REPORT

June 2012

VOLUME III

Environmental Assessment - Whytes Gully New Landfill Cell

Submitted to:
NSW Department of Planning and Infrastructure

Report Number. 117625003_159_R_Rev1

wollongong city of innovation

Golder Associates

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REPORT

AIR QUALITY ASSESSMENT: WHYTES GULLY NEW LANDFILL CELL

Golder Associates

Job No: 6051

20 June 2012

A PEL Company

PROJECT TITLE:	**AIR QUALITY ASSESSMENT: WHYTES GULLY NEW LANDFILL CELL**
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DOCUMENT CONTROL

VERSION	DATE	PREPARED BY	REVIEWED BY
R1 Draft1	09.01.12	J. Barnett	R. Kellaghan
R2 Draft2	20.01.12	J. Barnett	R. Kellaghan
R2 Final1	01.03.12	J. Barnett	R. Kellaghan
R3 Draft1	06.06.12	J. Barnett	R. Kellaghan
R3 Final	20.06.12	J. Barnett	R. Kellaghan

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1 INTRODUCTION

Wollongong City Council (WCC) are seeking approval to develop a new landfill cell within the existing landfill site at its Whytes Gully Resource Recovery Park (WGRRP). This new cell will provide additional approved landfill capacity to meet disposal needs in the long term (20-50 years).

PAEHolmes has been commissioned by Golder Associates to undertake an Air Quality Assessment for the proposed extension which will form part of the Environmental Assessment (EA).

The purpose of this report is to assess the air quality impacts, odour and dust, which may be associated with the proposed landfill cell and associated modifications to site layout.

The report comprises the following components.

- Project description
- A discussion of air quality and odour issues
- Existing air quality
- Dispersion modelling of odour and dust emissions.

The modelling has been carried out in accordance with the NSW Environment Protection Authority (EPA) "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales" (**NSW DEC, 2005**).

2 PROJECT DESCRIPTION AND LOCAL SETTING

The WGRRP facility is located at Kembla Grange, approximately 70 km southwest of the Sydney CBD and adjacent to Horsley and Farmborough Heights. **Figure 2.1** shows a map of the study area.

Landuse in the area is predominantly rural residential from northeast to southwest of the site. There are also light industrial areas to the east and south of the site. To the north of the site is the Illawarra Escarpment State Conservation Area and vegetated areas occupy land to the west.

Figure 2.2 presents a pseudo 3-dimensional plot of the existing local terrain in the study area. The terrain immediately surrounding the Project to the south is predominantly flat, with a sharp rise in terrain to the north and west. Lake Illawarra is located to the southeast of the site.

The WGRRP occupies land owned by the WCC. The existing site comprises of landfill activities, transfer station, stormwater ponds, leachate management system, a materials recovery facility, a recycling area, weighbridge and administration building.

The proposed extension includes construction of new staged landfill cells providing an additional 7,000,000 m^3 of capacity, extending the site capacity for up to 40 years of operation.

There are four main stages of the project, beginning at the eastern boundary and progressing in a westerly direction, as shown in **Figure 2.3**. In terms of modelling 'worst-case' odour scenarios, these will be Stage 1 and Stage 4. Stage 1 will represent a worst-case for those residences to the northeast and for Farmborough Heights, while Stage 4 will be worst for those residences to the northwest as operations approach that boundary.

Dust will be generated primarily from vehicles on unpaved surfaces, excavating and dumping of fill, shaping of the tipping face and wind erosion.

Odour from the landfill will be emitted from the active tipping face, newly covered areas, leachate ponds and intermediate cover areas. The locations and sizes of these areas will vary as the project progresses from east to west as shown in **Figure 2.1**.

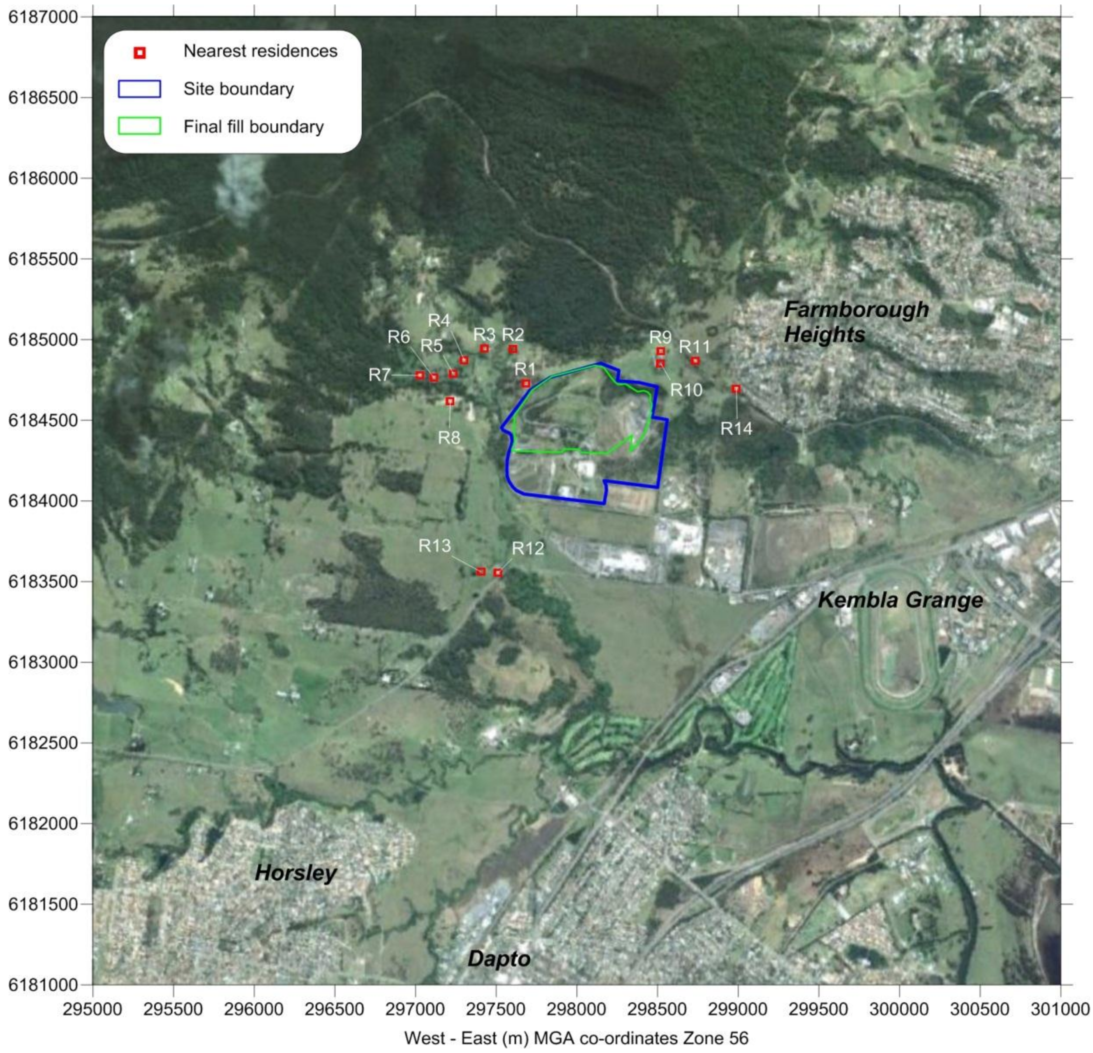


Figure 2.1: Study area

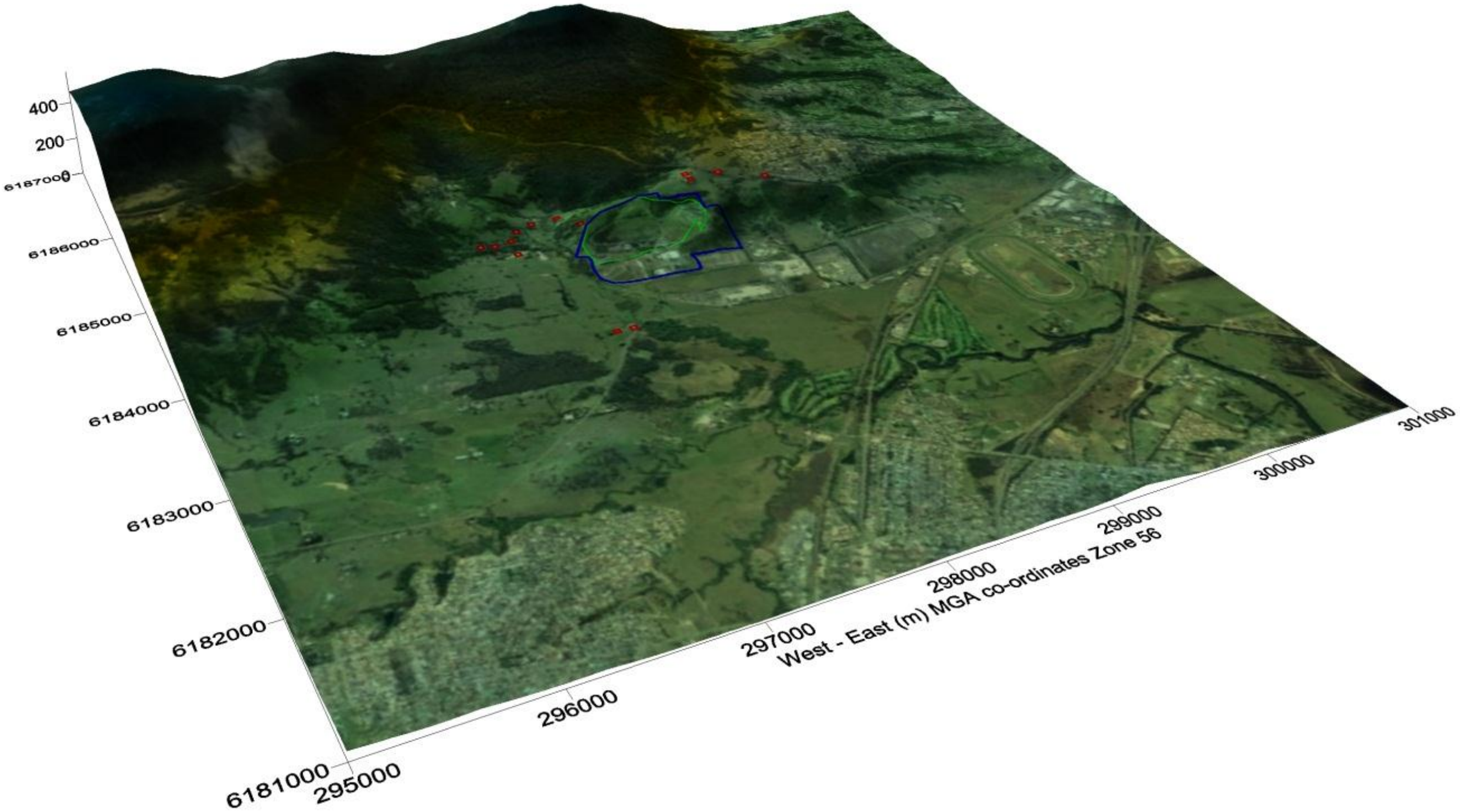


Figure 2.2: Pseudo 3-Dimensional Representation of the Project Area

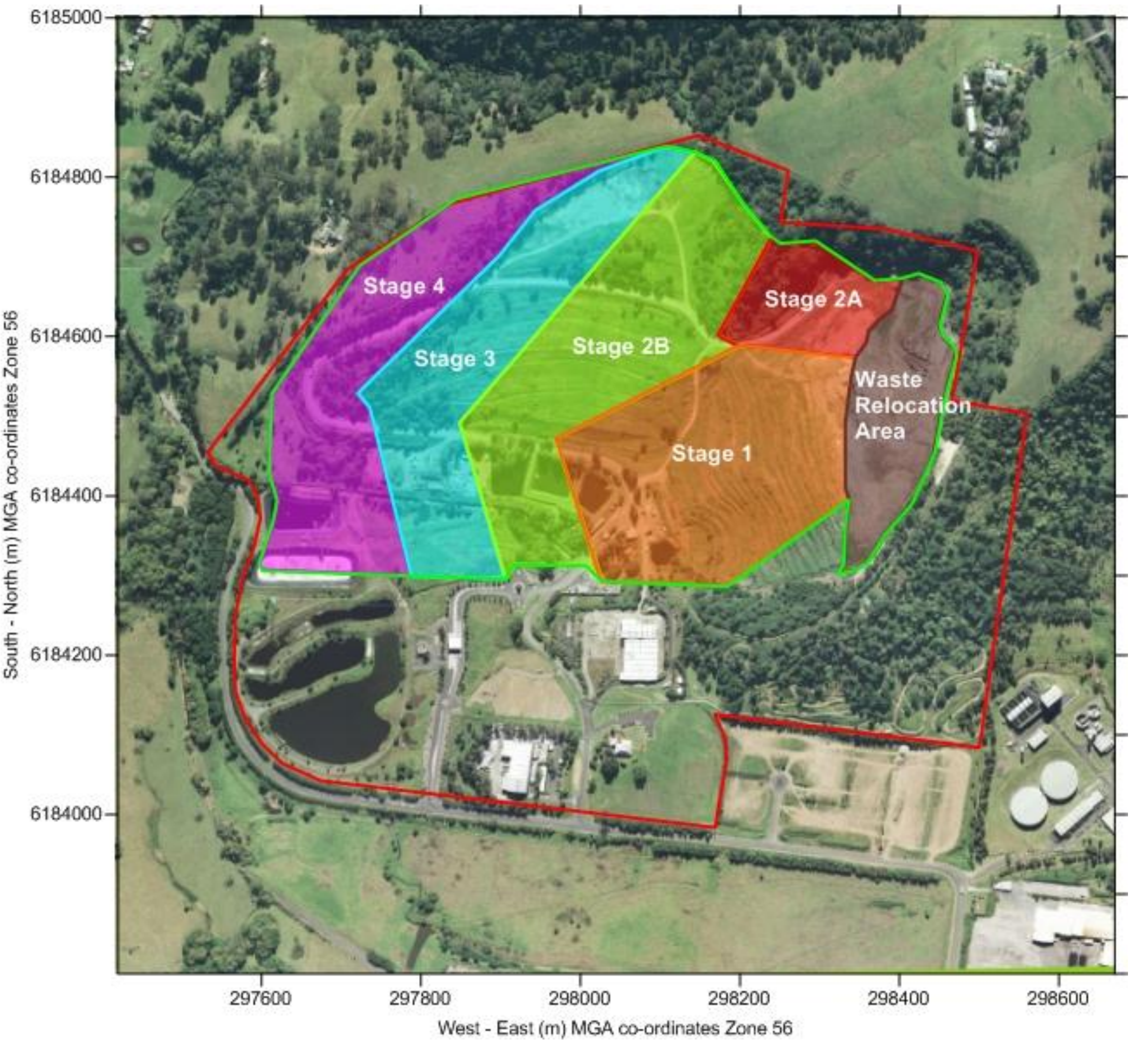


Figure 2.3: Proposed staged operations at Whytes Gully

3 DISCUSSION OF ODOUR AND AIR QUALITY ISSUES

3.1 Odour

3.1.1 Measuring odour concentration

There are no instrument-based methods that can measure an odour response in the same way as the human nose. Therefore "dynamic olfactometry" is typically used as the basis of odour management by regulatory authorities.

Dynamic olfactometry is the measurement of odour by presenting a sample of odorous air to a panel of people with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. The correlations between the known dilution ratios and the panellists' responses are then used to calculate the number of dilutions of the original sample required to achieve the odour detection threshold. The units for odour measurement using dynamic olfactometry are "odour units" (ou) which are dimensionless and are effectively "dilutions to threshold".

Olfactometry can involve a “forced choice” end point where panellists identify from multiple sniffing ports the one where odour is detected, regardless of whether they are sure they can detect odour. There is also a “yes/no” or “free choice” endpoint where panellists are required to say whether or not they can detect odour from one sniffing port. Forced choice olfactometry generally detects lower odour levels than yes/no olfactometry and is the preferred method for use in Australia.

In both cases, odorous air is presented to the panellists in increasing concentrations. For the forced-choice method, where there are multiple ports for each panellist, the concentration is increased until all panellists consistently distinguish the port with the sample from the blanks. For a yes/no olfactometer (which has only one sniffing port) one method used is to increase the concentration of odour in the sample until all panellists respond. The sample is then shut off and once all panellists cease to respond, the sample is introduced again at random dilutions and the panellists are asked whether they can detect the odour.

During the 1990s significant research was undertaken in Europe to refine the olfactometry method. This led to considerable improvements in panellist management and standardisation and, importantly, clear criteria for repeatability and reproducibility of results.

The draft Committé Européen de Normalisation (CEN) odour measurement standard (**CEN, 1996)** is a performance based standard with strict criteria for repeatability and reproducibility. The Australian standard (introduced in September 2001) (**Standards Australia, 2001**) is based upon the CEN standard.

As with all sensory methods of identification there is variability between individuals. Consequently the results of odour measurements depend on the way in which the panel is selected and the way in which the panel responses are interpreted.

3.1.2 Odour performance criteria

3.1.2.1 Introduction

The determination of air quality goals for odour and their use in the assessment of odour impacts is recognised as a difficult topic in air pollution science. The topic has received considerable attention in recent years and the procedures for assessing odour impacts using dispersion models have been refined considerably. There is still considerable debate in the scientific community about appropriate odour goals as determined by dispersion modelling.

The EPA has developed odour goals and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two factors that need to be considered:

1. what "level of exposure" to odour is considered acceptable to meet current community standards in NSW and
2. how can dispersion models be used to determine if a source of odour meets the goals which are based on this acceptable level of exposure

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors the most important of which are:

- the **F**requency of the exposure;
- the **I**ntensity of the odour;

- the **D**uration of the odour episodes; and
- the **O**ffensiveness of the odour (the so-called FIDO factor).

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDO factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour goals need to take account of these factors.

3.1.2.2 Complex mixtures of odorous air pollutants

The EPA Approved Methods include ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. They have been refined by the EPA to take account of population density in the area.

The difference between odour goals is based on considerations of risk of odour impact and not differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

In terms of odour impact, the location of the site is considered to be rural residential and therefore the relevant criterion will be greater than 2 ou for most residences. For the majority of residential properties in the area an assessment criterion of 5 ou would be more representative. However, the more stringent criterion of 2 ou would apply to the suburb of Farmborough Heights, including R14, to the northeast of the site.

Applying Equation 7.2 from Section 7.5.1 in the Approved Methods, an odour criteria for the remaining three groups of residences has been determined. The equation is as follows and the results are listed in Error! Reference source not found..

Criterion (OU) = (log$_{10}$(population) – 4.5)/-0.6

For the groups of residences R1 – R8 (northwest) and R12 – R13 (south), it was assumed that each residence housed an average of 5 people. Using the equation above, the most stringent criterion for each of these groups is 5 ou. Residences R9 – R11 are not part of the contiguous urban area of Farmborough Heights, as they are separated by rural land and also a railway line (in the case of R9 and R10). As such, an odour criterion of 5 ou is appropriate for this group.

An important point to note is that the odour assessment criteria are not intended to achieve 'no odour'. They are concerned with controlling odours to ensure offensive odour impacts will be effectively managed.

3.1.2.3 Other legislative considerations

There is a requirement in Section 129 of the *Protection of the Environment Operations Act* (POEO) which requires that there be *"no offensive odour beyond the boundary"*. **Section 7.1** will show that the Project complies with this requirement.

3.1.3 Peak-to-mean ratios

It is a common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because Gaussian dispersion models are only able to directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the EPA commissioned a study by **Katestone Scientific Pty Ltd (1995, 1998)**. This study recommended peak-to-mean ratios for a range of circumstances (as shown in **Appendix A**). The ratio is also dependent on atmospheric stability and the distance from the source. For area sources, as applies in this case, the peak to-mean ratio is 2.3 for stability classes A to D, and 2.5 for E and F class stability.

The EPA Approved Methods take account of this peaking factor and the goals shown in Error! eference source not found. are based on nose-response time.

3.2 Dust

Table 3.1 and **Table 3.2** summarise the air quality assessment criteria for particulate matter concentration and dust deposition. The air quality criteria relate to the total dust burden in the air and not just the dust from the Whytes Gully cell construction. In other words, some consideration of background levels needs to be made when using these criteria to assess impacts.

Table 3.1: EPA assessment criteria for particulate matter concentrations

Pollutant	Criteria	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 $\mu g/m^3$	Annual mean	NHMRC[1]
Particulate matter <10 μm (PM_{10})	50 $\mu g/m^3$	24-hour maximum	EPA
	30 $\mu g/m^3$	Annual mean	EPA
	50 $\mu g/m^3$	(24-hour average, 5 exceedances permitted per year)	NEPM[2]

[1] National Health and Medical Research Council
[2] National Environment Protection Measure

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 3.2** shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts (**NSW DEC, 2005**).

Table 3.2: EPA assessment criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

4 APPROACH TO ASSESSMENT

4.1 Modelling Methodology

The local meteorology was modelled using TAPM and CALMET models, described in **Sections 4.1.1** and **4.1.2**, respectively. Output from TAPM, plus regional observational weather station data were entered into CALMET, a meteorological pre-processor endorsed by the US EPA and recommended by the NSW EPA for use in non-steady state conditions. From this, a 1-year representative meteorological dataset was compiled, suitable for use in the 3-dimensional plume dispersion model, CALPUFF. Details on the model configuration and data inputs are provided in the following sections.

The choice of the CALMET/CALPUFF modelling system for this study is based on the fact that simple Gaussian dispersion models such as AUSPLUME, assume that the meteorological conditions are uniform spatially over the entire modelling domain for any given hour. While this may be valid for some applications, in complex flow situations, such as coastal environments, the meteorological conditions may be more accurately simulated using a wind field model such as CALMET.

4.1.1 TAPM

The Air Pollution Model, or TAPM, is a three dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. Detailed description of the TAPM model and its performance is provided in (Hurley 2008; Hurley, Edwards et al. 2008).

TAPM solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses.

For this project, TAPM was set up with 3 domains, composed of 27 grids along both the x and the y axes, centred on -34°27.5′ Latitude and 150°48′ Longitude. Each nested domain had a grid resolution of 30 km, 10 km and 3 km respectively.

Default TAPM terrain values are based on a global 30-second resolution (approximately 1 km) dataset provided by the US Geological Survey, Earth Resources Observation Systems (EROS). TAPM was used to generate gridded prognostic data (3D.dat) for the CALMET modelling domain.

4.1.2 CALMET

CALMET is a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are utilised in the CALPUFF dispersion model.

CALMET was initially run with a coarse resolution outer domain covering a 75 km x 75 km area, with the origin (SW corner) at 260.666 km Easting and 6146.949 km Northing (UTM Zone 56 S). This consisted of 50 x 50 grid points, with a 1.5 km resolution along both the x and y axes. This grid was selected to include as many local meteorological observations as possible. Terrain for this area was derived from Shuttle Radar Topography Mission (SRTM) data, sampled at three arc-seconds (or approximately 90m resolution). Land use for the domain was determined by aerial photography from Google Earth.

Observed hourly surface wind speed, wind direction, temperature and relative humidity data from the Bureau of Meteorology Albion Park, Bellambi, Kiama, Moss Vale and Wattamolla stations were used as input for CALMET. Cloud amount and cloud heights were sourced from observations at the Albion Park, Bellambi and Moss Vale stations. Hourly surface temperature and relative humidity from the EPA Kembla Grange station were also used as input for CALMET.

Together, the surface file and TAPM generated *3D.dat* files were used as input to CALMET to create a coarse resolution three-dimensional meteorological field for the region. CALMET uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to generate a three-dimensional wind field the region.

CALMET outputs from the outer grid were then used as input into the finer resolution inner grid domain of 26 km x 26 km, centred on the Whytes Gully site. The inner grid modelling was used to create a fine resolution three-dimensional meteorological field for the site. A summary of the data and parameters used as part of the meteorological component of this study are shown in **Table 4.1**. The meteorological modelling domain and locations of the surface station inputs are shown in **Figure 4.1**.

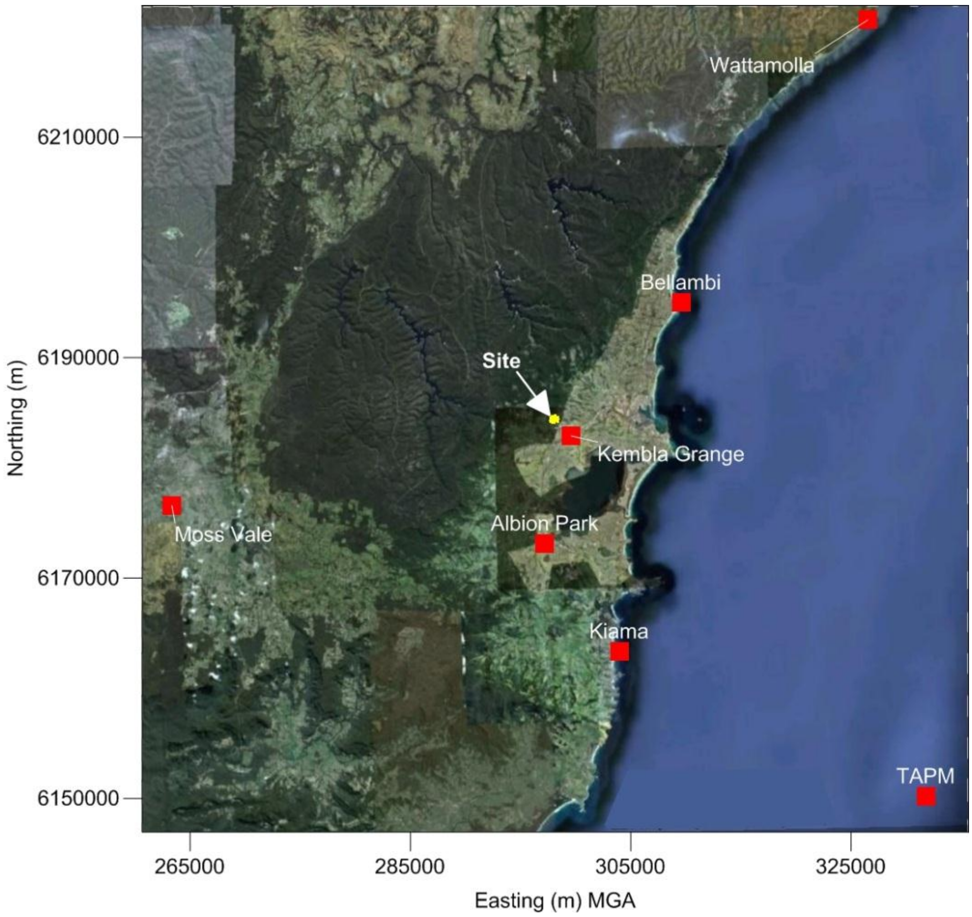


Figure 4.1: Modelling domain and meteorological input sites

Table 4.1: Meteorological parameters used for this study

TAPM (v 3.0)		
Number of grids (spacing)	3 (30 km, 10 km, 3 km)	
Number of grids point	27 x 27 x 35	
Year of analysis	2009	
Centre of analysis	Whytes Gully (-34° 27.5' S, 150° 48' E)	
CALMET (v. 6.4.0.05) - Outer Grid		
Meteorological grid domain	75 km x 75 km	
Meteorological grid resolution	1.5 km	
Grid origin	260.666 km 6146.949 km (UTM Zone 56)	
Surface meteorological stations	BoM Albion Park BoM Bellambi BoM Kiama BoM Moss Vale BoM Wattamolla EPA Kembla Grange	
Upper air	Data extracted from TAPM (3D.dat)	
Seven critical values	TERRAD RMAX1 RMAX2 R1 R2 IEXTRP BIAS 1 2 3 4 5 6 7	8 km 4 km 4 km 3 km 3 km -4 -1 -0.75 -0.5 0 0 0 0
CALMET (v. 6.4.0.05) - Inner Grid		
Meteorological grid domain	26 km x 26 km	
Meteorological grid resolution	0.25 km	
Grid origin	285 km 6171.5 km (UTM Zone 56)	
Surface meteorological stations	BoM Albion Park BoM Bellambi EPA Kembla Grange TAPM (for gaps in data)	
Upper air	Data extracted from TAPM	
Seven critical values	TERRAD RMAX1 RMAX2 R1 R2 IEXTRP BIAS 1 2 3 4 5 6 7	8 km 0.25 km 0.25 km 0.1 km 0.1 km -4 -1 -0.75 -0.5 0 0 0 0

4.1.3 CALPUFF

Odour and dust modelling was carried out across a computational grid within the CALMET domain and predictions made for each grid point, as well as for each of the 14 closest residences shown in **Figure 2.1** as R1 to R14. The MGA co-ordinates for these residences are listed in **Table 4.2**. The results for the computational grid and specific residential receptors were combined and used to create the contour plots shown in **Section 7**.

Table 4.2: Locations of specific residences modelled

Residence ID	MGA Easting (m)	MGA northing (m)
R1	297685	6184728
R2	297606	6184942
R3	297429	6184944
R4	297302	6184873
R5	297234	6184788
R6	297114	6184763
R7	297029	6184777
R8	297215	6184618
R9	298521	6184926
R10	298520	6184852
R11	298735	6184868
R12	297513	6183555
R13	297407	6183560
R14	298989	6184696

5 EXISTING ENVIRONMENT

5.1 Local Meteorology

5.1.1 Prevailing Winds

Summaries of the annual wind behaviour from meteorological data from the BoM Albion Park and EPA Kembla Grange stations are presented in **Figure 5.1** and **Figure 5.2**. These wind roses represent the surface station inputs used within the CALMET modelling as discussed in **Section 4.1**.

On an annual basis, winds at Albion Park are predominantly from the west, northeast and south. Spring, summer and autumn show similar patterns to the annual pattern while winter clearly shows prominent winds from the western quadrant.

The EPA Kembla Grange station has missing data from January to February and is 76% complete. Westerlies dominate in autumn and winter with north-easterlies also common in spring. For missing data periods at Kembla Grange, data from other stations are considered during the CALMET processing phase, as long as data exists within the modelling domain for each hour of the year at at least one monitoring station.

On an annual basis the percentage of calms at Albion Park and Kembla Grange are 19.0% and 30.0%, respectively, both of which are relatively high. The two stations show relatively similar distribution of winds but slight seasonal variations can be seen.

As discussed in **Section 4.1.2**, a CALMET data file was generated for the modelling domain. Meteorological data can be extracted for a point in the middle of the domain at the approximate location of the site. Windroses for this CALMET generated file are shown in **Figure 5.3**.

The CALMET generated windroses show the annual predominant wind direction is from the north-northwest rather than the westerlies observed at the BoM and EPA stations (see **Figure 5.1** and **Figure 5.2**). This is not entirely unexpected given the proximity of the elevated terrain immediately to the north-northwest potentially causing drainage flows at times.

Drainage flow, also referred to as katabatic drift, is often invoked as the conditions under which maximum odour impacts from ground-based sources are likely to occur. It is the movement of cold air down a slope, generally under calm conditions. Under these conditions, dispersion will be slow and impacts can be greatest. Drainage flow conditions occur in the early morning or evening, when the atmosphere is at its most stable, and are more frequent in autumn and winter when the thermal mixing of the atmosphere is less. The difference in wind direction shown in the windroses extracted at the site compared to the BoM and EPA data may be due to a mixture of katabatic drift and terrain influence as a result of the steep terrain to the north of the site.

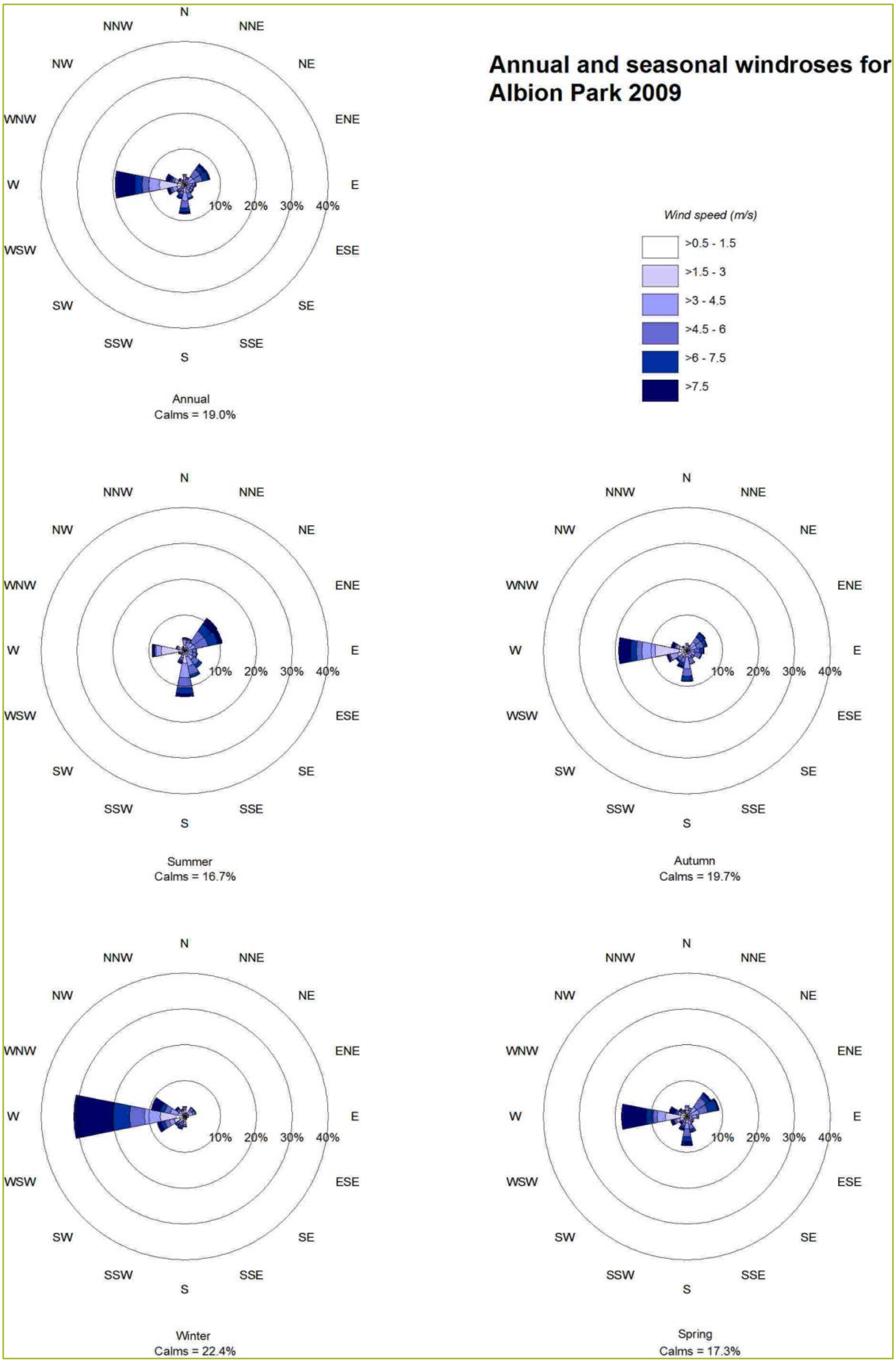


Figure 5.1: Wind Roses for Albion Park weather station, 2009

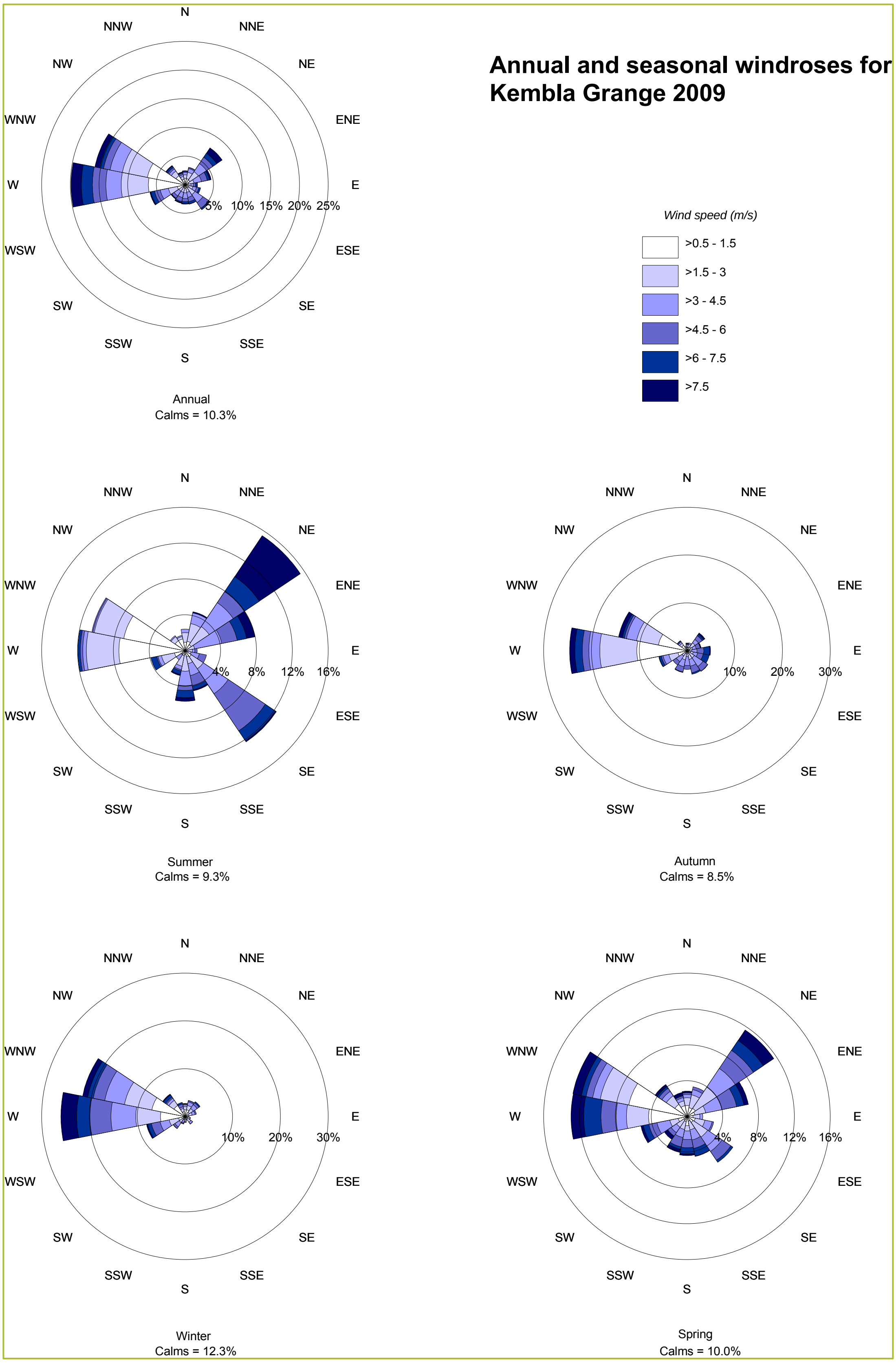


Figure 5.2: Wind Roses for Kembla Grange weather station, 2009

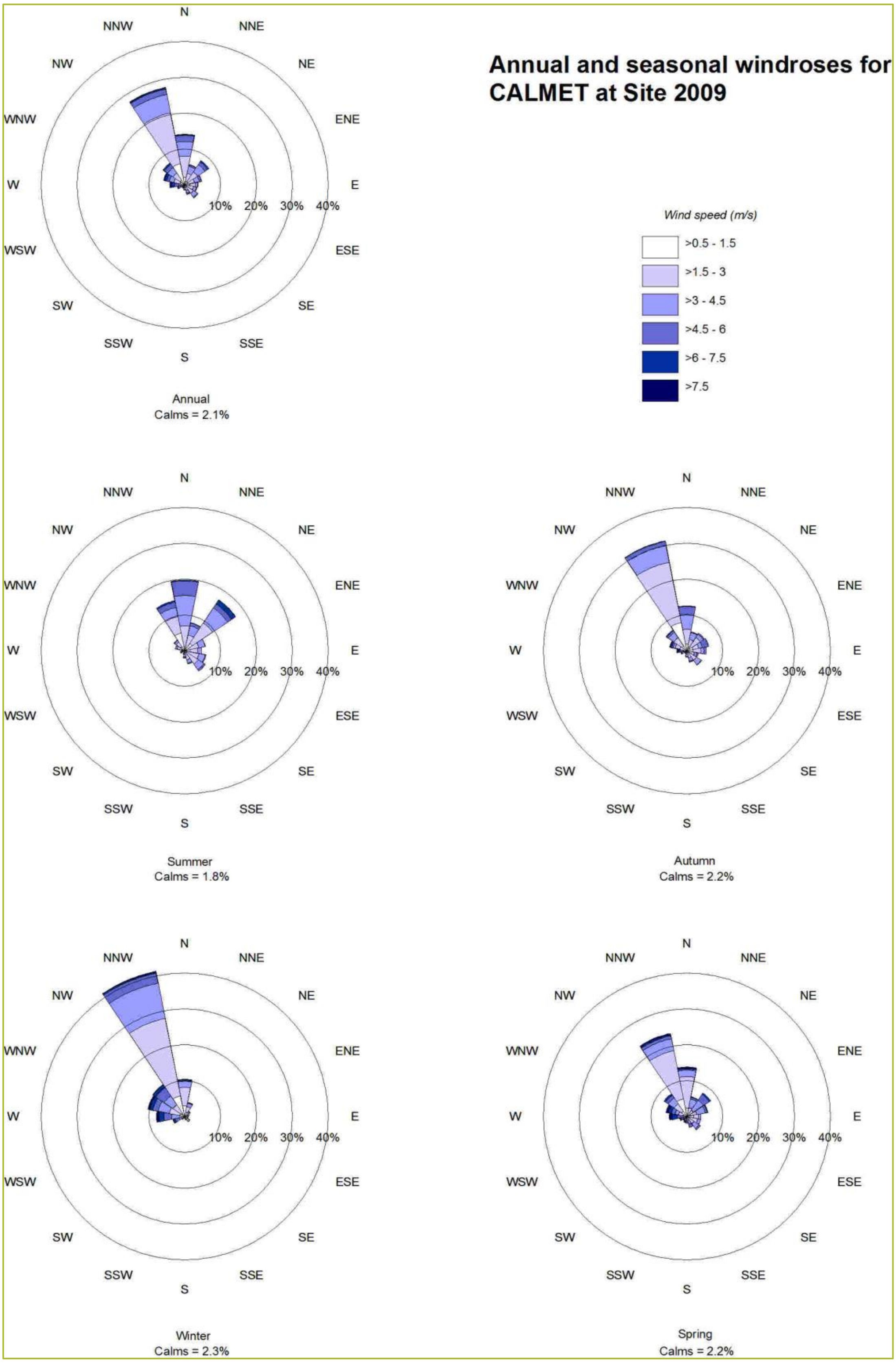


Figure 5.3: CALMET Generated Wind Rose for the site

5.1.2 Atmospheric Stability

An important aspect of plume dispersion is the level of turbulence in the atmosphere near the ground. Turbulence acts to dilute or diffuse a plume by increasing the cross-sectional area of the plume due to random motion. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits diffusion and is a critical factor in causing high plume concentrations downwind of a source. Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe the dispersion conditions in the atmosphere.

The best known stability classification is the Pasquill-Gifford scheme, which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, such as those that commonly occur under clear skies at night and in the early morning, especially during the cooler months. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are closely associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small.

The CALMET-generated meteorological data can be used to estimate stability class for the site and the frequency distribution of estimated stability classes is presented in **Figure 5.4**. The data show a large proportion of class F conditions (>27.7% of hours), and a total of 41.5% of hours with either E or F class.

It is noted that a turbulence based scheme within CALPUFF was used in the modelling and the Pasquill-Gifford stability class frequency is shown for information only. The use of turbulence based dispersion coefficients is recommended (**TRC, 2010**) for the same reasons that the US EPA has replaced PG-based dispersion with a turbulence-based approach in their regulatory model (AERMOD) and is in accordance with best science practice and model evaluation studies.

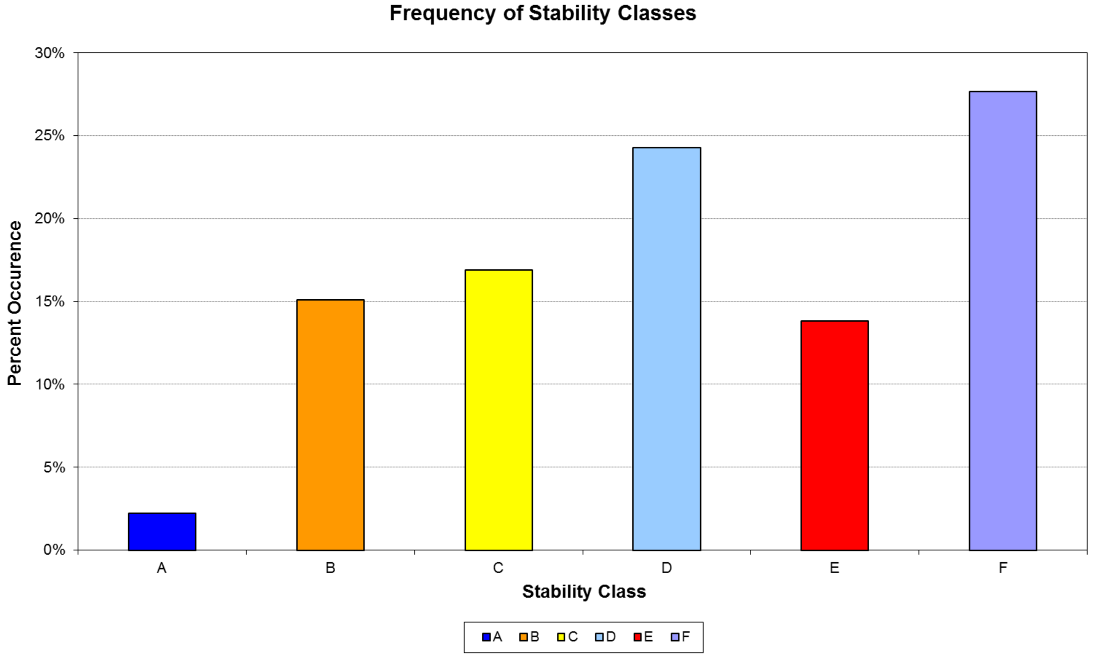


Figure 5.4: Stability Class Frequency (CALMET 2009)

5.1.3 Mixing Height

Mixing height is defined as the height above ground of a temperature inversion or statically stable layer of air capping the atmospheric boundary layer. It is often associated with, or measured by, a sharp increase of temperature with height, a sharp decrease of water-vapour, a sharp decrease in turbulence intensity and a sharp decrease in pollutant concentration. Mixing height is variable in space and time, and typically increases during fair-weather daytime over land from tens to hundreds of metres around sunrise up to 1–3 km in the mid-afternoon, depending on the location, season and day-to-day weather conditions. Sea breezes may, however, introduce complexities to the mixing height. The onset of a sea breeze at a particular location will often bring a reduction in the mixing height.

Mixing heights show diurnal variation and can change rapidly after sunrise and at sunset. Diurnal variation in the minimum, maximum and average mixing depths, based on the CALMET-generated meteorological data for the site, is shown in **Figure 5.5**. As expected, mixing heights begin to grow following sunrise with the onset of vertical convective mixing with maximum heights reached in mid to late afternoon.

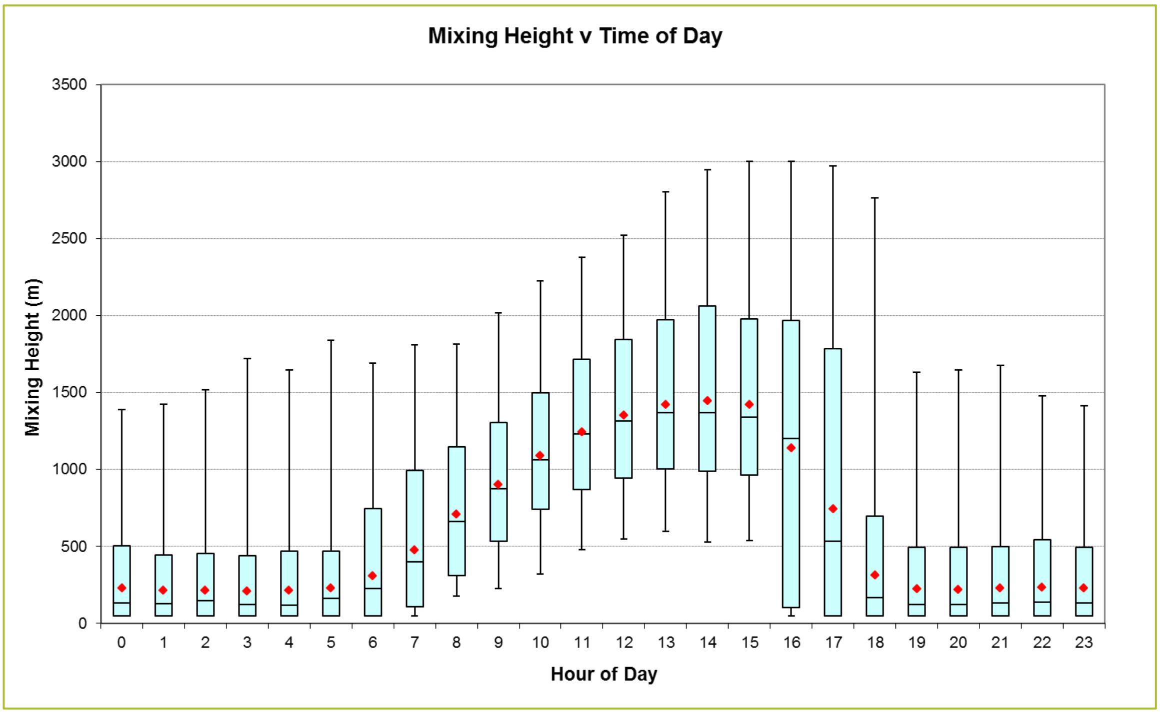


Figure 5.5: Average Daily Diurnal Variation in Mixing Layer Depth (CALMET 2009)

5.2 Dust

In addition to meteorological parameters, the EPA monitoring station at Kembla Grange also measures PM_{10} data using a Tapered Element Oscillating Microbalance (TEOM) system. The PM_{10} data available for 2009 (contemporaneous to the meteorological data summarised in **Section 5.1**), is presented in **Figure 5.6** and is likely to be representative of conditions near the Whytes Gully RRP site. It should be noted that the measurement for the 23rd September 2009 has been removed. There was a severe dust storm across the east cost of NSW and Queensland on that day and the extremely high reading of over 1,000 µg/m^3 is clearly not representative of typical conditions. There were also three other days with unusually elevated 24-hour levels, possibly due to bushfire or dust storm activity also, but generally concentrations are below 25 µg/m^3. The annual average is approximately 21 µg/m^3.

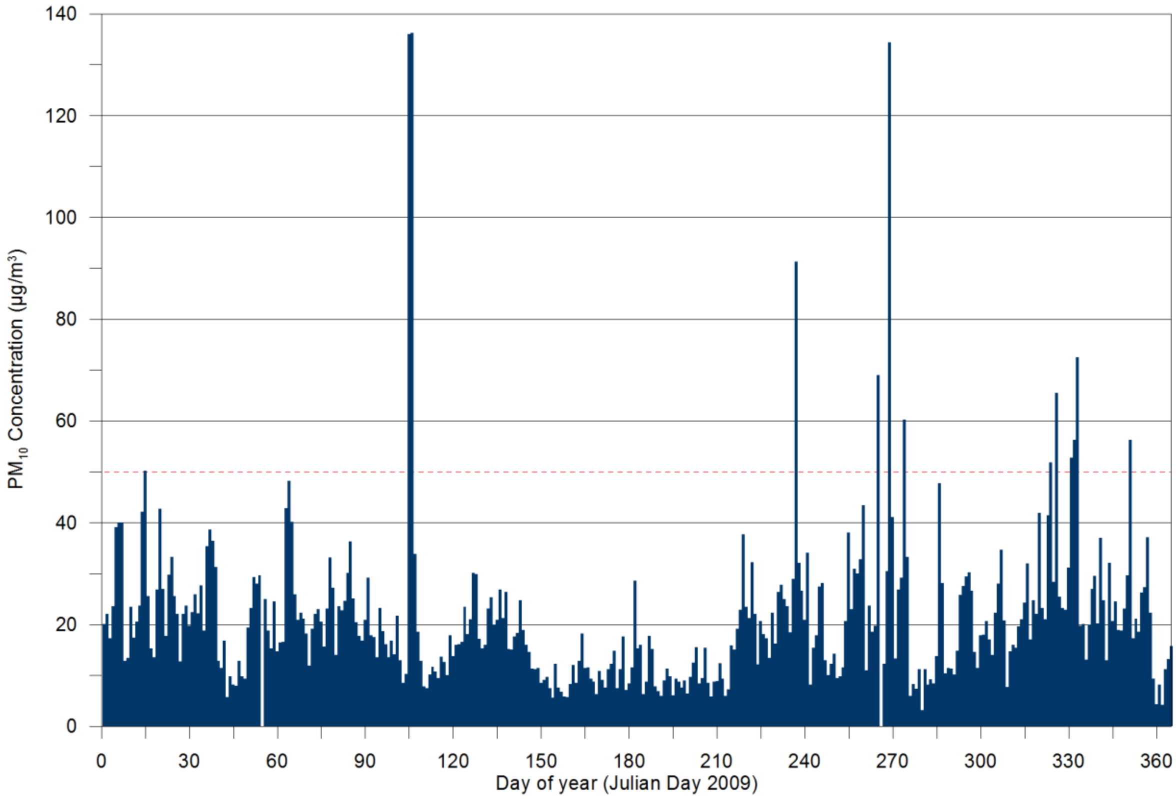


Figure 5.6: 24-hour average PM_{10} concentrations at Kembla Grange (2009)

6 ESTIMATED EMISSIONS

6.1 Odour

One of the main odour source at the Whytes Gully RRP is the active tipping face, while it remains uncovered during daily operations. It will be important that this area is kept to a minimum, particularly during Stage 4 when operations are closest to residences. Other sources include leachate, leachate treatment plant, daily cover area (150 mm of cover over waste), recently covered areas (300 mm of cover over waste), recently vegetated areas and a waste relocation excavation area in Stage 1. This waste relocation area is a recently filled area which is to be excavated and relocated into Stage 1 over the period of one year. The waste relocation area will essentially be similar to that of the active tipping face and daily cover in terms of odour emission. Stage 1 will therefore constitute a worst-case scenario for the residences to the northeast of the site, and for residences in Farmborough Heights. For the remaining residences to the north-northwest, Stage 4 represents a worst-case as operations are proposed to extend to the boundary as shown in **Figure 2.3**.

Table 6.1 presents estimated odour emission rates from the proposed facility. The specific odour emissions rates (SOER) have been determined from site specific odour measurements taken on 24 August 2011. Although there are difficulties in estimating odour emission rates from large area sources such as landfills, where emissions are generally not constant across the site and also vary with time, the results obtained are consistent with measurements made at other landfills in NSW and are therefore considered representative for the areas being modelled in this assessment. The laboratory analysis certificates for the odour measurements are presented in **Appendix B**. As is as yet no waste relocation (cutback) occurring, no direct measurements of this source could be made. This assessment has therefore assumed the highest measured SOER, the active tipping face, to apply to the waste relocation areas.

The modelled areas are conservatively high in order to achieve higher total odour emission rates from each source. Modelling was used to provide an indication of the maximum areas that can be disturbed or maintained at the minimum cover and still achieve compliance with odour goals. These areas are approximately equal to those listed in **Table 6.1**. Further description is provided in **Section 7.1**.

There is a Leachate Treatment Plant on site, which consists of two small tanks with a combined exposed area of of approximately 165 m^2. The conservative estimate of the total leachate area includes this plant, and emission rates would be expected to be similar, if not lower, than those measured for the leachate ponds.

Table 6.1: Measured odour emission rates from the Whytes Gully landfill

Source	Specific odour emission rate (ou.m^3/m^2/s)	Area (m^2)	Total odour emission rate (OU.m^3/s)
Stage 1			
Active tipping face	1.115	1,100	1,227
Waste Relocation area	1.115	1,800	2,007
Daily cover (150 mm)	1.023	19,800	20,255
90 days cover (300 mm)	0.035	14,000	490
Leachate	0.153	5,000	765
Stage 4			
Active tipping face	1.115	1,000	1,115
Daily cover (150 mm)	1.023	1,300	1,330
90 days cover (300 mm)	0.035	7,500	263
Vegetated area	0.035	20,000	700
Leachate	0.153	5,000	765

6.2 Dust

Dust generation during the construction of the new landfill cell, is estimated based on the amount of material being excavated, stockpile areas, on-site traffic movement and areas exposed to wind erosion. Landfilling operations will occur simultaneously with construction and haulage and covering activities have also been taken into consideration.

The operations which apply to each activity have been combined with emission factors developed, both within NSW and by the US EPA, to estimate the total amount of dust produced in during Stages 1 and 4. The emission factors applied are the most up to date methods for determining dust generation rates.

The most significant dust generating activities have been identified and the dust emission estimates are presented in **Table 6.2**. A summary of the emission factors and parameters used to calculate these is shown in **Appendix C**. A section of the construction schedule used to calculate the emissions is shown in **Appendix D**.

Table 6.2: Estimated dust emission rates for worst case year (kg/y)

Activity	Emission Rate (kg/y)			
	Year 1		Year 2	
	TSP	PM_{10}	TSP	PM_{10}
Dozers excavating	26,107	6,309	26,107	6,309
Loading excavated material to trucks	95	45	279	132
Hauling material to stockpiles	1,353	314	3,995	927
Unloading material to stockpiles	95	45	279	132
Loading cover to trucks	259	123	158	75
Hauling cover to active tip face area	7,423	1,722	2,260	524
Unloading cover	259	123	158	75
Spreading cover	17,405	4,206	17,405	4,206
Wind erosion from material stockpiles	438	219	438	219
Wind erosion from exposed working areas	2,190	1,095	1,752	876
Total Dust	**55,625**	**14,200**	**52,831**	**13,475**

7 IMPACT ASSESSMENT

7.1 Odour

The results of the CALPUFF dispersion modelling using the odour emissions data summarised in **Table 6.1** are presented as contour plots in **Figure 7.1** and **Figure 7.2**.

Figure 7.1 shows the predicted 99th percentile odour levels for the proposed Stage 1 operations. It can be seen that the 2 ou contour does not extend to Farmborough Heights, and therefore the proposal complies with the EPA criterion for those residences. This is not to say that the odour will never be detected, but that it is not predicted to be detected more than 1% of the time (88 hours per year) at the relative level.

Figure 7.2 shows the predicted 99th percentile odour levels for the proposed Stage 4 operations. It can be seen that the predicted odour concentration at the nearest residence at the northwest boundary is less than 5 ou (99th percentile). This indicates compliance with the EPA criterion at that location.

