Calls were identified using zero-crossing analysis and AnalookW software (version 3.8v, Chris Corben 2012). *The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay et al 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2017a).

Hollow-bearing trees

Hollow-bearing trees in the site were mapped where possible. Details regarding tree species, height, diameter at breast height and size and number of hollows were recorded.

Spotlighting and call playback

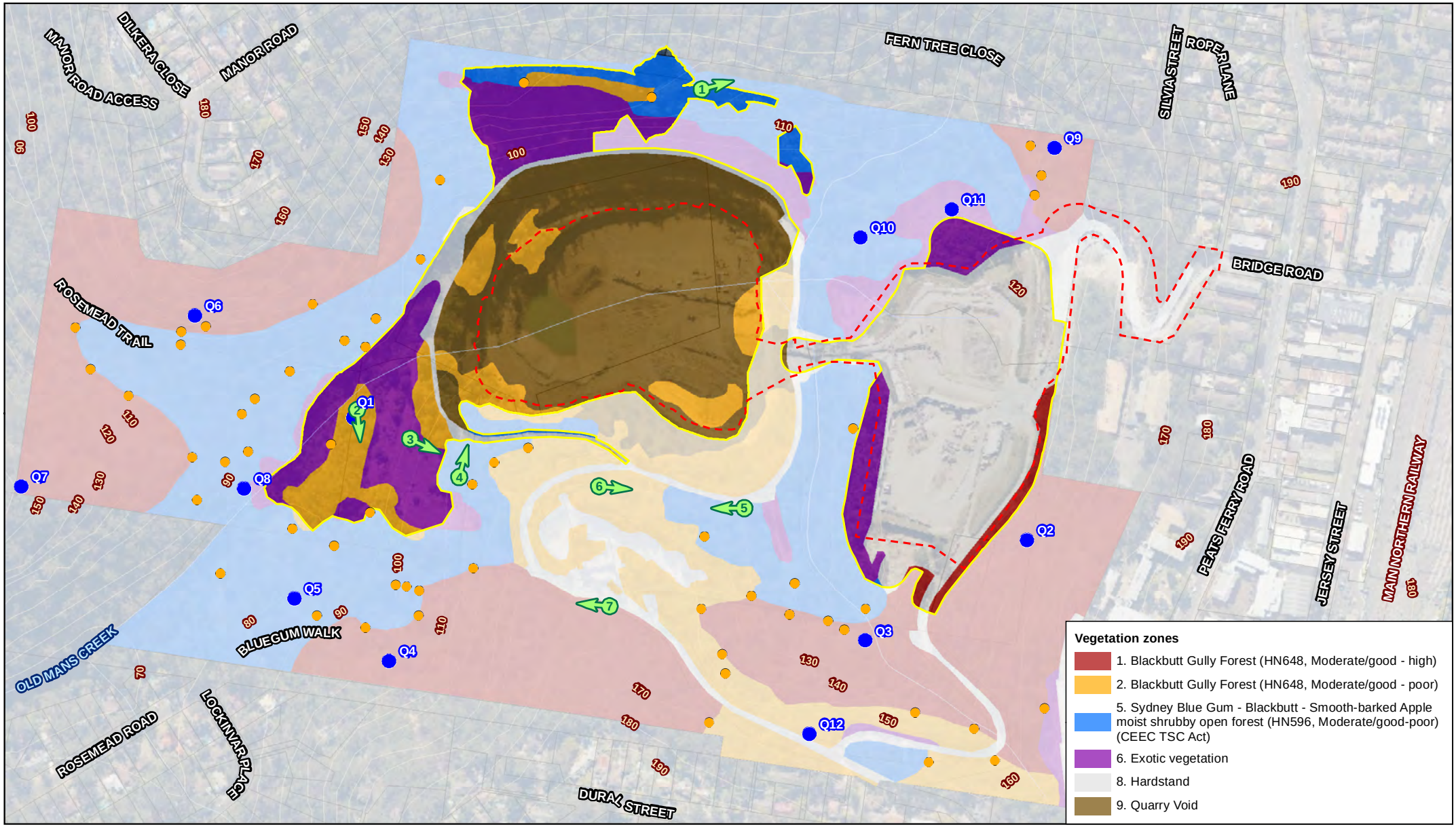
Spotlighting for nocturnal fauna, including in particular forest owls, was also carried out on one evening. Stag-watching was conducted at dusk at one large hollow-bearing stag located near a clearing. Spotlighting was then conducted along roads and tracks within the site. Call playback for the Powerful Owl, Masked Owl, Barking Owl, and Sooty Owl were conducted from above the quarry on the access road. Call playback for the Red-crowned Toadlet was conducted near seepages throughout the study area.

Opportunistic fauna surveys

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys while traversing the impact area. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

Aquatic habitat assessment

Habitat descriptions were documented with reference to the NSW Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (Turak *et al*, 2004), and included assessment of different instream habitat types, and the structure and condition of riparian vegetation. The information recorded was used to describe the nature of aquatic habitats present within the study area, and identify any areas of potential habitat for threatened aquatic Given the lack of natural waterways within the study area, no fish trapping or electrofishing surveys were carried out.



Paper Size A4

0 25 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Extent of works
- NorthConnex impact area
- Cadastre
- Rail
- Waterways
- Contours (10m)
- Kleinfelder Quadrat
- Kleinfelder Rapid Data Points
- GHD plot/transect

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 20 Nov 2018

Vegetation

Figure 11.1

G:\21\26457\GIS\Maps\Deliverables\Biodiversity\21_26457_Z003_Vegetation.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012; Vegetation mapping - Kleinfelder 2017. Created by:jwatson2

11.2 Existing environment

11.2.1 Flora species

A total of 82 flora species from 39 families were identified within the site during the field survey, including 39 exotic species and 43 native species. The Poaceae (grasses, 16 species, six native), Asteraceae (daisies; flowering herbs and sub-shrubs, seven species, one native) and Myrtaceae (flowering trees and shrubs, 10 species, all native) were the most diverse families recorded. Species were recorded within the seven plots completed during the field survey. No threatened flora species were recorded. The full list of species recorded is presented in Appendix F.

11.2.2 Noxious and environmental weeds

The site contains three species declared as priority weeds for the Greater Sydney region (which includes the Hornsby shire Council LGA), Ground Asparagus *(Asparagus aethiopicus)*, Pampas Grass *(Cortaderia selloana)*, Lantana *(Lantana camara)*. These species occur in low to moderate densities throughout the site.

The distribution of weeds at the site is closely tied to disturbance, with the concentration of weeds greatest in areas that have been previously cleared areas or that are closest to ongoing disturbance.

11.2.3 Vegetation

The majority of the impact area has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the impact area is a mixture of remnant, regrowth, revegetation and rehabilitation.

Vegetation has been mapped and described in the study area with reference to the BBAM. Using this methodology, field surveys confirmed the presence and distribution of two PCTs at the site. The stands of these vegetation types are in varying condition (according to the BBAM) and were split into broad condition states yielding vegetation zones as shown on Figure 11.1 and summarised in Table 11.1.

One of the vegetation zones within the impact area comprises a local occurrences of Blue Gum High Forest in the Sydney Basin Bioregion, which is listed as a CEEC under the NSW TSC Act. Note that the vegetation at the impact area does not meet the condition criteria for the related CEEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) TSC Act.

Table 11.1 Vegetation within the impact area

Zone ID	Veg Zone	PCT ID	Smith & Smith Map Unit	Kleinfelder Veg Type	GHD Veg Type	Condition	Conservation Significance	Area (ha)
HN648	1	1841	L1	Blackbutt Gully Forest (moderate-good_high)	Blackbutt Gully Forest (HN648, Moderate/good - high)	Moderate/good - high	Not listed	0.26
HN648	2	1841	L1	Blackbutt Gully Forest (moderate-good_poor)	Blackbutt Gully Forest (HN648, Moderate/good - poor)	Moderate/good - poor	Not listed	1.50
HN596	5	1237	BG2	Blue Gum Diatreme Forest (moderate-good_poor) (CEEC)	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	Moderate/good - poor	CEEC listed under the BC Act: Blue Gum High Forest in the Sydney Basin Bioregion	0.74
NA	6	N/A	N/A	Exotic Vegetation	Exotic Vegetation (Blackbutt Gully Forest HN648, Low)	Low	Not listed	3.39
N/A	8	N/A	N/A	Excluded	Hardstand	N/A	N/A	0.90
N/A	9/A	N/A	N/A	Quarry Void	Quarry Void	N/A	N/A	2.28
TOTAL								**9.07**

11.2.4 Groundwater-dependent ecosystems

Two groundwater systems occur at the quarry void. These consist of a shallow perched water system and a deeper system located within the fresh breccia and surrounding Hawkesbury Sandstone (AECOM, 2015). Groundwater is present within secondary structural features such as joints, fractures and bedding planes. Water flows into the quarry void due to the elevated surrounding groundwater levels compared to the levels within the pit. Historically this groundwater inflow resulted in filling of the base of the void with water, which was subsequently pumped out.

After the emplacement works under the 2016 Planning Approval commences, this groundwater inflow is anticipated to result in the “filling up” of void spaces in the emplaced material without significant observed standing water until the voids of the emplaced material have been filled. Land surrounding the quarry rim is between 60 and 180 m AHD, making the water table between 41 and 161 metres below ground level. This is likely to be beyond the rooting depth of most plant species in the vegetation types present at the site (Ecological, 2015). No groundwater dependent ecosystems are mapped at the site (BOM, 2018).

11.2.5 Fauna species

A total of 67 fauna species have been recorded in the impact area and adjacent areas during recent surveys by GHD, Kleinfelder (2017), Ecological Australia (2015) and Parsons Brinkerhoff (2004). This includes 53 bird species, four terrestrial or arboreal mammal species, five bat species, three reptile species, and two frog species. Two introduced species were recorded, the European Red Fox (*Vulpes vulpes*) and the Red-whiskered Bulbul (*Pycnonotus jocosus*).

11.2.6 Fauna habitats

Habitat features and resources in the site are described below with regards to the native fauna they may support with specific reference to threatened species potentially present in the site. The site generally has patches of good fauna habitat values, due to moderate habitat complexity, allowing for a moderate diversity of fauna species.

Eucalypt forest

Forested areas comprising a mix of PCTs in varying condition are present within much of the site. The structural diversity of the vegetation is generally intact with a complete mature upper canopy of eucalypts up to 25 metres tall over a diverse shrub and ground layer.

A range of eucalypt species are present that would provide foraging habitat for birds, possums and the Grey-headed Flying-fox throughout much of the year. Species include the spring-summer flowering Red Mahogany (*Eucalyptus resinifera*) and Sydney Red Gum (*Angophora costata*), the summer flowering Blackbutt (*E. pilularis*), and the sap-bearing and late-summer to autumn flowering Red Bloodwood (*C. gummifera*). The winter-flowering shrub, *Acacia longifolia*, is also present.

Hollow-bearing trees and stags, which could provide potential nesting habitat for arboreal mammals or birds, are present in low densities in the forested areas. Five hollow-bearing trees were recorded in the impact area (see Figure 11.1). Hollows were small (up to 10 cm). Larger hollows were recorded in trees in the surrounding Hornsby Quarry site. Hollows present are likely to be used by common parrot species, but would be too small for threatened cockatoos and owls. Hollow-dependent fauna recorded at the site that could use hollows present included various microchiropteran bats and small parrots. Feathers from a Powerful Owl were recorded at the site, however no hollow-bearing trees suitable for this species were recorded.

A shrubby understory is present in most locations, dominated by either native or exotic species depending on the degree of historical disturbance and modification within the area. Native midstorey species include *Acacia longifolia*, Large-leaf Hop-bush (*Dodonaea triquetra*), Coffee Bush (*Breynia oblongifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Exotic species include Canary Island Date Palm (*Phoenix canariensis*), Small-leaved Privet (*Ligustrum sinense*), Large-leaved Privet (*Ligustrum lucidum*), Camphor Laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*), Silky Oak (*Grevillea robusta*), Jacaranda (*Jacaranda mimosifolia*) and Japanese Hackberry (*Celtis sinensis*).

A low to moderate density of fallen timber and leaf litter is also present throughout forested areas, however as outlined above, fallen timber values were below benchmark values in all vegetation zones.

Habitat condition is considered to be good, based on the high levels of breeding, nesting, feeding and roosting resources mentioned above.

Typical Fauna species: Myrtaceous trees would provide foraging resources for a range of birds, including cockatoos, parrots and honeyeaters. Few honeyeaters were recorded during the surveys, most likely due to the low numbers of flowering trees at the time of the survey. Small honeyeaters recorded include the Eastern Spinebill (*Acanthorhynchus tenuirostris*), Lewin's Honeyeater (*Meliphaga lewinii*), and the Scarlet Honeyeater (*Myzomela sanguinolenta*) and large honeyeaters included the Red Wattlebird (*Anthochaera carunculata*). Parrots recorded included the Rainbow Lorikeet (*Trichoglossus haematodus*).

Black Sheoak (*Allocasuarina littoralis*), a preferred feed tree of the Glossy Black-cockatoo, is present in low densities at the site. Most casuarinas at the site are planted River Oaks (*Casuarina cunninghamiana*), which is not a preferred feed tree of the Glossy Black-cockatoo.

Termite mounds were recorded on the southern side of the site. These provide foraging habitat for the Short-beaked Echidna (*Tachyglossus aculeatus*), recorded in a fox scat at the site, and can also provide nesting habitat for the threatened Rosenberg's Goanna (*Varanus rosenbergi*).

A suite of small insectivorous woodland bird species, including thornbills (*Acanthiza* spp.), White-browed Scrub-wrens (*Sericornis frontalis*) and Fairy-wrens (*Malurus* spp.), were recorded foraging in the understory throughout the site.

Numerous sunskinks (*Lampropholis* sp.) were observed in leaf litter.

Exotic grassland and cleared areas

Exotic grassland occurs in the south of the site. The understorey is dominated by exotic perennial grass species, with occasional native grass, sedge and herbaceous species. Grassland areas would provide habitat for common reptiles such as sunskinks and snakes. Birds such as Australian Magpies and Sulphur-crested Cockatoos may also forage on occasion in this area. No threatened fauna was recorded.

Aquatic habitat

A small artificial pond is present near the old diesel pumps. This had a variety of emergent aquatic plants present. Drains and culverts are present at the site. These drain west towards Berowra Valley National Park. A number of creeks and drainage lines are present adjacent to the site. None of these had water during the survey.

No key fish habitat is present within the site. Berowra Creek, located downstream of the site, is mapped as having a freshwater fish community in fair condition (DPI, 2016).

The Emerald Spotted Tree Frog (*Litoria peroni*) was heard calling from the artificial pond.

No habitat for threatened aquatic species listed under the FM Act or threatened frogs listed under the TSC Act is present at the site. Water quality in creeks immediately adjacent to the site are likely to be poor due to the surrounding development and nature of the site, limiting habitat value for the Red-crowned Toadlet.

11.2.7 Conservation significance

Threatened ecological communities

Of the two PCTs identified on site, one is a threatened ecological community (TEC): Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (Blue Gum High Forest), a CEEC listed under the TSC Act.

Within the site, Blue Gum High Forest exists as a highly modified form of the CEEC, as a result of historical and ongoing disturbances, including extensive modification of the soil profile and landform of the site, vegetation clearing, quarry works, rehabilitation and revegetation works and weed infestation etc. All vegetation within the site has been impacted by these disturbances, along with fragmentation and disturbance from surrounding residential and infrastructure developments.

Threatened flora species

No threatened flora species were recorded within the study area during the field surveys conducted by GHD or by Kleinfelder (2017) or Ecological (2015). Ecological (2015) excluded all predicted threatened flora species from occurring within the site considered during their assessment due to a lack of suitable habitat .

To the west of the site, there is one record of Tangled Bedstraw (*Galium australe*) and one record of *Darwinia peduncularis* along Blue Gum Walk in Old Mans Valley from 2008 (OEH, 2017). These records have an accuracy of 1 km, based on the siting notes available in the licenced version of the NSW BioNet. These species were not located during the GHD survey or during previous surveys by Kleinfelder (2017) or Ecological (2015).

Threatened fauna species

Four threatened fauna species have been positively recorded at the site, either during GHD surveys or during previous surveys:

- Powerful Owl (*Ninox strenua*), listed as vulnerable species under the TSC Act and was recorded in the area.
- Varied Sittella (*Daphoenositta chrysoptera*), listed as vulnerable species under the TSC Act and was recorded in the area.
- Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as vulnerable species under the TSC Act and the EPBC Act, was recorded in the area.
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (possible identification based on anabat analysis), listed as vulnerable species under the TSC Act and was recorded in the area.

No threatened species listed under the FM Act are likely to occur at the site or downstream of the site.

11.3 Assessment of potential impacts

11.3.1 Construction

Direct impacts

Clearing of vegetation

Proposed works have been located to minimise direct impacts on native vegetation where possible. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest. A number of iterations of the project design have been made, each one further minimising impacts on native vegetation and fauna habitat.

The project would result in the removal of 2.5 ha of native vegetation, including 0.74 ha of vegetation commensurate with Blue Gum High Forest (see below for more detail). In addition, the project would remove 3.39 ha of exotic vegetation.

Clearing of 5.89 hectares of exotic and native vegetation would involve removal of a mixture of non-threatened native plants, many of which have been planted, including a number of semi-mature trees. Mature trees have value within plant populations as sources of pollen and seed, however given the uncertain origin of much of the vegetation within the site, this is not of particular concern within the site.

The extent of clearing of vegetation within the site is summarised in Table 11.2.

Table 11.2 Extent of impacts on vegetation within the site

Zone ID	PCT ID	GHD Veg Type	TSC Act Status	EPBC Act Status	Area (ha)
HN648	1841	Blackbutt Gully Forest (HN648, Moderate/good - high)	Not listed	Not listed	0.26
HN648	1841	Blackbutt Gully Forest (HN648, Moderate/good - poor)	Not listed	Not listed	1.50
HN596	1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	CEEC listed under the BC Act: Blue Gum High Forest in the Sydney Basin Bioregion	Not listed	0.74
		Exotic vegetation (Blackbutt Gully Forest HN648, Low)	Not listed	Not listed	3.39
		Hardstand			0.77
		Quarry void			1.41
				Native vegetation clearing	**2.50**
				Total vegetation clearing	**5.89**
				Total area	**8.28**

There are relatively extensive areas of comparable vegetation communities in the locality, including in Berowra Valley National Park and Ku-Ring-Gai Chase National Park, which combined protect over 19,000 ha of native vegetation. Berowra Valley National Park contains large areas of gully forest (over 1,800 ha), but only a small area of Blue Gum High Forest (less than 1 ha) according to broad-scale regional vegetation mapping by Tozer et al (2010). Around 15 ha of Blue Gum High Forest would be retained, predominantly within the wider site, and a small area in the adjacent National Park.The total area of native vegetation to be removed (2.5 hectares) is a small percentage of comparable vegetation within the locality of the study area

and would not threaten the persistence Blue Gum High Forest CEEC or the more common Blackbutt Gully Forest within the wider locality.

The majority of the vegetation to be cleared (3.39 ha) is disturbed, modified land containing a mixture of exotic species and planted natives, including a number of priority and/or environmental weeds. The project would reduce a source of weed propagules that are currently threatening adjoining areas of intact, better condition native vegetation. Provided the weed management measures proposed are adopted, the project may result in positive impacts on retained native vegetation adjoining the site by reducing the amount of weeds within the site.

Impacts on threatened flora: Blue Gum High Forest

A total of 0.74 hectares of Blue Gum High Forest would be removed by the project as a result of stabilistaion and geotechnical safety management works required to make the site safe. The areas to be removed comprise the disturbed and heavily modified edges of larger patches of vegetation, and much of this vegetation has been planted as part of previous rehabilitation activities. Patches to be impacted are already exposed to the influences of edge effects, weed invasion and track/access maintenance.

Blue Gum High Forest within the impact area occurs as a highly modified and poor condition form of the community, and does not meet the condition criteria for inclusion as the EPBC Act-listed CEEC. There are occurrences of better condition Blue Gum High Forest outside of the impact area boundary, as well as elsewhere in the locality within the reserve network. Kleinfelder (2017) mapped 15.63 ha of Blue Gum High Forest at the site, of which 4.35 ha was in good condition. The 2016 Planning Approval works impacted 0.06 ha of this community (Ecological 2015), and 0.74 ha would be impacted by the project. As such 14.83 ha of Blue Gum High Forest would be retained at the site. Given the small area of impact on disturbed and heavily modified areas of Blue Gum High Forest, and the comparatively larger area to be retained, impacts associated with the project are unlikely to threaten the viability or persistence of Blue Gum High Forest within the locality.

Appendix F provides a detailed assessment of significance of impacts on Blue Gum High Forest.

Removal of habitat resources

The 2.5 ha of native vegetation that would be removed provides foraging, breeding, roosting and nesting resources for a range of fauna species, including threatened species. However, the magnitude of impact is likely to be low given the historic and recent modification of the site and the presence of extensive areas of similar habitat in surrounding protected areas.

The clearing of native canopy species would result in the loss of nectar resources as well as foraging substrate for a diverse range of arboreal species, such as birds, reptiles (varanids), arboreal mammals and bats. Large areas of better quality habitat occur in surrounding areas.

The project would remove five hollow-bearing trees containing small hollows (<10 cm diameter). These may be utilised by mammal species such as the common Sugar Glider and some microbat species, as well as parrots and tree frogs. The removal of these trees within the construction footprint is unlikely to comprise the removal of a significant proportion of the total resource, such that any local populations of fauna would experience significant negative impacts. The project would remove fallen logs and rock outcrops, which represent potential den habitat for the Spotted-tailed Quoll. No evidence of use of termite mounds by Rosenberg's Goanna was observed.

The project would also involve the removal of 3.39 ha of low condition grassland, which provides foraging habitat for common birds and mammals, as well as shelter and foraging habitat for reptiles and frogs.

There would be no removal of natural creeklines, rather artificial drains and culverts would be extended. Culverts represent potential roosting habitat for microbat species. These are likely to be used as temporary roosts only for species such as the Eastern Bentwing Bat. Extension of these culverts could provide additional roots habitat in the future, if used by these species.

Fauna injury and mortality

Construction is likely to result in the injury or mortality of some individuals of less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the impact area during clearing activities. This may include species such as the Common Ringtail Possum, and frogs and lizards. There are few hollow-bearing trees in the impact area, and hollows are generally small, which reduces the risk of injury or mortality of larger hollow-nesting birds.

The potential injury or mortality of individuals within a maximum of 5.89 hectares of habitat (including 3.39 ha of low condition grassland), is highly unlikely to affect an ecologically significant proportion of any local populations. More mobile native fauna such as native birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the impact area are likely to evade injury during construction activities by moving into adjacent areas of habitat.

Recommendations have been made in Section 11.4 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

Fragmentation or isolation of habitat

The removal of native vegetation would occur around the edges of the existing quarry. There would be no isolation of habitat as a result of the project. Native vegetation surrounds the impact area and would continue to provide connectivity for fauna and flora. Revegetation in later phases of the project would improve habitat connectivity over the longer term.

Aquatic habitats

Aquatic habitats in the project area are limited. The project would remove small areas of low quality aquatic habitat associated with drainage structures and small depressions. Aquatic habitats would provide breeding and shelter resources for common frog and reptile species. These do not provide potential habitat for threatened fish. There would be no loss of key fish habitat or impacts on fish passage.

11.3.1 Indirect and operational impacts

Weed invasion and edge effects

Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators. Edge effects generally occur up to 50 metres away from the vegetation edge (Bali 2005).

The impacts of edge effects are visible across much of the impact area due to the presence of existing clearings for the quarry, access tracks and other ancillary areas. The project would create a new edge in some areas. Revegetation in later phases of the project would reduce edge effects in the long term.

Given the level of existing disturbance, the project would have a minor impact on the degree of weed infestation and other edge effects in the study area.

Surface water

The following pathways exist for potential impact on surface water quality by extracting water from the void (supplied by groundwater) and dewatering to the surface water system:

- Elevated concentrations of substances naturally in the groundwater system, in excess of the surface water system concentrations.
- Introduction of elevated concentrations of substances through leaching of the material placed under the 2016 approval.
- Introduction of elevated concentrations of substances through the activities associated with the construction works.
- Elevation of concentrations of substances through ongoing accumulation in the void through processes such as evaporation.

The water quality of water discharged from the void is anticipated to be generally similar to that of the receiving environment.

Sedimentation and erosion

The project has the potential to result in sedimentation and erosion within the impact area and adjoining areas downstream through soil disturbance and construction activities. Sediment laden runoff to waterways can alter water quality and adversely affect aquatic life. The project has the potential to introduce pollutants and sediments into Old Mans Creek. Water quality impacts would be managed through implementation of management during construction, including the provision of sedimentation basins, silt fences and other structures, and management of chemical storage and spills (see section 11.4).

The impact for the proposed works is not anticipated to be significant on the basis of the following:

- Downstream waterways are generally well vegetated, with defined stream patterns and outcrops of bedrock providing control on potential incisions.
- The downstream waterways, immediately downstream of the discharge point are of a significant catchment area where natural flood flows are likely to be of a much larger flow rate, and therefore the governing geomorphological process behind the system.

Groundwater

Significant volumes of surface water and particularly groundwater are intercepted by the quarry void. This intercepted water is then either evaporated or conveyed to the downstream surface water system. As the groundwater would flow inwards to the void, this would mitigate the risk of discharging lower quality water to the groundwater system in the wider area (noting that this lower quality water is not anticipated).

Pathogens

Construction activities within the impact area have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into adjacent native vegetation through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys.

Mitigation measures would be included in the Construction Environmental Management Plan to minimise the potential for the introduction or spread of disease that could potentially impact threatened biota (see Section 11.4).

Dust generation

Dust as a result of infilling of the existing quarry, vehicle movement and wind may currently affect native vegetation located adjacent to the impact area, however there was little evidence of dust in adjacent vegetation during the field survey. Dust is likely to be generated during clearing and construction activities. High dust levels could reduce habitat quality for flora and fauna species by reducing plant and animal health in areas of adjacent vegetation.

Mitigation measures would be included in the Construction Environmental Management Plan to minimise the potential for impacts of dust generation (Section 11.4). Dust is unlikely to substantially impact habitat for any threatened biota due to the mitigation measures proposed.

Noise

There would be noise impacts during the project as a result of vegetation clearing, the movement of vehicles and operation of plant. The impact area currently experiences substantial noise impacts from infilling of the quarry under the 2016 Planning Approval, and there is unlikely to be significantly more noise than is currently occurring. There is the potential for individuals that nest in trees that are close to the impact area abandoning their nests as a result of noise during construction. Noise may also affect general fauna activity in these areas. Given the existing noise levels in the vicinity of the project, any localised and temporary increase in noise levels during the construction activities are unlikely to substantially impact on native biota.

Vibration

Vibration impacts may result from works associated with the project, such as heavy vehicle movement and construction and operational activities. Vibration may deter native fauna from using the area surrounding the source of vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

Some level of vibration is already present within the impact area as a result of vehicles travelling along access roads, and the dumping of fill into quarry void. The project has the potential to increase vibration throughout the impact area and adjacent areas during construction. However impacts would be localised and temporary during construction.

11.3.2 Cumulative impacts

The project would increase the extent of vegetation clearing in the locality, and increase the removal of habitats for flora and fauna species, including threatened species. Recent projects that have impacted Blue Gum High Forest have included the construction of the Epping to Thornleigh Third Track and NorthConnex. Other developments in the locality would also lead to a reduction in vegetation and habitats available. Rehabilitation following reprofiling would minimise the cumulative impacts.

