Hornsby Shire Council
Hornsby Quarry Rehabilitation
Preliminary Vegetation Management Plan

Report prepared by Hornsby Shire Council

2019

Executive Summary

This Preliminary Vegetation Management Plan (VMP) has been prepared for the Hornsby Quarry rehabilitation and proposed parkland development (DA/101/2019). The purpose of this Preliminary VMP is to describe vegetation management actions within the extent of works and the surrounding area (hereafter 'the Impact Area' and 'the Site' respectively) to support the conservation of biodiversity values in accordance with conditions of approval. The detail within this Preliminary VMP will provide guidance on the development of a more detailed VMP, which will form part of a holistic Offsets Package for the development.

The Hornsby diatreme in Old Mans Valley was quarried throughout the 1900s, this Site is now known as the Hornsby Quarry. The decommissioned Hornsby Quarry was acquired by Hornsby Shire Council in 2002 (Council). Since then, it has remained closed to the public for safety reasons. Council has undertaken research and planning to rehabilitate the Site as a recreational area within the unique natural environment for use by the community.

Rehabilitation earthworks are required to stabilise the Quarry and to provide for safe access. The critical area requiring stabilisation is on the northern spoil mound. The material extracted from stabilising the mound will be used to provide additional fill for the void to be shaped into a suitable landform. Any further material required to provide fill may be sourced from the south west mound. Both mounds are modified areas currently vegetated with a mixture of canopy and weed species. In addition, the presence of critically endangered Blue Gum High Diatreme Forest has been identified.

The proposed rehabilitation earthworks require 0.74 ha of highly modified Blue Gum High Diatreme Forest, 1.76 ha of Blackbutt Gully Forest and 3.39 ha of exotic grassland to be removed from the northern spoil mound and the south western mound. In accordance with 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 and Council's Offset Policy, Council commissioned GHD Pty Ltd (GHD) to undertake an Environmental Impact Statement (EIS) to assess potential impacts on biodiversity. The EIS has undertaken vegetation mapping and condition assessment.

The aim of this Preliminary VMP is to identify how the Site's biodiversity will be protected, enhanced and restored in-perpetuity as part of the Site rehabilitation. Recommendations derive from best practice site rehabilitation, habitat protection and ecosystem enhancement. They are based on the mapped vegetation condition, previous and proposed levels of disturbance and the resilience of the vegetation to recover from that disturbance. Where soils have been heavily disturbed through modification, resilience is intrinsically low, and revegetation is the best option. There are three locations within the Impact Area where extensive soil modification has occurred and where revegetation is recommended: the eastern fill area, the northern spoil mound and the south western mound. Any revegetation is to include a representation of the floristic properties from the existing plant communities using locally sourced plant material. These works are proposed to improve the condition of the existing plant community types and increase the area of native vegetation present.

Vegetation management has been categorised into five (5) Management Zones based upon the position in the landscape and management actions required:

The Impact Area

- MZ1 North Sound Mound
- MZ2 South West Mound
- MZ3 Landscape Zone – including the eastern fill and crusher plant areas

The Site

- MZ4 Blackbutt Gully Forest
  MZ5 Blue Gum Diatreme Forest

The directives of this Preliminary VMP to achieve the aim include the following:

- Weed treatment
- Bush regeneration and revegetation
- Earthworks and soil preparation
- Retention, enhancement and restoration of habitat
- Management of edges, interface zones and buffers to maintain high levels of habitat connectivity in the region.

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Abbreviations

Abbreviation	Description
AS	Australian Standard
BBAM	BioBanking Assessment Methodology
BBGF	Blackbutt Gully Forest
BC Act	*Biodiversity Conservation Act* 2016
BGDF	Blue Gum Diatreme Forest
BVNP	Berowra Valley National Park
CBD	Central Business District
CEEC	Critically Endangered Ecological Community
DA	Development Application
EAR	Environmental Assessment Requirements
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
GBD	General Biosecurity Duty
MZ	Management Zone
PPE	Personal Protective Equipment
PCT	Plant Community Type
SEAR	Secretary's Environmental Assessment Requirements
VMP	Vegetation Management Plan

1 Introduction

1.1 Purpose

The rehabilitation and development of the former Hornsby Quarry as a new recreational parkland, Hornsby Park, has been proposed under DA/101/2019. The Secretary's Environmental Assessment Requirements (EAR No 1167) dated 6 September 2017 notes that the EIS, in determining an offsets package, should *identify the conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites.*

The purpose of this Preliminary Vegetation Management Plan (VMP) is to provide a general description of the ongoing conservation vegetation management actions for the offset site in accordance with the EAR's and any conditions of approval. This Preliminary VMP has been prepared under the assumption that offset works will be required in the Impact Area and surrounding area, the Site (Figure 2, Table 1). At this stage the final land use for the different areas within Hornsby Park has not been determined and as such this VMP should be viewed as a Preliminary document with the works described within providing guidance in the development of the final VMP.

1.2 Background

The northern portion of the Hornsby Diatreme has historically been mined for blue metal aggregate since the early 1900's. It was decommissioned and then acquired by Hornsby Council in 2002. Since that time, it has been closed to the public for safety reasons. Council has undergone extensive investigations to rehabilitate the Quarry. Plans are being prepared to stabilise the area and transform it into a place of ecological integrity to be enjoyed as a public recreational parkland. To do so, the void requires some further filling and shaping, and the north mound requires stabilising.

The initial works to stabilise the quarry by filling the void have been undertaken. Roads and Maritime Services were given approval to partially fill the void with material extracted from the NorthConnex tunnel works. This stage of the rehabilitation project pertaining to the development application proposes to undertake works on the north and southwest mounds by reshaping them into stable and functional landforms with managed water movement through the site. The material extracted will be used to further fill and shape the void. Vegetation will need to be removed from both the north and southwest mounds in the process. The project design and a tree audit has minimised the area of vegetation to be removed with the aim of minimising the impacts on native vegetation and fauna. Final landscape landform proposals for these two areas are revegetation, provision of an access track to a lookout on the north mound and an accessible natural area in the southwest.

This Preliminary VMP is to support the Environmental Impact Statement (EIS) prepared by GHD Pty Ltd (GHD) to address the requirements of the Secretary of the NSW Department of Planning and Environment (SEAR No 1167) dated 6 September 2017 as part of development proposal documentation required under DA/101/2019 submitted by Hornsby Council. It will address vegetation management both within the Impact Area as part of the DA and the Site.

The vegetation management of the Impact Area is currently complex, expensive and physically difficult to manage because of unsafe access and the high amount of established weed plumes on disturbed soils in a high-risk landform. The topography is steep and unstable, site soils are varied and disturbed. In addition, any woody weed management requires serious consideration due to the existing habitat provision and soil stabilising characteristics these weeds are providing. Any vegetation management decisions require consideration to all these factors with a long-term perspective. The proposed project will be disruptive in the short term but with stringent and accountable processes put in place, it will enable a much better long-term outcome for the plant communities, the connectivity to adjacent natural areas and as an education platform for the broader community. Confidence should be gained from the Sites' exhibited native vegetation resilience following historic disturbances by the area of regrowth present.

Table 1. 1: The Site Definition

Land Title	Lot A, B, C, D and E in 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
Location	Old Mans Valley and Hornsby Park, HORNSBY
Grid Reference	151.090704 E, -33.69740 S
Ownership	Hornsby Shire Council, Crown
Zoning	RE1 Public Recreation
Current Land Use	Decommissioned Quarry, Mountain Bike Track, Walking Tracks, Native Bushland