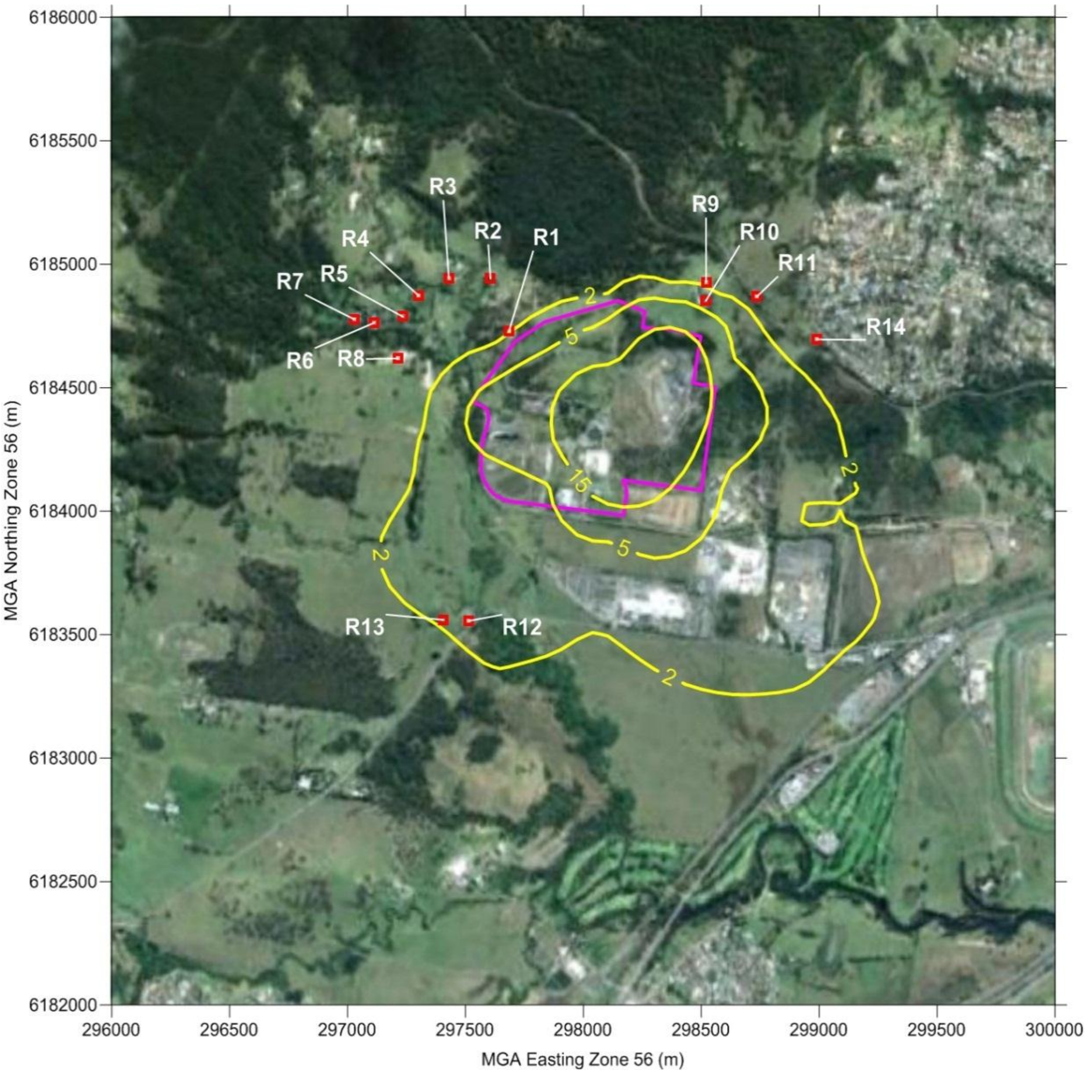
Table 7.1: 1-hour average (99th percentile) odour concentrations at individual residences

Residence ID	Stage 1 (ou)	Stage 4 (ou)
R1	2	3
R2	1	1
R3	1	1
R4	1	1
R5	1	< 1
R6	1	< 1
R7	1	< 1
R8	1	< 1
R9	2	< 1
R10	3	< 1
R11	1	< 1
R12	2	1
R13	2	1
R14	1	< 1

It is worth noting that the contours extend much further from the activity areas in Stage 1 relative to Stage 4. There are two main reasons for this. Firstly, Stage 1 involves excavating the cutback section in the north eastern corner of the site while simultaneously placing waste in the new Stage 1 area. As the waste relocation will involve uncovering recently emplaced putrescible waste, the odour emission rate has been assumed to be the same as that for an active tipping face. Stage 1 will therefore in effect consist of two active tipping areas and a larger daily cover area, and in terms of odour emission, approximately double that of Stage 4.

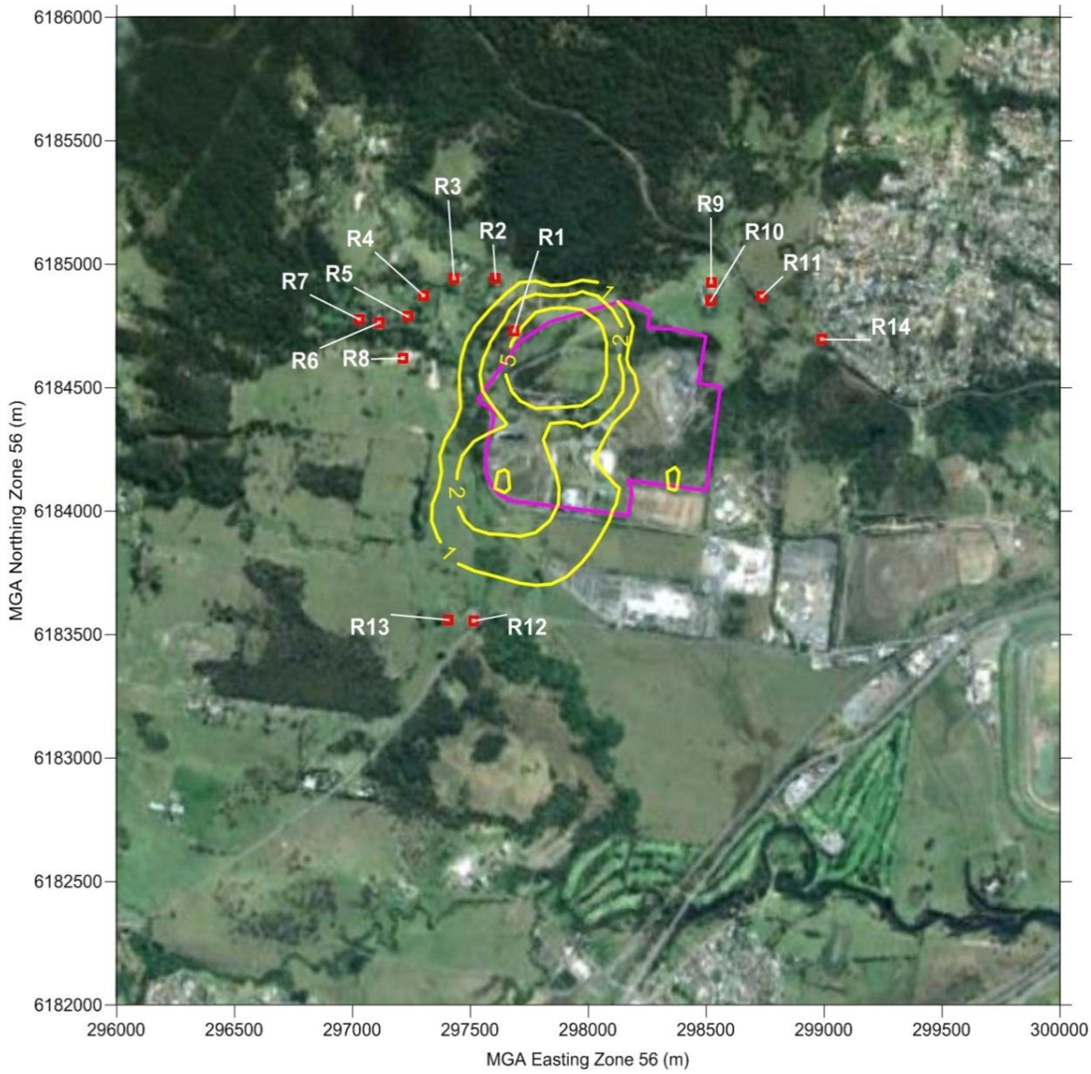
Secondly, as Stage 4 operations approach the western boundary of the site, they become very close to the nearest residence (R1), less than 100 m away. This meant that the combined area of the active tipping face and daily cover areas (those with the highest emission rates) had to be significantly reduced in order to achieve compliance with the EPA criterion at R1.

A number of modelling iterations were run to find the optimum areas that would achieve compliance and they were found to be approximately equal to those listed in **Table 6.1**. In practical terms, this means increasing the areas of 300 mm cover and keeping the active tipping face and daily cover area to a minimum.



Species: Odour	Location: Whytes Gully RRP	Scenario: Stage 1	Percentile: 99th	Averaging Time: Nose response
Model Used: CALPUFF v6.262	**Units:** Odour units (OU)	**Guideline:** EPA =5 OU	**Met Data:** 2009 CALMET-Generated	**Plot:** J. Barnett

Figure 7.1: 99 percentile predicted odour levels for Stage 1 operations



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Whytes Gully RRP	Stage 4	99th	Nose response
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Odour units (OU)	EPA =5 OU	2009 CALMET-Generated	J. Barnett

Figure 7.2: 99 percentile predicted odour levels for Stage 4 operations

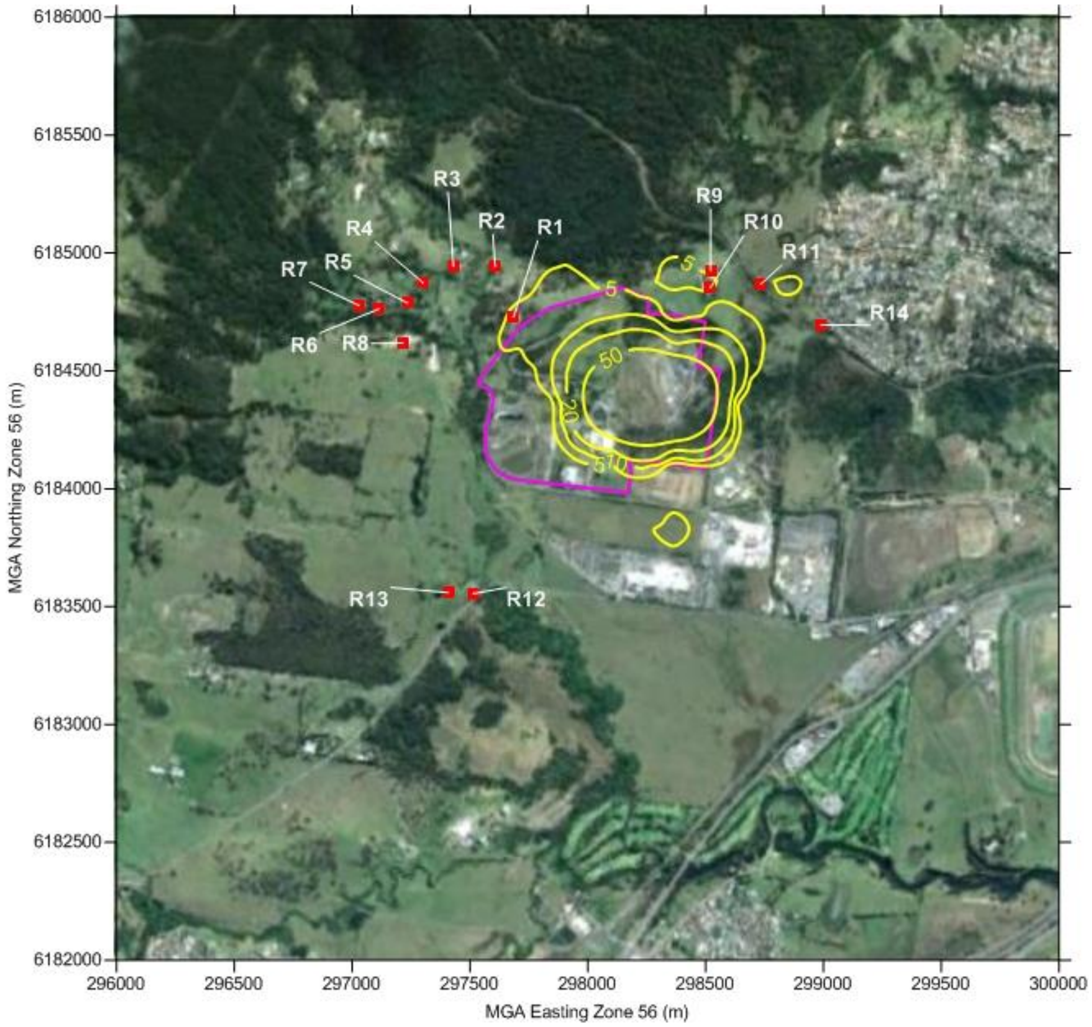
7.2 Dust

7.2.1 Stage 1

The results of the CALPUFF dispersion modelling using the estimated dust emissions summarised in **Table 6.2** are presented as contour plots in **Figure 7.3** to **Figure 7.6**. It can be seen from these plots that that dust levels are predicted to be very low, particularly for annual averages, and well below the relevant criteria.

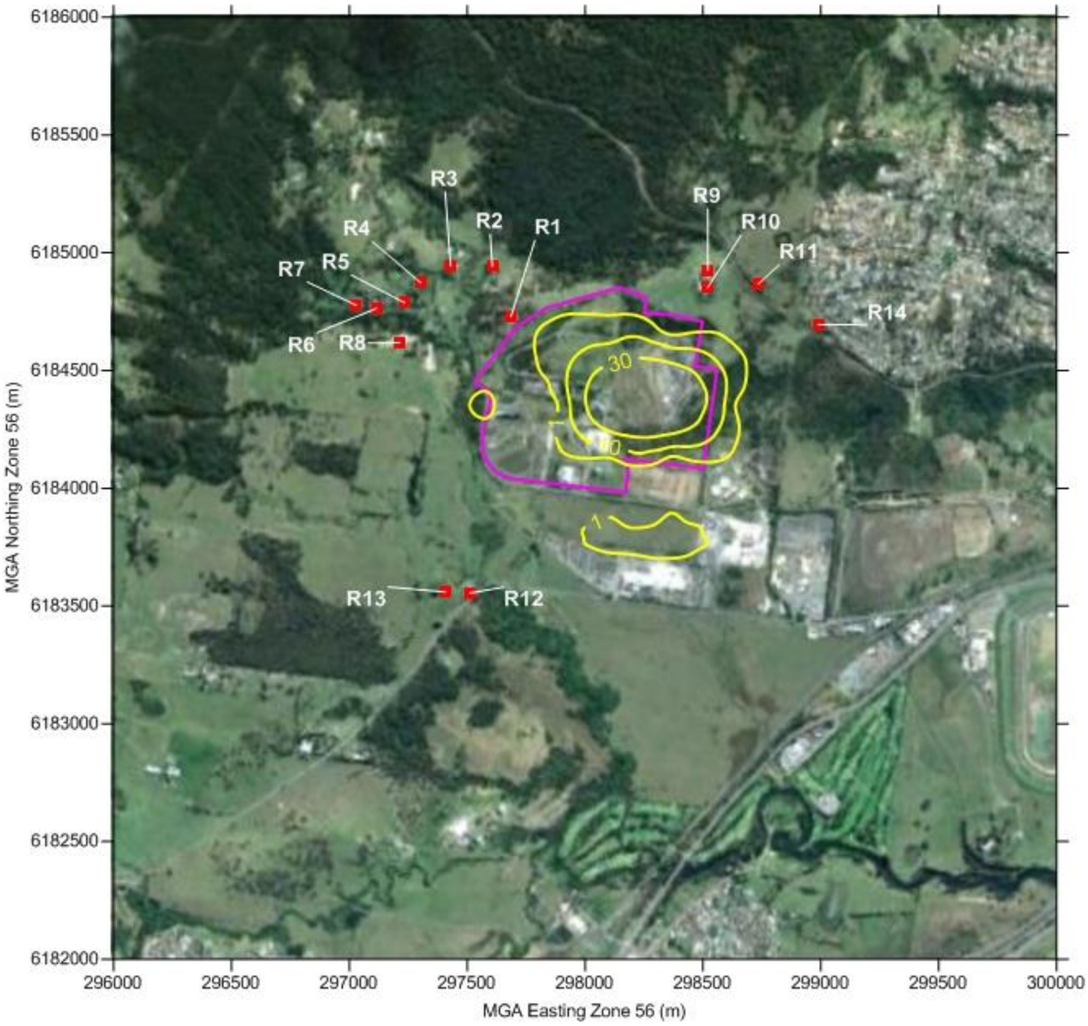
The highest predicted 24-hour PM_{10} concentration of 5.5 µg/m^3 is experienced at R1, the closest residence to the northwest boundary. To exceed 50 µg/m^3 the background PM_{10} concentration on that day would have to be more than 44 µg/m^3. In the monitoring period of 2009, this occurred only 15 times, or 4% of the time. The chance of the maximum concentration occurring at the same time is therefore significantly lower than 4%. There is further discussion on cumulative impacts in **Section 7.2.3**.

It should also be remembered that this would be a conservative methodology given that at least part of the existing background concentrations are due to existing operations at the Whytes Gully RRP and therefore there is an element of double counting in this approach. Notwithstanding this, the operations at the site should be managed so that dust emissions, particularly during construction, are kept to a minimum. Recommended mitigation measures will be discussed further in **Section 8**.



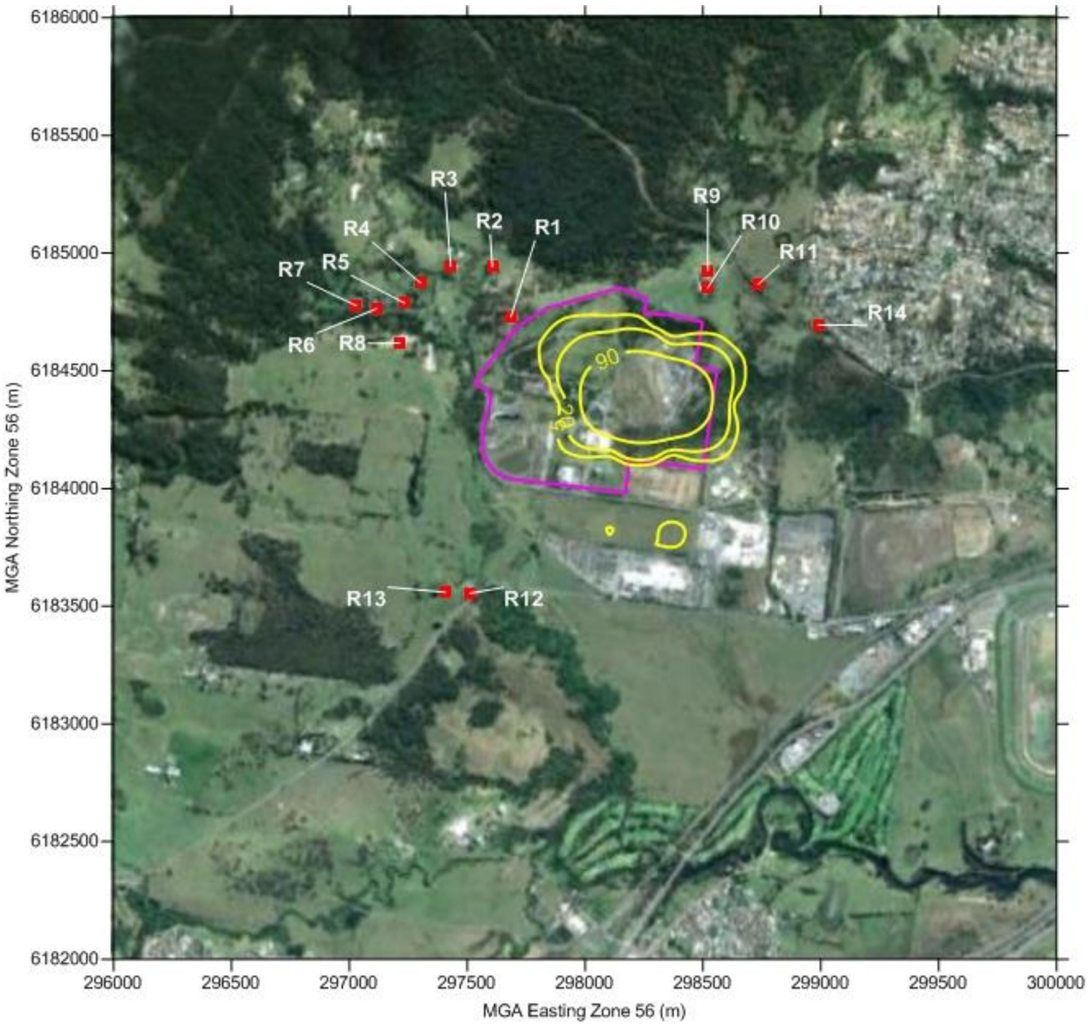
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Whytes Gully RRP	Stage 1	N/A	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Micrograms / cubic metre ($\mu g/m^3$)	50 $\mu g/m^3$	2009 CALMET-Generated	J. Barnett

Figure 7.3: Predicted 24-hour average PM_{10} concentration during Stage 1



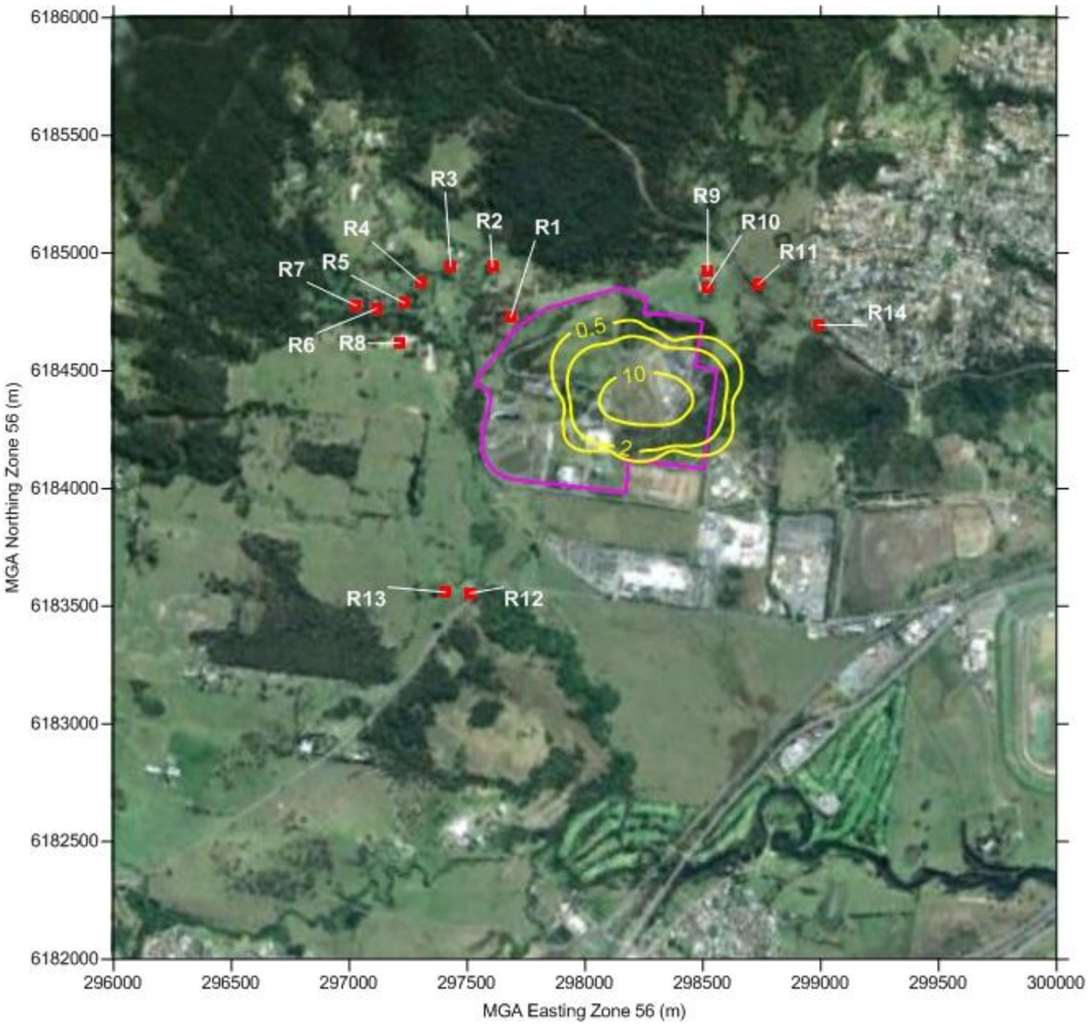
Species: PM$_{10}$	Location: Whytes Gully RRP	Scenario: Stage 1	Percentile: N/A	Averaging Time: Annual
Model Used: CALPUFF v6.262	**Units:** Micrograms / cubic metre (µg/m^3)	**Guideline:** 30 µg/m^3	**Met Data:** 2009 CALMET-Generated	**Plot:** J. Barnett

Figure 7.4: Predicted annual average PM$_{10}$ concentration during Stage 1



Species: TSP	Location: Whytes Gully RRP	Scenario: Stage 1	Percentile: N/A	Averaging Time: Annual
Model Used: CALPUFF v6.262	**Units:** Micrograms / cubic metre (µg/m^3)	**Guideline:** 90 µg/m^3	**Met Data:** 2009 CALMET-Generated	**Plot:** J. Barnett

Figure 7.5: Predicted annual average TSP concentration during Stage 1

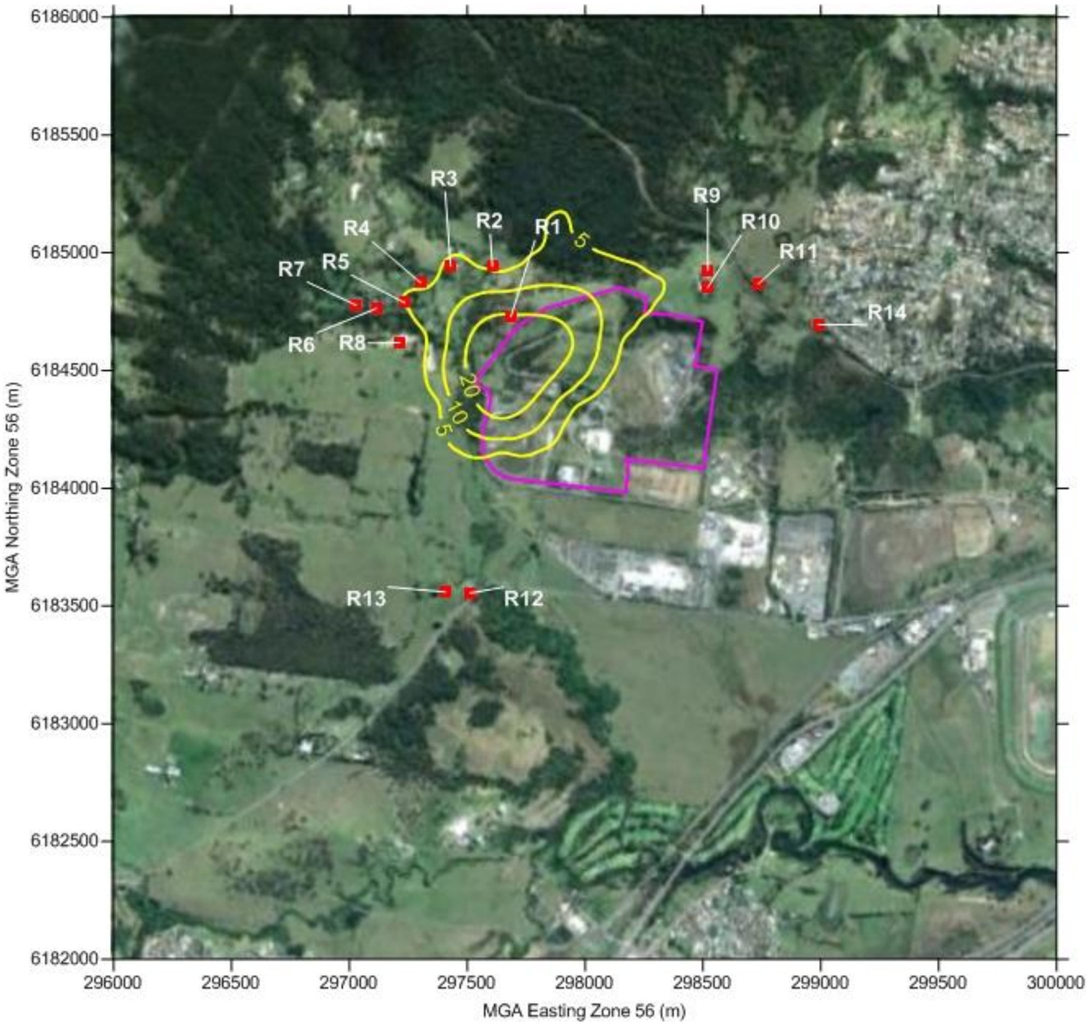


Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Whytes Gully RRP	Stage 1	N/A	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	grams/m^2/month (g/m^2/month)	2 g/m^2/month (Project alone)	2009 CALMET-Generated	J. Barnett

Figure 7.6: Predicted annual average dust deposition during Stage 1

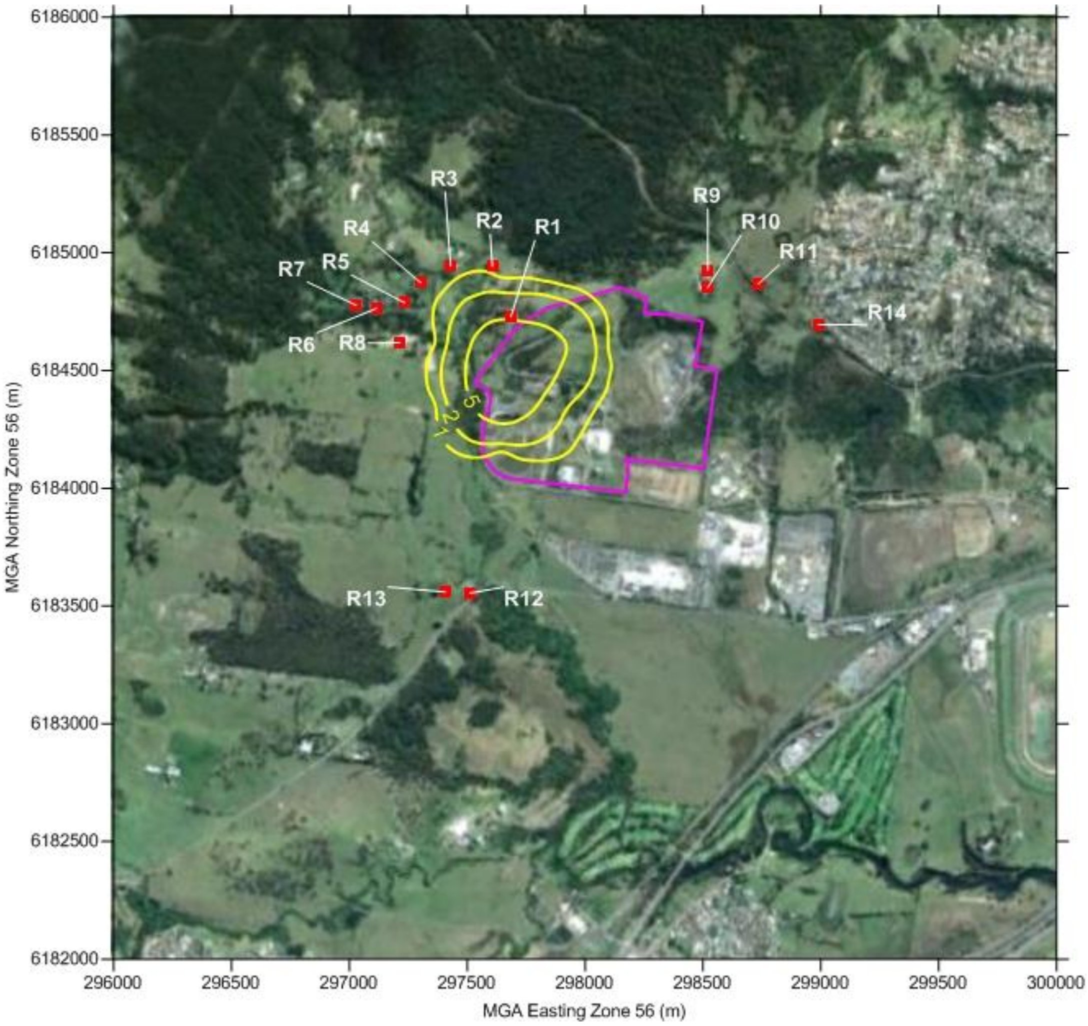
7.2.2 Stage 4

The results of the CALPUFF dispersion modelling using the estimated dust emissions summarised in **Table 6.2** are presented as contour plots in **Figure 7.7** to **Figure 7.10**. It can be seen from these plots that that dust levels are predicted to be very low, particularly for annual averages, and well below the relevant criteria. The highest predicted 24-hour PM_{10} concentration of 18.5 μg/m^3 is experienced at R1, the closest residence to the northwest boundary.



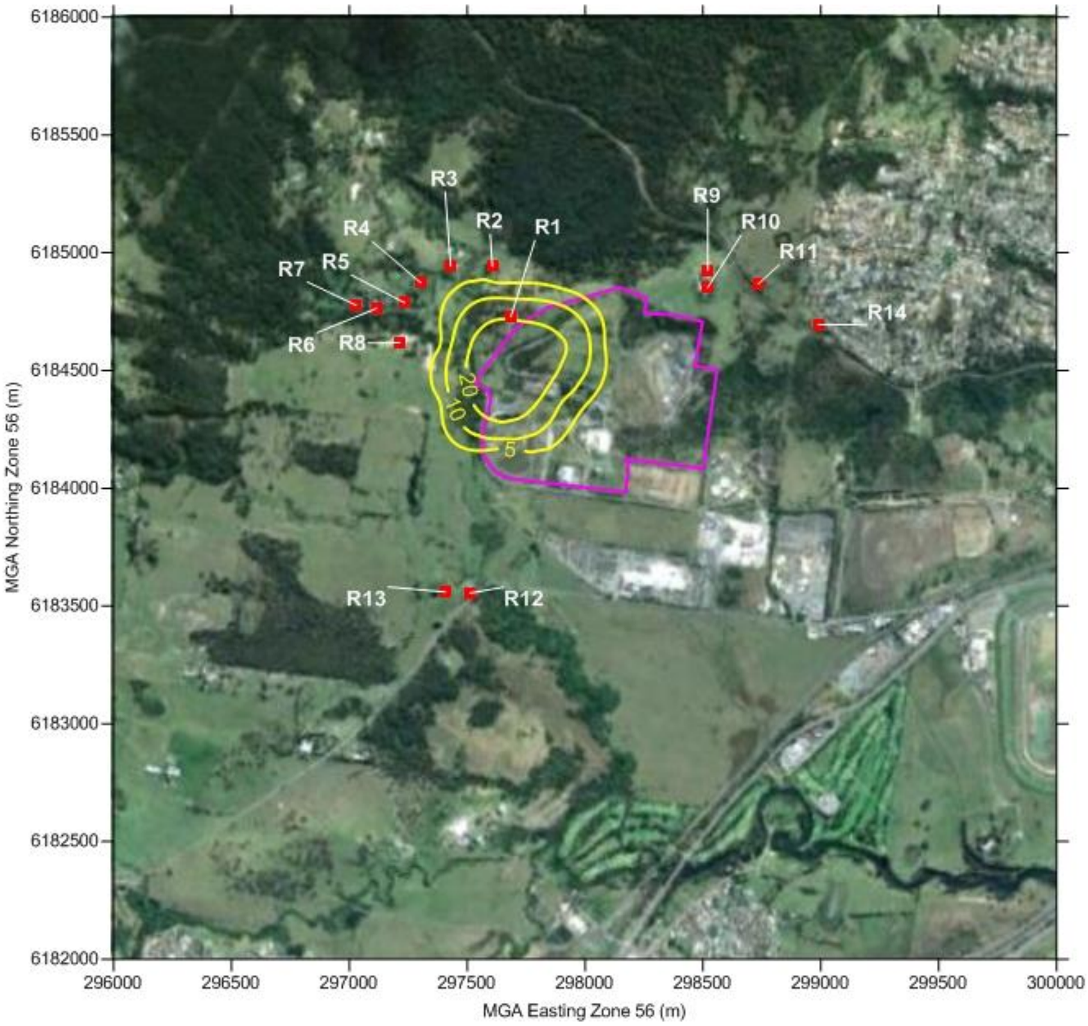
Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
PM_{10}	Whytes Gully RRP	Stage 4	N/A	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Micrograms / cubic metre (μg/m^3)	50 μg/m^3	2009 CALMET-Generated	J. Barnett

Figure 7.7: Predicted 24-hour average PM_{10} concentration during Stage 4



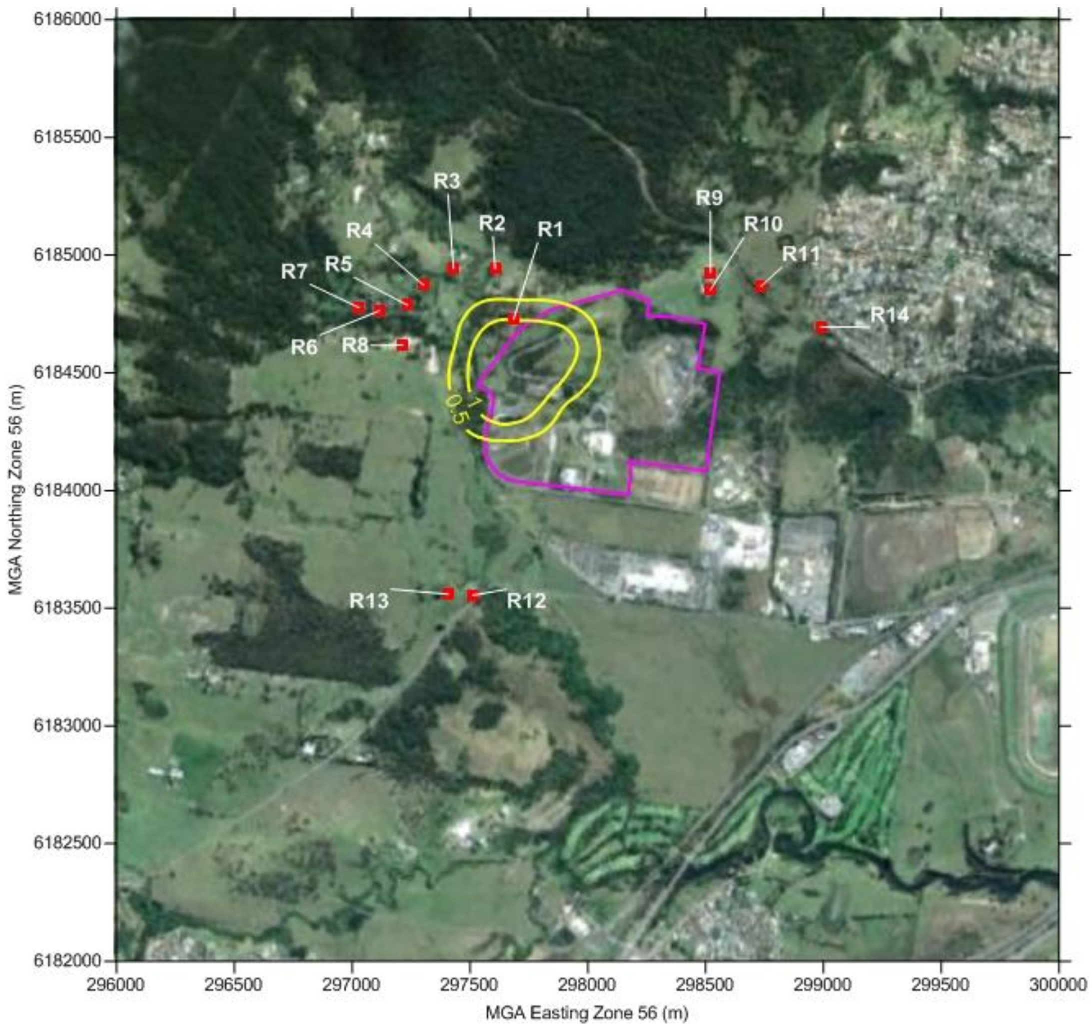
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Whytes Gully RRP	Stage 4	N/A	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Micrograms / cubic metre ($\mu g/m^3$)	30 $\mu g/m^3$	2009 CALMET-Generated	J. Barnett

Figure 7.8: Predicted annual average PM_{10} concentration during Stage 4



Species: TSP	Location: Whytes Gully RRP	Scenario: Stage 4	Percentile: N/A	Averaging Time: Annual
Model Used: CALPUFF v6.262	**Units:** Micrograms / cubic metre (μg/m^3)	**Guideline:** 90 μg/m^3	**Met Data:** 2009 CALMET-Generated	**Plot:** J. Barnett

Figure 7.9: Predicted annual average TSP concentration during Stage 4



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Whytes Gully RRP	Stage 4	N/A	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	grams/m^2/month (g/m^2/month)	2 g/m^2/month (Project alone)	2009 CALMET-Generated	J. Barnett

Figure 7.10: Predicted annual average dust deposition during Stage 4

7.2.3 Cumulative Impacts

It is important to note that it is not possible to accurately predict the cumulative 24-hour PM_{10} concentrations using dispersion modelling, due to the variability in ambient levels and spatial and temporal variation in any day to day anthropogenic activity.

The worst-case 24-hour PM_{10} concentrations are often strongly influenced by other sources in the area, such as bushfires and dust storms, which are essentially unpredictable and that these events dominate the worst-case PM_{10} concentrations.

As discussed earlier, residence R1 is predicted to experience the highest 24-hour PM_{10} concentrations in both Stages 1 and 4. **Figure 7.11** shows a time series of all 24-hour PM_{10} predictions for Stage 4 when operations are closest to R1, with the maximum of 18.6 µg/m^3 occurring on 20th April 2009. The majority (86%) of predictions are well below 10 µg/m^3.

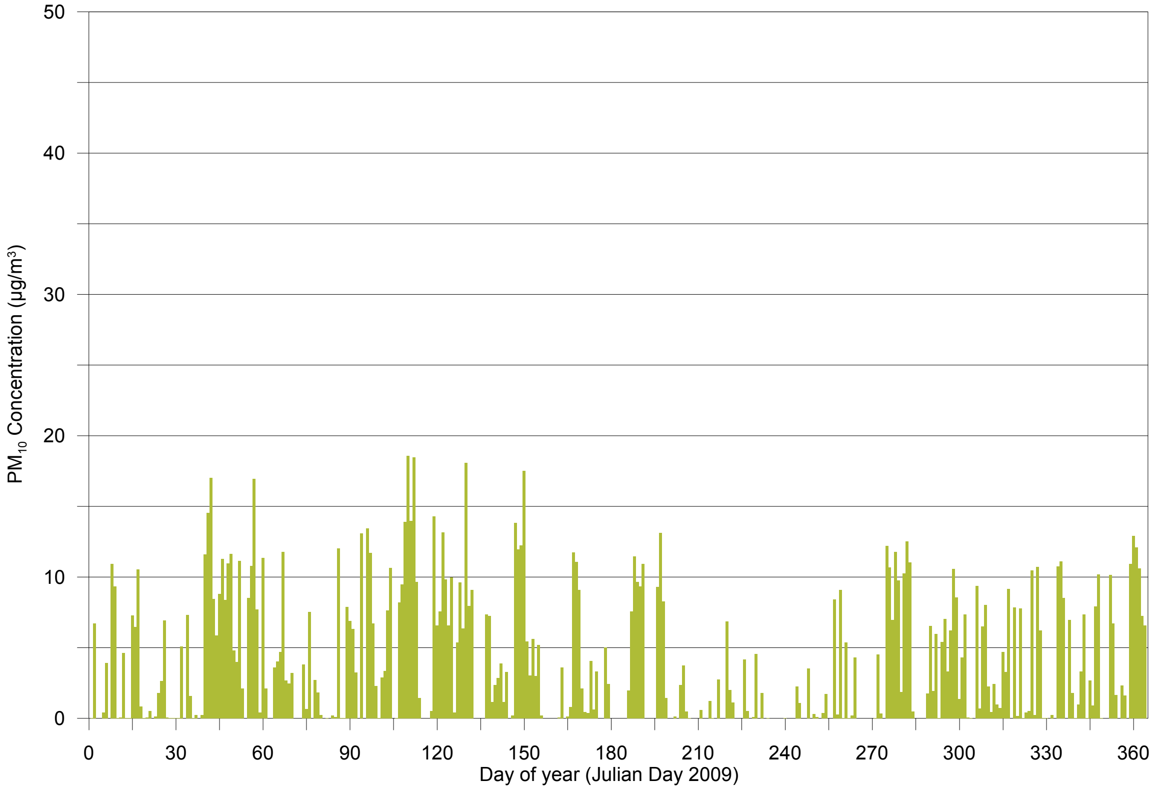


Figure 7.11: Time series of predicted 24-hour average PM_{10} concentrations at R1 during Stage 4

In order to determine what the cumulative impact of the Whytes Gully RRP might be when added to the existing background levels, it is necessary to look at contemporaneous measurements and predictions. **Figure 7.12** shows a time series of the measured 24-hour average PM_{10} concentrations at the EPA's Kembla Grange station, stacked with the predictions at R1 (as shown in **Figure 7.11**). It can be seen that there are 13 exceedances of the 50 µg/m^3 criterion just with the measured concentrations, that is, without any contribution from the Project. There are no occasions where an additional exceedance is predicted due to the Project.

This is also shown in the data presented in **Table 7.2**, where the top 10 measurements and the top 10 predictions throughout the year are shown with their corresponding predictions and measurements, respectively. It can be seen that there are no predicted additional exceedances due to the Project. For completeness, the same results are presented for R1 during Stage 1 (**Table 7.3**), and again, there are not predicted to be any additional exceedances due to to operations at the Whytes Gully site.

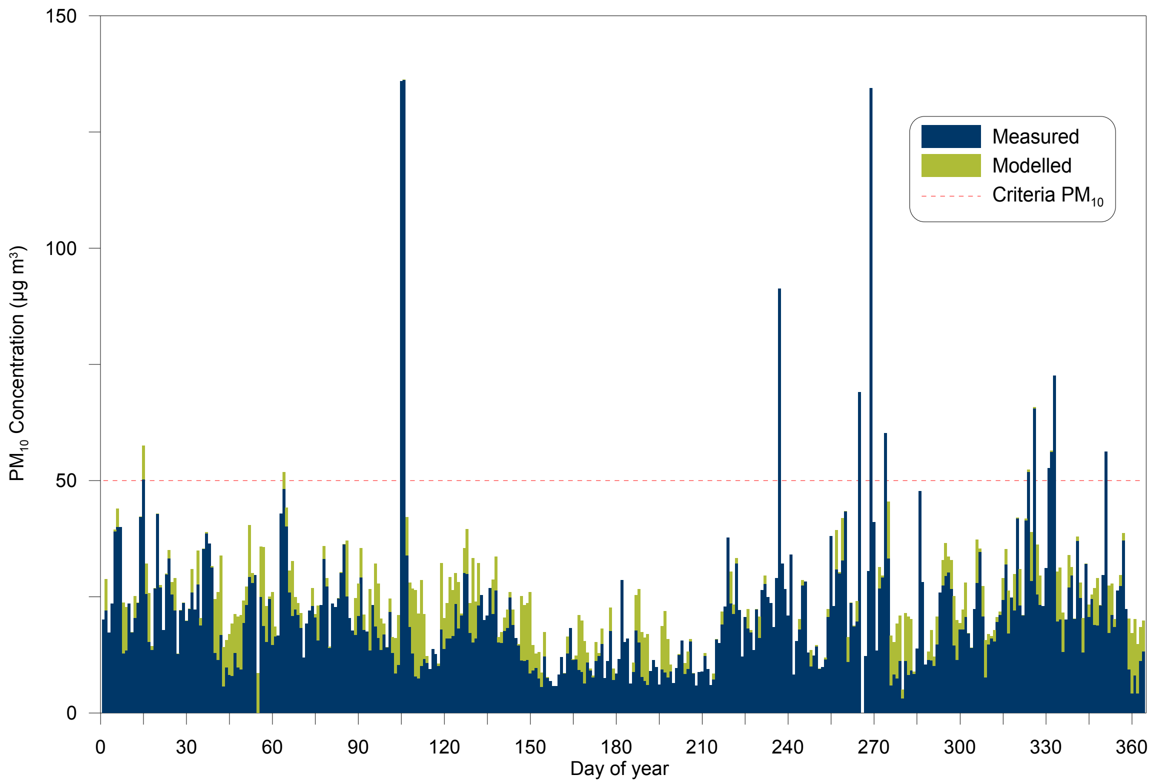


Figure 7.12: Time series of measured and modelled 24-hour average PM_{10} concentrations at R1

Table 7.2: Summary of contemporaneous impact and background levels for R1 during Stage 1

Top 10 measurements (µg/m^3)				Top 10 predictions at R1 (µg/m^3)			
Date	Measured	Predicted increment	Total	Date	Measured	Predicted increment	Total
16/04/2009	136.2	0.0	136.2	20/04/2009	7.9	18.6	26.4
15/04/2009	136.0	0.0	136.0	22/04/2009	10.1	18.5	28.6
26/09/2009	134.4	0.0	134.4	10/05/2009	15.3	18.1	33.3
25/08/2009	91.2	0.0	91.2	30/05/2009	8.5	17.5	26.0
29/11/2009	72.5	0.0	72.5	11/02/2009	16.9	17.0	33.9
22/09/2009	69.0	0.0	69.0	26/02/2009	18.8	16.9	35.7
22/11/2009	65.5	0.2	65.7	10/02/2009	11.4	14.5	26.0
1/10/2009	60.2	0.0	60.2	29/04/2009	17.9	14.3	32.2
17/12/2009	56.2	0.0	56.2	21/04/2009	7.4	14.0	21.4
28/11/2009	56.2	0.2	56.4	19/04/2009	12.8	13.9	26.7

Table 7.3: Summary of contemporaneous impact and background levels for R1 during Stage 4

Top 10 measurements (µg/m³)				Top 10 predictions at R1 (µg/m³)			
Date	Measured	Predicted increment	Total	Date	Measured	Predicted increment	Total
16/04/2009	136.2	0.0	136.2	10/02/2009	11.4	5.5	16.9
15/04/2009	136.0	0.0	136.0	27/12/2009	8.1	4.1	12.2
26/09/2009	134.4	0.0	134.4	21/02/2009	29.3	4.1	33.4
25/08/2009	91.2	0.0	91.2	2/11/2009	28.0	4.0	32.0
29/11/2009	72.5	0.0	72.5	13/11/2009	17.1	3.8	20.9
22/09/2009	69.0	0.0	69.0	21/11/2009	28.4	3.6	32.0
22/11/2009	65.5	0.1	65.6	4/04/2009	13.5	3.5	17.0
1/10/2009	60.2	0.0	60.2	6/04/2009	18.7	3.5	22.2
17/12/2009	56.2	0.0	56.2	15/02/2009	7.9	3.5	11.4
28/11/2009	56.2	0.1	56.3	27/03/2009	25.1	3.4	28.5

Predicted annual average concentrations are well below the EPA criteria. Assuming an annual average existing PM_{10} level of 21 µg/m^3 (see **Section 5.2**), predicted levels of approximately 5 µg/m^3 at the nearest residences will not cause an exceedance of the annual criterion. Similary, predicted TSP and dust deposition levels are extremely low at the nearest sensitive receptors.

8 MITIGATION AND MITIGATION MEASURES

8.1 Odour

Management practices to control odour emissions may include:

- traffic management procedure to co-ordinate the delivery schedule and avoid a queue of the incoming or outgoing trucks for extended periods of time
- spill management procedures to include immediate clean up of any spill/leakage from the incoming and outgoing trucks
- maintaining an odour complaint logbook and in the event of a complaint immediately investigate any unusual odour sources (including spill or leakage in the traffic areas) within the site boundary and take appropriate action to eliminate these
- emplacement of 150 mm of cover material on the active part of the landfill at the end of each working day
- application of an intermediate cover of 300 mm for areas not to be filled for more than 3 months
- restricting the area of the active tipping face and the daily cover area with 150 mm cover, during Stage 4 operations
- using a thicker cover of 300 mm during Stage 4.

8.2 Dust

There are a number of ways in which dust emissions during construction can be kept to a minimum. These include, but at not limited to the following:

- watering of unsealed haul roads and disturbed surfaces (including construction areas)
- restricting the size of disturbed areas as much as practicable
- prevention of truck over-loading and covering dusty loads
- washing down trucks before they leave the site
- temporarily suspending operations under extreme wind speed conditions.

9 CONCLUSIONS

This report has assessed the odour and dust impacts of the Project. Dispersion modelling has been used to predict off-site odour levels due to the activities of two worst-case stages of the Project. The dispersion modelling took account of local meteorological conditions and terrain information and used on-site measurements to determine odour emission rates to predict potential odour impacts at the nearest residences. Dust impacts were also assessed.

Results from the dispersion modelling suggest that the Project would comply with the EPA criteria at both the individual residences and at Farmborough Heights. Active tipping face and daily cover areas with 150 mm cover will need to be restricted during Stage 4 operations and a thicker cover of 300 mm used to help reduce odour emissions and potential impacts at the nearest residence to the northeast boundary.

Dust emissions from the proposed construction operations are minimal. Cumulative dust impacts were also assessed and it was found that the Project would be unlikely to result in cumulative impacts above the criterion. It is predicted that annual average dust concentrations are unlikely to make any noticeable contribution to particulate levels at any of the surrounding receptors.

Mitigation measures have been suggested for both odour and dust to keep emissions to a minimum, particularly dust during construction.

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APPENDIX A

Peak to mean table

Recommended factors for estimating peak concentrations for different source types, distances and stabilities

Source type	Stability	Near field				Far field			p
		i_{max}	x_{max}	P/M 60	P/M 3	i	P/M 60	P/M 3	
Area	Neutral, Convective Stable	0.5 0.5	500 – 1000 300 – 800	2.5 2.3	1.9 1.7	0.4 0.3	2.3 1.9	1.7 1.4	0.15 0.10
Line	Neutral, Convective Stable	1.0 1.0	350 250	6 6	2.8 2.8	0.75 0.65	6 6	2.8 2.8	0.25 0.25
Surface point	Neutral Stable Convective	2.5 2.5 2	200 200 1000	25 25 12	10 10 7	1.2 1.2 0.6	5 - 7 5 - 7 3 - 4	3 3 2.5	0.2 0.2 0.15
Tall point	Neutral, Stable Convective	4.5 2.3	5 h 2.5 h	35 17	8 4	1.0 0.5	6 3	1.3 1.1	0.5 0.5
Wake affected point	Neutral, Convective	0.4	-	2.3	1.4	-	2.3	1.4	0.1
Volume	Neutral, Convective	0.4	-	2.3	1.4	-	2.3	1.4	0.1

i_{max} is maximum centreline intensity of concentration
x_{max} is the approximation location of i_{max} in metres
P/M 60 is the peak-to-mean ratio for long averaging times (typically 1 hour), at a probability of 10^{-3}
P/M 3 is the best estimate of the peak-to-mean ratio for 3 minute averages, at probability 10^{-3}
p is the averaging time power law exponent
h is stack height

Source: **Katestone Scientific (1998)**

APPENDIX B

On-site Odour Measurements

The measured odour concentrations for each area were used to calculate a specific odour emission rate used for modelling. These calculations were based on the cross-sectional area of the flux hood (0.13 m^2) and the sweep air flow rate (3 l/min) through the hood.

THE ODOUR UNIT

THE ODOUR UNIT PTY LIMITED

NATA

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20110826_056

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate (ou.m^3/m^2/s)
6051-3-1	SC11367	25/08/2011 ----	26/08/2011 1029hrs	5	10	-	-	91	91	N/A
6051-2-1	SC11368	25/08/2011 ----	26/08/2011 1059hrs	5	10	-	-	91	91	N/A
6051-4-1	SC11369	25/08/2011 ----	26/08/2011 1132hrs	5	10	-	-	239	239	N/A
6051-3-2	SC11370	25/08/2011 ----	26/08/2011 1213hrs	5	8	-	-	2,660	2,660	N/A
6051-3-3	SC11371	25/08/2011 ----	26/08/2011 1243hrs	5	10	-	-	2,900	2,900	N/A

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty.Ltd:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty. Ltd. have performed the dilution of samples.

APPENDIX C

Dust emission estimation

Stage 1

ACTIVITY - Stage 1 TSP	TSP emission (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	units	Variable 5	units
Dozers excavating	26,107	1,560	h/y	16.7	kg/h	2	moisture content in %	10	silt content in %						
Excavators loading trucks	95	53,735	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling waste to stockpiles	1,353	53,735	t/y	0.0252	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	2.015	kg/VKT	3	% silt content
Unloading waste to stockpiles	95	53,735	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Loading cover to trucks	259	147,369	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling from stockpile to cover area	7,423	147,369	t/y	0.0504	kg/t	40	t/load	60	Vehicle gross mass (t)	1.0	km/return trip	2.015	kg/VKT	3	% silt content
Emplacing cover	259	147,369	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Dozers spreading cover	17,405	1,040	h/y	16.7	kg/h	2	moisture content in %	10	silt content in %						
Wind erosion from stockpiles	438	0.5	ha	0.1	kg/ha/h	8,760	h/y								
Wind erosion from exposed working areas	2,190	2.5	ha	0.1	kg/ha/h	8,760	h/y								

ACTIVITY - Stage 1 PM10	PM10 emission (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	units	Variable 5	units
Dozers excavating	6,309	1,560	h/y	4.0	kg/h	2	moisture content in %	10	silt content in %						
Excavators loading trucks	45	53,735	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling waste to stockpiles	314	53,735	t/y	0.0058	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	0.467	kg/VKT	3	% silt content
Unloading waste to stockpiles	45	53,735	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Loading cover to trucks	123	147,369	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling from stockpile to cover area	1,722	147,369	t/y	0.0117	kg/t	40	t/load	60	Vehicle gross mass (t)	1.0	km/return trip	0.467	kg/VKT	3	% silt content
Emplacing cover	123	147,369	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Dozers spreading cover	4,206	1,040	h/y	4.0	kg/h	2	moisture content in %	10	silt content in %						
Wind erosion from stockpiles	219	0.5	ha	0.05	kg/ha/h	8,760	h/y								
Wind erosion from exposed working areas	1,095	2.5	ha	0.05	kg/ha/h	8,760	h/y								

Stage 4

ACTIVITY - Stage 4 TSP	TSP emission (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	units	Variable 5	units
Dozers excavating	26,107	1,560	h/y	16.7	kg/h	2	moisture content in %	10	silt content in %						
Excavators loading trucks	279	158,610	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling waste to stockpiles	3,995	158,610	t/y	0.0252	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	2.015	kg/VKT	3	% silt content
Unloading waste to stockpiles	279	158,610	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Loading cover to trucks	158	89,739	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling from stockpile to cover area	2,260	89,739	t/y	0.0252	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	2.015	kg/VKT	3	% silt content
Emplacing cover	158	89,739	t/y	0.00176	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Dozers spreading cover	17,405	1,040	h/y	16.7	kg/h	2	moisture content in %	10	silt content in %						
Wind erosion from stockpiles	438	0.5	ha	0.1	kg/ha/h	8,760	h/y								
Wind erosion from exposed working areas	1,752	2.0	ha	0.1	kg/ha/h	8,760	h/y								

ACTIVITY - Stage 4 PM10	PM10 emission (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	units	Variable 5	units
Dozers excavating	6,309	1,560	h/y	4.0	kg/h	2	moisture content in %	10	silt content in %						
Excavators loading trucks	132	158,610	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling waste to stockpiles	927	158,610	t/y	0.0058	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	0.467	kg/VKT	3	% silt content
Unloading waste to stockpiles	132	158,610	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Loading cover to trucks	75	89,739	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Hauling from stockpile to cover area	524	89,739	t/y	0.0058	kg/t	40	t/load	60	Vehicle gross mass (t)	0.5	km/return trip	0.467	kg/VKT	3	% silt content
Emplacing cover	75	89,739	t/y	0.00083	kg/t	1.487	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %						
Dozers spreading cover	4,206	1,040	h/y	4.0	kg/h	2	moisture content in %	10	silt content in %						
Wind erosion from stockpiles	219	0.5	ha	0.05	kg/ha/h	8,760	h/y								
Wind erosion from exposed working areas	876	2.0	ha	0.05	kg/ha/h	8,760	h/y								

APPENDIX D

Construction schedule (in part)

Table D1: Values used for dispersion modelling of Stages 1 and 4

Stage	Life of Cell (Years)	Annual Excavation (m^3)	Annual cover* (m^3)
1	4.1	23,363	64,074
4	7.2	68,961	39,017

* Includes both daily cover and intermediate cover

The excavation and cover values shown in Table D1 were used as annual values for modelling. The total material volumes for the Project have been updated slightly since modelling was carried out, and are summarised below. The modelled values are considered conservative and are considered to provide a worst-case assessment of dust impacts. As shown in **Section 7.2**, even with these assumptions there are not predicted to be any additional exceedances of the air quality criteria.