11.3.3 Key threatening processes

A key threatening process (KTP) is defined under the TSC Act as an action, activity or proposal that:

- adversely affects two or more threatened species, populations or ecological communities
- could cause species, populations or ecological communities that are not currently threatened to become threatened.

KTPs potentially relevant to this project are listed in Table 11.3 below. Mitigation measures to limit the impacts of these KTPs are discussed in Section 11.3.6.

Table 11.3 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	The project includes the clearing of 5.89 hectares of native vegetation, much of which is disturbed from previous quarrying activities. Vast areas of intact native vegetation are present in the locality. This minor reduction in extent is highly unlikely to affect the viability of remnant vegetation in the wider area Hornsby Quarry area or locality or reduce the extent of habitat below a minimum size required for any fauna species. The implementation of vegetation management procedures is recommended to limit impacts on vegetation (see Section 11.4). Following reprofiling, revegetation works would be conducted which would improve vegetation in the longer term.
Clearing of hollow-bearing trees	TSC Act	Five trees with suitable hollows for small birds or mammals are likely to be removed by the project. No large hollows suitable for species such as cockatoos and forest owls would be removed. The implementation of habitat management procedures is recommended to limit impacts on fauna and their habitats as a result of removal of these hollow-bearing trees (see Section 11.4).
Removal of dead wood and dead trees	TSC Act	The impact area contains areas of fallen timber. The project will result in the removal of this timber during construction of the project. The implementation of habitat management procedures is recommended to limit impacts on fauna and their habitats (see Section 11.4).
Invasion of plant communities by perennial exotic grasses	TSC Act	The impact area features large areas of exotic grassland. There is the potential for perennial exotic grasses to invade adjacent native vegetation through disturbance during construction of the project and a shift of the disturbed edge into intact native vegetation. The project would include environmental management measures, including weed management and specific consideration of potential impacts on soil, water and native vegetation (see Section 11.4).
Infection of native plants by Phytophthora cinnamomi	TSC Act; EPBC Act	Proposed activities have the potential to introduce Phytopthora into the study area, through the transport and movement of plant, machinery and vehicles, as well as through any landscaping works following the proposed landform modification works. The project would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 11.4).
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Proposed activities have the potential to introduce Myrtle Rust to the impact area. The project would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 11.4).
Infection of frogs by amphibian chytrid	TSC Act; EPBC Act	Construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. The project

KTP	Status	Comment
causing the disease chytridiomycosis		would include environmental management measures including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 11.4).
The degradation of native riparian vegetation along NSW water courses	FM Act	Reprofiling and construction activities could have indirect impacts on riparian vegetation downstream of the study area through sedimentation, erosion and pollution. Mitigation measures are recommended to limit the potential for adverse impacts on riparian vegetation (see Section 11.4).
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	TSC Act; FM Act	The hydrology of the study area is already substantially modified by the existing quarry. The project would further alter the natural landform through placement of fill and modification of surface water flows. Mitigation measures are recommended to limit the potential for adverse impacts on aquatic habitats (see Section 11.4).
Human-caused climate change	TSC Act EPBC Act	Combustion of fuels associated with construction of the project would contribute to anthropogenic emissions of greenhouse gases. The increase in greenhouse gases could impact average temperatures, rainfall patterns and bushfires, which can impact vegetation and habitats for flora and fauna. In the long-term, replanting of forest would help offset carbon.

11.3.4 Impacts on State listed biota

The desktop assessment, field surveys and habitat assessments have been used to identify the threatened flora and fauna species, and ecological communities, that may be affected by the project, through either direct or indirect impacts. Details of these assessments is provided in Appendix F.

The project would have direct impacts on one threatened ecological community listed under the TSC Act. No threatened flora species are considered 'likely' to occur within the impact area, and as such, impacts on threatened flora species are unlikely. A total of 18 threatened fauna species are known or are likely to occur in the impact area.

Threatened ecological communities

Up to 0.74 hectares of Blue Gum High Forest would be removed from within the site. Blue Gum High Forest to be impacted is highly modified and degraded, with significant weed infestations in the midstorey and understorey, and consists of a mix of planted and regenerating vegetation. The project would remove a relatively minor area of habitat for this CEEC within the impact area and would not isolate any area of habitat from presently interconnected areas. The project is highly unlikely to have a significant adverse effect on the local occurrence of this community as:

- The project has been designed specifically to avoid impacts on good quality patches and to minimise impacts on poor quality patches.
- While up to 0.74 ha of poor condition would be removed, extensive, better condition areas of this community would be retained within the wider site outside of the extent of works and in the adjoining National Park (around 15 ha).
- The vegetation to be impacted comprises the highly modified and degraded, poor condition edges of larger tracts of vegetation, and the project will not substantially increase existing levels of fragmentation and isolation from other areas of habitat

- No critical habitat has been listed for this community and the project will not impact any areas of critical habitat.
- Landscaping works following completion of the project would focus on revegetating areas of Blue Gum High Forest, and would improve the condition of the community at the site in the long-term.

An assessment of significance pursuant to s5A of the EP&A Act has been prepared for this CEEC.

Threatened flora species

No threatened flora species were recorded during recent and previous surveys at the site. No threatened flora species are considered 'likely' to occur within the impact area given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms. A total of 18 species have a 'possible' likelihood of occurrence, given the presence of broadly suitable habitat, however there is little chance that they would actually occur within the impact area. Therefore, no assessments of significance pursuant to s5A of the EP&A Act have been prepared for threatened flora species.

Threatened fauna species

Foraging resources for threatened fauna that would be affected by the project are likely to be only a small proportion of the foraging habitat used by these species in the locality. The biodiversity assessment considered the potential impacts the project on threatened fauna species recorded or that have potential habitat in the project area. Assessments of significance pursuant to s5A of the EP&A Act have been prepared for species assessed as having a moderate or high level of impact as a result of the project.

These include species recorded at the site, such as the Powerful owl and the Varied Sitella and hollow-dependent microchiropteran bats. The project is unlikely to result in a significant impact on these species due to large areas of surrounding good quality habitat, the small area of edge effects and lack of impacts on breeding habitat.

11.3.5 Impacts on Commonwealth listed threatened biota

Threatened ecological communities

No threatened ecological communities as listed under the EPBC Act occur within the site or would be impacted by the project. The Blue Gum High Forest in the site does not meet the condition criteria for inclusion as the EPBC Act-listed form of the community. As such, no assessment of significance in accordance with the MNES *Significant Impact Guidelines 1.1* (DoE, 2013) have been prepared for Blue Gum High Forest.

Threatened flora species

No threatened flora species listed under the EPBC Act are considered 'likely' to occur within the impact area given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms. A total of 11 species listed under the EPBC Act have a 'possible' likelihood of occurrence, given the presence of broadly suitable habitat, however given the modified nature of the site, there is little chance that they would actually occur within the impact area. As such, no assessment of significance in line with the MNES *Significant Impact Guidelines 1.1* (DoE, 2013) have been prepared for threatened flora species.

Threatened species

The project would clear a small area of potential habitat for the Grey-headed Flying-fox and Spotted-tailed Quoll. Large areas of better quality habitat are located in nearby areas. No

assessments of significance in accordance with the EPBC Act Significant Impact Guidelines 1.1 are therefore considered necessary.

Migratory species

No migratory species were recorded within the site, however a number of migratory birds that occur in forest and woodland habitats have the potential to occur on occasion. The project is unlikely to seriously disrupt the lifecycle of a significant proportion of the population of any of these species. No assessments of significance are considered necessary.

11.3.6 Assessment of maintenance or improvement of biodiversity values

While the project would result in the clearing of 2.5 ha of native vegetation, a substantial revegetation program is proposed following completion of the reprofiling activities. The planting program would target canopy, shrub and groundcover species. Species selected must be representative of Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596) (Blue Gum High Forest). Plants will be of local provenance.

A suitable planting medium, including top soil profile, would be installed in areas proposed for revegetation. Soils would be sourced from site during construction activities, stored and then applied to the planting areas once the final landform is achieved. While much of the site is highly disturbed, SESL (2018) found a 30 year soil profile in the north-eastern section of the site which can be used as a benchmark for developing soil profile and fertility concepts for the revegetation. Council with the assistance of SESL propose to manufacture a new soil to replicate the natural soils for the Blue Gum High Forest part of the quarry rehabilitation.

The project would result in the clearing of 2.5 ha of highly modified and weed-infested native vegetation. Revegetation would include areas of replantings containing canopy, shrub and groundcover species. The lake, properly design and managed, would encourage the growth of submerged and emergent aquatic flora, which would in turn provide additional habitats for fauna. The reuse of salvaged hollows and logs in the parkland would further improve fauna habitat values. The restoration of a degraded patch of vegetation or the creation of a complementary patch of vegetation, and the provision of nest boxes, is required by Council's Green Offsets Code to offset impacts of the project on native vegetation and threatened species habitats. Based on these points, the future rehabilitation of the project site and provision of offsets would improve biodiversity values at the site and nearby areas in the long-term.

Based on these points, the future rehabilitation of the impact area would improve biodiversity values at the site in the long-term.

11.3.7 Summary of impact assessment

The majority of the site has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the site is a mixture of remnant, regrowth, revegetation and rehabilitation.

Field surveys confirmed the presence and distribution of two native PCTs in varying condition at the site:

- Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (Blue Gum High Forest), a CEEC listed under the TSC Act. This form of the community does not meet the condition criteria for inclusion as the EPBC Act-listed community.
- Blackbutt Gully Forest (HN648) (not a threatened community).

The project would remove 0.74 ha of Blue Gum High Forest and 1.76 ha of Blackbutt Gully Forest. This area of clearing has been substantially reduced through various iterations of the design, specifically to minimise impacts on Blue Gum High Forest.

No threatened flora species are considered 'likely' to occur within the impact area given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms.

The project would impact a small area of disturbed habitat for threatened fauna species. Up to 2.50 hectares of native vegetation that is foraging habitat for threatened fauna species such as the Powerful Owl, Varied Sittella and Eastern Bentwing Bat (among others), and up to five hollow-bearing trees that may provide roosting habitat for smaller species would be removed.

Assessments of significance pursuant to s5A of the EP&A Act have been prepared for these threatened biota. The project is unlikely to have a significant impact on any threatened biota within the study area. As such, a species impact statement is not required.

A range of mitigation measures (refer Section 11.4) have been proposed to ameliorate potential impacts of the project on habitat throughout the study area, as well as areas downstream of the proposed works. These include provision of no-go zones to protect native vegetation, fauna management protocols, site-specific erosion and sedimentation management strategies and revegetation following construction. Future revegetation would improve biodiversity values in the long term.

As the project is unlikely to have a significant impact on any MNES, no referral is considered necessary and no offset is required for threatened biota listed under the EPBC Act.

11.4 Mitigation and management measures

11.4.1 Avoidance of impacts

The impact area is located on land which has been previously modified by land clearing for quarrying. Mapping of biodiversity values, in particular threatened ecological communities, early in the project has allowed some avoidance of impacts in the detail design phase. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest.

A number of iterations of the project design have been made, each one further minimising impacts on native vegetation and fauna habitat, and increasing impacts on exotic vegetation and/or hardstand or quarry areas. This has allowed impacts on biodiversity values to be substantially reduced. A comparison of the area of vegetation clearing required for three design iterations is provided in Table 11.4.

Table 11.4 Design iterations and changes to vegetation clearing

Veg Zone ID	Veg Zone	Clearing area (ha)		
		February 2018 design	September 2018 design	October 2018 design
1	Blackbutt Gully Forest (HN648, Moderate/good - high)	0.94	0.26	0.26
2	Blackbutt Gully Forest (HN648, Moderate/good - poor)	3.71	1.53	1.50
5	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good-poor) (CEEC TSC Act)	4.65	0.90	0.74
6	Exotic vegetation (Blackbutt Gully Forest (HN648, Low))	2.98	3.41	3.39

Veg Zone ID	Veg Zone	Clearing area (ha)		
		February 2018 design	September 2018 design	October 2018 design
8	Hardstand	1.72	0.77	0.90
9	Quarry Void	2.77	1.41	2.28
	Total area	16.77	8.28	9.07
	Native vegetation	9.30	1.79	2.50
	Blue Gum High Forest	4.65	0.90	0.74

11.4.2 Offsetting of impacts

Council has developed the' Green Offsets Code' to manage impacts on native vegetation as a result of developments. The code identifies offset multipliers for different categories of vegetation and habitat. The proponent is required to undertake offset works comprising the restoration of a degraded patch of vegetation or the creation of a complementary patch of vegetation equivalent to the offset area.

An offset package for the project would be developed in accordance with Hornsby Shire Council's Green Offsets Code and with reference to OEH's recommendations.

11.4.3 Mitigation of impacts

Construction

In order to address the potential impacts of the project on biodiversity and to reduce the operation of KTPs, the mitigation measures outlined in Table 11.5 would be implemented.

Table 11.5 Proposed biodiversity mitigation measures

Impact	Mitigation	Timing
Seed collection	• Collection of seeds and propagules from areas of Blue Gum High Forest would be considered prior to vegetation clearing occurring. Seeds (if collected) would be planted in Council's community nursery and any individuals grown used for on-site plantings during creation of the parkland.	Pre-construction
General	• All workers would be provided with an environmental induction prior to starting work in the project area. This would include information on the ecological values of the study area, protection measures to be implemented to protect biodiversity and penalties for breaches. • Prepare a flora and fauna management plan as part of the Construction Environmental Management Plan, incorporating recommendations below, and expanding where necessary.	Pre-construction
Vegetation clearing	• Disturbance of vegetation would be limited to the minimum necessary to construct works. • Where the project area adjoins native vegetation, mark the limits of clearing and install temporary protective fencing around the vegetated area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. • Restrict equipment storage and stockpiling of resources to designated areas in cleared land.	Construction
Weeds	• Develop weed management actions to manage weeds during the construction phase of the project. This would include the management and disposal of the weeds that were recorded within the project area including the	Construction

Impact	Mitigation	Timing
	priority weeds listed in section 11.2.2 in accordance with the Biosecurity Act. • Vehicles and other equipment to be used within the impact area should be cleaned to prevent the introduction of further exotic plant species or disease.	
Fauna habitat	• An unexpected finds procedure would be developed for any threatened biota or habitat resources detected during pre-clearing or clearing surveys or revealed by other sources. • Protocols to prevent introduction or spread of chytrid fungus would be implemented following OEH Hygiene protocol for the control of disease in frogs (DECC, 2008c). • A trained ecologist would be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: - inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy - inspection of culverts proposed for demolition/removal for roosting microbats prior to works commencing - inspection and identification/marking of hollow-bearing trees and termite mounds - protocols for the removal of hollow-bearing trees and termite mounds must be developed prior to removal to minimise mortality or injury of native fauna - capture and relocation or captive rearing of less mobile fauna (such as nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required - salvage of habitat features such as mature tree trunks and woody debris from the project area for future use in the parkland or surrounding areas. • Clearing of mature, native trees would be minimised where possible and exclusion barriers set up to prevent indirect impacts.	Construction
Water Quality	• Erosion and sediment control plans would be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC, 2008d). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. • All water discharge into creeks would be guided by the ANZECC Water Quality Guidelines (2000). • Temporary scour protection and energy dissipation measures should be designed to protect receiving environments from erosion. • Erosion and sediment control measures would be established prior to construction. • Erosion and sediment control measures would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. • Stabilised surfaces would be reinstated as quickly as practicable after construction. • All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway.	Construction

Impact	Mitigation	Timing
	• Water would be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). • Vehicles must follow appropriate speeds to limit dust generation.	

Future parkland

The final created landform is proposed to be developed into a major parkland generally in accordance with the adopted Hornsby Shire Council (2015) Hornsby Park Plan of Management (including Hornsby Quarry and Old Mans Valley). Table 11.6 sets out recommendations for future landscaping and other mitigation measures to minimise indirect impacts on surrounding bushland areas in future stages of the site development.

Table 11.6 Recommended parkland mitigation measures

Impact	Mitigation	Timing
Flora	• Planting of locally endemic species, characteristic of Blue Gum High Forest and Blackbutt Gully Forest • Use of tube stock grown from seed collected from local sites that support remnant, intact stands of comparable vegetation	Following groundworks
Fauna	• Reuse of salvaged hollows and logs in the parkland	Following groundworks
Weeds	• Ongoing management of priority weeds according to legislative requirements.	Throughout operation of the parkland
Water quality	• Ongoing water quality management	Throughout operation of the parkland

12. Heritage

The information presented in this chapter is based on the findings of the Aboriginal Survey Report and Statement of Heritage Impacts prepared by Artefact Heritage. The reports are included in Appendix G and Appendix H of this EIS.

12.1 Aboriginal heritage

12.1.1 Approach and methodology

During the early stages of the design process, an Aboriginal heritage due diligence assessment of the project was prepared by Artefact Heritage in accordance with the OEH (2010) 'Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales'. The due diligence assessment identified two portions of the investigation area as archaeologically sensitive and recommended further investigation in consultation with the Metropolitan Local Aboriginal Land Council (LALC) be undertaken.

Artefact Heritage subsequently undertook an Aboriginal Archaeological Survey Report (ASR) to assess and identify any Aboriginal sites or areas of archaeological potential that might be impacted by the project. The ASR was undertaken in accordance with the 'Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales' (the Code of Practice) (DECCW, 2010). The assessment included:

- Aboriginal archaeological survey, with representatives from Metropolitan LALC, of those identified areas of archaeological sensitivity within the study area.
- Assessment of the Aboriginal cultural heritage values of the study area in accordance with the Code of Practice
- Identification of Aboriginal archaeological and cultural heritage values that may be impacted by the project
- Identification if any further investigations an mitigation and management measures may be required

The study area for the ASR is equivalent to the extent of works (as defined in Figure 6.1).

12.1.2 Existing environment

Aboriginal Heritage Information Management System

An extensive search of the Aboriginal Heritage Information System (AHIMS) database was undertaken with an approximate 4 km search area surrounding the site. A total of 17 sites are recorded within this search area. No registered sites exist within the site.

The majority of the recorded sites are art sites in the form of rock engravings.

It is noted that AECOM (2015) surveyed part of the proposed extent of works as part of the assessment of impacts from the NorthConnex operations for site establishment, operations and quarry filling. This assessment identified a single small rock overhang and potential archaeological deposit (PAD), which lies outside the NorthConnex project area and outside the proposed extent of works for this project. This site did not appear in the AHIMS search and may not have been registered yet.

Areas of archaeological sensitivity

Artefact undertook an Aboriginal heritage due diligence assessment for the project during the early stages of the design process and found that the majority of the study area was identified

as being disturbed and did not demonstrate archaeological sensitivity. Two areas on the eastern and northern margins were identified as archaeologically sensitive, with the potential for Aboriginal objects associated with natural sandstone outcrops to occur.

However, as a result of the design process, the proposed extent of works was revised since the completion of the Aboriginal heritage due diligence assessment. The revision resulted in the majority of the identified archaeological sensitive areas being removed from the extent of works.

The areas of archaeological sensitivity that remain within the extent of works are shown in Figure 12.1.

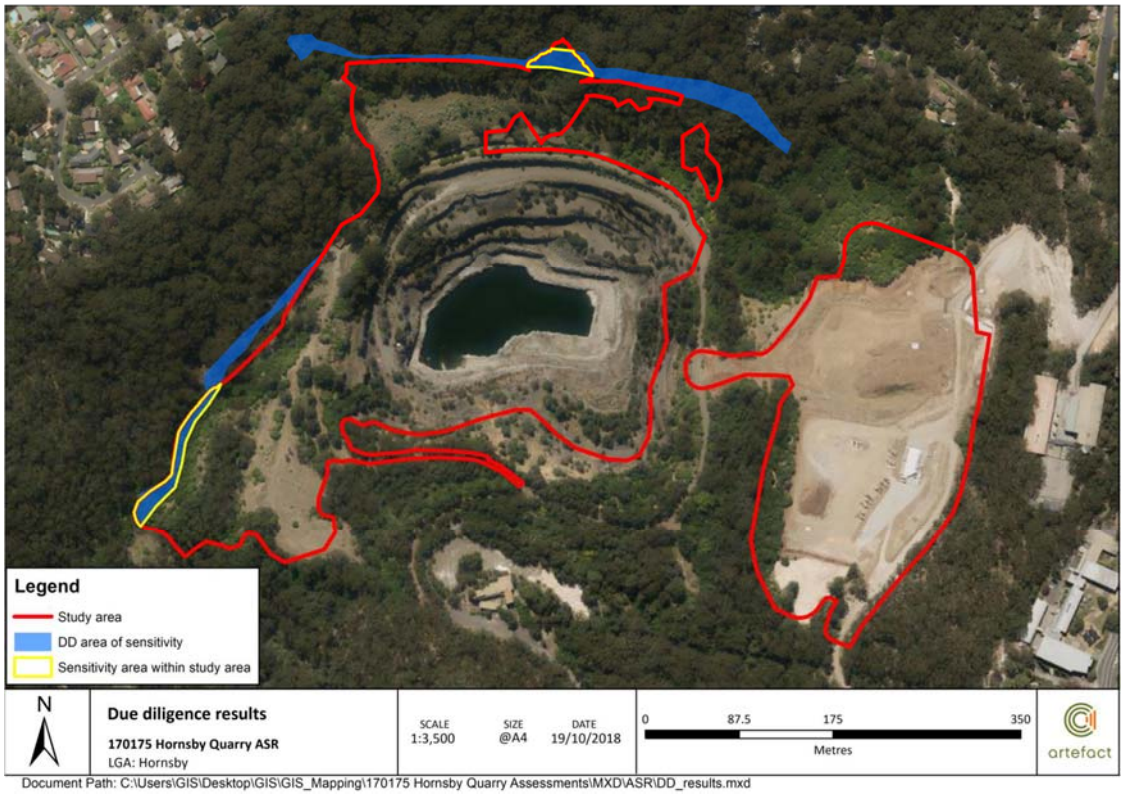


Figure 12.1 Areas of Aboriginal archaeological sensitivity identified during the due diligence assessment

12.1.3 Assessment of potential impacts

Archaeological survey

The archaeological survey was undertaken over one day on 21 September 2018. The survey was attended by representatives of Artefact Heritage, the Metropolitan LALC and Council. The areas identified as archaeologically sensitive (Figure 12.1) and within the study area were subject to the site survey.

Natural landform contexts were identified in small areas in the eastern and northern portions of the study area. These areas were located in slope landform contexts, the eastern area is located adjacent to Old Mans Creek, whilst the northern area is located on the southern margin of the ridge crest associated with Manor Road. Outcropping sandstone was identified in both areas, although no shelter formation suitable for habitation or art was identified, and no engravings or grinding grooves were identified. However, due to leaf litter and dense vegetation, surface visibility was limited in both areas, and outcropping sandstone in these areas should be considered archaeologically sensitive.

Archaeological significance

The survey did not result in the identification of any Aboriginal sites or areas of PAD. Therefore the study area does not demonstrate archaeological significance.

Aboriginal archaeological material, PAD or sandstone outcropping may be present below the fill/ spoil if the former landscape is intact. If the landscape below the fill is intact there is potential for Aboriginal archaeological potential to be high scientific significance as there is limited information on the Aboriginal occupation of the surrounding landscape.

Impacts to potential archaeological resources

Due to the highly disturbed nature of the ground, archaeological deposits are not likely to exist within the quarried portion of the site. The portion of the site that was surveyed that may contain Aboriginal archaeological sites would not be impacted by the project. The project is therefore unlikely to impact Aboriginal archaeological remains.

12.1.4 Mitigation and management measures

The ASR concluded that the project is unlikely to impact any intact archaeological remains and therefore no further archaeological investigation or mitigation is required. However an unexpected finds policy would be implemented in the event of Aboriginal archaeological deposits being identified during ground works and excavation.

The unexpected finds policy would involve the following actions:

- Stop work within the affected area, protect the potential archaeological find, and inform environment staff or supervisor
- Contact a suitably qualified archaeologist to assess the potential archaeological find
- If Aboriginal archaeological material is identified, works in the affected area would cease, and the OEH would be informed. Further archaeological mitigation may be required prior to works recommencing.
- If human remains are found:
  - not further disturb or move these remains
  - immediately cease all work at the particular location
  - notify NSW Police
  - notify OEH's Environment Line on 131 555 as soon as practicable and provide available details of the remains and their location
  - not recommence any work at the particular location unless authorised in writing by OEH.

12.2 Non-Aboriginal heritage

12.2.1 Approach and methodology

A Statement of Heritage Impact (SoHI) was prepared by Artefact Heritage to assess the potential heritage impacts of the project. The SoHI process included:

- Searches of statutory and non-statutory heritage registers
- Review of previous studies to identify the historical context of the study area
- Site survey
- Identification of statements of significance from listings

- Preparation of a Statement of Heritage Impact
- Development of mitigation and management measures generally consistent with the guidelines in the NSW Heritage Manual

12.2.2 Existing environment

Heritage registers

There are no National Heritage items or Commonwealth Heritage items within the site or in proximity to the site that would be affected by the project.

There is one item on the NSW State Heritage Register (SHR) within the site (Table 12.1). Mount Wilga House (SHR 00535) is located 220 m north of the site, however there are no direct sight lines to the project and therefore Mount Wilga house has not been assessed.

Table 12.1 SHR listed items within the extent of works

Item	Address	Significance	Listing No.
Old Man's Valley Cemetery	Old Mans Valley, off Quarry Road, Hornsby, NSW 2077	State	01764

The site has five listings within it on Schedule 5 of the Hornsby LEP. There are also an additional five items of environmental significance adjacent to the site. These are summarised in Table 12.2.

Table 12.2 Items listed on the Hornsby Local Environmental Plan 2013 within or adjacent to the extent of works

Item	Location	Address	Significance	Listing No.
Diatreme Hornsby Quarry and surrounding vegetation	Within the site Within earthworks design extent	1X Quarry Road	Local	A54
Old Man's Valley Cemetery, including Higgins' Family Cemetery, sandstone receptacle, cool room and site of Higgins homestead on which the Higgins Family Memorial is located	Within the site Outside earthworks design extent	1X Quarry Road	State	A55
Hornsby Park—Lone Pine and sandstone steps	Within the site Outside earthworks design extent	203X Pacific Highway	Local (regional)*	513
Sandstone steps	Within the site Outside earthworks design extent	Quarry Road	Local	537
Diatreme Hornsby Quarry and surrounding vegetation	Within the site Within earthworks design extent	1X Quarry Road	Local	538
Mount Errington Precinct, Hornsby West Side Heritage Conservation Area	Adjacent to the site	N/A	Local	C3
Peats Ferry Road Precinct, Hornsby West Side Heritage Conservation Area	Adjacent to the site	N/A	Local	C5

Item	Location	Address	Significance	Listing No.
“Norwood”	Adjacent to the site	6 Dural Street, Hornsby	Local	469
Road median, lights and palms	Adjacent to the site	Pacific Highway, Hornsby	Local	500
“Birklands”	Adjacent to the site	52 Dural Street	Local	824

In addition to the above, the Former Crushing Plant has previously been identified as being locally significant, although it is currently unlisted.

Figure 12.2 shows the heritage items in or adjacent to the extent of works.

The listed items located within the site are further described in the following sections. All photographs were taken by Artefact Heritage on 30 November 2017.