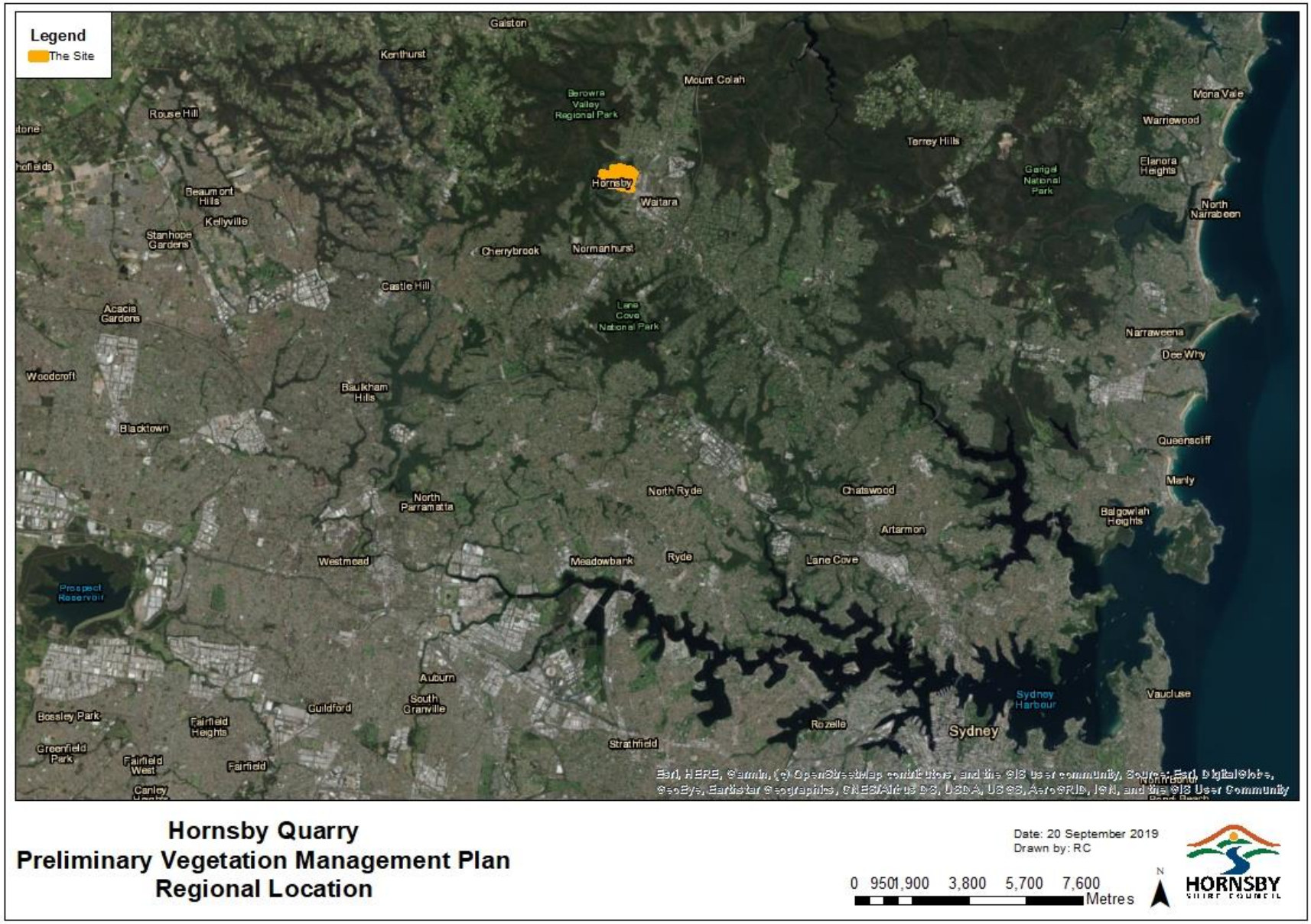

Figure 1. 1: The Site Regional Location

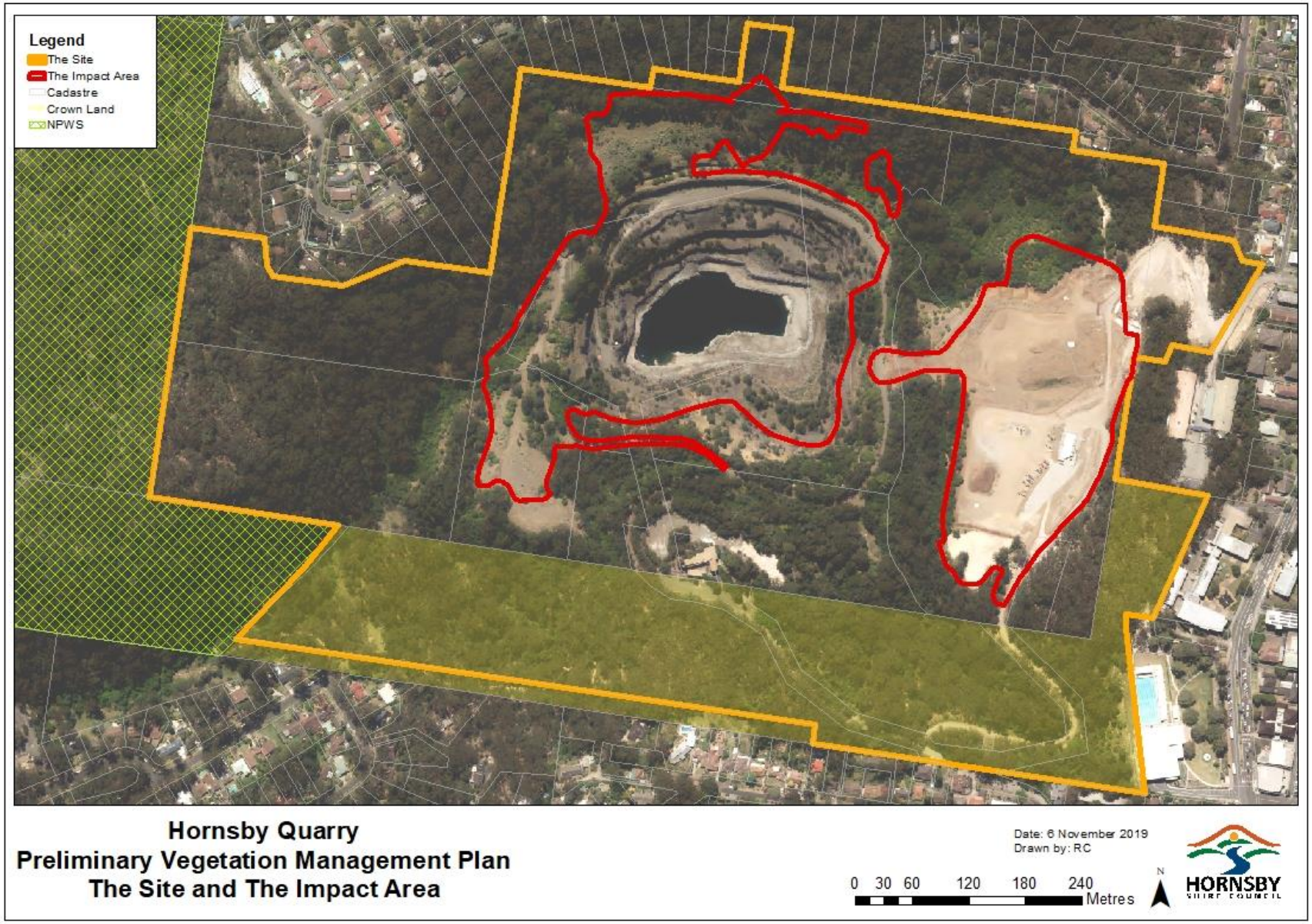

Figure 1. 2: The Site and The Impact Area

1.3 Aims and Objectives

This Preliminary VMP refers to areas of vegetation within the Impact Area of the Development Application and the vegetation of the surrounding bushland, defined as 'the Site' (Figure 1.2). The aim is to establish adaptive management actions to protect, enhance and conserve the Site's high level of ecological functions. The objectives to achieve the aim are to:

- Protect the Blue Gum High Diatreme Forest and surrounding vegetation
- Restore and conserve connectivity of native vegetation and habitat corridors in-perpetuity
- Sustainably re-establish native vegetation and associated ecological functions to a condition representative of the surrounding Plant Community Types (PCTs) in areas of major disturbance including areas requiring stabilisation works.

1.4 Scope of Works

The following scope of works was undertaken to prepare this Preliminary VMP:

- Review of previous reports: Soils - SESL (2018), Tree Survey - Arterra (2019), EIS - GHD (2019), Vegetation Survey and Mapping - Kleinfelder (2017), EcoLogical (2015), Dragonfly MBT REF (2011), Land Management Activity Reports), Preliminary Construction Environmental Management Plan – GHD (2019)
- On-ground field investigations
- Discussions with relevant stakeholders
- Consideration to the final earthwork requirements for stabilisation, vegetation condition and future surrounding landuse design

1.5 Plan Tenure

The Preliminary VMP is primarily to cover a period of five (5) years and then in-perpetuity under the guise of adaptive management. Levels and types of input and resources required to ensure natural processes ensure will need to be reviewed annually to assess if any alterations to ecological functionality are apparent due to disturbance: unforeseen, naturally occurring or through deviations from the original plan by others.

1.6 Legislation and planning controls

Table 1. 2: Relevant Legislation

Government Level	Relevant Policy/Legislation	Relevance to the Site
Local	• Hornsby Local Environmental Plan 2013	• RE1 Public Recreation (public open space or recreation; protect and enhance the natural environment for recreation; protect and maintain areas of bushland with ecological value) Note: A small section of R2 Low Density Residential Land is also incorporated into the Site.
State	• *Biodiversity Conservation Act 2016* • *NSW Biosecurity Act 2015*	• CEEC present. • Secretary's Environment Assessment Requirements (SEARs) published 28.08.17 (assess significance of impact including residual impacts to determine if Offsets are required.
Commonwealth	• *Environment Protection and Biodiversity Conservation Act 1999*	• CEEC present.

2 Existing Environment

2.1 Location

Hornsby is a suburb of Sydney located approximately 21 kilometres north west from the CBD. The Hornsby Quarry is located within the Old Mans Valley precinct and adjacent to Hornsby Park on the west side of the Hornsby CBD (Figure 1.1). Areas of native vegetation buffer the quarry from the built environment on the north, south and eastern boundaries. The native vegetation on the western boundary borders the Berowra Valley National Park. The Site has linkages to Dog Pound Creek, an extension of the diatreme supporting a Blue Gum Diatreme Forest protected in-perpetuity under the State's BioBanking Agreement Number 142 (Figures 1.2 and 2.1).

2.2 Topography

The original topography was that of gently undulating to low steep hills. Mining activities have highly modified the Site topography. The Site now forms an amphitheatre sloping away from the higher slopes of the built environment of Quarry, Old Peats Ferry, Manor and Summers Roads to the south, east and north respectively. Joe's Mountain within the Berowra Valley National Park is to the west (Figure 2.1).

The Quarry is surrounded by exposed rock cliffs including a representation of the diatreme formation on the eastern rock face. Steep exposed slopes extend from the northern and southern sides of the Quarry rim. A steep rise of natural forest vegetation extends from the western side.

2.3 Soil and Geology

The Quarry is at the northern end of the Hornsby diatreme, a rare volcanic structure formed within the joint system and horizontal layers of sedimentary rocks. Formed millions of years ago, the soil was a mixture of basaltic breccia, sedimentary breccia and metamorphosed Hawkesbury sandstone. The surrounding areas are Hawkesbury Sandstone (PSM 2006). The intrinsic qualities of Hornsby Diatreme's soil have resulted in its value to development and the mining of its properties. Based on Chapman and Murphy (1989) soil type descriptions, Hornsby (ho), Hawkesbury (ha) and Lucas Heights (lh) soils have been mapped on site in the *Soil Landscapes of the Sydney 1:100,00 Sheet.*

Previous studies of the Site soils have been undertaken by Coffeys and Partners Investigations (1990), Parsons Brickenhoff Investigations (2004), PSM Investigations (2006) and SESL (2019). These studies have identified the characteristics of the fill and will be discussed further in relation to suitability for supporting native vegetation in 2.8 Bushland Condition. The previous studies indicate that little, if any, of the remaining soil profiles exist in the Impact Area apart from the area north of the north wall. The Impact Area is now a mixture of varying development stages of breccia and sandstone overburden. Fill material associated with mining activities is located around the quarry and within the Impact Area.

The objective of the soil assessment report by SESL (2019) was with respect to the feasibility of, and directions to, engineering the site soils for re-establishing and supporting both Blue Gum Diatreme and Blackbutt Gully Forest vegetation. Two Bore Hole samples (BH1 and BH 4) were examined from amongst relatively intact native vegetation within a sandstone landscape and will be used as benchmark data for creating sandstone soil profiles. An additional two Bore Holes (BH14 and BH16) provided a good example of a young breccia profile. Replicating Bore Holes samples 14 and 16 as a representation of topsoil and subsoil horizons of a desirable soil profile will be the aim for Blue Gum Diatrame revegetation processes (SESL 2019).

2.4 Hydrology

Old Mans Valley is within the Hawkesbury Nepean River Catchment, the largest river/estuary system in the Sydney Region and one of the most important river systems in NSW. The land use of Old Mans Valley has changed overtime, and as such, so has the integrity of the natural water flows. Following thousands of years of Aboriginal occupation and use, the natural landforms were subjected to land clearing, then orcharding and finally mining activities. Water now flows into the valley from neighbouring urban and natural areas via ephemeral drainage lines. All surface water flows have been diverted around the quarry via a series of constructed channels and culverts to Old Mans Creek to the north west of the quarry, a tributary of Berowra Creek within the Hawkesbury River Catchment. Groundwater inflow has historically filled the base of the void with water requiring pumping out by Council under a *Water Management Act 2000,* dewatering licence with an allocation of 370 ML/year (Figure 2.1).