Stage	Area (m^2)	Airspace (cum)	Life of Cell (Years)	Operation Period	Proposed Capping Construction Period *	Proposed Liner Construction Period *
1	82,000	912,000	4.4	2013 - 2018	2016 - 2019	2013 - 2016
2A	22,500	343,000	2.4	2018 - 2020	2020 - 2021	2017 – 2018
2B	81,200	2,134,000	15.2	2020 - 2035	2023 - 2036	2019 – 2031
3	67,200	1,589,000	11.3	2035 - 2046	2038 - 2047	2035 – 2041
4	69,000	1,007,000	7.2	2046 - 2054	2048 - 2055	2046 – 2050
TOTAL	**321,900**	**5,985,000**	**40.5**			

	Cut (cu.m)	Fill (cu.m.)	Intermediate Cover (cu.m)	Capping (cu.m.)
Stage 1	60,400	98,000	26,000	61,000
Stage 2A	74,000	19,000	4,900	12,000
Stage 2B	25,000	95,000	23,000	54,000
Stage 3	29,000	76,000	23,000	53,000
Stage 4	172,000	44,000	28,000	66,000
Total	**288 400**	**332,000**	**104,900**	**246,000**

APPENDIX I

Traffic and Transport Assessment

Whytes Gully New Landfill Cell

Environmental Assessment

Transport Impact Assessment

transportation planning, design and delivery

Whytes Gully New Landfill Cell

Environmental Assessment

Transport Impact Assessment

Issue: B 08/03/12

Client: Golder Associates
Reference: JS10520
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By
B	08/03/12	Final	Matthew Houlden	Alan Stewart	

GTAconsultants

Certified System Quality ISO 9001

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1. Introduction

1.1 Background

The Whytes Gully Resource Recovery Park is located on Reddalls Road in Kembla Grange and has operated continuously since opening in 1983. The current landfill cells are reaching the end of their life and an extension is being sought to lengthen the life of the existing landfill site.

GTA Consultants was commissioned by Golder Associates in April 2011 to undertake a transport impact appraisal for the proposed development as part of the Environmental Assessment process for the Whytes Gully New Landfill Cell Project.

1.2 Purpose of this report

This report sets out an assessment of the anticipated transport implications of the proposed development, including consideration of the following:

i existing traffic conditions surrounding the site;
ii the traffic generating characteristics of the proposed development during construction and operation;
iii suitability of the proposed access arrangements for the site; and
iv the transport impact of the development proposal on the surrounding road network.

This report also addresses the traffic and transport issues identified in the Director General's Requirements (DGRs) for the project issued 11 August 2011.

1.3 References

In preparing this report, reference has been made to the following:

- Wollongong City Council Development Control Plan (DCP) No. 6, 1991;
- Wollongong City Council DCP 2009 Part D – Locality Based DCPs / Precinct Plans, Chapter D16: West Dapto Release Area;
- RTA Guide to Traffic Generating Developments, Version 2.2, October 2002;
- traffic and car parking surveys undertaken by GTA Consultants and Roar Data as referenced in the context of this report;
- staging plans for the proposed cell construction Drawing 117625003-012 Rev A prepared by Golder Associates dated 10/05/11;
- Director General's Requirements for the project dated 11 August 2011;
- comments from Roads and Maritime Services (RTA) dated 3 August 2011;
- comments from the Office of Environment and Heritage dated 5 August 2011; and
- other documents and data as referenced in this report.

This document generally follows the "RTA Guide to Traffic Engineering Developments" issues to consider when preparing a Traffic Impact Study.

1.4 Consultation

Throughout the project, members of the project team have consulted with Wollongong City Council and correspondence provided by Roads and Maritime Services has been used to guide this assessment.

2. Existing Conditions

The subject site is located on Reddalls Road in Kembla Grange. The site currently has a land use classification of IN2 (Light Industrial) and is occupied by the existing Wollongong Resource Recovery Park.

The surrounding properties include a mix of industrial uses, a cemetery and greenfield sites. The location of the subject site and its surrounding environs is shown in Figure 2.1 and Figure 2.2.

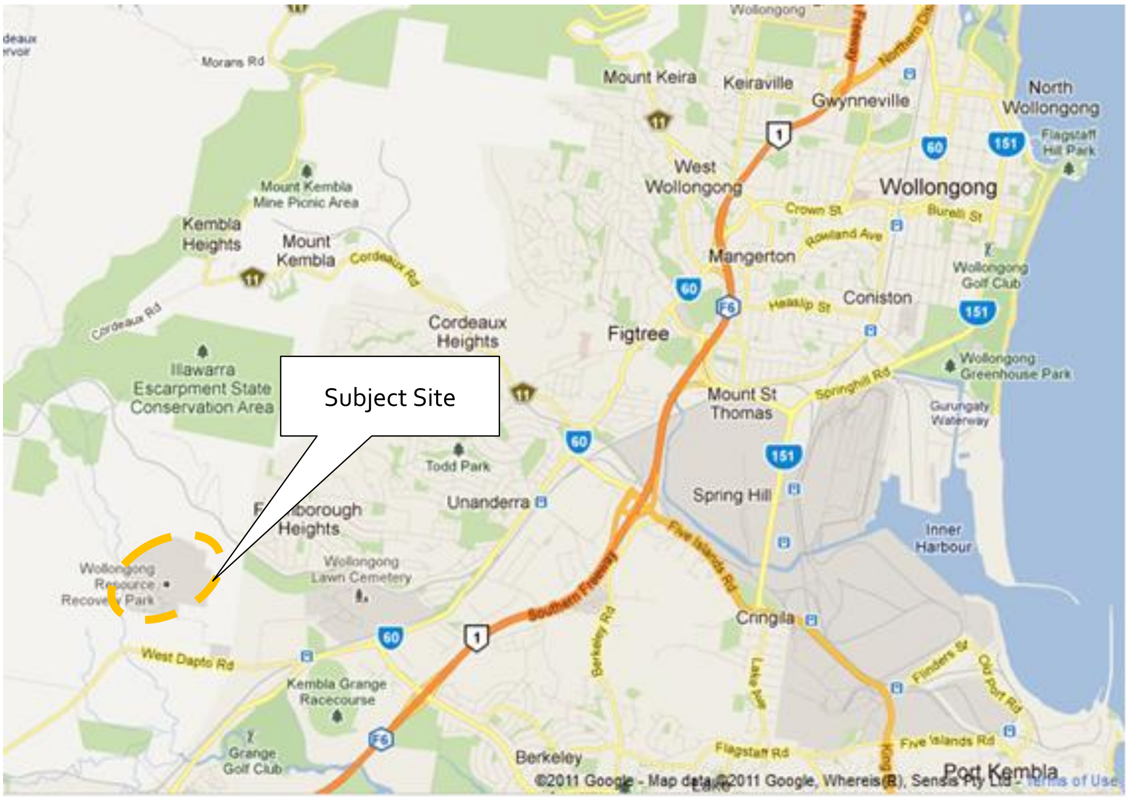


Figure 2.1: Subject site location

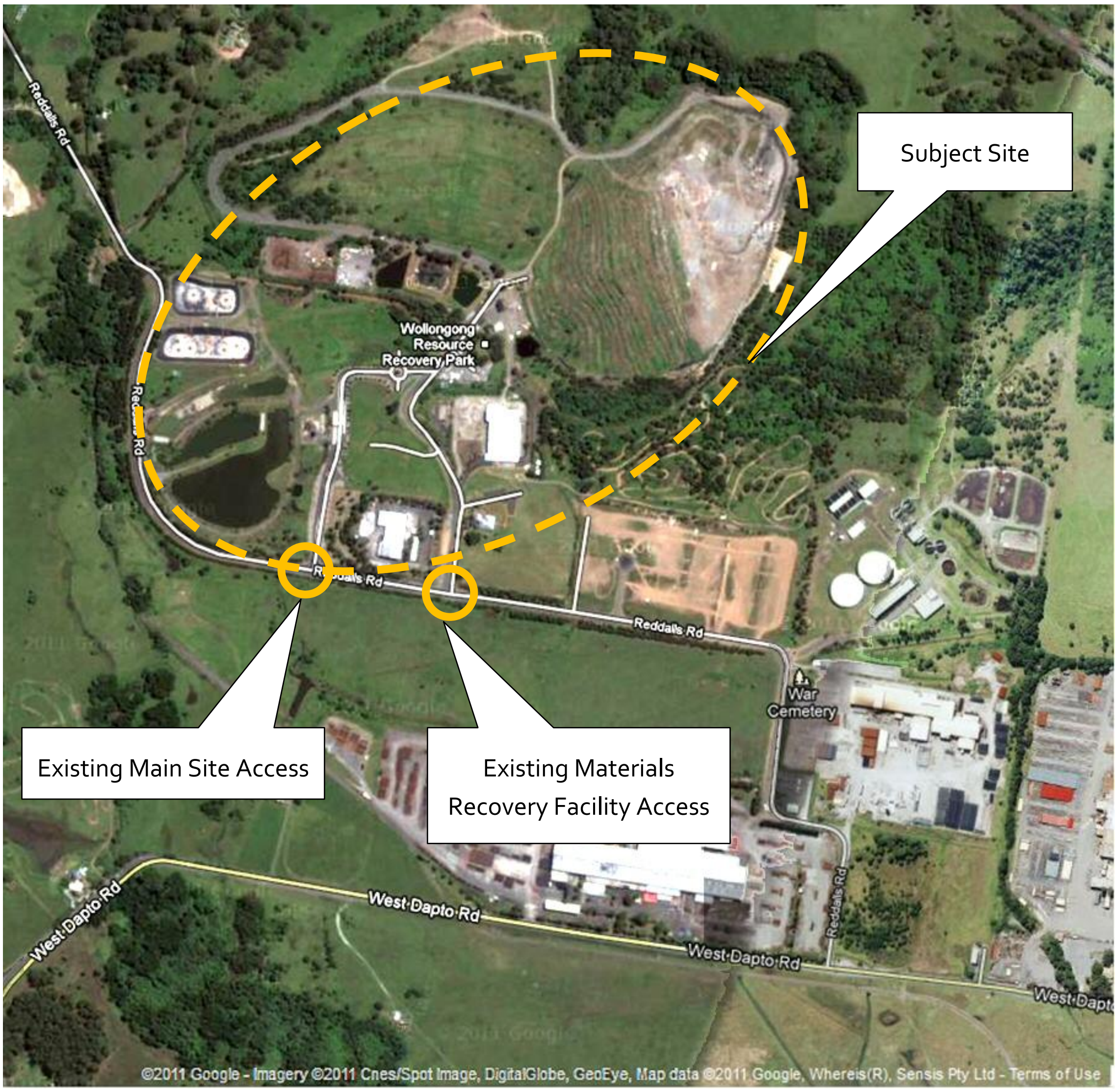


Figure 2.2: Subject site and its surrounds

2.1 Road Network

2.1.1 Adjoining Roads

Reddalls Road

Reddalls Road is a local road under the care control and management of the Wollongong City Council and provides connection to the site from West Dapto Road. It is a two-way road configured with a two-lane (one in each direction), 9.3 metre wide carriageway, set within a 23 metre road reserve (approx).

Reddalls Road is shown in Figure 2.3 and Figure 2.4. At the intersection with West Dapto Road, Reddalls Road carries approximately 840 vehicles per day[1].

1 Based on the peak hour traffic counts undertaken by Roar Data in July 2009 and assuming a peak-to-daily ratio of 10%.

Figure 2.3: Reddalls Road adjacent to subject site main entry (looking east)

Figure 2.4: Reddalls Road adjacent to subject site main entry (looking west)

West Dapto Road

West Dapto Road is a local road under the care control and management of the Wollongong City Council and in the vicinity of the site is a two-way road configured with a two-lane (one in each direction) , 7 metre wide carriageway. At its intersection with Reddalls Road, West Dapto Road has an Auxiliary Right turn (AUR) lane treatment providing an additional lane for vehicles turning right into Reddalls Road.

West Dapto Road is shown in Figures 2.4 and 2.5. Immediately east of Reddalls Road, West Dapto Road carries approximately 3,000 vehicles per day[1].

Figure 2.5: West Dapto Road adjacent to Reddalls Road (looking east)

Figure 2.6: West Dapto Road adjacent to Reddalls Road (looking west)

Princes Highway

The Princes Highway is a Regional Road under the care control and management of Roads and Maritime Services which provides access to the site via connection with West Dapto Road. It is a four-lane (two in each direction), 15 metre wide carriageway and provides a dedicated right turn lane into West Dapto Road.

Princes Highway is shown in Figures 2.5 and 2.6. Immediately north of West Dapto Road, Princes Highway carries approximately 10,300 vehicles per day[2].

Figure 2.7: Princes Highway at the intersection with West Dapto Road (looking north)

Figure 2.8: Princes Highway at the intersection with West Dapto Road(looking south)

2.2 Existing Site Staff Numbers

Information provided by Wollongong City Council indicates that there up to 10 staff on-site during the week and five staff working on the weekend. Information provided indicates that all staff currently drive to work on their own.

2.3 Opening Hours

Existing opening hours for the site are as follows:

- Monday to Friday: 7:30am to 4:30pm
- Saturday, Sunday and Public Holidays: 8:00am to 4:00pm.

2.4 Existing Traffic Route to and from the Site

Due to its location, the majority of traffic accesses the site from the east via Reddalls Road, West Dapto Road and the Princes Highway.

2.5 Traffic Volumes

The existing traffic volumes for surrounding intersections and the subject site are summarised in the following sections.

2.5.1 Surrounding Intersections

GTA Consultants commissioned Roar Data to undertake traffic movement counts at the intersections of Reddalls Road/West Dapto Road and West Dapto Road/Princes Highway on Thursday 2 July 2009 during the following peak periods:

2 Based on the peak hour traffic counts undertaken by Roar Data in July 2009 and assuming a peak-to-daily ratio of 10%.

- 7:00am and 9:00am; and
- 4:00pm and 6:00pm.

The AM and PM peak hour traffic volumes are summarised in Figure 2.9 to Figure 2.12 with full results contained in Appendix A.

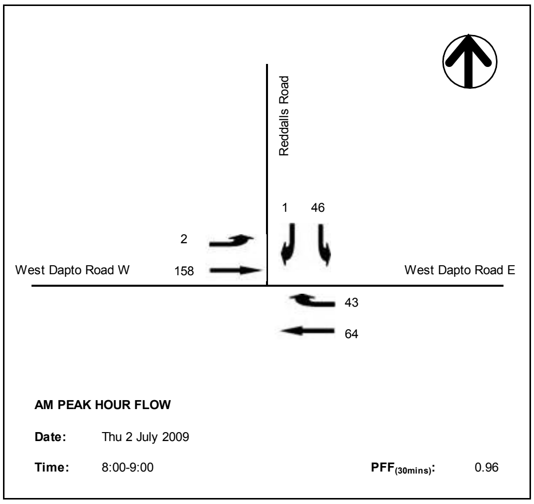


Figure 2.9: AM Peak hour traffic volumes - West Dapto Road/ Reddalls Road

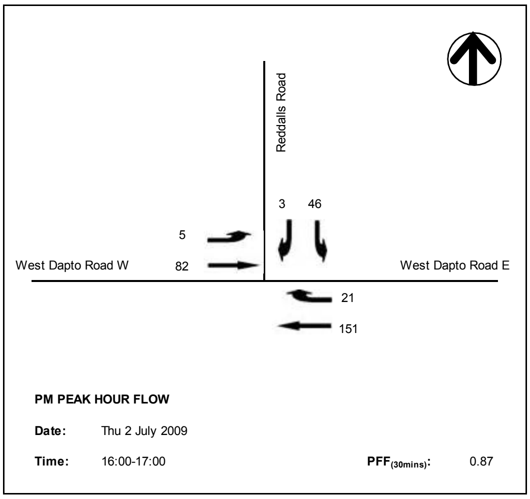


Figure 2.10: PM Peak hour traffic volumes - West Dapto Road/ Reddalls Road

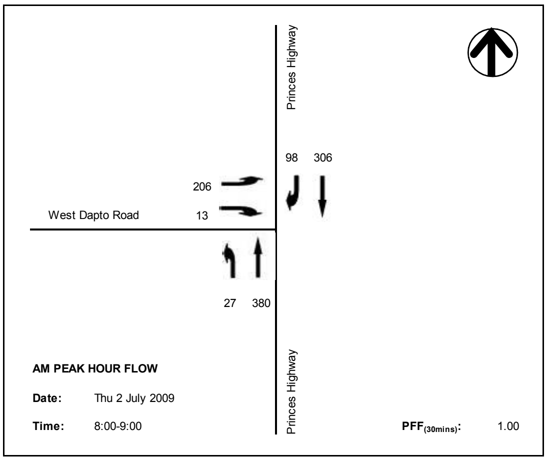


Figure 2.11: AM Peak hour traffic volumes - West Dapto Road/ Princes Highway

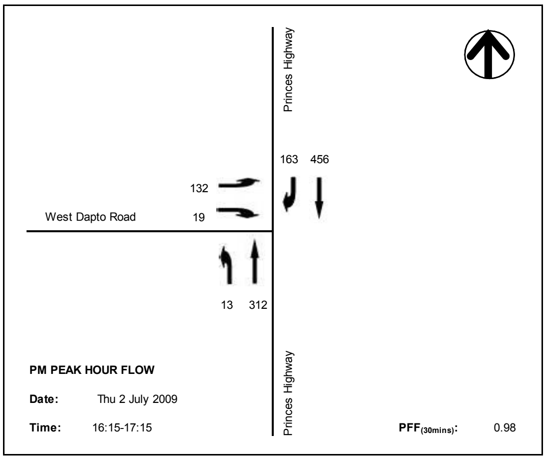


Figure 2.12: PM Peak hour traffic volumes - West Dapto Road/ Princes Highway

2.5.2 Existing Subject Site Volumes

Information on the existing traffic volumes for the main site entrance between Saturday 28 August 2010 and Sunday 28 August 2011 was provided by Wollongong City Council. The information provided indicated that the site (not including the Materials Recovery Facility (MRF) and Glengarry Cottage) currently caters for 108,568 inbound movements over the course of a year. Based on 364 operating days (the site is only closed on Christmas day), this equates to an average of 298 inbound movements per day. Doubling the inbound total to determine the inbound and outbound movements, equates to an average total of 596 movements per day for the site. Detailed weighbridge information is provided in Appendix B.

It is noted that this includes an average of 147 daily movements associated with green waste which will be relocated off-site during January 2012.

GTA Consultants commissioned Roar Data to undertake traffic movement counts at the existing main site access intersection as well as the secondary entrance on Reddalls Road (which provides access to the existing MRF and Glengarry Cottage) on Wednesday 26 October 2011 during the following peak periods:

- 7:00am and 9:00am; and
- 3:00pm and 5:00pm.

The AM and PM peak hour traffic volumes are summarised in Figure 2.13 and Figure 2.14 with full results contained in Appendix A.

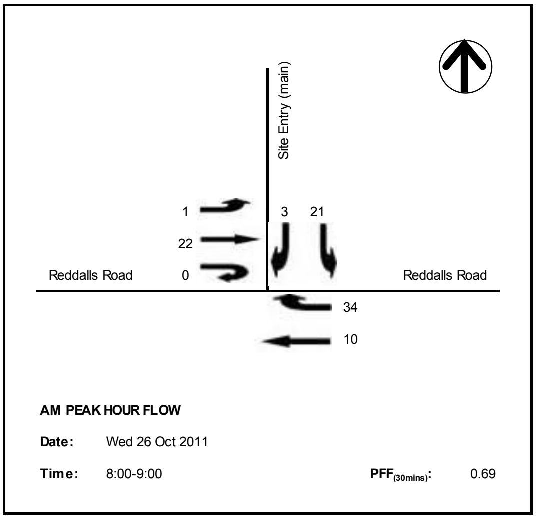


Figure 2.13: AM Peak hour traffic volumes Main Site Access / Reddalls Road

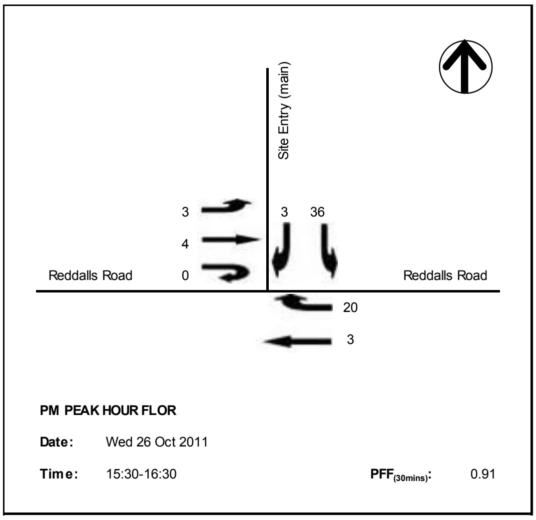


Figure 2.14: PM Peak hour traffic volumes – Main Site Access / Reddalls Road

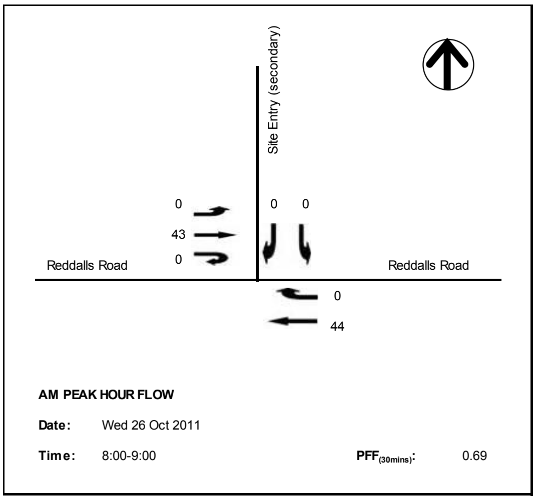


Figure 2.15: AM Peak hour traffic volumes – Secondary Site Access / Reddalls Road

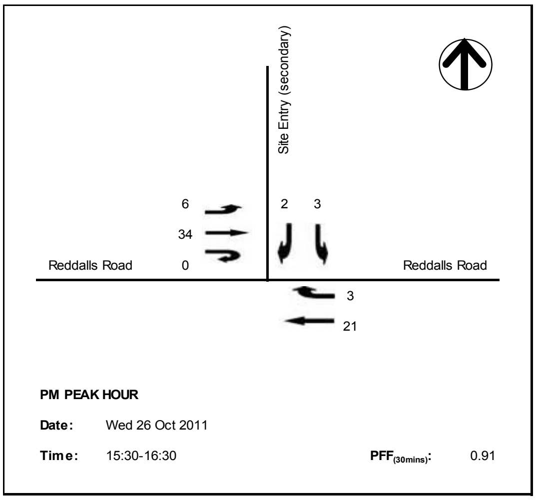


Figure 2.16: PM Peak hour traffic volumes – Secondary Site Access / Reddalls Road

GTA Consultants undertook additional counts on Wednesday 9 November 2011 between 2:30pm and 3:30pm. These results are provided in Figure 2.17 and Figure 2.18 with full results in Appendix A.

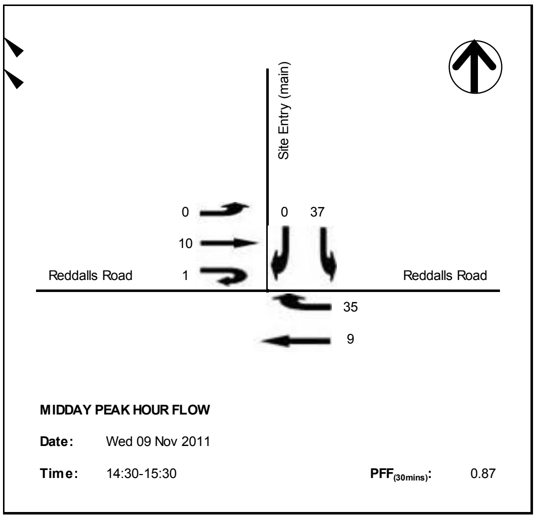


Figure 2.17: Midday peak hour traffic volumes – Main Site Access / Reddalls Road

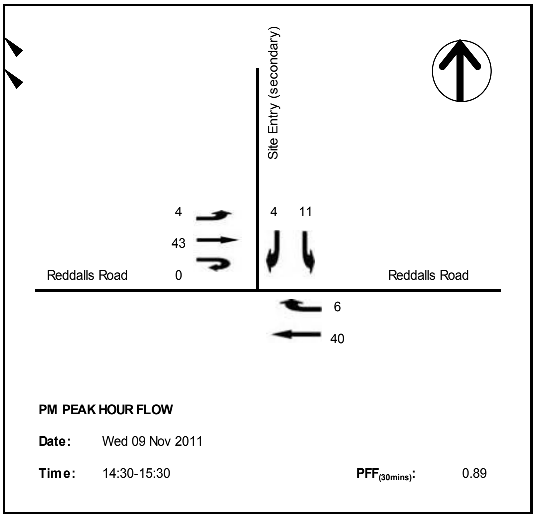


Figure 2.18: Midday peak hour traffic volumes – Secondary Access / Reddalls Road

2.6 Intersection Operation

The operation of key intersections in the vicinity of the subject site have been assessed using SIDRA INTERSECTION 5.1[3], a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by the RTA, is vehicle delay. SIDRA INTERSECTION 5.1 determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 2.1 shows the criteria that SIDRA INTERSECTION 5.1 adopts in assessing the level of service.

Table 2.1: SIDRA INTERSECTION Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Give Way & Stop Sign Intersections
A	0 to 14	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity, accident study required
E	57 to 70	At capacity, requires other control mode
F	Greater than 70	Extreme delay, major treatment required
NA	Not Applicable	Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

Table 2.2 presents a summary of the existing operation of the intersection, with full results presented in Appendix C of this report.

3 Program used under license from Akcelik & Associates Pty Ltd.

Table 2.2: Existing operating conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Reddalls Road/ West Dapto Road	AM	West Dapto Road (E)	0.08	6	4	NA
		Reddalls Road (N)	0.07	14	2	A
		West Dapto Road (W)	0.09	0	0	NA
	PM	West Dapto Road (E)	0.10	2	5	NA
		Reddalls Road (N)	0.05	11	1	A
		West Dapto Road (W)	0.05	1	0	NA
Princess Highway/ West Dapto Road	AM	Princess Highway (S)	0.11	1	0	NA
		Princess Highway (N)	0.18	4	6	NA
		West Dapto Road (W)	0.27	17	8	B
	PM	Princess Highway (S)	0.09	0	0	NA
		Princess Highway (N)	0.22	3	8	NA
		West Dapto Road (W)	0.16	17	4	B
Reddalls Road / Site Access	AM	Reddalls Road (E)	0.04	9	1	NA
		Site Access (N)	0.04	6	1	A
		Reddalls Road (W)	0.02	0	0	NA
	Midday	Reddalls Road (E)	0.04	9	2	NA
		Site Access (N)	0.06	5	2	A
		Reddalls Road (W)	0.01	1	0	NA
	PM	Reddalls Road (E)	0.01	14	0	NA
		Site Access (N)	0.04	5	1	A
		Reddalls Road (W)	0.00	6	0	NA

Table 2.2 indicates that the intersections of Reddalls Road/ West Dapto Road and Princess Highway/ West Dapto Road and the main site access currently operate well with minimal queues and delays on all approaches. This was verified during on-site observations.

A summary of the existing traffic conditions is provided in Figure 2.19 and Figure 2.20.

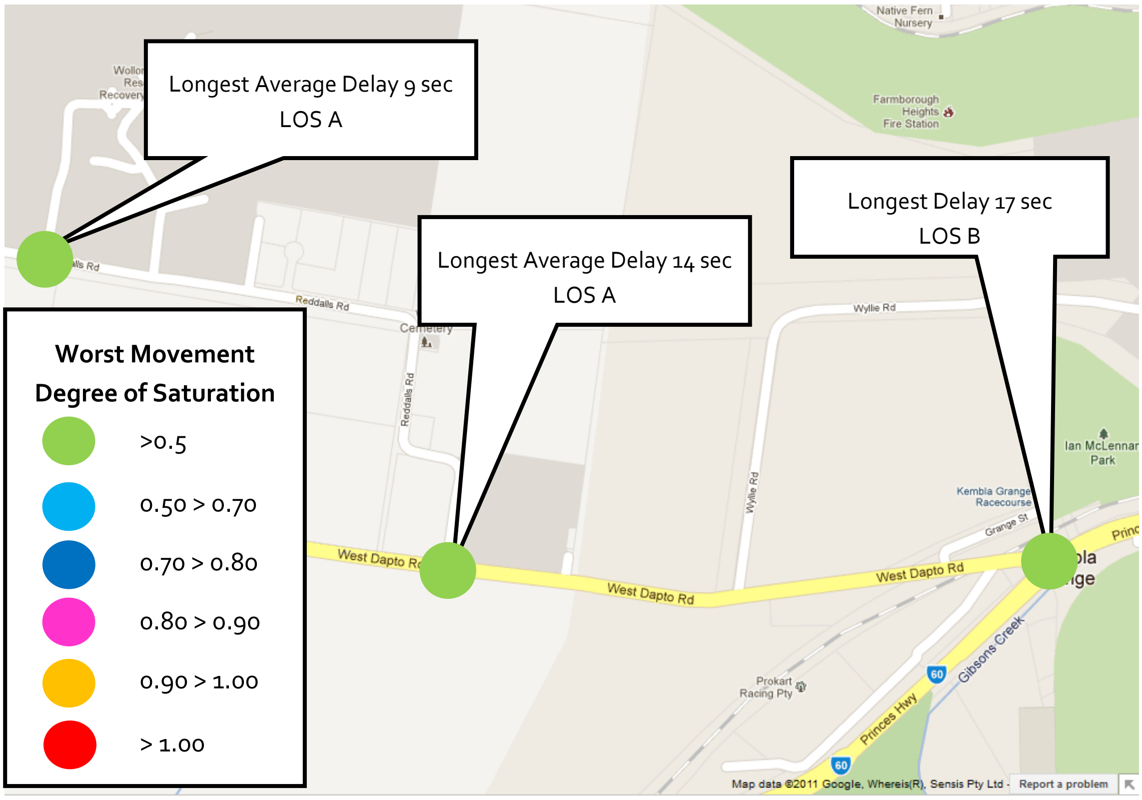


Figure 2.19: Existing AM intersection operation

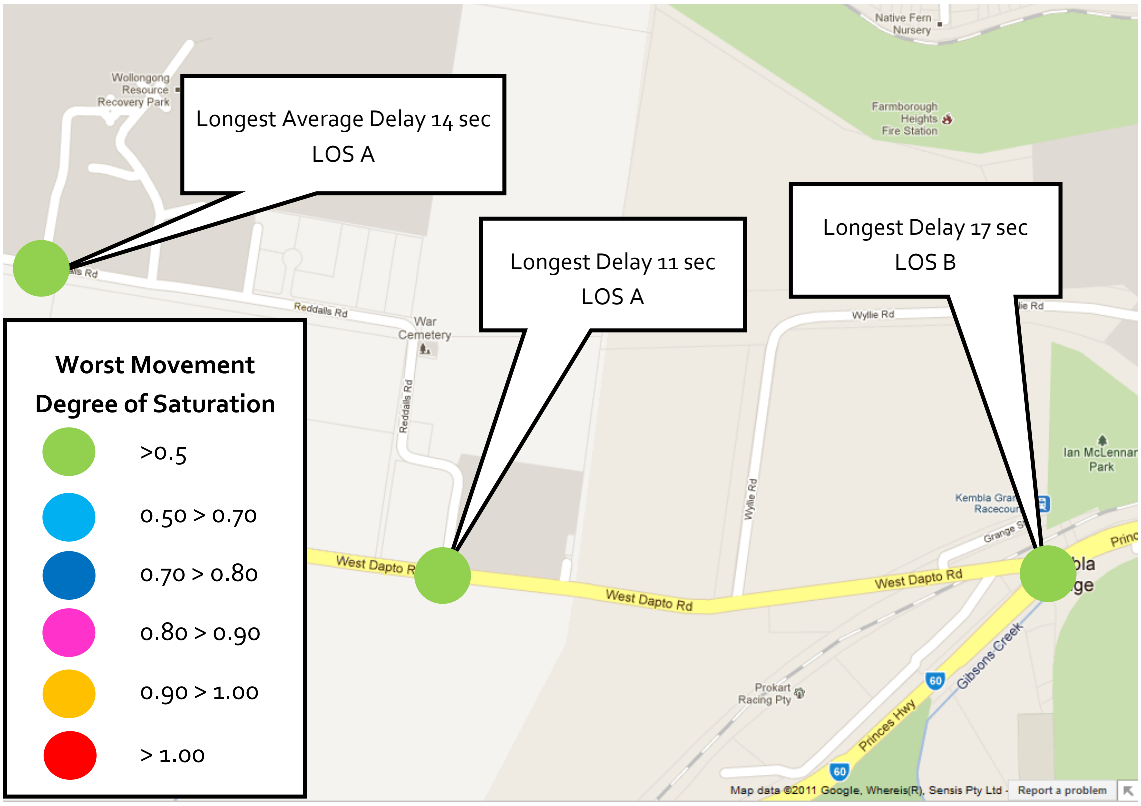


Figure 2.20: Existing PM intersection operation

2.7 Public Transport

A review of the public transport services available in the vicinity of the site is summarised in Table 2.3.

Table 2.3: Public transport provision

Service	Route	Route Description	Location of Stop	Distance to Nearest Stop	Frequency On/Off peak
Bus	37,57	University link via Wollongong, Shellharbour Square, Dapto, Unanderra and Wollongong	Along the Princes Highway near West Dapto Road	Approx. 2km from site	hourly on/off peak
	31,33	Wollongong to Dapto via Wollongong Hospital, Figtree, Unanderra & Kanahooka			hourly on/off peak
	43	Port Kembla to Dapto via Kanahooka and Berkeley			hourly on/off peak
Train	South Coast Line	Kembla Grange Racecourse/ South Coast Line	The train station is located on the Princes Highway close to the intersection with West Dapto Road.	Approx. 2km from site	Limited Use Station

There is limited public transport access to the site with buses only travelling on the Princes Highway with no services using West Dapto Road or travelling through Kembla Grange. The Kembla Grange train station, which from observation, has relatively low use outside racecourse event days, and the nearest bus stops are also located approximately 2 kilometres from the site.

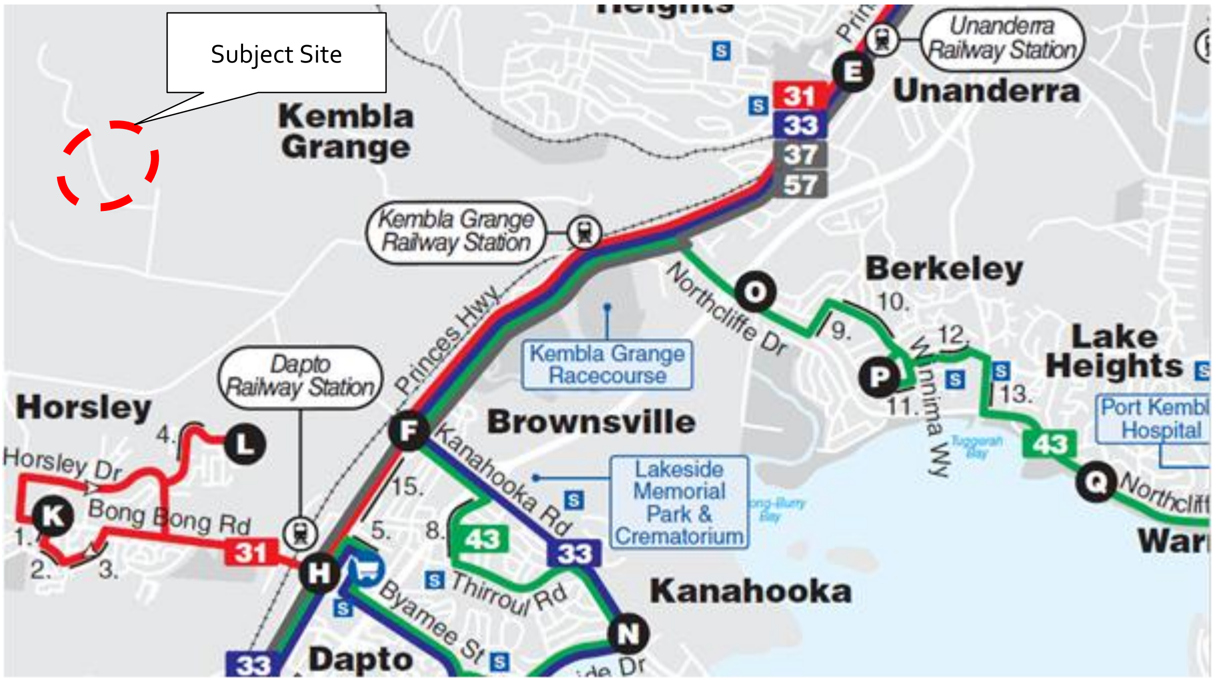


Figure 2.21: Public transport map

2.8 Pedestrian Infrastructure

There is no pedestrian infrastructure in the vicinity of the site along Reddalls Road.

2.9 Cycle Infrastructure

GTA Consultants has reviewed Wollongong City Council's 2006-2011 Bikeplan which indicates existing and proposed network routes within the area. There are no existing or proposed cycle routes or cycle facilities within the immediate vicinity of the site.

2.10 West Dapto Access Strategy

The ultimate West Dapto Land Release Area is located 12km south of Wollongong and covers an area of approximately 4,700 hectares. The release area would provide an additional 17,000 dwellings, 50,000 people and 184 hectares of employment land over the coming decades[4]. Access to the urban release area is currently restricted to three roads and an increase in road capacity is required to support the ultimate development. Wollongong Council has set a staged access strategy to improve road links and support the planned development. This strategy is summarised in Table 2.4.

4 wollongong.nsw.gov.au

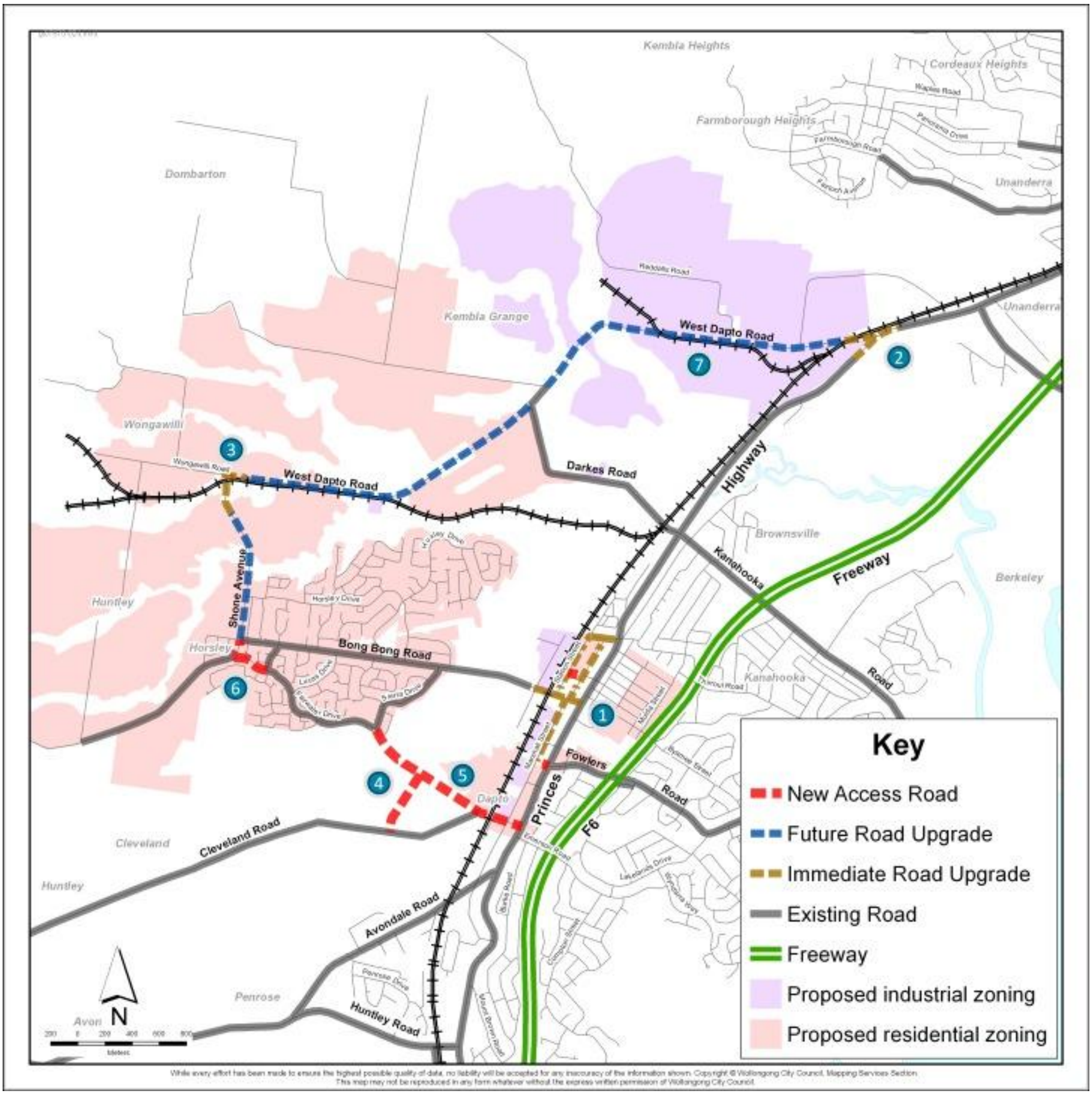


Figure 2.22: West Dapto access strategy

Source: wollongong.nsw.gov.au

The works proposed in Figure 2.22 (numbered 1 to 7) are described in Table 2.4.

Table 2.4: Summary of proposed works

Map Code	Road Link	Planned Works	Timing of Works [1]
1	Bong Bong Road / Princes Highway connections	Extend Fowlers Road to Marshall Street and provide new traffic facilities on Marshall Street to improve access to Bong Bong Road.	Complete
		Upgrade intersection Station Street and Bong Bong Road to formalise existing access to Unara Road to increase traffic capacity and reduce congestion.	Mid 2012
2	West Dapto Road	Realign the intersection with the Princes Highway and install traffic signals to improve safety and traffic capacity.	Early 2012
3	Shone Avenue	Realign Shone Avenue including the construction of a two lane bridge to improve safety and increase traffic capacity.	Early 2013
4	Fairwater Drive (East)	Staged extension of Fairwater Drive from Riverpark Way to Cleveland Road.	Complete
5	Cleveland Road	Staged upgrades to Cleveland Road to improve traffic capacity and pedestrian safety.	Early 2013
		Realign Cleveland Road West of the rail bridge including new bridges over Mullet Creek and flood relief channel.	Early 2013
6	Fairwater Drive (West)	Construct extension from Highcroft Boulevard to Bong Bong Road to complete missing link to Bong Bong Road / Shone Avenue to increase traffic capacity	Late 2011
7	West Dapto Road, Shone Avenue and Bong Bong Road	Staged widening of West Dapto Road and Shone Avenue including construction of new bridges. Drainage improvements on Bong Bong Road to improve safety, traffic capacity and reduce flood affectation.	2013/14 – 2023/24

[1] wollongong.nsw.gov.au/services/majorprojects/westdaptoaccess/ and West Dapto Initial Access Strategy, Wollongong City Council, 27/10/2009

Items two and seven are important in the context of this report.

A concept design of the West Dapto Road/ Princes Highway intersection upgrade is provided in Appendix D. This design has been incorporated into future modelling scenarios and information from Council suggests that construction is expected to be completed by the end of the 2011/2012 financial year.

3. Development Proposal

3.1 New Landfill Cells

The proposal includes the construction of new landfill cells at the Whytes Gully Resource Recovery Park to provide additional landfill capacity from 2013 to 2055. The proposed staging is set out in Section 3.1.1.

3.1.1 Development Staging

The construction and operation of new cells is proposed to occur in stages as outlined in Table 3.1.

Table 3.1: Construction and Operation Staging

Stage	Proposed Liner Construction Period [1]	Proposed Capping Construction Period [1]	Operation Period
1	2013 - 2016	2016 - 2019	2013 - 2018
2A	2017 – 2018	2020 - 2021	2018 - 2020
2B	2019 – 2031	2023 - 2036	2020 - 2035
3	2035 – 2041	2038 - 2047	2035 - 2046
4	2046 – 2050	2048 - 2055	2046 - 2054

[1] Not continuous during this period

More information on the expected impact during the construction period is provided in Section 4 of this report.

3.2 Vehicle Access

There is no change proposed to the existing access arrangements for the site or to fencing and landscaping at existing access points on Reddalls Road. Existing sight lines are satisfactory and no changes are required.

3.3 Car Parking

There is not expected to be any change to the existing staff numbers as a result of the proposed development. There would be some temporary car parking for construction staff which is further discussed in Section 4 of this report.

3.4 Internal Road Network

The internal access road to the landfill cells is proposed to be relocated once the individual landfill cells reach the end of their life cycle. This will correspond with the staging for the site as shown in Table 3.1. Any changes to the internal road network will be subject to detailed design at a later stage. Access will be maintained to on-site infrastructure as the new landfill cells are utilised.

4. Construction Impacts

4.1 Traffic Route to and from the Site

No change to the existing traffic routes to and from the site is proposed during construction.

4.2 Construction Staging and Progress

The construction of the Whytes Gully new landfill cells is proposed to occur in stages as summarised in Table 4.1.

Table 4.1: Construction Staging

Stage	Proposed Liner Construction Period [1]	Proposed Capping Construction Period [1]
1	2013 - 2016	2016 - 2019
2A	2017 – 2018	2020 - 2021
2B	2019 – 2031	2023 - 2036
3	2035 – 2041	2038 - 2047
4	2046 – 2050	2048 - 2055

[1] Not continuous during this period

Table 4.1 indicates that liner construction is expected to occur over three years for Stage 1 and varying lengths for future stages. The construction of each stage may not occur continuously for the allocated time due to the different stages of work required during the liner construction. As each section of the cell is filled, construction of the cell cap would occur.

During construction of each cell, material would be excavated from the area of each cell, used on-site (there are not expected to be any external truck movements during this time) and materials would be imported to the site. The liner would be constructed from the imported materials on-site.

During construction of the cap for each cell, material would be imported to the site and the cap constructed from the imported material.

4.2.1 Peak Construction Activity

Construction of each stage is proposed to occur over many years. During that time there would be periods of inactivity as a result of the construction process. The analysis in this report focuses on the peak construction activity within the allocated construction period.

During peak construction activity, work would take place six days per week with approximately 6 construction workers on-site at any one time. Construction work would typically take place during the following hours:

- Monday to Friday: 7:00am to 4:00pm; and
- Saturday: 8:00am to 1:00pm.

4.3 Traffic Impact Appraisal

The following sections set out the expected traffic impact of the proposed development during peak construction and operation.

4.3.1 Construction Vehicle Volumes

The construction work at each cell has three stages which include:

i extraction of material and preparation of the ground;
ii importing of material and construction of the liner, cell and intermediate cover material; and
iii importing of material and capping each cell at the end of its life.

The additional movements as a result of the construction stages are summarised as follows:

- The extraction phase would not involve any external truck movements as all material would be stored on-site for future use.
- Importing of material for liner, cell, intermediate cover material and capping would result in additional truck movements to and from the site.
- Each stage of works would result in additional staff movements to and from the site.

Note: Capping would likely be undertaken by Council.

Golder Associates provided GTA Consultants with the estimated volume of material that would be imported and this is summarised in Table 4.2.

Table 4.2: Volume (m3) of construction material

Stage	Volume Excavated	Fill Import [1]	Intermediate Cover Import	Capping Import	Intermediate Cover and Capping Import
1	60,400	98,000	26,000	61,000	87,000
2A	74,000	19,000	4,900	12,000	16,900
2B	25,000	95,000	23,000	54,000	77,000
3	29,000	76,000	23,000	53,000	76,000
4	172,000	44,000	28,000	66,000	94,000
Total	**288 400**	**332,000**	**104,900**	**246,000**	**350,900**

[1] Includes material for cell and liner construction including: subgrade, bunds, bearing layers, base layer and protection layer

Based on the information in Table 4.2, GTA Consultants has made a number of assumptions regarding the construction process to determine the expected additional volume of vehicles on the surrounding road network.

The expected number of additional construction vehicles during cell construction for each cell is summarised in Table 4.3

Table 4.3: Number of truck movements for importing cell and liner material

Stage	Fill Import (m3)	Average Truck Capacity (m3) [1]	Number of Imported Truck Loads	Peak Truck Movements / Day [2]
1	98,000	19	5,158	23
2A	19,000	19	1,000	23
2B	95,000	19	5,000	23
3	76,000	19	4,000	23
4	44,000	19	2,316	23
Total	**332,000**	**N/A**	**17,474**	**N/A**

[1] Based on GTA Consultants research for the capacity of a 30T Truck and Dog vehicle.
[2] 6 loads / truck x 4 trucks = 24 truck movements per weekday and 16 per Saturday during peak construction.
[3] Based on a fleet of 4 trucks and an average of 6 loads per weekday, 4 loads per Saturday during peak construction.
N/A Not Applicable
Note: Volumes are approximate

The expected number of additional construction vehicles during capping and intermediate cover of each cell is summarised in Table 4.4.

Table 4.4: Number of truck movements for importing intermediate cover and capping material

Stage	Intermediate Cover and Capping Material Imported (m3)	Average Truck Capacity (m3) [1]	Number of Imported Truck Loads	Peak Movements / Truck / Day [2]
1	87,000	19	4,579	23
2A	16,900	19	889	23
2B	77,000	19	4,053	23
3	76,000	19	4,000	23
4	94,000	19	4,947	23
Total	**350,900**	N/A	**18,468**	**N/A**

[1] Based on GTA Consultants research for the capacity of a 30T-50T Truck and Dog.
[2] 6 loads / truck x 4 trucks = 24 truck movements per weekday and 16 per Saturday.
[3] Based on a fleet of 4 trucks and an average of 6 loads per weekday, 4 loads per Saturday.
N/A Not Applicable
Note: Volumes are approximate

Table 4.3 and Table 4.4 indicate that the peak number of daily vehicle movements is expected to be 24 truck movements per day during the week and 16 truck movements on a Saturday for an average of 23 truck movements per day.

In a worst case scenario where both cell and liner construction and capping are occurring at the same time, up to 48 truck movements per weekday could be expected. In a worst case scenario where all eight trucks (four trucks associated with peak liner construction and four trucks associated with peak capping) arrive during the AM peak hour and depart during the PM peak hour, this would equate to an additional eight truck movements during each peak hour.

4.3.2 Expected Additional Staff Movements

It is expected that approximately six staff would be involved in construction on-site for the duration of each construction and capping stage of the project. Conservatively assuming that both stages are occurring at the same time and all staff arrive during the AM peak hour and depart during the PM peak hour, this would equate to an additional 12 vehicle movements during each respective peak hour.

A daily rate of 2.5 movements per staff member (12) has been adopted which equates to an anticipated daily volume of 30 vehicle movements per day.

4.3.3 Total Daily Construction Volume

Based on the above, the estimated additional site-generated traffic volumes during construction in the AM and PM peak hours on a weekday is provided in Figure 4.1 and Figure 4.2. In order to provide a conservative assessment, it is assumed that all vehicles would enter and exit the site via the intersection of West Dapto Road/ Princes Highway. For distribution, it is assumed that 80% would arrive from and depart to the north with the remaining 20% arriving from and departing to the south.

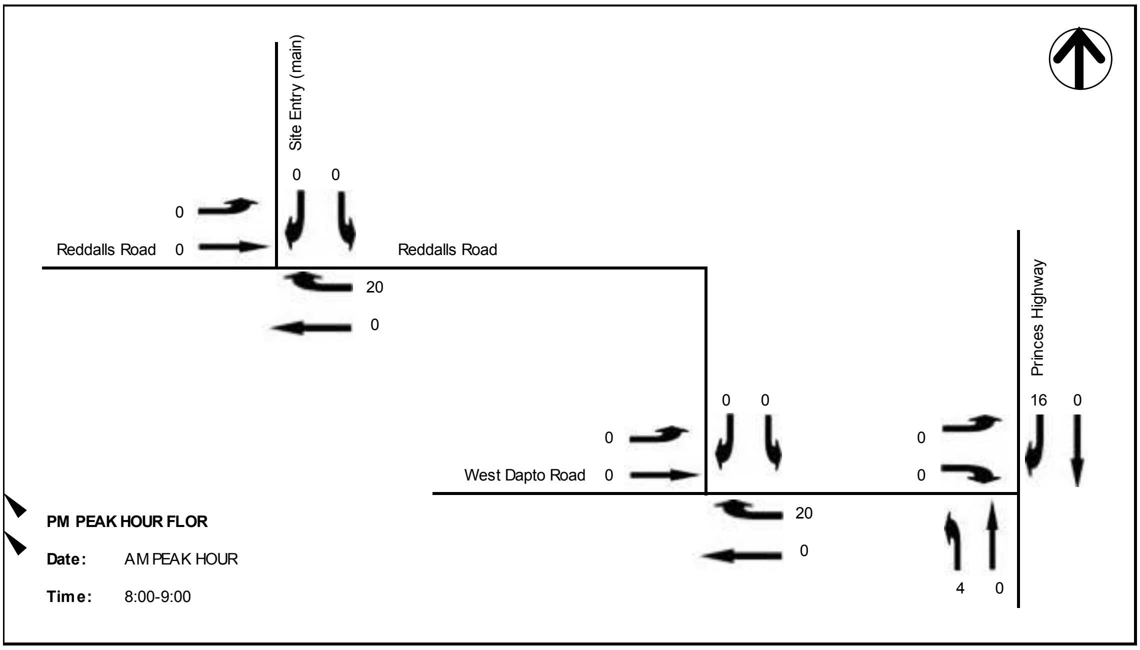


Figure 4.1: AM expected additional construction vehicles

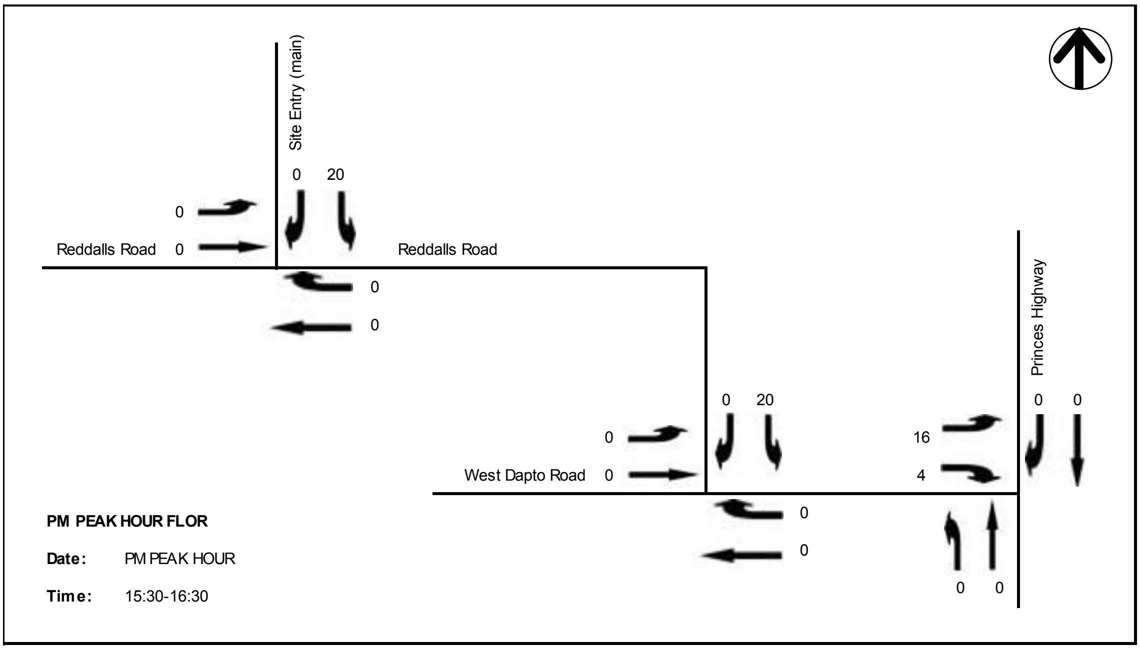


Figure 4.2: PM expected additional construction vehicles

To assess the impact on the main site entrance during the midday peak hour, an additional 10 vehicles entering and exiting the site has been assumed during this time.

4.3.4 Intersection Operation – No Traffic Growth

The impact of the site-generated traffic during construction activities on the existing road network volumes is summarised in Table 4.5 with full results provided in Appendix E. The analysis includes the signalisation of the intersection of Princes Highway/ West Dapto Road, which is expected to be completed prior to construction of the new cells commencing.

Table 4.5: Anticipated construction period operating conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Reddalls Road/ West Dapto Road	AM	West Dapto Road (E)	0.11	7	4	NA
		Reddalls Road (N)	0.07	14	2	A
		West Dapto Road (W)	0.09	0	0	NA
	PM	West Dapto Road (E)	0.10	2	5	NA
		Reddalls Road (N)	0.08	12	2	A
		West Dapto Road (W)	0.05	1	0	NA
Princes Highway/ West Dapto Road (signalised)	AM	Princess Highway (S)	0.32	14	28	A
		Racecourse Entry (E)	0.00	11	0	A
		Princess Highway (N)	0.43	18	22	B
		West Dapto Road (W)	0.16	19	13	B
	PM	Princess Highway (S)	0.25	14	21	A
		Racecourse Entry (E)	0.00	10	0	A
		Princess Highway (N)	0.45	17	30	B
		West Dapto Road (W)	0.13	19	11	B
Reddalls Road / Site Access	AM	Reddalls Road (E)	0.06	10	3	NA
		Site Access (N)	0.04	6	1	A
		Reddalls Road (W)	0.02	0	0	NA
	Midday	Reddalls Road (E)	0.05	10	2	NA
		Site Access (N)	0.07	5	3	A
		Reddalls Road (W)	0.01	1	0	NA
	PM	Reddalls Road (E)	0.01	14	0	NA
		Site Access (N)	0.06	5	2	A
		Reddalls Road (W)	0.00	6	0	NA

Table 4.5 indicates that during construction in the near future, that all intersections in the vicinity of the subject site are expected to operate well with acceptable queues and delays on all approaches. It is noted that if the signalisation of the intersection of Princes Highway/ West Dapto Road is delayed, there is adequate capacity in the intersection to cater for the expected additional traffic.