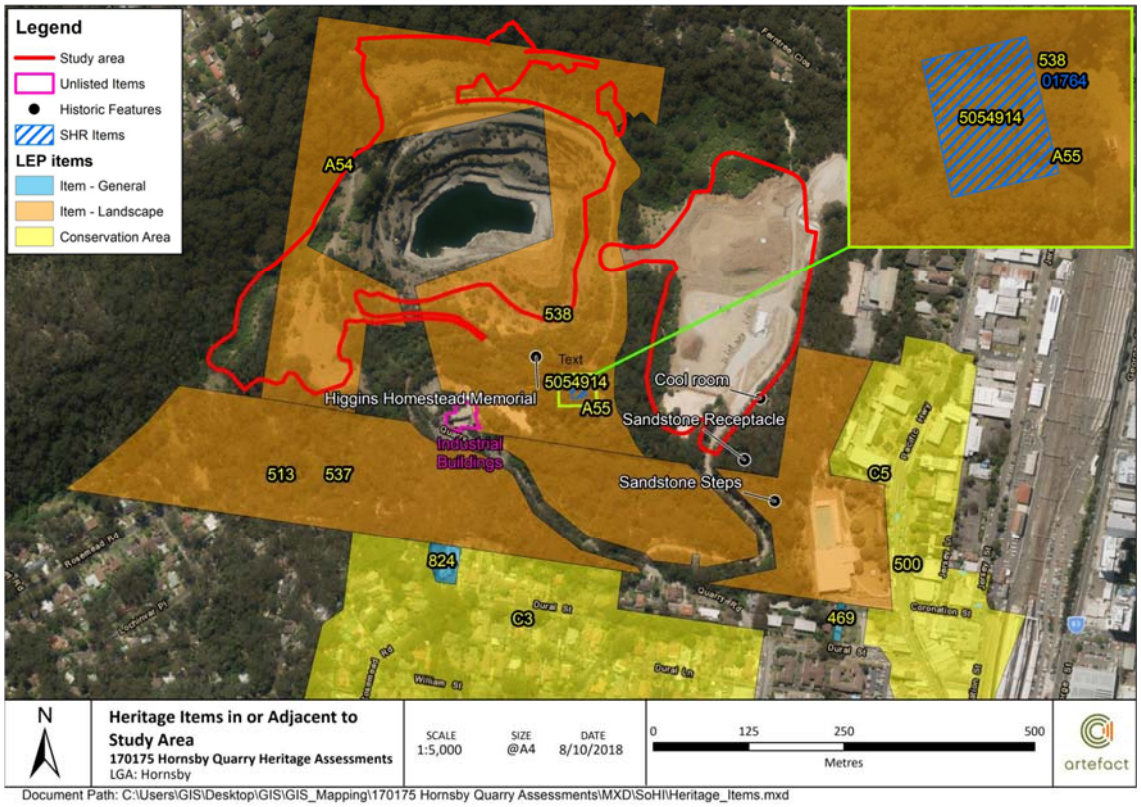


Figure 12.2 Heritage items in or adjacent to the site

Old Man's Valley Family Cemetery (SHR 01764, Hornsby LEP A55)

The Old Man's Valley Cemetery heritage item is enclosed by cyclone fencing, set back two metres from the original cemetery boundary. There are twenty-three recorded burials within the cemetery, though of these, only fifteen possess head stones, with another five visibly marked. Paths link the graves, which are interspersed with native and exotic plantings. There are also interpretive signs at the access gate to the cemetery. Refer Photograph 12.1 and Photograph 12.2.

Photograph 12.1 Entrance to the enclosed graveyard

Photograph 12.2 View of visible grave stones from south side of graveyard

Diatreme and quarry (Hornsby LEP A54 and 538)

The study area is located in an unusual geological formation – a diatreme. Diatremes are the remains of Maar Volcanos, which typically form as a result of the explosive interaction between molten volcanic material and groundwater. Maar Volcanos are formed when hot magma extrudes up through overlying strata and meets with groundwater, resulting in stream pressure-driven explosions that eject rock from below the Earth's crust upwards, with the fragments subsequently falling into a conical cavity, or core, within a compact area (Artefact Heritage, 2018).

As a result of historic quarrying activities, a cross-section of the structure of the diatreme was exposed in the eastern face of the quarry. The Hornsby Quarry is the largest diatreme known in the Sydney Basin, and is understood to be the only cross section through a diatreme in the State.

The quarry is currently enclosed by cyclone fencing (refer Photograph 12.3), set back from the quarry edge and is inaccessible for safety reasons. At the time of the site visit, the diatreme was not visible due to filling works associated with the NorthConnex project which temporarily covered it (Photograph 12.4).

Photograph 12.3 View south of the quarry

Photograph 12.4 View north east of the quarry and the infill covering the Diatreme

Hornsby Park (Hornsby LEP 513)

Hornsby Park is located on the western slope over Old Mans Valley. The park includes flagstone paths, lawn pergolas, annual planting beds, ornamental fountain, the Higgins memorial plaque and a series of 1930s and period lights. It also contains several noteable trees. See Photograph 12.5 and Photograph 12.6.

This heritage item previously comprised a commemorative Allepo Pine, ‘Lone Pine’, which was removed in August 2012 to necessitate construction of the new Hornsby Aquatic and Leisure Centre. The Hornsby Park – Lone Pine and sandstone steps heritage item is in the process of being revised to discount reference to the pine.

Photograph 12.5 View west of Hornsby Park garden and flower beds

Photograph 12.6 View north of Hornsby Park pavements and gardens

Sandstone Steps (Hornsby LEP 537)

The sandstone stairs run from the current vehicle track to an area close behind the Hornsby Aquatic Centre and are constructed of hand-carved sandstone.

Photograph 12.7 View east of Sandstone Steps at the lowest point of the slope

Photograph 12.8 View east of the Sandstone Steps at the highest point of the slope

12.2.3 Assessment of potential impacts

Archaeological potential and significance

Old Mans Valley represents a rare example of a complex of sites owned and occupied by one family from the initial settlement of the place until the middle of the twentieth century. Old Mans Valley provides encapsulation of the life of those who pioneered the settlement of the area and how the land was developed over a century.

Artefact Heritage identified two areas potential archaeology after considering areas of historic rural development, the extent of gross disturbance of the site since the rural development and mapping of the Higgin's family's development.

Figure 12.3 shows these identified areas of remaining archaeological potential.

These areas have potential to provide material history of part of the Higgins family from the 1830s until the 1970s. The cemetery is already recognised as state significant for its values.

The potential material remains of this occupation by the Higgins family and its ability to tell the story of the occupation of the study area through new means, across such a length of time is of great research value. Such deposits are of significance at the State level, due to their ability to shed light on early development of the Sydney basin and the continuation of that development into the late twentieth century.

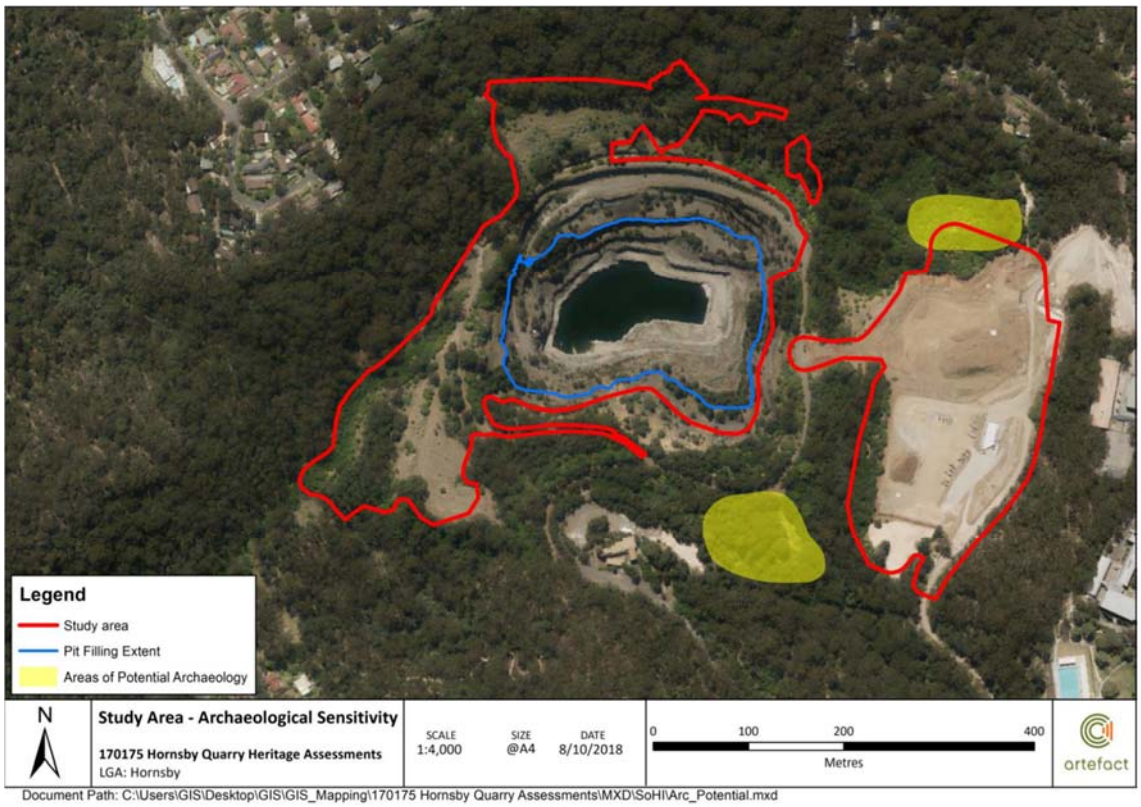


Figure 12.3 Areas of archaeological potential

Statement of Heritage Impact

Table 12.3 provides the Statement of Heritage Impact for the project. It is based on the assessed significance of heritage items in and near the site, their relationship with the surrounding area and assessed impacts. Full details are provided in Appendix H.

Table 12.3 Statement of Heritage Impact

Development	Discussion
What aspects of the project respect or enhance the heritage significance of the study area and nearby heritage items?	The project has been developed as far as possible to minimise direct impact on heritage items. The project would not result in any direct physical impact to the State listed Old Man's Valley Cemetery (SHR 01764), or locally listed items within the site including the 'Old Man's Valley Cemetery, including Higgins' Family Cemetery, sandstone receptacle, cool room and site of Higgins homestead on which the Higgins Family Memorial is located' heritage item (LEP A55), 'Hornsby Park—Lone Pine and sandstone steps' heritage item (LEP 513) and 'Sandstone steps' heritage item (LEP 537). Neutral to negligible impacts are anticipated for heritage items located adjacent to the site. The overall project, by improving safety and accessibility of the site, would ultimately allow for enhanced community visitation and engagement with the heritage items located within this historic precinct, and provide opportunities for greater understanding of their significant values and associations. The majority of areas identified as having archaeological potential would be avoided in the project.

Development	Discussion
What aspects of the project could have a detrimental impact on the heritage significance of the study area and nearby heritage items?	The project would result in direct impacts across much of the locally listed curtilage of the 'Diatreme Hornsby Quarry and surrounding vegetation' heritage item. These works would involve stabilising works which would directly impact the fabric and archaeological potential of the item, and would permanently change the form and configuration of the former quarry. The project would result in visual changes to the 'Diatreme Hornsby Quarry and surrounding vegetation' heritage item and its setting. There is potential for indirect physical impact by way of vibration during the proposed works to heritage items in the vicinity. This particularly relates to the headstones located within the Old Man's Valley Cemetery. Two areas of archaeological potential have been identified, one of which is within the extent of works (refer above and Figure 12.3). There is some chance archaeological remains associated with the Higgins family occupation of the site may be impacted in this area. As covered above, it is noted that stabilising works would ultimately allow for improved public engagement and accessibility with the former Diatreme Hornsby Quarry site and the surrounding historic precinct of Old Mans Valley. Preservation of the exposed diatreme and reinstatement of surrounding vegetation in the site generally as part of the future parkland development would assist in mitigating any potential physical and visual impacts and, as such, the project is considered acceptable from a heritage perspective.
Have more sympathetic options been considered and discounted?	It is understood that a 'do nothing' approach was the only sympathetic option identified. However, this approach was not found to meet the immediate objectives of the project. As the site is being filled with spoil from the NorthConnex project, a 'do nothing' approach would mean that the quarry would remain inaccessible to the public, even after the NorthConnex works reach completion.

At present, the diatreme and heritage items including Old Man's Valley Cemetery, which have been identified as having heritage significance, are inaccessible to the public due to safety risks. The project would address the safety risks and enable a public park to be created in the future. The project, by improving safety and accessibility of the site, would potentially result in enhanced community visitation and engagement with the heritage items located within this historic precinct, and provide opportunities for greater understanding of their significant values and associations.

12.2.4 Mitigation and management measures

The following mitigation and management measures are proposed to address potential non-Aboriginal heritage impacts:

- A Photographic Archival Recording (PAR) would be prepared prior to the project commencement. A copy of the PAR and the SoHI would be stored in the Hornsby Shire Council archives as a record of the site prior to the project.
- An Archaeological Research Design (ARD) would be prepared for the project. The ARD would determine if the project is likely to be located in areas where there may be significant archaeological remains, and recommend whether a permit under Section 140 or an exception under Section 139 of the *NSW Heritage Act 1977* will be required. The ARD would be prepared by a suitably qualified archaeologist.

- Should any unexpected archaeological finds be made during the project, work would cease immediately and a suitably qualified archaeologist would be contacted to assess the finds before any works continue.
- A condition report would be prepared for the SHR listed Old Man's Valley Cemetery (SHR 01764) prior to commencement of works and integrated into the Heritage Management Plan.

13. Traffic and transport

The information presented in this chapter is based on the findings of the traffic impact assessment undertaken by GHD. The traffic impact assessment report is included in Appendix I of this EIS.

13.1 Approach and methodology

A traffic impact assessment was undertaken to identify the potential impacts of the project on the surrounding road network and address the requirements of the traffic and transport component of the SEARs. The traffic impact assessment was undertaken with reference to the 'Guide to Traffic Generating Development' (formerly Roads and Transport Authority, now Roads and Maritime 2002) and 'Austroads Guide to Traffic Management Part 12: Traffic Impacts of Developments'.

While not mandatory, the guidelines suggest a process and method to assist in the development of the traffic impact assessment. The traffic operation assessment process outlined in the guidelines stipulates that the operating characteristics need to be compared with established performance criteria.

This assessment included:

- Existing conditions – a review of existing road features, traffic volumes and crash data;
- Proposed traffic – a review of additional traffic generated by the site for a worst-case construction traffic scenario; and
- Construction traffic impact – assessment of the performance of the existing intersections and future case scenarios with and without the project.

13.2 Existing environment

13.2.1 Existing road network characteristics

Roads within NSW are categorised in the following two ways:

- By classification (ownership)
- By the function that they perform.

Road classification

For management purposes, Roads and Maritime has three administrative classes of roads. These are:

- State Roads – Major arterial links through NSW and within major urban areas.
- Regional Roads – Roads of secondary importance between State Roads and Local Roads which, with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas.
- Local Roads – The remainder of the council controlled roads.

Functional Hierarchy

Roads and Maritime define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- Arterial Roads – controlled by Roads and Maritime, typically no limit in flow and designed to carry vehicles long distance between regional centres.
- Sub-Arterial Roads – can be managed by either council or Roads and Maritime under a joint agreement. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).
- Collector Roads – provide connectivity between local sites and the-arterial road network, and typically carry between 2,000 and 10,000 vehicles per day.
- Local Roads – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

Key roads

Key roads relevant to the project include the following:

- Bridge Road
- Peats Ferry Road
- Dural Street
- Quarry Road

The surrounding road network is illustrated in Figure 13.1.

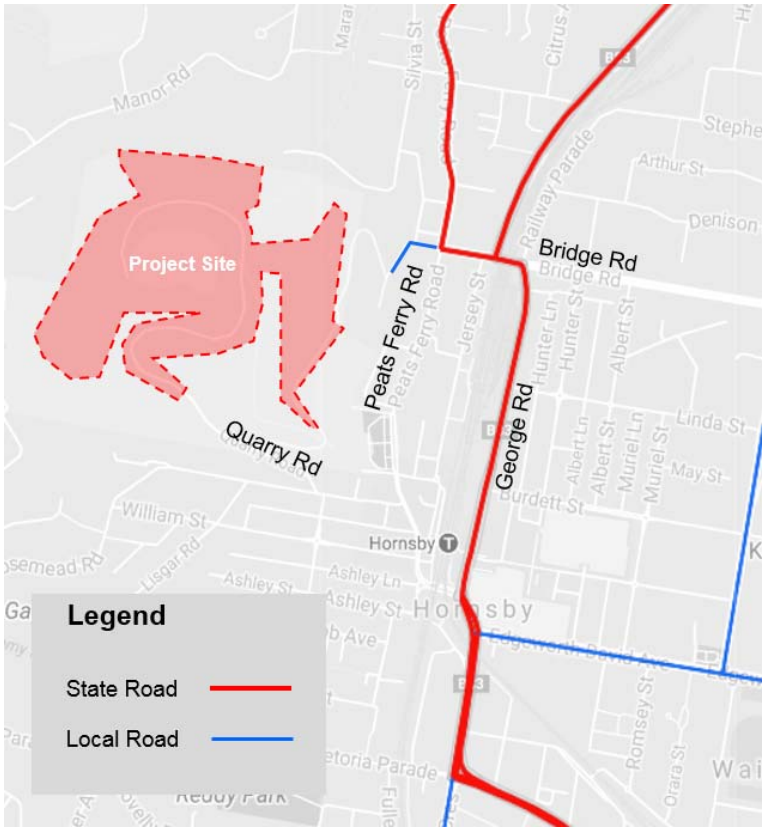


Figure 13.1 Surrounding roads

Source: Roads and Maritime – State and Regional Roads – Modified by GHD

Bridge Road

Bridge Road west of Peats Ferry Roadis a local road that provides access to the site and has a speed limit of 60 km/h.

Bridge Road has the following characteristics:

- The section west of Peats Ferry Road performs a sub-arterial function linking George Street and Jersey Street
- Two-way sealed road divided by double continuous solid lines
- Has a speed speed limit of 60 km/h
- Within the NorthConnex construction zone the speed limit is set at 30 km/h

At the time of assessment, only construction vehicles associated with NorthConnex are permitted access to the NorthConnex site via Bridge Road.

The northern TAFE carpark area is accessed via Bridge Road and is comprised of a small multi-deck and general carpark.

A view of Bridge Road is presented in Photograph 13.1.

Photograph 13.1 Bridge Road viewed east

Source: Google Maps Street View accessed April 2018

Peats Ferry Road

Peats Ferry Road through the Hornsby Town Centre is a local road. It provides links to the site via Bridge Road, Quarry Road, and Dural Street and has the following characteristics:

- Sub-arterial road that runs in a north-south direction between George Street and Bridge Road
- Predominantly one-lane, two-way road
- Provides a link between Hornsby in the south and Asquith in the north at which point it links back up to the Pacific Highway (B83)
- Posted speed limit on the road within proximity of the site and Hornsby town centre (with high pedestrian activity) is 40 km/h up to Jersey Lane (northbound) and becomes 60 km/h thereafter

- Southbound, a 60 km/h signposted speed limit exists after the Peats Ferry Road / Bridge Street intersection. This limit changes to 40 km/h high pedestrian zone after Jersey Lane and continues through to the Hornsby town centre and Hornsby Station.
- Carries approximately 28,000 vehicles per day (vpd).
- A view of Peats Ferry Road is presented in Photograph 13.2.

Photograph 13.2 Peats Ferry Road viewed north

Source: Google Maps Street View accessed April 2018

Quarry Road

Quarry Road is a local road that runs in a north-east direction and has the following characteristics:

- Two-way sealed road without any line marking
- Provides direct access to the site
- No speed limit signs are available and the default urban speed limit of 50 km/h applies.

A view of Quarry Road is presented in Photograph 13.3.

Photograph 13.3 Quarry Road viewed northwest

Source: Google Maps Street View accessed April 2018

Dural Street

Dural Street is a sub-arterial road that runs in an east-west direction, linking to Peats Ferry Road. Dural Street has the following characteristics:

- One-lane, two-way street up to Quarry Road
- Provides access to residential properties in Hornsby and to the site via Quarry Road
- No speed limit signs are available and the default urban speed limit of 50 km/h applies.
- Approximately 70 metres west of the intersection with Peats Ferry Road a regulatory 40 km/h speed limit applies.

A view of Dural Street is presented in Photograph 13.4.

Photograph 13.4 Dural Street viewed west

Source: Google Maps Street View accessed April 2018

George Street

George Street functions as an arterial road within the Hornsby Town Centre and has the following characteristics:

- Intended to divert traffic from Peats Ferry Road on the west of Hornsby to the east of Hornsby Station
- Two lanes in each direction separated by a double solid line.
- The southern section of George Street provides a narrow median with pedestrian fencing to discourage pedestrians from crossing the road in an unsafe manner
- The posted speed limit is 60 km/h
- Parking is not permitted on either side of the road.

A view of George Street is presented in Photograph 13.5.

Photograph 13.5 George Street viewed north

Source: Google Maps Street View accessed April 2018

13.2.2 Travel modes

The average travel mode in Hornsby LGA was compiled as shown in Table 13.1. This data was based on TfNSW, Household Travel Survey from 2015/2016). Private vehicles are the predominant mode of transport in the study area (65 percent as driver and passenger) followed by walking (16 percent) then train (12 percent).

Table 13.1 Average weekday travel mode share for Hornsby LGA

Mode	Hornsby (%)
Driver	45
Passenger	20
Rail	12
Bus	4
Walk	16
Other	3

Source: TfNSW, Household Travel Survey 2015/16

13.2.3 Existing road network performance

Traffic crashes

Crash statistics for a five-year period from 2011 to 2016 within the vicinity of the site was taken from the NSW Transport for NSW Centre for Road Safety website and analysed.

A total of 39 crashes occurred on the local road network in proximity to the site. No fatal crashes occurred during this period. 15 crashes involved some form of injury and the remaining crashes were non-casualty.

Between December 2017 and the time of report writing two crashes were recorded which resulted in pedestrian fatalities. These incidents took place at the intersection of Peats Ferry Road and Bridge Road and involved the following:

- Incident involving NCX truck in the evening at the intersection of Peats Ferry Road and Bridge Road.

- Incident involving northbound bus turning right from Peats Ferry Road into Bridge Road hitting a pedestrian.

The location of the crashes are shown in Figure 13.2.

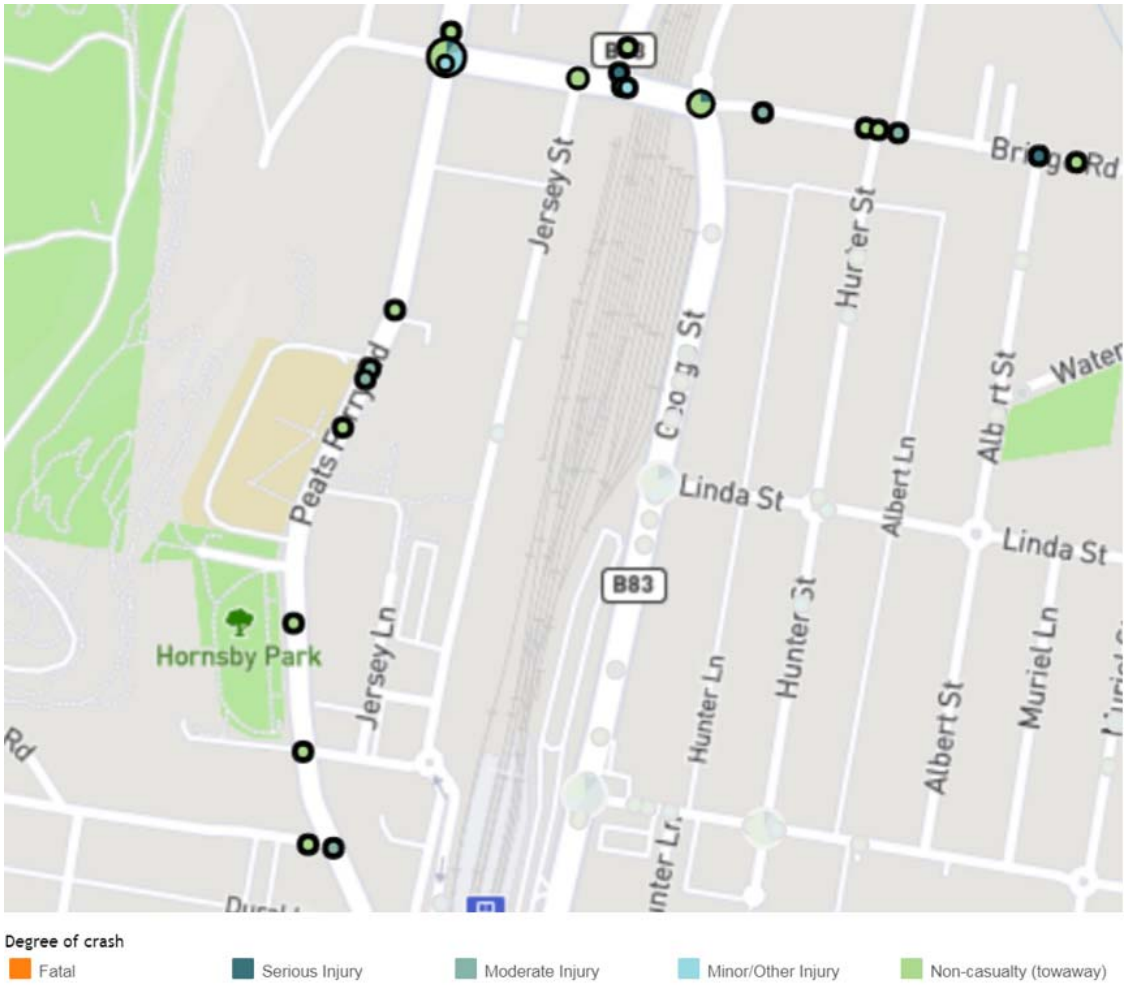


Figure 13.2 Crashes map

Source: TfNSW Centre for Road Safety

The most common type of crash were rear end crashes, making up 20 percent of the total. This could be due to vehicles following too closely to allow sufficient time to stop. A 40 km/h zone was implemented in 2013.

This is followed by right through and off road left either into a parked vehicle or other object which both made up 15 percent respectively. The types of crashes are categorised below in Figure 13.3.