Figure 2. 1: Location, Topography, Hydrology

2.5 Vegetation Communities

Both Kleinfelder (2017) and GHD (2019) identified two vegetation communities present within the Site and the Impact Area using Biobanking Assessment Methodology, 2014. For the purposes of this Preliminary VMP, the Smith & Smith naming classification will be used to describe both plant communities Blue Gum Diatreme Forest (BGDF) and Blackbutt Gully Forest (BBGF). (Table 2.1, Figure 2.2, Appendix 1).

Table 2. 1: Hornsby Shire Vegetation communities and other vegetation classifications

Hornsby vegetation community (Smith & Smith 2008)	Australian endangered ecological community (EPBC Act)	NSW endangered ecological community (BCT Act)	BioMetric Vegetation Type (NSW BioBanking Scheme)	NSW Plant community Type (VIS Classification 2.1) PCTID
Blue Gum Diatreme Forest BGDF)	Blue Gum High Forest in the Sydney Basin Bioregion (CE)	Blue Gum High Forest in the Sydney Basin Bioregion (CE)	HN596/ME001. Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin	1237. Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
Blackbutt Gully Forest (BBGF)	Not Listed	Not Listed	HN648 Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region.	1841. Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enrichhed sandstone slopes and gullies of Sydney region.

The Blue Gum Diatreme Forest is listed as a critically endangered ecological community (CEEC) under the *NSW Biodiversity Conservation Act 2016* and critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Blue Gum Shale Forest. The community is very restricted and may now be confined to the Hornsby Local Government Area (Smith & Smith 2008).

The area of each plant community within the project boundary is as follows:

Table 2. 2: Plant Community Areas

Plant Community Type	Total Area within the Site (Ha)	Area within the Impact Area (Ha)
Blue Gum High Diatreme Forest	15.75	0.74
Blackbutt Gully Forest	20.46	1.76
Blackbutt Gully Forest Regrowth	6.95	3.39
Total	**43.16**	**5.89**

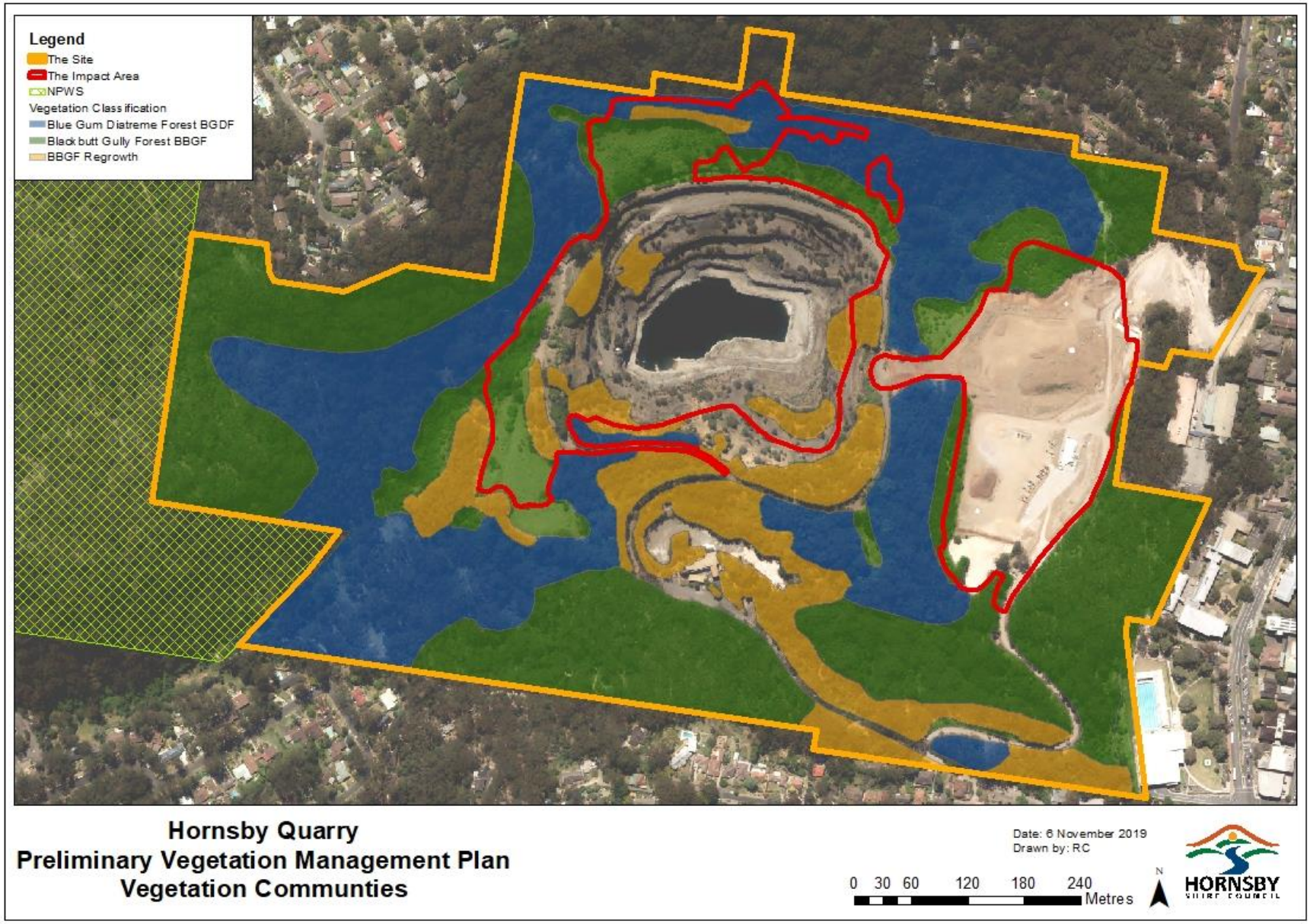

Figure 2. 2: Vegetation Communities

2.6 Conservation Significance

The Blue Gum Diatreme Forest is listed as critically endangered under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Biodiversity Conservation Act 2016.* The existing condition of the forest is variable and is highly modified within the Impact Area due to past mining activities.

Two threatened plant species have been recorded near the Site boundary but not within the Impact Area, *Galium australe* Tangled Bedstraw and *Darwinia peduncularis.*

Four threatened fauna species have been positively recorded within the Site boundary:

- Eastern Bentwing Bat *Miniopterus schreibersii oceanensis,* listed as vulnerable under the BC Act
- Grey-headed Flying-Fox *Pteropus poliocephalus,* listed as vulnerable under the BC Act and the EPBC Act
- Powerful Owl *Ninox strenua,* listed as vulnerable under the BC Act
- Varied Sittela *Daphoenositta chrysoptera,* listed as vulnerable under the BC Act and the EPBC Act

The Site and the Impact Area provide significant roosting, nesting, sheltering and foraging sites for arboreal herpetofauna, mammals, microbats and birds who can move freely between the native vegetation within these areas and the neighbouring bushland.

2.7 Biodiversity Corridor Value, Connectivity and Edge Effects

The core area of bushland in the Site has a significant connection to largely undisturbed bushland. On the western boundary is the Berowra Valley National Park (BVNP). Connected to the BVNP are Council Bushland Reserves including the Rosemead Road Bushland as well as both the Dog Pound Creek and Galston Park BioBanking sites to the south and west respectively. To the north, Council's reserves, Turner Road Bushland, Woolwash Bay and Furber Park connects the BVNP to Muogamarra Nature Reserve and the Marramarra National Park, all on the banks of Berowra Creek flowing into the Hawkesbury River (Figure 2.3).

Vegetation within the Site is subject to edge effects resulting from fragmentation due to historic, current and surrounding land uses. Fragmentation is a threatening process to biodiversity as it changes ecological functionality. The ecological functions change in varying degrees of intensity along a gradient from the exposed edge to the forest core. GHD have noted that edge effects are known to extend up to 50 metres beyond the edge of vegetation (Figure 9). The results of edge effects include increased temperatures, wind and light and reduced humidity and shelter. This preliminary VMP aims to reduce the impact of edge effects during operations and to reduce current levels of fragmentation through increased connective corridors and condition of core bushland (refer to section 3.4.5). Strong consideration to be given to the current habitat value woody weed plumes are providing when planning strategic weed removal prior to operations and through the rehabilitation process.

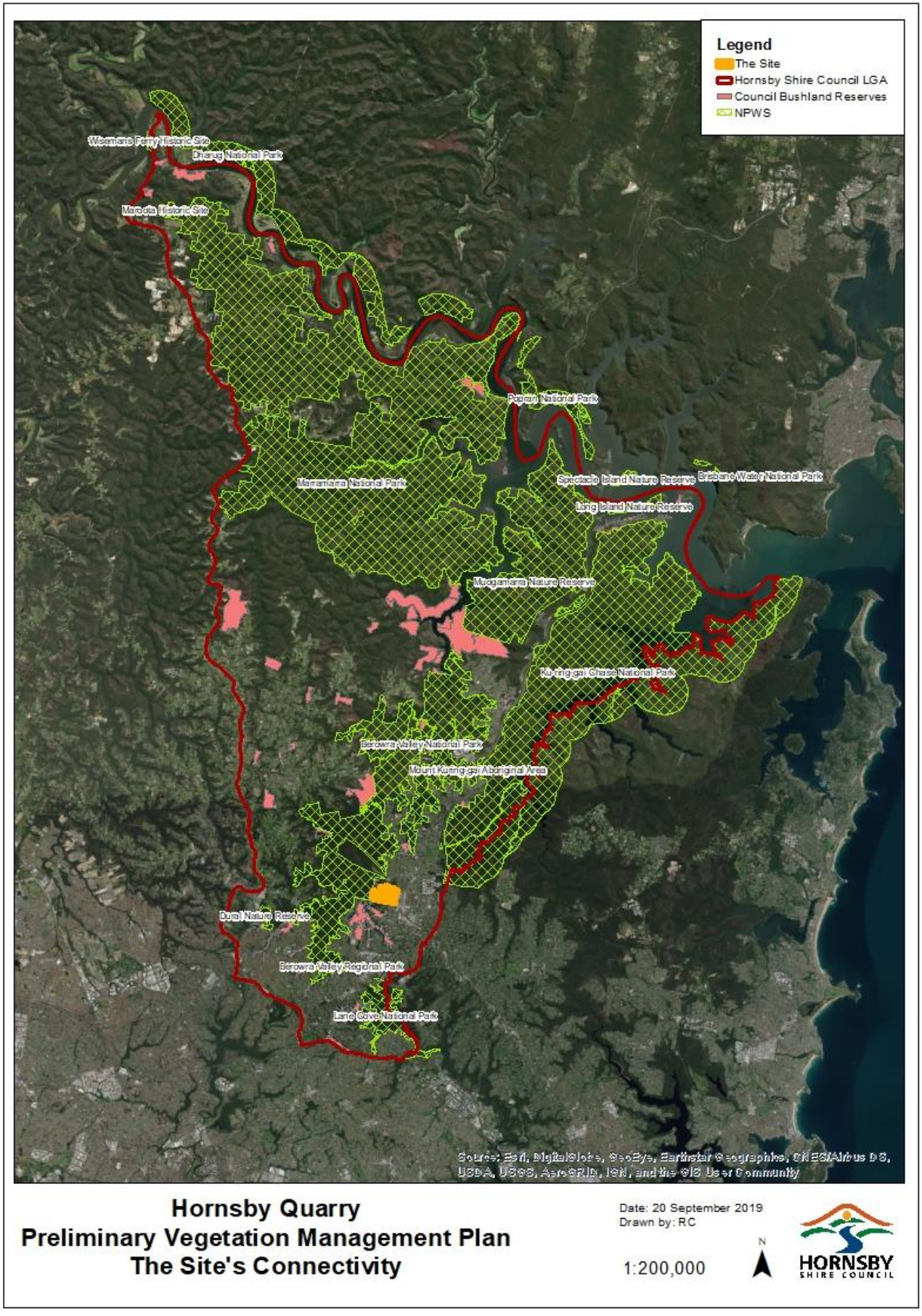

Figure 2. 3: Connectivity

2.8 Bushland Condition

The soil structure and composition within the Site and the Impact Area have been highly modified due to mining activities and as a result the native vegetation has been compromised. The current bushland condition directly reflects the amount and type of soil disturbance that has occurred. Previous studies mapped and described the Plant Community Types (PCTs) and condition with reference to the BBAM methodology.