4.4 Parking Impact

For most of the project construction period, there would typically be around 6 construction workers on site each day. It is assumed that all staff would arrive by private vehicle and as such, there should be a minimum on-site parking provision for construction workers of 6 spaces. There would be sufficient space on-site in the vicinity of the construction area to accommodate this requirement.

5. Operational Traffic Assessment

5.1 Traffic Route to and from the Site

No change to existing traffic routes to and from the site are proposed in the future.

5.2 Future Traffic Growth

The maximum total material received at the Wollongong Resource Recovery Park (WGRRP) (ie including cover material to landfill) has been approximately 180,000 tonnes per annum for the past 5 years. Of this, the total waste received at the WGRRP (including waste to the MRF, green waste processing and other resource recovery) has been approximately 120,000 to 150,000 tonnes per annum for the past 5 years. It is noted that the green waste processing is relocating offsite in January 2012 (accounting for approximately 27,000 tonnes of waste per annum in 2011).

The population within the Wollongong LGA is predicted to increase at a rate of around 0.07 % per annum over the coming years resulting in increased waste generation. Conservatively, based on an annual increase of 0.07 % the total waste received at the WGRRP (excluding green waste) would increase from 120,000 to 165,000 tonnes per annum by 2055 and total material (including cover and excluding green waste) received at the WGRRP would increase from 150,000 to 210,000 tonnes per annum by 2055.

Airspace demand (ie total material including cover placed in the landfill) has varied over the past 5 years from around 180,000 tonnes per annum to 125,000 tonnes per annum in recent years. Conservatively, based on population increase of 0.07 % airspace demand (ie material placed in the landfill including cover) would increase from 125,000 to 180,000 tonnes per annum by 2055.

In parallel with the increase in waste generation due to population, Wollongong City Council's Waste Strategy outlines measures to increase waste minimisation and resource recovery and recycling and thereby divert waste from landfill. This strategy projects diversion of municipal waste from landfill to increase from current (2011) 54% to 66% by 2014 and to 75% by 2035. This diversion will likely result in reduced volume of material received at the WGRRP and will also likely result in an increase in waste flow to resource recovery and recycling facilities located off-site and at the WGRRP. By 2014 WCC's Waste Strategy also commits Council to reviewing alternative waste technologies which will significantly contribute to reduction in waste long term.

The Project does not seek to increase the volume of material accepted at the WGRRP as it is expected that the increase in waste volume as a result of population growth would likely be offset by waste minimisation, resource recovery and recycling initiatives.

This assumption is made based on existing trends as well as anticipated changes to facilities and services. However, a conservative sensitivity assessment during the operational phase of the project to review an increase in material accepted per annum to 180,000 tonnes per annum and 210,000 tonnes per annum respectively has been undertaken.

It is also noted that the Helensburgh landfill site will close in the near future however this is not expected to result in additional waste at the Kembla Grange site as it is expected that all vehicles would travel to the closer Menai facility instead of Kembla Grange.

The sensitivity assessment, assuming no upgrade to West Dapto Road but including the signalisation of the Princes Highway / West Dapto Road intersection, is set out in the following sections.

5.2.1 Sensitivity Test 1 – 180,000 tonnes per annum (+20%)

In order to provide a sensitivity assessment during the operational phase of the first new cell, an increase to 180,000 tonnes of waste material accepted per annum has been adopted. This is an increase of 20%.

Surveys of the existing facility indicate an average daily volume of 596 vehicles with a maximum peak hour volume of 72. To provide a conservative sensitivity test, GTA Consultants has tested a scenario where background and operational traffic growth both occur prior to road upgrades on the surrounding road network along with construction and capping of one cell.

In this scenario, all volumes in the study intersections have been increased by 20%. The results of this analysis are summarised in Table 5.1 with full results provided in Appendix E.

It is also noted that the green waste component of the facility is being relocated off-site in January 2012 and these volumes have not been removed from the sensitivity analysis.

Table 5.1: Anticipated future operational period operating conditions (+20%)

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Reddalls Road/ West Dapto Road	AM	West Dapto Road (E)	0.13	7	6	NA
		Reddalls Road (N)	0.08	14	3	A
		West Dapto Road (W)	0.10	0	0	NA
	PM	West Dapto Road (E)	0.12	2	6	NA
		Reddalls Road (N)	0.10	12	3	A
		West Dapto Road (W)	0.06	1	0	NA
Princes Highway/ West Dapto Road	AM	Princess Highway (S)	0.38	15	34	B
		Racecourse Entry (E)	0.00	11	0	A
		Princess Highway (N)	0.57	18	28	B
		West Dapto Road (W)	0.19	20	16	B
	PM	Princess Highway (S)	0.30	14	26	A
		Racecourse Entry (E)	0.00	10	0	A
		Princess Highway (N)	0.59	18	37	B
		West Dapto Road (W)	0.15	19	13	B
Reddalls Road / Site Access	AM	Reddalls Road (E)	0.07	10	3	NA
		Site Access (N)	0.04	6	2	A
		Reddalls Road (W)	0.02	0	0	NA
	Midday	Reddalls Road (E)	0.06	10	2	NA
		Site Access (N)	0.09	6	3	A
		Reddalls Road (W)	0.01	1	0	NA
	PM	Reddalls Road (E)	0.01	14	1	NA
		Site Access (N)	0.07	5	3	A
		Reddalls Road (W)	0.01	6	0	NA

Table 5.1 indicates that with a 20% increase in operational and background traffic along with construction and capping occurring at the same time, the intersections within the vicinity of the subject site are expected to operate satisfactorily with acceptable degrees of saturation and queues on all approaches. The expected future operation is shown in Figure 5.1 and Figure 5.2.

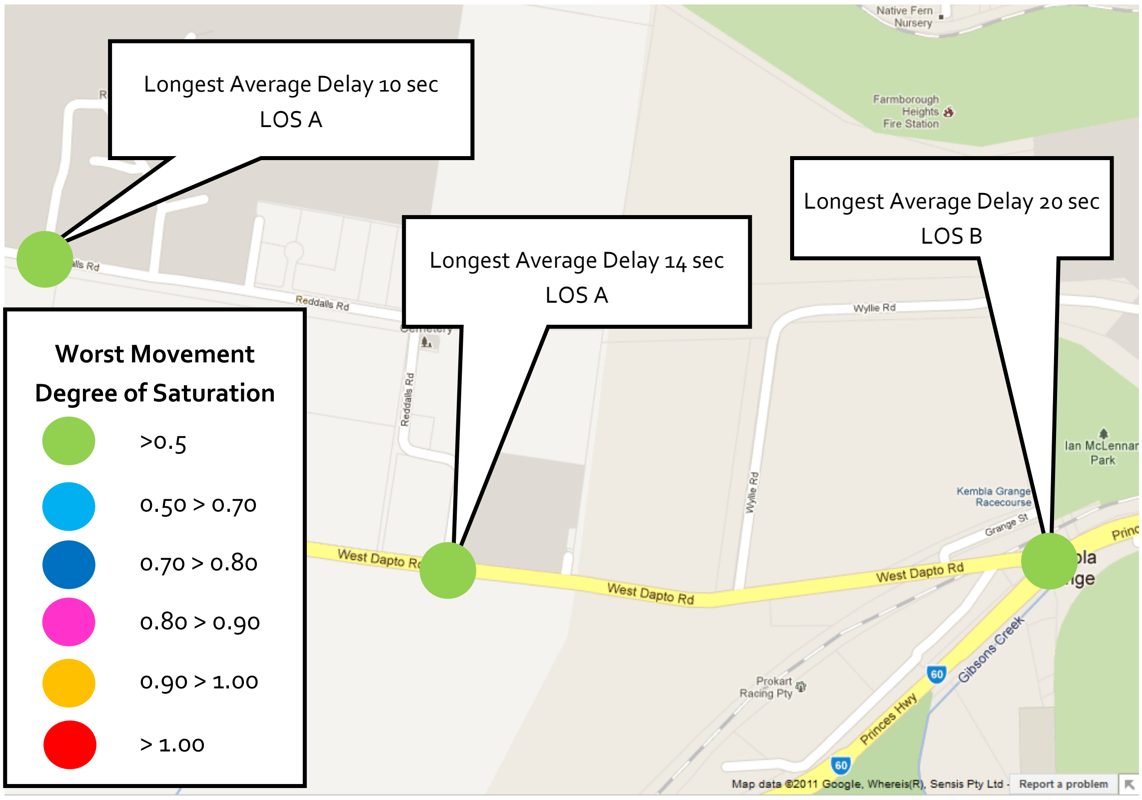


Figure 5.1: Future sensitivity analysis AM intersection operation (+20%)

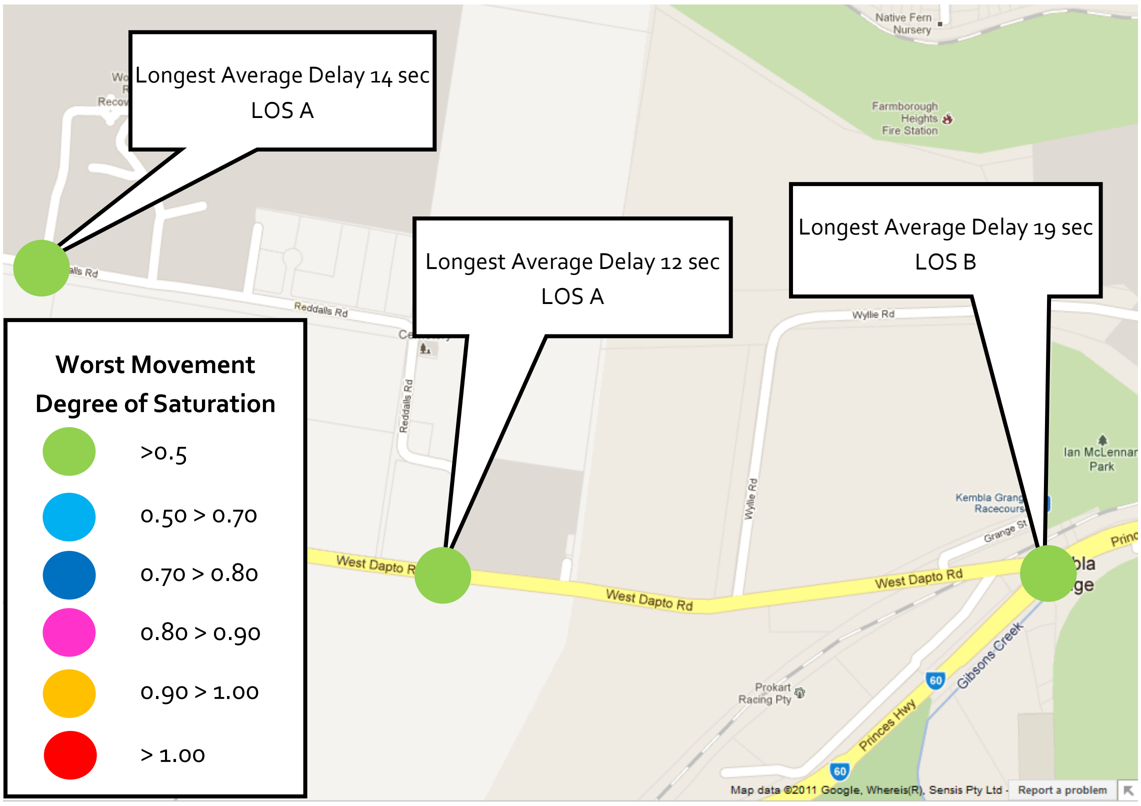


Figure 5.2: Future sensitivity analysis PM intersection operation (+20%)

5.2.2 Sensitivity Test 2 – 210,000 tonnes per annum (+40%)

In order to provide a sensitivity assessment during the operational phase of the first new cell, an increase to 210,000 tonnes of waste material accepted per annum has been adopted. This is an increase of 40%.

In this scenario, all volumes in the study intersections have been increased by 40% based on the same methodology set out in sensitivity test 1. The results of this analysis are summarised in Table 5.2 with full results provided in Appendix E.

It is also noted that the green waste component of the facility is being relocated off-site in January 2012 and these volumes have not been removed from the sensitivity analysis.

Table 5.2: Anticipated future operational period operating conditions +140%

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Reddalls Road/ West Dapto Road	AM	West Dapto Road (E)	0.16	8	7	NA
		Reddalls Road (N)	0.10	15	3	B
		West Dapto Road (W)	0.12	0	0	NA
	PM	West Dapto Road (E)	0.14	2	7	NA
		Reddalls Road (N)	0.12	12	4	A
		West Dapto Road (W)	0.07	1	0	NA
Princes Highway/ West Dapto Road	AM	Princess Highway (S)	0.45	15	41	B
		Racecourse Entry (E)	0.01	11	0	A
		Princess Highway (N)	0.74	20	38	B
		West Dapto Road (W)	0.22	20	20	B
	PM	Princess Highway (S)	0.35	14	31	A
		Racecourse Entry (E)	0.00	11	0	A
		Princess Highway (N)	0.74	19	46	B
		West Dapto Road (W)	0.18	19	15	B
Reddalls Road / Site Access	AM	Reddalls Road (E)	0.09	10	4	NA
		Site Access (N)	0.05	6	2	A
		Reddalls Road (W)	0.02	0	0	NA
	Midday	Reddalls Road (E)	0.07	10	3	NA
		Site Access (N)	0.10	6	4	A
		Reddalls Road (W)	0.01	1	0	NA
	PM	Reddalls Road (E)	0.02	14	1	NA
		Site Access (N)	0.08	5	3	A
		Reddalls Road (W)	0.01	6	0	NA

Table 5.2 indicates that with a 40% increase in operational and background traffic along with construction and capping occurring at the same time, the intersections within the vicinity of the subject site are expected to operate satisfactorily with acceptable degrees of saturation and queues on all approaches. The expected future operation is shown in Figure 5.3 and Figure 5.4.

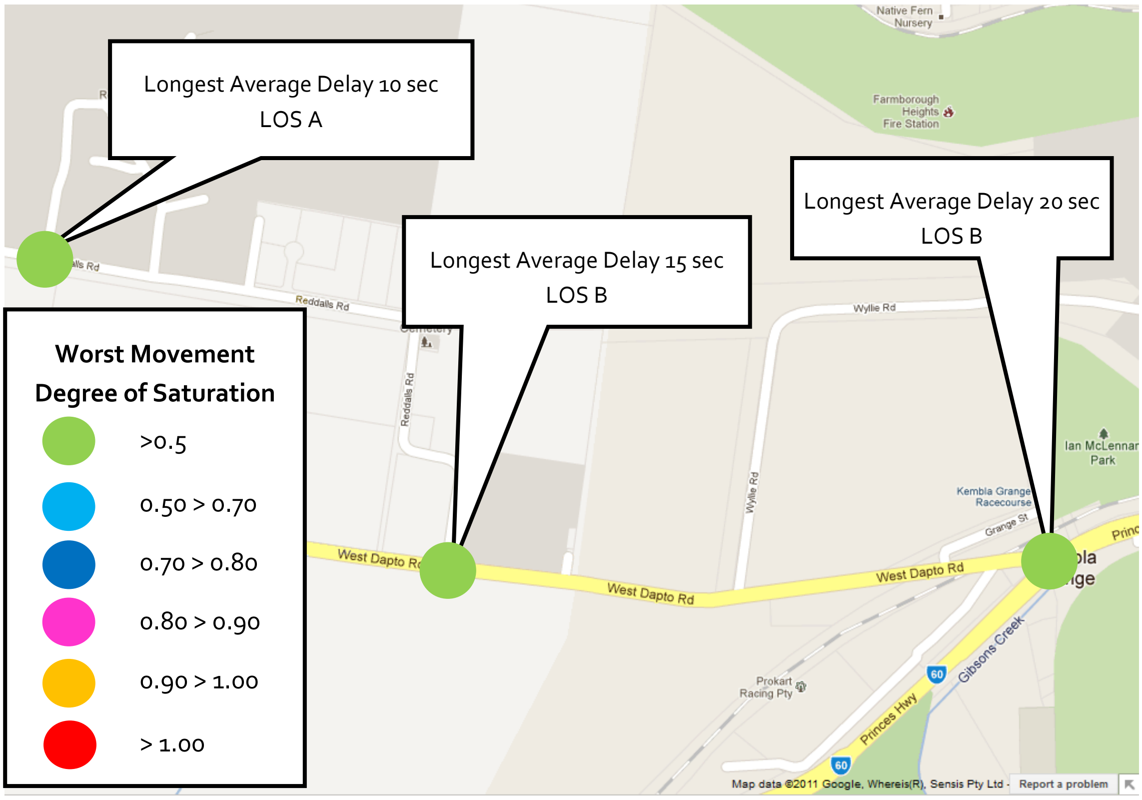


Figure 5.3: Future sensitivity analysis AM intersection operation (+40%)

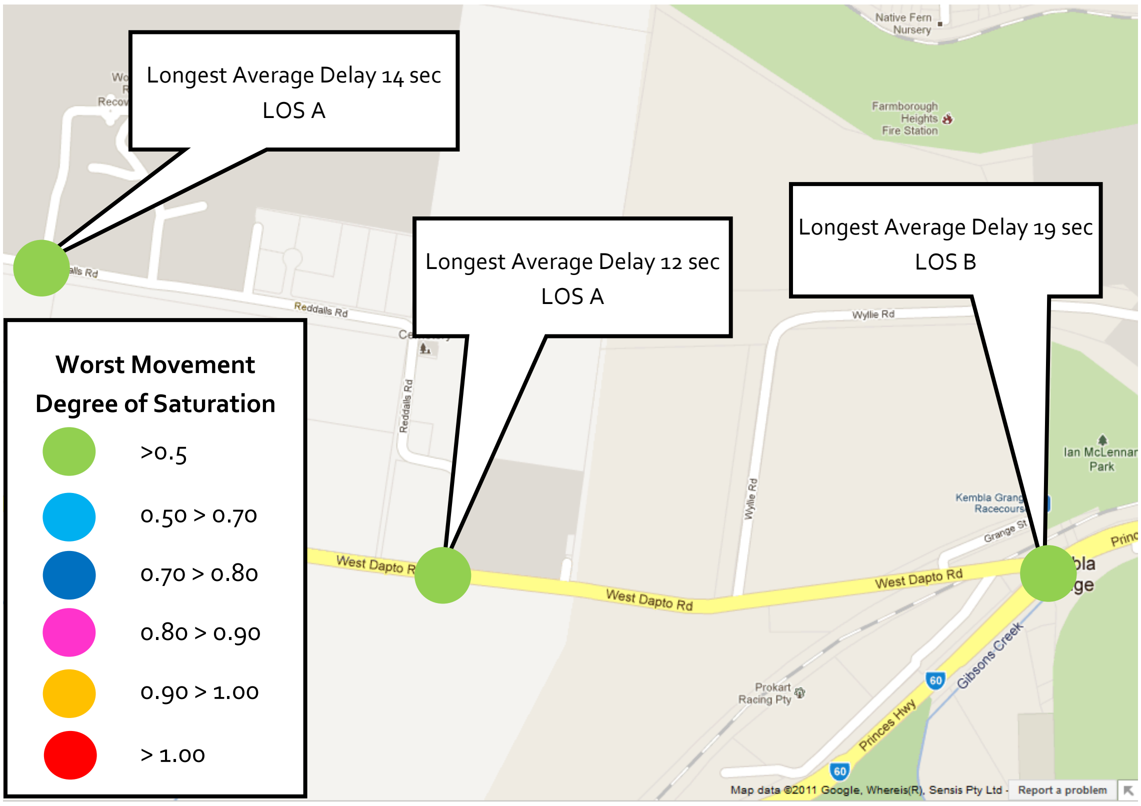


Figure 5.4: Future sensitivity analysis PM intersection operation (+40%)

5.3 Future Road Network

As previously explained, there are a number of road network changes proposed as part of the West Dapto Access Strategy. The intersection of Princes Highway/ West Dapto Road is proposed to be signalised in early 2012 and West Dapto Road is expected to be upgraded over 10 years between 2013/14 and 2023/24 to cater for additional traffic. These changes in the road network are expected to cater for the growth of the West Dapto release area as well as the future construction and operational volumes associated with this site.

6. Mitigation and Management Measures

As discussed in this report, the future construction and operation of the site is not expected to compromise the safety or function of the existing or future surrounding road network and as such, no mitigation or management measures are required.

7. Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made:

i The site is expected to generate up to 6 and 15 vehicle movements in any peak hour and daily respectively during the construction of each landfill cell.

ii The site is expected to generate up to 6 and 15 vehicle movements in any peak hour and daily respectively during the capping of each landfill cell.

iii Where construction of one landfill cell and capping of another are occurring at the same time, up to 12 vehicle movements could be generated during any peak hour with up to 30 movements generated daily.

iv There is no change proposed to the existing access arrangements for the site or to fencing and landscaping at existing access points. Existing sight lines are satisfactory and no changes are required.

v The Project does not seek to increase the volume of material accepted at the WGRRP as it is expected that the increase in waste volume as a result of population growth would likely be offset by waste minimisation, resource recovery and recycling initiatives.

vi There is adequate capacity in the surrounding road network to cater for the construction and operation under a sensitivity assessment scenario where all traffic is increased 40%. These volumes also include the green waste volumes which are to be relocated off-site during January 2012.

vii The intersection of Princes Highway/ West Dapto Road is proposed to be signalised in early 2012 and West Dapto Road is expected to be upgraded over 10 years between 2013/14 and 2023/24 to cater for additional traffic. These changes in the road network are expected to cater for the growth of the West Dapto release area as well as the future construction and operational volumes associated with this site.

viii It is noted that if the signalisation of the intersection of Princes Highway/ West Dapto Road is delayed, there is adequate capacity in the intersection to cater for the expected additional traffic.

ix The future construction and operation of the site is not expected to compromise the safety or function of the existing or future surrounding road network and as such, no mitigation or management measures are required.

Appendix A

Existing Traffic Survey Results

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants

Job No/Name : 2745 Kembal Grange West Dapto Rd

Day/Date : Thursday 2nd July 2009

Lights	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	17	18	23	1	6	50	**115**
0715 - 0730	36	27	28	2	7	50	**150**
0730 - 0745	61	25	45	1	2	65	**199**
0745 - 0800	61	25	55	6	4	68	**219**
0800 - 0815	65	17	59	0	5	87	**233**
0815 - 0830	79	19	51	6	5	94	**254**
0830 - 0845	68	21	39	4	9	100	**241**
0845 - 0900	86	23	42	3	8	86	**248**
Per End	**473**	**175**	**342**	**23**	**46**	**600**	**1659**

Heavies	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	5	2	1	0	1	2	**11**
0715 - 0730	0	3	3	0	1	3	**10**
0730 - 0745	2	1	1	0	2	3	**9**
0745 - 0800	2	1	1	0	0	0	**4**
0800 - 0815	3	7	4	0	0	2	**16**
0815 - 0830	2	4	4	0	0	4	**14**
0830 - 0845	2	2	2	0	0	2	**8**
0845 - 0900	1	5	5	0	0	5	**16**
Per End	**17**	**25**	**21**	**0**	**4**	**21**	**88**

Combined	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	22	20	24	1	7	52	**126**
0715 - 0730	36	30	31	2	8	53	**160**
0730 - 0745	63	26	46	1	4	68	**208**
0745 - 0800	63	26	56	6	4	68	**223**
0800 - 0815	68	24	63	0	5	89	**249**
0815 - 0830	81	23	55	6	5	98	**268**
0830 - 0845	70	23	41	4	9	102	**249**
0845 - 0900	87	28	47	3	8	91	**264**
Per End	**490**	**200**	**363**	**23**	**50**	**621**	**1747**

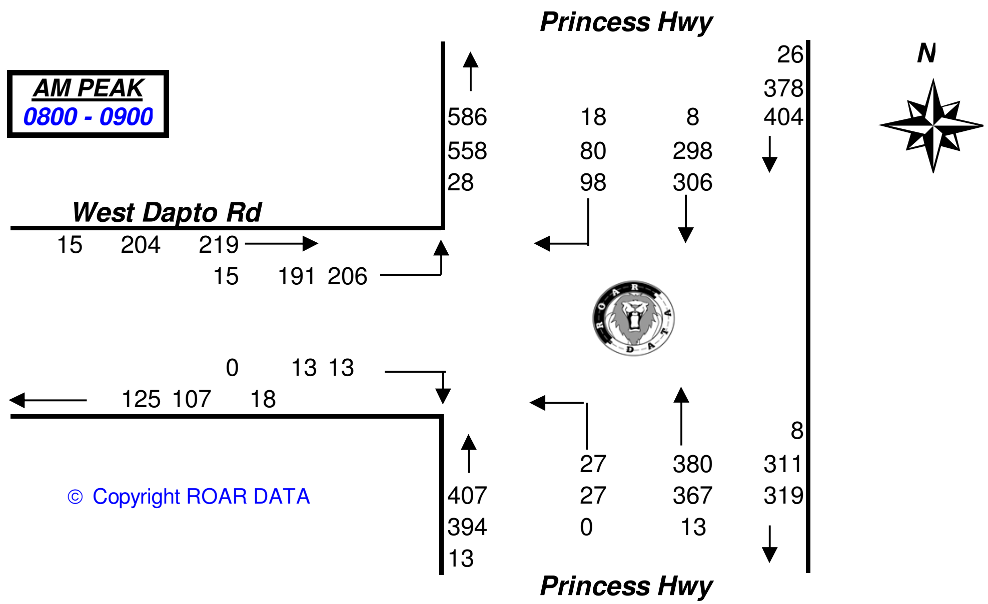
Lights	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	175	95	151	10	19	233	**683**
0715 - 0815	223	94	187	9	18	270	801
0730 - 0830	266	86	210	13	16	314	**905**
0745 - 0845	273	82	204	16	23	349	**947**
0800 - 0900	298	80	191	13	27	367	**976**
PEAK HR	**298**	**80**	**191**	**13**	**27**	**367**	**976**

Heavies	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	9	7	6	0	4	8	**34**
0715 - 0815	7	12	9	0	3	8	39
0730 - 0830	9	13	10	0	2	9	**43**
0745 - 0845	9	14	11	0	0	8	**42**
0800 - 0900	8	18	15	0	0	13	**54**
PEAK HR	**8**	**18**	**15**	**0**	**0**	**13**	**54**

Combined	NORTH		WEST		SOUTH		
	Princess		West Dapto		Princess		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	184	102	157	10	23	241	**717**
0715 - 0815	230	106	196	9	21	278	840
0730 - 0830	275	99	220	13	18	323	**948**
0745 - 0845	282	96	215	16	23	357	**989**
0800 - 0900	306	98	206	13	27	380	**1030**
PEAK HR	**306**	**98**	**206**	**13**	**27**	**380**	**1030**

Peds	NORTH	WEST	SOUTH	
Time Per	Princess	West Dapto	Princess	TOT
0700 - 0715				**0**
0715 - 0730		*NOT*		**0**
0730 - 0745		*REQUIRED*		**0**
0745 - 0800				**0**
0800 - 0815				**0**
0815 - 0830				**0**
0830 - 0845				**0**
0845 - 0900				**0**
Per End	**0**	**0**	**0**	**0**

	NORTH	WEST	SOUTH	
Peak Per	Princess	West Dapto	Princess	TOT
0700 - 0800	0	0	0	**0**
0715 - 0815	0	0	0	**0**
0730 - 0830	0	0	0	**0**
0745 - 0845	0	0	0	**0**
0800 - 0900	0	0	0	**0**
PEAK HR	**0**	**0**	**0**	**0**



R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2745 Kembal Grange West Dapto Rd
Day/Date : Thursday 2nd July 2009

Lights

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	113	48	39	9	3	72	284
1615 - 1630	117	44	45	5	4	62	277
1630 - 1645	108	32	28	6	4	70	248
1645 - 1700	114	39	25	1	1	78	258
1700 - 1715	113	41	30	7	4	96	291
1715 - 1730	113	50	14	5	2	78	262
1730 - 1745	86	65	26	2	1	63	243
1745 - 1800	79	41	17	0	2	55	194
Per End	843	360	224	35	21	574	2057

Heavies

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	1	0	0	0	0	4	5
1615 - 1630	1	4	1	0	0	2	8
1630 - 1645	2	0	1	0	0	2	5
1645 - 1700	1	1	1	0	0	1	4
1700 - 1715	0	2	1	0	0	1	4
1715 - 1730	1	0	0	0	0	0	1
1730 - 1745	1	0	0	0	0	2	3
1745 - 1800	2	1	0	0	0	0	3
Per End	9	8	4	0	0	12	33

Combined

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	114	48	39	9	3	76	289
1615 - 1630	118	48	46	5	4	64	285
1630 - 1645	110	32	29	6	4	72	253
1645 - 1700	115	40	26	1	1	79	262
1700 - 1715	113	43	31	7	4	97	295
1715 - 1730	114	50	14	5	2	78	263
1730 - 1745	87	65	26	2	1	65	246
1745 - 1800	81	42	17	0	2	55	197
Per End	852	368	228	35	21	586	2090

Lights

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	452	163	137	21	12	282	1067
1615 - 1715	452	156	128	19	13	306	1074
1630 - 1730	448	162	97	19	11	322	1059
1645 - 1745	426	195	95	15	8	315	1054
1700 - 1800	391	197	87	14	9	292	990
PEAK HR	452	156	128	19	13	306	1074

Heavies

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	5	5	3	0	0	9	22
1615 - 1715	4	7	4	0	0	6	21
1630 - 1730	4	3	3	0	0	4	14
1645 - 1745	3	3	2	0	0	4	12
1700 - 1800	4	3	1	0	0	3	11
PEAK HR	4	7	4	0	0	6	21

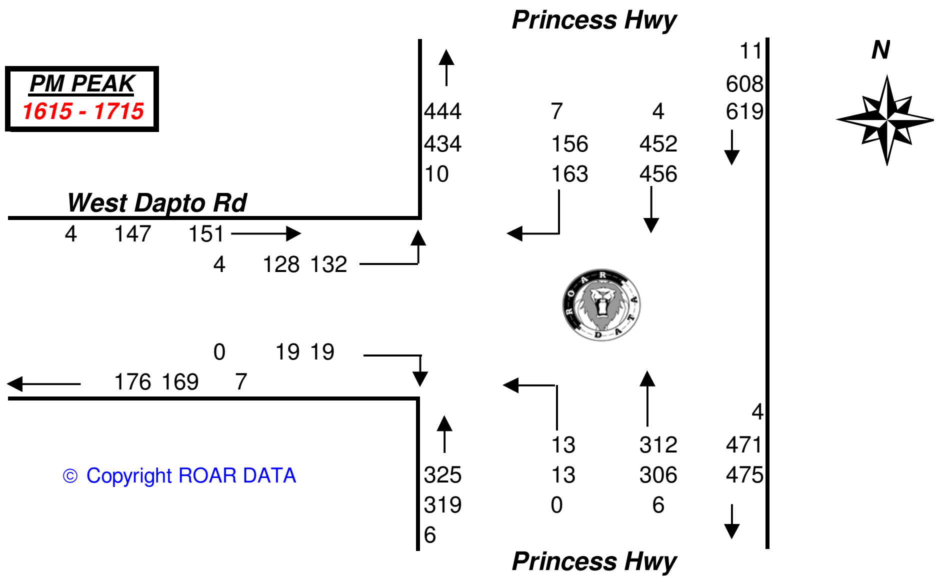
Combined

	NORTH		WEST		SOUTH		
	Princess		*West Dapto*		*Princess*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	457	168	140	21	12	291	1089
1615 - 1715	456	163	132	19	13	312	1095
1630 - 1730	452	165	100	19	11	326	1073
1645 - 1745	429	198	97	15	8	319	1066
1700 - 1800	395	200	88	14	9	295	1001
PEAK HR	456	163	132	19	13	312	1095

Peds

	NORTH	WEST	SOUTH	
Time Per	Princess	West Dapto	Princess	TOT
1600 - 1615				0
1615 - 1630		NOT		0
1630 - 1645		REQUIRED		0
1645 - 1700				0
1700 - 1715				0
1715 - 1730				0
1730 - 1745				0
1745 - 1800				0
Per End	0	0	0	0

	NORTH	WEST	SOUTH	
Peak Per	Princess	West Dapto	Princess	TOT
1600 - 1700	0	0	0	0
1615 - 1715	0	0	0	0
1630 - 1730	0	0	0	0
1645 - 1745	0	0	0	0
1700 - 1800	0	0	0	0
PEAK HR	0	0	0	0



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2745 Kembal Grange West Dapto Rd
Day/Date : Thursday 2nd July 2009

Lights

	WEST		NORTH		EAST		
	West Dapto		Reddalls Rd		West Dapto		
Time Per	T	L	R	L	R	T	TOT
0700 - 0715	25	0	0	2	6	13	46
0715 - 0730	23	1	0	0	7	17	48
0730 - 0745	35	1	1	0	9	12	58
0745 - 0800	44	0	0	5	4	15	68
0800 - 0815	49	0	1	7	8	12	77
0815 - 0830	38	1	0	9	6	14	68
0830 - 0845	32	1	0	8	11	11	63
0845 - 0900	35	0	0	6	3	23	67
Per End	281	4	2	37	54	117	495

Heavies

	WEST		NORTH		EAST		
	West Dapto		Reddalls Rd		West Dapto		
Time Per	T	L	R	L	R	T	TOT
0700 - 0715	0	0	0	0	1	0	1
0715 - 0730	1	0	0	0	2	2	5
0730 - 0745	1	0	0	0	0	5	6
0745 - 0800	0	0	0	0	1	0	1
0800 - 0815	0	0	0	5	2	4	11
0815 - 0830	1	0	0	1	5	0	7
0830 - 0845	3	0	0	4	2	0	9
0845 - 0900	0	0	0	6	6	0	12
Per End	6	0	0	16	19	11	52

Combined

	WEST		NORTH		EAST		
	West Dapto		Reddalls		West Dapto		
Time Per	T	L	R	L	R	T	TOT
0700 - 0715	25	0	0	2	7	13	47
0715 - 0730	24	1	0	0	9	19	53
0730 - 0745	36	1	1	0	9	17	64
0745 - 0800	44	0	0	5	5	15	69
0800 - 0815	49	0	1	12	10	16	88
0815 - 0830	39	1	0	10	11	14	75
0830 - 0845	35	1	0	12	13	11	72
0845 - 0900	35	0	0	12	9	23	79
Per End	287	4	2	53	73	128	547

Lights

	WEST		NORTH		EAST		
	West Dapto		Reddalls Rd		West Dapto		
Peak Per	T	L	R	L	R	T	TOT
0700 - 0800	127	2	1	7	26	57	220
0715 - 0815	151	2	2	12	28	56	251
0730 - 0830	166	2	2	21	27	53	271
0745 - 0845	163	2	1	29	29	52	276
0800 - 0900	154	2	1	30	28	60	275
PEAK HR	154	2	1	30	28	60	275

Heavies

	WEST		NORTH		EAST		
	West Dapto		Reddalls Rd		West Dapto		
Peak Per	T	L	R	L	R	T	TOT
0700 - 0800	2	0	0	0	4	7	13
0715 - 0815	2	0	0	5	5	11	23
0730 - 0830	2	0	0	6	8	9	25
0745 - 0845	4	0	0	10	10	4	28
0800 - 0900	4	0	0	16	15	4	39
PEAK HR	4	0	0	16	15	4	39

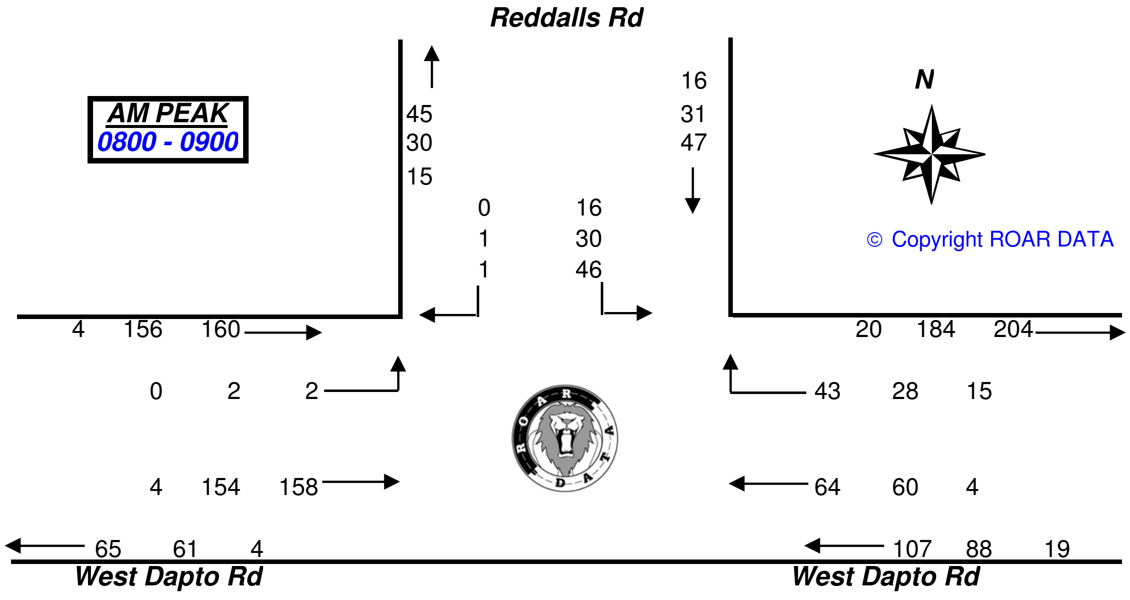
Combined

	WEST		NORTH		EAST		
	West Dapto		Reddalls		West Dapto		
Peak Per	T	L	R	L	R	T	TOT
0700 - 0800	129	2	1	7	30	64	233
0715 - 0815	153	2	2	17	33	67	274
0730 - 0830	168	2	2	27	35	62	296
0745 - 0845	167	2	1	39	39	56	304
0800 - 0900	158	2	1	46	43	64	314
PEAK HR	158	2	1	46	43	64	314

Peds

	WEST	NORTH	EAST	
Time Per	West Dapto	Reddalls Rd	West Dapto	TOT
0700 - 0715				0
0715 - 0730		NOT		0
0730 - 0745		REQUIRED		0
0745 - 0800				0
0800 - 0815				0
0815 - 0830				0
0830 - 0845				0
0845 - 0900				0
Per End	0	0	0	0

	WEST	NORTH	EAST	
Peak Per	West Dapto	Reddalls Rd	West Dapto	TOT
0700 - 0800	0	0	0	0
0715 - 0815	0	0	0	0
0730 - 0830	0	0	0	0
0745 - 0845	0	0	0	0
0800 - 0900	0	0	0	0
PEAK HR	0	0	0	0



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants

Job No/Name : 2745 Kembal Grange West Dapto Rd

Day/Date : Thursday 2nd July 2009

Lights

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Time Per	T	L	R	L	R	T	TOT
1600 - 1615	26	1	0	7	6	49	**89**
1615 - 1630	19	2	0	20	7	37	**85**
1630 - 1645	18	2	1	12	2	37	**72**
1645 - 1700	17	0	2	5	3	27	**54**
1700 - 1715	11	1	1	5	2	39	**59**
1715 - 1730	10	0	0	1	3	43	**57**
1730 - 1745	14	0	1	3	4	50	**72**
1745 - 1800	15	0	0	6	4	51	**76**
Per End	**130**	**6**	**5**	**59**	**31**	**333**	**564**

Heavies

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Time Per	T	L	R	L	R	T	TOT
1600 - 1615	0	0	0	0	0	0	**0**
1615 - 1630	0	0	0	0	2	1	**3**
1630 - 1645	1	0	0	2	0	0	**3**
1645 - 1700	1	0	0	0	1	0	**2**
1700 - 1715	0	0	0	0	0	1	**1**
1715 - 1730	0	0	0	0	0	0	**0**
1730 - 1745	0	0	0	0	0	0	**0**
1745 - 1800	0	0	0	0	0	0	**0**
Per End	**2**	**0**	**0**	**2**	**3**	**2**	**9**

Combined

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Time Per	T	L	R	L	R	T	TOT
1600 - 1615	26	1	0	7	6	49	**89**
1615 - 1630	19	2	0	20	9	38	**88**
1630 - 1645	19	2	1	14	2	37	**75**
1645 - 1700	18	0	2	5	4	27	**56**
1700 - 1715	11	1	1	5	2	40	**60**
1715 - 1730	10	0	0	1	3	43	**57**
1730 - 1745	14	0	1	3	4	50	**72**
1745 - 1800	15	0	0	6	4	51	**76**
Per End	**132**	**6**	**5**	**61**	**34**	**335**	**573**

Lights

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Peak Per	T	L	R	L	R	T	TOT
1600 - 1700	80	5	3	44	18	150	**300**
1615 - 1715	65	5	4	42	14	140	**270**
1630 - 1730	56	3	4	23	10	146	**242**
1645 - 1745	52	1	4	14	12	159	**242**
1700 - 1800	50	1	2	15	13	183	**264**
PEAK HR	**80**	**5**	**3**	**44**	**18**	**150**	**300**

Heavies

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Peak Per	T	L	R	L	R	T	TOT
1600 - 1700	2	0	0	2	3	1	**8**
1615 - 1715	2	0	0	2	3	2	**9**
1630 - 1730	2	0	0	2	1	1	**6**
1645 - 1745	1	0	0	0	1	1	3
1700 - 1800	0	0	0	0	0	1	**1**
PEAK HR	**2**	**0**	**0**	**2**	**3**	**1**	**8**

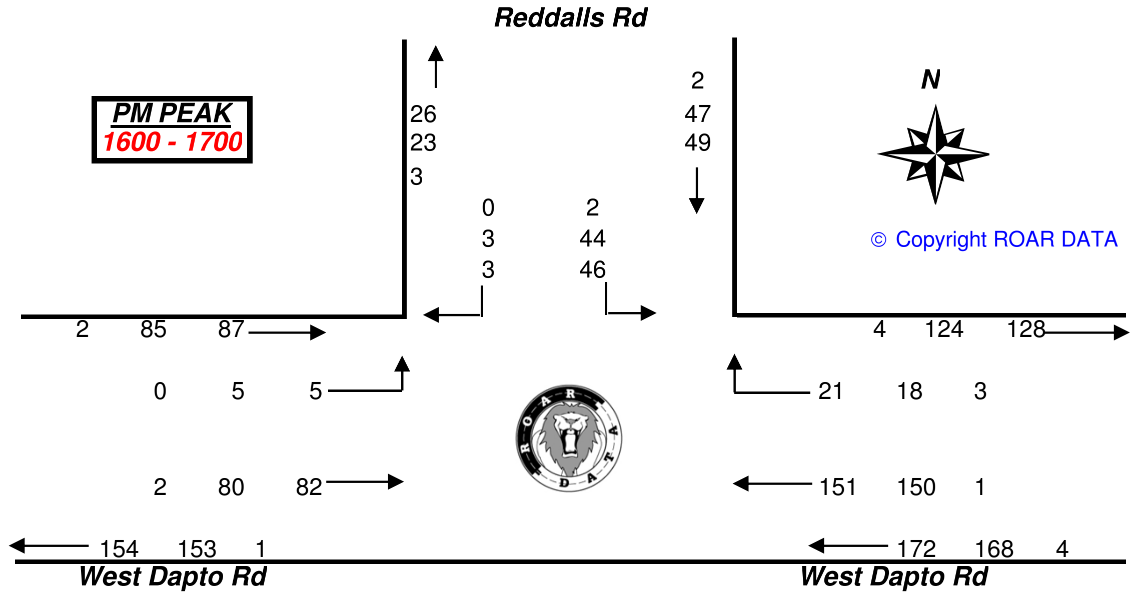
Combined

	WEST		NORTH		EAST		
	West Dapto		*Reddalls Rd*		*West Dapto*		
Peak Per	T	L	R	L	R	T	TOT
1600 - 1700	82	5	3	46	21	151	**308**
1615 - 1715	67	5	4	44	17	142	**279**
1630 - 1730	58	3	4	25	11	147	**248**
1645 - 1745	53	1	4	14	13	160	245
1700 - 1800	50	1	2	15	13	184	**265**
PEAK HR	**82**	**5**	**3**	**46**	**21**	**151**	**308**

Peds

	WEST	NORTH	EAST	
Time Per	West Dapto	Reddalls Rd	West Dapto	TOT
1600 - 1615				**0**
1615 - 1630		*NOT*		**0**
1630 - 1645		*REQUIRED*		**0**
1645 - 1700				**0**
1700 - 1715				**0**
1715 - 1730				**0**
1730 - 1745				**0**
1745 - 1800				**0**
Per End	**0**	**0**	**0**	**0**

	WEST	NORTH	EAST	
Peak Per	West Dapto	Reddalls Rd	West Dapto	TOT
1600 - 1700	0	0	0	**0**
1615 - 1715	0	0	0	**0**
1630 - 1730	0	0	0	**0**
1645 - 1745	0	0	0	**0**
1700 - 1800	0	0	0	**0**
PEAK HR	**0**	**0**	**0**	**0**



TURNING MOVEMENT SURVEY

Intersection of Site Entry (main) & Reddalls Road, Reddalls Road, Kembla Grange

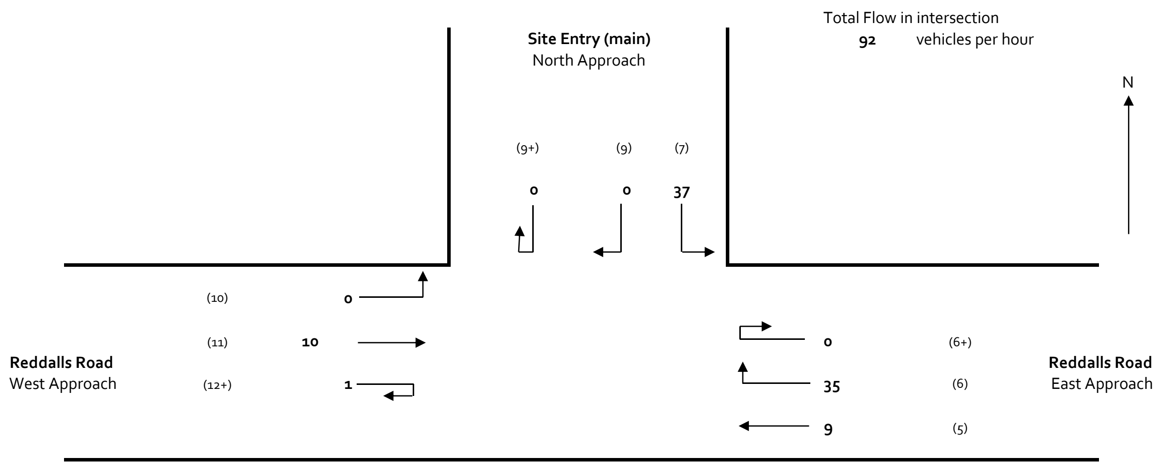
Date: Wed 09 Nov 2011

15 minute Data

Time	Movement									Total
	Reddalls Road East Approach			Site Entry (main) North Approach			Reddalls Road West Approach			
	Through 5	Right 6	U Turn 6+	Left 7	Right 9	U Turn 9+	Left 10	Through 11	U Turn 12+	
14:00-14:15										
14:15-14:30										
14:30-14:45	1	13	0	10	0	0	0	4	0	28
14:45-15:00	4	7	0	13	0	0	0	1	0	25
15:00-15:15	3	8	0	9	0	0	0	4	1	25
15:15-15:30	1	7	0	5	0	0	0	1	0	14
15:30-15:45										
15:45-16:00										
16:00-16:15										
16:15-16:30										
16:30-16:45										
16:45-17:00										
17:00-17:15										
17:15-17:30										
17:30-17:45										
17:45-18:00										
Total	9	35	0	37	0	0	0	10	1	92

Hourly flows

Time	Movement									Total
	Reddalls Road South Approach			Site Entry (main) East Approach			Reddalls Road West Approach			
	Through 5	Right 6	U Turn 6+	Left 7	Right 9	U Turn 9+	Left 10	Through 11	U Turn 12+	
14:00-15:00										
14:15-15:15										
Peak 14:30-15:30	9	35	0	37	0	0	0	10	1	92 Peak
14:45-15:45										
15:00-16:00										
15:15-16:15										
15:30-16:30										
15:45-16:45										
16:00-17:00										
16:15-17:15										
16:30-17:30										
16:45-17:45										
17:00-18:00										
Peak Hour	9	35	0	37	0	0	0	10	1	92



PM PEAK HOUR FLOW

Intersection of	Date	Time
Site Entry (main) &	Wed 09 Nov 2011	14:30-15:30
Reddalls Road		
Reddalls Road, Kembla Grange	PFF$_{(30mins)}$: 0.87	

TURNING MOVEMENT SURVEY

Intersection of Site Entry (secondary) & Reddalls Road, Reddalls Road, Kembla Grange

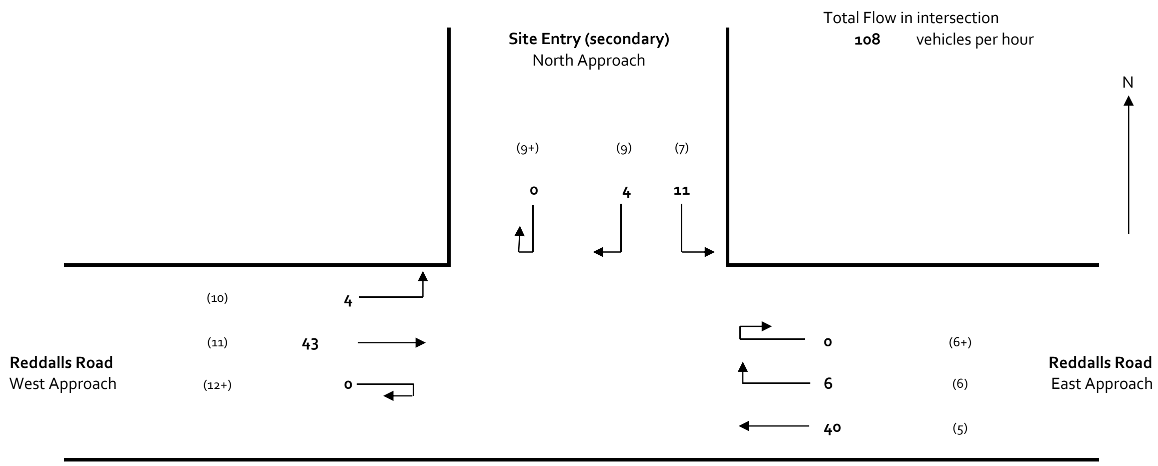
Date: Wed 09 Nov 2011

15 minute Data

Time	Movement									Total
	Reddalls Road East Approach			Site Entry (secondary) North Approach			Reddalls Road West Approach			
	Through	Right	U Turn	Left	Right	U Turn	Left	Through	U Turn	
	5	6	6+	7	9	9+	10	11	12+	
14:00-14:15										
14:15-14:30										
14:30-14:45	12	4	0	3	2	0	2	12	0	35
14:45-15:00	10	0	0	1	1	0	0	14	0	26
15:00-15:15	10	0	0	4	1	0	1	12	0	28
15:15-15:30	8	2	0	3	0	0	1	5	0	19
15:30-15:45										
15:45-16:00										
16:00-16:15										
16:15-16:30										
16:30-16:45										
16:45-17:00										
17:00-17:15										
17:15-17:30										
17:30-17:45										
17:45-18:00										
Total	40	6	0	11	4	0	4	43	0	108

Hourly flows

Time	Movement									Total
	Reddalls Road South Approach			Site Entry (secondary) East Approach			Reddalls Road West Approach			
	Through	Right	U Turn	Left	Right	U Turn	Left	Through	U Turn	
	5	6	6+	7	9	9+	10	11	12+	
14:00-15:00										
14:15-15:15										
Peak 14:30-15:30	40	6	0	11	4	0	4	43	0	108 Peak
14:45-15:45										
15:00-16:00										
15:15-16:15										
15:30-16:30										
15:45-16:45										
16:00-17:00										
16:15-17:15										
16:30-17:30										
16:45-17:45										
17:00-18:00										
Peak Hour	40	6	0	11	4	0	4	43	0	108



PM PEAK HOUR FLOW

Intersection of | **Date** | **Time**

Site Entry (secondar & | Wed 09 Nov 2011 | 14:30-15:30

Reddalls Road

Reddalls Road, Kembla Grange

PFF$_{(30mins)}$: 0.89

Appendix B

Existing Weighbridge Data

WOLLONGONG CITY COUNCIL

41 BURELLI STREET WOLLONGONG NSW 2521 AUSTRALIA

Tran By Product By Rate Summary

Print Date &Time: 29/08/2011 - 1:58:30PM

Date is between 28/08/2010 and 28/08/2011 AND Site equals Whytes Gully Site

Site: WhytesGully — Whytes Gully Site

Product: Construction Mat. - L/fill Gas Collection Systems. Code:

Rate	Items	Qty	Net	C/M
Drainage Gravels	4	0	49.80	0.00
Totals for product Construction Mat. - L/fill Gas Collection S	**4**		**49.80**	**0.00**

Product: Consumable Product Delivery Code:

Rate	Items	Qty	Net	C/M
Consumable Prod. Del	238	0	130.38	0.00
Totals for product Consumable Product Delivery (CONSUM	**238**		**130.38**	**0.00**

Product: Dead Animals Code:

Rate	Items	Qty	Net	C/M
Large Animal	8	0	3.58	0.00
Medium Animal	15	0	4.30	0.00
RSPCA Wastes	1	0	0.12	0.00
Small Animal	143	0	15.22	0.00
Totals for product Dead Animals (DEAD ANIMALS)	**167**		**23.22**	**0.00**

Product: General Waste Code:

Rate	Items	Qty	Net	C/M
Annual Clean Up	592	0	2,689.42	0.00
Charity Exemption	1,474	0	1,188.20	0.00
Council Tipped Waste	2,715	0	4,802.42	0.00
Dom Weighed Load	20,250	0	3,114.63	0.00
Greenwaste Cont.	21	0	73.68	0.00
Kerbside Collection	6,921	0	39,274.50	0.00
MRF Cont - glass	1	0	7.18	0.00
MRF Contamination	288	0	2,032.36	0.00
Pensioner	9,420	0	463.14	0.00
Rise & Shine	145	0	61.00	0.00
SQID Material	6	0	29.74	0.00
Totals for product General Waste (GENERAL WASTE)	**41,833**		**53,736.27**	**0.00**

Product: General Waste Code:

Rate	Items	Qty	Net	C/M
Comm Weighed Load	7,095	0	38,196.20	0.00
Totals for product General Waste (GENERAL WASTE - CC	**7,095**		**38,196.20**	**0.00**

Tran By Product By Rate Summary

29/08/2011 - 1:58:30PM

Site: WhytesGully Whytes Gully Site

Product: Green Waste Code:

Rate	Items	Qty	Net	C/M
Charity Exemption	29	0	27.72	0.00
Com Weighed Load	4,437	0	1,731.10	0.00
Council Green Waste	554	0	257.62	0.00
Dom Weighed Load	15,609	0	2,962.44	0.00
Kerbside Collection	2,771	0	24,163.76	0.00
Pensioner	3,383	0	194.18	0.00
Totals for product Green Waste (GREEN WASTE)	**26,783**		**29,336.82**	**0.00**

Product: Landfill Operational Materials Code:

Rate	Items	Qty	Net	C/M
Landfill Cover	1,107	0	8,373.76	0.00
Slag / Brecketts	694	0	22,042.06	0.00
Totals for product Landfill Operational Materials (LANDFII	**1,801**		**30,415.82**	**0.00**

Product: Outbound Products Code:

Rate	Items	Qty	Net	C/M
Computer/Television	8	0	32.14	0.00
E-Waste Kerbside	2	0	5.46	0.00
General Recyclables	4	0	3.20	0.00
Glass	75	0	19.94	0.00
Green Waste Contract	1,059	0	27,393.74	0.00
Mattresses	63	0	32.48	0.00
Metals	68	0	574.06	0.00
Motor Oil	48	0	26.92	0.00
Paper/Cardboard	295	0	270.36	0.00
Public Free Mulch	336	0	108.20	0.00
Rejected Material	568	0	35.96	0.00
Revolve Cntr O/bound	26	0	4.62	0.00
Tyres	1	0	5.30	0.00
Totals for product Outbound Products (OUTBOUND PROD	**2,553**		**28,512.38**	**0.00**

Product: Recyclables Inwards Code:

Rate	Items	Qty	Net	C/M
Mixed Recyclables	16,649	0	1,017.38	0.00
Revolve Material	1,198	0	46.40	0.00
Totals for product Recyclables Inwards (RECYCLABLES II	**17,847**		**1,063.78**	**0.00**

Product: Road or Other Construction Material Code:

Rate	Items	Qty	Net	C/M
Sub-Base	8	0	99.60	0.00
Totals for product Road or Other Construction Material (CC	**8**		**99.60**	**0.00**

Site: WhytesGully — Whytes Gully Site

Product: Site Visitors — Code:

Rate	Items	Qty	Net	C/M
Contract Employee	3,528	0	445.56	0.00
Council Employee	3,599	0	203.68	0.00
Operational Equipmen	257	0	1,874.76	0.00
Totals for product Site Visitors (SITE VISITORS)	**7,384**		**2,524.00**	**0.00**

Product: Special Wastes — Code:

Rate	Items	Qty	Net	C/M
Special Wastes	1	0	0.12	0.00
Totals for product Special Wastes (SPECIAL WASTES)	**1**		**0.12**	**0.00**

Product: Specified item Charity Exemption — Code:

Rate	Items	Qty	Net	C/M
Product Charges	3	0	2.56	0.00
Totals for product Specified item Charity Exemption (SPECI	**3**		**2.56**	**0.00**

Product: Specified Item General Levy — Code:

Rate	Items	Qty	Net	C/M
Specified Item Levy	993	0	86.14	0.00
Totals for product Specified Item General Levy (SPEC. ITE	**993**		**86.14**	**0.00**

Product: Specified Items — Code:

Rate	Items	Qty	Net	C/M
Computer	30	35	0.00	0.00
Computer & Monitor	32	37	0.00	0.00
Computer Monitor	87	128	0.00	0.00
Mattress	988	1,237	0.00	0.00
Television - Large	31	33	0.00	0.00
Television - Small	552	883	0.00	0.00
Tyres - Car or 4WD	60	300	0.00	0.00
Totals for product Specified Items (SPECIFIED ITEMS)	**1,780**			**0.00**

Product: Weighbridge Ticket — Code:

Rate	Items	Qty	Net	C/M
Vehicle Tare <4.5 T	71	0	27.28	0.00
Vehicle Tare >4.5T	7	0	0.02	0.00
Totals for product Weighbridge Ticket (WEIGHBRIDGE TI	**78**		**27.30**	**0.00**

	Items		Net
Totals for site WhytesGully	**108,568**		**184,204.39**
GRAND TOTALS	**108,568**		**184,204.39**