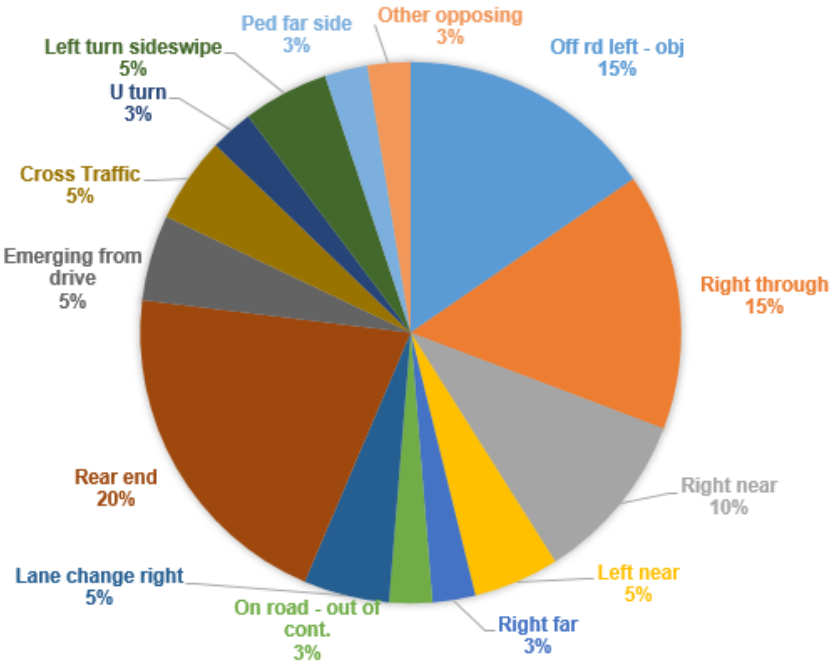


Figure 13.3 Types of crashes

Existing intersection traffic volumes

A turn count was provided by Council for the Peats Ferry Road / Bridge Road intersection. The survey was undertaken on 15 May 2015. The peak periods were identified as follows:

- AM peak: 7:30 am – 8:30 am
- PM peak: 5:00 pm – 6:00 pm

The turn movements in the AM and PM peak hours of the Peats Ferry Road / Bridge Road intersection are shown in Figure 13.4 and Figure 13.5.

During the duration of construction of the NorthConnex project the left and right turns from Peats Ferry Road were illegal. Following completion and demobilisation of the NorthConnex project, the banned left turn into Bridge Road and right turn from Peats Ferry Road into Bridge Road (west) from Peats Ferry Road (west) will be made legal.

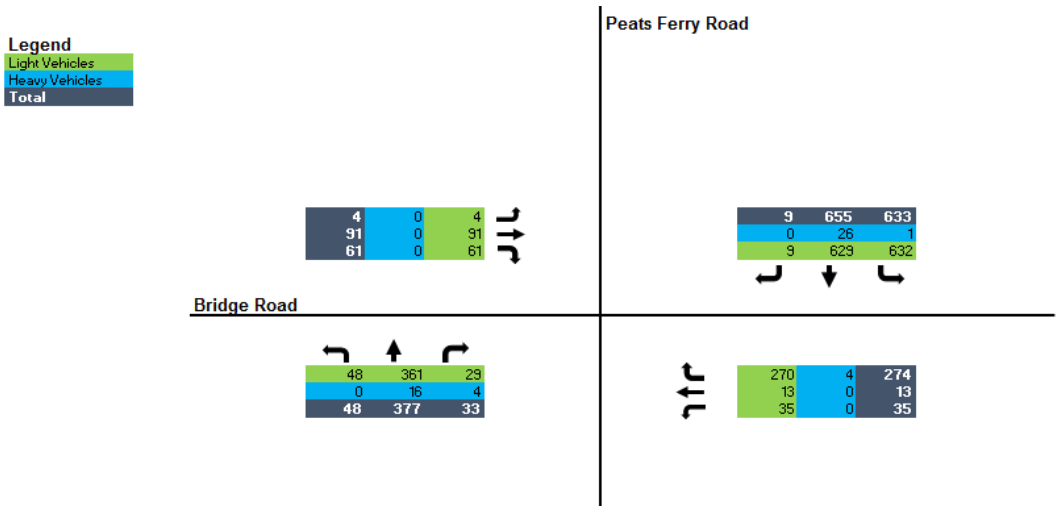


Figure 13.4 Traffic volume 2015 survey results AM peak

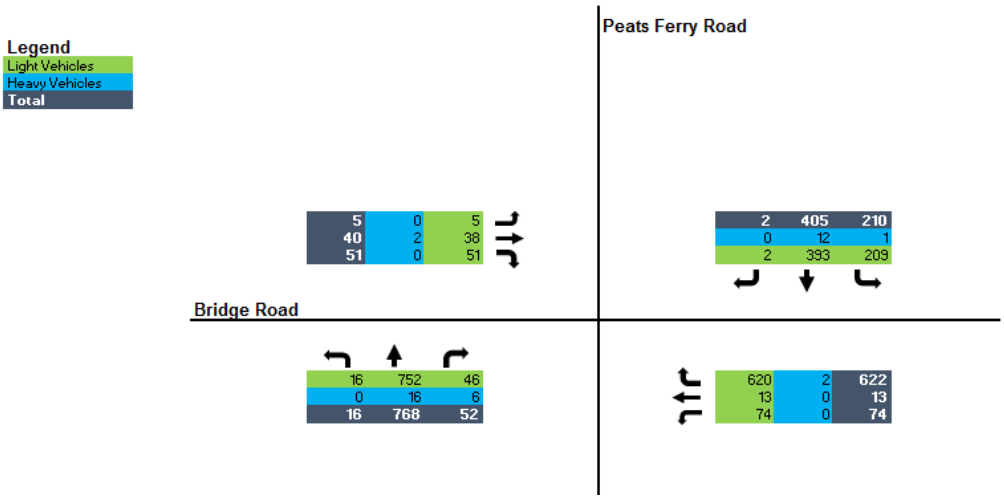


Figure 13.5 Traffic volume 2015 survey results PM peak

Existing intersection performance

A level of service (LoS) analysis was carried out for the Peats ferry Road/Bridge Road intersection during AM and PM weekday peak period conditions using the SIDRA intersection model. SIDRA model calculates capacities, queue lengths and delays for traffic signals, roundabouts and priority controlled intersections.

The criteria for evaluating the operational performance of intersections is based on the LoS, which is applied to each band of average delay per vehicle.

The LoS criteria for evaluating the operational performance of intersections is provided in Table 13.2.

Table 13.2 Level of service criteria for intersections

Level of service	Average delay per vehicle (secs/veh)	Traffic signals, roundabouts	Give way & stop signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required

Level of service	Average delay per vehicle (secs/veh)	Traffic signals, roundabouts	Give way & stop signs
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

Source: Guide to Traffic Generating Developments (Roads and Maritime 2002)

Notes:

1. The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
2. The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
3. The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach

The 2018 traffic volumes were analysed using SIDRA Intersection 7 modelling software and the forecasted volumes for 2018 to estimate the existing performance of the intersections near the site access at Bridge Road. The results of the SIDRA assessment are summarised in Table 13.3.

Table 13.3 indicates that the overall intersection at Peats Ferry Road / Bridge Road was mainly operating at level of service B, with acceptable delays and some available capacity in both the AM and PM peak periods.

Table 13.3 Existing intersection performance modelling results (2018)

Intersection	Priority type	AM peak			PM peak		
		LOS	Ave. Delay (s)	Deg of Sat.	LOS	Ave. Delay (s)	Deg of Sat.
Peats Ferry Road / Bridge Road	Signalised	B	26.8	0.844	B	27.3	0.834

Notes:

1. The average delay (Ave. Delay) for priority-controlled intersections is selected from the movement on the approach with the highest average delay, given in seconds per vehicle.
2. The level of service (LOS) for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
3. The degree of saturation (Deg of Sat) is defined as the ratio of the arrival flow (demand) to the capacity of each approach.

13.2.4 Background traffic

Roads and Maritime Traffic Volume viewer was used to determine traffic growth trends on Pacific Highway (now named Peats Ferry Road) around the vicinity of the project site.

Table 13.4 shows the average annual daily traffic volumes on Peats Ferry Road north and south of the site and is summarised as follows:

- Average annual daily traffic has increased by 687 and decreased 1,884 vehicles per day (veh/day) on average respectively over the three years
- Growth rate of approximately one to two percent per year.

Table 13.4 Peats Ferry Road (Pacific Highway) traffic volumes

Daily Tra ffic Volumes (vpd)	2015	2016	2017	Traffic volume increase (%)
South of Mills Avenue ID 74202	19,258	20,372	19,945	2
North of Pennant Hills Rd ID 74011	37,393	36,205	35,549	1

Source: Roads and Maritime – Traffic Volume Viewer, retrieved 5 April 2018

This growth rate has been projected to the surveyed traffic volumes on the local road network to calculate the background and construction scenario traffic volumes. The stick diagram of the traffic distributions for the AM and PM peaks are illustrated in Figure 13.6 and Figure 13.7 respectively.

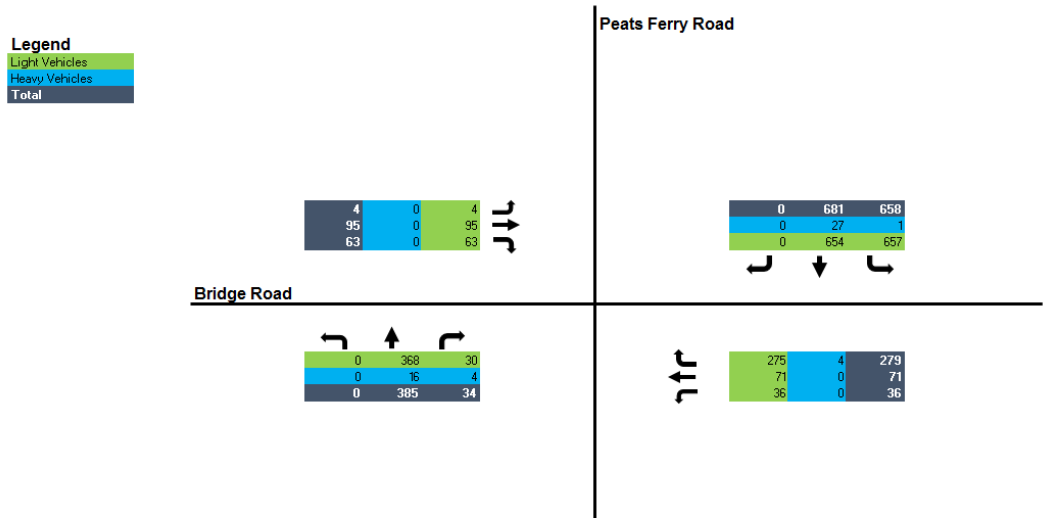


Figure 13.6 Projected 2018 traffic volumes AM peak

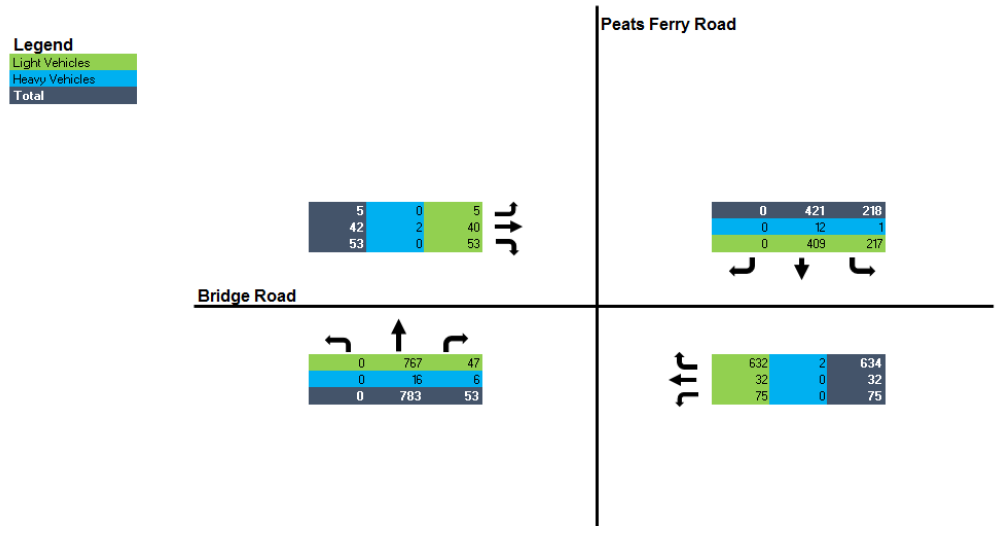


Figure 13.7 Projected 2018 traffic volumes PM peak

13.3 Assessment of potential impacts

13.3.1 Projected traffic generation

Employee and visitor movement

The employee traffic and any visitor movements due to the project have been estimated for a period of one hour to account for the peak periods of activity for a worst-case scenario.

It is noted that in reality, workers would likely be arriving to the site prior to the road network peak taking place (7.30 am) but there is the possibility of overlap due to the time difference. As a conservative approach, no reductions to account for potential ride-sharing were made.

The figures for the AM and PM peak periods are summarised in Table 13.5 and Table 13.6 respectively. Inbound indicates vehicles entering the site and outbound indicates vehicles exiting the site.

Table 13.5 AM peak hour traffic trip generation

Vehicle types	Light vehicles (veh/h)		Heavy vehicles (veh/h)		Total vehicles (veh/h)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Construction workforce	30	0	0	0	30	0

Table 13.6 PM peak hour traffic trip generation

Vehicle types	Light vehicles (veh/h)		Heavy vehicles (veh/h)		Total vehicles (veh/h)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Construction workforce	0	30	0	0	0	30

Heavy plant and equipment movement

It is anticipated that a total of 26 heavy plant and equipment vehicles would be used for this project. It is expected that this delivery would be made during off-peak hours and therefore not impact on the peak hour operational performance of the road network. Furthermore, delivery of the heavy plant and equipment would occur at the beginning of the works and collection of the plant and equipment would occur after completion of the work.

On a more regular basis, a fuel truck would be making deliveries to the site. Again, this would have a negligible impact similar to the abovementioned conditions due to insignificant increase in traffic volumes.

13.3.2 Projected traffic distribution

Estimated additional traffic

The anticipated distribution of the traffic associated with the development from the Quarry site has been based upon staff residency locations and location population densities. The additional traffic associated with the project include employee/visitor movements and heavy plant/vehicle movements as discussed above in Section 13.3.1.

It is expected that vehicle trips generated by the construction activity will travel along Bridge Road and Peats Ferry Road and use the existing Peats Ferry Road / Bridge Road intersection to gain access to the site.

The distribution of the peak hour traffic volumes generated from the development is summarised in Table 13.7 and Table 13.8 and illustrated in Figure 13.8 and Figure 13.9.

Table 13.7 Traffic distribution AM peak

Vehicle component	Percentage split	Road section	Direction	Volume
Light vehicle	50	Peats Ferry Road	Northbound	15
Light vehicle	27	Peats Ferry Road	Southbound	8
Light vehicle	23	Bridge Road	Westbound	7
Total				**30**

Table 13.8 Traffic distribution PM peak

Vehicle component	Percentage split	Road section	Direction	Volume
Light vehicle	50	Peats Ferry Road	Southbound	15
Light vehicle	27	Peats Ferry Road	Northbound	8
Light vehicle	23	Bridge Road	Eastbound	7
Total				**30**

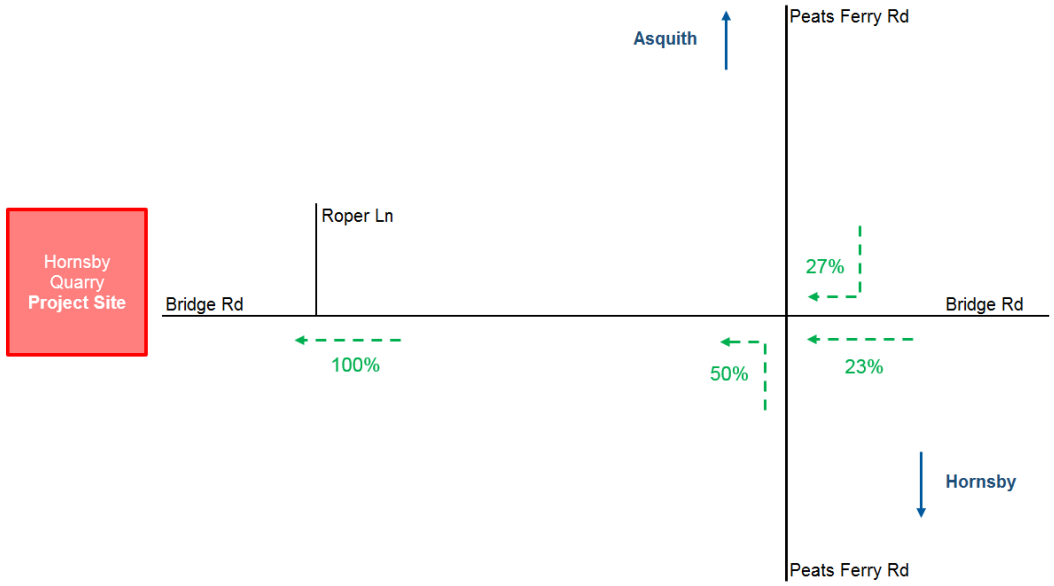


Figure 13.8 Trip distribution AM peak

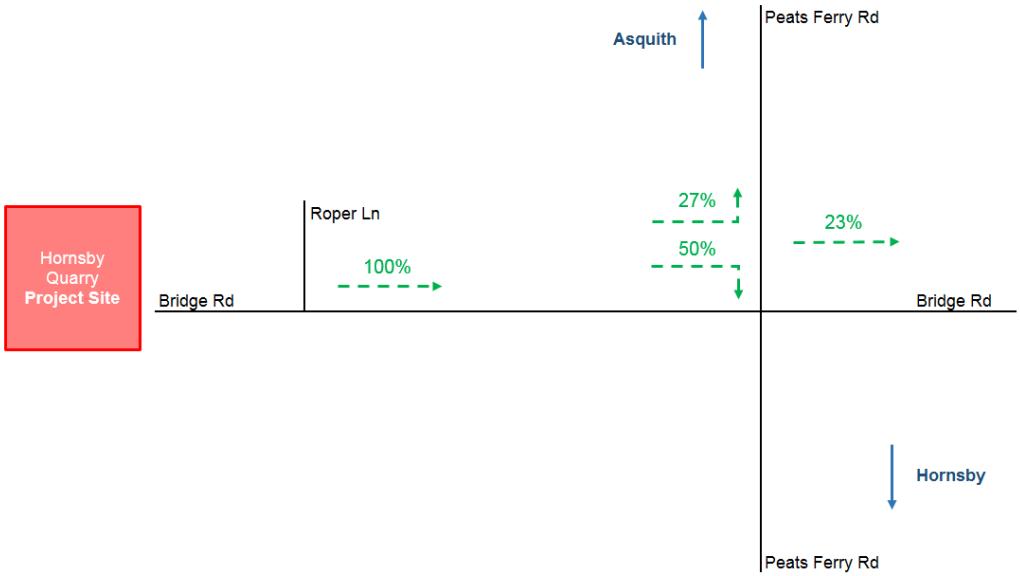


Figure 13.9 Trip distribution PM peak

Estimated total traffic

The 2018 traffic volumes based on background traffic and additional estimated traffic associated with works at the project are summarised in Figure 13.10 and Figure 13.11.

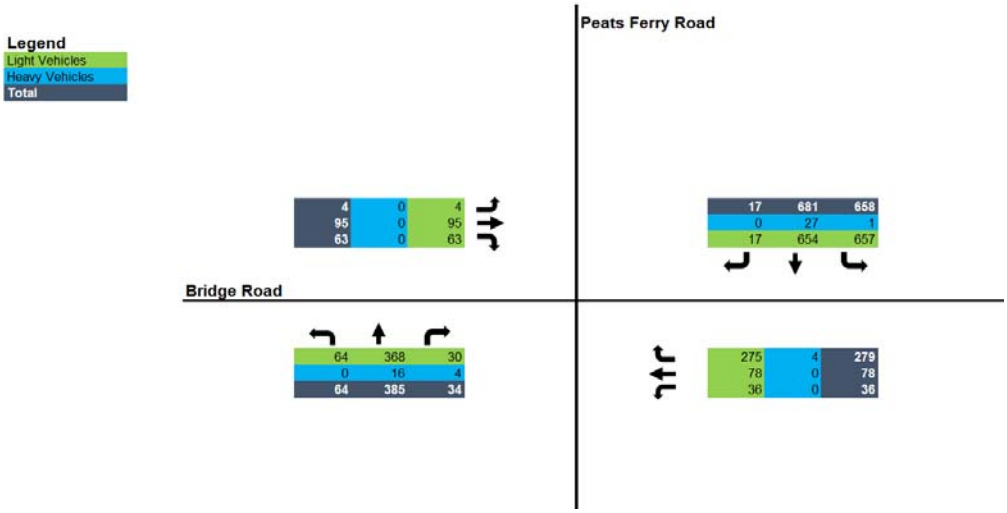


Figure 13.10 Projected 2018 total traffic volumes AM peak

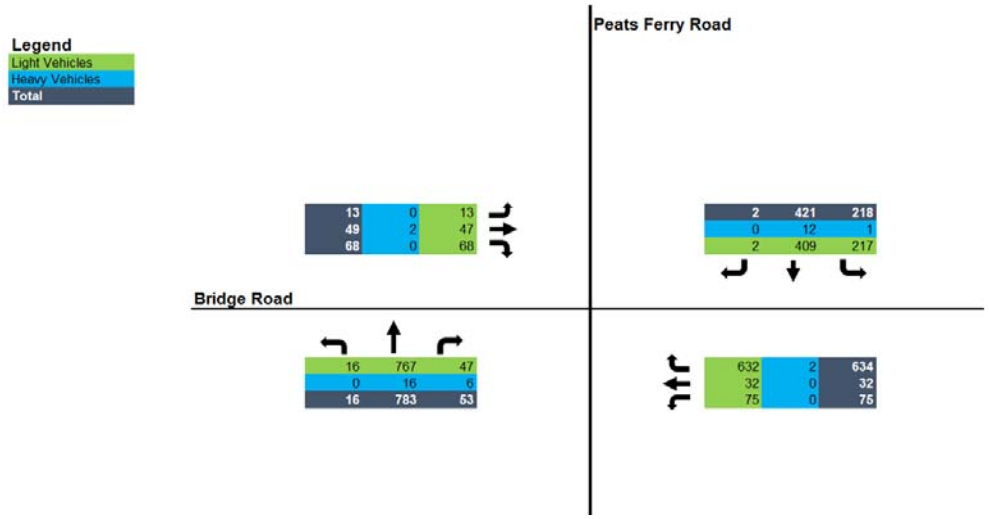


Figure 13.11 Projected 2018 total traffic volumes PM peak

13.3.3 Intersection performance – construction scenario

Peats Ferry Road / Bridge Road

The SIDRA Intersection results for Peats Ferry Road / Bridge Road for the construction traffic scenario during the morning and evening peak periods is summarised in Table 13.9.

The SIDRA output results indicate that:

- The magnitude of the impacts are not likely to be significantly different to that of the existing situation and would fall within typical daily fluctuations of traffic volumes
- The LoS remains B for the AM and PM cases but the average delay increased by approximately one second for the PM case. The degree of saturation also remained relatively similar.
- Traffic generated by construction works at the quarry site is expected to have negligible impacts on the safety and efficiency of the local road network.

Table 13.9 Intersection performance modelling results (2018) - construction scenario

Intersection	Priority Type	AM peak			PM peak		
		LoS	Ave. Delay (s)	Deg of Sat.	LoS	Ave. Delay (s)	Deg of Sat.
Peats Ferry Road / Bridge Road	Signalised	B	26.9	0.744	B	28.4	0.772

Traffic management and road safety will be improved with the implementation of the mitigation measures outlined in Section 13.4.

Peats Ferry Road / William Street

The delivery of the heavy plant and equipment vehicles would be undertaken outside of the peak hours of the surrounding road network. No intersection modelling has been completed for this intersection since the impact on the capacity as a result of this delivery would be negligible.

13.3.4 Proposed site access

Access to the site is adjacent to Roper Lane and provided directly from Bridge Road, which links to Peats Ferry Road forming part of the Pacific Highway.

Approach Sight Distance

Approach Sight Distance (ASD) is the minimum level of sight distance for minor road approaches in all intersections to ensure that drivers are aware of the presence of an intersection and possible conflicting vehicle movements.

The ASD for the project has been assessed in accordance with Section 3.2.1 of the *Austroads Guide to Road Design Part 4A: Un-signalised and Signalised Intersections*.

For this observation, the relevant approach considers the layout of Bridge Road, as pictured in Photograph 13.6.

Photograph 13.6 Bridge Road viewed east

Source: Google Maps Street View accessed April 2018

Safe Intersection Sight Distance

Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be provided for major roads at any intersection.

The SISD has been assessed in accordance with Section 3.2.2 of the *Austroads Guide to Road Design Part 4A: Un-signalised and Signalised Intersections*.

For this observation, the relevant approach considers the layout of Roper Lane as pictured in Photograph 13.7. Roper Lane is currently closed at Bridge Road due to NorthConnex works in the quarry.

Photograph 13.7 Roper Lane viewed north

Source: Google Maps Street View accessed April 2018

The minimum requirements for the ASD and SISD applicable to the project access are summarised in Table 13.10.

The table illustrates that the available sight distances are satisfactory in both directions. The measured distances exceed the minimum required distances, taking into consideration adjoining property boundaries and parked vehicles.

Table 13.10 Sight Distance criteria assessment

Road	Sight distance type	Minimum required (m)	Measured (m)
Bridge Road	ASD	40	58
Roper Lane	SISD	73	105

13.3.5 Public transport services

In accordance with the low volumes of vehicle movements associated with the project, the impacts on the public transport services operating in proximity to the subject site are expected to be negligible.

13.3.6 Walking and cycling

An increase in vehicle volumes along the surrounding road network would potentially impact on the walking and cycling facilities. The associated impacts, although minimal, may include the following:

- Walking
  - The overall walking amenities throughout the study area, particularly around the key roads
  - Delays to pedestrians are expected to be minimal.
- Cycling
  - On road cyclists could experience minor increases in delays at intersections due to the increase in traffic volumes

A Construction Traffic Management Plan would be prepared prior to construction commencing which would identify measures to minimise impacts on pedestrians and bicycle riders.

13.3.7 Parking

Parking demand

The project would operate with 30 employees at the site and adopting the conservative estimate (assuming a vehicle occupancy of one), 30 parking spaces would be required.

Parking provision

Provision has been made for onsite parking. It has been assumed that workers to the site would use a designated available area to park their vehicles on site.

The designated parking zone should provide for:

- Construction crew members / workers
- Space for loading and unloading of equipment and materials.

It has been assumed that the parking demands generated by the project would be satisfactorily accommodated on-site with no demand for on-street parking.

Therefore, the proposed parking provisions are considered supportable.

13.4 Mitigation and management measures

The following mitigation measures are proposed to minimise traffic and access impacts of the project:

- A detailed Construction Traffic Management Plan would be prepared and approved by Council prior to construction commencing. The Construction Traffic Management Plan would include the following:
  - Traffic control measures in works areas
  - Restrictions on the delivery of heavy plant and materials to site during peak traffic periods
  - Appropriate entry/exit points for the proposed construction compound area(s)
  - Advising motorists of the change in traffic conditions associated with the work.
- Appropriate exclusion barriers, signage and site supervision to ensure that the site is controlled and that unauthorised vehicles and pedestrians are excluded from the works area
- The construction contractor to liaise with Council in relation to the location of proposed construction compound areas and any other requirements. If alternate construction compound locations are identified, approval would be obtained from Council and further assessment carried out
- Only existing roads and access roads would be utilised
- Roper Lane would remain closed at Bridge Road
- The community would be kept informed about the project through advertisements in the local media, notices and/or signs.
- All traffic control devices would be in accordance with AS 1742.3-2009 – Manual of uniform traffic control devices: traffic control for works on roads and Roads and Maritime Traffic control at worksites manual.