This Preliminary VMP will use a version of bushland condition mapping adapted from The National Trust of Australia (NSW) Bush Regenerator's Handbook 3rd Edition (2010). The method describes the native vegetation condition by assessing the structure, species composition, diversity, response to disturbance (i.e. native resilience) and density of weeds present. The description then indicates the appropriate management strategies required to achieve aims and objectives of native vegetation restoration, protection and preservation (Table 2.3).

The Site has been assessed using The National Trust methodology following site inspections, previous studies review and a desktop. Once assessed, both the Impact Area and the Site have been mapped into Management Zones using the most appropriate management strategies indicated by the National Trust methodology assessment with the aim of maintaining the ecological integrity of the bushland in-perpetuity (Figure 2.4). It should be noted that the Impact Area has been mapped into Zones with consideration of the proposed works (Figure 3.1, Section 3. Site Management). A detailed and refined bushland condition and management assessment for these Zones is beyond the scope of this preliminary report and will be undertaken in the more detailed VMP as part of the development Offsets Package.

Table 2.3: Bushland condition mapping adapted from The National Trust of Australia (NSW)

Colour Code	Condition of Bushland	Weed Density	Description	Management
Green	**Good**	<5%	High level of native vegetation structure, species composition and diversity. Virtually weed/exotic plant free. Soil in-tact. High Level of resilience.	**Low (Regeneration)** Maintain connectivity to bushland of similar condition. Prevent impacts from bushland of lesser condition. Monitor for possible wind or bird dispersed weed/exotic plants.
Blue	**Fair**	6-20%	Plant community slightly compromised but native species dominate the site. Minor infestations of weed/exotic plants. Soil intact. Good level of resilience.	**Medium (Regeneration)** Assess cause of infestation and address where possible (eg neighbouring property source, overclearing, overuse). Remove weed/exotic plants with best practice bush regeneration techniques.
Orange	**Poor**	21-60%	Dominant native species highly suppressed, one or more strata layers missing. Severe infestations of weed/exotic plants. Soil integrity low. Poor level of resilence.	**High (Regeneration and Revegetation)** Assess cause of infestation and address where possible (eg modified soils, neighbouring property source, overclearing, overuse). Remove weed/exotic plants with best practice bush regeneration techniques. 'Assisted regeneration' eg revegetation, physical disturbance, fire.
Red	**Very Poor**	>61%	Only mature specimens of the dominant highest stratum of the PCT remain. Recruitment absent due to modified soils and heavy infestation of weeds/exotic plants. Bushland has been completely replaced by exotics.	**Extremely High (Revegetation)** Ability of the PCT to recover is extremely low, at times non-existent. 'Assisted regeneration' will require soil reconstruction, revegetation and ongoing weed/exotic plant treatment.

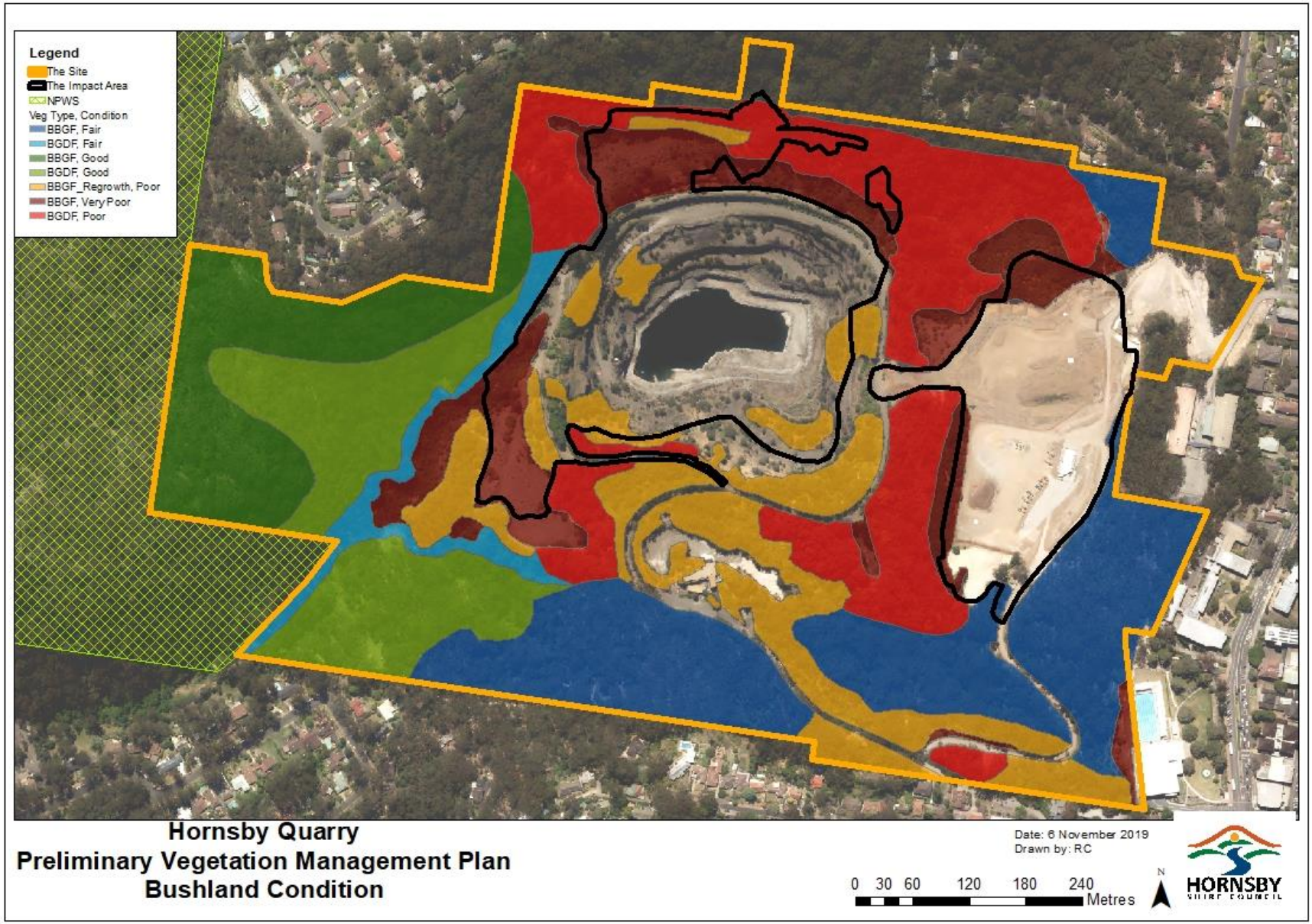

Figure 2. 4: Bushland Conditi

3 Site Management

3.1 Management Zones Overview

Vegetation management focuses on areas within the Impact Area as well as the surrounding bushland within the Site boundary. The proposal stipulates that some vegetation within the Impact Area will require clearing for Earthworks. The areas will then be revegetated with locally provenant plant species to represent the original plant communities following the completion of works. Though this Preliminary VMP, the proposal also aims to regenerate and revegetate areas of the Site and manage it in-perpetuity, with the intent of increasing the ecological integrity of the region. The strategy is to work with the staging of the Hornsby Park Project and beyond to ensure the aims and objectives of the Preliminary VMP are achieved. Strategies to achieve these are as follows:

- Prepare a buffer on the interface prior to disturbance of an area and reduce fragmentation
- Propagate plant material
- Strategically stage weed removal
- Engineer site soils to reflect benchmark data for both plant communities
- Identify future threats to the natural environment and mitigate effects

To implement these strategies the Impact area and the Site have been divided into management zones based on the position in the landscape, vegetation type and proposed earth works (Figure 3.1).

3.2 Site Management – 'The Impact Area'

3.2.1 Management Zone 1 – North Mound

The North Mound land formation is a steep wall on the northern boundary above the quarry (Figure 3.1). Historical photographs indicate its creation during the 1960's and then further excavation occurred from the eastern edge of the north mound from around 1989 resulting in a modified slope of 1:12.

Soil testing results indicate both varying soil profile types and depths. Geotechnical reports indicate localised high levels of instability. Current access for management is limited due to the steep slope. Weed density is high and consists of woody and wind dispersed weed species. The weeds present are a source of weed seed within the Impact Area, the Site and beyond to adjoining land.

The proposal is to stabilise the area with earthworks and reduce the slope to improve access for management. Some of the material from the slope will be used to partially fill the void.

The vegetation on the North Mound has been mapped as Blue Gum Diatreme Forest (BGDF), Blackbutt Gully Forest (BBGF) and Exotic (GHD EIS 2018 Figure 4.1). Where earthworks are undertaken revegetation will be carried out. The bushland of very poor condition that isn't impacted will require assisted regeneration and regeneration (refer to section 3.3). Improved site soils to support BGDF and BBHF PCTs are to be engineered and applied prior to planting. Where soil depth is limited, shallow rooted species will be chosen. Specific species selection around the lookout will also be required to maintain views into the Quarry.

3.2.2 Management Zone 2 – South West Mound

The South West Mound is located on the south west corner of the Quarry area and below the crusher plant (Figure 3.1). Historical aerial photographs show this area cleared of vegetation dating back to 1942. Modifications to the soil and shape of the area appear to have commenced in the 1960's. The South West Mound is now a terraced slope of overburden that supports a mixture of canopy species with a weedy midstorey and a plateau of exotic grasses and herbaceous weed species.