Report End

Appendix C

Existing Sidra Results

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (AM)
Existing
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	31	0	31	6.3	1874	0.017	20[6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	36	45	80	22.2	983	0.082	100	8.3	LOS A	0.4	3.5	500	–	0.0	0.0
Approach	0	67	45	111	17.8		0.082		6.0	NA	0.4	3.5				
North: Reddalls Road N leg																
Lane 1	48	0	1	49	34.0	741	0.066	100	14.0	LOS A	0.2	2.2	500	–	0.0	0.0
Approach	48	0	1	49	34.0		0.066		14.0	LOS A	0.2	2.2				
West: West Dapto Road W leg																
Lane 1	2	165	0	167	2.5	1918	0.087	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	165	0	167	2.5		0.087		0.1	NA	0.0	0.0				
Intersection				327	12.4		0.087		4.2	NA	0.4	3.5				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (PM)
Existing
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	37	0	37	0.7	1942	0.019	20[6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	136	24	160	2.7	1680	0.095	100	2.4	LOS A	0.6	4.6	500	–	0.0	0.0
Approach	0	174	24	198	2.3		0.095		1.9	NA	0.6	4.6				
North: Reddalls Road N leg																
Lane 1	53	0	3	56	4.1	1074	0.052	100	11.3	LOS A	0.2	1.4	500	–	0.0	0.0
Approach	53	0	3	56	4.1		0.052		11.3	LOS A	0.2	1.4				
West: West Dapto Road W leg																
Lane 1	6	94	0	100	2.3	1916	0.052	100	0.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	6	94	0	100	2.3		0.052		0.6	NA	0.0	0.0				
Intersection				354	2.6		0.095		3.0	NA	0.6	4.6				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing AM

JS10520
Princes Highway/ West Dapto Road (AM)
Exisiting
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	27	176	0	203	3.0	1901	0.107	100	1.6	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	204	0	204	3.4	1908	0.107	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	27	380	0	407	3.2		0.107		0.8	NA	0.0	0.0				
North: Princes Highway N																
Lane 1	0	153	0	153	2.6	1917	0.080	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	153	0	153	2.6	1917	0.080	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	98	98	18.4	556	0.176	100	15.9	LOS B	0.8	6.4	45	Turn Bay	0.0	0.0
Approach	0	306	98	404	6.4		0.176		3.9	NA	0.8	6.4				
South West: West Dapto Rd W																
Lane 1	206	0	0	206	7.3	757	0.272	100	16.0	LOS B	1.1	8.3	500	–	0.0	0.0
Lane 2	0	0	13	13	0.0	202 [1]	0.064	100	26.6	LOS B	0.2	1.3	10	Turn Bay	0.0	0.0
Approach	206	0	13	219	6.8		0.272		16.7	LOS B	1.1	8.3				
Intersection				1030	5.2		0.272		5.4	NA	1.1	8.3				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing PM

JS10520
Princess Highway/ West Dapto Road (PM)
Exisiting
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	13	152	0	166	1.8	1920	0.086	100	1.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	166	0	166	1.9	1926	0.086	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	13	318	0	332	1.8		0.086		0.5	NA	0.0	0.0				
North: Princes Hwy N																
Lane 1	0	233	0	233	0.9	1939	0.120	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	233	0	233	0.9	1939	0.120	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	166	166	4.3	762	0.218	100	13.2	LOS A	1.0	7.6	45	Turn Bay	0.0	0.0
Approach	0	465	166	632	1.8		0.218		3.5	NA	1.0	7.6				
South West: West Dapto Rd W																
Lane 1	135	0	0	135	3.0	849	0.159	100	14.8	LOS B	0.6	4.4	500	–	0.0	0.0
Lane 2	0	0	19	19	0.0	178	0.109	100	32.8	LOS C	0.4	2.5	10	Turn Bay	0.0	0.0
Approach	135	0	19	154	2.6		0.159		17.0	LOS B	0.6	4.4				
Intersection				1117	1.9		0.218		4.4	NA	1.0	7.6				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing AM

JS10520 - Reddalls Road / Site Entrance
Existing Conditions
AM Peak 08:00 - 09:00
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	14	0	14	0.0	1950	0.007	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	49	49	32.4	1309[1]	0.038	100	12.0	LOS A	0.2	1.5	207	Turn Bay	0.0	0.0
Approach	0	14	49	64	25.0		0.038		9.3	NA	0.2	1.5				
North: Main Entrance																
Lane 1	30	0	4	35	37.5	966	0.036	100	5.6	LOS A	0.1	1.3	500	–	0.0	0.0
Approach	30	0	4	35	37.5		0.036		5.6	LOS A	0.1	1.3				
West: Reddalls Road (W)																
Lane 1	1	32	0	33	0.0	1946	0.017	100	0.5	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	1	32	0	33	0.0		0.017		0.5	NA	0.0	0.0				
Intersection				132	22.0		0.038		6.1	NA	0.2	1.5				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing Midday

JS10520 - Reddalls Road / Site Entrance
Existing Conditions
Midday Peak 14:30 - 15:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	13	0	13	0.0	1950	0.007	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	51	51	32.4	1310 [1]	0.039	100	11.9	LOS A	0.2	1.5	207	Turn Bay	0.0	0.0
Approach	0	13	51	64	25.7		0.039		9.5	NA	0.2	1.5				
North: Main Entrance																
Lane 1	54	0	4	58	39.6	1002	0.058	100	5.5	LOS A	0.2	2.2	500	–	0.0	0.0
Approach	54	0	4	58	39.6		0.058		5.5	LOS A	0.2	2.2				
West: Reddalls Road (W)																
Lane 1	1	14	0	16	0.0	1941	0.008	100	1.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	1	14	0	16	0.0		0.008		1.0	NA	0.0	0.0				
Intersection				138	28.6		0.058		6.8	NA	0.2	2.2				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing PM

JS10520 - Reddalls Road / Site Entrance
Existing Conditions
PM Peak 15:30 - 16:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	3	0	3	0.0	1950	0.002	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	20	20	15.0	1621	0.012	100	16.6	LOS B	0.1	0.4	207	–	0.0	0.0
Approach	0	3	20	23	13.0		0.012		14.4	NA	0.1	0.4				
North: Main Entrance																
Lane 1	36	0	3	39	35.9	1038	0.038	100	5.3	LOS A	0.2	1.4	500	–	0.0	0.0
Approach	36	0	3	39	35.9		0.038		5.3	LOS A	0.2	1.4				
West: Reddalls Road (W)																
Lane 1	3	4	0	7	42.9	1452	0.005	100	6.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	3	4	0	7	42.9		0.005		6.1	NA	0.0	0.0				
Intersection				70	29.0		0.038		8.4	NA	0.2	1.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Rd/Secondary Site Entrance - Existing Midday

JS10520 Whytes Gully
Reddall Road / Secondary Site Entrance
Existing Traffic Movement Midday 14:30-15:30
Giveway / Yield (Two-Way)

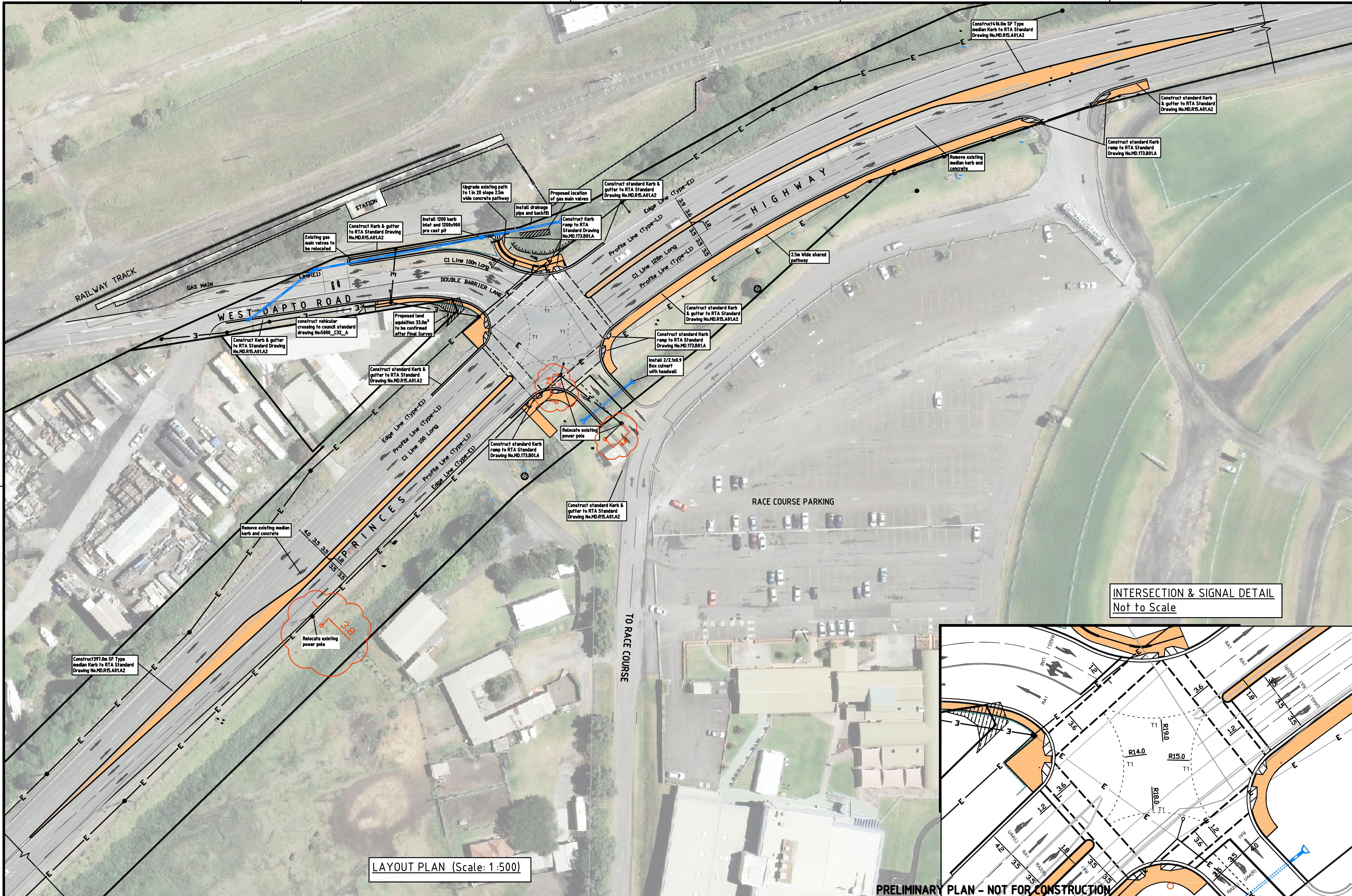
Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road																
Lane 1	0	28	0	28	35.0	1589	0.018	100	0.0	LOS A	0.0	0.0	85	Turn Bay	0.0	0.0
Lane 2	0	17	7	23	39.3	1304	0.018	100	4.1	LOS A	0.1	0.9	500	–	0.0	0.0
Approach	0	45	7	52	37.0		0.018		1.9	NA	0.1	0.9				
North: Secondary Site Entrance																
Lane 1	12	0	4	17	46.7	636	0.026	100	2.6	LOS A	0.1	0.9	500	–	0.0	0.0
Approach	12	0	4	17	46.7		0.026		2.6	LOS A	0.1	0.9				
West: Reddalls Road																
Lane 1	4	48	0	53	34.0	1583	0.033	100	1.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	4	48	0	53	34.0		0.033		1.1	NA	0.0	0.0				
Intersection				121	37.0		0.033		1.6	NA	0.1	0.9				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

Appendix D

Intersection of Princes Highway/ West Dapto Road Concept Design



ISSUE	DESCRIPTION	DRAWN	APPR'D	DATE
3	West Dapto Road kerb alignment changed	RK		27/07/11
2	UPDATED PLAN AND NOTES AS PER RTA COMMENTS.	RK		31.03.11
1	CONCEPT DESIGN LAYOUT SUBMITTED TO RTA FOR REVIEW	RK		15.03.01

0 10 20 30 40 50 60 70 80 90 100mm ON ORIGINAL PLAN

DATUM AHD	SURVEYOR
AZIMUTH MGA	FIELD BOOK
RELATED PLANS	

DRAWN T.Ruthira	DATE 02/2011
DESIGNED T.Ruthira	DATE 02/2011
CHECKED T.Valic	DATE

APPROVED (FOR COUNCIL USE ONLY)

SENIOR DESIGN ENGINEER - CIVIL / DESIGN & TECHNICAL SERVICES MANAGER

DATE

NCS INTERNATIONAL CERTIFIED QUALITY MANAGEMENT SYSTEM ISO9001

SCALES 1 : 500

NORTH POINT

CITY OF WOLLONGONG

PRINCES HIGHWAY KEMBLA GRANGE WEST DAPTO TO ACCESS STRATEGY

wollongong city of innovation

DESIGN & TECHNICAL SERVICES Ph 02 42277111

DESIGN PCS No.	DES 16661
FILE NUMBER	PJ 1095
SHEET OF	SHEETS

A1 ORIGINAL

DRAWING No.	SHEET No.	ISSUE
4617	SK1	3

Appendix E

Future Sidra Analysis and Sensitivity Testing

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM Construction

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (AM)
Existing Construction
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	41	0	41	6.3	1874	0.022	20[6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	26	66	92	27.9	853	0.107	100	10.3	LOS A	0.5	4.3	500	–	0.0	0.0
Approach	0	67	66	132	21.3		0.107		7.1	NA	0.5	4.3				
North: Reddalls Road N leg																
Lane 1	48	0	1	49	34.0	741	0.066	100	14.0	LOS A	0.2	2.2	500	–	0.0	0.0
Approach	48	0	1	49	34.0		0.066		14.0	LOS A	0.2	2.2				
West: West Dapto Road W leg																
Lane 1	2	165	0	167	2.5	1918	0.087	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	165	0	167	2.5		0.087		0.1	NA	0.0	0.0				
Intersection				348	14.1		0.107		4.7	NA	0.5	4.3				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

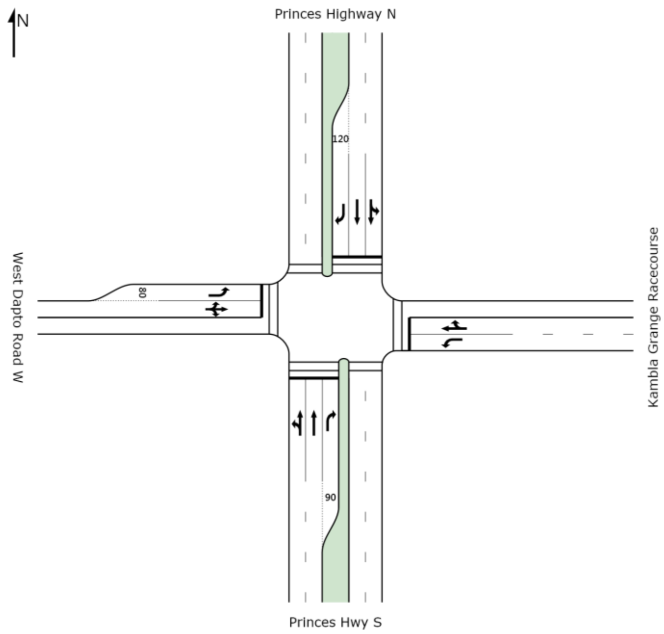
Site: Reddalls RD/West Dapto RD Existing AM Construction

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (PM)
Existing Construction
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	38	0	38	0.7	1942	0.019	20[6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	136	24	160	2.7	1673	0.096	100	2.5	LOS A	0.7	4.7	500	–	0.0	0.0
Approach	0	174	24	198	2.3		0.096		2.0	NA	0.7	4.7				
North: Reddalls Road N leg																
Lane 1	76	0	3	79	14.5	976	0.081	100	12.0	LOS A	0.3	2.4	500	–	0.0	0.0
Approach	76	0	3	79	14.5		0.081		12.0	LOS A	0.3	2.4				
West: West Dapto Road W leg																
Lane 1	6	94	0	100	2.3	1916	0.052	100	0.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	6	94	0	100	2.3		0.052		0.6	NA	0.0	0.0				
Intersection				377	4.9		0.096		3.7	NA	0.7	4.7				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.



LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing AM - Construction

JS10520
Princes Highway/ West Dapto Road (AM)
Exisiting Construction
Signals - Fixed Time   Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows L	T	R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	33	173	0	206	2.9	646	0.319	100	15.1	LOS B	3.8	27.4	500	–	0.0	0.0
Lane 2	0	207	0	207	3.4	649	0.319	100	13.5	LOS A	3.8	27.7	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	388	0.003	100	33.4	LOS C	0.0	0.1	90	Turn Bay	0.0	0.0
Approach	33	380	1	414	3.1		0.319		14.4	LOS A	3.8	27.7				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.001	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	2	0.0	616	0.003	100	10.7	LOS A	0.0	0.2	500	–	0.0	0.0
Approach	1	1	1	3	0.0		0.003		10.8	LOS A	0.0	0.2				
North: Princes Highway N																
Lane 1	1	152	0	154	2.6	652	0.236	100	13.2	LOS A	2.8	19.7	500	–	0.0	0.0
Lane 2	0	154	0	154	2.6	652	0.236	100	13.1	LOS A	2.8	19.7	500	–	0.0	0.0
Lane 3	0	0	120	120	22.8	279	0.430	100	29.0	LOS C	2.6	22.1	120	Turn Bay	0.0	0.0
Approach	1	306	120	427	8.3		0.430		17.6	LOS B	2.8	22.1				
West: West Dapto Road W																
Lane 1	118	0	0	118	7.3	741	0.159	100	19.4	LOS B	1.8	13.5	80	Turn Bay	0.0	0.0
Lane 2	99	1	14	114	6.4	718	0.159	100	19.4	LOS B	1.8	13.0	500	–	0.0	0.0
Approach	217	1	14	232	6.8		0.159		19.4	LOS B	1.8	13.5				
Intersection				1075	6.0		0.430		16.7	LOS B	3.8	27.7				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing PM - Construction

JS10520
Princes Highway/ West Dapto Road (PM)
Exisiting Construction
Signals - Fixed Time   Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	14	149	0	163	1.7	653	0.249	100	14.0	LOS A	2.9	20.8	500	–	0.0	0.0
Lane 2	0	163	0	163	1.9	655	0.249	100	13.1	LOS A	2.9	20.9	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	326	0.003	100	35.1	LOS C	0.0	0.1	90	Turn Bay	0.0	0.0
Approach	14	312	1	327	1.8		0.249		13.6	LOS A	2.9	20.9				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.001	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	2	0.0	637	0.003	100	10.1	LOS A	0.0	0.2	500	–	0.0	0.0
Approach	1	1	1	3	0.0		0.003		10.4	LOS A	0.0	0.2				
North: Princes Highway N																
Lane 1	1	227	0	229	0.9	659	0.347	100	13.8	LOS A	4.3	30.3	500	–	0.0	0.0
Lane 2	0	229	0	229	0.9	659	0.347	100	13.7	LOS A	4.3	30.3	500	–	0.0	0.0
Lane 3	0	0	172	172	4.3	379	0.453	100	27.2	LOS B	3.7	26.6	120	Turn Bay	0.0	0.0
Approach	1	456	172	629	1.8		0.453		17.4	LOS B	4.3	30.3				
West: West Dapto Road W																
Lane 1	93	0	0	93	8.1	737	0.127	100	19.3	LOS B	1.4	10.6	80	Turn Bay	0.0	0.0
Lane 2	62	1	24	88	5.8	692	0.127	100	19.2	LOS B	1.3	9.8	500	–	0.0	0.0
Approach	156	1	24	181	7.0		0.127		19.2	LOS B	1.4	10.6				
Intersection				1140	2.6		0.453		16.6	LOS B	4.3	30.3				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing AM - Construction

JS10520 - Reddalls Road / Site Entrance
Existing Construction
AM Peak 08:00 - 09:00
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	14	0	14	0.0	1950	0.007	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	78	78	35.2	1279 [1]	0.061	100	12.1	LOS A	0.3	2.5	207	Turn Bay	0.0	0.0
Approach	0	14	78	93	29.7		0.061		10.2	NA	0.3	2.5				
North: Main Entrance																
Lane 1	30	0	4	35	37.5	957	0.036	100	5.6	LOS A	0.1	1.3	500	–	0.0	0.0
Approach	30	0	4	35	37.5		0.036		5.6	LOS A	0.1	1.3				
West: Reddalls Road (W)																
Lane 1	1	32	0	33	0.0	1946	0.017	100	0.5	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	1	32	0	33	0.0		0.017		0.5	NA	0.0	0.0				
Intersection				161	25.2		0.061		7.2	NA	0.3	2.5				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing Midday - Construction

JS10520 - Reddalls Road / Site Entrance
Existing Conditions Construction
Midday Peak 14:30 - 15:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	13	0	13	0.0	1950	0.007	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	65	65	32.4	1310 [1]	0.050	100	11.9	LOS A	0.2	2.0	207	Turn Bay	0.0	0.0
Approach	0	13	65	78	27.0		0.050		9.9	NA	0.2	2.0				
North: Main Entrance																
Lane 1	68	0	4	72	40.3	1005	0.072	100	5.5	LOS A	0.3	2.8	500	–	0.0	0.0
Approach	68	0	4	72	40.3		0.072		5.5	LOS A	0.3	2.8				
West: Reddalls Road (W)																
Lane 1	1	14	0	16	0.0	1941	0.008	100	1.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	1	14	0	16	0.0		0.008		1.0	NA	0.0	0.0				
Intersection				167	30.2		0.072		7.1	NA	0.3	2.8				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing PM - Construction

JS10520 - Reddalls Road / Site Entrance
Existing Construction
PM Peak 15:30 - 16:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	3	0	3	0.0	1950	0.002	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	20	20	15.0	1621	0.012	100	16.6	LOS B	0.1	0.4	207	–	0.0	0.0
Approach	0	3	20	23	13.0		0.012		14.4	NA	0.1	0.4				
North: Main Entrance																
Lane 1	57	0	3	60	37.3	1044	0.057	100	5.3	LOS A	0.2	2.1	500	–	0.0	0.0
Approach	57	0	3	60	37.3		0.057		5.3	LOS A	0.2	2.1				
West: Reddalls Road (W)																
Lane 1	3	4	0	7	42.9	1452	0.005	100	6.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	3	4	0	7	42.9		0.005		6.1	NA	0.0	0.0				
Intersection				90	31.5		0.057		7.7	NA	0.2	2.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM Construction +20%

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (AM)
Existing Construction +20%
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	51	0	51	6.3	1874	0.027	20 [6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	29	79	108	28.3	803	0.134	100	10.9	LOS A	0.6	5.5	500	–	0.0	0.0
Approach	0	80	79	159	21.3		0.134		7.4	NA	0.6	5.5				
North: Reddalls Road N leg																
Lane 1	57	0	1	59	34.0	705	0.083	100	14.4	LOS A	0.3	2.7	500	–	0.0	0.0
Approach	57	0	1	59	34.0		0.083		14.4	LOS A	0.3	2.7				
West: West Dapto Road W leg																
Lane 1	3	198	0	200	2.5	1918	0.104	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	3	198	0	200	2.5		0.104		0.1	NA	0.0	0.0				
Intersection				417	14.1		0.134		4.9	NA	0.6	5.5				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM Construction +20%

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (PM)
Existing Construction +20%
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	45	0	45	0.7	1942	0.023	20 [6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	163	29	192	2.7	1659	0.116	100	2.7	LOS A	0.8	5.9	500	–	0.0	0.0
Approach	0	208	29	237	2.3		0.116		2.2	NA	0.8	5.9				
North: Reddalls Road N leg																
Lane 1	91	0	4	95	14.5	953	0.100	100	12.2	LOS A	0.4	3.0	500	–	0.0	0.0
Approach	91	0	4	95	14.5		0.100		12.2	LOS A	0.4	3.0				
West: West Dapto Road W leg																
Lane 1	7	113	0	120	2.3	1916	0.063	100	0.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	7	113	0	120	2.3		0.063		0.6	NA	0.0	0.0				
Intersection				452	4.9		0.116		3.9	NA	0.8	5.9				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing AM - Construction +20%

JS10520
Princes Highway/ West Dapto Road (AM)
Exisiting Construction +20%
Signals - Fixed Time   Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	39	208	0	247	2.9	646	0.383	100	15.5	LOS B	4.7	33.8	500	–	0.0	0.0
Lane 2	0	248	0	248	3.4	649	0.383	100	13.9	LOS A	4.7	34.1	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	361	0.003	100	34.3	LOS C	0.0	0.2	90	Turn Bay	0.0	0.0
Approach	39	456	1	496	3.1		0.383		14.7	LOS B	4.7	34.1				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.002	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	3	0.0	597	0.004	100	10.8	LOS A	0.0	0.3	500	–	0.0	0.0
Approach	1	1	1	4	0.0		0.004		10.8	LOS A	0.0	0.3				
North: Princes Highway N																
Lane 1	1	183	0	184	2.6	652	0.283	100	13.5	LOS A	3.4	24.1	500	–	0.0	0.0
Lane 2	0	184	0	184	2.6	652	0.283	100	13.3	LOS A	3.4	24.1	500	–	0.0	0.0
Lane 3	0	0	144	144	22.8	252	0.571	100	30.3	LOS C	3.4	28.4	120	Turn Bay	0.0	0.0
Approach	1	367	144	512	8.3		0.571		18.1	LOS B	3.4	28.4				
West: West Dapto Road W																
Lane 1	141	0	0	141	7.3	741	0.190	100	19.5	LOS B	2.2	16.5	80	Turn Bay	0.0	0.0
Lane 2	119	1	16	137	6.4	718	0.190	100	19.5	LOS B	2.1	15.8	500	–	0.0	0.0
Approach	260	1	16	278	6.8		0.190		19.5	LOS B	2.2	16.5				
Intersection				1291	6.0		0.571		17.1	LOS B	4.7	34.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing PM - Construction +20%

JS10520
Princes Highway/ West Dapto Road (PM)
Exisiting Construction +20%
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows L	T	R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	16	179	0	195	1.7	653	0.299	100	14.2	LOS A	3.6	25.5	500	–	0.0	0.0
Lane 2	0	196	0	196	1.9	655	0.299	100	13.4	LOS A	3.6	25.6	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	293	0.004	100	36.0	LOS C	0.0	0.2	90	Turn Bay	0.0	0.0
Approach	16	374	1	392	1.8		0.299		13.9	LOS A	3.6	25.6				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.002	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	3	0.0	622	0.004	100	10.1	LOS A	0.0	0.2	500	–	0.0	0.0
Approach	1	1	1	4	0.0		0.004		10.4	LOS A	0.0	0.2				
North: Princes Highway N																
Lane 1	1	273	0	274	0.9	659	0.416	100	14.2	LOS A	5.3	37.4	500	–	0.0	0.0
Lane 2	0	274	0	274	0.9	659	0.416	100	14.1	LOS A	5.3	37.4	500	–	0.0	0.0
Lane 3	0	0	206	206	4.3	351	0.586	100	28.3	LOS B	4.7	34.0	120	Turn Bay	0.0	0.0
Approach	1	547	206	754	1.8		0.586		18.0	LOS B	5.3	37.4				
West: West Dapto Road W																
Lane 1	112	0	0	112	8.1	737	0.152	100	19.4	LOS B	1.7	12.9	80	Turn Bay	0.0	0.0
Lane 2	75	1	29	105	5.8	692	0.152	100	19.3	LOS B	1.6	11.9	500	–	0.0	0.0
Approach	187	1	29	217	7.0		0.152		19.3	LOS B	1.7	12.9				
Intersection				1367	2.6		0.586		17.0	LOS B	5.3	37.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing AM - Construction +20%

JS10520 - Reddalls Road / Site Entrance
Existing Construction +20%
AM Peak 08:00 - 09:00
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	17	0	17	0.0	1950	0.009	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	94	94	35.2	1278[1]	0.073	100	12.2	LOS A	0.3	3.1	207	Turn Bay	0.0	0.0
Approach	0	17	94	111	29.7		0.073		10.3	NA	0.3	3.1				
North: Main Entrance																
Lane 1	37	0	5	42	37.5	944	0.044	100	5.7	LOS A	0.2	1.6	500	–	0.0	0.0
Approach	37	0	5	42	37.5		0.044		5.7	LOS A	0.2	1.6				
West: Reddalls Road (W)																
Lane 1	2	38	0	40	0.0	1946	0.021	100	0.5	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	38	0	40	0.0		0.021		0.5	NA	0.0	0.0				
Intersection				193	25.2		0.073		7.2	NA	0.3	3.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing Midday - Construction +20%

JS10520 - Reddalls Road / Site Entrance
Existing Conditions Construction +20%
Midday Peak 14:30 - 15:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	16	0	16	0.0	1950	0.008	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	78	78	32.4	1310[1]	0.060	100	11.9	LOS A	0.3	2.4	207	Turn Bay	0.0	0.0
Approach	0	16	78	94	27.0		0.060		10.0	NA	0.3	2.4				
North: Main Entrance																
Lane 1	82	0	5	87	40.3	999	0.087	100	5.5	LOS A	0.4	3.4	500	–	0.0	0.0
Approach	82	0	5	87	40.3		0.087		5.5	LOS A	0.4	3.4				
West: Reddalls Road (W)																
Lane 1	2	17	0	19	0.0	1941	0.010	100	1.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	17	0	19	0.0		0.010		1.0	NA	0.0	0.0				
Intersection				200	30.2		0.087		7.2	NA	0.4	3.4				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing PM -

JS10520 - Reddalls Road / Site Entrance
Existing Construction +20%
PM Peak 15:30 - 16:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	4	0	4	0.0	1950	0.002	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	24	24	15.0	1618	0.015	100	16.6	LOS B	0.1	0.5	207	–	0.0	0.0
Approach	0	4	24	28	13.0		0.015		14.4	NA	0.1	0.5				
North: Main Entrance																
Lane 1	68	0	4	72	37.3	1042	0.069	100	5.3	LOS A	0.3	2.6	500	–	0.0	0.0
Approach	68	0	4	72	37.3		0.069		5.3	LOS A	0.3	2.6				
West: Reddalls Road (W)																
Lane 1	4	5	0	8	42.9	1452	0.006	100	6.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	4	5	0	8	42.9		0.006		6.1	NA	0.0	0.0				
Intersection				108	31.5		0.069		7.8	NA	0.3	2.6				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM Construction +40%

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (AM)
Existing Construction +40%
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	62	0	62	6.3	1874	0.033	20[6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	31	92	123	28.8	754	0.164	100	11.7	LOS A	0.8	6.8	500	–	0.0	0.0
Approach	0	93	92	185	21.3		0.164		7.8	NA	0.8	6.8				
North: Reddalls Road N leg																
Lane 1	67	0	1	69	34.0	670	0.102	100	14.8	LOS B	0.4	3.4	500	–	0.0	0.0
Approach	67	0	1	69	34.0		0.102		14.8	LOS B	0.4	3.4				
West: West Dapto Road W leg																
Lane 1	3	230	0	233	2.5	1918	0.122	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	3	230	0	233	2.5		0.122		0.1	NA	0.0	0.0				
Intersection				487	14.1		0.164		5.1	NA	0.8	6.8				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls RD/West Dapto RD Existing AM Construction +40%

JS10520
Reddalls Rd/ West Dapto Rd Kembla Grange (PM)
Existing Construction +40%
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Demand Flows Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: West Dapto Road E leg																
Lane 1	0	53	0	53	0.7	1942	0.027	20 [6]	0.0	LOS A	0.0	0.0	40	Turn Bay	0.0	0.0
Lane 2	0	190	34	223	2.7	1643	0.136	100	3.0	LOS A	1.0	7.2	500	–	0.0	0.0
Approach	0	243	34	277	2.3		0.136		2.4	NA	1.0	7.2				
North: Reddalls Road N leg																
Lane 1	106	0	5	111	14.5	929	0.119	100	12.3	LOS A	0.5	3.6	500	–	0.0	0.0
Approach	106	0	5	111	14.5		0.119		12.3	LOS A	0.5	3.6				
West: West Dapto Road W leg																
Lane 1	8	132	0	140	2.3	1916	0.073	100	0.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	8	132	0	140	2.3		0.073		0.6	NA	0.0	0.0				
Intersection				528	4.9		0.136		4.0	NA	1.0	7.2				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing AM - Construction +40%

JS10520
Princes Highway/ West Dapto Road (AM)
Exisiting Construction +40%
Signals - Fixed Time   Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	46	243	0	288	2.9	646	0.446	100	15.9	LOS B	5.6	40.5	500	–	0.0	0.0
Lane 2	0	289	0	289	3.4	649	0.446	100	14.3	LOS A	5.7	40.8	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	336	0.004	100	35.1	LOS C	0.0	0.2	90	Turn Bay	0.0	0.0
Approach	46	532	1	579	3.1		0.446		15.1	LOS B	5.7	40.8				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.002	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	3	0.0	577	0.005	100	10.8	LOS A	0.0	0.3	500	–	0.0	0.0
Approach	1	1	1	4	0.0		0.005		10.9	LOS A	0.0	0.3				
North: Princes Highway N																
Lane 1	1	213	0	215	2.6	652	0.330	100	13.7	LOS A	4.0	28.7	500	–	0.0	0.0
Lane 2	0	215	0	215	2.6	652	0.330	100	13.6	LOS A	4.0	28.7	500	–	0.0	0.0
Lane 3	0	0	168	168	22.8	228	0.737	100	35.1	LOS C	4.6	38.3	120	Turn Bay	0.0	0.0
Approach	1	428	168	598	8.3		0.737		19.7	LOS B	4.6	38.3				
West: West Dapto Road W																
Lane 1	165	0	0	165	7.3	741	0.222	100	19.7	LOS B	2.6	19.5	80	Turn Bay	0.0	0.0
Lane 2	139	1	19	159	6.4	718	0.222	100	19.7	LOS B	2.5	18.8	500	–	0.0	0.0
Approach	304	1	19	324	6.8		0.222		19.7	LOS B	2.6	19.5				
Intersection				1506	6.0		0.737		17.9	LOS B	5.7	40.8				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Princes Highway/ West Dapto Road Existing PM - Construction +40%

JS10520
Princes Highway/ West Dapto Road (PM)
Exisiting Construction +40%
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: Princes Hwy S																
Lane 1	19	208	0	228	1.7	653	0.349	100	14.5	LOS B	4.3	30.4	500	–	0.0	0.0
Lane 2	0	228	0	228	1.9	655	0.349	100	13.7	LOS A	4.3	30.5	500	–	0.0	0.0
Lane 3	0	0	1	1	0.0	264	0.006	100	37.0	LOS C	0.0	0.2	90	Turn Bay	0.0	0.0
Approach	19	437	1	457	1.8		0.349		14.2	LOS A	4.3	30.5				
East: Kambla Grange Racecourse																
Lane 1	1	0	0	1	0.0	780	0.002	100	11.0	LOS A	0.0	0.1	500	–	0.0	0.0
Lane 2	0	1	1	3	0.0	611	0.005	100	10.8	LOS A	0.0	0.3	500	–	0.0	0.0
Approach	1	1	1	4	0.0		0.005		10.9	LOS A	0.0	0.3				
North: Princes Highway N																
Lane 1	1	318	0	320	0.9	659	0.485	100	14.6	LOS B	6.4	44.9	500	–	0.0	0.0
Lane 2	0	320	0	320	0.9	659	0.485	100	14.5	LOS A	6.4	44.9	500	–	0.0	0.0
Lane 3	0	0	240	240	4.3	326	0.738	100	32.5	LOS C	6.3	45.5	120	Turn Bay	0.0	0.0
Approach	1	638	240	880	1.8		0.738		19.4	LOS B	6.4	45.5				
West: West Dapto Road W																
Lane 1	131	0	0	131	8.1	737	0.177	100	19.5	LOS B	2.0	15.3	80	Turn Bay	0.0	0.0
Lane 2	87	1	34	123	5.8	691	0.177	100	19.4	LOS B	1.9	14.1	500	–	0.0	0.0
Approach	218	1	34	253	7.0		0.177		19.5	LOS B	2.0	15.3				
Intersection				1595	2.6		0.738		17.9	LOS B	6.4	45.5				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing AM - Construction +40%

JS10520 - Reddalls Road / Site Entrance
Existing Construction +40%
AM Peak 08:00 - 09:00
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Demand Flows Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	20	0	20	0.0	1950	0.010	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	110	110	35.2	1278 [1]	0.086	100	12.2	LOS A	0.4	3.6	207	Turn Bay	0.0	0.0
Approach	0	20	110	130	29.7		0.086		10.3	NA	0.4	3.6				
North: Main Entrance																
Lane 1	43	0	6	49	37.5	930	0.052	100	5.8	LOS A	0.2	1.9	500	–	0.0	0.0
Approach	43	0	6	49	37.5		0.052		5.8	LOS A	0.2	1.9				
West: Reddalls Road (W)																
Lane 1	2	45	0	47	0.0	1946	0.024	100	0.5	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	45	0	47	0.0		0.024		0.5	NA	0.0	0.0				
Intersection				225	25.2		0.086		7.3	NA	0.4	3.6				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing Midday - Construction +40%

JS10520 - Reddalls Road / Site Entrance
Existing Conditions Construction +40%
Midday Peak 14:30 - 15:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Demand Flows Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	18	0	18	0.0	1950	0.009	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	91	91	32.4	1310 [1]	0.070	100	12.0	LOS A	0.3	2.8	207	Turn Bay	0.0	0.0
Approach	0	18	91	110	27.0		0.070		10.0	NA	0.3	2.8				
North: Main Entrance																
Lane 1	95	0	6	101	40.3	992	0.102	100	5.6	LOS A	0.4	4.1	500	–	0.0	0.0
Approach	95	0	6	101	40.3		0.102		5.6	LOS A	0.4	4.1				
West: Reddalls Road (W)																
Lane 1	2	20	0	22	0.0	1941	0.011	100	1.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	2	20	0	22	0.0		0.011		1.0	NA	0.0	0.0				
Intersection				233	30.2		0.102		7.2	NA	0.4	4.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Reddalls Road / Main Entrance - Existing PM -

JS10520 - Reddalls Road / Site Entrance
Existing Construction +40%
PM Peak 15:30 - 16:30
Stop (Two-Way)

Lane Use and Performance

	Demand Flows L	Demand Flows T	Demand Flows R	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Lane Length	SL Type	Cap. Adj.	Prob. Block.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
East: Reddalls Road (E)																
Lane 1	0	4	0	4	0.0	1950	0.002	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	28	28	15.0	1615	0.018	100	16.6	LOS B	0.1	0.6	207	–	0.0	0.0
Approach	0	4	28	33	13.0		0.018		14.4	NA	0.1	0.6				
North: Main Entrance																
Lane 1	79	0	4	83	37.3	1039	0.080	100	5.4	LOS A	0.3	3.1	500	–	0.0	0.0
Approach	79	0	4	83	37.3		0.080		5.4	LOS A	0.3	3.1				
West: Reddalls Road (W)																
Lane 1	4	6	0	10	42.9	1452	0.007	100	6.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	4	6	0	10	42.9		0.007		6.1	NA	0.0	0.0				
Intersection				126	31.5		0.080		7.8	NA	0.3	3.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model used.

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APPENDIX J

Cultural Heritage Assessment

APPENDIX J1

Aboriginal Cultural Heritage Assessment Report

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Whytes Gully New Landfill Cell

Aboriginal Cultural Heritage Assessment Report

Golder Associates on behalf of Wollongong City Council

January 2012

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Project no: *12443*

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Reviewer:

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DOCUMENT CONTROL SHEET

PROJECT	Whytes Gully New Landfill Cell Expansion, Kembla Grange
PROJECT NO	12443
REPORT TO	Golder Associates on Behalf of Wollongong City Council
REPORT TITLE:	Whytes Gully Aboriginal Cultural Heritage Assessment Report
AUTHOR(S):	Asher Ford and Paul Howard

REVISION	PREPARED	INTERNAL REVIEW	EXTERNAL REVIEW	AMENDED
Draft A	Asher Ford	Sam Higgs	Jacinta McMahon	24 Feb 2012
Final	Asher Ford			

REVISION	ISSUED	NAME	SIGNED
A	13 January 2012	Asher Ford	
Final	24 February 2012	Asher Ford	

EXECUTIVE SUMMARY

This Aboriginal Cultural Heritage Assessment Report (ACHAR) has been commissioned for the proposed Whytes Gully New Landfill Cell (the Project), at Kembla Grange NSW (the Study Area) on behalf of Wollongong City Council (WCC). The project is seeking approvals under Part 3A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and this investigation has been undertaken in accordance with the requirements of the Director Generals Requirements (DGRs). The report details the results of Aboriginal cultural heritage investigations for the Project, the results of consultation with Registered Aboriginal Parties (RAPs) and proposed management recommendations. A consultation log with copies of RAP submissions is located in Appendix 1. Archaeological investigations for Aboriginal heritage are detailed in the Aboriginal Archaeological Report (AAR) which is attached to this report in Appendix 2.

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Project Area and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
    - Ethos of the Australia ICOMOS Burra Charter
    - The DECCW 2010 *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Continued consultation with the registered Aboriginal parties*

It is recommended that Wollongong City Council continue to inform the registered Aboriginal parties about the management of Aboriginal cultural heritage sites within the Study Area throughout the life of the project, including pre-excavation and pre-construction on-site meetings. This recommendation is in keeping with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW).

Recommendation 2: *Cultural Awareness Training*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about Aboriginal cultural heritage within the study area and information for the visual identification of Aboriginal cultural material, particularly stone artefacts.

ACKNOWLEDGEMENTS

Biosis Research gratefully acknowledges the contributions of the following organisations in preparing this report:

- Illawarra Local Aboriginal Land Council
- Wodi Wodi Elders Corporation
- Gandagarra Elders Group
- La Perouse Botany Bay Aboriginal Corporation
- North Illawarra Aboriginal Collective Inc.
- Golder Associates on behalf of Wollongong City Council

ABBREVIATIONS

ACHAR	Aboriginal Cultural Heritage Assessment Report
AGD	Australian Geodetic Datum
AHIMS	Aboriginal Heritage Information Management System
CHL	Commonwealth Heritage List
CMA	Catchment Management Authority
DA	Determining Authority
DECCW	Department of Environment, Climate Change and Water
DP	Deposited Plan
DSEWPC	Department of Sustainability, Environment, Water, Population and Community
DEWHA	Department of Environment, Water, Heritage and Arts
EPA	Environment Planning and Assessment
EPBC	Environmental Protection and Biodiversity Conservation
EPRG	Environmental Protection and Regulation Group
GDA	Geocentric Datum of Australia
GPS	Global Positioning System
ICOMOS	International Council on Monuments and Sites
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LPMA	Land and Property Management Authority
MGA	Map Grid of Australia
NHL	National Heritage List
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Service
NTSCORP	Native Title Services Corporation
REF	Review of Environmental Factors
REP	Regional Environmental Plan

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1.0 INTRODUCTION

1.1 Project Background

This ACHAR has been commissioned for the proposed Whytes Gully New Landfill Cell (the Project), at Kembla Grange NSW (the Study Area) on behalf of Wollongong City Council (WCC). The project is seeking approvals under Part 3A of the EP&A Act and this investigation has been undertaken in accordance with the requirements of the DGRs. The report details the results of Aboriginal cultural heritage investigations for the Project, the results of consultation with Registered Aboriginal Parties (RAPs) and proposed management recommendations. A consultation log with copies of RAP submissions is located in Appendix 1. Archaeological investigations for Aboriginal heritage are detailed in the AAR which is attached to this report in Appendix 2.

1.2 Proposed Development

WCC are proposing to develop a new landfill cell within the Whytes Gully Resource Recovery Park (WGRRP) (Figure 2). The development will include the staged construction and operation of a new landfill cell and will involve the following activities that could potentially harm Aboriginal heritage:

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- bulk earthworks, which will removal of topsoil and subsoil.

1.3 Planning Approvals

The proposed development will be assessed under the transitional arrangements applying to the former Part 3A of the EP&A Act. Other potentially relevant legislation, planning instruments and guidelines that will inform the ACHAR include:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987* (ATSIHPA Act);
- *ICOMOS Australia Burra Charter 1999* (the Burra Charter);
- *National Parks & Wildlife Act 1974* (NPW Act) (as amended 2010); and,
- *West Dapto Local Environment Plan 2010* (LEP 2010).

1.4 Project Brief

The ACHAR has been conducted in line with the requirements of the DGRs and guidelines issued by the NSW Office of Environment and Heritage (OEH). The objectives of the ACHA investigation process were to:

- Conduct heritage register searches to identify previously recorded cultural heritage sites in the vicinity of the proposed Study Area. Searches will include the Aboriginal Heritage Information Management System (AHIMS);

- Conduct additional background research in order to recognise any identifiable regional trends in site distribution and location and provide a site prediction model;

- Undertake a comprehensive survey of the Study Area, relocating any previously recorded sites (on AHIMS);

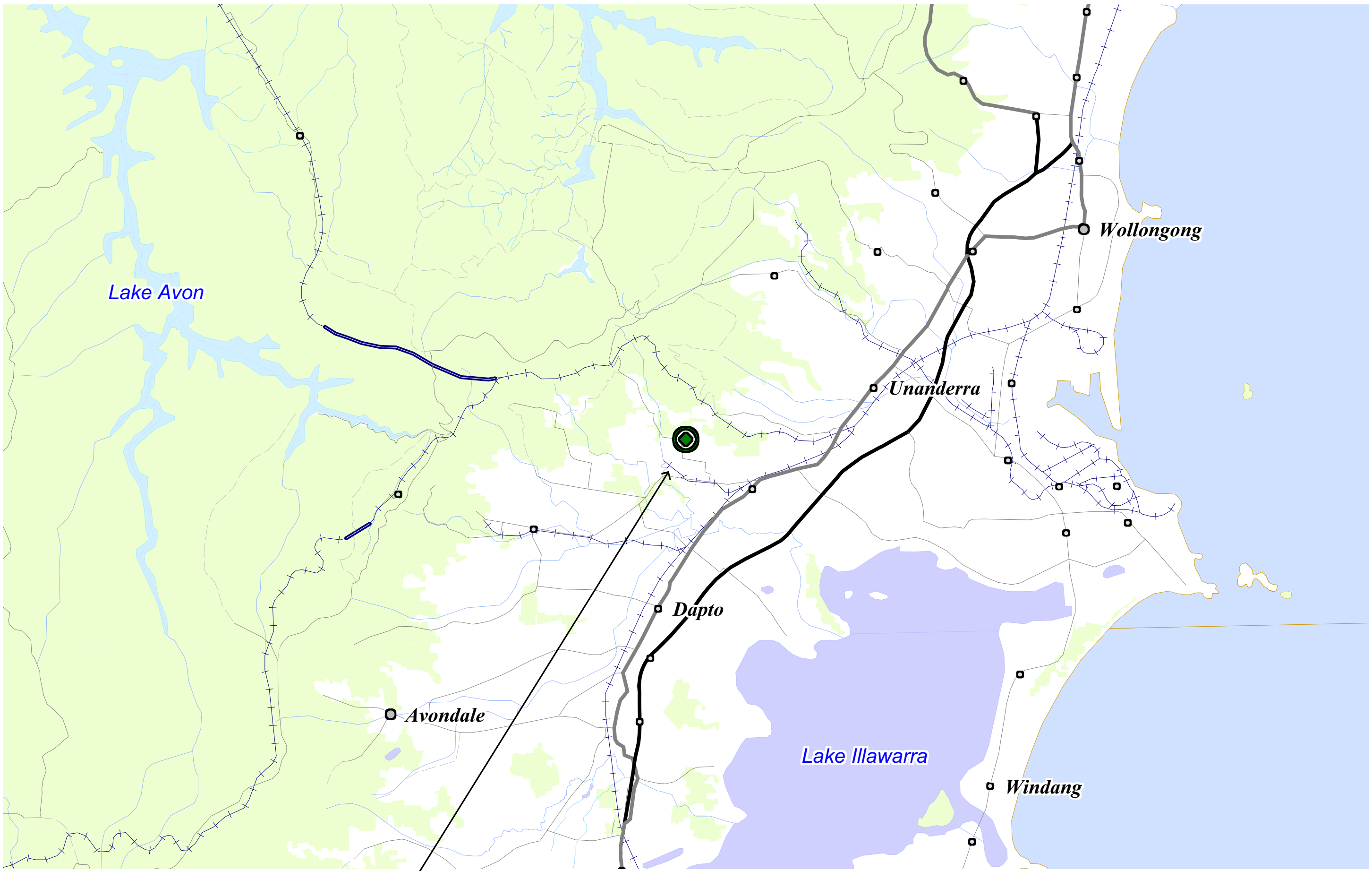
- Undertake test excavations of any potential archaeological deposits identified during the field survey;

- Record and assess sites identified during the survey in compliance with the guidelines issued by the OEH;

- Assess the heritage significance of all identified Aboriginal cultural heritage sites and Places;

- Identify impacts to all identified Aboriginal and historical cultural heritage sites and Places based on potential ground disturbance from the proposed construction of the proposed cable alignment; and

- Make recommendations to minimise or mitigate impacts to cultural heritage values within the Study Area.



Study Area

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Figure 1: Location of the Study Area in a regional context

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Scale: 0 0.25 0.5 0.75 1.0 kilometres

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Figure 2: Study Area.

Date: 6 September 2011 | Drawn by: ANP
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metres

Scale: 1:3,600 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 2

2.0 DESCRIPTION OF THE AREA

2.1 Study Area Description

The proposed development is located at WGRRP, Kembla Grange, Wollongong, NSW (Figure 1 following). The Study Area includes the following lots:

- Lot 501, DP 1079122;
- Lot 502, DP 1079122;
- Lot 2, DP 240557;
- Lot 51, DP 1022266;
- Lot 52, DP 1022266; and,
- Lot 53, DP 1022266.

The site is bounded by Reddalls Road to the south, Dapto Creek to the west and grazing farm land to the north, northeast and east (Figure 2). The Study Area is located within the current boundary of the WGRRP.

2.2 Aboriginal Heritage

2.2.1 AHIMS Search Results

An AHIMS search was conducted using a 3 x 3 km search area centred on the Study Area. The search identified 16 Aboriginal sites within the search area, predominately Isolated Finds (56.25%, n=9) and Open Camp Sites (43.75%, n=7) (**Error! Reference source not found.**). Of these sites, only one was located in the Study Area, isolated artefact RR2 (AHIMS # 52-2-3867). As shown in Table 1 below, sites were located across a range of landforms, but all are in relatively close proximity to water.

The variability in descriptions provided in AHIMS site cards can often reduce the detail of information within various analysis categories. Each analysis only includes sites for which information had been recorded that was applicable to one or more categories used in the particular analysis. The AHIMS database only includes Aboriginal sites registered with AHIMS and is not a complete list of Aboriginal sites within any given area.

Table 1: AHIMS search results (Sites located within the Study Area are shaded orange)

AHIMS Site Number	Site Name	Site Type	Landform	Distance to Water
52-2-3281	WDRA_AX_17	Open Camp Site	Spur Crest	25-65m
52-2-3279	WDRA_AX_14	Open camp site	Lower Hillslope	20m
52-2-3814	Smiths Lane AFT-1	Isolated Find	Ridge	100m
52-2-3295	WDRA_AX_11	Artefact	Alluvial flat	100m

AHIMS Site Number	Site Name	Site Type	Landform	Distance to Water
		Scatter		
52-2-3592	Farmborough Road IF-1	Isolated Find	Spur	5m
52-2-3815	Riverpark Way AFT-1	Isolated Find	Ridge	100m
52-2-3282	WDRA_AX_19	Open Camp Site	Alluvial Flat	N/A
52-2-3272	WDRA_AX_41	Isolated Find	Middle Hillslope	>100m
52-2-3286	WDRA_AS_04	Open Camp Site	Alluvial Flat	80m
52-2-3294	WDRA_AX_10	Isolated Find	Alluvial flat	30m
52-2-3278	WDRA_AX_13	Open Camp Site	Alluvial Flat	10m
52-2-3292	WDRA_AX_07	Open Camp Site	Alluvial Flat	10m
52-2-3298	WDRA_AX_12	Isolated Find	Spur	60m
52-2-3290	WDRA_AX_08	Artefact Scatter	Alluvial Flat	20m
52-2-3271	WDRA_AX_40	Isolated Find	Spur Crest	>100m
52-2-3867	RR2	Isolated Find	Alluvial Flat	20m

2.2.2 Archaeological Assessment Results

The Aboriginal archaeological assessment (Appendix 2) identified four Aboriginal sites in the Study Area as shown in Table 2, Figure 4 and discussed in Section 4.

Table 2: Aboriginal Heritage Sites in the Study Area

Site Name	Features	Survey Unit	Landform	Condition
RR2 (AHIMS # 52-2-3867)	Isolated Artefact	Floodplain	Floodplain	Destroyed
Whytes Gully 1	Isolated Artefact	Ridges	Crest	Fair
Whytes Gully 2	Artefact Scatter	Ridges	Crest	Fair
Whytes Gully 3	Shell Material	Ridges	Footslope	Highly Disturbed

2.2.3 Sites Subject to Impacts

Of the four Aboriginal sites in the Study Area, only RR2 (AHIMS # 52-2-3867)will be impacted by the proposed development. The remaining sites are outside of the development footprint (Figure 3).

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Figure 3: AHIMS Search.

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Acknowledgements:
Site Data - OEH
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0 0.2 0.4 0.6 0.8 1.0
kilometres

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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
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N W E S

Figure 4

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Figure 4: Aboriginal Heritage Sites in the Study Area.

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File number: 12443	Checked by: ASF
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metres

Scale: 1:4,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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2.3 Environmental Description

It is important to consider the local environment of the Study Area in any heritage assessment. Firstly the environment can influence human occupation and associated land use and consequently the distribution and character of cultural material. Secondly environmental processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly environmental features can contribute to the significance that places can have for people.

2.3.1 Topography and Drainage

The Study Area is dominated by two ridgelines, one ascending west to east along the northern boundary and the second descending south along the eastern boundary before swinging west into the lower southeast of the Study Area (Figure 2). These two ridgelines slope south and west into natural gullies that flatten out onto the alluvial floodplain surrounding Dapto Creek. Prior to the development of the landfill, water drained off the two ridgelines, down gullies and into a creek line running southwest across the floodplain into Dapto Creek (Plate 1). This creek line and the majority of natural drainage lines have been either removed or altered by subsequent landfill developments (Figure 2).

Plate 1: 1970 Aerial Photograph of the Study Area prior to development

2.3.2 Geology and Soils

The underlying geology of the Study Area comprises undifferentiated grey siltstone, sandstone, shale, carbonaceous claystone, laminate and quartz lithic sandstone (3). This is overlain by Illawarra Coal Measure deposits of resistant inter-bedded quartz-lithic sandstone, grey siltstone, clay laminite and carbonaceous claystone and Quaternary alluvial deposits in low lying sections of the Study Area (Bannerman and Hazelton, 1990).

Table 3: Geological units within the Study Area. (Bannerman and Hazelton 1990).

Geological Unit	Geological Description	Age and Depositional Sequence	Location
Qal	Alluvium, gravel, swamp deposits and sand dunes	Quaternary Alluvial Deposits	Alluvial deposits are located on the floodplain and low lying areas of the Study Area.
Pi	Shale, sandstone, conglomerate, tuft, chert, coal and turbanite seams.	Permian. Illawarra Coal Measures	
Psb	Undifferentiated siltstone, shale, swamp deposits and sand dunes	Permian. Berry Formation	Deposited throughout the entire Study Area.

The Study Area is associated with two soil landscapes, Gwynneville and Fairy Meadow (Hazelton and Tille 1990). The residual Gwynneville soil landscape is associated with the ridgelines and slopes of the Study Area and is a product of the erosional breakdown of the Illawarra Coal Measures through sheet wash and exposure. As a result the Gwynneville soil landscape is characterised by shallow sandy loams and clays directly over bedrock (Hazelton and Tille 1990: 38). The Fairy Meadow soil landscape is associated with the alluvial floodplains of the Study Area and consists of alluvial soils overlying Quaternary deposits (Hazelton and Tille 1990: 100). The dominant soil materials of the Gwynneville and Fairy Meadow soil landscapes are outlined in **Error! Reference source not found.** below.

Table 4: Gwynneville Soil Landscape Characteristics (Hazelton and Tille 1990: 38).

Soil Material	Description
Gwynneville 1 (gw1)	Friable brown sandy loam, gw1 is typically the topsoil associated with higher exposed areas such as upper and mid slopes. Generally gw1 is between 10 and 30cm thick on the upper and mid slopes of the ridgelines and between 20 to 50 cm thick on the lower slopes and isolated sections of the mid slopes. On the ridgeline and ridgeline crests, gw1 directly overlies bedrock.
Gwynneville 2 (gw2)	Friable sandy clay loam, gw2 is typically the topsoil located on lower slopes. Soils are generally between 20 and 50cm thick and overlie a shallow layer of gw3 or bedrock.
Gwynneville 3 (gw3)	Brown pedal clay, gw3 lies below either gw1 or gw2. Gw3 is generally deeper on the upper and mid slopes, forming a soil layer of up to 100cm in depth. On the lowers slopes, gw3 is much shallower being <60cm deep.
Fairy Meadow 1 (fw1)	Brownish black loose sandy loam, fw1 is associated with upper floodplains and typically forms a topsoil of up to 20cm thick.

Soil Material	Description
Fairy Meadow 2 (fw2)	Brown sand, fw 2 either underlies fw1 on upper floodplains for forms the topsoil on lower floodplains. Depths vary, but fw2 is generally up to 40cm thick.
Fairy Meadow 3 (fw3)	Yellowish brown clay, underlies fw2 for a depth of up to 50cm.
Fairy Meadow 4 (fw4)	Olive brown clays, underlies fw3 for a depth of up to 80cm and sits above Quaternary sediments.

2.3.3 Flora

The Coastal Plains of the Illawarra region are characterised by mixed warm temperate and subtropical rainforest complexes on rich shale soils and alluvium under the escarpment, interspersed with patches of sclerophyll forest and woodland and estuarine and swamp communities. Open forest, Acacia scrub vegetation community, subtropical rainforest, eucalypt forest, would have once covered the Study Area prior to European land use (Comber 2009). Many species within these vegetation communities would have been utilised by the Aboriginal groups inhabiting the region.

2.3.4 Fauna

The vegetation communities supported a range of faunal resources that would have been utilised by Aboriginal peoples. Terrestrial and avian resources were not only used for food, but also provided (and often continue to provide) a significant contribution to the social and ceremonial aspects of Aboriginal life. Several species of animal were utilised including molluscs, fish, birds and terrestrial animals (Chafer 1997). While possums are the most common native fauna remaining in the Study Area, the area is now dominated by feral fauna.

2.3.5 Land Use History

The region surrounding the Study Area was initially colonised around 1815, with initial activity focused on timber clearing and mixed farming. Cedar cutters were the first to open up the Illawarra area as early as 1805. When they had exhausted the easily accessible timber by 1820, cattle grazing took over and the Coastal Plain was extensively cleared for pastoral estates and farms. Many early houses were built of rough slab or timber construction (Kass 2010: 66). The use of cattle for the production of beef and milk increased after 1887, when wheat was no longer considered a viable option for the region. Producers supplied various local butter and cheese factories located close by to the transport link provided by the railway. Dairying and beef production remain important local industries in the Dapto area today.

The Study Area is most likely to have been used for various farming practices up to 1983 with aerial photographs from 1951 to the 1970s showing large scale vegetation clearance and the ongoing development of farming infrastructure, as seen in Plates 1 and 2. Remnant vegetation only appears to occur in the upper northeast and central southeast sections of the Study Area, with the majority of other vegetation currently in the Study Area being regrowth (see Plates 1 and 2, also Figure 2). Agricultural modifications to the landscape include the development of dams along natural drainage lines and buildings in the centre and central west of the Study Area (see Plates 1 and 2).

The major land use history development within the Study Area has been the ongoing development and expansion of the WGRRP. First developed in 1983, the area was initially 25 hectares (Koetigg 1982: 10) and included the development of roads and the initial landfill cell, clearly visible in Plate 3. Subsequent development has seen the addition of another landfill cell and ponds as part of a leachate collection system in the central and southwest sections of the Study Area (Plates 4 and 5 and Figure 2). Previous construction activities have involved significant earthworks that have completely removed surface soils, resulting in significant ground disturbance across the area. However undisturbed areas do remain predominately on the periphery of the current landfill areas, as indicated in Figure 5.