It should be noted that Council has prepared plans for an upgrade of the Peats Ferry Road / Bridge Road intersection. The upgrade works is proposed to be complete by the time the (future parkland is open). The upgrade to the Peats Ferry Road / Bridge Road intersection includes the following:

- Addition of dedicated right turn lane on Peats Ferry Road (northbound) into Bridge Road (eastbound)
- Addition of dedicated right turn lane on Peats Ferry Road (southbound) into Bridge Road (westbound)
- Addition of dedicated left turn slip lane on Peats Ferry Road (southbound) into Bridge Road (eastbound)

For the further details of the proposed upgrade concept plan, see Appendix I.

14. Land resources

This section provides an assessment of the potential impacts on soils and land capability (including potential erosion and land contamination) and landforms (topography), including consideration of the long-term geotechnical stability of the proposed new landforms.

14.1 Approach and methodology

Soils and land capability

The assessment of potential impacts on soils and land capability included consideration of:

- Soil profile investigation undertaken by SESL Australia (included in Appendix K)
- Previous soils and contamination investigations at the site which have been documented in the AECOM (2015) EIS and Parsons Brinckerhoff (2004) land capability study and master plan.
- Requirements of SEPP 55 to demonstrate that land at the site is suitable for the proposed development

Geotechnical assessment and analysis

A geotechnical assessment and analysis (Appendix J) was undertaken to provide guidance during the concept design development on potential geotechnical solutions to slope stability concerns, retaining wall design, earthworks and potential costs. The assessment included:

- Review of previous geotechnical assessments undertaken for the site
- Assessment of the global stability of the southern quarry wall
- Assessment of the viability of maintaining the existing access track located immediately above the southern quarry wall and identification of potential engineering measures to stabilise the track in the long-term
- Assessment of the stability of the northern spoil mound including analysis of the factor of safety, likelihood and consequence of failure and identification of suitable engineering solutions and long-term monitoring maintenance plan in accordance with relevant standards and guidelines
- Assessments and guidance on suitable rock-fall protection measures including rock-fall simulation analysis to establish the extent of ‘safe’ exclusion zones for the public and base of the quarry as well as identification of other suitable protection measures
- Proof of concept level retaining wall assessments to identify suitable soil retaining methods for the detailed design stage
- Identification of future geotechnical investigations to be undertaken during detailed design

14.2 Existing environment

14.2.1 Soils

Soil landscapes and characteristics

SESL Australia (2017) identified that the natural soil landscapes of the site include the Hornsby diatreme (which is an outcome of volcanic sedimentary breccia) as well as basaltic breccia and metamorphosed Hawkesbury sandstone. Ashfield Shales are also seen as outcrops to the east and northeast of the quarry.

There are two types of breccia found at the site, volcanic breccia and muddy breccia. The volcanic breccia consists grey to green-grey volcanic rock combined with mantle material, sandstone and shale. This material is higher-strength and does not weather as easily as muddy breccia. The muddy breccia consists of the finer volcanic breccia materials and has a low to medium strength and can weather quickly. There is now a colluvial breccia which consists of basaltic or muddy breccia fines eroded and deposited at the bottom of slopes of overburden during the life of the quarry.

Acid sulphate soils

The Australian Soils Resource Information System (ASRIS) and the Hornsby LEP acid sulfate soils map indicates that there is a low probability of acid sulfate soils occurring on the site.

Erosion

Parsons Brinkerhoff (2004) describes there being minimal areas of active erosion at the site, with erosion areas generally limited to access tracks and roads. Although tracks and roads are generally well maintained, areas of concentrated flow erosion (gullying) do exist.

14.2.2 Contamination

Previous soils and contamination investigations at the site have been documented in the AECOM (2015) EIS and Parsons Brinckerhoff (2004) land capability study and master plan. These studies have been used to:

- Provide information on the current and historical land use of the site
- identify areas of potential contamination at the site and within the extent of works
- Demonstrate that the site is suitable for the proposed works in accordance with *State Environmental Planning Policy No. 55 - Remediation of Land 1998* (SEPP55)

Changes in land use

Parsons Brinkberhoff (2004) undertook an environmental site assessment as part of the land capability study for the site. This included review of aerial photographs and land title information for the site. The following changes in land use activity and ownership over time were identified:

- The site was originally settled by the Higgins family from the 1820s, and used for market gardens and orchard cultivation up until the 1960s
- Part of the site was leased to Hornsby Blue Metal Limited in 1924, resulting in the commencement of quarrying activities in the central portion of the study area by 1930
- Hornsby Blue Metal Limited acquired the majority of the study area between 1960 and 1968, with quarrying works subsequently being extended to form a large hard rock quarry by 1965
- filling of part of the original quarry area (located just to the north of the existing quarry) with natural overburden material from the quarry occurred between 1955 and 1965
- site infrastructure including a number of small site buildings, the crushing plant facility, the workshop buildings, and fuel depot were constructed by 1969
- overburden from the quarry operations was used in the early 1980 and again in 1986/87 to fill the eastern portion of the site, with a view of establishing playing fields
- the quarry site was purchased by Farley & Lewers Limited in 1982, with quarrying operations continuing with little change
- the quarry was purchased by CSR in 1985; and

- intensive quarrying activities appeared to have ceased by late 1992 with the site being left relatively unchanged except for the increase in vegetative cover (both native flora through regeneration projects and extensive weed colonisation of the filled areas).

Since this study, the works under the 2016 Planning Approval have been undertaken including filling of the quarry void with spoil material from NorthConnex.

SafeWork NSW Records

Parsons Brinkberhoff (2004) also identified the following records of historic dangerous goods at the site:

- an underground storage tank, previously located in the vicinity of the office and workshop area at the quarry, was used to store petrol. During the operation of the quarry, the initial underground storage tank had a capacity of approximately 9,000 litres. This underground storage tank was replaced in 1968 with a smaller 4,500 litre capacity underground storage tank for the continued storage of petrol. This underground storage tank was subsequently removed in 1997-98. Parsons Brinkberhoff (2004) did not identify any environmental reports associated with the decommissioning of the petrol underground storage tank. It is likely that the underground storage tank pit was backfilled with overburden material.
- two above-ground storage tanks are located in the vicinity of the office and workshop area at the quarry. These above-ground storage tanks were used to store diesel. These above-ground storage tanks had capacities of 25,000 and 30,000 litres respectively and remain on site in a bunded area. Parsons Brinkberhoff (2004) was unable to identify unable to ascertain if the above-ground storage tanks were empty or not. Two bowsers are adjacent to the bunded above-ground storage tanks.
- two explosive magazines located to the northeast of the crushing plant facility and accessed via an internal road. These magazines were used to store up to 1,000 kg each of gelignite. SafeWork NSW records indicate that all explosives were consumed prior to the cessation of quarrying activities at the study area.
- a detonator magazine located in the vicinity of the workshop and office area of the quarry. This magazine had a storage capacity of 5,000 detonators. As with the gelignite, all detonators were consumed prior to the cessation of quarrying activities at the site.

Potential contamination sources

AECOM (2015) identified a number of areas of potential contamination on the site:

- Crushing plant facility located south of the quarry void.
- Partial remains, consisting primarily of foundation material, of (demolished) workshop buildings, located west of the quarry void.
- Fuel storage and dispensing facilities located near to the demolished workshop buildings on the western side of the quarry void.
- Two 28,000 litre above-ground storage tanks on the western side of the quarry void. One tank which was used for storage of diesel for groundwater maintenance pumping.
- One 1,000 litre diesel generator at approximately RL 46 AHD on the western side of the quarry void, located inside of a container.
- A detonator magazine located to the west of the quarry void in the vicinity of the demolished workshop area.
- Areas of fill, consisting predominantly of overburden material generated during quarry operations, on the northern, eastern and south western sides of the quarry void.

The 1,000 L diesel generator has been relocated to RL 60 m AHD as part of the NorthConnex filling works.

Table 14.1 provides a summary of these potential contamination sources and associated potential contaminants of concern at the site identified by AECOM (2015).

Table 14.1 Potential contamination and contaminants of concern

Area	Potential contaminant source	Potential contaminates of concern
Former workshop and office area buildings		
Two above ground storage tanks and bowsers, each with a capacity of 28,000 litres	Fuel (diesel)	Total petroleum hydrocarbons (TPH), benzene/ toluene/ ethylbenzene/ xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs)
One above ground storage tank with a capacity of 1,000 litres	Fuel (diesel)	TPH, BTEX, PAHs
Previous petrol underground storage tank and associated pipe work/bowsers	Fuel (petrol)	TPH, BTEX, lead
One above ground storage tank and sump	Waste oil/ solvents	TPH, BTEX, PAHs, phenols, solvents (volatile hydrocarbons, semi-volatile organic compounds), heavy metals
Storage of oils Storage of derelict machinery	Oils (lubricants, hydraulic) Corrosion of equipment	TPH, PAHs. Heavy metals
Degraded building materials	Fibrous cement sheeting and corrosion of metal surfaces	Asbestos and heavy metals
Former electricity substation	Transformer oil	TPH, PAH, polychlorinated biphenyls (PCBs)
Weed spraying	Weed control chemicals	Organochlorine pesticides (OCPs), organophosphate pesticides (OPPs) and arsenic
Crushing plant facility		
Machinery and vehicle parking	Leakages of hydraulic and lubricant oils as well as fuels	TPH, BTEX, PAHs, heavy metals
Storage/use of oils and stabilising agents (e.g. cement, limes)	Oils, cements and limes	TPH/PAHs, heavy metals and elevated (alkaline) soil pH
Degraded building materials	Fibrous cement sheeting and corrosion of metal surfaces	Asbestos and heavy metals
Filled areas		
Fill material other than that derived from quarrying operations (i.e. overburden material)	Imported fill materials (uncontrolled activities) Equipment breakdowns and fluid loss (oils, fuels and hydraulics)	Heavy metals, TPH, BTEX, PAHs, OCPs, PCBs, asbestos and other contaminants associated with unknown fill material
Explosive and detonator magazines		
Storage of explosives and detonators	Explosives (gelignite) detonators	Nitrates and heavy metals
Weed spraying	Weed control chemicals	OCPs, OPPs and arsenic

Area	Potential contaminant source	Potential contaminates of concern
Degraded building materials	Fibrous cement sheeting and corrosion of metal surfaces	Asbestos and heavy metals

14.2.3 Landform and topography

The site includes a quarry void, internal access roads and a cleared area to the east. The quarry pit extends from RL 8 m AHD to RL 90 m AHD. However NorthConnex has undertaken filling of the void in accordance with the 2016 Planning Approval. The extent of filling from NorthConnex is expected to reach approximately RL 55 m AHD.

According to AECOM (2015), the elevation of the site area falls from a high point of around 180 m AHD in the east, at the top of the eastern ridge line which defines the eastern boundary of Old Mans Valley, to a low point of around 60 m AHD to the west. The rim of the quarry void is around 120 m AHD on the southern side and around 100 m AHD on the northern side. The low point of the quarry void rim is located on the south west side at around 87 m AHD.

The northern and north western sides of the site are bound by a ridgeline along which Manor Road has been constructed. The ground falls very steeply from the north western corner of the site towards the southeast. Grades in this part of the site are up to 58 percent (30 degrees).

Very steep grades of up to 47 per cent (25 degrees) characterise the northern part of Old Mans Valley. The southern portion of Old Mans Valley is at moderate to very steep grades between 16 and 40 percent (nine to 22 degrees), falling towards the north and north-west.

From the Hornsby TAFE located immediately east of the site, the ground falls very steeply towards the eastern side of the quarry site, at grades of between 36 per cent and 78 per cent (20 degrees to 38 degrees). At the base of this slope, the flat, gentle slopes of the eastern side of the quarry site fall at grades generally less than 10 per cent (six degrees).

A broad ridge on the southern and south west extent of the quarry generally falls towards the north and north west, along which Quarry Road has been constructed. The northern parts of the ridge line fall steeply at grades of 70 per cent to 75 per cent (35 degrees to 37 degrees) towards the north, extending from the crushing plant area towards the quarry void. The fill area on which the crushing plant is located is a generally flat area comprised of gentle slopes of less than 10 per cent (six degrees).

The north western and western facing portions of the southern ridge fall steeply to very steeply towards Old Mans Creek. Slopes in this part of the site vary from 31 per cent to 65 per cent (17 degrees to 33 degrees). The toe of the slopes commencing at the north western and western facing flanks extend out into the relatively flat south western fill area, which generally falls at grades of less than 10 per cent (six degrees).

14.2.4 Geotechnical stability

The geotechnical assessment (Appendix K) identified some potential geotechnical challenges associated with redeveloping the site economically. These included global slope stability, erosion, rock-fall and long-term settlement.

The stability issues can be summarised as follows:

- Southern quarry wall global and localised stability
- Northern quarry spoil mound stability
- Localised rock-falls or soil erosion (encompassing discrete blocks detaching and falling from the quarry face or shallow depth soil slumping).

Southern quarry face and access track

Several geotechnical hazards are present in the vicinity of the southern quarry wall and access tracks including:

- Potential sliding failure of the south-eastern quarry wall along shear planes within muddy breccia bands, with failure on the toe of the sliding rockmass occurring along a combination of shallow dipping joints and through intact SW/F volcanic breccia.
- Steep fill and residual soil slopes above the access track, that could slide or slump onto the thoroughfares.
- Steep fill and residual soil slopes below the access track, that could slide or slump, undermining the thoroughfares.
- Upper part of the southern quarry wall, comprising steep residual soil/weathered rock slopes below the access track.
- Minor/local rock-fall from the exposed quarry walls.

Northern spoil mound

The northern spoil mound area was identified in previous reports (PSM, 2007) as an area with potential high instability. The mound was placed between the quarry void and residences to the north on Manor Road during historic quarrying operations over 30 years ago. The upper portion is overburden fill from the quarrying operations and was placed with minimal compaction.

A trapped low point to the north of the mound was drained via a corrugated steel pipe, but this has subsequently collapsed and so the area is now not drained and has potential for failure. In addition, there is a section of spoil to eastern end that is excessively steep with a significant likelihood of instability. Various options considered to address this situation are discussed in Section 5.3.2.

14.3 Assessment of potential impacts

14.3.1 Soils and land capability

Erosion

According to Parsons Brinkerhoff (2004), the soils at the site have an inherently low soil erosion hazard potential if undisturbed, and on gentle slopes. Whereas disturbed soils on moderate slopes have moderate to high erosion hazard potential, especially with concentrated flows and disturbed soils on steeps slopes have a very high erosion hazard potential. Parsons Brinkerhoff (2004) also noted that fill soils generally have a lower erosion hazard potential than the naturally occurring soils. There is also the potential for soil mass movement on shallow soils over sandstone, especially when saturated.

While the erosion potential of many areas of the site is high, there are a number of erosion control measures that can be implemented to effectively control erosion.

As discussed in Chapter 10, the ‘inwards draining’ nature of the site reduces sedimentation risks dramatically and water quality risks from erosion and sedimentation are anticipated to be manageable through the development of a construction phase soil and water management plan (including consideration of erosion and sediment control) and water quality monitoring program.

Acid sulfate soils

Acid sulfate soils are not expected to occur at the site. However, in the unlikely event that acid sulfate soils are encountered, they would be effectively managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998).

Contamination

In accordance with SEPP 55, the potential contamination impacts from the project have been assessed. As outlined in Section 14.2.2 a number of areas of potential contamination have been identified as still being present on the site. Some of these have potential to be disturbed as a result of the project. In particular this would include:

- Filled areas
- Former workshop and office building area west of the quarry void, including detonator magazine in the vicinity of the demolished workshop area

The fill placed by NorthConnex consists of VENM and ENM generated solely from tunnelling activtites and would have very low potential for contamination. The majority of historic fill around the site is expected to be overburden won from within the site, also with very little potential for contamination. The nature of any unknown types of fill that would be moved as part of the project would be confirmed prior to construction commencing to ensure the disturbance of fill would not result in the spread of contamination.

Further investigation would be undertaken prior to any works in the immediate vicinity of the former workshop and office building areas to identify appropriate management measures and procedures to manage potential contamination or hazardous materials identified during construction.

Neither the above ground storage tanks nor the crushing plant would be disturbed by the project.

Potentially contaminated areas directly affected by the project would be managed in accordance with the requirements of the CLM Act and Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011).

In addition, should any diesel generators or fuel tanks require relocation or removal, procedures would be developed to ensure that these works are undertaken in a manner which minimises the risk of spills and contamination.

During construction, earthmoving plant and equipment would be filled by a mobile fuel tank on a regular basis. Procedures and safeguards would be put in place to ensure the risk of spills and leaks are minimised during filling.

With further investigations and the implementation of the identified mitigation and management measures, the site is considered to be suitable for the proposed works.

14.3.2 Landform (topography) and geotechnical stability

The project includes extensive earthworks and changes to the landform (topography of the site). As described in Chapter 6, the reshaping works would create a landform that is generally in accordance with Option 1 in the Clouston Associates (2014) Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands (p. 88). The landform has been designed to be suitable for future development of a parkland with the flexibility to host a range of recreational activities. The future parkland design would be subject to a separate approval and developed in consultation with the community.

In response to the identified geotechnical challenges, a series of Factor of Safety and risk-based assessments were undertaken. Full details are documented in the geotechnical options review and residual risk assessment (Appendix J). A summary of the conclusions of the geotechnical assessment is as follows:

- Further detailed assessment of the southern quarry wall global stability shows that the stability is acceptable. Therefore, no access constraints or design response are proposed to address the global stability of the southern quarry wall. The existing quarry access road arrangements can be maintained and monitored to keep the factor of safety within acceptable limits.
- The Southern Access Track at the crest of the southern quarry wall has localised instability issues associated with residual soils and fill material eroding and 'slipping off' the rock profile beneath. A robust structural solution (raked mini-pile wall including capping beam with edge protection) is suggested. It is envisaged that this would enable the existing southern access track to continue to be used for maintenance and pedestrian access in the long term.
- Northern Spoil Mound stability issues are proposed to be addressed by a combination of proactive engineering measures to improve stability (regrading to a shallower angle, slope reinforcement and drainage measures) with a continuance of long term monitoring and maintenance preferred in some areas.
- Throughout the site a combined approach is proposed to address the localised effects of erosion and small scale slope failures in soil and rock slopes A 'tool box' of measures is proposed including:
  - Toe exclusion zones to prevent park users from exposure to rock-fall and small-scale soil slope failure hazards.
  - Preventative measures such as rock bolts, face mesh, catch fences, catch ditches, facing 'skin' walls (e.g. gabions secured to exposed rock faces) and maintained erosion protection on soil slopes (vegetation erosion protection envisaged in most areas).
  - Monitoring and maintenance as required, in all areas.

The future parkland layout proposes widening, re-alignment and extension of access tracks to improve access into the quarry space. This generates several new retaining / deck structures and new cuttings of differing heights and curved geometries.

Some of the proposed new retaining structures will be founded over deep (up to 55 m) NorthConnex fill material and in some areas founded within a few metres of dolerite bedrock at the edges of the park. This situation creates the potential for high differential settlement within the same structure and between adjacent structures.

The structures will need to be carefully designed to minimise the potential for high differential settlements.

The following suite of design solutions is proposed:

- Reinforced earth retaining walls or steep reinforced earth slopes (50 to 70 degrees) in fill areas. The walls can be faced with gabions or similar architectural finishes and steep slopes can be vegetated. The reinforced earth walls / slopes can make use of the existing fill on the site and are relatively flexible structures, able to tolerate significant post construction settlement.
- Where existing access roads need to be extended out beyond the current cliff-line a short distance (approx. 4 m or less) a structural solution (suspended deck on column arrangement) is considered favourable over retaining solutions. Due to the rock slope

geometry simple gravity or reinforced earth retaining structures are unlikely to be practical or economic in these areas.

- Existing and proposed new cut slopes in rock would be mapped during and post excavation to identify any rock reinforcement (rock bolts for large blocks and mesh for extensive weak or rubbly zones) assessed on a case-by-case basis.
- Earthworks to form the foundation for the retaining walls in fill areas would be subject to suitable levels of earthworks control (compaction) to achieve the required soil strength parameters and limit post construction settlement to manageable levels. Ground improvement may be required in some areas subject to detailed design level investigation and assessment.

Figure 14.1 summarises the proposed geotechnical safety management measures for the site that would be incorporated into the project.

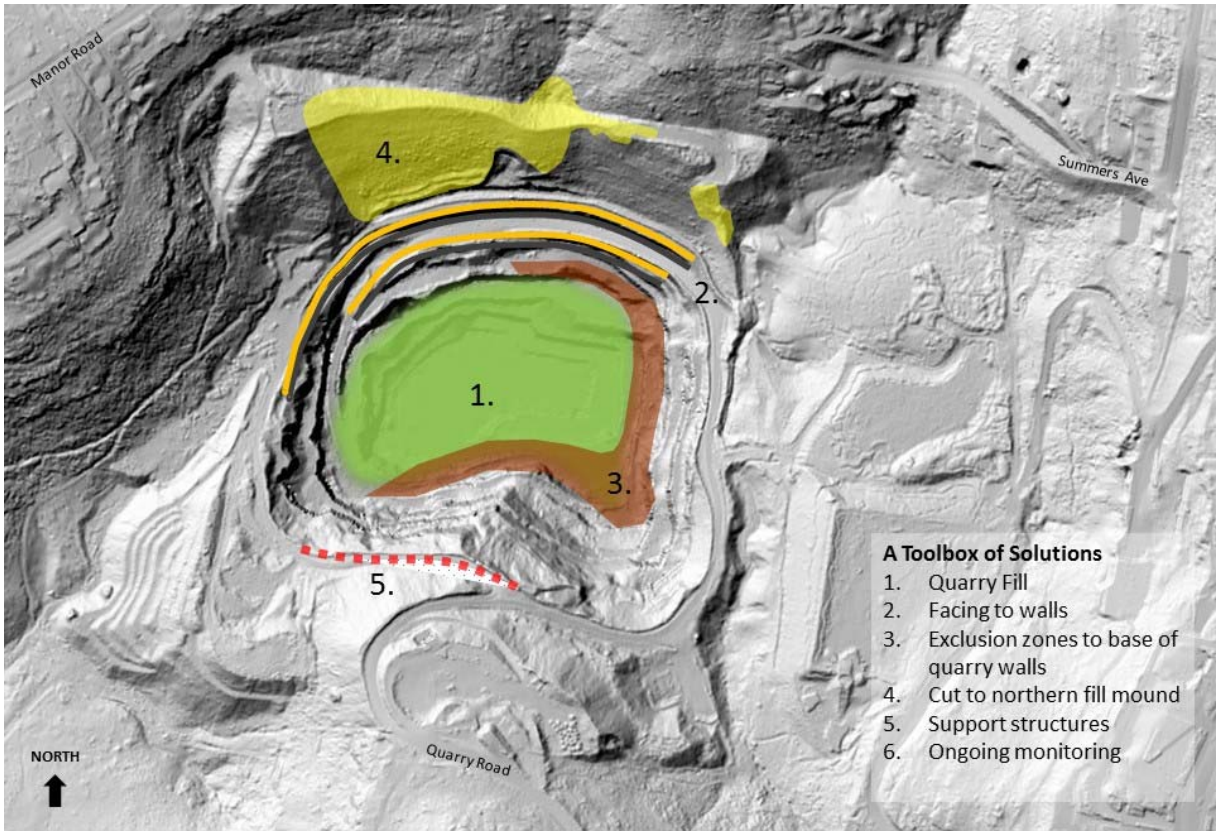


Figure 14.1 Summary of proposed geotechnical safety management solutions

14.4 Mitigation and management measures

The following mitigation measures are proposed to address potential impacts on land resources:

- The Construction Environmental Management Plan prepared for the project would include:
  - a Soil and Water Management Plan which includes erosion and sediment control plans (as discussed in Section 10.4)
  - procedures to manage potential contaminants and or hazardous materials identified during the works
  - procedures for refuelling
  - procedures to address spills and leaks

- If acid sulfate soils are encountered, they would be managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998)
- Potentially contaminated areas directly affected by the project would be managed in accordance with the requirements of the CLM Act and Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (EPA, 1997)
- Further geotechnical assessment would be undertaken as part of detailed design and construction planning (see below).

Further geotechnical assessment

During detailed design, further geotechnical investigative work would be undertaken to confirm the concepts and inform the detailed design process. This may include:

- Southern Access Track (raked mini-piles and capping beam solution proposed) - a geophysical survey to estimate bedrock levels followed by a series of short boreholes to confirm the rock profile and provide soil engineering properties to inform detailed design.
- Northern Spoil Mound - a geophysical survey to assess the underlying fill and bed-rock profile (useful in determining stability for construction and in the permanent condition).
- Rock-fall trials to refine the rock-fall predictive models and identify the location of protective measures such as ditches or bunds.
- Investigation and testing of the NorthConnex fill to determine compaction, permeability properties and densification with depth.

15. Waste management

15.1 Waste generation and waste streams

The following wastes may be generated during the project:

- Vegetation from clearing activities
- Top soil and spoil from earthworks/excavations
- General waste from site personnel (such as food scraps, aluminium cans, glass bottles, plastic and paper containers, paper, cardboard and other office wastes)
- Wastewater and sewage from site office/compounds and amenities

Table 15.1 provides a summary of the relevant activities, associated proposed waste streams and estimated quantities expected to be generated at the site.

Table 15.1 Summary of potential waste streams

Activity	Waste stream	Likely classification	Expected quantity
Clearing and grubbing	Vegetation	General solid waste (non-putrescible)	5.9 ha
Top soil stripping	Top soil	General solid waste (non-putrescible)	2.7 ha
Cut and fill earthworks	Spoil*	General solid waste (non-putrescible)	500,000 m^3
Construction workers	Food scraps, containers, packaging, paper, cardboard and other office type waste	General solid waste (putrescible) General solid waste (non-putrescible)	1,100 L/week
	Wastewater and sewage from site office/amenities	Liquid waste	3 kL/day

*It is noted that all excavated spoil would be reused on site as fill material.

15.2 Assessment of potential impacts

Improper waste management can impact on a range of environmental values including soil, air, surface water and groundwater quality. Improper waste management may also cause a range of public health hazards. The potential impacts of the identified waste streams on environmental values, if unmanaged, are identified in Table 15.2.

Table 15.2 Potential waste stream impacts

Waste stream	Potential impact	Proposed management measures
Vegetation	Fire hazard Spread of weeds Visual amenity Leachate	• Vegetation would be mulched or composted onsite and then blended with soils and used for site rehabilitation works. • Appropriate management (collection and treatment) of leachate from any onsite mulching and composting • Weed management protocols
Top soil	Dust generation Degradation of water resources Spread of weeds Visual amenity	• Top soil would be retained to be used as part of proposed rehabilitation and regeneration activities • Weed management protocols

Waste stream	Potential impact	Proposed management measures
		• Erosion and sediment control measures • Dust control measures
Spoil	Dust generation Degradation of water resources Visual amenity	• There would be no surplus spoil requiring offsite disposal – all spoil would be reused on site as fill • Erosion and sediment control measures • Dust control measures
Food scraps, containers, packaging, paper, cardboard and other office type waste	Source of litter Visual amenity Vermin Odour	• Mobile bins and skip bins • Separate bins to allow source separation and recovery of recyclables • Offsite disposal/recycling • Regular collection of waste and recyclables
Wastewater and sewage from site office/amenities	Contamination of land, surface and groundwater Degradation of water resources Spread of disease Odour	• Appropriate storage of wastewater/sewage generated from site offices/amenities • Regular offsite transport of wastewater/sewage for disposal at a licensed facility

The management of wastes generated during the project would be in accordance with relevant NSW legislation and the principles of the waste management hierarchy set out in the NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (EPA, 2014a).