Soil testing results indicate soils are not engineered and vary in type and structure between the terraced slope and the plateau. The terraced slope has been filled with clayey gravel sands, large boulders and a variety of dumped manmade objects. In contrast, the plateau is composed of sandy gravels, cobbles and boulders.

The proposal is to partially reshape the mound to blend in with surrounding topography, re-use the material excavated to partially fill the void and introduce engineered site soils to support restoration of BGDF and BBGF PCTs.

Whilst the south west mound holds significant numbers of mature *Eucalyptus saligna* Blue Gums, the vegetation of the area has been mapped as Blackbutt Gully Forest (BBGF) and Exotic (GHD EIS 2018 Figure

4.1). The bushland condition of the South Mound Bushland is poor. Best practice bush regeneration and 'assisted regeneration' (revegetation) is required.

3.2.3 Management Zone 3 – Landscape Zone (Eastern Fill area and Quarry Void)

Management Zone 3 has two distinct areas, the eastern fill area and the Quarry void (Figure 3.1). The eastern area was previously a non-engineered fill area (PSM 2006) with a low vegetative cover of predominately weed species. NorthConnex occupied and reshaped the area for transporting and partially filling the void with material excavated from the NorthConnex tunnel. The proposal is to use this area as the main access point to the Hornsby Park area, to provide a sports field and other recreation activities. The area has been cleared of all vegetation apart from a strip of Blackbutt Gully Forest (BBGF) along the eastern escarpment and exotic vegetation on the north and western boundaries (GHD EIS 2018 Figure 4.1).

The void has been largely filled with material from the NorthConnex tunnel and re-shaped in preparation for further fill and final landscaping as a recreational area for public use. The vegetation mapping (BBAM 2014) indicates representative pockets of BBGF vegetation on the Quarry walls. It is dominated by canopy species. *Casuarina cunninghamiana* has a significant presence in this area, a species not naturally found in Hornsby.

Landscape plans for both areas will incorporate planting with both BBGF and BGDF species to increase the integrity of connectivity within the site. The strip of BBGF on the eastern escarpment will require bush regeneration maintenance. The area dominated by exotic vegetation on the north and western boundaries will require assisted regeneration.

3.3 Site Management – 'The Site'

3.3.1 Management Zone 4 – Blackbutt Gully Forest (BBGF)

Management Zone 4 is the area within the Site beyond the Impact Area mapped as BBGF (Figure 3.1). It occupies the South, Eastern and Western edges of the Site. This Zone is significant as a buffer to the core bushland beyond the Impact Area.

The crusher plant fill area is within this Zone. It has been significantly disturbed and now has a mixture of engineered and non-engineered soils. It is supporting a mixture of native canopy and woody weed species. The area has potential to be restored as a core part of Hornsby Park for use by the community.

Additional existing facilities in this zone include:

- The new access road from Bridge Street built by NorthConnex
- The mountain bike track, a 6 km network of trails on the eastern and southern boundaries.
- Fire trails
- Access to the Great North Walk
- The Hornsby Heritage Steps

The level of soil disturbance and site resilience varies through the Zone from fill soils to intact and undisturbed soils. The position in the landscape, surrounding land uses (residential properties, roads and the Hornsby Pool) as well as the type and level of activity throughout the Zone directly or indirectly put the area at risk to key threatening processes (e.g. loss of habitat, altered hydrological flows, clearing of native vegetation, bush rock removal, loss of hollow-bearing trees, removal of dead wood and dead trees, predation by feral animals, invasion of exotic plant species and infection of native plants by pathogens).

The Zone's condition varies from very poor to good. Given the varied bushland condition results, soil quality and land uses, management actions include bush regeneration, assisted revegetation and revegetation.

3.3.2 Management Zone 5 – Blue Gum Diatreme Forest (BGDF)

Management Zone 5 is the Zone within the Site beyond the Impact Area mapped as BGDF (Figure 3.1). It runs in a north-south direction through the centre of the site reflecting the original diatreme location prior to Quarrying activities. This Zone is significant as a buffer to core bushland. The soils and water movement through the Zone have been significantly disturbed throughout during and following mining activities. Current weed plumes reflect the levels and location of disturbance with dense pockets of woody weeds dominating the midstory in these locations. Structures and facilities in this Zone include:

- The Higgins Family Cemetery
- Rosemead Road Park
- Fire Trails
- Access to the Great North Walk
- The Hornsby Heritage Steps

The Zone's condition varies from very poor to good. Given the varied bushland condition results, soil quality and water movement through the site, management actions include bush regeneration, assisted revegetation and revegetation.

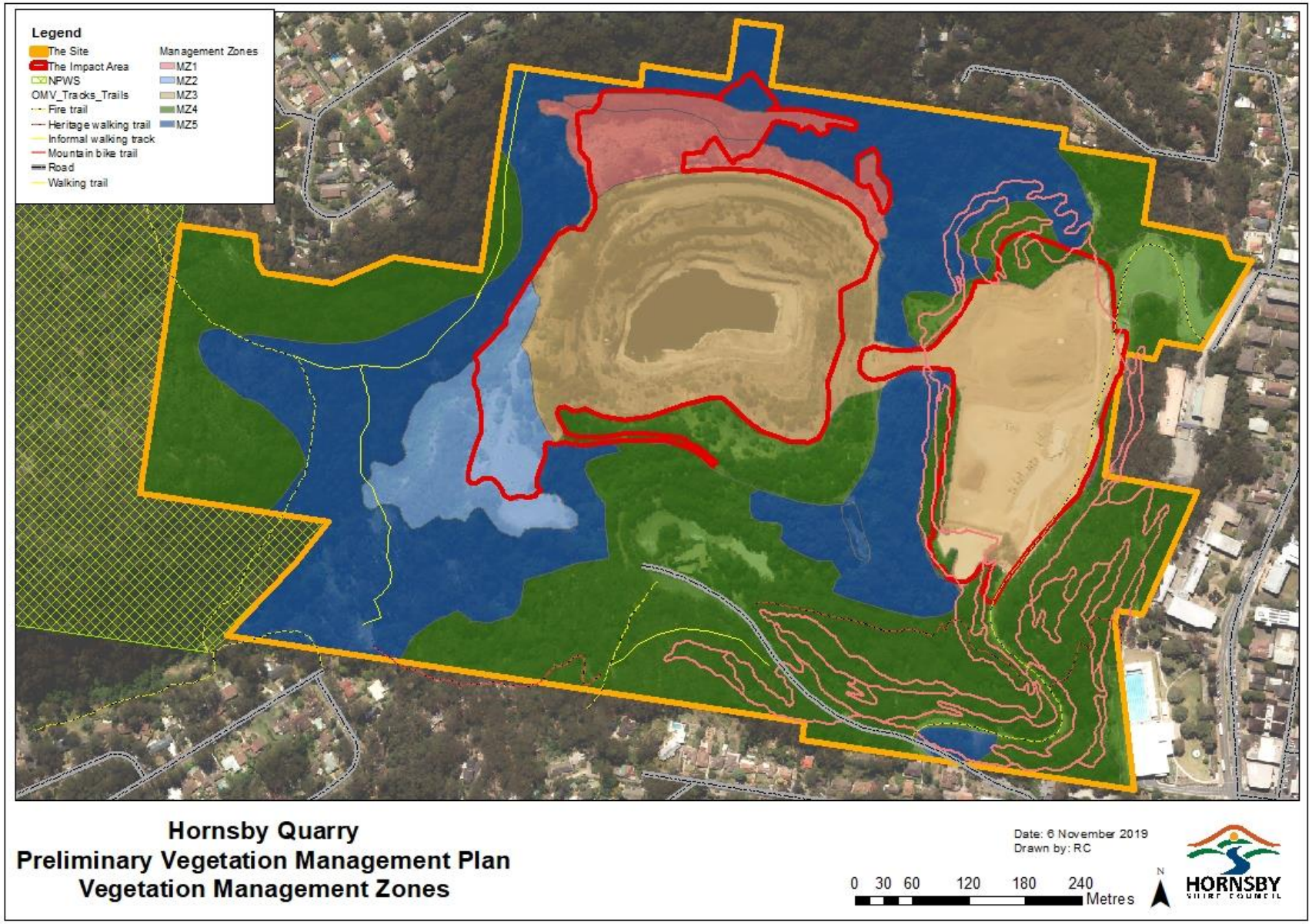

Figure 3. 1: Vegetation Management Zones

3.4 Management Zones Action Requirements

Table 3. 1: Management Actions per Zone
(Refer to Figure 3.2)

		The Impact Area			The Site		
Management Action	**Site Set-up**	**MZ1**	**MZ2**	**MZ3**	**MZ4**	**MZ5**	**On-going**
Implement hygiene protocols	✓	✓	✓	✓	✓	✓	✓
Prepare and implement habitat program	✓	✓	✓	✓			✓
Set-up interface zones and buffers to mitigate edge effects through construction	✓	✓	✓	✓	✓	✓	✓
Install fauna friendly fencing around exclusion zones – TBD							
Commence strategic weed removal – target climbers and high priority weeds	✓	✓	✓	✓	✓	✓	✓
Seed collection	✓	✓	✓		✓	✓	✓
Trial revegetation in engineered soils	✓			✓			
Apply engineered soils - reflect BGDF and BBGF PCT's for revegetation		✓	✓	✓			
Revegetation with native plant species		✓	✓	✓	✓	✓	
Bush Regeneration		✓	✓		✓	✓	✓
Assisted Bush Regeneration				✓	✓	✓	