Plate 2 1951 Aerial Photograph of the Study Area

Plate 3 1984 Aerial Photograph of the Study Area

Plate 4: 1994 Aerial Photograph of the Study Area

Plate 5: 2005 Aerial Photograph of the Study Area

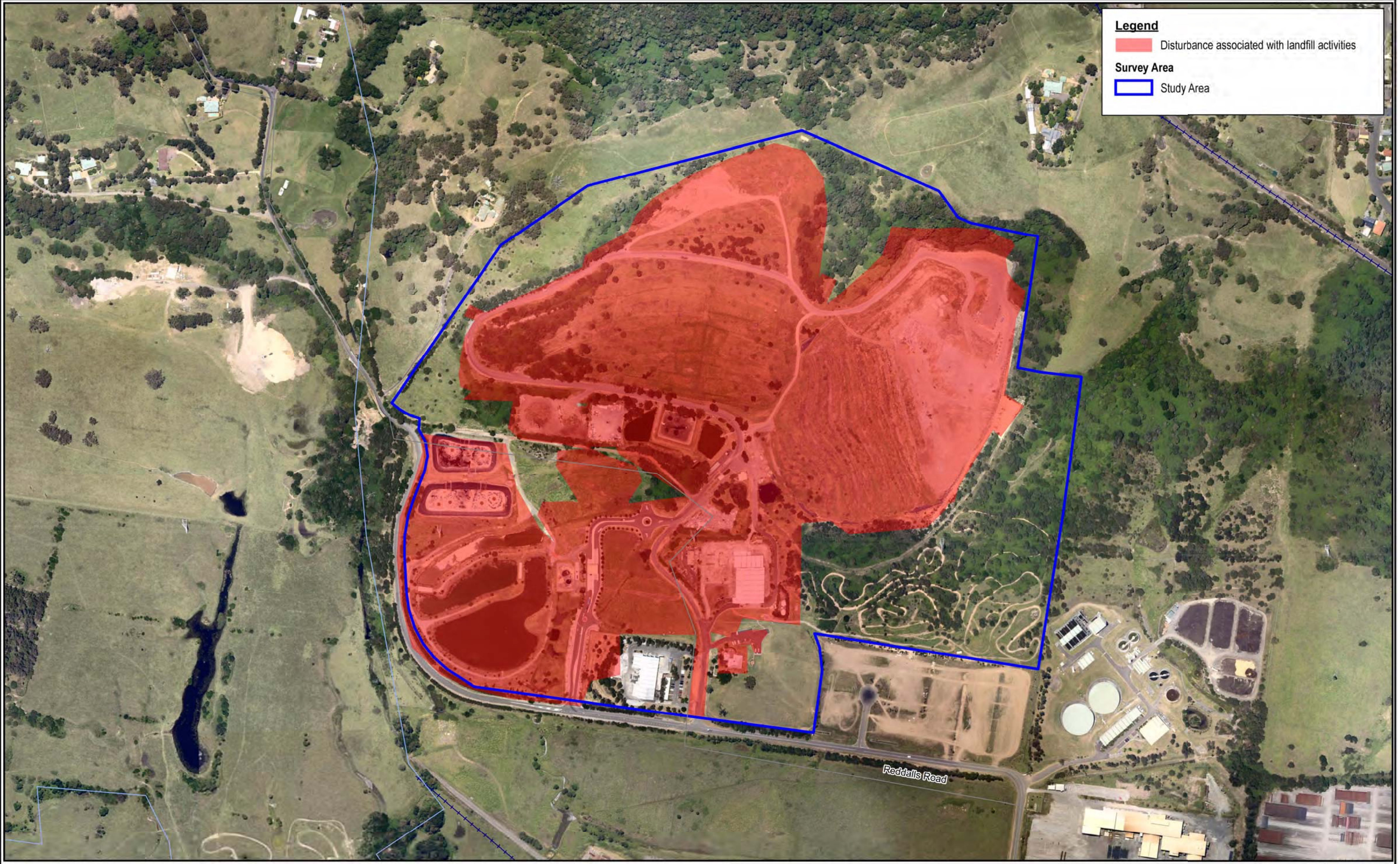

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Figure 5: History of Disturbance within the Study Area.

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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

Figure 5

3.0 CONSULTATION PROCESS

Consultation with the Aboriginal community was undertaken in accordance with the DGRs and the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, the details of which are described below. A full Consultation Log, copy of public notices and RAP responses are provided in Appendix 1.

3.1 Stage 1 Notification of Project Proposal and Registration of Interest

3.1.1 Step 1 Notification of Project Proposal

In accordance with the consultation requirements, Biosis Research sent a letter notifying the following bodies regarding the development proposal and proposed ACHA on the 23 June 2011:

- WCC;
- OEH Parramatta Office;
- NSW Native Title Services Corporation Limited (NTSCORP Limited);
- The Registrar, *Aboriginal Land Rights Act 1983* of Aboriginal Owners;
- National Native Title Tribunal (NNTT);
- Southern Rivers Catchment Management Authority (SRCMA); and,
- Illawarra Local Aboriginal Land Council (ILALC).

Of these bodies, OEH, ILALC, The Registrar *Aboriginal Land Rights Act 1983*, NNTT and SRCMA replied to the notification letter and provided information for Aboriginal stakeholders known to have an interest for the Study Area.

A search conducted by the Office of the Registrar, *Aboriginal Land Rights Act 1983 (NSW)* on the 27 June 2011 listed no Aboriginal Owners with land within the Study Area. The Office of the Registrar recommended that the ILALC be contacted.

A search conducted by the NNTT on the 30 June 2011 listed no Registered Native Title Claims, Unregistered Claimant Applications or Registered Indigenous Land Use Agreements within the Study Area.

The SRCMA responded to the notification letter on the 05 July 2011 and did not identify any Aboriginal stakeholders known to have an interest in the Study Area.

OEH responded to the notification letter on the 04 July 2011 specifying the names and contact details of the following 14 Aboriginal groups or individuals that might have an interest in the project:

- ILALC;
- Korewal Elouera Jerrungurah Tribal Elders Council (KEJ);
- Illawarra Aboriginal Corporation (IAC);
- The Wadi Wadi Coomaditichie Aboriginal Corporation (WWCAC);

- The Wodi Wodi Elders Corporation (WWEC);
- Woronora Plateau Gundungara Elders Council (WPGEC);
- Wulungu Elders Council (WEC);
- Coomaditchie United Aboriginal Corporation (CUAC);
- Gandangara Elders Group (GEG);
- North Illawarra Aboriginal Collective Inc. (NIAC);
- La Perouse Botany Bay Corporation (LPBBC);
- Gary Caines;
- Ken Foster; and,
- Kullila Site Consultants and Koori Site Management (KSC).

NIAC also represents the WWCAC and the WEC, all subsequent correspondence to these groups was addressed to NIAC.

3.1.2 Step 2 Public Advertisement

A public notification was published in the *The Illawarra Mercury* on the 07 July 2011. The advertisements invited Aboriginal people who hold cultural knowledge to register their interest in a process of consultation. The registration period for consultation was advertised as between the 07 July 2011 and the 21 July 2011.

3.1.3 Step 3 Registration of Interest

Aboriginal stakeholders were provided with letters notifying them of the proposed project and requesting them to register their interest in being consulted for the project. Letters were sent on the 8 July 2011 to Aboriginal stakeholders identified in Stage 1. These groups included:

- ILALC;
- KEJ;
- IAC;
- NIAC;
- WWEC;
- WPGEC;
- CUAC;
- GEG;
- LPBBC;
- Gary Caines;
- Ken Foster; and,

- KSC.

Seven Aboriginal stakeholders reregistered as RAPs, the following responses were received for registration:

- ILALC

  The ILALC left a phone message with Biosis Research on the 22 July 2011 and a follow-up phone call on the 25 July 2011 confirmed that ILALC wished to be registered for consultation.

- KEJ

  KEJ sent through a fax on the 25 July 2011 confirming that they wished to be registered for consultation.

- WWEC

  WWEC contacted Biosis Research by phone on the 15 July 2011 confirming that they wished to be registered for consultation.

- LPBBC and WPGEC

  LPBBC replied by email on behalf of themselves and WPGEC on the 12 July 2011 that both groups wished to be registered for consultation.

- KSC

  KSC contacted Biosis Research by phone on the 08 July 2011 confirming that they wished to be registered for consultation.

- NIAC

  An email response was received by NIAC on the 22 July 2011 requesting that they be registered for consultation on behalf of all NIAC member groups (NIAC, WEC and WWCAC).

3.2 Stage 2 Presentation of information about the Proposed Project

On the 25 July 2011 Biosis Research provided the RAPs with a Project Information Pack providing information about the proposed development works and the assessment process.

3.3 Stage 3: Gathering Information about Cultural Significance.

3.3.1 Step 1 Review of Project Methodology

The draft assessment methodology was sent to the RAPs for comment on the 27 July 2011, however no comments were received.

3.3.2 Step 2 Field Survey

RAPs were invited to participate in a field survey of the Study Area on the 26 August 2011, and all RAPs sent representatives. Details of the field survey results are contained in the archaeological report in Appendix 2.

In response to the field survey, Illawarra LALC issued a report on the 26 August 2011. The report detailed that one quartz artefact and shell material identified as Blood Mussel (potentially *Mytilus rubensis*) was located in the area identified as Whytes Gully 3.

The report made the following recommendations regarding further investigation for Aboriginal heritage:

- *It needs to be established if the soil is landfill or not (at Whytes Gully 3) and further testing needs to be carried out in the area due to poor visibility.*

  Following the field survey and revised test excavation methodology and sampling strategy was devised based on discussions with RAPs in the field.

- *The Archaeologists needs to research all maps, plans and historical documentation relating to the history of Whytes Gully.*

  Background research into the land use history of Whytes Gully, including review of historical mapping and aerials was undertaken as part of the review of background information in the Aboriginal archaeological report (see Appendix 2).

- *Any further testing carried out on this site will require Aboriginal site monitoring.*

  All RAPs were invited to participate in the test excavation program.

The following recommendations were made for Aboriginal heritage in regards to the Project overall:

- *Any Aboriginal artefacts identified during the construction should remain in their place; if this is not possible then a care and control process should be discussed with the relevant Aboriginal stakeholders.*
- *The Wollongong City Council should enter into discussion with the Aboriginal community regarding employment opportunities created throughout this project.*
- *Any excavation work carried out on this site will require Aboriginal site monitoring.*

As the Aboriginal cultural heritage assessment had not been completed, these recommendations were not addressed at this stage.

3.3.3 Step 3 Revised Test Excavation Methodology

Following the results of the survey a revised test excavation and sampling methodology was developed and is detailed in the AAR (see Appendix 2). This revised methodology was provided to the RAPs to review by email on the 01 November 2011 and discussed by phone with each RAP on the 14 November 2011. All RAPs responded to the revised test excavation methodology between the 14 November 2011 and the 18 November 2011 (see Appendix 1). The following recommendations were raised by WWEC:

- *If skeletal remains are found within the project site or in any other area within the test excavation investigative area, as supported in DECC Guidelines, work cease immediately and that I be contacted (if not present) so I can consult with an elder before the retrieval process.*

  In the event that Aboriginal ancestral remains are encountered all work would cease and the protocols outlined in Requirement 25 of the *Code of Practice for Archaeological Investigations of Aboriginal Objects in New South Wales* (DECCW 2010) be complied with.

- *Any sites which are not recorded with the AHIMS Registrar be submitted via the relevant Aboriginal Site Impact Recording Form.*

Sites cards for all sites identified during the investigation process have been submitted to AHIMS.

3.3.4 Step 4 Test Excavation

Test excavations were undertaken between the 21 November 2011 and the 16 December 2011. All RAPs were invited to participate in the test excavation program and details of participation are contained in Appendix 1.

3.4 Stage 4 Review of Draft Report.

A copy of the AAR was provided to RAPs for comments on the 13 January 2012. The following comments were received from RAPs:

ILALC provided an email response to the report on the 16 January 2012 with the following comments:

- *I agree that it is highly likely that artefacts may be found during excavation*

The result of the archaeological investigation indicated that it is considered possible but unlikely that artefacts will be encountered during construction (Biosis Research 2012: 53).

- *I agree with recommendation 1 of the report, it is imperative that WCC continue to inform the Aboriginal groups about the Management of the cultural heritage sites within the study area.*

Consultation with RAPs in regards to the management of Aboriginal sites within the Study Area will be ongoing.

- *I disagree with recommendation 2 as years of Aboriginal knowledge and wisdom cannot be learnt or transferred in an induction. The ILALC recommends that all excavation work carried out on this site will require Aboriginal site monitoring.*

Test excavation results of the AAR indicate that there is a low likelihood that construction work will encounter Aboriginal objects in areas of the development footprint that have no been disturbed by previous construction phases of the WGRRP. There is a very low likelihood that Aboriginal objects will be encountered in areas of the development footprint that have been disturbed by previous construction phases of the WGRRP. Given the low chance of encountering Aboriginal objects during construction Aboriginal site monitoring is not considered an appropriate management measure.

NIAC provided an email response to the report on the 20 January 2012 which agreed with the recommendations.

4.0 SUMMARY OF ABORIGINAL HERITAGE VALUES

The archaeological investigation identified four low density flaked stone artefact scatters (52-2-3867, Whytes Gully 1 and Whytes Gully 2) in the Study Area. The Study Area contains of mixture of ridgeline and floodplain platforms and within the local region, low density artefact scatters are the most common site identified (see AAR Appendix 2). Low density artefact scatters in the Study Area are most likely the result of Aboriginal people moving across the landscape and indicate that the Study Area was most likely a movement corridor between floodplains to the west and south and hills below the escarpment to the north. The shell material at Whytes Gully 3 is in a highly disturbed context and has been imported to site. It is considered highly likely that this fill is from a nearby locality (such as Lake Illawarra) as the shell species present are common to the area. Details for each Aboriginal site are given below:

52-2-3867 (RR2)

52-2-3867 is an isolated quartz artefact recorded by South East Archaeology in 2001, although the site card was not submitted until 2011. The site was recorded in the central southwest of the Study Area. The isolated artefact was recorded in a disturbed context and the current survey confirmed that in the area it was located, a settling pond has subsequently been built (Figure 12). The artefact was unable to be relocated and the site is considered to be destroyed.

Whytes Gully 1

Whytes Gully 1 is an isolated artefact recorded on a ridgeline crest on the northwest boundary of the Study Area and consists of a basalt flake recovered in the first 10 cm of topsoil (see Figure 12).

Whytes Gully 2

Whytes Gully 2 is an artefact scatter recorded on a ridgeline crest on the northeast boundary of the Study Area and consists of three flaked stone artefacts recovered in the first 10 cm of topsoil (see Figure 12).

Whytes Gully 3

Whytes Gully 3 covers a portion of lower slope of the eastern ridgeline in the southeast section of the Study Area. The site extends approximately 110 m southwest to northeast and is 50 m wide covering an area of 3626 m^2. Shell fragments and quartz material was identified in this area, with shell species including *Anadara trapezia*, *Bembicium auratum* and *Bedeva hanleyi*. The site is in a disturbed context and has been imported in to the Study Area as part of a fill deposit to build up the motorcross track.

5.0 ABORIGINAL CULTURAL HERITAGE VALUES ASSESSMENT

5.1 General Description

According to Allen and O'Connel (2003), Aboriginal people have inhabited the Australian continent for the last 50,000 years, and the NSW area, according to Bowler at al (2003), for over 42,000 years. These dates are subject to continued revision as further evidence is conducted.

Without being part of the Aboriginal culture and the productions of this culture it is not possible for people to fully understand their meaning to Aboriginal people – only to move closer towards understanding this meaning with the help of the Aboriginal community. Similarly, definitions of Aboriginal culture and cultural heritage without this involvement constitute outsider interpretations.

With this preface Aboriginal cultural heritage broadly refers to things that relate to Aboriginal culture and hold cultural meaning and significance to Aboriginal people (DECC 2005: 1; DECCW 2010: 3). There is an understanding in Aboriginal culture that everything is interconnected. In essence, Aboriginal cultural heritage can be viewed as potentially encompassing any part of the physical and/or mental landscape, that is, 'Country'.

Aboriginal people's interpretation of cultural value is based on their "traditions, observance, lore, customs, beliefs and history" (also see DEC (now DECCW) 2005: 1; DECCW 2010: 3). The things associated with Aboriginal cultural heritage are continually/actively being defined by Aboriginal people. These things can be associated with traditional, historical or contemporary Aboriginal culture (also see DEC (now DECCW) 2005: 1; DECCW 2010: 3).

5.1.1 Tangible Aboriginal Cultural Heritage

Three categories of tangible Aboriginal cultural heritage may be defined:

- Things that have been observably modified by Aboriginal people;
- Things that may have been modified by Aboriginal people but no discernable traces of that activity remain; and
- Things never physically modified by Aboriginal people (but associated with Dreamtime Ancestors who shaped those things).
- Specific examples would include (Table 5):

Table 5: Categories of tangible Aboriginal cultural heritage and specific examples

Things observably modified by Aboriginal people		
Objects	Specific examples	Animals, modified trees, art, grinding grooves, stone, wood or shell artefacts, earth mounds, fish traps, habitation structures, stone arrangements, quarries
Places		Massacre or Ceremonial sites with material evidence
Things modified by Aboriginal people but no discernable traces of that activity remain		
Objects	Specific examples	A cultural scar on a tree that has since grown over the scar
Places		Massacre or Ceremonial sites with material evidence; rock walls previous covered by art that has since washed away
Things never physically modified by Aboriginal people (but modified by the Dreamtime Ancestors who shaped those things)		
Objects	Specific examples	Animals, for example, totems
Places		Dreaming sites

5.1.2 Intangible Aboriginal Cultural Heritage

Examples of intangible Aboriginal cultural heritage would include memories of stories and 'ways of doing', which would include language and ceremonies (DECC 2005: 1; DECCW 2010: 3).

5.1.3 Statutory

Currently Aboriginal cultural heritage, as statutorily defined by the National Parks and Wildlife Act 1974, consists of objects and places.

Aboriginal objects are defined as:

"*any deposit, object or material evidence…relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains*"

Aboriginal places are defined as a place that is or was of special Aboriginal cultural significance. Places are declared under section 84 of the *NPW Act 1974.*

5.1.4 Values

Aboriginal cultural heritage is broadly valued by Aboriginal people as it is used to define their identity as both individuals and as part of a group (also see DECC 2005: 1, 3; DECCW 2010: iii). More specifically is it used:

- To provide a :
    - "connection and sense of belonging to Country" (DECCW 2010: iii)
    - Link between the present and the past (DEC 2005: 2-3; and DECCW 2010: 3)
- As a learning tool to teach Aboriginal culture to younger Aboriginal generations and the general public (DECCW 2010: 3)

- As further evidence of Aboriginal occupation prior to European settlement for people who do not understand the magnitude to which Aboriginal people occupied the continent (also see DECCW 2010: 1; DECCW 2010: 3).

5.2 Cultural Heritage Values

The two main values addressed when assessing the significance of Aboriginal sites are cultural values to the Aboriginal community and archaeological (scientific) values.

5.2.1 Aboriginal Cultural Heritage Values

Cultural significance of Aboriginal cultural heritage can only be assessed by the Aboriginal community. Comment on the cultural significance of Aboriginal cultural heritage relevant to the project was sought from the Aboriginal parties with the provision of proposed methodology for consultation and archaeological test excavations.

No written comments where provided by RAPs on the cultural heritage values of specific Aboriginal sites identified within the Study Area, however it was expressed both during the field survey and test excavations that Aboriginal objects are important to the local Aboriginal community. RAPs link the Study Area to part of wider cultural landscape and have a strong desire to retain Aboriginal objects in place or "country". This has been expressed in the following written comments:

"*…also that any artefacts that are found to be reburied back on country, the whole area is of great significance to the Aboriginal people of the Illawarra*" (LPBBC Email 18 November 2011).

"Any Aboriginal artefacts identified during the construction should remain in their place; if this is not possible then a care and control process should be discussed with the relevant Aboriginal stakeholders." (LALC Letter 26 August 2011).

5.2.2 Archaeological Values

An assessment of the archaeological (scientific) values of the four Aboriginal within the Study Area are detailed in the attached AAR (Appendix 2). Based on the results of the archaeological investigation, an archaeological significance rating of low was applied to all four Aboriginal sites.

5.3 Statement of Significance

The significance of sites was assessed in accordance with the following criteria:

- Requirements of the DECCW *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*; and the

- 'Australia International Council on Monuments and Sites (ICOMOS) Burra Charter' (Australia ICOMOS 1999).

Use of these guidelines in combination is widely considered to represent the best practice for assessments of Aboriginal cultural heritage. The identification and assessment of cultural heritage values includes the four values of the Burra Charter: social, historical, scientific and aesthetic values. The resultant statement of significance (Table 6) has been constructed for the study area.

Table 6: Statement of Significance.

Site Name	Criteria	Ranking
RR2 AHIMS (52-5-0070)	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value.	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses little archaeological values.	Low
	Aesthetic – the site does not have any Specific Aesthetic values.	Low
Whytes Gully 1	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses little archaeological values.	Low
	Aesthetic – the site does not have any Specific Aesthetic values.	Low
Whytes Gully 2	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses little archaeological values.	Low
	Aesthetic – the site does not have any Specific Aesthetic values.	Low

Site Name	Criteria	Ranking
Whytes Gully 3	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses little archaeological values.	Low
	Aesthetic – the site does not have any Specific Aesthetic values.	Low

6.0 PROPOSED DEVELOPMENT LIMITATIONS & MITIGATION MEASURES

At present, a site is used for informal recreational purposes such as fishing, bushwalking and other activities. Informal access and use of the site for motorbike and horse riding has resulted in the degradation and erosion of the lake shore and LIA are looking to revitalise the area through provision of additional facilities. Continued maintenance and revegetation of the area are considered to comply with the principles of Ecologically Sustainable Development (ESD). Proposed works will also include construction of bridges, pathway, shelters, viewing platforms and bank protection.

WCC are proposing to develop a new landfill cell within the WGRRP (Figure 2). The Study Area has been used as a landfill site since 1983 and the Project aims to develop the WGRRP for this continued use. The development will include the staged construction and operation of a new landfill cell and will involve the following activities that could potentially harm Aboriginal heritage:

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- bulk earthworks, which will removal of topsoil and subsoil.

6.1 Predicted Physical Impacts

There are four Aboriginal sites within the Study Area that could potentially be impacted (including indirect impacts) by the proposed development:

- 52-2-3867 (RR2)
- Whytes Gully 1
- Whytes Gully 2
- Whytes Gully 3

Whtyes Gully 1, Whytes Gully 2 and Whytes Gully 3 are outside of the development footprint and will not be impacted (see Figure 4). 52-2-3867 is located close to the boundary of the footprint development but has already been destroyed and no further loss of value to this site can occur. The assessed statements of impact for Aboriginal sites in the Study Area has been summarised in Table 7 below.

Table 7: Impact Assessment to the Aboriginal archaeological sites recorded within the Project Area

Site Name	Type of harm	Degree of Harm	Consequence of Harm
52-2-3867 (RR2)	None	None	Total Loss of Value has Occurred
Whytes Gully 1	None	None	None
Whytes Gully 2	None	None	None
Whytes Gully 3	None	None	None

6.1.1 Management and Mitigation Measures

Ideally, heritage management involves conservation of sites through the preservation and conservation of fabric and context within a framework of "*doing as much as necessary, as little as possible*" (Marquis-Kyle and Walker 1994: 13). In cases where conservation is not practical, several options for management are available. For sites, management often involves the salvage of features or artefacts, retrieval of information through excavation or collection (especially where impact cannot be avoided) and interpretation.

Currently, Whytes Gully 1, Whytes Gully 2 and Whytes Gully 3 lie outside of the development footprint and will not be impacted. Although there is only a low potential that unidentified Aboriginal cultural material may be encountered during construction it is possible that cultural material may be encountered and appropriate cultural awareness training and contingency plans should be provided to workers and contractors undertaking construction work.

7.0 RECOMMENDATIONS

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Project Area and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
    - Ethos of the Australia ICOMOS Burra Charter
    - The DECCW 2010 *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Continued consultation with the registered Aboriginal parties*

It is recommended that Wollongong City Council continue to inform the registered Aboriginal parties about the management of Aboriginal cultural heritage sites within the Study Area throughout the life of the project, including pre-excavation and pre-construction on-site meetings. This recommendation is in keeping with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW).

Recommendation 2: *Cultural Awareness Training*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about Aboriginal cultural heritage within the study area and information for the visual identification of Aboriginal cultural material, particularly stone artefacts.

7.1 Contingency Plans

7.1.1 Discovery of unanticipated Aboriginal cultural material

All Aboriginal places and objects are protected under the NSW National Parks and Wildlife Act 1974. This protection extends to Aboriginal objects and Places that have not been identified but might be unearthed during construction. The following contingency plan describes the actions that must be taken in instances where Aboriginal cultural material is uncovered. Any such discovery at the activity area must follow these steps:

1. **Discovery:** Should unanticipated Aboriginal cultural material be identified during any works, works must cease in the vicinity of the find.

2. **Notification:** OEH and EPA must be notified of the find.

3. **Management:** In consultation with OEH and EPA, the Illawarra Local Aboriginal Land Council and a qualified archaeologist, a management strategy should be

developed to manage the identified Aboriginal cultural material. This may include the requirement to apply for an Aboriginal Heritage Impact Permit.

4. **Recording:** The find will be recorded in accordance with the requirements of the *National Parks and Wildlife Act 1974* and OEH guidelines.

7.1.2 Discovery of unanticipated human remains

The following contingency plan describes the actions that must be taken in instances where human remains or suspected human remains are discovered. Any such discovery at the activity area must follow these steps:

1. **Discovery:** If suspected human remains are discovered all activity in the vicinity of the human remains **must stop** to ensure minimal damage is caused to the remains; and the remains must be left in place, and protected from harm or damage.

2. **Notification:** Once suspected human skeletal remains have been found, the Coroners Office and the NSW Police must be notified immediately. Following this, the find must be reported to OEH and it is recommended that it is also reported to the Illawarra Local Aboriginal Land Council.

3. **Management:** If the human remains are of Aboriginal ancestral origin an appropriate management strategy will be developed in consultation with Aboriginal Stakeholders and OEH.

4. **Recording:** The find will be recorded in accordance with the requirements of the *National Parks and Wildlife Act 1974* and OEH guidelines.

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APPENDICES

APPENDIX 1 – CONSULTATION LOG WHYTES GULLY NEW LANDFILL CELL

Stage 1 – Notification of Project Proposal and Registration of Interest

Step 1- Identification of Aboriginal people/parties with an interest in the proposed project area.

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
OEH Parramatta Office	Letter – 23 June 2011	Letter – 04 July 2011	OEH identified 14 Aboriginal people/parties who have an interest in the project.
Illawarra Local Aboriginal Land Council	Letter – 23 June 2011	No Response	
Native Title Services CORP Limited	Letter – 23 June 2011	No Response	
Wollongong City Council	Letter – 23 June 2011	No Response	
National Native Title Tribunal	Letter – 23 June 2011	Letter – 30 June 2011	NNTT did not identified any Aboriginal people/parties who may have an interest in the project
Office of the Registrar, Department of Aboriginal Affairs	Letter – 23 June 2011	Letter – 27 June 2011	The Office of the Registrar identified one Aboriginal party who have an interest in the project
Southern Rivers Catchment Management Authority	Letter – 23 June 2011	Letter – 5 July 2011	SRMA did not identified any Aboriginal people/parties who may have an interest in the project

Step 2- Public Advertisement

Public notices were published in the *Illawarra Mercury* on the 07 July 2011. A copy of the advertisement is provided.

NSW GOVERNMENT

Office of Environment & Heritage

Our reference: DOC11/29867

Attn: Mr Asher Ford
Biosis Research
8 Tate Street
WOLLONGONG NSW 2500

Dear Mr Ford,

Thank you for your letter dated 17/6/2011 to the Office of Environment and Heritage (OEH) (formerly the Department of Environment Climate Change and Water) regarding obtaining a list of the Aboriginal stakeholders that may have an interest in projects for the area of Whytes Gully, Kembla Grange.

Before making an application for the issue of an Aboriginal Heritage Impact Permit, the applicant must carry out an Aboriginal community consultation process in accordance with the National Parks and Wildlife Regulation 2009 and completed to the stage described in subclause 80C.

Please find attached the list of Aboriginal stakeholders known to OEH that may have an interest in the project. OEH's list of regional stakeholders is a list of groups, organisations or individuals who may hold cultural knowledge relevant to a proposal in a region. Consultation with Aboriginal people should not be confused with employment. Inclusion on the OEH's list is not an automatic right to employment. It is the decision of a proponent on who they choose to engage to deliver services based on a range of considerations including skills, relevant experience, and OHS considerations. To be clear, the proponent is under no obligation to employ Aboriginal people registered for consultation.

Further, receipt of this information does not remove the requirement of a proponent/consultant to advertise in local print media and contact other bodies seeking interested Aboriginal parties. Consultation with Aboriginal stakeholders must be in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* which can be found on the OEH public website by accessing the following link:

http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf

Please note that these requirements replace the *Interim Community Consultation Requirements for Applicants, December 2004.*

The Department of Environment, Climate Change and Water is now known as the Office of Environment and Heritage, Department of Premier and Cabinet

PO Box 668 Parramatta NSW 2124
Level 7, 79 George St Parramatta NSW 2150
Tel: (02) 9995 5000 Fax: (02) 9995 6900
ABN 30 841 387 271
www.environment.nsw.gov.au

If you wish to discuss any of the above matters further please contact Miranda Morton, Aboriginal Heritage Planning Officer, on (02) 9995 6836.

Yours sincerely

S. Harrison 04/07/11

SUSAN HARRISON
Acting Manager Planning & Aboriginal Heritage
Environment Protection and Regulation
Office of Environment and Heritage
Department of Premier and Cabinet

Illawarra Area			
ILLAWARRA LOCAL ABORIGINAL LAND COUNCIL	Sharralyn Robinson	(02) 42263338	3 Ellen Street, Wollongong, NSW 2500
Korewal Elouera Jerrungurah Tribal Elders Council	Uncle Rueben Brown	(02) 4271 3069	Fax Number (02) 4271 3069
Illawarra Aboriginal Corporation	Rhonda Cruse	02 4262 2978	22 Kenny Street, Wollongong, NSW 2500
The Wadi Wadi Coomaditchie Aboriginal Corporation (represented by NIAC)		02 4283 3009	PO Box 595 Moss Vale NSW 2577
The Wodi Wodi Elders Corporation	Kim Davis/Lisa Davis	02 4272 9290	484 Northcliffe Drive, Berkeley, NSW 2506
Woronora Plateau Gundungara Elders Council	Norma Simms	04660 94491	10 Murrong Place, La Perouse NSW 2036
Wulungu Elders Council (NIAC)	Paul Cummins	418971660	(contact is through NIAC)
Coomaditchie United Aboriginal Corporation	Lorraine Brown	02 4274 7477	PO Box 160, Warrawong NSW 2502
Gandangara Elders Group	Ms Kim Moran	(02) 4285 4792 OR 0488079653	48 Rothery Street, Bellambi NSW 2518
NIAC		Ph: 4883 6639	PO Box 595 Moss Vale NSW 2577
La Perouse Botany Bay Corporation	Yvonne Simms	04660 94491 Fax (02) 9311 3440	10 Murrong Place, La Perouse NSW 2036
Gary Caines (individual)		(02) 42272690	28 Gowan Brae Avenue, Mt Ousley, NSW 2519
Ken Foster (individual)		0411 818 091	68 Australia St Matraville
Kullila Site Consultants and Koori Site Management	Paul Charles	0423795389	14 Werang Road, Primbee, NSW, 2502

National Native Title Tribunal

30 June 2011

New South Wales and Australian Capital Territory Registry
Level 25, 25 Bligh Street
Sydney NSW 2000
GPO Box 9973
Sydney NSW 2000
Telephone (02) 9227 4000
Facsimile (02) 9227 4030

Asher Ford
Consultant Archaeologist
Biosis Research
8 Tate Street
WOLLONGONG NSW 2500

Our Reference: 4349/11KW
Your Reference: Whytes Gully Landfill Cell

Dear Sir/Madam

Native Title Search Results of Kembla Grange within Wollongong Local Government Area

Thank you for your letter of 17 June 2011.

My search on 30 June 2011 found:

Register Type	**NNTT Reference Numbers**
National Native Title Register	Nil.
Register of Native Title Claims	Nil.
Unregistered Claimant applications	Nil.
Register of Indigenous Land Use Agreements	Nil.

I have included a NNTT Registers fact sheet to help you understand the search result.

Please note that there may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed in the Federal Court may not appear on the Tribunal's databases.

If you need more information please call me on 1800 640 501.

Yours sincerely

Kimberley Wilson
Search Co-ordinator

Telephone (02) 9235 6328
Facsimile (02) 9233 5613
Email Kimberley.wilson@nntt.gov.au

Encl

Searching the NNTT Registers in New South Wales

Search service
On request the National Native Title Tribunal will search its public registers for you. A search may assist you in finding out whether any native title applications (claims), determinations or agreements exist over a particular area of land or water.

In New South Wales native title cannot exist on privately owned land including family homes or farms.

What information can a search provide?
A search can confirm whether any applications, agreements or determinations are registered in a local government area. Relevant information, including register extracts and application summaries, will be provided.

In NSW because we cannot search the registers in relation to individual parcels of land we search by local government area.

Most native title applications do not identify each parcel of land claimed. They have an external boundary and then identify the areas not claimed within the boundary by reference to types of land tenure e.g., freehold, agricultural leasehold, public works.

What if the search shows no current applications?
If there is no application covering the local government area this only indicates that at the time of the search either the Federal Court had not received any claims in relation to the local government area or the Tribunal had not yet been notified of any new native title claims.

It does not mean that native title does not exist in the area.

Native title may exist over an area of land or waters whether or not a claim for native title has been made.

Where the information is found
The information you are seeking is held in three registers and on an applications database.

National Native Title Register
The National Native Title Register contains determinations of native title by the High Court, Federal Court and other courts.

Register of Native Title Claims
The Register of Native Title Claims contains applications for native title that have passed a registration test.

Registered claims attract rights, including the right to negotiate about some types of proposed developments.

Register of Indigenous Land Use Agreements
The Register of Indigenous Land Use Agreements contains agreements made with people who hold or assert native title in an area.

The register identifies development activities that have been agreed by the parties.

Application summaries
An application summary contains a description of the location, content and status of a native title claim.

This information may be different to the information on the Register of Native Title Claims, e.g., because an amendment has not yet been tested.

How do you request a search?

A search request form is available on the Tribunal's web site at:
http://www.nntt.gov.au/registers/search.html
This form says how much searches cost.
Mail, fax or email your request to the Tribunal's Sydney registry, identifying the local government area/s you want searched.

Email: SydneySearch@nntt.gov.au
Fax: (02) 9233 5613
Address: GPO Box 9973, Sydney NSW 2001
Phone: (02) 9235 6300

OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

11-13 Mansfield Street
Glebe NSW 2037
PO Box 112, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Asher Ford
BIOSIS RESEARCH
8 Tate Street
Wollongong NSW 2500

Dear Asher

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter dated 17th June 2011 regarding an Aboriginal heritage project at Kembla Grange, NSW.

I have searched the Register of Aboriginal Owners and the project area described does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act* 1983 (NSW).

I suggest you contact the Illawarra Local Aboriginal Land Council. They may also be able to assist you in identifying other Aboriginal stakeholders for this project.

Yours sincerely

TDantoine

Tabatha Dantoine
Administration Officer
Office of the Registrar, *Aboriginal Land Rights Act* (1983)

27 June 2011

Southern Rivers CMA CATCHMENT MANAGEMENT AUTHORITY

5 July 2011

Biosis Research
8 Tate Street
Wollongong NSW 2500

Dear Asher Ford

Archaeological Investigation: Cultural Heritage Assessment Whytes Gully New Landfill Cell

Thank you for your letter dated 17 June 2011, requesting assistance with identifying Aboriginal stakeholder groups or persons who may have an interest in your project area.

Southern Rivers Catchment Management Authority (CMA) acknowledges that CMAs have been listed in *Section 4.1.2 (g)* of the *Aboriginal cultural heritage consultation requirements for proponents 2010,* under *Part 6, National Parks and Wildlife Act 1974* as a source of information to obtain the "names of Aboriginal people who may hold cultural knowledge relevant to determining the significance of Aboriginal *objects* and/or *places*".

Southern Rivers CMA is a partner with many Aboriginal communities in the region on many natural resource management (NRM) projects. However, Southern Rivers CMA is not the primary source for contacting or managing contact lists for Aboriginal communities or persons that may inform or provide comment on planning issues. Southern Rivers CMA considers cultural heritage issues that relate to land-use planning in general and only considers culture and heritage issues in the context of NRM.

We strongly recommend that you make contact with the Office of Environment and Heritage (OEH) Cultural Heritage Division, Parramatta for all-inclusive contact lists of persons and organisations that may assist with your investigation.

Should you wish to discuss this matter further, please contact Ken Davies, Aboriginal Cultural Officer, Southern Rivers CMA on (02) 4224 9714.

Yours sincerely,

for

Noel Kesby
General Manager

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4271 8300 or 0412 287 730

2321841
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$$$ for Cars
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2335431
Scrap Cars & M/cycles
We pickup & pay cash
Phone 0448 712 394

Vans & 4WD's

2347064
WHEELCHAIR VAN
KIA Carnival Van 2000, wheelchair conv $32,000 + cost of vehicle. 122,260kms, new eng replaced 94,600kms, man, good cond. BL51DP. $10,500 ono. 4285 5203.

Motor Cycles

2348008
KAWASAKI KD80, 5 sp man, new back tyre, good condition, $1,000ono. Dirt bike. Call Al or Nicole on 4261 1998.

Public Notices

2348607
CRAZY PRICES
at
PURPLE DAISY BOUTIQUE
Winter Clearance
Crown Street Mall & Fairy Meadow

Holiday & Travel

2345527


Removalists

2334482
LA SHA Removals
Furniture removals. Prices fr $45-$75-$99/hr. Ph: 0468 916 083/0431 093 693

2348635
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Legal Notices

2348278
IN THE SUPREME COURT OF NEW SOUTHWALES EQUITY DIVISION - PROBATE LIST

After 14 days from publication of this notice an application for probate of the Will dated 21st August 2008 of **IRIS MARGARET HEATHERINGTON** late of Berkeley, Widow, will be made by **DOUGLAS MAXWELL HEATHERINGTON** the Executor named in the Will. Creditors are require to send particulars of thier claimsupon her estate to WILLIAM LAWSON, Solicitor, Suite 1, First Floor, 72 King Street, WARRAWONG, NSW 2502 (DX 25901, WARRAWONG).

2348361
IN THE SUPREME COURT OF NEW SOUTH WALES EQUITY DIVISION - PROBATE LIST

After 14 days from publication of this notice an application for probate of the Will dated 14 November 2007 of **TREVOR HARRY MIDDLETON** late of Oak Flats in the State of New South Wales, Retired Contractor, will be made by **Jason Harry Falla Middleton** the Executor of the Will.

Creditors are required to send particulars of their claims upon his estate to:

Williamson Isabella Solicitors
23 Princes Highway Dapto NSW 2530
DX 26301 Dapto
Phone: (02) 4261 3355
Ref: JI:NS 110466

2348345
IN THE SUPREME COURT OF NEW SOUTH WALES EQUITY DIVISION - PROBATE LIST

After 14 days from publication of this notice an application for probate of the Will dated 14 May 2009 of **ALLAN GRIFFITHS PERRETT** late of Dapto in the State of New South Wales, Retired Technical Teacher, will be made by **Betty Joyce Perrett** the Executrix of the Will.

Creditors are required to send particulars of their claims upon his estate to:

Williamson Isabella Solicitors
23 Princes Highway Dapto NSW 2530
DX 26301 Dapto
Phone: (02) 4261 3355
Ref: JI:NS 110464

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Legal Notices

2348288
IN THE SUPREME COURT OF NEW SOUTH WALES EQUITY DIVISION - PROBATE LIST

After 14 days from publication of this notice an application for probate of the Will dated 2 November 1994 of ALFRED JOSEPH HUMPHRIES late of Woonona in the State of New South Wales, Retired, will be made by Alfred Joseph Humphries and Mary Magdalene Whitehead the executors of the Will.

Creditors are required to send particulars of their claims upon his estate to: DRIBBUS KOVACEVIC LAWYERS
Ground Floor
69-71 Church Street
Wollongong NSW 2500

2348338
NOTICE OF INTENDED DISTRIBUTION OF ESTATE

Any person having any claim upon the estate of **MARIA VEEVERS** late of Figtree, in the State of New South Wales, Widow, who died on 24 January 2011, must send particulars of the claim to the legal representative for the estate at care of **Williamson Isabella**, Solicitors, 5/55 Kembla Street, Wollongong NSW 2500, not more than 31 days from publication of this notice.

After that time the legal representative intends to distribute the property in the estate having regard only to the claims of which the legal representative had notice at the time of distribution.

Psychic Notices & Clairvoyants

2341037
AAESHA'S Quality Psychics $3.96pm mobex 1902 216 018 C/Card $3.60pm 1300 276 475.

2345885
AAESHA'S Quality Psychics $3.96pm mobex 1902 216 018 C/Card $3.60pm 1300 276 475.

2322773
CLAIRVOYANT/PSYCHIC Sharon Brooks as heard on radio. Now available for private readings. 4284 5518.

2341034
GODDESS Circle $3.96pm mobex 1902 276 034 C/Card $3.60pm 1300 349 734.

2345886
GODDESS Circle $3.96pm mobex 1902 276 034 C/Card $3.60pm 1300 349 734.

2341035
GUIDING Light Psychics $3.96 pm mobex 1902 256 031 C/card $3.60pm 1300 278 734.

2345882
GUIDING Light Psychics $3.96 pm mobex 1902 256 031 C/card $3.60pm 1300 278 734.

Adult Services

[redacted]

Public Notices

2348083
ILLAWARRA CANCER CARERS

Major Raffle Drawn at the Banquet at the Beach

Raffle results are as follows:

1st Prize
Ticket No A0344 G Lacey - Figtree
2nd Prize
Ticket No D0980 M Harper-Richardson - West Wollongong
3rd Prize
Ticket No C0050 N Balatti - Primbee
4th Prize
Ticket No D0971 S Jones - University of Wollongong
Mystery Prize
Ticket No C0293 J Naughton - Jamberoo
Booksellers Prize
J Armstrong - Oak Flats

ILLAWARRA MERCURY

Public Notices

2347869
Wollongong City Council Notification & Registration of Aboriginal Interests

Golder Associates, on behalf of Wollongong City Council, has engaged Biosis Research to undertake an Aboriginal Cultural Heritage Assessment for the proposed Whytes Gully New Landfill Cell at the Whytes Gully Resource Recovery Park, Kembla Grange, NSW. The proposed Whytes Gully New Landfill Cell project is located within the existing Whytes Gully Resource Recovery Park site and will involve sub surface works.

The Aboriginal Cultural Heritage Assessment will entail a background review and pedestrian survey of the proposed Whytes Gully New Landfill Cell area. Based on the results of the background review and pedestrian survey, sub-surface investigation and an application for an Aboriginal Heritage Impact Permit (AHIP) may be undertaken if required.

Wollongong City Council wishes to invite Aboriginal people who hold cultural knowledge in determining the significance of Aboriginal object(s) and/or places in the vicinity of Kembla Grange to assist and inform the Aboriginal Cultural Heritage Assessment. For more information or to register in writing please contact:

Asher Ford
Biosis Research
8 Tate Street
Wollongong NSW 2500
Tel: (02) 4229 5222
Fax: (02) 4229 5500

REGISTRATIONS MUST BE RECEIVED BEFORE 5.00PM, 21 JULY 2011

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RESULTS

RACING

Randwick

NSW TAB DIVS

RACE 1: 2 9 1. Win $3.20 place $1.30 $3.10 $3.30. **Q:** $27.10. **E:** $28.80. **T:** $292.00. **F4:** 2-9-1-7 $3534.80.

RACE 2: 2 7 4. Win $3.50 place $1.50 $2.10 $1.60. **Q:** $13.70. **E:** $28.90. **T:** $62.80. **F4:** 2-7-4-9 $406.30. **RD:** 2-2 $10.70.

RACE 3: 17 12 6. Win $3.10 place $1.50 $5.70 $2.20. **Q:** $36.20. **E:** $53.80. **T:** $355.60. **F4:** 17-12-6-2 $1504.80. **RD:** 2-17 $12.70. **Scr:** 7, 10, 13, 15, 16, 18.

RACE 4: 9 1 10. Win $5.00 place $1.90 $1.60 $1.70. **Q:** $9.40. **E:** $20.00. **T:** $85.40. **F4:** 9-1-10-8 $273.90. **RD:** 17-9 $16.90. **Scr:** 3, 7.

RACE 5: 1 5 9. Win $2.30 place $1.30 $3.70 $2.90. **Q:** $16.00. **E:** $35.00. **T:** $135.80. **F4:** 1-5-9-14 $1620.30. **RD:** 9-1 $12.20. **Scr:** 2, 7, 13, 15.

RACE 6: 10 8 6. Win $7.10 place $2.20 $3.30 $1.60. **Q:** $46.10. **E:** $102.90. **T:** $358.00. **F4:** 10-8-6-11 $1084.80. **RD:** 1-10 $18.80. **Scr:** 2, 12.

RACE 7: 3 12 8. Win $4.10 place $1.80 $5.10 $2.00. **Q:** $45.30. **E:** $65.50. **T:** $402.50. **F4:** 3-12-8-6 $2473.30. **RD:** 10-3 $31.20. **Scr:** 9, 11.

DAILY DOUBLE: Bereft (1) + Circle Of Power (3) $10.20. **Subs:** 1, 3.

QUADDIE: 9-1-10-3: $415.40. **Subs:** 1-1-11-3.

BIG6 on 2,3,4,5,6,7: 2-17-9-1-10-3: Major (winners of 6 races): $10,369.70. Supplementary (winners of first 5 races): $194.60. Subs: 2,5,1,1,11,3.

Sandown

NSW TAB DIVS

RACE 1: 2 6 4. Win $2.70 place $1.80 $1.20 NTD. **Q:** $3.80. **E:** $8.00. **T:** $73.50. **F4:** 2-6-4-3 $127.60.

RACE 2: 2 4 3. Win $1.30 place $1.04 $2.30 NTD. **Q:** $3.30. **E:** $4.30. **T:** $9.30. **F4:** 2-4-3-6 $8.60. **RD:** 2-2 $6.70. **Scr:** 1, 5, 7.

RACE 3: 3 4 2. Win $4.80 place $2.10 $1.04 NTD. **Q:** $4.10. **E:** $11.40. **T:** $27.10. **F4:** 3-4-2-5 $118.50. **RD:** 2-3 $13.60. **Scr:** 1.

RACE 4: 2 3 11. Win $4.40 place $1.60 $1.80 $4.80. **Q:** $9.10. **E:** $17.90. **T:** $223.50. **F4:** 2-3-11-6 $1530.30. **RD:** 3-2 $21.70. **Scr:** 4.

RACE 5: 6 1 2. Win $13.70 place $2.70 $1.10 $1.50. **Q:** $8.70. **E:** $38.10. **T:** $111.80. **F4:** 6-1-2-4 $540.50. **RD:** 2-6 $117.20. **Scr:** 7.

RACE 6: 5 3 11. Win $2.20 place $1.40 $2.60 $3.40. **Q:** $13.10. **E:** $20.10. **T:** $207.60. **F4:** 5-3-11-9 $720.20. **RD:** 6-5 $53.50. **Scr:** 2, 6, 7, 12, 18.

RACE 7: 4 6 10. Win $54.00 place $10.70 $1.40 $4.80. **Q:** $90.80. **E:** $267.20. **T:** $3098.10. **F4:** 4-6-10-1 $15,034.20. **RD:** 5-4 $133.70.

RACE 8: 5 4 7. Win $5.00 place $1.90 $1.40 $2.80. **Q:** $7.80. **E:** $17.00. **T:** $103.60. **F4:** 5-4-7-1 $288.00. **RD:** 4-5 $230.70.

DAILY DOUBLE: Testascana (5) + Chatham Road (5) $22.10. **Subs:** 5, 1.

QUADDIE: 6-5-4-5: $21.179.00. **Subs:** 1-5-6-1.

Gawler

NSW TAB DIVS

RACE 1: 9 7 10. Win $2.80 place $1.20 $2.40 $3.00. **Q:** $10.10. **E:** $17.20. **T:** $115.90. **F4:** 9-7-10-2 $505.10 & 9-7-10-4 $510.00. **Scr:** 13, 14.

RACE 2: 11 6 10. Win $3.30 place $1.50 $2.80 $2.50. **Q:** $13.10. **E:** $23.70. **T:** $152.60. **F4:** 11-6-10-9 $349.00. **RD:** 9-11 $21.30. **Scr:** 8, 16, 17.

RACE 3: 11 1 13. Win $46.10 place $3.80 $7.50 $4.00. **Q:** $497.00. **E:** $418.40. **T:** $11,435.80. **F4:** 11-1-13-7 Not won, pool jackpots. **RD:** 11-11 $101.90. **Scr:** 6.

RACE 4: 12 3 6. Win $9.20 place $2.10 $1.40 $3.00. **Q:** $21.20. **E:** $45.00. **T:** $409.30. **F4:** 12-3-6-9 $1075.90. **RD:** 11-12 $347.90. **Scr:** 4, 5, 7.

RACE 5: 9 3 5. Win $11.90 place $3.20 $1.90 $3.70. **Q:** $44.10. **E:** $94.10. **T:** $762.70. **F4:** 9-3-5-2 $3619.10. **RD:** 12-9 $111.60. **Scr:** 6, 14.

RACE 6: 8 5 12. Win $10.40 place $3.30 $4.80 $4.90. **Q:** $70.60. **E:** $157.40. **T:** $1230.60. **F4:** 8-5-12-1 $4400.40. **RD:** 9-8 $200.10.

RACE 7: 10 13 9. Win $78.60 place $17.20 $6.00 $2.70. **Q:** $344.80. **E:** $1026.50. **T:** $21,222.50. **F4:** 10-13-9-3 Not won, pool jackpots. **RD:** 8-10 $208.80. **Scr:** 15, 16, 17, 18.

RACE 8: 13 2 14. Win $9.30 place $3.10 $2.50 $2.80. **Q:** $48.40. **E:** $102.90. **T:** $650.50. **F4:** 13-2-14-5 $4176.20. **RD:** 10-13 $335.10. **Scr:** 7, 10, 11.

RACE 9: 7 3 8. Win $11.60 place $2.60 $5.40 $4.20. **Q:** $117.40. **E:** $154.90. **T:** $3022.40. **F4:** 7-3-8-6 $5706.30. **RD:** 13-7 $128.80. **Scr:** 4.

DAILY DOUBLE: Brilliant Ween (10) + Fraacharm (7) $375.10. **Subs:** 6, 6.

QUADDIE: 8-10-13-7: $22,936.00. **Subs:** 1-6-8-6.

Doomben

NSW TAB DIVS

RACE 1: 1 5 2. Win $3.50 place $1.60 $1.70 $1.80. **Q:** $7.20. **E:** $14.50. **T:** $49.50. **F4:** 1-5-2-7 $232.80.

RACE 2: 1 10 2. Win $1.60 place $1.04 $1.50 $2.20. **Q:** $4.60. **E:** $4.10. **T:** $23.20. **F4:** 1-10-2-6 $82.60. **RD:** 1-1 $4.80. **Scr:** 5, 7, 9.

RACE 3: 3 7 10. Win $3.20 place $1.40 $2.70 $1.30. **Q:** $15.80. **E:** $27.80. **T:** $66.30. **F4:** 3-7-10-2 $471.20. **RD:** 1-3 $4.50. **Scr:** 6, 8.

RACE 4: 3 15 7. Win $12.50 place $4.30 $4.30 $1.90. **Q:** $81.80. **E:** $147.30. **T:** $984.30. **F4:** 3-15-7-14 $5817.20. **RD:** 3-3 $27.10. **Scr:** 2, 6, 11, 13, 17, 18.

RACE 5: 5 9 7. Win $4.90 place $1.80 $5.50 $2.90. **Q:** $59.70. **E:** $60.70. **T:** $876.50. **F4:** 5-9-7-3 $4168.60. **RD:** 3-5 $85.50.

RACE 6: 3 9 1. Win $2.50 place $1.20 $2.60 $1.90. **Q:** $15.30. **E:** $18.60. **T:** $63.60. **F4:** 3-9-1-4 $181.20. **RD:** 5-3 $14.40.

RACE 7: 5 1 10. Win $2.40 place $1.50 $4.60 $2.50. **Q:** $22.20. **E:** $36.30. **T:** $168.50. **F4:** 5-1-10-6 $602.80. **RD:** 3-5 $6.10. **Scr:** 3, 7, 15, 18.

DAILY DOUBLE: Crosscannons (5) + Belltone (5) $13.40. **Subs:** 5, 5.

QUADDIE: 3-5-3-5: $568.60. **Subs:** 14-5-3-5.

Belmont

NSW TAB DIVS

RACE 1: 1 12 9. Win $4.90 place $2.10 $2.00 $9.40. **Q:** $11.50. **E:** $17.50. **T:** $637.70. **F4:** 1-12-9-13 $3118.60. **Scr:** 8, 17.

RACE 2: 11 6 13. Win $6.40 place $2.30 $8.10 $5.90. **Q:** $126.70. **E:** $209.90. **T:** $1604.40. **F4:** 11-6-13-9 Not won, pool jackpots. **RD:** 1-11 $43.00.

RACE 3: 5 3 1. Win $28.10 place $5.70 $2.70 $2.90. **Q:** $99.60. **E:** $197.10. **T:** $1649.20. **F4:** 5-3-1-7 $24,031.00. **RD:** 11-5 $184.40.

RACE 4: 15 11 5. Win $2.50 place $1.60 $2.80 $5.50. **Q:** $21.90. **E:** $36.60. **T:** $609.30. **F4:** 15-11-5-14 $7072.40. **RD:** 5-15 $201.40. **Scr:** 16.

RACE 5: 7 3 15. Win $13.10 place $3.30 $4.90 $5.10. **Q:** $87.00. **E:** $232.60. **T:** $2037.60. **F4:** 7-3-15-2 $4202.00. **RD:** 15-7 $58.90. **Scr:** 6, 17, 18, 20.

RACE 6: 1 12 13. Win $4.50 place $1.70 $1.50 $4.90. **Q:** $8.00. **E:** $15.80. **T:** $184.00. **F4:** 1-12-13-10 $2518.40. **RD:** 7-1 $164.00.

RACE 7: 12 6 14. Win $4.00 place $1.80 $2.10 $7.00. **Q:** $11.80. **E:** $19.50. **T:** $573.70. **F4:** 12-6-14-13 $2430.80. **RD:** 1-12 $22.20. **Scr:** 3, 16, 17, 18.

RACE 8: 2 11 5. Win $11.50 place $3.80 $15.00 $7.10. **Q:** $568.90. **E:** $919.00. **T:** $26,365.10. **F4:** 2-11-5-6 Not won, pool jackpots. **RD:** 12-2 $111.60. **Scr:** 14, 17, 19, 20.

DAILY DOUBLE: Cara Carabini (1) + November Red (2) $230.30. **Subs:** 12, 16.

QUADDIE: 7-1-12-2: $5534.00. **Subs:** 2-12-1-16.

GREYHOUNDS

Nowra

NSW TAB DIVS

RACE 1: 3 4 1. Win $2.60 place $1.30 $1.70 $1.80. **Q:** $8.60. **E:** $12.30. **T:** $81.10. **F4:** 3-4-1-2 $196.70. **Scr:** 9, 10.

RACE 2: 5 6 3. Win $6.70 place $2.00 $1.50 $1.04. **Q:** $13.70. **E:** $35.40. **T:** $106.70. **F4:** 5-6-3-7 $379.90. **RD:** 3-5 $21.40. **Scr:** 9, 10.

RACE 3: 4 3 5. Win $8.00 place $3.00 $2.80 $1.60. **Q:** $36.80. **E:** $77.70. **T:** $380.90. **F4:** 4-3-5-2 $1194.50. **RD:** 5-4 $39.80. **Scr:** 9, 10.

RACE 4: 2 6 9. Win $4.70 place $1.80 $1.80 $2.10. **Q:** $14.10. **E:** $41.00. **T:** $109.90. **F4:** 2-6-9-3 $763.40. **RD:** 4-2 $17.70. **Scr:** 5, 10.

RACE 5: 1 2 4. Win $1.70 place $1.30 $2.00 $1.70. **Q:** $3.90. **E:** $6.40. **T:** $22.90. **F4:** 1-2-4-3 $93.80. **RD:** 2-1 $29.80. **Scr:** 5, 8.

RACE 6: 1 10 2. Win $7.50 place $1.60 $2.90 $2.10. **Q:** $73.10. **E:** $60.30. **T:** $248.80. **F4:** 1-10-2-4 $1797.30. **RD:** 1-1 $36.50. **Scr:** 3, 6.

RACE 7: 7 5 3. Win $11.10 place $2.00 $3.20 $2.10. **Q:** $95.30. **E:** $270.10. **T:** $489.40. **F4:** 7-5-3-4 $3568.30. **RD:** 1-7 $259.70. **Scr:** 9, 10.

RACE 8: 3 1 2. Win $7.30 place $2.60 $1.80 $1.30. **Q:** $19.20. **E:** $38.50. **T:** $76.70. **F4:** 3-1-2-5 $671.40. **RD:** 7-3 $148.50. **Scr:** 9, 10.

RACE 9: 2 6 8. Win $2.00 place $1.20 $1.60 $5.80. **Q:** $6.80. **E:** $6.20. **T:** $112.90. **F4:** 2-6-8-4 $443.60. **RD:** 3-2 $9.30. **Scr:** 9, 10.

RACE 10: 1 3 2. Win $2.20 place $1.70 $2.90 NTD. **Q:** $10.00. **E:** $14.30. **T:** $47.40. **F4:** 1-3-2-6 $148.70. **RD:** 2-1 $3.90. **Scr:** 5, 8, 9, 10.

DAILY DOUBLE: Garry's Tiger (1) + Number Krunch (3) $132.30. **Subs:** 7, 2.

QUADDIE: 1-1-7-3: $3388.00. **Subs:** 1-7-4-2.

PACING

Bathurst

NSW TAB DIVS

RACE 1: 7 5 4. Win $5.60 place $2.70 $7.40 $2.20. **Q:** $75.50. **E:** $100.50. **T:** $758.50. **F4:** 7-5-4-3 $3699.00. **Scr:** 11.

RACE 2: 1 8 5. Win $8.30 place $2.50 $1.90 $1.40. **Q:** $22.30. **E:** $107.70. **T:** $121.40. **F4:** 1-8-5-2 $1029.70. **RD:** 7-1 $181.20. **Scr:** 6.

RACE 3: 9 6 4. Win $6.10 place $1.60 $1.30 $6.00. **Q:** $6.60. **E:** $16.80. **T:** $232.80. **F4:** 9-6-4-7 $2318.10. **RD:** 1-9 $86.70. **Scr:** 1.

RACE 4: 9 4 5. Win $2.70 plc $1.04 $2.30 $2.20. **Q:** $18.70. **E:** $34.00. **T:** $88.10. **F4:** 9-4-5-2 $242.30. **RD:** 9-9 $14.20. **Scr:** 3.