The project has been designed so that no surplus top soil or spoil would be generated requiring offsite disposal. Top soil would be retained for use on other parts of the site as part of proposed rehabilitation and regeneration programs/activities. Vegetation removed would also be mulched on site and blended with retained top soil or directly reused as part of rehabilitation works. Further details on the proposed rehabilitation are provided in Chapter 18.

15.3 Mitigation and management measures

The following mitigation and management measures would be implemented to minimise potential waste management impacts during the project:

- A waste management sub-plan would be prepared as part of the Construction Environmental Management Plan for the project. The plan would include procedures for the management of wastes in accordance with relevant NSW legislation and the principles of the waste management hierarchy set out in the NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (EPA, 2014a).
- Cleared vegetation would be shredded and mulched/composted and used for soil manufacture or reused on site wherever practicable. Care would be taken to ensure any onsite reuse would not spread weeds.
- General waste from site personnel would be temporarily stored in mobile skip bins or wheelie bins on the site before being collected for recycling or disposal. Recyclable waste such as containers, paper and cardboard etc would be collected separately to facilitate offsite recycling.
- Wastewater and sewage from site offices/amenities would be appropriately stored and regularly transported off site for disposal at a licensed facility.

16. Visual

16.1 Approach and methodology

The visual impact assessment was prepared with reference to The Landscape Institute and the Institute for Environmental Management and Assessment in the UK (2013) 'Guidelines for Landscape and Visual Impact Assessment, Third Edition'. The assessment included:

- Review of the various aspects of the project, primarily in terms of scale, bulk earthwork requirements, technical specifications, and landscaping
- Analysis of the subject site, particularly with regard to visual qualities, visual exposure, landscape values and characteristics
- Identification of a theoretical visual catchment and potential visual receptors, and the subsequent identification of key sensitive receptor groups
- Rating of sensitivity of representative receptors groups
- Identification of potential impacts on identified key receptor groups and rating of magnitude of impacts for each receptor group
- Rating of impact significance on each receptor group. The significance of impacts has been evaluated as a product of:
  - the sensitivity or value of the receptor being affected, and
  - the magnitude of impacts on the identified receptor
- Identification of potential mitigation measures for any impacts seen to exceed community expectations or planning intents for the site and for this type of development.

The assessment included extensive desktop analysis as well as a site visit on 4 July 2018. The desktop analysis included a review of:

- GIS data sets
- aerial photography
- models of the local topography
- the project.

During the site investigation, the weather was clear and fair and regarded as typical weather for the locality.

16.2 Assessment magnitude and significance

16.2.1 Impact magnitude

Impact magnitude was evaluated based on variables such as: the extent of the project that would be visible, the proportion of the visible parts of the project to the entire view, the nature and intensity of the impacts, whether key features were obscured or affected, the geographic extent of the impacts, the duration and reversibility of particular impacts, and the likelihood of occurrence of impacts.

As for receptor sensitivity, the nature and the magnitude of impacts were rated. Table 16.1 below describes impacts that constitute each rating.

Table 16.1 Visual impact magnitude description

Rating	Descriptor
High	Severe consequences, significant at a regional level, likely to be unacceptable at a regional level. Large number of people measurably affected. Substantial / obvious changes due to total loss of, or change to, elements, features or characteristics of the landscape which are regionally significant.
Moderate	Moderate consequences, significant at a local level and likely to be unsatisfactory at a local level. Discernible changes due to partial loss of, or change to the several elements, features or characteristics of the landscape which are locally significant.
Low	Low consequences, significant at a local level, likely to a satisfactory at a local level providing appropriate mitigation measures are implemented. Minor change in the landscape due to loss or change to one or two elements, features, or characteristics of the landscape which are locally significant.
Negligible	No consequences or significance. Almost imperceptible or no change to the landscape as there is little or no loss of / or change to the elements, features or characteristics of the landscape.

16.2.2 Impact significance

The significance of impacts was evaluated as a product of:

- the sensitivity or value of the environment or receptor being affected, and
- the magnitude of impact on that environment or receptor.

Again a rating is assigned, based on the matrix presented at Table 16.2. The ratings themselves are not a determination of the acceptability of the project, they are simply a means of comparing impacts on different receptors, and with consideration of different impacts.

The process of assessment and the use of ratings tables reflects typical outcomes for visual impacts, particularly:

- Impacts on receptors that are particularly sensitive to changes in views and visual amenity are more likely to be significant.
- Impacts on receptors at scenic routes or lookouts are more likely to be significant.
- Impacts that constitute a substantial change to the visual environment a likely to be more significant than impacts that do not cause substantial change.

Table 16.2 Visual impact significance rating

Receptor Sensitivity	Impact magnitude			
	High	Moderate	Low	Negligible
High	High	Moderate-High	Moderate	Low
Moderate	Moderate-High	Moderate	Moderate-Low	Negligible
Low	Moderate	Moderate-Low	Low	Negligible
Negligible	Low	Negligible	Negligible	Negligible

Typically, impacts with a significance rating of moderate or higher pose some concern and flag the need for mitigation measures. However, no rating is intended to indicate the acceptability or unacceptability of the proposal.

16.3 Existing environment

16.3.1 Landscape character of the site and surrounding areas

The site itself is characterised by the quarry void, which is approximately 10 ha in size (300 m wide) and the main visual feature of the site. The exposed slopes around the quarry pit are surrounded by dense vegetation. The vegetation (substantial stands of trees) and topography of the site and adjoining lands screen the quarry pit from the surrounding residential properties and businesses. The topography and dense bushland provides a sense of isolation and enclosure. The site is generally bounded by ridgelines from all sides.

Although the site is generally screened, some limited views of some parts of the site are possible from residences on Fern Tree Close and some parts of Dural Street and Rosemead Road. The sloping and vegetated edges of Old Mans Valley are used by mountain bikers and bushwalkers and mountain bike tracks and walking trails afford some limited views of the site. It is noted that the quarry itself is currently closed to public access and existing visibility of the void is limited.

The area surrounding the project is a suburban environment with a mix of land uses, characters and forms including low to medium density residential areas, some commercial properties, recreational and public open spaces and schools and other community facilities.

16.3.2 Sensitive receivers

Sensitive visual receptors are defined as a person and/or viewer group that would experience a potential impact. They are considered in terms of viewing locations where the project may be visible to residents, or areas where visitors spend extended amounts of time. Sensitive receptors include houses as well as areas from which fixed or transient views would be possible, but where the time of stay is shorter, such as roads, lookouts, or recreational areas.

Based on a review of the topography, GIS and aerial imagery and site inspections, the existing dense vegetation is expected to conceal most of the project activities. Existing vegetation and ridgelines form a visual barrier to most potential visual receivers. Visibility also generally decreases further from the quarry.

The key locations which have potential to have some visibility during the project include:

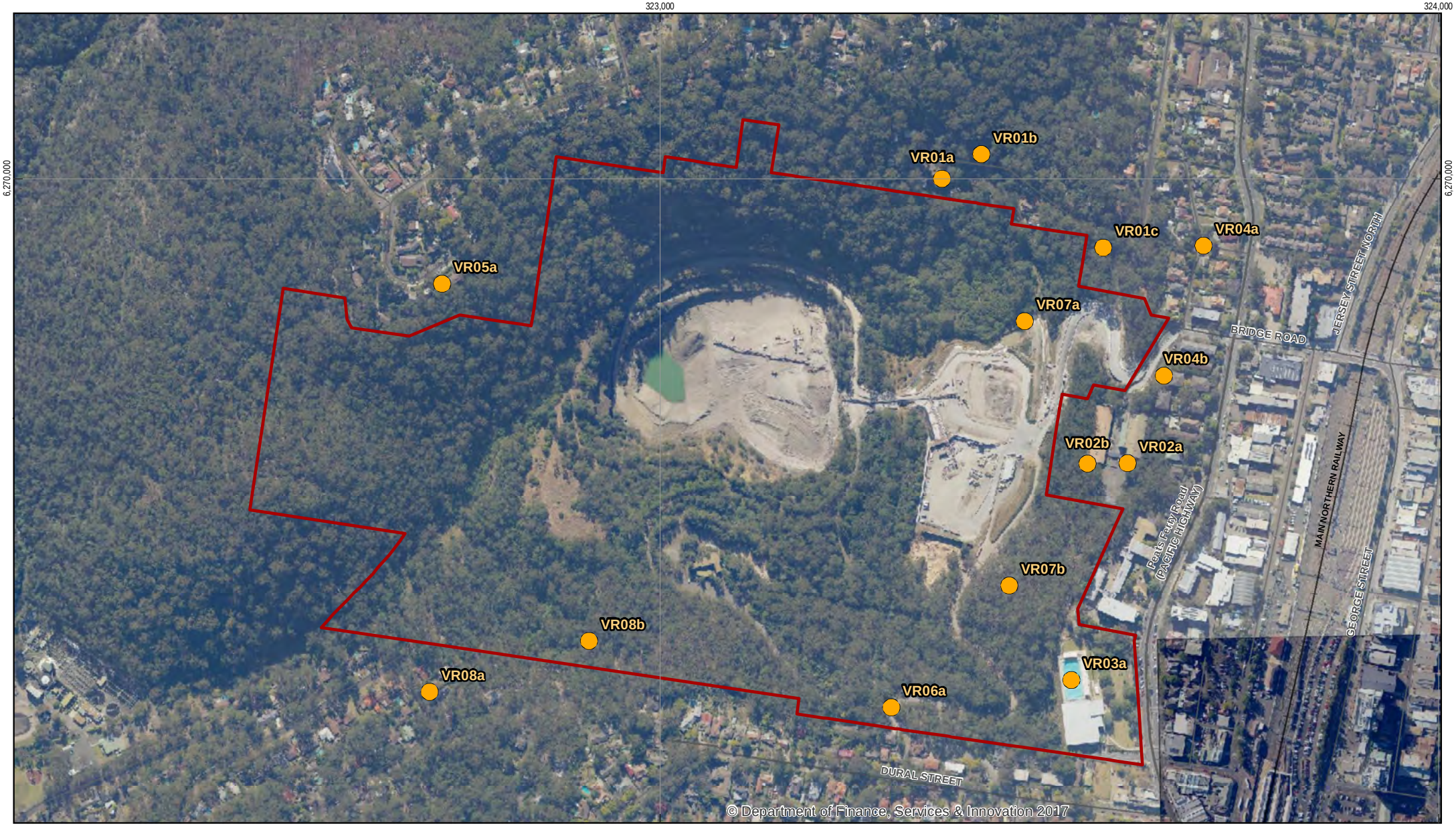
- **V01**: Residences to the north of the site, off Fern Tree Close and Manor Road which may have distance glimpses of the site through small breaks in dense vegetation
- **V02**: Hornsby TAFE on Bridge Road to the east of the site, which has adjacent views towards Old Mans Valley
- **V03**: Hornsby Aquatic and Leisure Centre on Bridge Road to the north east of the site, which may have distant glimpses of Old Mans Valley
- **V04**: Residences along Bridge Road to the east of the site, which may have some views of the site, and in particular Old Mans Valley
- **V05**: Residences on Manor Road to the north of the site, which currently have limited views of the site
- **V06**: Residences on Quarry Road to the south of the site, which currently have limited views of the site

- **V07**: Visitors to the Hornsby Mountain Bike Trail (mountain bikers)
- **V08**: Visitors to Blue Gum Walking Track to the south and east of the site (bushwalkers)

These are shown on Figure 16.1.

Views from residential streets such as Bridge Road and Fern Tree Close towards the site are limited based on the density and extent of intervening vegetation. Views of the site from Manor Road are obstructed by vegetation.

Visitors to the site (mountain bike riders and bushwalkers) would have intermittently unobstructed views due to proximity and mobile access through parts of the site.



Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND
- The site
- Visual receptor
- Railway

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 20 Nov 2018

Locations of visual receptor groups and photos

Figure 16.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

16.4 Assessment of potential impacts

16.4.1 Potential impact generators

The main potential impact generator is considered to be changes to the landform profile due to earthworks activities as well as removal of vegetation in order to facilitate earthmoving activities. Significant earthworks on the site will alter the heights of some areas of the site as well as the shape of the void and surrounds.

16.4.2 Assessment of view points

The following tables provide an assessment of visual impact significance for each of the identified potential viewpoints. The assessment considered the existing views and the potential changes to those views that may occur as a result of the project.

VR01 – residences to the north

Table 16.3 provides a summary of the assessed impact significance of VR01.

Table 16.3 VR01 Impact assessment – residences to the north

Consideration	Rating and comment
Sensitivity	**Moderate** Views towards the site from residences to the north (along Fern Tree Close) are dominated by dense vegetation and other residences. Several residences enjoy enclosed views due to surrounding natural vegetation while others are more expansive. This viewpoint is therefore considered to have moderate vulnerability to change.
Magnitude	**Moderate** The proposed earthworks associated with the project would result in potential visual impacts due to changing landform and removal of vegetation. The reshaping works would change the topography of the quarry however views from these residences are limited due to the density and extent of intervening vegetation. There may be some views of works in Old Mans Valley and the north east part of the site from residences on the western end of Fern Tree Close. Therefore the magnitude of change at this viewpoint is considered to be Moderate.
Impact significance	**Moderate**

The viewpoints in Photograph 16.1 and Photograph 16.2 show the view of the site from Fern Tree Close and Photograph 16.3 shows the view from Summers Avenue. Along these roads the view is significantly reduced due to the vegetation, however, the visibility from the residences may be more expansive depending on the building layouts and magnitude of clearing to the south of the buildings.

Photograph 16.1 Viewpoint VR01a

Photograph 16.2 Viewpoint VR01b

Photograph 16.3 Viewpoint VR01c

VR02 – Hornsby TAFE

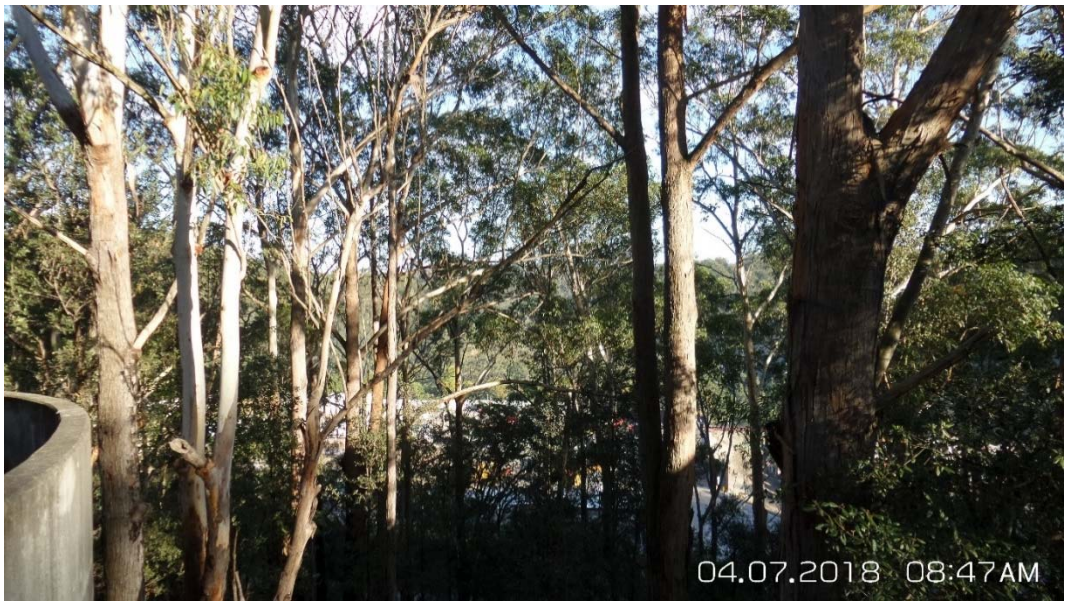
Table 16.4 provides a summary of the assessed impact significance of VR02.

Table 16.4 VR02 Impact assessment – Hornsby TAFE

Consideration	Rating and comment
Sensitivity	**Moderate** The Hornsby TAFE has clear views towards the site, particularly towards Old Mans Valley. The NorthConnex stockpile area at Old Mans Valley is currently visible from this receiver. However the sensitivity of the TAFE users is considered to be moderate at most. For educational activities conducted indoors the visual environmental is not expected to contribute greatly to the overall users educational experience.
Magnitude	**Moderate** Some earthmoving equipment and activities would be visible, particularly in Old Mans Valley but also changes to the upper portions of the void may also be visible. However the intermittent nature of users of the TAFE facility would mitigate the extent and duration of potential visual impacts. Therefore the magnitude of change at this viewpoint associated with the landform reprofiling would be moderate.
Impact significance	**Moderate**

Photograph 16.4 and Photograph 16.5 show the view of the site from the TAFE building and carpark. The elevation of the building's floors and the removal of vegetation allows a clear view of the site from this location.

Photograph 16.4 Viewpoint VR02a



Photograph 16.5 Viewpoint VR02b

VR03 – Hornsby Aquatic and Leisure Centre

Table 16.5 provides a summary of the assessed impact significance of VR03.

Table 16.5 VR03 Impact assessment – Hornsby Aquatic and Leisure Centre

Consideration	Rating and comment
Sensitivity	**Moderate** The Hornsby Aquatic and Leisure Centre has very limited views towards Quarry Road and Old Mans Valley. However distance and existing vegetation screens direct views of the majority of the site. The sensitivity of the Aquatic and Leisure Centre users is considered to be moderate at most. For swimming and other aquatic leisure activities the distant visual environmental is not expected to contribute greatly to the overall users experience.
Magnitude	**Low** Glimpses of earthmoving equipment and activities at Old Mans Valley may be visible from this location. However the intermittent nature of users of the aquatic and leisure facility would mitigate the extent and duration of potential visual impacts. Therefore the magnitude of change at this viewpoint associated with the landform reprofiling would be low.
Impact significance	**Moderate-Low**

Photograph 16.6 was taken at the outdoor swimming pool at Hornsby Aquatic and Leisure Centre. Visibility of the site is largely restricted due to the dense vegetation, however, the elevation of the building's ground level and the sections of cleared vegetation allow some visibility to Old Mans Valley.

Photograph 16.6 Viewpoint VR03a

VR04 – Residences along Bridge Road

Table 16.6 provides a summary of the assessed impact significance of VR04.

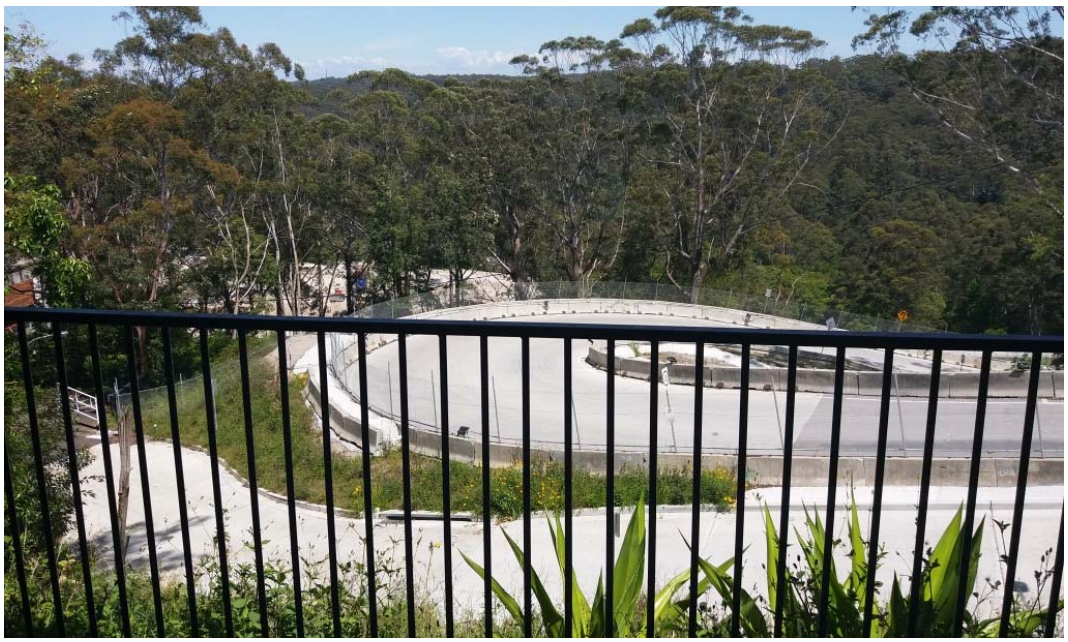
Table 16.6 VR04 Impact assessment – residences along Bridge Road

Consideration	Rating and comment
Sensitivity	**Moderate** Some residences along Bridge Road to the east of the site may have views to some parts of Old Mans Valley (the current NorthConnex stockpile area) and more distant glimpses of other parts of the site. The unit blocks that back onto Peats Ferry Road in particular have existing views to Old Mans Valley. Some residences in this area enjoy attractive natural views towards the west featuring existing vegetation. Residences at this viewpoint location currently experience frequent truck movements associated with the filling works. The sensitivity to change would be considered moderate.
Magnitude	**Moderate** Due to some visibility of the site from these residences and the distance to the majority of proposed works, the magnitude of change at this viewpoint associated with the landform reprofiling would be moderate.
Impact significance	**Moderate**

Photograph 16.7 was taken from Roper Lane as Bridge Road was temporarily closed for roadworks at the time of the visual assessment. Roper Lane is considered to have a similar view of the site for some parts of Bridge Road. From Roper Lane the site was not visible due to dense vegetation located between the road and the site.

However, some residences on Bridge Road would have a more significant visual impact due to being more closely located to the site or elevated (particularly the unit blocks that back on the Peats Ferry Road). Photograph 16.8 was taken from the rear of properties at 215/217 Peats Ferry Road during a supplementary visit on 20 November 2018. Parts of the site (Old Mans Valley) is visible from these residences.

Photograph 16.7 Viewpoint VR04a



Photograph 16.8 Viewpoint VR04b

VR05 – Residences along Manor Road

Table 16.7 provides a summary of the assessed impact significance of VR05.

Table 16.7 VR05 Impact assessment – residences along Manor Road

Consideration	Rating and comment
Sensitivity	**High** Residences along Manor Road to the north of the site are currently well screened as existing dense vegetation limits visibility of the site. The residences in this area enjoy attractive natural views of vegetation in the direction of the site. The sensitivity to change would be considered high.
Magnitude	**Low** Potential works to the northern spoil mound and west of the void would be in closest proximity to these receivers. Due to the limited visibility of the site from these residences and the limited works proposed in the northern and western part of the site, the magnitude of change is expected to be low.
Impact significance	**Moderate**

Photograph 16.9 shows the view of the site from Manor Road, which was found to be limited due to dense vegetation. Only glimpses of the site could be seen from this road. Some residences may have a clearer view depending on the layout of the buildings and the magnitude of clearing to the east of the residences.

Photograph 16.9 Viewpoint VR05a

VR06 – Residences along Quarry Road

Table 16.8 provides a summary of the assessed impact significance of VR06.

Table 16.8 VR06 Impact assessment – residences along Quarry Road

Consideration	Rating and comment
Sensitivity	**High** Residences along Quarry Road to the south of the site are currently well screened as existing dense vegetation limits visibility of the site. The residences in this area enjoy attractive natural views of vegetation in the direction of the site. The sensitivity to change would be considered high.
Magnitude	**Low** Potential works to the southern access road would be in closest proximity to these receivers. Due to the limited visibility of the site from these residences and the limited works proposed in the southern part of the site, the magnitude of change is expected to be low.
Impact significance	**Moderate**

Photograph 16.10 shows the view of the site from Quarry Rd, which was found to be limited due to dense vegetation. Only glimpses of the site could be seen from this road. Some residences may have a clearer view due to the increased elevation at the properties.

Photograph 16.10 Viewpoint VR06a

VR07 – Visitors to Hornsby Mountain Bike Trail

Table 16.9 provides a summary of the assessed impact significance of VR07.

Table 16.9 VR07 Impact assessment – visitors to Hornsby Mountain Bike Trail

Consideration	Rating and comment
Sensitivity	**High** The sensitivity of visitors to Hornsby Mountain Bike Trail and Blue Gum Walking Track to visual changes would be high. Visitors would enjoy expansive views of natural landscapes.
Magnitude	**Low** Visitors to the Hornsby Mountain Bike Trail would have intermittently unobstructed but views of the Old Mans Valley but limited views of the void. Some temporary closures or rerouting of trails is expected to occur to ensure public safety, during which no site activities would be visible. The intermittent nature of visitors to these trails would mitigate the extent and duration of any potential visual impacts.
Impact significance	**Moderate**

Photograph 16.11 and Photograph 16.12 show the view of the site from two of the mountain bike trails. In some locations the view is entirely limited due to dense vegetation. Whereas, in other location the tracks are within close proximity to Old Mans Valley and the magnitude of vegetation clearing allows the site to be clearly visible.

Photograph 16.11 Viewpoint VR07a

Photograph 16.12 Viewpoint VR07b

VR08 – Visitors to Blue Gum Walking Track and Rosemead Road Picnic Area

Table 16.10 provides a summary of the assessed impact significance of VR08.

Table 16.10 VR08 Impact assessment – visitors to Blue Gum Walking Track and Rosemead Road Picnic Area

Consideration	Rating and comment
Sensitivity	**High** The sensitivity of visitors to Blue Gum Walking Track and the picnic area to visual changes would be high. Visitors currently enjoy views of dense vegetation.
Magnitude	**Low** Visitors to the Blue Gum Walking Track would have limited to no views of the site. The intermittent nature of visitors to these trails would mitigate the extent and duration of any potential visual impacts.
Impact significance	**Moderate**

Photograph 16.13 and Photograph 16.14 show the view of the site from the Rosemead Road Picnic Area and Blue Gum Walking Track, respectively. The current dense vegetation significantly restricts view to the site from these viewpoints.

Photograph 16.13 Viewpoint VR08a

Photograph 16.14 Viewpoint VR08b

Summary of assessment of impacts

The assessment considered impacts on six groups of potential receptors, including residential receptors, users of nearby educational and recreational facilities and visitors to recreational biking and walking trails. All receptor groups were determined to have a sensitivity of moderate or high. This was largely due to the quality of natural views and landscapes and the type of outlooks.

The magnitude of impacts on each identified receptor group was determined to be moderate or less, largely due to the location, topography and surrounding vegetation screening which would limit the potential visual impacts or due to the intermittent nature of visitors/users of facilities/trails.

It is noted that following completion of the project, Council intends to develop the site for future community use as a parkland. This future development would improve the visual and landscape aspects of the site and have an overall beneficial visual impact on existing visual receivers.

Works would also be limited to standard work hours only. Therefore, there would be no visual impacts during night time hours as a result of lighting or other activities.

Nonetheless a number of mitigation measures are proposed to further minimise the temporary visual impacts associated with the project (refer Section 16.5).

16.5 Mitigation and management measures

The following mitigation measure would be implemented to ensure potential visual impacts are minimised:

- Ensuring earthworks activities would be limited to standard construction hours
- Screening vegetation would be maintained where practicable
- Community updates and newsletters would be provided to nearby properties

17. Socio-economic

17.1 Approach and methodology

An assessment of the likely social and economic impacts of the project was undertaken to address the social and economic requirements of the SEARs. The assessment included:

- Overview of existing socio-economic environment
- Qualitative assessment of impacts on surrounding community and economy
- Development of mitigation and management measures

17.2 Existing environment

Land use and existing development in the areas surrounding the site are predominantly:

- Suburban residential
- Commercial and light industrial land uses along Peats Ferry Road

17.2.1 Hornsby LGA

The 2016 NSW Population Projection developed by NSW Department of Planning & Environment states that the population in Hornsby LGA was 149,650 in 2016 and is expected to increase to 159,050 in 2021 and 164,650 in 2026.