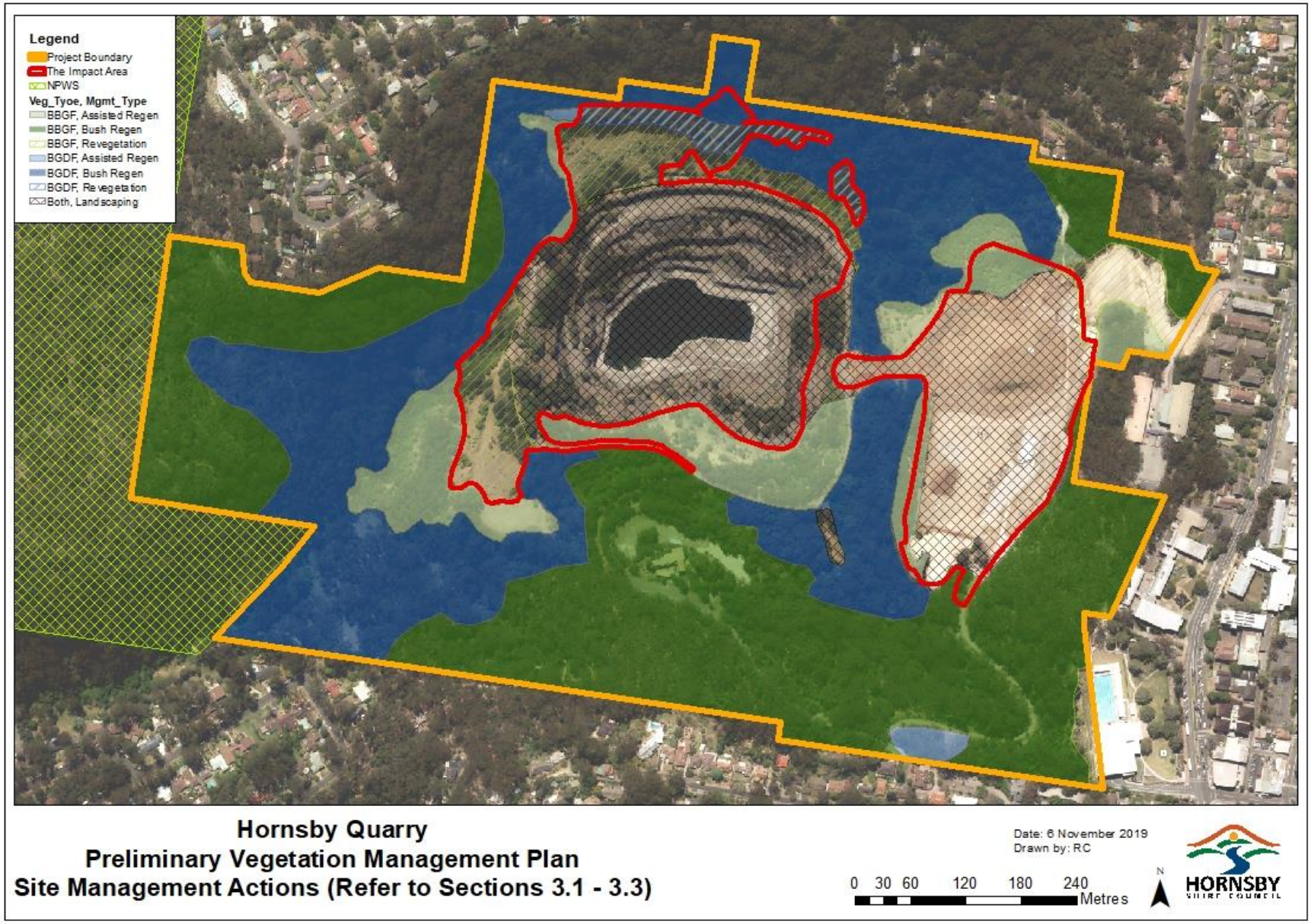

Figure 3. 2: Site Management Actions (Refer to Section 3.1 - 3.3)

3.5 Weed Treatment

A weed is a plant that is growing in the wrong location, dominating the landscape and suppressing plants which should normally exist. With reference to bushland, weeds are plants which do not grow within the classified plant community type. Bushland weeds are known to be opportunistic in a disturbed area with adaptations of rapid growth, effective dispersal mechanisms and therefore, the capacity to alter ecological systems to increase disturbance and conditions for their survival. Whilst undesirable, the value of weeds as habitat for fauna should be considered in a treatment plan.

3.5.1 Priority Weeds

The *Biosecurity Act 2015* and regulations provide a list of priority weeds and high-risk activities at a State level. The following Table lists priority weeds within the Site. This includes their status at a State and the Greater Sydney Local Land Services Regional scale, and outcomes to demonstrate compliance with the General Biosecurity Duty (GBD).

The Biosecurity Act prioritises weeds based upon management objectives. Prevention is the highest followed by Eradication, Containment and Asset Protection.

Table 3. 2: Priority Weeds

Botanical Name	**Common Name**	**State level Category**	**Regional Level Category**	***Biosecurity Act 2015* requirementts and Strategic response in region for GBD**
Anredera cordifolia	Madeira vine	Asset Protection		No movement import or sale
Asparagus aethiopicus	Asparagus weed	Asset Protection		No movement import or sale
Cortaderia jubata	Pampas grass		Asset Protection	Fully and continuously suppressed and destroyed
Genista monspessulana	Cape/Montpellier broom	Asset Protection		No movement import or sale
Lantana camara	Lantana	Asset Protection		No movement import or sale
Ligustrum lucidum	Privet – broad-leaf	Asset Protection		No movement import or sale
Ligustrum sinense	Privet – narrow leaf	Asset Protection		No movement import or sale
Olea europaea subsp. *cuspidata*	African olive		Containment	Prevent spread, reduce impact on assets, identify assets for targeted mgmt
Rubus fruticosus	Blackberry	Asset Protection		No movement import or sale
Senecio madagascariensis	Fire Weed	Asset Protection		No movement import or sale

Biosecurity duty definitions

General Biosecurity Duty: *All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*

Asset Protection: *These weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets.*

Containment: *These weeds are widely distributed in the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable.*

3.5.2 Weeds of Regional Concern

The following Table lists weeds within the Site that are of regional concern because, by definition, they present a risk to biodiversity due to the likelihood of them spreading throughout the Site and into the surrounding areas. Despite appearing in separate lists within the *Biosecurity Act 2015,* they will also be treated as a priority due to the impact they will have on the success of rehabilitation.

Table 3. 3: Weeds of Regional Concern

Botanical Name	Common Name	Asset/value at risk
Eragrostis curvula	African lovegrass	Environment
Cardiospermum grandiflorum	Balloon vine	Environment
Cinnamumum campphora	Camphor laurel	Environment, Agriculture, Human health
Delairea odorata	Cape Ivy	Environment
Senna pendula	Cassia, Senna	Environment
Cotoneaster spp	Cotoneaster	Environment
Ageratina adenophora	Crofton weed	Environment
Ageratina riparia	Mistflower	Environment, Agriculture
Araujia sericifera	Moth vine	Environment
Ochna serrulata	Ochna	Environment
Lonicera japonica	Japanese Honeysuckle	Environment
Tradescantia fluminensis	Trad	Environment
Andropogon virginicus	Whistky Grass	Environment
Solanum mauritianum	Wild tobacco bush	Environment, Agriculture

3.5.3 Weed Control Methods

Weed control is required to improve the ecological integrity of the Site. It is necessary to assist the natural systems present by removing competition from weeds and prevent further spread of weeds. Best practice bush regeneration works from ‘good’ bush to ‘poor’ bush, thus allowing natural processes the best opportunity to re-establish and defend against potential weed incursions. Weed treatment is to be undertaken in the following stages:

- Primary – the initial weed treatment. The appropriate timing, area and method of treatment is determined by weed species, weed density, site resilience, adjoining land use and the weed plumes potential as a soil stabiliser or habitat.
- Secondary – weed control that is follow-up work required after primary weed control. Work is targeted on germinating weed seed in the soil or opportunistic weed spread following primary weed treatment. Secondary weed control can be the most time consuming and expensive weed management stage. Timing of works is crucial to efficient and effective secondary weed treatment.
- Maintenance – this final stage of work is to be applied following restoration success. The amount of maintenance required depends on whether the cause of weed incursion has been sufficiently managed.

Weed control is to be undertaken by professional bush regenerators who are adept in undertaking integrated weed management. The complexity of the Site and the nature and extent of degradation will require a combination of management methods. These may include the following:

- Manual hand removal
- Biological control
- Herbicide application
- Slashing, mowing
- Flame or steam weeding
- Fire
- Supplementary Planting
- Surface capping and mulching

3.6 Bush Regeneration, Assisted Regeneration and Revegetation

Bush Regeneration is the dynamic and specialised process used to restore an altered natural area to a healthy and sustainable representation of its original composition of Australian plants. It is a complex and evolving process requiring strategic methods, precise observations and adaptive management to relieve the native plants from existing impacts, favour their growth and allow for germination of the native seed bank and spores in the soil.

Natural **bush regeneration** involves controlling weeds using weed control methods (refer to section 3.5.3). **Assisted regeneration** combines the natural regeneration methods with revegetation. Revegetation is the process of artificially reintroducing native plant material through a variety of methods including planting, transplanting, direct seeding, surface capping, mulching, hydromulching or brushmatting.

Best practice bush regeneration only considers revegetation in areas that have been extensively modified for a long period of time resulting in little or no native seed bank within the soil and a low likelihood of natural regeneration. The act of revegetation reintroduces native plants to provide an environment conducive to further native germination, out compete exotic weed species, create buffers on good bush interfaces and restock the native seed bank.

3.6.1 Revegetation Location

Revegetation is required in Management Zones 1 and 2 based on the condition assessments and modifications required to stabilise the site and improve access for ongoing vegetation management. The species list will reflect the mapped locations of the current plant community types. In locations where, exotic plants have been mapped, plant species will be chosen from both BGDF and BBGF PCTs and planted in locations to reflect the position in the landscape including the surrounding vegetation type.

3.6.2 Seed Collection

Tree Canopy

Wherever Eucalyptus spp. trees are to be removed for earthworks seed should be taken from the crowns before the material is chipped or disposed of. This must happen on the day of felling as the seed is quickly released once sap flow is stopped.

For every 10 trees felled seed should be collected from at least one(10% of trees felled are then sampled). At least three branches of seed-bearing material should be reserved. Branches would ideally be 10cm in diameter at the cut end and be approximately 2-3 m in length. These must then have the fruit removed as soon as possible into a bag/container.

Mid-storey/Understorey smaller trees and shrubs

These species either have seed held within the canopy available 12 months of the year, or, they are shed annually in a short window of time and hence are only available once a year. As such, species with seed available 12 months of the year can be treated as the first example above- Eucalyptus spp.

The other plants will need to be targeted when they have seed shed imminent. These species need to be identified and mapped in order of abundance on the Site before clearing can occur. The majority of these species have seed available in autumn if they are of mesophylic origin or in November/ December if they are of sclerophylic origin. Seed for both types of plants are hand harvested from the individuals following Florabank Guidelines.

Ground layer

Ground layer consists of grasses, herbs and groundcovers. Many can be propagated by cloning if seed is unavailable at the time of collection. This is best undertaken in cooler months. Grasses generally shed seed over mid-summer to early autumn depending on species. They can easily be collected in volume by hand collecting. As with shrubs these species need to be identified and mapped in order of abundance on site for targeted seed collecting before clearing can occur.

Natural areas abundant in seed and propagules outside of the Impact Area and the Site should be identified as donor sites to provide seed where critical species for PCT to be restored are missing or unavailable in the Site itself.

3.6.3 Revegetation Plant Material

All plant material to be used for revegetation will be locally provenant species sourced from similar PCTs including the neighbouring BGDF. Where planting requires propagation, the material required will be propagated in Council's Community Nursery. The Community Nursery has NIASA accreditation (2005-2019) and EcoHort Certification (2017-2019). There is currently BBGF seed stock available in the Nursery Seed Bank collected from the Bridge Street area prior to NorthConnex occupation of the site.