RACE 5: 6 9 1. Win $1.50 place $1.10 $3.70 $1.04. **Q:** $9.00. **E:** $15.60. **T:** $41.60. **F4:** 6-9-1-8 $148.10. **RD:** 9-6 $3.00. **Scr:** 3.

RACE 6: 10 7 9. Win $1.70 place $1.10 $2.10 $2.10. **Q:** $9.10. **E:** $13.90. **T:** $87.10. **F4:** 10-7-9-3 $787.50. **RD:** 6-10 $2.80.

RACE 7: 2 1 10&11dh. Win $3.00 place $1.20 $1.20 (10) $2.70 (11) $6.00. **Q:** $3.50. **E:** $6.40. **T:** (2-1-10) $26.60,(2-1-11) $56.60. **F4:** 2-1-10-11 $275.30 & 2-1-11-10 $399.10. **RD:** 10-2 $10.30. **Scr:** 8.

RACE 8: 5 2 1. Win $3.60 place $1.90 $4.70 $1.04. **Q:** $70.80. **E:** $45.10. **T:** $134.80. **F4:** 5-2-1-8 $403.10. **RD:** 2-5 $28.00.

DAILY DOUBLE: Veracity Red (6) + Doesentmatta (2) $4.40. **Subs:** 6, 1.

QUADDIE: 9-6-10-2: $30.80. **Subs:** 2-6-10-1.

Step 3- Registration of Interest.

The registration period ran from the 07 July 2011 to the 21 July 2011. Leeway was given to Aboriginal parties/groups who provided responses shortly after the close of this period and they have been registered as Aboriginal parties for consultation.

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council	Letter – 08 July 2011	Phone – 22 July 2011 Phone – 25 July 2011	Registered for consultation.
Coomaditchie Untied Aboriginal Corporation	Letter – 08 July 2011	No response	
Illawarra Aboriginal Corporation	Letter – 08 July 2011	No response	
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	Letter – 08 July 2011	Fax – 25 July 2011	Registered for Consultation
Wodi Wodi Elders Corporation	Letter – 08 July 2011	Phone – 15 July 2011	Registered for Consultation
Gary Caines	Letter – 08 July 2011	No response	
Gandangara Elders Group	Letter – 08 July 2011	No response	
Ken Foster	Letter – 08 July 2011	No response	
Woronora Plateau Gundungara Elders Council	Letter – 08 July 2011	Email – 12 July 2011	Registered for Consultation

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Kullila Site Consultants and Koori Site Management.	Letter – 08 July 2011	Phone – 08 July 2011	Registered for Consultation
La Perouse Botany Bay Aboriginal Corporation	Letter – 08 July 2011	Email – 12 July 2011	Registered for Consultation
North Illawarra Aboriginal Collective Inc.	Letter – 08 July 2011	Email – 22 July 2011	Registered for Consultation
The Wadi Wadi Coomaditchie Aboriginal Corporation and Wulungu Elders Council were contacted via the North Illawarra Aboriginal Collective Inc.			

BIOSIS RESEARCH

RECORD OF CONVERSATION

Project Number: 12443

Project Name: Whyte Gully

Author: Asher Ford

Date: 25/07/2011 Time: 1.30pm Page: 1 of 1

Meeting/Phone Conversation with: Liza Haywood of ILALC

Telephone: Ashers Landline

Other Attendees at Meeting: –

Record of Discussion

Follow up call on phone message from S Robison on 22/07/2011. Discussed booking for Coledale survey. Discussed Whytes Gully and query on registration. LH said definatly intrested but SR away so nominating for consultation. Asked for LH to send through email request.

Signed:

KOREWAL=LA PEROUSE. ELOUERA=ILLAWARRA.
JERRUNGARUGH=SHOALHAVEN
Tribal Elders : Aboriginal Corporation

Reuben Brown
86 Hertford Street
BERKELEY, NSW 2506
Ph/fax: (02) 4271 3069

Asher Ford
Fax: (02) 4229 5500

Dear Asher,

I recently called by phone, but thought it would be best to write to you in regards to the Whytes Gully New Landfill Cell Cultural Heritage Assessment, to register as an interested stakeholder.

Kind Regards,

R. Brown

Reuben Brown
25th July 2011

BIOSIS RESEARCH

RECORD OF CONVERSATION

Project Number: 12443

Project Name: Whytes Gully

Author: Paul Howard

Date: 15.7.2011 Time: 12.30pm Page: 1 of 1

Meeting/Phone Conversation with: James Davis of Wodi Wodi Elderscorp

Telephone:

Other Attendees at Meeting:

Record of Discussion

- Reply to Whytes Gully
- Expression of interest.

Signed:

Asher Ford

From: NIAC <illert@sctelco.net.au>
Sent: Friday, 22 July 2011 5:37 PM
To: Asher Ford
Subject: Whyates Gully New landfill ACHA

Dear Asha,

We would like to put in an expression of interest regarding the Whytes Gully New Landfill Cultural Heritage Assessment on behalf of the Wadi Wadi Coomaditchie Aboriginal Corporation and the Woronora Plateau Gundungara Elders Council.

Kind regards
Daniela Reverberi (NIAC technical officer)
Northern illawarra Aboriginal Collective

BIOSIS
RESEARCH

RECORD OF CONVERSATION

Project Number: 12443

Project Name: Whytes Gully

Author: Asher ford and Paul Howard

Date: ______ Time: ______ Page: 1 of 1

Meeting/Phone Conversation with: Maria Maher of KWHAC

Telephone: 8.7.2011

Other Attendees at Meeting: ______

Record of Discussion

- Expressions of interest for Consultation
- Phone Conversation

Signed:

Asher Ford

From: yvonne jane x <yvonne.simms@hotmail.com>
Sent: Tuesday, 12 July 2011 12:02 PM
To: Asher Ford
Subject: Whytes Gully New Landfill Cell- Cultural Heritage Assesment

Dear Asher, The Woronora Plateau Gundangarra Elders Council Aunty Norma Simms and the La Perouse Botany Bay Aboriginal Corporation would like to be part of the cultural heritage assesment taking place at Whytes Gully Resource Recovery Park site.

Regards Yvonne

Aunty Norma Simms

Yvonne Simms
La Perouse/Botany Bay
Aboriginal Corporation

10 Murrong Place
LA PEROUSE NSW 2036

Ph: 0466 094 491

Stage 2 – Presentation of Information about the Proposed Project

Step 1- Provision of Project Information Pack.

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council	Letter – 25 July 2011	No Response	
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	Letter – 25 July 2011	No Response	
Wodi Wodi Elders Corporation	Letter – 25 July 2011	No Response	
Woronora Plateau Gundungara Elders Council	Letter – 25 July 2011	No Response	
Kullila Site Consultants and Koori Site Management.	Letter – 25 July 2011	No Response	
La Perouse Botany Bay Aboriginal Corporation	Letter – 25 July 2011	No Response	
North Illawarra Aboriginal Collective Inc.	Letter – 25 July 2011	No Response	

Stage 3 – Gathering Information about Cultural Significance

Step 1- Provision of Project Methodology Pack.

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council	Letter – 27 July 2011	No Response	
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	Letter – 27 July 2011	No Response	
Wodi Wodi Elders Corporation	Letter – 27 July 2011	No Response	
Woronora Plateau Gundungara Elders Council	Letter – 27 July 2011	No Response	
Kullila Site Consultants and Koori Site Management.	Letter – 27 July 2011	No Response	
La Perouse Botany Bay Aboriginal Corporation	Letter – 27 July 2011	No Response	
North Illawarra Aboriginal Collective Inc.	Letter – 27 July 2011	No Response	

Illawarra Local Aboriginal Land Council
3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

BIOSIS RESEARCH

PAUL HOWARD –ARCHAEOLOGIST

REPORT

ABORIGINAL CULTURAL HERITAGE ASSESSMENT

WHYTES GULLY

ABORIGINAL SITE OFFICER
JON KIRBY - FRIDAY 26 AUGUST 2011

Illawarra Local Aboriginal Land Council

3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

SURVEY AIM

Conduct an Archaeological investigation to identify Aboriginal artefacts and the cultural significance of the area.

SURVEY EXAMINATION

Jon Kirby -26 August 2011

Today I attended a site inspection with Archaeologist Paul Howard and other Aboriginal Site officers. We completed a site induction and then we all spread out in a line. We walked down the Ridgecrest to the North West corner; the visibility was very poor due to the long grass. We continued to inspect the north East Ridgecrest on top, there are very few rainforests like the one found in this area in the Illawarra, they must be protected.

We continued onto the South East part of the site where there is a Motor Bike track, one (1) artefact was found: 1 x Quartz and plenty of Bimbella shells (Blood Mussels). The visibility was good along the motor track.

We moved onto to the cottage where the visibility was poor due to the long grass. Further test pits will be required on this part of the site and on the lower spur crest to identify if there are any artefacts are in this area.

OUTCOME:

One (1) artefact was found: 1 x Quartz and plenty of Bimbella shells (Blood Mussels).

Illawarra Local Aboriginal Land Council

3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

RECOMMENDATION:

- It needs to be established if the soil is landfill or not and further testing needs to be carried out in the area due to poor visibility.
- The Archaeologist needs to research all maps, plans, and historical documentation relating to the history of Whytes Gully.
- Any further testing carried out on this site will require Aboriginal site monitoring.
- Any Aboriginal artefacts identified during construction should remain in their place; if this is not possible then a care and control process should be discussed with the relevant Aboriginal stakeholders.
- The Wollongong City Council should enter into discussion with the Aboriginal community regarding employment opportunities created throughout this project.
- Any excavation work carried out on this site will require Aboriginal site monitoring.

If you require any further information regarding this report, please don't hesitate to contact me on the number listed below.

Yours in UNITY

S Rob

Sharralyn Robinson
CEO
Ph: 42 263338
M: 0410 125463

Step 3- Revised Test Excavation Methodology

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council	Email – 01 November 2011 Phone – 14 November 2011	Email – 17 November 2011	Agreed with revised test excavation methodology
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	Email – 01 November 2011 Phone – 14 November 2011	Fax – 14 November 2011	Agreed with revised test excavation methodology
Wodi Wodi Elders Corporation	Email – 01 November 2011 Phone – 14 November 2011	Email – 18 November 2011	Agreed with revised test excavation methodology
Woronora Plateau Gundungara Elders Council	Email – 01 November 2011 Phone – 14 November 2011	Email – 18 November 2011	Agreed with revised test excavation methodology
Kullila Site Consultants and Koori Site Management.	Email – 01 November 2011 Phone – 14 November 2011	Email – 18 November 2011	Agreed with revised test excavation methodology
La Perouse Botany Bay Aboriginal Corporation	Email – 01 November 2011 Phone – 14 November 2011	Email – 18 November 2011	Agreed with revised test excavation methodology
North Illawarra Aboriginal Collective Inc.	Email – 01 November 2011 Phone – 14 November 2011	Email – 14 November 2011	Agreed with revised test excavation methodology

RECORD OF CONVERSATION

☐ Meeting ☐Telephone

Project number: 12443 Date/Time: 14.11.11 10.25am

Project Name: Whytes Gully

Author/s: Paul Howard

Conversation with: Name Sharralyn Robinson Organisation ILALC

Other attendees:

Record of discussion: Methodology accepted from Illawarra Local Aboriginal Land Council

Signed
On behalf of Biosis Research Pty. Ltd.

Page 1 of 1

Asher Ford

Subject: FW: 12443 Whytes Gully Revised Test Excavation Methodology

---

From: S Robinson [mailto:srobinson@exemail.com.au]
Sent: Wednesday, 16 November 2011 2:44 PM
To: Paul Howard
Subject: RE: 12443 Whytes Gully Revised Test Excavation Methodology

Hi Paul

Thankyou for sending the information on the revised test excavation methodology for Whytes Gully dated 1 November 2011.

I have read through the methodology and agree with the recommendations.

It is important to protect Significant sites, it is through these test excavations that we will determine the level of significance and the protection and preservation required.

Yours in UNITY

Sharralyn Robinson
Illawarra Local Aboriginal Land Council
CEO
Ph: 42 26 3338
Fax: 42 26 3360
M: 0410 125463

I acknowledge the traditional owners and custodians of the land I work on as the first people of this country.

RECORD OF CONVERSATION

□ Meeting □Telephone

Project number: 12443 Date/Time: 16.11.2011 10.00am

Project Name: Whytes Gully

Author/s: Rueben Browing Paul Howard

Conversation with: Name Organisation Korewal Elouera Jerrungurrah

Other attendees:

Record of discussion: Methodology accepted from Korewal Elouera Jerrungurrah

Signed

On behalf of Biosis Research Pty. Ltd.

Page 1 of 1

PAUL HOWARD

FAX= 42295500

REUBEN BROWN
86 HARTFORD ST
BERKELEY 2506
Ph/FAX=42713069

PAUL,

RE YOUR REQUEST METHODOLIGY ABOUT WHYTES GULLY WEST DAPTO.
I SUPPORT THE IDEA AND WILL BE IN IN TOUCH AND SEE YOU NEXT WEEK.

Kind Regards
Reuben Brown

14-11-2011.

RECORD OF CONVERSATION

☐ Meeting ☐Telephone

Project number: 12443 Date/Time: 14.11.2011. 10.21am

Project Name: Whytes Gully

Author/s: Paul Howard.

Conversation with: Name James Davis Organisation Wodi Wodi Elders Corp.

Other attendees:

Record of discussion: Methodology Accepted from The Wodi Wodi Elders Corporation

Signed

On behalf of Biosis Research Pty. Ltd.

Page 1 of 1

Asher Ford

Subject: FW: Shone Ave revised test excvation methodology.

From: James Davis [mailto:jvdcorp@hotmail.com]
Sent: Friday, 18 November 2011 3:25 PM
To: Paul Howard
Subject: RE: Shone Ave revised test excvation methodology.

Dear Paul

I support the revised methodology for Whytes Gully but suggest that:

- If skeletal remains are found within the project site or in any other area within the investigative area, as supported in DECC Guidelines, work cease immediately and that I be contacted (if not present) so I can consult with an elder before the retrieval process.

- Any sites which are not recorded with the AHIMS Registrar be submitted via the relevant Aboriginal Site Impact Recording Form.

Sincerely

James Davis
Wodi Wodi Traditional Owner

RECORD OF CONVERSATION

□ Meeting □Telephone

Project number: 12443 Date/Time: 14.11.11 10.05am

Project Name: Whytes Gully

Author/s: Paul Howard

Conversation with: Name Daniela Reverbri Organisation NIAC

Other attendees:

Record of discussion: Methodology Accepted from Northern Illawara Aboriginal Corporation

Signed [signature]

On behalf of Biosis Research Pty. Ltd.

Page 1 of 1

Asher Ford

From: NIAC <illert@sctelco.net.au>
Sent: Monday, 7 November 2011 10:48 AM
To: Paul Howard
Subject: Re: 12443 Whytes Gully Revised Test Excavation Methodology

CONFIDENTIAL
From
Northern Illawarra Aboriginal Collective

To Biosis Research
Attention Paul Howard

Subject: 12443 Whytes Gully Revised Test Excavation Methodology

Dear Paul,

Thank you for the Biosis report. We have now had time to review Biosis Whytes Gully Teast Excavation Methodology. We are happy with the thoroughness and care taken in the test excavation design.

Regards
Daniela Reverberi (NIAC technical officer)
Paul Cummins (Gundungara Elder)
Keith Ball (Wadi Wadi Elder)

BIOSIS
RESEARCH

RECORD OF CONVERSATION

Project Number: 12443

Project Name: Whytes Gully

Author: Paul

Date: 14.11.2011 Time: 10.30 am Page: 1 of 1

Meeting/Phone Conversation with: Maria Maher of Kullila Welfare and Housing

Telephone:

Other Attendees at Meeting:

Record of Discussion Methodology accepted by Maria Maher on behalf of NKSM and KWHAC

Signed:

Asher Ford

Subject: FW: 12443 Whytes Gully Revised Test Excavation Methodology

---

From: Geoffrey Maher [mailto:g.m.maher@hotmail.com]
Sent: Friday, 18 November 2011 11:05 AM
To: Paul Howard
Subject: RE: 12443 Whytes Gully Revised Test Excavation Methodology

Dear Paul'

RE: Whytes Gully New Landfill Cell.

Kullila Site Consultants and National Koori Site Management, Both accept your proposed Methodology.

Cheers

Maria Maher

BIOSIS
RESEARCH

RECORD OF CONVERSATION

Project Number: 12443

Project Name: Whytes Gully

Author: Paul Howard

Date: 14.11.2011 Time: 10.35am Page: 1 of 1

Meeting/Phone Conversation with: Yvonne Simms of LPBBC

Telephone:

Other Attendees at Meeting:

Record of Discussion Methodology Accepted from La Perouse Botany Bay corporation and on behalf of Woronora Gundangara Elders Corp.

Signed:

Asher Ford

Subject: FW: 12443 Whytes Gully Revised Test Excavation Methodology

From: yvonne jane x [mailto:yvonne.simms@hotmail.com]
Sent: Friday, 18 November 2011 10:46 AM
To: Paul Howard
Subject: RE: 12443 Whytes Gully Revised Test Excavation Methodology

Hi Paul, Aunty Norma and myself agree with the methodology,Whytes Gully New Landfill Cell,
also that any artefacts that are found to be reburied back on country the whole area is of great significance to the Aboriginal people of the illawarra

Cheers Yvonne

Yvonne Simms
La Perouse/Botany Bay
Aboriginal Corporation

10 Murrong Place
LA PEROUSE NSW 2036

Ph: 0466 094 491

Step 4- Test Excavation

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council		Email – 17 November 2011	A letter report was provided by ILALC discussing the results of test excavation undertaken up to the 17 November 2011 and providing recommendations for further investigations
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation		No response	
Wodi Wodi Elders Corporation		No response	
Woronora Plateau Gundungara Elders Council		No response	
Kullila Site Consultants and Koori Site Management.		No response	
La Perouse Botany Bay Aboriginal Corporation		No response	
North Illawarra Aboriginal Collective Inc.		No response	

Illawarra Local Aboriginal Land Council

3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

BIOSIS RESEARCH

PAUL HOWARD –ARCHAEOLOGIST

REPORT

ABORIGINAL CULTURAL HERITAGE ASSESSMENT
WHYTES GULLY
TEST PITS

ABORIGINAL SITE OFFICERS

LEANNE TUNGAI 21 NOVEMBER - 5 DECEMBER 2011
JOHNNY PAGETT 28-30 NOVEMBER 2011

Illawarra Local Aboriginal Land Council

3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

SURVEY AIM

Aboriginal Site Officers will oversee and monitor test pits to identify, protect and salvage Aboriginal Artefacts and significant Archaeological material.

SURVEY EXAMINATION

LEANNE TUNGAI
21 November 2011

- Five spits dug – 20 metres apart
- Sieved all day found one (1) flake in pit 3
- Bagged flake and put back in pit 3
- 30 buckets left to sieve through but we ran out of time today

5 December 2011

Top of tip north side dug (2) pits
Bottom of hill on west side dug four (4) pits
Sieved found nothing in the four (4) pits there is more pits to do

JOHN PAGETT
28 November 2011

Today we monitored the diggings of two (2) pits (pad 1), 4 pits (pad 3)

OUTCOME:

Another Site Officer commented there was one (1) isolated find – I was not there that day
In the (6) Test pits I monitored no artefacts were found

- Possible two (2) artefacts reburied

30 November 2011

Today we monitored two pits (pad 4) and then went back to pad 1 and monitored two (2) pits

There is a need to monitor 11 more test pits in pad 1 and 9 in pad 2

OUTCOME:

No artefacts were identified today

No restriction RE: Expansion at Whytes Gully – Resource Recovery Park

Illawarra Local Aboriginal Land Council

3 Ellen Street WOLLONGONG NSW 2500 Ph: 42263338 Fax: 42263360

RECOMMENDATION:

- Any further excavation work carried out on this site will require Aboriginal site monitoring.
- There was a need to monitor 11 more test pits in pad 1, and 9 in pad 2.
- Any Aboriginal artefacts identified during excavation should remain in their place; if this is not possible then a care and control process should be discussed with the relevant Aboriginal stakeholders.
- The Wollongong City Council should enter into discussion with the Aboriginal community regarding employment opportunities created throughout this project.

If you require any further information regarding this report, please don't hesitate to contact me on the number listed below.

Yours in UNITY

S Rob

Sharralyn Robinson
CEO
Ph: 42 263338
M: 0410 125463

Stage 4 – Review of Draft Report

Step 1- Provision of Draft Report for Review.

Organisation Contacted	Date and Type of Contact	Date and Type of Response	Response Details
Illawarra Local Aboriginal Land Council	Email and hardcopy delivered on request – 13 January 2012	Email -16 January 2011	An email was provided by ILALC providing recommendations for the Project.
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	Email – 13 January 2012	No Response	
Wodi Wodi Elders Corporation	Email – 13 January 2012	No Response	
Woronora Plateau Gundungara Elders Council	Email – 13 January 2012	No Response	
Kullila Site Consultants and Koori Site Management.	Email – 13 January 2012	No Response	
La Perouse Botany Bay Aboriginal Corporation	Email – 13 January 2012	No Response	
North Illawarra Aboriginal Collective Inc.	Email – 13 January 2012	Email – 20 January 2012	A email response was provided by NIAC agreeing to the recommendations

Asher Ford

Subject: FW: Whytes Gully Report for review

From: S Robinson [mailto:srobinson@exemail.com.au]
Sent: Monday, 16 January 2012 1:35 PM
To: Asher Ford
Subject: RE: Whytes Gully Report for review

Hi Asher

Thankyou for forwarding the Whytes Gully New Landfill Cell-Aboriginal Archaeological Report

I have read through the report and wish to make the following comments:

- I agree that it is highly likely that artefacts may be found during excavation

- I agree with recommendation 1 of the report, it is imperative that WCC continue to inform the Aboriginal groups about the Management of the cultural heritage sites within the study area.

- I disagree with recommendation 2 as years of Aboriginal knowledge and wisdom cannot be learnt or transferred in an induction. The ILALC recommends that all excavation work carried out on this site will require Aboriginal site monitoring.

If you require any further information regarding these comments, please don't hesitate to contact me on the number listed below.

Yours in UNITY

Sharralyn Robinson
Illawarra Local Aboriginal Land Council
CEO
Ph: 42 26 3338
Fax: 42 26 3360
M: 0410 125463

I acknowledge the traditional owners and custodians of the land I work on as the first people of this country.

APPENDIX 2: ABORIGINAL ARCHAEOLOGICAL REPORT

BIOSIS
RESEARCH

Whytes Gully New Landfill Cell
Aboriginal Archaeological Report

Report to:

Golder Associates on behalf of Wollongong City Council

January 2012

BIOSIS
RESEARCH

Ballarat:
449 Doveton Street North Ballarat3350
Ph: (03) 5331 7000 Fax: (03) 5331 7033
email: ballarat@biosisresearch.com.au

Melbourne:
38 Bertie Street Port Melbourne 3207
Ph: (03) 9646 9499 Fax: (03) 9646 9242
email: melbourne@biosisresearch.com.au

Canberra:
Unit 16 / 2 Yallourn Street Fyshwick ACT
Ph: (02) 6228 1599 Fax: (02) 6280 8752
email: canberra@biosisresearch.com.au

Sydney:
18-20 Mandible Street Alexandria NSW 2015
Ph: (02) 9690 2777 Fax: (02) 9690 2577
email: sydney@biosisresearch.com.au

Wangaratta:
26a Reid Street Wangaratta VIC 3677
Ph: 03 5721 9453 Fax: 03 5721 9454
email: wangaratta@biosisresearch.com.au

Wollongong:
8 Tate Street Wollongong 2500
Ph: (02) 4229 5222 Fax: (02) 4229 5500
email: wollongong@biosisresearch.com.au

Project no: ***12443***

Authors: Asher Ford and Paul Howard

Reviewer: Melanie Thomson, Lyn O'Brien and Sam Higgs

Mapping: Ashleigh Pritchard

LGA: Wollongong City Council

DOCUMENT CONTROL SHEET

Project	Whytes Gully New Landfill Cell Expansion, Kembla Grange
Project No	12443
Report To	Golder Associates on Behalf of Wollongong City Council
Report Title:	Whytes Gully Archaeological Assessment Report
Author(s):	Asher Ford and Paul Howard

Revision	Prepared	Internal Review	External Review	Amended
A	Asher Ford	Melanie Thomson		23/12/2011
B	Asher Ford	Lyn O'Brien	Jacinta McMahon	06/01/2012
C	Asher Ford	Sam Higgs	Jacinta McMahon	11/01/2012
Final	Asher Ford			

Revision	Issued	Name	Signed
A	21 September 2011	Asher Ford	
B	23 December 2012	Asher Ford	
C	11 January 2012	Asher Ford	
Final	24 February 2012	Asher Ford	

ACKNOWLEDGEMENTS

Biosis Research gratefully acknowledges the contributions of the following organisations in preparing this report:

- Illawarra Local Aboriginal Land Council
- Wodi Wodi Elders Corporation
- Gandagarra Elders Group
- La Perouse Botany Bay Aboriginal Corporation
- North Illawarra Aboriginal Collective Inc.
- Golder Associates on behalf of Wollongong City Council

ABBREVIATIONS

ACHAR	Aboriginal Cultural Heritage Assessment Report
AGD	Australian Geodetic Datum
AHIMS	Aboriginal Heritage Information Management System
c.	Approximately
CHL	Commonwealth Heritage List
CMA	Catchment Management Authority
CMP	Construction Management Plan
CoB	Close of Business
DA	Determining Authority
DECCW	Department of Environment, Climate Change and Water (Now OEH and EPA)
DoP	Department of Planning
DP	Deposited Plan
DSEWPC	Department of Sustainability, Environment, Water, Population and Community
DV	Distance Visibility
DEWHA	Department of Environment, Water, Heritage and Arts
EPA	Environment Protection Authority (previously a part of OEH and DECCW)
EP&A Act	Environment Planning and Assessment Act
EPBC	Environmental Protection and Biodiversity Conservation
EPRG	Environmental Protection and Regulation Group
ESC	Effective Survey Coverage
GDA	Geocentric Datum of Australia
GPS	Global Positioning System
GSV	Ground Surface Visibility
ICOMOS	International Council on Monuments and Sites
ID	Internal Diameter
ILUA	Indigenous land use agreements
km	Kilometre
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LPMA	Land and Property Management Authority
m	Metre
mm	Millimetre

MGA	Map Grid of Australia
NHL	National Heritage List
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Service
NTSCORP	Native Title Services Corporation
NSW	New South Wales
OEH	Office of Environment and Heritage (Formally DECCW)
OD	Outside Diameter
PAD	Potential Archaeological Deposit
REF	Review of Environmental Factors
REP	Regional Environmental Plan
RNE	Register of the National Estate
SEPP	State Environmental Planning Policy
SHI	State Heritage Inventory
SHR	State Heritage Register

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EXECUTIVE SUMMARY

This Aboriginal archaeological report (AAR) has been commissioned as part of an Aboriginal Cultural Heritage Assessment (ACHA) for the proposed Wollongong City Councils (WCC) Whytes Gully New Landfill Cell extension, Kembla Grange NSW (the Study Area). Archaeological investigations for Aboriginal heritage within the Study Area have been undertaken in compliance with the *Code of Practice for the Protection of Aboriginal Objects in New South Wales 2010*.

One Aboriginal site has previously been recorded in the Study Area, 52-2-3867. 52-2-3867 is an isolated quartz artefact recorded by South East Archaeology in 2001, although a site card was not submitted until 2011. The site was recorded in the central southwest of the Study Area. The isolated artefact was recorded in a disturbed context and the current survey confirmed that in the area it was located a settling pond has subsequently been built (see Figure 12). The artefact was unable to be relocated and the site is considered to be destroyed.

A field survey of the Study Area has identified five Potential Archaeological Deposits (PADs). Of these, PAD 1, PAD 2, PAD 3 and PAD 4 have the potential to be impacted by the proposed development. PAD 5 is part of a heritage area and will not be impacted by the proposed development. Sub surface investigations were undertaken to determine the extent, nature and significance of any potential Aboriginal cultural material in PADs that had the potential to be impacted. Sub surface investigations identified three Aboriginal archaeological sites:

- Whytes Gully 1 – an isolated artefact
- Whytes Gully 2 – a low density artefact scatter; and,
- Whytes Gully 3 – shell material that has been imported into the Study Area as part of a fill deposit.

Strategies have been developed based on the archaeological significance of cultural heritage relevant to the Study Area and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
    - Ethos of the Australia ICOMOS Burra Charter
    - The DECCW 2010 *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Continued consultation with the registered Aboriginal parties*

It is recommended that Wollongong City Council continue to inform the registered Aboriginal parties about the management of Aboriginal cultural heritage sites within the

Study Area throughout the life of the project, including pre-excavation and pre-construction on-site meetings. This recommendation is in keeping with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW).

Recommendation 2: *Cultural Awareness Training*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about Aboriginal cultural heritage within the study area and information for the visual identification of Aboriginal cultural material, particularly stone artefacts.

1.0 INTRODUCTION

This Aboriginal Archaeology Report (AAR) has been commissioned as part of an ACHA for the proposed WCC Whytes Gully New Landfill Cell (the Project), at Kembla Grange NSW (the Study Area). Archaeological investigations for Aboriginal heritage within the Study Area have been undertaken in compliance with the *Code of Practice for the Protection of Aboriginal Objects in New South Wales 2010* and the results of these investigations are detailed in this report.

1.1 Project Background

WCC are proposing to develop a new landfill cell within the Whytes Gully Resource Recovery Park (WGRRP), which will include the staged construction and operation of a new landfill cell. An ACHA for the proposed development area is being undertaken as part of the environmental assessment for the Project in accordance with the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). The ACHA will also inform the design and planning stages of the proposed development. In preparing the ACHA, archaeological investigations for Aboriginal cultural heritage have been conducted in line with the requirements of the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales 2010*. The objectives of the investigation process are to:

- Conduct heritage register searches to identify previously recorded cultural heritage sites in or within the vicinity of the proposed Study Area. Searches will include the Aboriginal Heritage Information Management System (AHIMS), the National Heritage List, Commonwealth Heritage List, Register of the National Estate, State Heritage Register, Local Environmental Plan and National Trust heritage lists;

- Conduct additional background research in order to recognise any identifiable regional trends in site distribution and location and provide a site prediction model for the Study Area;

- Undertake a comprehensive survey of the Study Area, relocating any previously recorded sites (on AHIMS);

- Record and assess sites identified during the survey in compliance with the guidelines issued by the NSW Office of Environment and Heritage (OEH);

- Assess the heritage significance of all identified Aboriginal cultural heritage sites and places;

- Identify impacts to all identified Aboriginal cultural heritage sites and places based on potential ground disturbance from the proposed construction of the new landfill cell; and

- Make recommendations to minimise or mitigate potential impacts of the new landfill cell to cultural heritage values within the Study Area.

1.2 Study Area

The proposed development is located at WGRRP, Kembla Grange, Wollongong, NSW (Figure 1 following). The Study Area includes the following lots:

- Lot 501, DP 1079122;
- Lot 502, DP 1079122;
- Lot 2, DP 240557;
- Lot 51, DP 1022266;
- Lot 52, DP 1022266; and,
- Lot 53, DP 1022266.

The site is bounded by Reddalls Road to the south, Dapto Creek to the west and grazing farm land to the north, northeast and also the east (Figure 2). The Study Area is located within the current boundary of the WGRRP.

1.3 Planning Approvals

The proposed development will be assessed under the transitional arrangements applying to the former Part 3A of the EP&A Act. Other potentially relevant legislation, planning instruments and guidelines that will inform the ACHA include:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987* (ATSIHPA Act);
- *ICOMOS Australia Burra Charter 1999* (the Burra Charter);
- *National Parks & Wildlife Act 1974* (NPW Act) (as amended 2010); and,
- *West Dapto Local Environment Plan 2010* (LEP 2010).

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Figure 1: Location of the Study Area in a regional context

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Figure 2: Study Area.

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Scale: 1:3,600 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 2

1.4 Investigators and Contributors

Asher Ford	**BA (Hons)**	**4 years experience**
Asher is a Consultant Archaeologist with the Wollongong office of Biosis Research. Asher has over three years experience as a consultant archaeologist, with application to cultural heritage management for various projects throughout Victoria, New South Wales and South Australia. Asher has acquired extensive experience over the past three years as both a project archaeologist and project manager. His skills include Aboriginal and non-Aboriginal archaeological assessments, Aboriginal and historical site recording, survey, sub surface testing and excavation, project research, geographic information systems (GIS), graphics and report writing. Asher has technical experience in recording artefact scatters, scarred trees, middens, axe grinding grooves, rock shelters, art sites and stone features across a range of Australian environments including the Victorian Western Volcanic Plains, Gippsland, the Victorian High Country, the Murray River, the Cumberland Plains, the Illawarra region, the Hunter Valley, the NSW Southern Tablelands and the Woomera Prohibited Area. Asher has authored and / or co-authored over 30 consultant reports.		Project Roles • Lead cultural heritage advisor; • Aboriginal community consultation; • Archaeological survey leader; • Development of recommendations; and • Preparation of the report.
Melanie Thomson	**BA (Hons)**	**10 years experience**
Melanie Thomson has over seven years experience as an archaeologist with application to cultural heritage management for various projects throughout Queensland, New South Wales and Victoria. Melanie has acquired extensive experience working as a consulting archaeologist for Biosis Research over the past eight years as both a project archaeologist and project manager. During this time, she has developed skills in both Aboriginal and historical archaeological research, survey, excavation, monitoring, and reporting. She also has technical skills to undertake the analysis of Aboriginal stone tools and historical artefacts. Melanie specialises in assessing the Social Value of Cultural Landscapes in association with Aboriginal and Historical sites. Melanie's broad knowledge and understanding of the needs of key stakeholder groups, including Aboriginal communities, clients and government agencies, gives her the ability to successfully complete successfully completes projects with satisfactory outcomes for all parties, on time and on budget. Melanie has authored and / or co-authored over 60 consultant reports, with significant involvement in the Crookwell Windfarm Development, VicUrban Officer Project, the VicRoads Urban Projects report and the West Cliff and Dendrobium BHP Billiton Environmental Assessments.		Project Roles • Technical Review
Ashleigh Pritchard	**Dip GIS**	**3 years experience**
Ashleigh is the GIS Officer with the Wollongong office of Biosis Research Pty Ltd. Ashleigh is experienced with aerial photography interpretation, geo-rectification and digitising of various image files, including scanned maps and historic survey plans. She has utilised a variety of software packages for a variety of needs, from spatial analysis, drafting and the creation of digital and hardcopy map products. Furthermore she is experienced with utilising various forms of data from a variety of sources such as AutoCAD or MS Excel spread sheets.		Project Roles • Mapping production

Lyn O'Brien	BA (Hons)	12 Years Experience
Lyn is a Senior Archaeologist with the Canberra office of Biosis Research. Lyn has worked as a consultant in archaeology for over 12 years and has been involved in numerous projects in the Hunter Valley, South NSW Coast, Perisher, Goulburn region, Wollongong, Namadgi National Park and the ACT regions. Lyn has developed strong project management skills and conducted numerous Aboriginal and historical field surveys, community consultations, excavations, impact assessments, significance assessments and management plans. Lyn has detailed knowledge of the NSW heritage statutory framework, heritage codes of practice and best practice approaches to managing heritage values. Lyn has authored and / or co-authored over numerous consultant reports, with significant involvement in the Paddys River Aboriginal Cultural Heritage Assessment, Birkenburn Sand Quarry Extension Aboriginal Cultural Heritage Assessment and HMAS Harman Data Cable Installation Aboriginal and Historical Cultural Heritage Impact Assessment.		Project Roles • Technical Review
Sam Higgs	**BA (Hons)**	**9 Years Experience**
Samantha recently joined Biosis Research Pty. Ltd. as a Senior Archaeologist, bringing with her more than seven years of experience. She is a skilled project manager, and is especially proficient in Aboriginal archaeological survey, excavation, assessment, monitoring, and reporting. She is experienced in community consultation and has developed skills in Aboriginal archaeological research. Samantha is currently undertaking a PhD at ANU in Rock art and Contemporary art in the Western Desert. As a part of her PhD fieldwork Sam has worked with Indigenous artists in the Martu Native Title Determined Area of Western Australia recording rock art in remote areas and interviewing artists about their current art practise. This has developed her skills in ethnographic recording using film and digital recording technologies. Since joining Biosis Research, Samantha has been involved in numerous field and desk-based projects related to Aboriginal cultural heritage. She has outstanding communication skills, regularly consulting with clients and Aboriginal community groups and also writing reports.		Project Roles • Technical Review
Paul Howard	**BEnvSc (Hons) BA**	**2 years experience**
Paul is a Field Archaeologist with the Wollongong office of Biosis Research. Paul has over two years archaeological field experience in Australia and Cambodia, which includes excavations of both historical and Aboriginal sites; Aboriginal field surveys involving site recordings of rock shelters, grinding grooves artefacts and middens; and historical and Aboriginal artefact cataloguing and analysis.		Project Roles • Aboriginal community consultation; • Archaeological survey; and • Preparation of the report

1.5 Development Proposal

WCC are proposing to develop a new landfill cell within the WGRRP (Figure 2). The development will include the staged construction and operation of a new landfill cell and will involve the following activities that could potentially harm Aboriginal heritage:

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- bulk earthworks, which will involve the removal of topsoil and subsoil.

2.0 DESKTOP ASSESSMENT

The desktop assessment includes a background review of previous archaeological work, the landscape context of the Study Area, the ethnohistory of the local area, regional trends of Aboriginal site locations and a site prediction model.

2.1 Landscape Context

It is important to consider the local environment of the Study Area in any heritage assessment. Firstly the environment can influence human occupation and associated land use and consequently the distribution and character of cultural material. Secondly environmental processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly environmental features can contribute to the significance that places can have for people.

2.1.1 Topography and Drainage

The Study Area is dominated by two ridgelines, one ascending west to east along the northern boundary and the second descending south along the eastern boundary before swinging west into the lower southeast of the Study Area (Figure 2). These two ridgelines slope south and west into natural gullies that flatten out onto the alluvial floodplain surrounding Dapto Creek. Prior to the development of the landfill, water drained off the two ridgelines, down gullies and into a creek line running southwest across the floodplain into Dapto Creek (Plate 1). This creek line and the majority of natural drainage lines have been either removed or altered by subsequent landfill developments (Figure 2).

Plate 1: 1970 Aerial Photograph of the Study Area prior to development

2.1.2 Geology and Soils

The underlying geology of the Study Area comprises undifferentiated grey siltstone, sandstone, shale, carbonaceous claystone, laminate and quartz lithic sandstone (Table 1). This is overlain by Illawarra Coal Measures deposits of resistant inter-bedded quartz-lithic sandstone, grey siltstone, clay laminite and carbonaceous claystone and Quaternary alluvial deposits in low lying sections of the Study Area (Bannerman and Hazelton, 1990).

Table 1: Geological units within the Study Area. (Bannerman and Hazelton 1990).

Geological Unit	Geological Description	Age and Depositional Sequence	Location
Qal	Alluvium, gravel, swamp deposits and sand dunes	Quaternary Alluvial Deposits	Alluvial deposits are located on the floodplain and low lying areas of the Study Area.
Pi	Shale, sandstone, conglomerate, tuft, chert, coal and turbanite seams.	Permian. Illawarra Coal Measures	
Psb	Undifferentiated siltstone, shale, swamp deposits and sand dunes	Permian. Berry Formation	Deposited throughout the entire Study Area.

The Study Area is associated with two soil landscapes, Gwynneville and Fairy Meadow (Hazelton and Tille 1990). The residual Gwynneville soil landscape is associated with the ridgelines and slopes of the Study Area and is a product of the erosional breakdown of the Illawarra Coal Measures through sheet wash and exposure. As a result the Gwynneville soil landscape is characterised by shallow sandy loams and clays directly over bedrock (Hazelton and Tille 1990: 38). The Fairy Meadow soil landscape is associated with the alluvial floodplains of the Study Area and consists of alluvial soils overlying Quaternary deposits (Hazelton and Tille 1990: 100). The dominant soil materials of the Gwynneville and Fairy Meadow soil landscapes are outlined in Table 2 below.

Table 2: Gwynneville Soil Landscape Characteristics (Hazelton and Tille 1990: 38).

Soil Material	Description
Gwynneville 1 (gw1)	Friable brown sandy loam, gw1 is typically the topsoil associated with higher exposed areas such as upper and mid slopes. Generally gw1 is between 10 and 30cm thick on the upper and mid slopes of the ridgelines and between 20 to 50 cm thick on the lower slopes and isolated sections of the mid slopes. On the ridgeline and ridgeline crests, gw1 directly overlies bedrock.
Gwynneville 2 (gw2)	Friable sandy clay loam, gw2 is typically the topsoil located on lower slopes. Soils are generally between 20 to 50cm thick and overlie a shallow layer of gw3 or bedrock.
Gwynneville 3 (gw3)	Brown pedal clay, gw3 lies below either gw1 or gw2. gw3 is generally deeper on the upper and mid slopes, forming a soil layer of up to 100cm in depth. On the lowers slopes, gw3 is much shallower being <60cm deep.

Soil Material	Description
Fairy Meadow 1 (fw1)	Brownish black loose sandy loam, fw1 is associated with upper floodplains and typically forms a topsoil of up to 20cm thick.
Fairy Meadow 2 (fw2)	Brown sand, fw 2 either underlies fw1 on upper floodplains for forms the topsoil on lower floodplains. Depths vary, but fw2 is generally up to 40cm thick.
Fairy Meadow 3 (fw3)	Yellowish brown clay, underlies fw2 for a depth of up to 50cm.
Fairy Meadow 4 (fw4)	Olive brown clays, underlies fw3 for a depth of up to 80cm and sits above Quaternary sediments.

2.1.3 Flora

The Coastal Plains of the Illawarra region are characterised by mixed warm temperate and subtropical rainforest complexes on rich shale soils and alluvium under the escarpment, interspersed with patches of sclerophyll forest and woodland and estuarine and swamp communities. Open forest, Acacia scrub vegetation community, subtropical rainforest, eucalypt forest, would have once covered the Study Area prior to European land use (Comber 2009). Many species within these vegetation communities would have been utilised by the Aboriginal groups inhabiting the region.

2.1.4 Fauna

The vegetation communities supported a range of faunal resources that would have been utilised by Aboriginal peoples. Terrestrial and avian resources were not only used for food, but also provided (and often continue to provide) a significant contribution to the social and ceremonial aspects of Aboriginal life. Several species of animal were utilised including molluscs, fish, birds and terrestrial animals (Chafer 1997). While possums are the most common native fauna remaining in the Study Area, the area is now dominated by feral fauna.

2.1.5 Land Use History

The region surrounding the Study Area was initially colonised around 1815, with initial activity focused on timber clearing and mixed farming. Cedar cutters were the first to open up the Illawarra area as early as 1805. When they had exhausted the easily accessible timber by 1820, cattle grazing took over and the Coastal Plain was extensively cleared for pastoral estates and farms. Many early houses were built of rough slab or timber construction (Kass 2010: 66). The use of cattle for the production of beef and milk increased after 1887, when wheat was no longer considered a viable option for the region. Producers supplied various local butter and cheese factories located close by to the transport link provided by the railway. Dairying and beef production remain important local industries in the Dapto area today.

The Study Area is most likely to have been used for various farming practices up to 1983 with aerial photographs from 1951 to the 1970s showing large scale vegetation clearance and the ongoing development of farming infrastructure, as seen in Plates 1 and 2. Remnant vegetation only appears to occur in the upper northeast and central southeast sections of the Study Area, with the majority of other vegetation currently in the Study Area being regrowth (see Plates 1 and 2, also Figure 2). Agricultural modifications to the landscape include the development of dams along natural drainage lines and buildings in the centre and central west of the Study Area (see Plates 1 and 2).

The major land use history development within the Study Area has been the ongoing development and expansion of the WGRRP. First developed in 1983, the area was initially 25 hectares (Koetigg 1982: 10) and included the development of roads and the initial landfill cell, clearly visible in Plate 3. Subsequent development has seen the addition of another landfill cell and ponds as part of a leachate collection system in the central and southwest sections of the Study Area (Plates 4 and 5 and Figure 3). Previous construction activities have involved significant earthworks that have completely removed surface soils, resulting in significant ground disturbance across the area. However undisturbed areas do remain predominately on the periphery of the current landfill areas, and indicated in Figure 3.

Plate 2 1951 Aerial Photograph of the Study Area

Plate 3 1984 Aerial Photograph of the Study Area

Plate 4: 1994 Aerial Photograph of the Study Area

Plate 5: 2005 Aerial Photograph of the Study Area

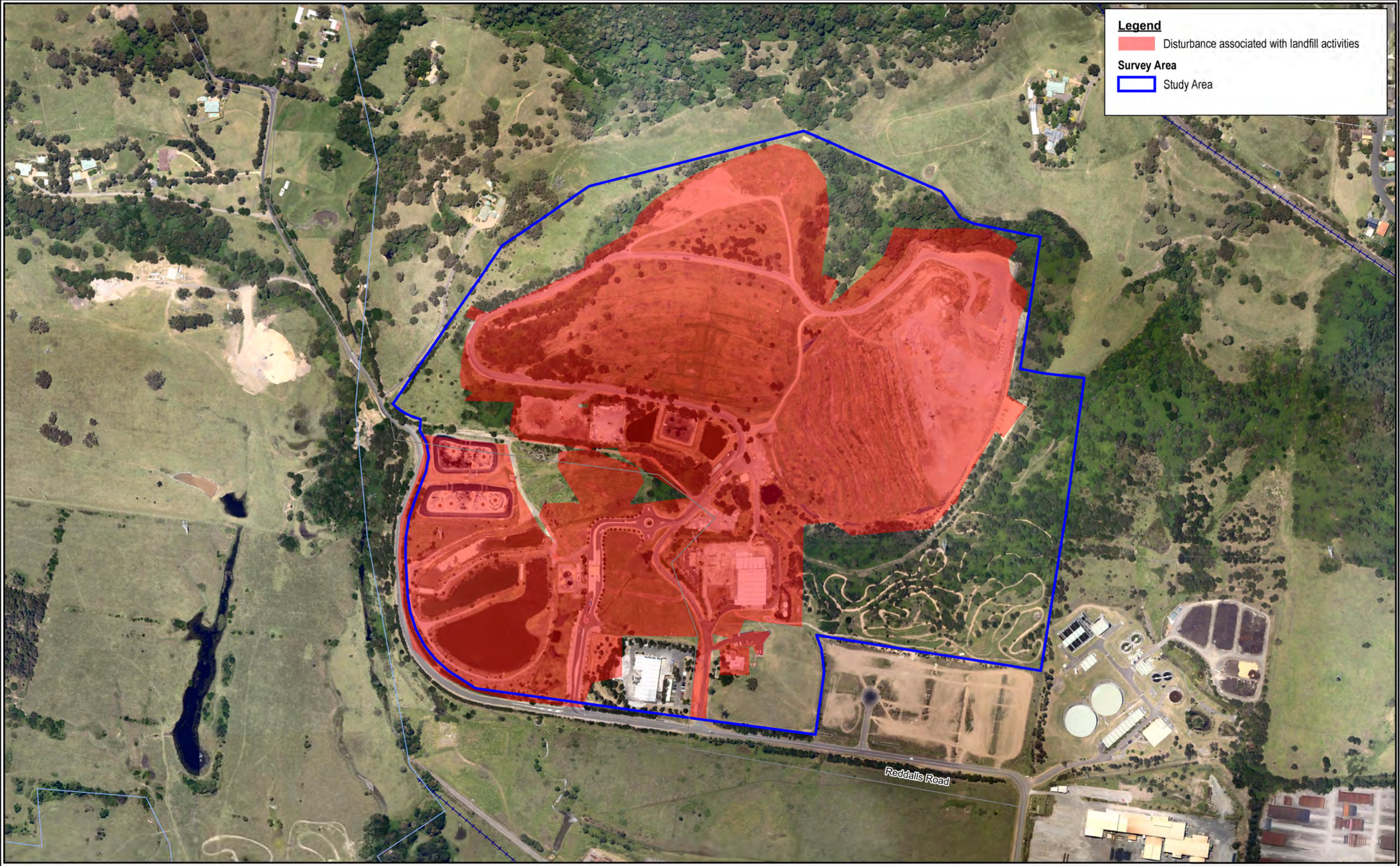

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Figure 3: History of Disturbance within the Study Area.

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Scale: 1:5,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 3

2.2 Ethnohistory Context

Despite a proliferation of known Indigenous sites there is considerable ongoing debate about the nature, territory and range of pre-contact Indigenous language groups in the greater Sydney region. These debates have arisen largely due to the lack of ethnographic and linguistic information recorded at the time of European contact. By the time colonial diarists, missionaries and proto-anthropologists began making detailed records of Indigenous people in the late 19th Century, pre-European Indigenous groups had been broken up and reconfigured by European colonisation activity. The following information relating to Indigenous people on the Illawarra is based on such early detailed records.

Despite conflicting views between historical sources of the exact boundaries of tribal groups in the region, the linguistic evidence does identify distinct language groups at the time of European contact. Based on this information it appears that the Study Area was situated within the Tharawal (also Dharawal, Darawal, Carawal, Turawal, Thurawal) linguistic group. The named groups (often referred to as 'clans', 'bands' or 'tribes') belonging to the Tharawal/Dharawal language group included the following: Gweagal, Norongerraga, Illawarra, Threawal, Tagary, Wandeandega, Wodi Wodi and Ory-ang-ora (Tindale 1974).

Ethnographic evidence considered by Sefton (1988: 22-29) indicates population mobility on the Woronora Plateau with frequent contact between the neighbouring Gandangarra, Cobrakall (Liverpool and Cabramatta) and Wodi Wodi (Illawarra).

The areas inhabited by each of the groups are considered to be indicative only and would have changed through time and possibly also depending on circumstances (i.e. availability and distribution of resources). Interactions between different types of social groupings would have varied with seasons and resource availability. It has been noted that interactions between the groups inhabiting the many resource zones of the Sydney Basin (coastal and inland) would have varied but were continuous. This is reflected in the relatively homogenous observable cultural features such as art motifs, technology and resource use (McDonald 1992).

2.3 Archaeological Context

A large number of cultural heritage surface (surveys) and sub-surface (excavations) investigations have been conducted throughout the Wollongong region. Two localised studies undertaken that consider the current Study Area, through archaeological survey and desktop assessments, are discussed in Section 2.3.3. An overview of the regional and local archaeological context is also discussed below.

2.3.1 AHIMS Search Results

An AHIMS search was conducted using a 3 x 3 km search area centred on the Study Area. The search identified 16 Aboriginal sites within the search area, predominately Isolated Finds (56.25%, n=9) and Open Camp Sites (43.75%, n=7) (Figure 4). Of these sites, only one was located in the Study Area, isolated artefact RR2 52-2-3867. As shown in Table 3 below, sites were located across a range of landforms, but all are in relatively close proximity to water.

The variability in descriptions provided in AHIMS site cards can often reduce the detail of information within various analysis categories. Each analysis only includes sites for which information had been recorded that was applicable to one or more categories used in the particular analysis. The AHIMS database only includes Aboriginal sites registered with AHIMS and is not a complete list of Aboriginal sites within any given area.

Table 3: AHIMS search results (Sites located within the Study Area are shaded orange)

Site Number	Site Name	Site Type	Landform	Distance to Water
52-2-3281	WDRA_AX_17	Open Camp Site	Spur Crest	25-65m
52-2-3279	WDRA_AX_14	Open camp site	Lower Hillslope	20m
52-2-3814	Smiths Lane AFT-1	Isolated Find	Ridge	100m
52-2-3295	WDRA_AX_11	Artefact Scatter	Alluvial flat	100m
52-2-3592	Farmborough Road IF-1	Isolated Find	Spur	5m
52-2-3815	Riverpark Way AFT-1	Isolated Find	Ridge	100m
52-2-3282	WDRA_AX_19	Open Camp Site	Alluvial Flat	N/A
52-2-3272	WDRA_AX_41	Isolated Find	Middle Hillslope	>100m
52-2-3286	WDRA_AS_04	Open Camp Site	Alluvial Flat	80m
52-2-3294	WDRA_AX_10	Isolated Find	Alluvial flat	30m
52-2-3278	WDRA_AX_13	Open Camp Site	Alluvial Flat	10m
52-2-3292	WDRA_AX_07	Open Camp Site	Alluvial Flat	10m
52-2-3298	WDRA_AX_12	Isolated Find	Spur	60m
52-2-3290	WDRA_AX_08	Artefact Scatter	Alluvial Flat	20m
52-2-3271	WDRA_AX_40	Isolated Find	Spur Crest	>100m
52-2-3867	RR2	Isolated Find	Alluvial Flat	20m

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Figure 4: AHIMS Search.

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kilometres

Scale: 1:20,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

Figure 4

2.3.2 Regional overview

Numerous archaeological investigations have been conducted on the south coast of New South Wales in the past 30 years. Studies were initially concentrated on coastal and estuarine zones; however, with demand for an increased understanding of the forest hinterland zones, the focus of investigations has widened. The majority of south coast sites date to the last 6,000 years when the sea-level stabilised following the last ice age. Prior to this, sea-levels were lower and the coast-line was located approximately 14 km to the east of its current position. Coastal sites older than 6,000 years are rare, as most would have been inundated by the rising sea. Pleistocene-aged Indigenous sites on the south coast include Bass Point, dated at 17,010+/-650 BP (ANU-536) (Bowdler 1976:254) and Burrill Lake rock shelter, dated at 20,830+/-810 BP (ANU-138) (Lampert 1971:122). Test excavations undertaken at the Wollingurry Point midden dated the site to 3360 +/- 90 years BP (Navin 1987b:104).

Several studies of site patterns and distribution have been completed for the Illawarra and South Coast. Lampert (1971:114-130) identified three basic groups of site types:

- Specialised foreshore sites focused on exploitation of coastal resources, such as fish, shellfish and marine birds (e.g. Durras North, Wollumboola and Wattamolla). Specialised fishing equipment, including spears tipped with bone points and shell fish hooks, were used at such sites;

- Specialised estuarine sites focussed on the exploitation of inland resources (e.g. Shoalhaven Creek and Bomaderry Creek). These sites contain evidence of estuarine fish and shellfish exploitation; and,

- Combination sites located beside creeks or estuaries near the sea shore where a mix of inland and coastal resources were exploited (e.g. Burrill Lake, Currarong and Curracurrang).

More recent research has highlighted the diversity of landscapes that were utilised by Indigenous people, including the forest hinterland (Byrne 1983; Dallas & Sullivan 1995; Sefton 1980), coastal plains, foreshores, foothills and escarpments surrounding Lake Illawarra. Sites found within these landscapes include artefact scatters, isolated finds, middens, rock shelters with art and/or deposits, scarred trees, grinding grooves and burial sites.

Several regional patterns have been identified in the Indigenous cultural heritage record in the Illawarra region. In 2000 Navin Officer Heritage Conservation Pty Ltd (Navin Officer) prepared the Shellharbour City Council Indigenous Heritage Concept incorporating land south of the current Study Area. Based on examination of background variables, Navin Officer (2000:51-52) generated a predictive model for site locations. Predictive modelling pertinent to open artefact scatters and landform utilisations are included below.

- Sites are likely to occur at varying densities in all broad topographic zones. However, a range of micro-topographic variables can effectively predict topographies that are archaeologically sensitive. These include relatively level ground without significant surface rock, proximity to a freshwater source and locally elevated and well-drained ground;

- Sites tend to be situated at or close to ecotones – the areas where different environments meet;
- Artefact occurrences, detected as isolated finds or surface scatters of artefacts and/or subsurface archaeological deposits, are likely to be the most common site type within the region;
- Artefact scatters (also termed open camp sites), are most likely to occur on level, well-drained ground, either adjacent to sources of freshwater and wetlands, or along the crests of spurs and ridgelines;
- Ridge and spurlines, which afford effective through-access relative to the surrounding landscape, will tend to contain more frequent and larger sites;
- The crests of low relief spurs that extend into and across valley floor flats are likely to be a focus for occupation due to their well drained and elevated context in close proximity to a range of exploitable environments; and,
- Isolated finds can occur anywhere in the landscape and may represent the random loss, deliberate discard of artefacts, or the remains of dispersed artefact scatters.

2.3.3 Local Overview

Ten Aboriginal cultural heritage investigations have been conducted within three kilometres of the Study Area. These investigations, briefly summarised below, include the following: Dallas and Sullivan (1995), Sefton (1990), Silcox (1993), Saunders (1993), South East Archaeology (1997, 2001), Comber (2009) AMBS (2006), AHMS (2010) and Biosis Research (2011).

Koettig (1982) undertook an archaeological survey for the central sections of the current Study Area, encompassing the first stage of the Whytes Gully Landfill. The survey did not identify any new Aboriginal archaeological sites for the proposed development. No comment was made on potential for Aboriginal cultural heritage to be present in the Study Area.

Sefton (1990) conducted an archaeological survey for the West Dapto Stage One Release Area for Kevin Mills and Associates Pty Ltd. The project area was approximately 2km southwest from the current Study Area. The survey identified three new sites, an artefact scatter was found near Mullet Creek (52-2-1544) and two scar trees (52-2-1542, 52-2-1543). All of these sites were retained.

Sefton (1992) undertook an archaeological survey of the central east sections of the Study Area covered by development of the eastern gully of the Whytes Gully Landfill. No Aboriginal archaeological sites were identified during the survey.

Saunders (1993) undertook an archaeological investigation for a proposed subdivision located at West Dapto, 3km southwest of the Study Area. The assessment included an archaeological survey and sub surface investigations. One new Aboriginal site was identified during sub surface investigations, an artefact scatter of five artefacts located on the southern side of Bong Bong Road. These were later deposited at the Australian Museum for safe keeping at the discretion of the Illawarra Local Aboriginal Land Council.

Silcox (1993) also undertook a cultural heritage assessment for a proposed sub-division in West Dapto, 3km southwest of the Study Area. The survey did not identify any potential for Aboriginal heritage within the proposed sub-division area.

Gay, English and Officer (1994) completed an Aboriginal and Historical archaeological and cultural heritage assessment for a water quality project approximately 500m east of the Study Area. An archaeological survey did not identify any new Aboriginal sites or areas of potential for Aboriginal cultural material.

South East Archaeology (2001) undertook an archaeological survey for the deviation of Reddalls Road, located adjacent to the southern boundary of the Study Area. One isolated artefact (52-2-3867) was identified close to the Waste Disposal Centre. It was also determined, however, that the area in which the artefact had been located had been disturbed quite extensively in the past.

AMBS (2006) completed an extensive cultural heritage management plan of the West Dapto area, situated to the southwest of the Study Area. The scope of the investigation included locating previously recorded Aboriginal sites and recording new sites for the proposed West Dapto Urban Release Area (WDURA). The investigations included an archaeological survey and sub-surface investigations. Aboriginal sites identified during the assessment that are within close proximity to the current Study Area include:

- 52-2-3279: which was a large scatter of 146 artefacts near Sheaffes Road on a lower hillslope overlooking a creekline;
- 52-2-3295: three artefacts at the northern corner of Sheaffes Road on a alluvial flat;
- 52-2-3282: three artefacts found at West Dapto Road on an alluvial flat;
- 52-2-3272: an isolated find in a paddock near West Dapto Road on a mid hillslope;
- 52-2-3286: six artefacts at the property on the northern side of Avondale Road off the Princes Highway, on an alluvial flat near Mullet Creek;
- 52-2-3292: 24 artefacts were recovered located along Darkes Road, Princes Highway on an alluvial flat in close proximity to a creekline;
- 52-2-3298: one isolated find found at the end of Sheaffes Road on a spur towards the base of the escarpment;
- 52-2-3290: 13 artefacts were recovered from the excavation on the property along Darkes Road, off Princes Highway on an alluvial flat; and
- 52-2-3271: an isolated artefact was found on a spur crest.