Table 17.1 summarises the population statistics of the Hornsby LGA between 2006 and 2016.

Table 17.1 Hornsby LGA census statistics

Selected medians	2006	2011	2016
Median age of persons (years)	38	39	40
Median total personal income ($ weekly)	$580	$682	$793
Median total family income ($ weekly)	$1,763	$2,119	$2,372
Median total household income ($ weekly)	$1,514	$1,824	$2,121
Median rent ($ weekly)	$300	$400	$500

Source: Australian Bureau of Statistics (ABS) - Census

The Australian Bureau of Statistics 2016 Census states that the largest industries of employment in the Hornsby LGA are:

- Computer system design and related services
- Hospitals (except psychiatric hospitals)
- Banking
- Primary education
- Secondary education

Further, the most common occupations include:

- Professionals – 33.7%
- Managers – 15.6%
- Clerical and administrative workers – 14.6%
- Technicians and Trade Workers – 9.8%
- Community and personal service workers – 8.8%

17.2.2 Hornsby West Area

The site is specifically located in the Hornsby West Main Statistical Area (SA2). Table 17.2 summarises the population characteristics of the Hornsby West area in 2016.

Table 17.2 Hornsby West census statistics

Selected medians	2016
Median age of persons (years)	39
Median total personal income ($ weekly)	$751
Median total family income ($ weekly)	$2,119
Median total household income ($ weekly)	$1.828
Median rent ($ weekly)	$430

Source: Australian Bureau of Statistics (ABS) - Census

The Australian Bureau of Statistics 2016 Census states that the largest industries of employment in the Hornsby West community are:

- Computer system design and related services
- Hospitals (except psychiatric hospitals)
- Banking
- Aged care residential services
- Secondary education

The most common occupations include:

- Professionals – 34.1%
- Clerical and administrative workers – 14.4%
- Managers – 13.7%
- Technicians and Trade Workers – 10.1%
- Community and personal service workers – 9.3%

17.3 Assessment of potential impacts

17.3.1 Social impacts

The key potential social impacts that may result from the project include:

- Change in community use of land – development of infrastructure can result in a change in land use which may affect how the community uses the land, or limit future community use of land
- Employment – there is the potential for employment to be generated during construction of the project (temporary)
- Amenity – construction can result in impacts to local amenity unless appropriate design and mitigation measures are adopted. In particular, there is the potential for air quality (dust, odour), noise, traffic and visual impacts

These potential impacts are considered in more detail below in relation to the project.

Change in land use

The site has been closed to the public for a long time. However the project would provide a landform suitable for future development into a community parkland and make the site safe for the community. While this project does not include the parkland development, it is a critical step

in the process of opening the site up to the public for recreational use. Potential future benefits of the change in land use from quarry to community park (which would be facilitated by the project) include:

- House prices – urban parks are a valuable part of the living environment and are typically reflected in higher real estate prices (for both houses and apartment).
- Human health and wellbeing – parks and park use can have a positive impact on both mental and physical wellbeing, either through direct or indirect effects such as recreation and leisure activities.
- Tourism – leisure visits outside of the own living or working environment can promote the health and wellbeing of visitors and also contribute to the local economy
- Social cohesion/identity – urban parks can help strengthen social ties, relations and cohesion
- Biodiversity – biodiversity has a direct link to human wellbeing (e.g. through nature experience)

It is also noted that by improving safety and accessibility of the site, the project would ultimately allow for enhanced community visitation and engagement with the heritage items located within the site, and provide opportunities for greater understanding of their significant values and associations.

These positive long-term social benefits of development of the future parkland need to be considered against the potential short-term social and amenity impacts of the construction associated with the project, as discussed below.

Employment

The project is expected to require the direct employment of up to 30 full time equivalent staff on site during the construction works. However there would also be indirect employment benefits related to the project for example, associated with further detailed design, additional investigations, procurement and tendering etc.

Amenity

The project has potential to result in amenity impacts to residents and businesses located in close proximity to the site. The potential negative impacts during construction would be temporary and would be significantly reduced by the implementation of appropriate design features and stringent environmental management controls guided by the Construction Environmental Management Plan.

As described above, these short term impacts need to be considered against the positive long-term benefits of developing the site into a parkland in the future.

Noise

Potential noise impacts were considered by the noise impact assessment, summarised in Section 8. The assessment identified that the predicted noise levels during construction would be greater than the noise management levels at several receivers under some modelled scenarios. The magnitudes of construction noise levels are dependent on the duration of construction, the type of equipment, location of activities, the surrounding environment's background noise levels and the weather conditions during construction.

All feasible and reasonable work practices and mitigation measures would be applied to help reduce the potential noise impacts. However, these mitigation measures are unlikely to reduce

noise levels below the construction noise management levels (ICNG) and the project noise trigger levels (NPI) at the nearest sensitive receivers.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise levels are generally conservative and would only be experienced for limited periods during construction.

Air quality

Potential air quality impacts were considered by the air quality impact assessment, summarised in section 9. The assessment identified that no exceedances of the air quality criteria are predicted.

Traffic

Potential traffic impacts were considered by the traffic impact assessment, summarised in Chapter 13. The assessment identified that:

- The magnitude of the impacts are not likely to be significantly different to that of the existing situation and would fall within typical daily fluctuations of traffic volumes
- Traffic generated by construction works at the site is expected to have negligible impacts on the safety and efficiency of the local road network.

Visual amenity

Potential visual impacts were considered by the visual impact assessment provided in section 16. The magnitude of impacts on each identified receptor group was determined to be moderate or less, largely due to the location, topography and surrounding vegetation screening which would limit the potential visual impacts or due to the intermittent nature of visitors/users of facilities/trails.

The negative amenity impacts are temporary and it is noted that following completion of the project, Council intends to develop the site for future community use as a parkland. This future development would improve the visual and landscape aspects of the site and have an overall beneficial visual impact on existing visual receivers.

17.3.2 Economic impacts

Direct impacts

The estimated capital investment value of the project is $28 million dollars. The project would also directly employ up to 30 full time equivalent personnel during construction. This would provide a one off boost to the Hornsby economy in terms of local output, employment, wages and salaries and value added.

Flow on benefits

There would also be economic flow on benefits of the construction spend. These are:

- Flow on industrial effects in terms of local purchases of goods and services and associated indirect impacts with increased local economic output, jobs, wages and salaries and value added.
- Flow on consumption effects as a result of increased wages and salaries paid to employees as a result of increased direct and indirect output and corresponding job creation. The

consumption effects would further boost economic output, jobs, wages and salaries and value added.

Economic flow on benefits would be spread across greater Sydney as well as the local Hornsby area.

Broader economic benefits to the region

The project would allow the development of a parkland for community use in the future. The parkland would result in additional tourist visits to the Hornsby region once the park has opened. These benefits would be permanent due to ongoing future parkland visitation.

17.4 Mitigation and management measures

A number of mitigation measures have been identified through the assessment process to address potential negative amenity impacts. These are discussed in the respective chapters for noise and vibration (section 8.4), air quality (section 9.4), traffic (section 13.4) and visual amenity (16.5).

In addition, the community would be kept informed about the project as well as the potential future parkland development through advertisements in the local media, notices and/or signs, Council's website and Council's 40,000+ email list.

18. Rehabilitation

This chapter provides a description of the proposed rehabilitation measures that would be undertaken as part of the project. Justification for the proposed final landform and consideration of the objectives of relevant strategic land use plans or policies is provided in Chapter 5.

18.1 Proposed rehabilitation measures

Council is proposing to undertake extensive bush regeneration work across the site. In addition to this, general landscaping is proposed as part of the future parkland development (which will be subject to a separate approval). The bush regeneration measures proposed as part of this project include:

- Retainment of top soil and manufacture of soils
- Tree planting and reestablishment of Blue Gum High Forest

All appropriate topsoil from the proposed earthworks would be retained on site for reuse in the bush revegetation work. To supplement the retained topsoils, it is proposed to 'manufacture' soils from proposed areas of cut and by blending it with mulch or compost generated onsite from cleared vegetation (green waste).

Council has engaged Sydney Environmental Soil Laboratory (SESL) to assist in the development of an appropriate profile for this manufactured soil. This manufactured soil would replicate the original soil profile and be used to re-establish Blue Gum High Forest and other appropriate plant communities across steep embankments through the revegetation program.

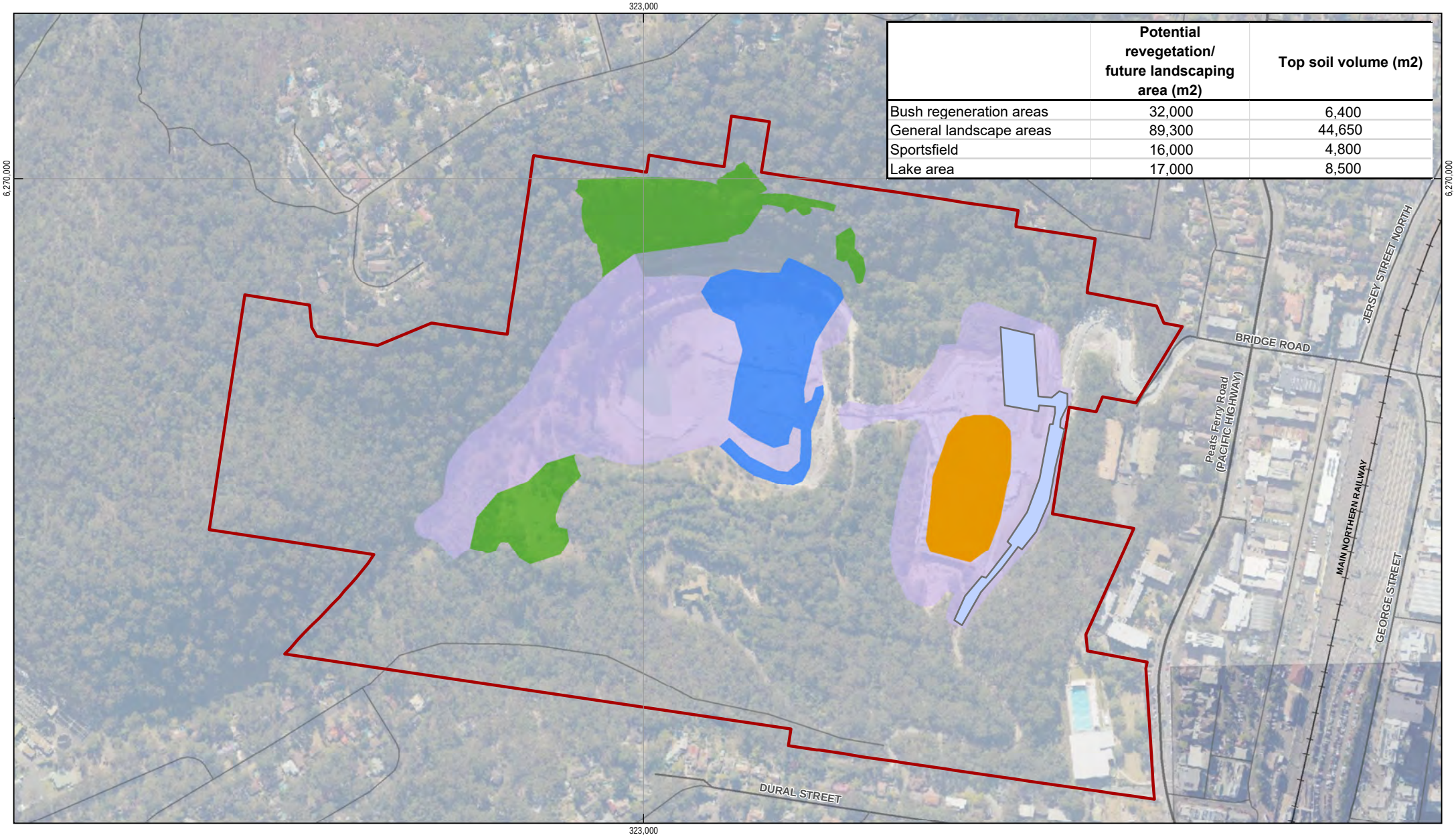
There is potential for approximately 32,000 m^2 of the site to be subject to targeted revegetation and bush regeneration (placement of retained and manufactured soils and tree planting) as part of the project as summarised in Table 18.1 and shown on Figure 18.1.

Table 18.1 Summary of potential bush regeneration areas

Location	Approximate area (m^2)
South west fill area	10,800
Northern spoil mound	21,200
Total	**32,000**

The proposed potential bush regeneration works is expected to require approximately 6,400 m^3 of topsoil, which would be generated from a combination of screened breccia/fill (80%) and mulch/compost (20%).

In addition to the potential revegetation and bush regeneration works for this project, as part of the future parkland development, approximately 89,300 m^2 is expected to be landscaped and approximately 16,000 m^2 is expected to be turfed for sportsfield(s).



	Potential revegetation/ future landscaping area (m2)	Top soil volume (m2)
Bush regeneration areas	32,000	6,400
General landscape areas	89,300	44,650
Sportsfield	16,000	4,800
Lake area	17,000	8,500

Paper Size A4

0 20 40 80 120 160

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The site
- Sportsfield
- Revegetation and bush regeneration areas
- General landscape areas
- Lake area
- Car park

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 07 Dec 2018

Potential revegetation areas, soil volumes and potential future landscaping areas

Figure 18.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Sixmaps imagery, NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy

18.2 Implementation of the rehabilitation strategy

Sufficient financial resources will be made available to implement the proposed revegetation and bush regeneration measures (as described in Section 18.1) as part of the project as well as future landscaping proposed as part of the future parkland (separate approval). The State Government recently provided funding for the preparation and development of the site into a parkland. Council has also set aside additional funding for the rehabilitation elements of the project. The offsets package to be developed as part of the approvals process (refer to Section 11.4.2) will specify the works required, location, duration and funding.

18.3 Biosecurity (pests and weeds)

As discussed in Section 11.2.2, the site contains three species declared as priority weeds for the Greater Sydney region:

- Ground Asparagus (*Asparagus aethiopicus*)
- Pampas Grass (*Cortaderia selloana*)
- Lantana (*Lantana camara*).

These weed species occur in low to moderate densities throughout the site. The weed management measures proposed as part of the project include:

- Development of weed management actions during the construction phase of the project. This would include the management and disposal of the weeds that were recorded within the site including the priority weeds listed above. The weed management actions would be in accordance with the *Biosecurity Act 2015*.
- Vehicles and other equipment would be cleaned to prevent the introduction of further exotic plant species or disease.

The project would actually reduce a source of weed propagules that are currently threatening adjoining areas of intact, better condition native vegetation. Provided the proposed weed management measures are adopted, the project may result in positive impacts on retained native vegetation adjoining the site by reducing the amount of weeds within the site.

19. Other issues

19.1 Human health

19.1.1 Approach and methodology

A qualitative assessment to potential human health risks was undertaken. This included:

- Review of potential impacts to air quality, noise and vibration
- Identification and characterisation of the community that may be affected by these impacts
- Assessment of air quality impacts on health
- Assessment of noise and vibration impacts on health

19.1.2 Existing environment

Sensitive receivers

Sensitive receivers are locations in the local community where more sensitive members of the population, such as infants and young children, the elderly or those with existing health conditions or illnesses, may spend a significant period of time. These locations comprise hospitals, child care facilities, schools and aged care homes/facilities. The assessment of potential impacts on the surrounding community, particularly in relation to air quality, has considered all impacts at all individual residential homes and business in the vicinity of the quarry.

Existing health of the population

The Australian Bureau of Statistics 2016 Census indicates that suburb of Hornsby is generally similar to Greater Sydney and NSW in terms of social demographics. Some demographic information is provided in Chapter 17.

The health of a local community is influenced by a complex range of factors such as age, socio-economic status, social capital, behaviours, beliefs and lifestyle, life experiences, country of origin, genetic predisposition and access to health and social care (EnRiskS, 2015).

EnRisks (2015) identified that for the population in the Northern Sydney area, the health statistics (including mortality rates and hospitalisation rates) are generally lower than compared with a number of other health areas and the whole of NSW.

Existing air quality

The existing air quality in and around the site is described in Section 9.2.1 and in Appendix D including background ambient levels of TSP, PM_{10} and $PM_{2.5}$.

In general, NSW is considered to have good air quality by international standards. The greater Sydney area is most significantly affected by bushfires (including hazard reduction burns) and dust storms with transport-related emissions identified as the largest source of human-related pollution (EnRiskS, 2015).

Existing noise

The existing noise levels around the site is described in Section 8.2.2 and in Appendix C including noise levels during September (while the 2016 Planning Approval filling works are being undertaken at the site) as well as noise levels measured in 2015 as part of the 'Hornsby Quarry – Road Construction Spoil Management Project EIS' (AECOM, 2015).

The current dominant noise sources are due to earthmoving equipment within the quarry site, the screener transporting material from the spoil site to the quarry and heavy vehicle movements to and from the site associated with the 2016 Planning Approval filling works.

Otherwise the noise environment surrounding the site is characterised by the local road network and railway station/northern rail line.

19.1.3 Assessment of potential impacts

Air quality

Emissions to air associated with the project have been assessed in detail in Appendix D and summarised in Chapter 9.

The project construction has been assessed over three scenarios which represent potential worst case situations. Plant and equipment throughputs and location are different for each scenario, as described in Section 9.3.2.

Dust and particular matter was identified as the pollutant most likely to impact nearby sensitive receptors. The assessment of dust and particulate matter includes:

- Total suspended particulates (TSP)
- Particulate matter smaller than 10 microns (PM_{10})
- Particulate matter smaller than 2.5 microns ($PM_{2.5}$) and
- Dust deposition

Fine particle emissions associated with exhausts from mobile plant and stationary engines used during construction activities are accounted for in the emission factors for earthmoving and handling used in the air quality assessment.

Air quality goals for PM_{10}, and advisory goal for $PM_{2.5}$, have been established by NEPC (NEPC 2002, 2003) that are based on the protection of human health and well-being. The goals apply to average or regional exposures by populations from all sources, not to localised “hot-spot” areas such as locations near industry, busy roads or mining. They are intended to be compared against ambient air monitoring data collected from appropriately sited regional monitoring stations.

In addition, the assessment of impacts from any development requires consideration of air quality goals/guidelines that are outlined in the Approved Methods (EPA, 2016). The guidelines are primarily derived from the NEPC, with the exception of an annual average PM_{10} guideline which is derived from older goals adopted by the EPA (EPA, 1998). The air quality goals relate to total particulate matter burden in the air and not just the particulate matter from the project, hence use of these criteria requires consideration of background levels of particulate matter and other local sources. Similar to the NEPC criteria, these guidelines do not apply to localised “hot-spot” areas such as locations near industry, busy roads or mining. However, in the absence of alternative measures, the EPA does apply these criteria to assess the potential for impacts to arise at such locations, particularly for new projects.

Air quality goals for the project were identified in accordance with the Approved Methods (EPA, 2016). The air quality assessment (Appendix D and Chapter 9) found that the project is not expected to exceed air quality goals at any nearby private receptors.

While the project is not expected to exceed air quality goals, a number of mitigation measures are also proposed to further reduce the potential exposure associated with the project.

Therefore the project is not expected to result in any significant air quality impact or significant air quality health risk.

It is noted that minimal dust is expected to be generated from the site outside standard work hours as the site would not be operational and would therefore have a minimal effect on pollutant levels.

Noise and vibration

Noise associated with the project has been assessed in detail in Appendix C and summarised in Chapter 8.

The construction noise guidelines applicable to the project has considered the health effects of noise and the relevant guidance from the World Health Organisation and the Environmental Health Council of Australia in determining appropriate noise management levels (criteria).

Noise levels that do not comply with these guidelines/criteria may have the potential to have negative health outcomes for the community adjacent to the project. The ICNG requires feasible and reasonable management measures to be implemented to minimise impacts. Where this process is followed, and where project works are only expected to occur for a short period of time (as is the case with the project) no adverse health effects are expected to occur in the community.

The noise and vibration impact assessment predicts noise levels would exceed the construction noise management levels at most of the sensitive receivers within the study area during recommended standard hours. Noise levels are not predicted to exceed the highly noise affected criteria at any residential receivers.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works will be temporary during the construction period and would not represent a continuous impact on the community and surrounding environment due to changes in activities and plant used. The predicted noise levels are generally considered conservative and would likely only be experienced for limited periods during construction. Potential impacts would be reduced through the introduction of the proposed feasible and reasonable mitigation measures (Section 8.4).

The noise and vibration impact assessment identified safe working distances for vibration activities for structural damage to standard/heritage structures and for human comfort. No adverse structural damage impacts to buildings are anticipated as a result of the project. One building within Hornsby TAFE has been identified within the safe working distance for human comfort. Mitigation measures have been recommended to reduce potential construction vibration impacts.

Where the proposed noise and vibration management and mitigation measures are adopted, no adverse health impacts are expected in the local community.

19.1.4 Mitigation and management measures

The potential human health risks from the project are associated with air quality and noise and vibration impacts. As such the proposed mitigation measures are:

- Air quality mitigation and management measures identified in Section 9.4
- Noise and vibration mitigation and management measures identified in Section 8.4

19.2 Hazards and risk

19.2.1 Approach and methodology

The hazard analysis was prepared consistent with the requirements of SEPP 33 and the publications Hazardous Industry Planning Advisory Paper No. 6 'Guidelines for Hazard Analysis' (HIPAP 6) and HIPAP No. 4 'Risk Criteria for land Use Safety Planning'.

The analysis was prepared to show that any residual risk levels are acceptable in relation to the surrounding land use, and that potential risks would be appropriately managed. This has been done by:

- Identifying intrinsic hazards and abnormal operating conditions that could give rise to hazards
- Identifying the range of safeguards
- Assessing the risks by determining the probability (likelihood) and consequence (effects) of hazardous events for people, the surrounding land uses and environment
- Identifying approaches to reduce the risks by elimination, minimisation and/or incorporation of additional protective measures.

Hazards and risks relating to surface water and groundwater are addressed in Chapter 10 and soil contamination is addressed in Chapter 14.

19.2.2 Preliminary risk screening

In accordance with the requirements of SEPP 33, a preliminary risk screening of the project was undertaken. The need for a preliminary hazard analysis (PHA) is determined by the results of the preliminary risk screening. The methodology for risk screening is outlined in the Department of Planning (1994) 'Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines'. The guidelines provide a risk-screening procedure based on the quantity of dangerous goods to be used by a project and the distance these materials are stored from a site's boundary.

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development should be considered potentially hazardous and a PHA is required. Also, if the quantities are close to the screening threshold values and the development site is near a sensitive receiver then the proposed development is also considered to be potentially hazardous and a PHA is required.

The results of the preliminary risk screening indicated that a PHA is not required, as all materials, including transportation frequencies, do not exceed the respective thresholds, and the proposal is not considered potentially hazardous. However, to demonstrate that potential hazards have been considered and control measures put in place, a hazard identification process was completed.

Dangerous good inventory

Table 19.1 provides the dangerous goods storage inventory for the project. A fuel truck would be moved around the site to provide diesel for plant and equipment on site. The fuel truck may be temporarily parked on the site, but no onsite 'storage' of fuel is proposed.

Table 19.1 Dangerous goods storage

Chemical	UN	Class	Packing group	Hazchem code	Storage capacity*
Diesel	1202	3	III	3Z	5,000 L (4.25 tonne)

* fuel truck, not stored on site

The SafeWork NSW notification threshold for diesel is 10,000 kg or L. Where dangerous goods are used or stored in greater than the threshold quantities, Safework NSW must be notified, and manifests and emergency plans must be developed.

Dangerous good storage screening

Under SEPP 33, Class 8 Dangerous Goods are arranged by their packing group and evaluated against a threshold above which the site would be deemed to be 'potentially hazardous industry'. The proposed inventory of Dangerous Goods to be stored and utilised on site is provided in Table 19.2.

Table 19.2 Dangerous goods screening

Chemical	Maximum quantity on site	Threshold
Diesel	4.25 tonne	• Must be at least 5 m from facility boundary • Must be at least 8 m from a sensitive receptor

In accordance with SEPP 33, the diesel inventory does not exceed the screening threshold for onsite storage of Dangerous Goods.

In order to avoid exceeding the screening threshold, the inventory of diesel must be stored more than five metres from the site boundary and more than eight metres from a sensitive receptor. The proposed diesel fuel truck would not be parked within these threshold distances.

Transportation screening

The project would involve a number of light vehicles entering the surrounding road network due to workers travelling to and from the site. There would be occasional delivery of diesel to the site (fuel truck) for the earthmoving plant and equipment. This could be several times per week.

The transportation screening thresholds for the movement of Dangerous Goods (both incoming and outgoing) are listed in Table 19.3. The SEPP 33 threshold only applies to movements greater than 2 tonne.

Table 19.3 Vehicle movements of Dangerous Goods

Chemical	Monthly movements	Annual threshold	Peak weekly threshold
Diesel	15	1000	60

As the total weekly movements of Class 3 Dangerous Goods would be well below the peak weekly and the annual threshold, it is concluded that the transport of Dangerous Goods is not potentially hazardous and therefore does not require a route evaluation.

Summary of the risk screening results

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development (the project) should be considered a 'potentially hazardous industry' or a 'potentially offensive industry' and a PHA is required.

The results of the Dangerous Goods storage and transport screening indicate that the project would not result in any of the thresholds being exceeded. As a result, the project is not considered to be a 'potentially hazardous industry' and a PHA is not required.

However, to demonstrate that potential hazards have been identified and control measures are in place, a hazard identification process has been completed, as outlined in section 19.2.3.

19.2.3 Hazard identification

Hazard identification represents a Level 1 or qualitative risk assessment and involves documenting all possible events that could lead to a hazardous incident. It is a systematic process listing potential causes and consequences (in qualitative terms). Reference is also made to proposed operational and organisational safeguards that would prevent such hazardous events from occurring, or should they occur, that would mitigate the impact on the plant, its equipment, people and the surrounding environment. This process enables the establishment, at least in principle, of the adequacy and relevancy of proposed safeguards.

The aim of the hazard identification study process is to highlight any residual risks associated with the interaction of the project with the surrounding environment. A range of possible hazard scenarios was developed but a consequence and likelihood assessment was not completed as none of the hazardous scenarios were considered credible for offsite impact. The results of this hazard identification process are provided in Table 19.4.

The hazard identification process did not identify any significant hazards with the potential for offsite impact that would not be suitably controlled.