3.6.4 Revegetation, Site Preparation and Timing

Site preparation will include recommendations as per sections 3.7.1 Earthworks, 3.7.2 Soil Preparation and 3.5 Weed Treatment.

Timing of planting will be subject to the completion of the earthworks program. Ideally planting should be undertaken in Autumn to enable the plants to establish prior to hot Summer weather conditions. Spring has been viewed as the next best time for planting as Winter has deemed to be too cold and Summer too hot for new plants to establish. However, due to Sydney's recent climate exhibiting dry Spring, wet Summer and relatively warm Winter conditions, consideration can be given to altering the timing of planting and adapted to suit long term weather forecasts.

Staged and supplementary planting will be necessary to enable successional growth and assist with maintenance. Some locations will primarily be planted with fast growing canopy and shrub species representative of primary succession species (Fabaceae Family species). This will deter annual weed establishment by creating shade cover and nurture the soil for secondary succession (longer lived slower growing species).

3.6.5 Revegetation Methods, Maintenance and Monitoring

Planting material will be a combination of Hiko Cells or tubestock. The optimum planting density is between five and eight plants per square metre. As planting is to reflect the existing plant communities, densities from each stratum should be based on the mature PCTs. To assist establishment, each plant should be planted into a pre-watered hole with water-holding crystals and slow-release fertiliser then watered in post planting.

Hydromulching using a mixture of sterile grasses and a native grass mix can be used prior to planting.

Follow up watering will be required. Deep watering on a weekly basis until plant establishment is optimal (at least 6 weeks). Additional water may be required depending on weather conditions. Watering to be via a water breaker to ensure the soil surface structure is not damaged, runoff is minimised, and water reaches the roots of the plants where it is required.

Weed management during the establishment phase will be necessary. All weeds should be treated with the aim of breaking the life cycle, i.e. prior to flowering and seeding.

A planting schedule will be required to monitor plant survival and replacement requirements. Monitoring of plants for herbivory will indicate the necessity for protective fencing.

3.7 Site Preparation

Site preparation requires the final landform to be completed to support implementation of this Preliminary VMP.

3.7.1 Earthworks

Earthworks will be required in Management Zones 1 and 2 to stabilise the soil and provide detailed contouring to prevent erosion and reflect the adjacent environment. Earthwork planning and design is to accommodate extraction of different soil types to be stockpiled and used in soil profile engineering. The success of revegetation will depend highly on the quality of the engineered soils and early consideration of the soil properties required is highly recommended.

Once soil profiles are established, landscape features are required to assist with stabilisation and erosion control. They will also create microclimate pockets to 'kick-start' habitat creation and provide decomposition elements. These are to include but are not limited to rock boulders, natural debris and any timber required to be felled as part of the works. Landscape features are to mimic the natural environment. While random in their location, they should follow contours and maintain connectivity. Earthworks planning, and design is to include survey and stockpile areas for any material that can be used for habitat. Any machines used for earthwork should aerate soils as they exit the site to avoid risk of soil compaction.

3.7.2 Soils

Engineering of site soils is required prior to revegetation. Soils in Management Zones 1 and 2 are to be suitable to support BGDF and BBGF. Specifications for engineered soils need to refer to SESL's report (SESL 2019) and the recommendation of 'concept' profile of soils found at BH1 and BH4 for sandstone soil profile and BH14 and BH16 for breccia soil profile. Engineering of site soils are to be incorporated into Earthworks (refer to section 3.4.1).

Engineered soils should be trialled and tested for suitability prior to installation of plant material.

VENM crushed sandstone capping to a depth of approximately 300mm could be considered where suitable site soil is not available or if access is limited.

3.7.3 Fauna Management: Habitat Retention and Enhancement

The proposed works will have direct and indirect impacts on fauna within and beyond the impact area. Actions are required to mitigate the impacts. A Habitat Retention and Enhancement Plan is to be developed and implemented prior to any works commencing in Management Zones 1 and 2. The Plan should include, but is not limited to, the following:

- Ground dwelling fauna habitat creation - survey area for location of habitat to be retained, survey for potential material that can be used for habitat creation, develop donor site and storage plan for surveyed material;
- Nesting box strategy including target species (eg. microbats, arboreal mammals, birds, native bees), design principles, installation/creation location, monitoring and maintenance;
- Foraging, breeding, nesting and shelter habitat - retain, protect, replace protective vegetative cover (evaluate potential of weed plumes as habitat prior to removal – plan to retain sections of weeds on edges prior to replacement habitat creation);
- Retain and protect any water features;
- Identify likelihood of predation
- Management of existing tree hollows - Five hollow bearing trees have been recorded in the Impact Area (GHD 2019). Prior to any works, the hollows should be examined for any occupants. Relocation is to be undertaken by a qualified ecologist and/or wildlife handler. The hollows should then be dismantled and relocated to the nearby buffer area at the interface. A qualified ecologist and/or wildlife handler should be on site for any tree removal activities.

3.7.4 Tree Protection

Tree protection measures to be installed around all trees to be retained. Tree protection measures are to reflect best practice in accordance with Australian Standard (AS) 4970-2009 *Protection of Trees on Development Sites.* Wherever possible, habitat trees should be identified, retained and protected.

3.7.5 Interface zones, edge effects and buffers

An interface is the area between bushland and another adjoining land use. It is the area that experiences changes in ecological functions known as edge effects (refer to section 2.7). The Site has many interface areas due to the high amount and range of surrounding and interspersed land uses. With respect to the Impact Area, edge effects are already evident and to a large degree, currently extend to 50m around the Impact Area as predicted by GHD. To mitigate the current edge effect impacts and those predicted to occur as works commence, buffers will need to be created along interface areas of Management Zones 1 and 2.

The purpose of a buffer is to reduce levels of edge effects by creating a barrier. In this situation, buffers will be created with dense planting of quick growing shrub species. Existing weed plumes will also be utilised as immediate buffers and planting will be scheduled to complement the timing of their staged removal. Further regeneration and revegetation works throughout the Site will also provide a buffer by reducing fragmentation, enhancing connectivity and assisting with ongoing maintenance of the natural areas on the southern and eastern boundaries.

3.7.6 Protection of Bushland during construction

Access to the bushland is to be restricted to certain personnel during construction. No machines or equipment are to go beyond the Impact Area. Signage is to be installed at regular intervals along the interface to signify no entry. Monitoring of the bushland is to be undertaken to identify if fencing is necessary. If so, fauna friendly and fit for purpose fencing is to be installed to enforce no access. That is, fencing that will allow animals to pass through or underneath, and with gaps left at corners to act as a gateway. No barbed wire or electric fencing is to be used.

Wires should be called if any fauna is injured or displaced through construction.

3.7.7 Hygiene

A strict hygiene protocol is essential to prevent the spread of pathogens, including *Phytophthora cinnamomi,* Myrtle Rust and weed propagules.

Procedures and guidelines should include disinfecting machinery, PPE, tools and equipment prior to entering and when leaving the site. Protocol details can by sourced from the following link, 'Bushland Hygiene Protocols for Phytophthora' and 'Preventing spread of Myrtle Rust in bushland below: http://www.hornsby.nsw.gov.au/environment/flora-and-fauna/bushland-management/bushcare/volunteer-resources

4 Implementation

4.1 Monitoring, Reporting, Evaluation and Adaptive Management

The responsibility for the implementation of this Preliminary VMP will be upon Hornsby Shire Council. The Natural Resources Branch should be assigned to the management of the bushland. All project management meetings and decisions should be inclusive of the assigned project manager. It should be noted, activities can directly or indirectly impact the surrounding bushland, in this regard the precautionary principle should be applied.

Any weed management should be undertaken by suitably qualified and experienced bush regenerators with a TAFE Certificate IV in Conservation and Land Management or similar. All works should comply with best practice bush regeneration techniques within an adaptive management program (Buchanan 2009).

A monitoring program should be developed and is to include an annual assessment of the works undertaken, an evaluation of the site response and an adaptive management plan for the way forward. The initial key performance indicators of this Preliminary VMP will be measured by the success of revegetation in Management Zones 1 and 2 and the establishment of locally endemic plant species utilised in the design and implementation of Management Zone 3, all within the Impact Area. All revegetation is to be documented with a map including species, numbers, source of material and planting locations at installation. The area should be surveyed for fatalities on an annual basis and replacement plants installed where necessary. A 5% failure rate is acceptable.

The success of managing bushland within the Site will be assessed by the enhancement of the Site's species diversity and the restoration of ecosystem functionality. The baseline data presented by previous reports (Arterra 2019, GHD 2019, Kleinfelder 2017 and EcoLogical 2015 in particular) provide a reasonable quantitative assessment of site floristics and structural integrity to compare with information gathered in future years. Monitoring and reporting beyond the Impact Area is not within scope of this report and to be determined when the detailed and refined bushland condition and management assessment for these areas has been undertaken.

5 Summary

Hornsby Park is to be developed as a parkland which supports recreational pursuits and prioritises conservation of its natural areas. To obtain such conservation and recreation objectives, priority is to be given to managing impacts on the natural area from the threatening process of fragmentation, edge effects and loss of habitat. This can be achieved by increasing areas of core native vegetation, connectivity and appropriate access as discussed. The final detail on management actions for the Site are to be developed in accordance with the principles of this Preliminary VMP.

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PSM Appendix A
https://www.hornsby.nsw.gov.au/_resources/documents/council/current-works-and-projects/quarry/psm-geo-report/PSM-Geotechnical-Report-Appendix-A.pdf

SESL (2018) *Hornsby Park/Quarry Soil Profile Investigation Hornsby, 2077.* Prepared for Hornsby Council.

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Appendix 1 – Smith and Smith PCT Descriptions

3.4 Blue Gum Diatreme Forest (Community BG2)

Description: Tall open-forest dominated by *Eucalyptus saligna* (Sydney Blue Gum). Other, less common tree species include *Angophora costata* (Sydney Red Gum), *Eucalyptus pilularis* (Blackbutt), *E. piperita* (Sydney Peppermint) and *Syncarpia glomulifera* (Turpentine). Low tree and shrub species include *Acacia parramattensis*, *Angophora floribunda*, *Pittosporum undulatum*, and the introduced *Cinnamomum camphora*, *Ligustrum lucidum* and *L. sinense*. Ground layer species include *Adiantum aethiopicum*, *Blechnum cartilagineum*, *Calochlaena dubia*, *Dichondra repens*, *Lomandra longifolia*, *Microlaena stipoides*, *Oplismenus aemulus*, *Poa affinis*, *Pteridium esculentum*, and the introduced *Lonicera japonica*. Climbers include *Morinda jasminoides*, *Pandorea pandorana*, *Smilax australis* and *Stephania japonica*.

Distribution and habitat in survey area: Restricted to gullies on Jurassic diatremes (volcanic necks) along tributaries of Waitara Creek at Hornsby and Westleigh.

Total extent in survey area: 14 ha.