Table 19.4 Hazard identification

Hazard Scenario	Causes	Consequences	Identified / recommended safeguards
Exposure to dust	• Dust generated during earthworks • Vehicle movements on unsealed surfaces	• Health risk	• Use of water to wet down dust generating material • Machinery operator to keep cabin door closed • Other workers on site to avoid standing close and/or to use respiratory protection • Dust control procedures
Vehicle interactions	• Vehicle/loader movements in vicinity of personnel	• Personal injury	• Traffic management plan including standard traffic rules, signage etc. • Site speed limits to be imposed and monitored • Site layout to minimise vehicle reversing • Driver competency • Workplace Health and Safety plan • Safe Work Method Statements (SWMS) • Machine inductions/licensing • Reversing alarms • Fixed mirrors • High visibility PPE
Natural hazards	• Flooding, earthquake, lightning	• Personal injury • Possible fire	• Emergency preparedness plan and procedures • Housekeeping standards • Site drainage
Insects, ticks, leeches, snakes	• Contact with insects, ticks, leeches	• Personal injury • Health risk	• Staff to wear appropriate clothing and PPE and spray repellent containing DEET • Housekeeping standards
Fire	• Nearby bushfire • Diesel fire • Arson	• Asset damage • Personal injury	• Fuel tanker to be maintained appropriately • Refuelling procedures • Housekeeping standards • Emergency preparedness plan and procedures
Loss of containment of diesel	• Damage to fuel truck (external impact) • Misalignment of valves and connections during filling	• Environmental damage • Personal injury	• Fuel tanker to be maintained appropriately • Inspection and maintenance regime • Refuelling procedures • Housekeeping standards
Struck by flying/falling object	• Incorrect use of plant and equipment • Dropped object from height	• Personal injury / fatality	• Inspection and maintenance of equipment • Procedure for use of equipment

Hazard Scenario	Causes	Consequences	Identified / recommended safeguards
Crushed	• Dozer or other earthmoving plant and equipment • Vehicle tipping over	• Personal injury / fatality	• Operating procedures • Exclusion zones
Manual handling	• Repairs to equipment	• Personal injury	• Rotation of job roles • Use of specialist equipment suppliers
Slips, trips, falls, collisions, egress	• Poor design • Sharp objects on surface	• Personal injury / fatality	• Safety in design • Formed surface • Water management – adequate and rapid drainage
Engulfment	• Collapse of earth mounds or stockpiles • Collapse/failure of quarry face(s) or other areas	• Personal injury / fatality	• Safety in design • Operating procedures • Exclusion zones
Noise	• Heavy machinery	• Personal injury	• Hearing protection

19.2.4 Mitigation and management measures

If changes occur to the inventories or types of Dangerous Goods to be stored on site, the screening process would be repeated in order to determine if those changes trigger the need for a PHA to be conducted.

As part of the detailed design and construction management, a detailed hazard identification process and safety in design process would be undertaken.

The identified / recommended safeguards identified in the hazard identification would be implemented.

20. Environment management

20.1 Environmental management framework

20.1.1 Site regulatory requirements

The project would be subject to and required to operate in accordance with the EPL issued for the crushing, grinding and separation works.

EPLs are issued by the NSW EPA to owners or operators of premises under the POEO Act. EPLs are a regulatory measure to control impacts of pollution in NSW. The EPL would place conditions on the proposed construction activities, which may include noise, dust, monitoring and reporting requirements, requirements for managing complaints, etc.

20.1.2 Construction environmental management plan

A Construction Environmental Management Plan would be developed prior to construction. It would include:

- Environmental goals and objectives
- Commonwealth and state statutory requirements including licences and approvals
- Environmental management procedures including:
  - Safeguards to be implemented
  - List of actions, timing and responsibilities
  - Reporting requirements
  - Specifications incorporating environmental safeguards
  - Training of personnel (principal and contractors) in environmental awareness
  - Environmental accident and incident reporting requirements
  - Process surveillance and auditing procedures
  - Environmental complaint handling procedures
  - Site management and control procedures.
- Monitoring requirements including a monitoring plan which details location, duration and frequency of monitoring and procedures and conditions to be followed
- Emergency response including an emergency response plan, incorporating procedures for fire, pollution incidents and accidents. The plan would detail procedures to be followed, responsibilities, equipment and contact details for responsible site staff and emergency authorities
- Review and auditing procedures.

The Construction Environmental Management Plan would include sub plans to address key issues such as (but not limited to):

- Soil and Water Management Plan
- Flora and Fauna Management Plan
- Heritage Management Plan
- Construction Traffic Management Plan
- Noise and Vibration Management Plan
- Waste Management Plan

The Construction Environmental Management Plan would incorporate the measures identified in Table 20.1 and be updated following detailed design, and to include any other measures of conditions of approval.

20.2 Summary of mitigation and management measures

The Construction Environmental Management Plan would contain detailed mitigation measures and procedures to address potential impacts associated with the proposed construction activities.

Table 20.1 summarises the mitigation and management measures identified as part of the technical studies undertaken for the EIS.

Table 20.1 Mitigation and management measures

Issue	Mitigation and management measures
Noise	The following measures would be incorporated into the Construction Environmental Management Plan as general work practice: All activities on site would be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 7:00 am to 1:00 pm on Saturday • All personnel on site would be made aware of the potential for noise impacts and should aim to minimise impact or elevated noise levels, where possible. • Regular identification of noisy activities and adoption of improvement techniques • Minimise the need for vehicle reversing (for example, by arranging for one-way site traffic routes) • Construction heavy vehicles utilising Dural Street and Quarry Road would be limited to one vehicle per hour during the night period • Scheduling of respite periods for high noise activities including rock breaking, ripping and sawing • A noise monitoring program would be carried out for the duration of the works in accordance with any approval and license conditions • No swearing or unnecessary shouting or loud stereos/radios on site • All employees, contractors and sub-contractors would receive an environmental induction. The induction would include: – all relevant project specific and standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work – any limitations on high noise generating activities – location of nearest sensitive receivers – construction employee parking areas – designated loading/ unloading areas and procedures – construction traffic routes – site opening/closing times (including deliveries) – environmental incident procedures • Notification detailing work activities, dates and hours, impacts and mitigation measures indication of work schedule, and contact phone number (for noise complaints and project information) would be made available for the community. The following measures would be implemented to reduce noise at source: • Substitution: – Where reasonably practicable, noisy plant would be replaced by less noisy alternatives • Modification of equipment: – All engine covers would be kept closed while equipment is operating. – Plant and vehicles would be kept properly serviced and fitted with appropriate mufflers and silencers, where applicable. – The use of exhaust brakes would be eliminated, where practical.

Issue	Mitigation and management measures
	– Where practical, plant operating on site would be fitted with broadband reversing alarms. – Acoustic enclosures would be provided for suitable equipment • Use and siting of plant: – The offset distance between noisy plant and adjacent sensitive receivers would be maximised where practical – Plant used intermittently would be throttled down or shut off – Noise-emitting plant would be directed away from sensitive receivers, where possible • Regular and effective maintenance: – Regular inspection and maintenance of equipment to ensure it is in good working order and checking the condition of mufflers – Machines found to produce excessive noise compared to industry best practice would be removed from the site or stood down until repairs or modifications can be made. – Ensure air lines on pneumatic equipment do not leak – Return of any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair. • Alternative methods: – Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting. The suitability of alternative methods should be considered on a case-by-cases basis.
Vibration	• Where vibratory rolling or compacting works undertaken within 100 metres of the most western building of the Hornsby TAFE, the occupants of this building would be notified of the expected impacts. • Should complaints be received, vibration monitoring would be undertaken to determine the extent of the vibration impact and to guide mitigation measures, which may include the use of smaller equipment when the TAFE is in use. • Where practical, rolling works near the TAFE would be undertaken during their holiday break period to minimise potential vibration impacts.
Air quality	• Where appropriate, material would be watered prior to it being loaded for on-site haulage • The size of storage piles would be minimised where possible • Cleared areas of land would be limited where practicable and only cleared when necessary to reduce fugitive dust emissions • On-site traffic would be controlled by designating specific routes for haulage and access and limiting vehicle speeds to below 25 km/h • All trucks hauling material on the way to the site would be covered and a reasonable amount of vertical space would be maintained between the top of the load and top of the trailer • Operations conducted in areas of low moisture content material would be suspended during high wind speed events or water sprays would be used • Rock saws would be equipped with in built wet control systems that reduce dust generation to negligible levels. These wet control systems would be used during all rock sawing activities.
Soils and water	• A Soil and Water Management Plan would be developed prior to construction, in accordance with Landcom (2015) ‘The Blue Book’, including consideration of erosion and sediment control impacts. • Measurement of pumped dewatering volumes when when they occur using the existing flow measurement weir available to Council. Date would be stored in a central location and maintained for the duration of the project. • Continuation of the current groundwater extraction licencing arrangements. • Monitoring of the quality of the water in the void, at the location of extraction for dewatering. This monitoring would be undertaken every three months until two years after the target water level is reached, and every 6 months subsequent to that. It would include the following analytes:

Issue	Mitigation and management measures
	– pH – Total Dissolved Solids – Turbidity – Dissolved Oxygen – Total Suspended Solids – Ammonia – Oxidised Nitrogen – Total Nitrogen – Total Phosphorus – Faecal Coliforms – Enterococci • Continuation of all other requirements of the groundwater licence not already covered in the above items. • Procedures for the management of water quality with respect to human health and primary contact recreation have been developed, although these are considered separate to this assessment. • Should one of the below be triggered an appropriate management plan would be developed and implemented within 6 months of the second occurrence: – Annual dewatering volume exceeds the maximum predicted rate of 112 ML/year in two consecutive years. – In an annual period, the following are observed for any monitored water quality analyte: ▪ The 80th percentile monitored concentration over a two year period exceeds the REHV trigger value; and ▪ The median concentration exceeds the median concentration for monitored historical discharges before commencement of the project.
Biodiversity	• An offset package for the project would be developed in accordance with Hornsby Shire Council's Green Offsets Code and with reference to OEH's recommendations. • Collection of seeds and propagules from areas of Blue Gum High Forest would be considered prior to vegetation clearing occurring. Seeds (if collected) would be planted in Council's community nursery and any individuals grown used for on-site plantings during creation of the parkland. • All workers would be provided with an environmental induction prior to starting work in the project area. This would include information on the ecological values of the study area, protection measures to be implemented to protect biodiversity and penalties for breaches. • Prepare a flora and fauna management plan as part of the Construction Environmental Management Plan, incorporating recommendations below, and expanding where necessary. • Disturbance of vegetation would be limited to the minimum necessary to construct works. • Where the project area adjoins native vegetation, mark the limits of clearing and install temporary protective fencing around the vegetated area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. • Restrict equipment storage and stockpiling of resources to designated areas in cleared land. • Develop weed management actions to manage weeds during the construction phase of the project. This would include the management and disposal of the weeds that were recorded within the project area including the priority weeds listed in section 11.2.2 in accordance with the Biosecurity Act. • Vehicles and other equipment to be used within the impact area should be cleaned to prevent the introduction of further exotic plant species or disease.

Issue	Mitigation and management measures
	• An unexpected finds procedure would be developed for any threatened biota or habitat resources detected during pre-clearing or clearing surveys or revealed by other sources. • Protocols to prevent introduction or spread of chytrid fungus would be implemented following OEH Hygiene protocol for the control of disease in frogs (DECC, 2008b). • A trained ecologist would be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: - inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy - inspection of culverts proposed for demolition/removal for roosting microbats prior to works commencing - inspection and identification/marking of hollow-bearing trees and termite mounds - protocols for the removal of hollow-bearing trees and termite mounds must be developed prior to removal to minimise mortality or injury of native fauna - capture and relocation or captive rearing of less mobile fauna (such as nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required - salvage of habitat features such as mature tree trunks and woody debris from the project area for future use in the parkland or surrounding areas. • Clearing of mature, native trees would be minimised where possible and exclusion barriers set up to prevent indirect impacts. • Erosion and sediment control plans would be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC, 2008c). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. • All water discharge into creeks would be guided by the ANZECC Water Quality Guidelines (2000). • Temporary scour protection and energy dissipation measures should be designed to protect receiving environments from erosion. • Erosion and sediment control measures would be established prior to construction. • Erosion and sediment control measures would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. • Stabilised surfaces would be reinstated as quickly as practicable after construction. • All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway. • Water would be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). • Vehicles must follow appropriate speeds to limit dust generation.
Aboriginal heritage	An unexpected finds policy would be implemented in the event of Aboriginal archaeological deposits being identified during ground works and excavation. The unexpected finds policy would involve the following actions: • Stop work within the affected area, protect the potential archaeological find, and inform environment staff or supervisor • Contact a suitably qualified archaeologist to assess the potential archaeological find • If Aboriginal archaeological material is identified, works in the affected area would cease, and the OEH would be informed. Further archaeological mitigation may be required prior to works recommencing.

Issue	Mitigation and management measures
	• If human remains are found: - not further disturb or move these remains - immediately cease all work at the particular location - notify NSW Police - notify OEH's Environment Line on 131 555 as soon as practicable and provide available details of the remains and their location - not recommence any work at the particular location unless authorised in writing by OEH.
Non-Aboriginal heritage	• A Photographic Archival Recording (PAR) would be prepared prior to the project commencement. A copy of the PAR and the SoHI would be stored in the Hornsby Shire Council archives as a record of the site prior to the project. • An Archaeological Research Design (ARD) would be prepared for the project. The ARD will determine if the project is likely to be located in areas where there may be significant archaeological remains, and recommend whether a permit under Section 140 or an exception under Section 139 of the NSW Heritage Act 1977 will be required. The ARD would be prepared by a suitably qualified archaeologist. • Should any unexpected archaeological finds be made during the project, work would cease immediately and a suitably qualified archaeologist would be contacted to assess the finds before any works continue. • A condition report would be prepared for the SHR listed Old Man's Valley Cemetery (SHR 01764) prior to commencement of works and integrated into the Heritage Management Plan.
Traffic and transport	• A detailed Construction Traffic Management Plan would be prepared and approved by Council prior to construction commencing. The Construction Traffic Management Plan would include the following: - Traffic control measures in works areas - Restrictions on the delivery of heavy plant and materials to site during peak traffic periods - Appropriate entry/exit points for the proposed construction compound area(s) - Advising motorists of the change in traffic conditions associated with the work. • Appropriate exclusion barriers, signage and site supervision to ensure that the site is controlled and that unauthorised vehicles and pedestrians are excluded from the works area • The construction contractor would liaise with Council in relation to the location of proposed construction compound areas and any other requirements. If alternate construction compound locations are identified, approval would be obtained from Council and further assessment carried out • Only existing roads and access roads would be utilised • The community would be kept informed about the project through advertisements in the local media, notices and/or signs, Council's website and Council's 40,000+ email list. • All traffic control devices would be in accordance with AS 1742.3-2009 – Manual of uniform traffic control devices: traffic control for works on roads and Roads and Maritime Traffic control at worksites manual.
Land resources	• The Construction Environmental Management Plan prepared for the project would include: - procedures to manage potential contaminants and or hazardous materials identified during the works - procedures for refuelling - procedures to address spills and leaks • If acid sulfate soils are encountered, they would be managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998) • Potentially contaminated areas directly affected by the project would be managed in accordance with the requirements of the CLM Act and

Issue	Mitigation and management measures
	Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011) • Further geotechnical assessment would be undertaken as part of detailed design and construction planning. This may include: - Southern Access Track (raked mini-piles and capping beam solution proposed) - a geophysical survey to estimate bedrock levels followed by a series of short boreholes to confirm the rock profile and provide soil engineering properties to inform detailed design. - Northern Spoil Mound - a geophysical survey to assess the underlying fill and bed-rock profile (useful in determining stability for construction and in the permanent condition). - Rock-fall trials to refine the rock-fall predictive models and identify the location of protective measures such as ditches or bunds. - Investigation and testing of the NorthConnex fill to determine compaction, permeability properties and densification with depth.
Waste	• A waste management sub-plan would be prepared as part of the Construction Environmental Management Plan for the project. The plan would include procedures for the management of wastes in accordance with relevant NSW legislation and the principles of the waste management hierarchy set out in the NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (EPA 2014a). • Cleared vegetation would be shredded and mulched/composted and used for soil manufacture or reused on site where practicable. Care would be taken to ensure any onsite reuse would not spread weeds. • General waste from site personnel would be temporarily stored in mobile skip bins or wheelie bins on the site before being collected for recycling or disposal. Recyclable waste such as containers, paper and cardboard etc would be collected separately to facilitate offsite recycling. • Wastewater and sewage from site offices/amenities would be appropriately stored and regularly transported off site for disposal at a licensed facility.
Visual	• Earthworks activities would be limited to standard construction hours • Screening vegetation would be maintained where practicable • Community updates and newsletters would be provided to nearby properties
Socio-economic	• The community would be kept informed about the project through advertisements in the local media, notices and/or signs

22. Justification & conclusions

22.1 Justification for undertaking the project

The project is considered justified because:

- It is consistent with strategic land use planning for the site
- It provides a number of benefits
- It would not have any significant long term negative environmental or social impacts
- It is in the public interest and the site is suitable for the project
- It is consistent with the objects of the EP&A Act
- It is consistent with the principles of ecologically sustainable development
- The consequences of not proceeding with the project are not considered to be acceptable.

22.1.1 Consistency with strategic land use planning for the site

The site has been subject to extensive investigations and studies since Council acquired the site in 2002. These studies are discussed in Section 5.1.1. Through these studies, Council identified that the site requires rehabilitation by partial filling and stabilisation of specific areas to make the site safe to open to the public and development into a community parkland.

The adopted Plan of Management (Hornsby Shire Council, 2015) for Hornsby Park defines development allowed in Hornsby Park including asset maintenance, landscaping, provision of community facilities, parking, access roads and buildings, provision of ancillary facilities and deposition of NorthConnex spoil in the quarry void.

Consistent with the Plan of Management (Hornsby Shire Council, 2015), the project would facilitate rehabilitation and preparation of the site for future public recreation purposes as a parkland.

The project is also consistent with Goal 27 of NSW 2021, which aims to recognise the need to enhance the cultural, creative, sporting and recreation opportunities to strengthen communities and support healthy lifestyles.

The project would also be an important contributor to delivering the vision and meeting the aims of the NSW Government's (2014) 'A Plan for Growing Sydney'.

22.1.2 Summary of project benefits

Overall the project would:

- Rehabilitate and stabilise the site to make it safe to open to the public in the future
- Create a landform that is flexible and suitable for future development of a unique parkland and a range of recreational activities
- Enhance the biodiversity values of the site in the long term through extensive bush regeneration works
- Provide employment for approximately 30 full time equivalent staff for the duration of the project
- Provide capital investment of $28 million dollars which would be spent in the local Hornsby and wider Sydney region – leading to direct and flow on economic benefits

- Ultimately allow for enhanced community visitation and engagement with the biodiversity and heritage features of the site

22.1.3 Environmental considerations

Environmental investigations were undertaken during preparation of the EIS to assess the potential impacts. These included assessments of:

- noise and vibration
- air quality
- soils and water
- biodiversity
- heritage
- traffic and transport
- land resource
- waste management
- visual amenity
- socio-economics
- other issues including human health and hazards and risk

The EIS has documented the potential impacts of the proposal, considering both potential positive and negative impacts, and identifies mitigation and management measures to protect the environment where required.

As described in Chapter 20, the project would incorporate management measures and design features to ensure that potential impacts are managed and mitigated as far as practicable.

The project also has a number of environmental benefits. The project includes extensive rehabilitation works including bush regeneration – soil transplant, soil manufacture and planting of Blue Gum High Forest.

22.1.4 Social and economic considerations

Some social and economic considerations are discussed in Chapter 17. The main socio-economic consequences of the project are:

- An estimate capital investment of $28 million dollars which would be spent in the local Hornsby and wider Sydney region through the proposed construction activities
- Direct employment of approximately 30 full time equivalent staff on site during construction plus indirect employment related to detailed design, additional investigations, procurement and tendering
- Flow on economic benefits of the capital investment spend:
  - Industrial effects: local purchases of goods and services
  - Flow on consumption effects
- Improvements to safety and accessibility of the site

While this project does not include the parkland development, it is a critical step in the process of opening the site up to the public for recreational use in the future. Potential future benefits of the change in land use from quarry to community park (which would be facilitated by the project) include:

- House prices – urban parks are a valuable part of the living environment and are typically reflected in higher real estate prices (for both houses and apartments).
- Human health and wellbeing – parks and park use can have a positive impact on both mental and physical wellbeing, either through direct or indirect effects such as recreation and leisure activities.
- Tourism – leisure visits outside of the own living or working environment can promote the health and wellbeing of visitors and also contribute to the local economy
- Social cohesion/identity – urban parks can help strengthen social ties, relations and cohesion
- Biodiversity – biodiversity has a direct link to human wellbeing (e.g. through nature experience)

The project would also ultimately allow for enhanced community visitation and engagement with the heritage items located within the site, and provide opportunities for greater understanding of their significant values and associations.

In relation to amenity, the project has potential to result in amenity impacts to residents and businesses located in close proximity to the site. The potential negative impacts during construction would be temporary and would be significantly reduced by the implementation of appropriate design features and stringent environmental management controls guided by the Construction Environmental Management Plan.

As described above, these short term impacts need to be considered against the positive long-term benefits of developing the site into a parkland in the future.

22.1.5 Suitability of the site

The site is considered suitable for the project for the following reasons:

- The project is consistent with strategic land use plans adopted by Council for the site
- The site is zoned RE1 Public Recreation and the project is considered to meet the objectives of the zone
- It is located close to major transport routes
- Council, as land owner endorses the project at the site.

22.1.6 The public interest

The proposed rehabilitation, stabilisation and geotechnical safety management works and landform reshaping would enable the future development of an extensive area of parkland for future public recreational use. The project design has been developed carefully to reduce potential impacts on the community and the environment. The project also includes a number of environmental safeguards to mitigate potential amenity impacts. The project would create increased employment opportunities for local and other people. Therefore the project is considered to be in the public and community's interest.

22.1.7 Consequences of not proceeding

Should the project not proceed, geotechnical safety management works and reshaping of the site would not be able to be undertaken. This would leave the site unsuitable for development into a parkland for community use. The site would need to remain closed to the public indefinitely due to safety reasons and Council would have to forgo the development of an important community facility and continue indefinitely to implement and maintain safety procedures.

In this case, the community would not be able to benefit from the future parkland, which is envisaged to be a unique community space. In addition, the historic values of the site including for example the diatreme, Old Mans Valley Cemetery etc would remain inaccessible to the community.

The social benefits associated with creation of a community parkland would also not be realised.

22.2 Consistency with the objects of the EP&A Act

Table 22.1 identifies the objects of the EP&A Act and their relevance to the project.

Table 22.1 Consistency with the objects of the EP&A Act

Object	Comment
(a)(i) to encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment	The project incorporates stabilisation and geotechnical safety management works that would make the site safe for community access in the future. It would create a landform suitable for future development as a parkland for community use. The project also incorporates rehabilitation measures including extensive bush regeneration across various parts of the site. The project design and mitigation measures have been based on consideration of the natural and artificial resources of the study area.
(a)(ii) to encourage the promotion and co-ordination of the orderly and economic use and development of land	The project would allow the future development of land as a community parkland. The site would otherwise remain closed to the public and unable to be developed and used beneficially.
(a)(iii) to encourage the protection, provision and co-ordination of communication and utility services	The project would not impact on communication or utility services.
(a)(iv) to encourage the provision of land for public purposes	The project would enable the development of an extensive area of parkland for future public recreational use in the future.
(a)(v) to encourage the provision and co-ordination of community services and facilities	The project would assist in meeting the need for future community public recreational space.
(a)(vi) to encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats	The project has included extensive design refinements to reduce potential impacts to the environment, and in particular the CEEC. Potential impacts have been identified within the EIS and mitigation and management measures have been proposed to encourage the protection of the environment.
(vii) to encourage ecologically sustainable development	Considered in Section 22.2.1
(viii) to encourage the provision and maintenance of affordable housing	Not relevant to the project
(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State	Not relevant to the project
(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment	The project has involved public consultation during preparation of the EIS.

22.2.1 Consideration of ecologically sustainable development

Clause 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* lists the principles of ecologically sustainable development as:

a) ***The precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

   (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

   (ii) an assessment of the risk-weighted consequences of various options.

*(b) **inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;*

*(c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration; and*

*(d) **improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services.*

An assessment of the project against these principles is provided below.

Precautionary principle

A range of environmental studies have been undertaken as part of development of the project and the environmental assessment process, to ensure that the potential impacts are understood. The assessment of the potential impacts of the project is considered to be consistent with the precautionary principle. The assessments that have been undertaken are consistent with accepted scientific and assessment methodologies, and have taken into account relevant statutory and agency requirements.

The project has evolved throughout the preparation of the EIS. Modifications have been made to the earthworks design to minimise and avoid impacts wherever they have been identified by the studies undertaken. In particular, extensive work has been undertaken through a series of design iterations and investigations to reduce potential impacts on the CEEC. This is discussed in Section 11.4.1. Constructability and design reviews also resulted in revisions to the design to minise impact on CEEC.

A number of safeguards have also been proposed to minimise potential impacts during construction activities. The selected construction contractor(s) would be required to prepare a Construction Environment Management Plan prior to commencing construction. This would ensure that the project achieves a high-level of environmental performance and is operated in accordance with best practice principles.

Inter-generational equity

It is recognised that the nature of the project has potential to result in some temporary environmental impacts such as noise, air quality, increased traffic and visual impacts. The EIS has assessed these and other impacts and proposed mitigation and management measures to minimise adverse affects on amenity and the quality of the surrounding environment. The potential for environmental impacts of the project has to be balanced against the long-term benefits of preparing the site for future development into a community parkland. The future parkland would be a direct benefit to future generations.

In addition, proposed rehabilitation measures (including SEPP 55 works) would enhance the biodiversity of the site in the long term as planted trees grow. This is considered to also be a direct benefit to future generations.

Conservation of biological diversity and ecological integrity

As discussed in Chapter 11, while the project would result in the clearing of 2.5 ha of native vegetation, a substantial revegetation program is proposed following completion of the reprofiling activities. The planting program would target canopy, shrub and groundcover species. Species selected would be representative of Blue Gum High Forest.

A suitable planting medium, including top soil profile, would be installed in areas proposed for revegetation.

Revegetation would include areas of replantings containing canopy, shrub and groundcover species. The reuse of salvaged hollows and logs in the parkland would further improve fauna habitat values. Based on these points, the future rehabilitation of the impact area would improve biodiversity values at the site in the long-term.

Improved valuation, pricing, and incentive mechanisms

The assessment has identified the environmental and other consequences of the project and has identified mitigation measures where appropriate to manage any adverse impacts. The construction works would be in accordance with relevant legislation and the Construction Environmental Management Plan.

Requirements imposed in terms of implementation of these measures would result in an economic cost to the proponent. Implementation of mitigation measures increases both the capital and ongoing costs of the project, signifying that environmental resources have been given appropriate valuation.

The design of the project has been developed with an objective of minimising potential impacts on the surrounding environment, reducing the need for mitigation measures. This is in accordance with sustainability principles.

The economic costs of environmental works and management would be incorporated into the construction contract(s) for the works.

22.3 Conclusion

The project involves:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform as described in Section 6.2 and shown on Figure 6.2.

This EIS has been prepared in accordance with the provisions of the EP&A Act. It addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the SEARs).

As summarised in Section 22.1, the project justification is robust and the project responds to a recognised need and provides a number of benefits, including addressing existing issues associated with the site. The EIS has demonstrated that the site is suitable for the proposed use, the project is in the public interest and that it is consistent with the objectives of the EP&A Act and the principles of ecologically sustainable development.

Detailed environmental investigations have been undertaken to assess the potential environmental impacts of the project. These included specialist assessments of noise and

vibration, air quality, soils and water, biodiversity, heritage, traffic and transport, land resource, waste management, visual amenity and socio-economics. The EIS has documented the potential environmental impacts, considering both negative and positive impacts (and benefits).

Many of the potential issues identified in the initial risk assessment of the project would be effectively managed/eliminated through careful design features. To manage other issues, and in some cases eliminate them completely, the EIS chapters outline a range of mitigation measures that would be implemented during the project construction. The EIS has demonstrated that the project would not have a significant impact on the community or environment, with implementation of the proposed mitigation measures.

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