Conservation significance: Forms part of the critically endangered ecological community, 'Blue Gum High Forest', as listed in the NSW *Threatened Species Conservation Act 1995* (NSW Scientific Committee 2007), but not as listed in the Australian *Environment Protection and Biodiversity Conservation Act 1999*, which only covers the Blue Gum Shale Forest (Threatened Species Scientific Committee 2005a). The community has a very restricted distribution in the Sydney region, and may now be confined to the Hornsby Local Government Area (Benson and Howell 1994; map unit 6c, subunit i). It has been depleted by extensive quarrying for blue metal aggregate at Old Mans Valley, which is the largest of the diatremes. **Critically Endangered Community**

Photo 5. Blue Gum Diatreme Forest, Hornsby

3.9 Blackbutt Gully Forest (Community L)

Description: Tall open-forest in which the main tree species are *Eucalyptus pilularis* (Blackbutt), *Angophora costata* (Sydney Red Gum) and *Syncarpia glomulifera* (Turpentine). Other, less common tree species include *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint) and *E. resinifera* (Red Mahogany), with occasional *E. punctata* (Grey Gum) and *E. saligna* (Sydney Blue Gum). Low tree and shrub species include *Acacia linifolia*, *Allocasuarina littoralis*, *A. torulosa*, *Banksia serrata*, *Callicoma serratifolia*, *Ceratopetalum gummiferum*, *Dodonaea triquetra*, *Elaeocarpus reticulatus*, *Grevillea linearifolia*, *Leptospermum trinervium*, *Persoonia linearis*, *Pittosporum undulatum* and *Pultenaea flexilis*. Ground layer species include *Calochlaena dubia*, *Dianella caerulea*, *Entolasia stricta*, *Lomandra longifolia*, *Microlaena stipoides*, *Pratia purpurascens*, *Pteridium esculentum* and *Xanthosia pilosa*. Climbers include *Billardiera scandens*, *Cassytha pubescens* and *Smilax glyciphylla*.

Distribution and habitat in survey area: Gullies on Hawkesbury Sandstone with a shale influence (from shale lenses in the sandstone or from proximity to Wianamatta Group shales), in the southern parts of the Shire (Epping to Galston).

Total extent in survey area: 836 ha.

Conservation significance: Identified as a locally significant community in the Hornsby Shire Biodiversity Conservation Strategy (Hornsby Shire Council 2004). Although it is a common community in Hornsby Shire, it is uncommon and poorly conserved outside the Shire. For example, only small areas occur in Ku-ring-gai Chase National Park (Thomas and Benson 1985a). **Locally Significant Community**

Photo 9. Blackbutt Gully Forest, Beecroft

Appendix 2 – Photo Reference Points

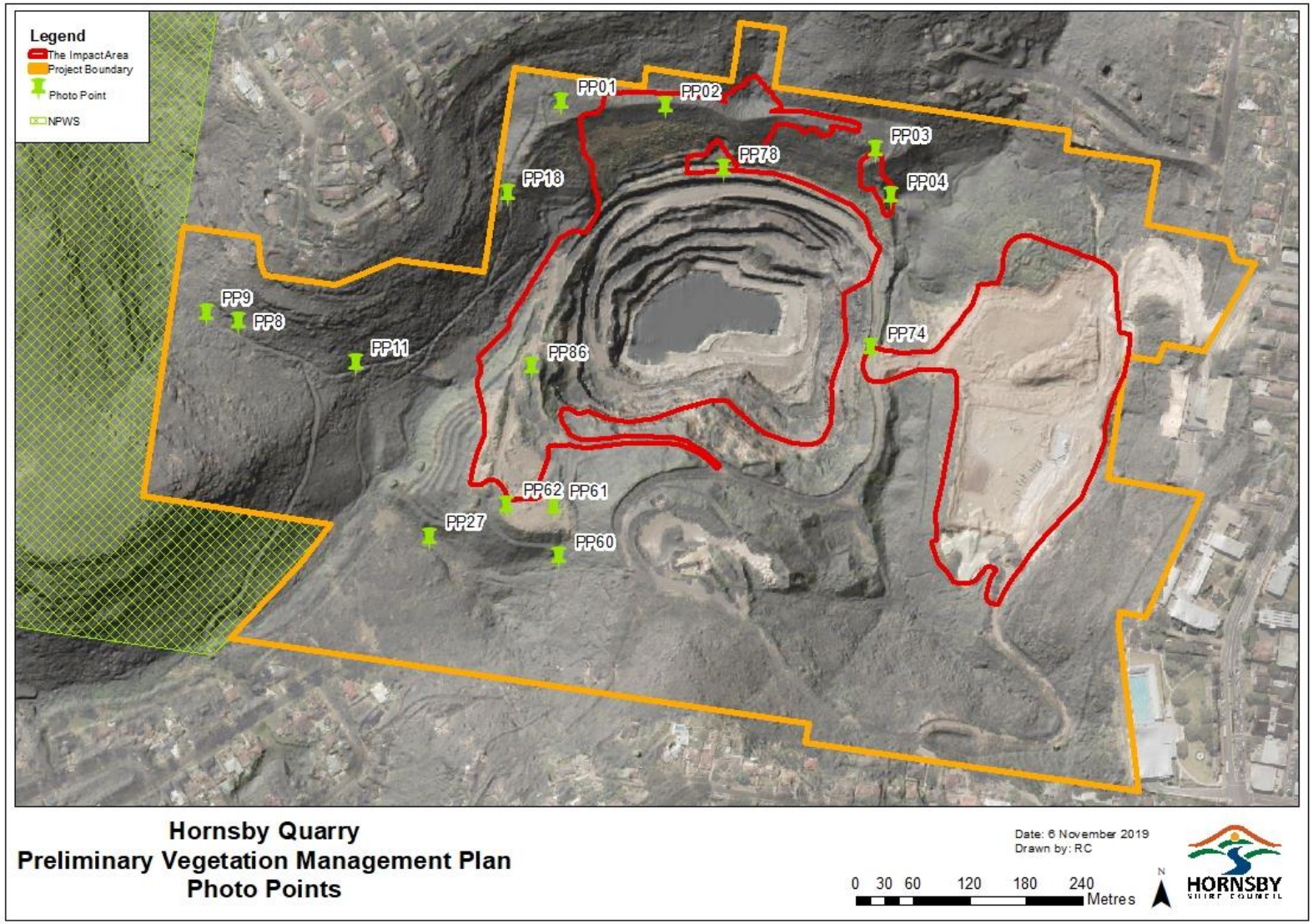

Figure A2. 1: Photo point Locations

PP01 – MZ1 - Look out location

PP02 – MZ1 – Pampas Grass. RHS trees beyond impact zone

PP03 – MZ1 – Looking south through Privet understorey into the void. Unstable soils within impact area.

PP03 – MZ1 – Looking south through Privet understoery into the void. Unstable soils within impact area.

PP04 – MZ1 – Looking north from up slope. Unstable soils within impact area.

PP04 – MZ1 – Looking north from up slope. Unstable soils within impact area.

PP78 – MZ1 Looking north

PP78 – MZ1 Looking north

PP78 – MZ1 – from top of rim looking west

PP78 – MZ3 Partially filled void looking south east

PP74 – MZ3 Partially filled void looking west

PP61 – MZ2 looking west

PP62 – MZ2 looking north

PP60 – Beyond impact area below crusher plant looking north

PP86 – Looking north into void through Privet understorey.

PP27 – On impact area interface looking west. Impact area to the right of PP.

PP27 – On impact area interface looking east. Impact area to the left of PP.

PP11 – In Blue Gum Diatreme Forest looking east to Impact Area. Site of potential Edge Effects.

PP18 – Beyond impact area looking north. Modified drainage system.

PP8 – BBGF looking north

PP9 BBGF looking southwest

Appendix 3 – Hornsby Quarry Rehabilitation (EAR 1167)

NSW GOVERNMENT | Office of Environment & Heritage

DOC17/431342
EAR 1167

Mr Tertius Greyling
Senior Environmental Assessment Officer
NSW Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Mr Greyling

Request for SEARs - Hornsby Quarry Rehabilitation (EAR 1167)

I refer to your email received 15 August 2017, by the Office of Environment and Heritage (OEH) requesting requirements for the preparation of an Environmental Impact Statement (EIS) for the above proposal. OEH understands that the proposal involves:

- Major stabilisation works to both the north and south faces of the Hornsby Quarry void to make them safe.
- Earthworks across other parts of Hornsby Park in order to rehabilitate the site.
- Placement of material from stabilisation works and other earthworks in the quarry void to create a final landform suitable for future development into a community parkland.

OEH recommends that the EIS include an assessment of potential impacts on biodiversity and OEH estate (Attachment 1).

If you have any further questions about this matter please contact Dana Alderson on 8837 6304 or dana.alderson@environment.nsw.gov.au.

Yours sincerely

S. Harrison 31/08/17

SUSAN HARRISON
Senior Team Leader Planning
Greater Sydney

PO Box 644 Parramatta NSW 2124
Level 6, 10 Valentine Ave Parramatta NSW 2150
Tel: (02) 9995 5000 Fax: (02) 9995 6900
ABN 30 841 387 271
www.environment.nsw.gov.au

ATTACHMENT 1 – Office of Environment and Heritage - Hornsby Quarry Rehabilitation (EAR 1167)

1. Biodiversity

OEH data indicates the presence of the critically endangered Blue Gum High Forest vegetation community. It is therefore recommended the EARs include a biodiversity assessment to be undertaken in accordance with the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (November 2004)* and the *NSW Guide to Surveying Threatened Plants (February 2016)*. These guidelines and other information on threatened species surveys and assessments, can be downloaded from the OEH website at: www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.

OEH further recommends that the proposal be designed to avoid and minimise impacts on biodiversity and offset remaining direct and indirect biodiversity impacts. In determining an appropriate offset package it is recommended that the EIS:

a. Accord with the 13 OEH offsetting principles available at http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm.
b. Use the BioBanking Assessment Methodology (OEH, 2014) to determine the quantum of offsets required to compensate for those remaining biodiversity impacts.
c. Identify the conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites.
d. Include a specific Statement of Commitments for the proposed offset package which is informed by a., b. and c. above and by any consultation with OEH.

With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the EIS should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

2. Impacts on OEH Estate

As the development adjoins Berowra Valley Regional Park, the EIS must address the matters to be considered as outlined in the *Guidelines for developments adjoining land managed by the OEH* (OEH, 2013) which include:

a. erosion and sediment control;
b. stormwater runoff;
c. wastewater;
d. management implications relating to pests, weeds and edge effects;
e. fire and the location of asset protection zones;
f. boundary encroachments and access through OEH lands;
g. visual, odour, noise, vibration, air quality and amenity impacts;
h. threats to ecological connectivity and groundwater dependent ecosystems; and
i. cultural heritage.

(END OF SUBMISSION)