The investigations concluded that all of the WDURA was considered to contain areas of potential archaeological deposits, and it was therefore recommended there should be further investigation and management of areas with high cultural and archaeological potential.

Navin (2007) undertook an archaeological assessment of a proposed residential development at Farmborough Road, Farmborough Heights, east of the Study Area. One Aboriginal isolated artefact occurrence was identified approximately 400 metres from the current Study Area, at the base of a Melaleuca tree (FRIF1: 52-2-3592).

Comber (2009) undertook an Aboriginal Cultural Heritage Assessment 2.5km away from the Study Area, for the proposed West Dapto Work Site near Dapto High School. No new Aboriginal archaeological sites were uncovered in the assessment, however the proposed development area was considered to have potential for archaeological deposits.

AHMS (2010) undertook an Aboriginal and non-indigenous assessment of a Stockland subdivision off Bong Bong Road, West Dapto approximately 3kms southwest of the Study Area. Three sites were found including an artefact scatter of 10 flaked stone artefacts (52-2-3779), one Potential Archaeological Deposit (PAD) (52-2-3778) and an artefact scatter of 3 flaked stone artefacts (52-2-3277). All three sites were considered to have potential for archaeological deposits.

Biosis Research (2011) conducted an Aboriginal Heritage Assessment and Impact Management Study for a Sydney Water project approximately 3km southwest of the Study Area. Two new Aboriginal Sites were found, one at Riverpark Way (52-2-3815) and also Smiths Lane (52-2-3814).

2.3.4 Archaeological Summary

In conclusion, the local and regional archaeological studies indicate that most likely aboriginal site type to be present are flaked stone artefact scatters, which have been recorded on all landform types in the local region. However extensive disturbance from earthworks has removed large portions of natural soils in the Study Area and will have removed the potential for the flaked stone artefact scatters in these areas. There is potential for scarred trees in the local region however the majority of the Study Area has been previously cleared apart from two sections of remnant vegetation. If scarred trees have previously been surveyed they will be located in areas of remnant vegetation.

2.4 Archaeological Site Type Definitions and Predictive Model

A model was formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the Study Area and where they are more likely to be located.

This model is based on:

- Site distribution in relation to landscape descriptions within the Study Area;
- Consideration of site type, raw material types and site densities likely to be present within the Study Area;
- Findings of the ethnohistorical research on the potential for material traces to present within the Study Area;
- Potential Aboriginal use of natural resources present or once present within the Study Area; and

- Consideration of the temporal and spatial relationships of sites within the Study Area and surrounding region.

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the sub-surface investigations across the present Study Area (see Table 4 below and Figure 5 following). The definition of each site type is described first, followed by the predicted likelihood of this site type occurring within the Study Area.

Table 4: Aboriginal Site Prediction Model

Site Type	Site Description	Potential
Flaked Stone Artefact Scatters and Isolated Artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density ‘background’ scatters and isolated finds.	**Low to high:** Stone artefact sites have been previously recorded in the region across a wide range of landforms including alluvial flats, slopes, ridgelines and crests and they have the potential to be present in undisturbed landforms.
Shell Middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	**Very Low:** Shell midden sites have not been recorded within the Study Area and are not likely to be present in the current landforms. There is a very low potential of Shell Middens being present in the Study Area.
Quarries	Raw stone material procurement sites.	**Very Low:** There is no record of any quarries being within or surrounding the Study Area. The geology of the Study Area has had reports of background quartz which had not been knapped (South East Archaeology, 2001: 52-2-3867).
Potential Archaeological Deposits (PADs)	Sub surface deposits of cultural material.	**Low to High:** PADs have been previously recorded in the region across a wide range of landforms including alluvial flats, slopes, ridgelines and crests and they have the potential to be present in undisturbed landforms.
Scarred Trees	Trees with cultural modifications	**Low:** A small number of mature native trees have survived within the Study Area. Historical aerial photography from 1951 indicates that the area was almost completely cleared and any remaining scar trees will be present in remnant stands of native vegetation in the upper northeast and central southeast sections of the Study Area .

Site Type	Site Description	Potential
Axe Grinding Grooves	Grooves created in stone platforms through ground stone tool manufacture.	**Very Low:** The geology of the Study Area lacks suitable horizontal sandstone rock outcrops for axe-grinding grooves. Therefore there is low potential for axe grinding grooves to occur.
Burials	Aboriginal burial sites.	**Very Low:** Aboriginal burial sites are generally situated within deep, soft sediments, caves or hollow trees. Areas of deep sandy deposits will have the potential for Aboriginal burials. The soil profiles associated with the Study Area are not commonly associated with burials.
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	**Very Low:** The sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist, which are not present in the Study Area.
Aboriginal Ceremony and Dreaming Sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	**Low:** There are currently no recorded mythological stories for the Study Area.
Post-Contact Sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	**Low:** There is one historical site located in the Study Area, but it does not contain Aboriginal artefacts.

Site Type	Site Description	Potential
Aboriginal Places	Aboriginal places may not contain any “archaeological” indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	**Low:** There are currently no recorded Aboriginal historical associations for the Study Area.

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Figure 5: Areas of Potential for Aboriginal Cultural Heritage within the Study Area.

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Figure 5

3.0 FIELD SURVEY

A field survey of the Study Area was undertaken on the 26 August 2011. Field Survey methodology, results and discussion are provided below.

3.1 Methodology

3.1.1 Aims of the Survey

The principle aims of the survey are to:

- Provide Registered Aboriginal Parties (RAPs) an opportunity to view the Study Area and to discuss previously identified Aboriginal object(s) and/or Place(s) in or within close proximity to the Study Area;
- To attempt to relocate RR2 (52-2-3867) or to determine if it has been destroyed;
- To undertake a systematic survey of the Study Area targeting areas with the potential for Aboriginal heritage;
- Identify and record Aboriginal archaeological sites visible on the ground surface; and,
- Identify and record areas of potential archaeological deposits (PADs).

3.1.2 Survey Methodology

The survey methods were intended to assess and understand the landforms and to determine whether any archaeological material from Aboriginal occupation or landuse exists within the Study Area.

Sampling Strategy

The survey effort targeted those portions of the Study Area that are undisturbed by the WGRRP, identified during the Desktop phase of the assessment (Figure 5 previously). All landforms within these undisturbed areas were sampled, unless preliminary survey transects provided clear and obvious evidence that the landform had been substantially altered by earthworks. Due to dense vegetation and limited ground surface visibility, a full coverage survey was not undertaken.

Recording Techniques

Recording during the survey followed the guidelines of the OEH, in particular the *Code of Practise for Archaeological Investigation of Aboriginal objects in New South Wales* (DECCW 2010). Information that was recorded during the survey included:

- Aboriginal objects or sites present in the study area during the survey;
- Survey coverage;
- Any resources that may have potentially have been exploited by Aboriginal people;

- Landforms;
- Photographs of the site indicating landforms;
- Evidence of disturbance; and,
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the Study Area was undertaken. Photographs and recording techniques incorporated into the survey included representative photographs of survey units, landforms, vegetation coverage, ground surface visibility and the recording of soil information for each survey unit where possible. Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal cultural heritage and points marking the boundary of the landform elements were recorded using a hand-held Global Positioning System (GPS) and the Map Grid of Australia (94) (MGA) coordinate system.

3.2 Survey Results

A total of 16 transects were walked across two landform units in the Study Area (Figure 6). The field survey identified five areas of PAD but was unable to relocate 52-2-3867 (Figure 7). The results from the field surveys have been summarized in Table 5 below, with full details for each survey transect provided in Appendix 1.

Generally the survey was hampered by poor ground surface visibility and narrow survey transects in some areas due to slope and dense vegetation. While these limitations reduced the overall effective survey coverage, each landform was able to be effectively sampled in order to determine areas of PAD.

Table 5: Survey Effort Summary by Landform Units

Landform Unit - Ridges	
Landform Area (m²)	531365 m²
Approximate area (m²) assessed	13,422 m²
Landform Elements	Hillcrest, upper slope, mid slope, lower slope, foot slope, cliff-foot slope, cliff.
Notable disturbances	Vegetation clearance across large areas of the landform, native animal tracks, vehicle tracks, earthworks associated with motorcross track and dumping of rubbish.
Disturbance level	Low to High
Visibility	Approximately <20% (low) overall due to dense ground cover – higher in areas of native vegetation
Notable exposures	Animal tracks and motorbike tracks
Area of exposure	Approximately <20% overall
Effective survey coverage	0.5%
Aboriginal sites	None
Potential Archaeological Deposits	PAD 1, PAD 2, PAD 3, PAD 4 & PAD 5
Archaeological Sensitivity	High – hillcrests and gently sloped sections of lower slopes/foot slopes. Low – All other areas of the landform due to steep slopes.
Photos	

Plate 6: Hillcrest in northwest of Study Area.

Plate 7: Upper ridge slopes in northwest of Study Area.

Plate 8: Cliff-foot slopes in north of Study Area

Plate 9: Motorcross track cutting through lower slopes in southeast section of the Study Area.

Landform Unit – Flood Plain	
Landform Area (m²)	125081 m²
Approximate area (m²) assessed	1,820 m²
Landform Elements	Plain
Notable disturbances	Vehicle tracks, earthworks associated with Whytes Gully Resource Recovery Park.
Disturbance level	Low to High
Visibility	Approximately <10% (low) overall due to dense ground cover
Notable exposures	Vehicle tracks.
Area of exposure	Approximately <10% overall
Effective survey coverage	0.02%
Aboriginal sites	None
Potential Archaeological Deposits	None
Archaeological Sensitivity	Low

Photo(s)

Plate 10: Looking north at RR2 52-2-3867

Plate 11: Bitumen road in central section of the Study Area.

Plate 12: Heavily modified floodplain in southwest of Study Area.

Plate 13: Flood plain in central section of the Study Area.

3.2.1 Previously Recorded Aboriginal sites

Only one Aboriginal archaeological site has been previously recorded in the Study Area, RR2 (52-2-3867). This site was recorded in 2001 but not registered with AHIMS until 2011. At the time of recording, it is unclear if the leachate ponds in the southwest of the Study Area were fully constructed. Plate 5 shows that by 2005 the leachate ponds had been completed and the GPS coordinates locate the site within one of the leachate ponds. Given the level of construction at the site Plate 10 and 12), which was in progress at the time of recording but had not been completed, it is most likely that the site has since been destroyed.

3.2.2 Potential Archaeological Deposits

Five PADs were identified in the Study Area during the survey. The details for each PAD are discussed below.

PAD 1

PAD 1 covers the gently sloped portions of the ridge crest in the northwest of the Study Area (Figure 7, Plate 6). The PAD extends approximately 210 m southwest to northeast and is 35 m wide covering an area of 5786 m². While mature native trees are present in this area, no evidence of cultural scarring was identified. As discussed in Section 2.4, ridge crests are areas known to have a high potential for Aboriginal cultural material in the local area. The most likely Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.

PAD 2

PAD 2 covers a gentle “bump” on the lower slopes of a ridgeline in the western section of the Study Area. The PAD extends approximately 40 m west to east and is 35 m wide covering an area of 680 m². While the surrounding landform is wet, this area was relatively dry and overlooks West Dapto Creek to the west. The most likely Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.

PAD 3

PAD 3 covers a gently slopped hillcrest on the northern boundary of the Study Area. The PAD extends approximately 60 m north to south and is 55 m wide covering an area of 2770 m². While mature native trees are present in this area, no evidence of cultural scarring was identified. As discussed in Section 2.4, ridge crests are areas known to have a high potential for Aboriginal cultural material in the local area. The most likely Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.

PAD 4

PAD 4 covers a portion of lower slope of the eastern ridgeline in the southeast section of the Study Area. The PAD extends approximately 110 m southwest to northeast and is 50 m wide covering an area of 3626 m². Shell fragments and quartz material was identified in this area, with shell species including *Anadara trapezia*, *Bembicium auratum* and *Bedeva hanleyi*. These shell species are all estuarine with the nearest possible source being Lake Illawarra 3.5 km to the southeast.

The shell scatter is located in a black sandy loam across a terraced motocross track. The PAD has been heavily disturbed by earthwork as part of the motocross track construction. Sections of the motocross track above and below the terraced section show natural soil profiles of a thin grey loam over brown/orange clays and subsoils, which is substantially different from the soil profile in which the shell material is present. This would suggest that material has been imported to site as part of the motocross track construction.

The most likely Aboriginal heritage to be present in this PAD is shell midden material. While it is possible that a shell midden is in context, the distance from the nearest waterbody suggests that the material on site is not in its original context and has been imported.

PAD 5

PAD 5 covers a gentle slope on the lower slopes of a ridgeline in the southeast section of the Study Area. The PAD extends approximately 40 m west to east and is 35 m wide covering an area of 3839 m^2. While the surrounding landform is wet, the PAD area was relatively dry and overlooks West Dapto Creek flood plains to the south. The most likely Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.

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Figure 6: Survey Effort.

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Figure 6

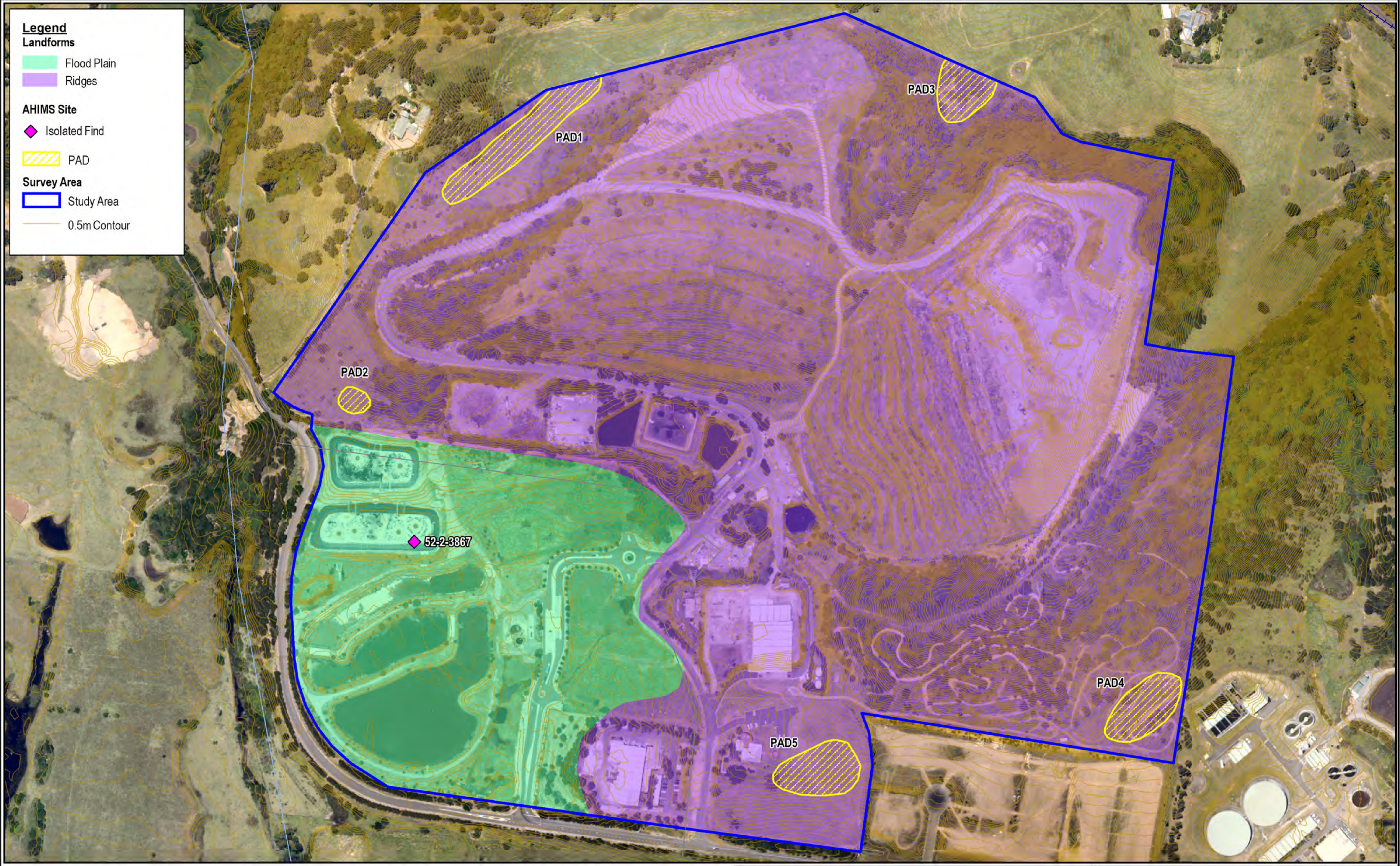

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Figure 7: Survey Results.

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Figure 7

4.0 TEST EXCAVATION

4.1 Methodology

4.1.1 Aims of the Test Excavation

Five PADs have been identified within the Study Area. Of these, PAD 1, PAD 2, PAD 3 and PAD 4 have the potential to be impacted by the proposed development. PAD 5 is part of a heritage area and will not be impacted by the proposed development. The aim of sub surface investigations was to determine the extent, nature and significance of any potential Aboriginal cultural material in PADs that had the potential to be impacted.

4.1.2 Test Excavation Methodology

The proposed sub-surface investigation methodology is informed by the *Code of Practise for Archaeological Investigation of Aboriginal objects in New South Wales* (DECCW 2010) and industry best practice.

The sub-surface investigation methodology for PAD 1, PAD 2 and PAD 3 was as follows:

- Each PAD was systematically gridded at 20m intervals to provide test excavation locations;
- A 50cm x 50 cm test pit was excavated in each test excavation location in 10cm spits, with the first test pit in each PAD being excavated in 5 cm spits;
- All test excavation locations were excavated using hand tools only;
- All material excavated from each test location was sieved using a 5 mm aperture wire-mesh sieve;
- All test excavation locations were excavated to a culturally sterile layer; and,
- Records of each test excavation location included the following:
    - unique test pit identification number;
    - soil colour and texture;
    - amount and location of artefacts within deposit;
    - nature of disturbance if present;
    - stratigraphy;
    - archaeological features (if present);
    - photographic records; and,
    - spit records.

For safety reasons all test pits were backfilled with sieved spoil at the end of the excavation to ensure a level surface within the Study Area. Any Aboriginal archaeological material recovered from a test pit was analysed on site and reburied.

The proposed sub-surface investigation methodology for PAD 4 was as follows:

- Two 50cm x 50 cm test pits were excavated in the PAD to determine if:
    - The soil in which shell material present is fill or a natural soil layer; and,
    - To determine if the shell material present is midden deposit or natural shell deposit.

  The two 50cm x 50 cm test pits were excavated in the same manner as described for PADs 1 to 3 above.

- If the shell material at PAD 4 was determined to be part of midden material then the following testing would be undertaken to test the extent of the midden material:
    - The PAD would be systematically gridded at 10m intervals to provide test excavation locations;
    - A 100 mm auger hole would be excavated in each test excavation location in 10 cm spits;
    - Excavation at each test excavation location would cease when midden material was encountered.
    - Records of each test excavation location wouldl be undertaken which would include the following:
        - unique test pit identification number;
        - soil colour and texture;
        - amount and location of artefacts within deposit;
        - nature of disturbance if present;
        - stratigraphy;
        - archaeological features (if present);
        - photographic records; and,
        - spit records.

OEH were notified two weeks prior to sub-surface investigations taking place.

4.2 Test Excavation Results

This section presents results of test excavations carried out between the 21st November 2011 and the 6th December 2011. A total of 46 test pits were excavated within 4 PADs (see Plates 14 to 23 and Figures 8 to 11). Individual test pit and soil analysis results are provided in Appendix 2. A catalogue of flaked stone artefacts is provided in Appendix 3. Results by PAD are shown in Table 6 and a detailed discussion of results is provided below.

Table 6: Test Excavation Results by PAD

PAD	Landform	PAD Area	Area Tested	% of PAD effectively tested	No of sites	No of artefacts
PAD 1	Crest	5786m²	5.5m²	0.09%	1	1
PAD 2	Lower Hillslope	680m²	2.25m²	0.33%	0	0
PAD 3	Crest	2771m²	3m²	0.12%	1	1
PAD 4	Lower Hillslope	3627m²	0.5m²	0.01%	1	0

4.2.1 PAD 1

A total of 22 test pits were excavated at PAD 1 with cultural material identified in one test pit, Test Pit 3 close to the northern boundary of the Study Area (see Figure 8). One basalt flake artefact was identified at between 0 and 10cm (Plate 15). This site has been designated Whytes Gully 1. In general, the soil deposits at PAD 1 were relatively shallow (between 20cm and 40cm in depth), loamy and terminated at a clay or sandstone base, with an average pH of between 6 and 7.

Plate 14 Testing at PAD 1

Plate 15 Basalt Flake from Test Pit 3

4.2.2 PAD 2

A total of 9 test pits were excavated at PAD 2 and no cultural material was identified (Figure 9). The soil deposits at PAD 2 varied in depth between 30cm and 80cm, with loamy soils terminating at a clay base. Clay content was high in comparison to PADs 1 and 3, pH ranged between 4.5 and 5.5 which was lower all other areas tested.

Plate 16 Looking east at PAD 2

Plate 17 Soil profile at Test Pit 44

4.2.3 PAD 3

A total of 12 test pits were excavated at PAD 3, with cultural material identified in three test pits, 23, 24 and 34 (Figure 10). One basalt core, one basalt angular fragment and one chert angular fragment were identified, all at depths between 0 and 10cm (Plate 19 to 21). This site has been designated Whytes Gully 2. In general, the soil deposits at PAD 2 were relatively shallow (between 40cm and 50cm in depth), loamy and terminated at a clay or sandstone base, with an average pH of between 6 and 7.

Plate 18 Excavating at PAD 3

Plate 19 Basalt core from Test Pit 23

Plate 20 Basalt angular fragment from Test Pit 24

Plate 21 Chert angular fragment from Test Pit 34

4.2.4 PAD 4

A total of 2 test pits were excavated at PAD 4 to confirm the absence or presence of shell midden material (Figure 11). No shell material was identified in the soil deposits at PAD 4 and soil profiles consisted of a shallow clay loam (10cm to 30cm in depth over clay), pH ranged between 6 and 6.5. Shell midden deposits were not confirmed and observations on site indicate that shell material was imported with fill that has been used to build up sections of the motocross track. There is potential for imported Aboriginal cultural material to be present within PAD 4 in a highly disturbed context. Shell material present at PAD 4 has been recorded as Whytes Gully 3.

Plate 22 Looking north at testing being undertaken at PAD 4

Plate 23 Soil Profile at Test Pit 36

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Figure 8: Test Excavation Results at PAD 1

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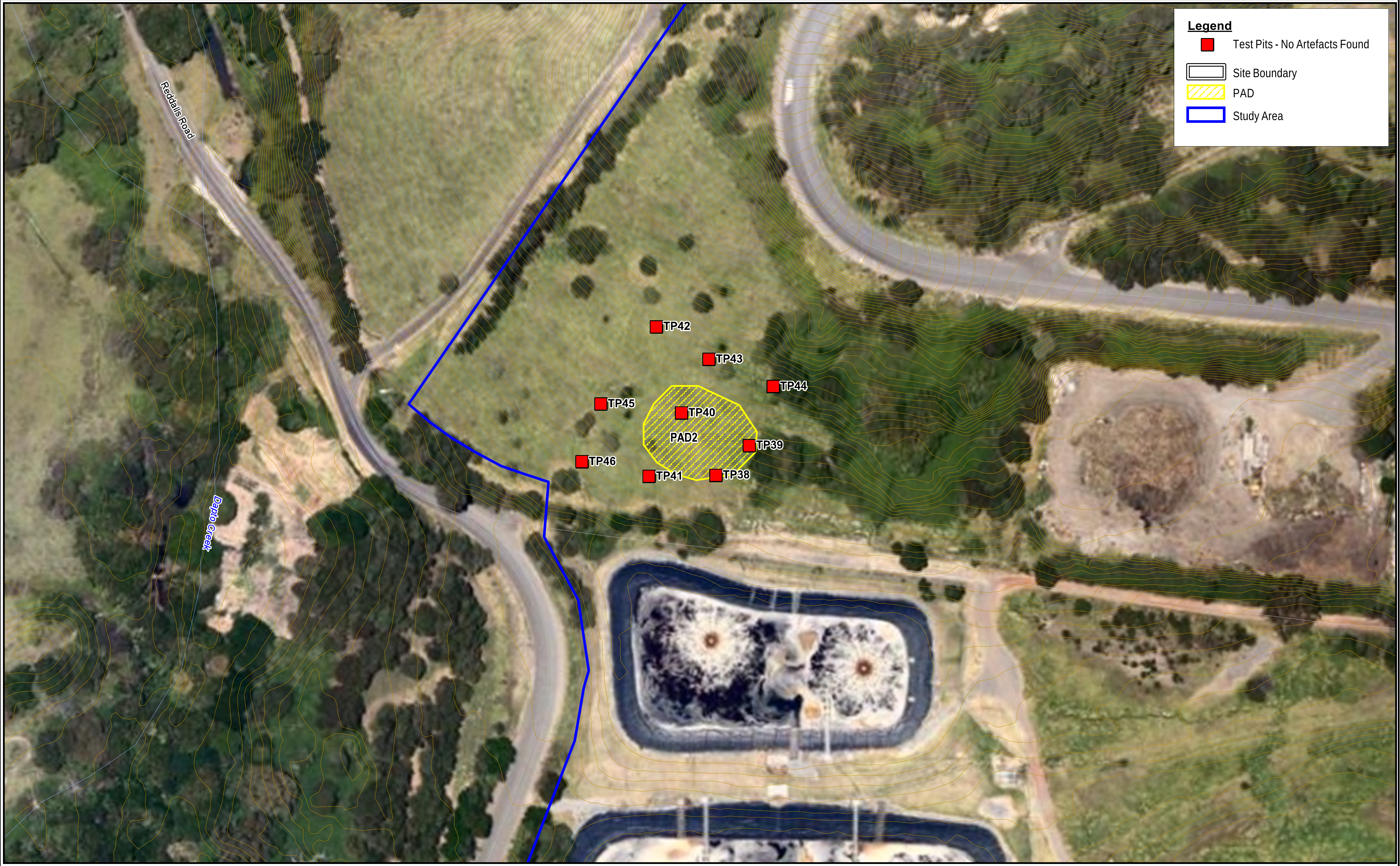

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Figure 9: Excavation Results at PAD 2

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Figure 10: Test Excavation Results at PAD 3

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Figure 11: Test Excavation Results at PAD 4

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5.0 ABORIGINAL HERITAGE SITES

5.1 Site Descriptions

There are four identified Aboriginal archaeological sites in the study area as shown in Table 7, Figure 12 and discussed below.

Table 7: Aboriginal Heritage Sites in the Study Area

Site Name	Features	Survey Unit	Landform	Condition
52-2-3867 (RR2)	Isolated Artefact	Floodplain	Floodplain	Destroyed
Whytes Gully 1	Isolated Artefact	Ridges	Crest	Fair
Whytes Gully 2	Artefact Scatter	Ridges	Crest	Fair
Whytes Gully 3	Shell Material	Ridges	Footslope	Highly Disturbed

5.1.1 52-2-3867 (RR2)

52-2-3867 is an isolated quartz artefact recorded by South East Archaeology in 2001, although the site card was not submitted until 2011. The site was recorded in the central southwest of the Study Area. The isolated artefact was recorded in a disturbed context and the current survey confirmed that in the area it was located, a settling pond has subsequently been built (Figure 12). The artefact was unable to be relocated and the site is considered to be destroyed.

5.1.2 Whytes Gully 1

Whytes Gully 1 is an isolated artefact recorded on a ridgeline crest on the northwest boundary of the Study Area and consists of a basalt flake recovered in the first 10 cm of topsoil (see Figure 12).

5.1.3 Whytes Gully 2

Whytes Gully 2 is an artefact scatter recorded on a ridgeline crest on the northeast boundary of the Study Area and consists of three flaked stone artefacts recovered in the first 10 cm of topsoil (see Figure 12).

5.1.4 Whytes Gully 3

Whytes Gully 3 covers a portion of lower slope of the eastern ridgeline in the southeast section of the Study Area. The site extends approximately 110 m southwest to northeast and is 50 m wide covering an area of 3626 m². Shell fragments and quartz material was identified in this area, with shell species including *Anadara trapezia*, *Bembicium auratum* and *Bedeva hanleyi*. The site is in a disturbed context and has been imported in to the Study Area as part of a fill deposit to build up the motorcross track.

5.2 Discussion

The Study Area contains of mixture of ridgeline and floodplain platforms. The results of sub surface test excavations are consistent with the expectations of the site predictions for these landforms, with low density flaked stone artefact scatters (52-2-3867, Whytes Gully 1 and Whytes Gully 2) being the most common site type encountered. Low density artefact scatters such as these are most likely the result of Aboriginal people moving across the landscape and indicates that the Study Area was most likely a movement corridor between floodplains to the west and south and hills below the escarpment to the north. The shell material at Whytes Gully 3 is in a highly disturbed context and has been imported to site. It is considered highly likely that this fill is from a nearby locality (such as Lake Illawarra) as the shell species present are common to the area.

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Figure 12: Aboriginal Heritage Sites in the Study Area.

Date: 6 January 2012 | Drawn by: ANP/JMS
File number: 12443 | Checked by: ASF
Location:-..PP:\12400s\12443\Mapping\Report Figures\12443 F12_Arch Sites.WOR

Acknowledgements:
Aerial Imagery - NearMap
Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003-)

0 40 80 120 160 200
metres

Scale: 1:4,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N W E S

6.0 SCIENTIFIC SIGNIFICANCE ASSESSMENT

Archaeological significance (also called scientific significance, as per the ICOMOS Burra Charter) refers to the value of archaeological objects or sites as they relate to research questions that are of importance to the archaeological community, including indigenous communities, heritage managers and academic archaeologists. Generally the value of this type of significance is determined on the basis of the potential for sites and objects to provide information regarding the past life-ways of people (Burke and Smith 2004: 249, NPWS 1997b). For this reason, the NPWS (now part of OEH) summarises the situation as ‘while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential’ (NPWS 1997b: 26). The NPWS criteria for archaeological significance assessment are based largely on the ICOMOS Burra Charter. Rating scientific significance of archaeological sites in the Study Area has been undertaken using a rating formula developed by Bowdler (1981) and Sullivan and Bowdler (1984). This system rates sites according to contents, condition and representativeness which when taken together give an indication of the sites overall research potential.

Research Potential

Research potential is assessed by examining *site content* and *site condition*. Site content refers to all cultural materials and organic remains associated with human activity at a site. Site content also refers to the site structure – the size of the site, the patterning of cultural materials within the site, the presence of any stratified deposits and the rarity of particular artefact types. As the site contents criterion is not applicable to scarred trees, the assessment of scarred trees is outlined separately below. Site condition refers to the degree of disturbance to the contents of a site at the time it was recorded.

The *site contents* ratings used for archaeological sites are:

0 - No cultural material remaining.

1 - Site contains a small number (e.g. 0–10 artefacts) or limited range of cultural materials with no evident stratification.

2 - Site contains a larger number, but limited range of cultural materials; and/or some intact stratified deposit remains; and/or are or unusual example(s) of a particular artefact type.

3 - Site contains a large number and diverse range of cultural materials; and/or largely intact stratified deposit; and/or surface spatial patterning of cultural materials that still reflect the way in which the cultural materials were deposited.

The *site condition* ratings used for archaeological sites are:

0 - Site destroyed.

1 - Site in a deteriorated condition with a high degree of disturbance; lack of stratified deposits; some cultural materials remaining.

2 - Site in a fair to good condition, but with some disturbance.

3 - Site in an excellent condition with little or no disturbance. For surface artefact scatters this may mean that the spatial patterning of cultural materials still reflects the way in which the cultural materials were laid down.

Pearson and Sullivan note that Aboriginal archaeological sites are generally of high research potential because ‘they are the major source of information about Aboriginal prehistory’ (1995: 149). Indeed, the often great time depth of Aboriginal archaeological sites gives them research value from a global perspective, as they are an important record of humanity’s history. Research potential can also refer to specific local circumstances in space and time – a site may have particular characteristics (well preserved samples for absolute dating, or a series of refitting artefacts, for example) that mean it can provide information about certain aspects of Aboriginal life in the past that other less or alternatively valuable sites may not (Burke and Smith 2004: 247-8). When determining research potential value particular emphasis has been placed on the potential for absolute dating of sites.

The following sections provide statements of significance for the Aboriginal archaeological sites recorded during the sub-surface testing for the assessment. The significance of each site follows the assessment process outlined above. This includes a statement of significance based on the categories defined in the Burra Charter. These categories include social, historic, scientific, aesthetic and cultural (in this case archaeological) landscape values. Nomination of the level of value—high, moderate, low or not applicable—for each relevant category is also proposed. Where suitable the determination of cultural (archaeological) landscape value is applied to both individual sites and places (to explore their associations) and also, to the Study Area as a whole. The nomination levels for the archaeological significance of each site are summarised below.

Representativeness

Representativeness refers to the regional distribution of a particular site type. Representativeness is assessed by whether the site is *common*, *occasional*, or *rare* in a given region. Assessments of representativeness are subjectively biased by current knowledge of the distribution and number of archaeological sites in a region. This varies from place to place depending on the extent of archaeological research. Consequently, a site that is assigned low significance values for contents and condition, but a high significance value for representativeness, can only be regarded as significant in terms of knowledge of the regional archaeology. Any such site should be subject to re-assessment as more archaeological research is undertaken.

Assessment of representativeness also takes into account the contents and condition of a site. For example, in any region there may only be a limited number of sites of any type that have suffered minimal disturbance. Such sites would therefore be given a high significance rating for representativeness, although they may occur commonly within the region.

The *representativeness* ratings used for archaeological sites are:

1 - common occurrence

2 - occasional occurrence

3 - rare occurrence

Overall scientific significance ratings for sites, based on a cumulative score for site contents, site integrity and representativeness are:

1-3 low scientific significance

4-6 moderate scientific significance

7-9 high scientific significance

Each site is given a score on the basis of these criteria – the overall scientific significance is determined by the cumulative score. This scoring procedure has been applied to the Aboriginal archaeological sites identified during the sub-surface testing. The results are in Table 10.

6.1 Statements of Archaeological Significance

The following archaeological significance assessment is based on Requirement 11 of the Code *of practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a). Using the scientific values and significance assessment criteria detailed above, an assessment of significance was determined and a rating for each site was determined. The details of archaeological significance assessment are given in Table 8 below.

Table 8: Significance assessment of archaeological sites recorded within the Project Area.

Site Name	Site Content	Site Condition	Representativeness	Scientific Significance
52-2-3867 (RR2)	0	0	1	1 – Low
Whytes Gully 1	1	1	1	3 – Low
Whytes Gully 2	1	1	1	3 – Low
Whytes Gully 3	1	1	1	3 – Low

6.1.1 52-2-3867 (RR2)

52-2-3867 is an isolated artefact that has been destroyed by subsequent development and is a common site in the local region. The site has very limited potential to provide new information about the exploitation of raw stone materials and site patterning across a regional landscape. For these reasons, this site is considered to be of low scientific significance.

6.1.2 Whytes Gully 1

Whytes Gully 1 is an isolated artefact located in a fairly undisturbed context and is a common site in the local region. The site has limited cultural material and no clear stratigraphic cultural deposits. The site has limited potential to provide new information about the exploitation of raw stone materials and site patterning across a regional landscape. For these reasons, this site is considered to be of low scientific significance.

6.1.3 Whytes Gully 2

Whytes Gully 2 is a low density artefact scatter located in a fairly undisturbed context and is a common site in the local region. The site has limited cultural material and no clear stratigraphic cultural deposits. The site has limited potential to provide new information about the exploitation of raw stone materials and site patterning across a regional landscape. For these reasons, this site is considered to be of low scientific significance.

6.1.4 Whytes Gully 3

Whytes Gully 3 consists of shell material located in a highly disturbed context and is a common site in the local region. The site has a range of faunal cultural material and any stratigraphic cultural deposits have been destroyed. The site has limited potential to provide new information about the exploitation of shellfish resources and site patterning across a regional landscape. For these reasons, this site is considered to be of low scientific significance.

7.0 IMPACT ASSESSMENT

7.1 Proposed Development

The current proposal for the Whytes Gully Recovery Park New Landfill Cell will include the following activities that could impact Aboriginal heritage:

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- bulk earthworks, which will involve the removal of topsoil and subsoil.

These activities have the potential to partially or completely remove or disturb archaeological deposits and Aboriginal objects through earthworks and construction activities. The expected development footprint is shown in Figure 12.

7.2 Predicted Physical Impacts

There are four Aboriginal sites within the Study Area that could potentially be impacted (including indirect impacts) by the proposed development:

- 52-2-3867 (RR2)
- Whytes Gully 1
- Whytes Gully 2
- Whytes Gully 3

Whtyes Gully 1, Whytes Gully 2 and Whytes Gully 3 are outside of the development footprint and will not be impacted (see Figure 12). 52-2-3867 is located close to the boundary of the footprint development but has already been destroyed and no further loss of value to this site can occur. The assessed statements of impact for Aboriginal sites in the Study Area has been summarised in Table 9 below.

Table 9: Impact Assessment to the Aboriginal archaeological sites recorded within the Project Area

Site Name	Type of harm	Degree of Harm	Consequence of Harm
52-2-3867 (RR2)	None	None	Total Loss of Value has Occurred
Whytes Gully 1	None	None	None
Whytes Gully 2	None	None	None
Whytes Gully 3	None	None	None

7.3 Management and Mitigation Measures

Ideally, heritage management involves conservation of sites through the preservation and conservation of fabric and context within a framework of "*doing as much as necessary, as* *little as possible*" (Marquis-Kyle and Walker 1994: 13). In cases where conservation is not practical, several options for management are available. For sites, management often involves the salvage of features or artefacts, retrieval of information through excavation or collection (especially where impact cannot be avoided) and interpretation.

Currently, Whytes Gully 1, Whytes Gully 2 and Whytes Gully 3 lie outside of the development footprint and will not be impacted. Although there is only a low potential that unidentified Aboriginal cultural material may be encountered during construction it is possible that cultural material may be encountered and appropriate cultural awareness training and contingency plans should be provided to workers and contractors undertaking construction work.

8.0 RECOMMENDATIONS

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Project Area and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
  - Ethos of the Australia ICOMOS Burra Charter
  - The DECCW 2010 *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Continued consultation with the registered Aboriginal parties*

It is recommended that Wollongong City Council continue to inform Aboriginal groups about the management of Aboriginal cultural heritage sites within the Study Area throughout the life of the project, including pre-excavation and pre-construction on-site meetings. This recommendation is in keeping with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW).

Recommendation 2: *Cultural Awareness Training*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about Aboriginal cultural heritage within the study area and information for the visual identification of Aboriginal cultural material, particularly stone artefacts.

8.1 Contingency Plans

8.1.1 Discovery of unanticipated Aboriginal cultural material

All Aboriginal places and objects are protected under the NSW National Parks and Wildlife Act 1974. This protection extends to Aboriginal objects and places that have not been identified but might be unearthed during construction. The following contingency plan describes the actions that must be taken in instances where Aboriginal cultural material is uncovered. Any such discovery at the activity area must follow these steps:

1. **Discovery:** Should unanticipated Aboriginal cultural material be identified during any works, works must cease in the vicinity of the find.
2. **Notification:** OEH and EPA must be notified of the find.
3. **Management:** In consultation with OEH and EPA, the Illawarra Local Aboriginal Land Council and a qualified archaeologist, a management strategy should be

developed to manage the identified Aboriginal cultural material. This may include the requirement to apply for an Aboriginal Heritage Impact Permit.

4. **Recording:** The find will be recorded in accordance with the requirements of the *National Parks and Wildlife Act 1974* and OEH guidelines.

8.1.2 Discovery of unanticipated human remains

The following contingency plan describes the actions that must be taken in instances where human remains or suspected human remains are discovered. Any such discovery at the activity area must follow these steps:

1. **Discovery:** If suspected human remains are discovered all activity in the vicinity of the human remains <u>**must stop**</u> to ensure minimal damage is caused to the remains; and the remains must be left in place, and protected from harm or damage.

2. **Notification:** Once suspected human skeletal remains have been found, the Coroners Office and the NSW Police must be notified immediately. Following this, the find must be reported to OEH and it is recommended that it is also reported to the Illawarra Local Aboriginal Land Council.

3. **Management:** If the human remains are of Aboriginal ancestral origin an appropriate management strategy will be developed in consultation with Aboriginal Stakeholders and OEH.

4. **Recording:** The find will be recorded in accordance with the requirements of the *National Parks and Wildlife Act 1974* and OEH guidelines.

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APPENDICES

APPENDIX 1 – SURVEY TRANSECTS

Transect Number	1	**Landform Unit**	Ridges (Hills)	**Landform Element**	Hillcrest	**Transect length (m)**	97	**Transect width (m)**	8
Transect Area (m²)	772	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	Small granite boulders	**Vegetation**	Low exotic grasses with some mature gum trees	**Disturbance**	Low – vegetation clearance	**Slope**	Gentle	**Potential for Aboriginal Heritage**	High – PAD 1
Transect Number	2	**Landform Unit**	Ridges (Hills)	**Landform Element**	Hillcrest	**Transect length (m)**	163	**Transect width (m)**	8
Transect Area (m²)	1301	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	Small granite boulders	**Vegetation**	Low exotic grasses with some mature gum trees	**Disturbance**	Low – vegetation clearance	**Slope**	Gentle	**Potential for Aboriginal Heritage**	High – PAD 1
Transect Number	3	**Landform Unit**	Ridges (Hills)	**Landform Element**	Upper Slope	**Transect length (m)**	66	**Transect width (m)**	8
Transect Area (m²)	532	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses with some mature gum trees	**Disturbance**	Low – vegetation clearance	**Slope**	Steep	**Potential for Aboriginal Heritage**	Low

Transect Number	4	**Landform Unit**	Ridges (Hills)	**Landform Element**	Mid Slope	**Transect length (m)**	73	**Transect width (m)**	8
Transect Area (m²)	582	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses with some mature gum trees	**Disturbance**	Low – vegetation clearance	**Slope**	Steep	**Potential for Aboriginal Heritage**	Low
Transect Number	5	**Landform Unit**	Ridges (Hills)	**Landform Element**	Lower Slope	**Transect length (m)**	93	**Transect width (m)**	8
Transect Area (m²)	743	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses	**Disturbance**	Low – vegetation clearance	**Slope**	Steep	**Potential for Aboriginal Heritage**	Low
Transect Number	6	**Landform Unit**	Ridges (Hills)	**Landform Element**	Footslope	**Transect length (m)**	43	**Transect width (m)**	8
Transect Area (m²)	344	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses	**Disturbance**	Low – vegetation clearance	**Slope**	Moderate	**Potential for Aboriginal Heritage**	Low

Transect Number	7	**Landform Unit**	Ridges (Hills)	**Landform Element**	Footslope	**Transect length (m)**	66	**Transect width (m)**	8
Transect Area (m²)	529	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses	**Disturbance**	Low – vegetation clearance	**Slope**	Moderate	**Potential for Aboriginal Heritage**	Moderate – PAD 2
Transect Number	8	**Landform Unit**	Flood Plain	**Landform Element**	Plain	**Transect length (m)**	146	**Transect width (m)**	8
Transect Area (m²)	1167	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses	**Disturbance**	High – earthwork	**Slope**	Flat	**Potential for Aboriginal Heritage**	Low
Transect Number	9	**Landform Unit**	Flood Plain	**Landform Element**	Plain	**Transect length (m)**	81	**Transect width (m)**	8
Transect Area (m²)	645	**Ground Surface Visibility (%)**	20	**Exposure (%)**	0	**Effective Survey Area (m²)**	26	**Exposure Type**	Vehicle Tracks
Soils	Clays	**Vegetation**	Low exotic grasses	**Disturbance**	High – earthwork	**Slope**	Flat	**Potential for Aboriginal Heritage**	Low

Transect Number	10	**Landform Unit**	Ridges (Hills)	**Landform Element**	Upper Slope	**Transect length (m)**	142	**Transect width (m)**	2
Transect Area (m²)	284	**Ground Surface Visibility (%)**	10	**Exposure (%)**	10	**Effective Survey Area (m²)**	3	**Exposure Type**	Animal tracks
Soils	Dark grey loam	**Vegetation**	Low exotic grasses and lantana	**Disturbance**	Low – vegetation clearance	**Slope**	Steep	**Potential for Aboriginal Heritage**	Low
Transect Number	11	**Landform Unit**	Ridges (Hills)	**Landform Element**	Hillcrest	**Transect length (m)**	84	**Transect width (m)**	2
Transect Area (m²)	169	**Ground Surface Visibility (%)**	10	**Exposure (%)**	10	**Effective Survey Area (m²)**	2	**Exposure Type**	Animal tracks and scratching's
Soils	Dark grey loam	**Vegetation**	Native vegetation and lantana	**Disturbance**	Low – Animal tracks and scratching's	**Slope**	Gentle	**Potential for Aboriginal Heritage**	High – PAD 3
Transect Number	12	**Landform Unit**	Ridges (Hills)	**Landform Element**	Hillcrest	**Transect length (m)**	174	**Transect width (m)**	2
Transect Area (m²)	349	**Ground Surface Visibility (%)**	40	**Exposure (%)**	50	**Effective Survey Area (m²)**	14	**Exposure Type**	Animal tracks
Soils	Dark grey loam	**Vegetation**	Native vegetation and lantana	**Disturbance**	Low – Animal tracks	**Slope**	Gentle	**Potential for Aboriginal Heritage**	Low

Transect Number	13	**Landform Unit**	Ridges (Hills)	**Landform Element**	Cliff-foot Slope	**Transect length (m)**	112	**Transect width (m)**	2
Transect Area (m²)	224	**Ground Surface Visibility (%)**	80	**Exposure (%)**	80	**Effective Survey Area (m²)**	90	**Exposure Type**	None
Soils	Dark grey loam	**Vegetation**	Rain forest	**Disturbance**	Low – Animal tracks	**Slope**	Moderate/Steep	**Potential for Aboriginal Heritage**	Low
Transect Number	14	**Landform Unit**	Ridges (Hills)	**Landform Element**	Footslope	**Transect length (m)**	271	**Transect width (m)**	4
Transect Area (m²)	1084	**Ground Surface Visibility (%)**	80	**Exposure (%)**	80	**Effective Survey Area (m²)**	694	**Exposure Type**	None
Soils	Black loam and orange brown sub soils	**Vegetation**	Low exotic grasses	**Disturbance**	High - Earthworks	**Slope**	Moderate	**Potential for Aboriginal Heritage**	High – PAD 4
Transect Number	15	**Landform Unit**	Ridges (Hills)	**Landform Element**	Mid Slope	**Transect length (m)**	809	**Transect width (m)**	4
Transect Area (m²)	3234	**Ground Surface Visibility (%)**	80	**Exposure (%)**	0	**Effective Survey Area (m²)**	2070	**Exposure Type**	None
Soils	Grey loam and orange brown sub soils	**Vegetation**	Low exotic grasses	**Disturbance**	High - Earthworks	**Slope**	Moderate/Steep	**Potential for Aboriginal Heritage**	Low

Transect Number	16	**Landform Unit**	Ridges (Hills)	**Landform Element**	Lower Slope	**Transect length (m)**	183	**Transect width (m)**	8
Transect Area (m²)	183	**Ground Surface Visibility (%)**	0	**Exposure (%)**	0	**Effective Survey Area (m²)**	0	**Exposure Type**	None
Soils	N/A	**Vegetation**	Low exotic grasses	**Disturbance**	Low – Vegetation clearance	**Slope**	Gentle/Moderate	**Potential for Aboriginal Heritage**	High – PAD 5

APPENDIX 2 – TEST PIT RESULTS

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
1	1	21/11/2011	1: 0-5cm	Very dark brown, loamy clay, grass roots, moist	10YR 2/2	7	No
			2: 5-10cm	Very dark brown, loamy clay, grass roots, moist	10YR 2/2	7	No
			3: 10-15cm	Dark brown, clayey loam, small sandstone inclusions, 2%	10 YR 3/3	6	No
			4: 15-20cm	Dark brown, clayey loam, small sandstone inclusions, 2%	10 YR 3/3	6	No
			5: 20-25cm	Mottled dark brown, with increase of sandstone inclusion, dark brown clayey loam coming through at base	10 YR 3/3 & 7YR 3/2	6.5	No
			6: 25-30cm	Mottled dark brown, with increase of sandstone inclusion, dark brown clayey loam coming through at base	10 YR 3/3 & 7YR 3/2	6.5	No
			7: 30-35cm	Dark yellowish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing	10YR 3/4	6.5	No
			8: 35-40cm	Dark yellowish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing	10YR 3/4	6.5	No
2	1	21/11/2011	1: 0-10cm	Very dark brown, loamy clay, grass roots, moist	10YR 2/2	7	No
			2: 10-20cm	Dark brown, clayey loam, small sandstone inclusions, 2%	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, with increase of sandstone inclusion 20%, clayey loam coming through at base	10 YR 3/3	6.5	No
			4: 30-40cm	Dark yellowish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing to 30%	10YR 3/4	6.5	No
3	1	21/11/2011	1: 0-10cm	Very dark greyish brown, loamy clay, grass roots, moist	10YR 3/2	7	Yes – Basalt Flake
			2: 10-20cm	Dark brown, clayey loam, with occasional sandstone nodules 2%	2: 10-20cm	6	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			3: 20-30cm	Mottled dark brown, with increase of sandstone inclusion 20%, clayey loam with occasional sandstone nodules	3: 20-30cm	6.5	No
			4: 30-40cm	Dark yellowish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing to 20%	4: 30-40cm	6.5	No
4	1	21/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass	10YR 3/2	7	No
			2: 10-20cm	Dark brown, silty loam, small sandstone inclusions, 20%	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, sandstone base running through the base of the test pit	10 YR 3/3	6.5	No
5	1	22/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass	10YR 3/2	7	No
			2: 10-20cm	Dark brown, silty loam, small sandstone inclusions, 20%	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, clay at base	10 YR 3/3	6.5	No
6	1	21/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, tree roots	10YR 3/2	7	No
			2: 10-20cm	Dark brown, silty loam, small sandstone inclusions, 20%, tree roots	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, clay at base, sandstone rock inclusions 30%	10 YR 3/3	6	No
7	1	30/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, tree roots	10YR 3/2	6.5	No
			2: 10-20cm	Dark brown, silty loam, small sandstone inclusions, 20%, tree roots	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, clay at base, sandstone rock inclusions 30%	10 YR 3/3	6	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			4: 30-40cm	Very dark brown, clayey loam, clay increasing with depth, sandstone inclusions increasing to 30%	10YR 2/2	7	No
8	1	30/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, moist due to rain	10YR 3/2	6.5	No
			2: 10-20cm	Dark brown, silty loam, small sandstone inclusions, 20%,	10 YR 3/3	6	No
			3: 20-30cm	Mottled dark brown, clay at base, sandstone rock inclusions 30%	10 YR 3/3	6	No
			4: 30-40cm	Very dark greyish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing to 30%	10YR 3/2	7	No
9	1	30/11/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, moist due to rain	10YR 3/2	6.5	No
			2: 10-20cm	Dark brown, silty clay, small sandstone inclusions, 20%,	10 YR 3/3	6	No
			3: 20-30cm	Very dark greyish brown, clayey loam, clay increasing with depth, sandstone inclusions increasing to 30%	10YR 3/2	7	No
10	1	30/11/2011	1: 0-10cm	Black, soft friable loam, grass, moist due to rain	10YR 2/1	6	No
			2: 10-20cm	Very dark brown, silty clay, small sandstone inclusions,	10 YR 2/2	5.5	No
			3: 20-30cm	Very dark grey, clayey loam, clay increasing with depth, sandstone inclusions increasing to 30%	10YR 3/1	5	No
11	1	02/12/2011	1: 0-10cm	Very dark grey, soft friable loam, grass, moist due to rain	10YR 2/2	7	No
			2: 10-20cm	Very dark brown, silty clay, small sandstone inclusions,	10 YR 2/2	7	No
			3: 20-30cm	Very dark grey, clay increasing with depth	10YR 3/1	6.5	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
12	1	02/12/2011	1: 0-10cm	Very dark grey, soft friable loam, grass, moist due to rain	10YR 2/2	7	No
			2: 10-20cm	Very dark brown, silty clay, small sandstone inclusions,	10 YR 2/2	7	No
			3: 20-30cm	Very dark grey, clay increasing with depth	10YR 3/6	6.5	No
13	1	02/12/2011	1: 0-10cm	Very dark grey, soft friable loam, grass, moist due to rain	10YR 2/2	7	No
			2: 10-20cm	Very dark brown, silty clay, small sandstone inclusions,	10 YR 2/2	7	No
			3: 20-30cm	Very dark brown, silty clay,	10YR 3/6	7	No
14	1	02/12/2011	1: 0-10cm	Black, soft friable loam, grass, moist due to rain	10YR 2/1	6.5	No
			2: 10-20cm	Very dark greyish brown, silty clay, small sandstone inclusions,	10 YR 3/2	6	No
			3: 20-30cm	Yellowish brown, silty clay, small sandstone inclusions,	10YR 5/4	5.5	No
			4: 30-40cm	Yellowish brown, sandstone base.	10YR 5/4	5.5	No
15	1	02/12/2011	1: 0-10cm	Very dark brown, silty loam, grass, moist due to rain	10YR 2/2	6.5	No
			2: 10-20cm	Very dark greyish brown, silty clay, sandstone rock at base	10 YR 3/2	7	No
16	1	02/12/2011	1: 0-10cm	Very dark brown, silty loam, grass, moist due to rain	10YR 2/2	7	No
			2: 10-20cm	Very dark greyish brown, silty clay	10 YR 3/4	6.5	No
			3: 20-30cm	Dark brown, clay increasing with depth	10 YR 3/3	6.5	No
17	1	02/12/2011	1: 0-10cm	Very dark brown, soft silty loam, grass, moist due to rain, worms, ants, grubs	10YR 2/2	7	No
			2: 10-20cm	Very dark grey, silty loam, rock inclusions	10 YR 3/1	6.5	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			3: 20-30cm	Dark yellowish brown, clay increasing with depth	10 YR 3/6	6.5	No
18	1	02/12/2011	1: 0-10cm	Very dark grey, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 3/1	6	No
			2: 10-20cm	Very dark grey, silty loam, sandstone rock base	10 YR 3/1	6	No
19	1	02/12/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6	No
			2: 10-20cm	Very dark grey, silty loam	10 YR 3/1	6	No
			3: 20-30cm	Dark yellowish brown, clay	10 YR 3/6	7	No
20	1	02/12/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6	No
			2: 10-20cm	Very dark grey, clayey silt	10 YR 3/1	6	No
			3: 20-30cm	Dark yellowish brown, clay at base	10 YR 3/6	7	No
21	1	05/12/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 3/2	7	No
			2: 10-20cm	Very dark greyish brown, clayey silt	10 YR 3/2	6.5	No
			3: 20-30cm	Dark yellowish brown, clay with sandstone rock	10 YR 3/2	7	No
22	1	05/12/2011	1: 0-10cm	Very dark greyish brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 3/2	6.5	No
			2: 10-20cm	Very dark grey, clayey silt	10 YR 3/1	7	No
			3: 20-30cm	Brown, clay with sandstone rock	10 YR 4/3	7	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
23	3	28/11/2011	1: 0-5cm	very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	Yes – Basalt Core
			2: 5-10cm	very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			3: 10-15cm	brown, soft silty loam	10 YR 4/3	7	No
			4: 15-20cm	brown, soft silty loam, petrified wood found	10 YR 4/3	7	No
			5: 20-25cm	brown, silty loam	10 YR 4/3	6	No
			6: 25-30cm	brown, silty loam	10 YR 4/3	6	No
			7: 30-35cm	brown, sandstone rock inclusions	10 YR 4/3	6	No
			8: 35-40cm	brown, sandstone rock inclusions clay at base	10 YR 4/3	6	No
24	3	28/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	Yes – Basalt angular fragment
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Brown, silty loam	10 YR 4/3	6	No
			4: 30-40cm	Brown, clay at base	10 YR 4/3	6	No
25	3	28/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Brown, silty loam	10 YR 4/3	6	No
			4: 30-40cm	Brown, clay at base	10 YR 4/3	7	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
26	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Brown, silty loam	10 YR 4/3	6	No
			4: 30-40cm	Brown, clay at base	10 YR 4/3	7	No
27	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Brown, silty loam, ochre found at base	10 YR 4/3	6	No
			4: 30-40cm	Brown, clay at base and ochre inclusions	10 YR 4/3	7	No
28	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Brown, rock inclusions, soft friable loam	10 YR 4/3	6	No
			4: 30-40cm	Brown, rock inclusions, soft friable loam	10 YR 4/3	6	No
			5: 40-50cm	Brown, rocky loam, clay at base	10 YR 4/3	7	No
29	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Brown, soft silty loam	10 YR 4/3	7	No
			3: 20-30cm	Dark brown, loamy silt	10 YR 3/3	6	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			4: 30-40cm	Brown, loamy sand with clay at base	10 YR 3/3	6	No
30	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Dark brown, soft silty loam	10 YR 3/3	7	No
			3: 20-30cm	Dark brown, loamy silt	10 YR 3/3	6	No
			4: 30-40cm	Yellowish brown, loamy sand with rock at base	10 YR 5/4	5.5	No
31	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Dark brown, soft silty loam, sandstone rock inclusions	10 YR 3/3	7	No
			3: 20-30cm	Dark brown, loamy silt, large rock	10 YR 3/3	6	No
			4: 30-40cm	Yellowish brown, loamy sand with rock at base	10 YR 5/4	5.5	No
32	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Dark brown, soft silty loam, sandstone rock inclusions	10 YR 3/3	7	No
			3: 20-30cm	Dark brown, loamy silt	10 YR 3/3	7	No
			4: 30-40cm	Very dark greyish brown, clay at base	10 YR 3/2	7	No
33	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	No
			2: 10-20cm	Dark brown, soft friable silty loam	10 YR 3/3	7	No
			3: 20-30cm	Dark brown, loamy silt	10 YR 3/3	7	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			4: 30-40cm	Very dark greyish brown, clay at base, sandstone inclusions	10 YR 3/2	7	No
34	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs	10 YR 2/2	6.5	Yes – Chert Angular Fragment
			2: 10-20cm	Dark brown, soft friable silty loam	10 YR 3/3	6.5	No
			3: 20-30cm	Dark brown, loamy silt	10 YR 3/3	6	No
			4: 30-40cm	Very dark brown, sandstone at base	10 YR 2/2	6	No
35	3	29/11/2011	1: 0-10cm	Very dark brown, soft friable loam, grass, moist due to rain, worms, ants, grubs, charcoal inclusions <25%	10 YR 2/2	6.5	No
			2: 10-20cm	Dark brown, loamy silt	10 YR 3/3	6.5	No
			3: 20-30cm	Dark brown, silty clay	10 YR 3/3	6	No
			4: 30-40cm	Very dark brown, clayey moist soil, water building up at base	10 YR 3/2	6	No
36	4	30/11/2011	1: 0-5cm	Dark yellowish brown , soft friable loam	10 YR 4/6	6.5	No
			2: 5-10cm	Dark brown, silty loam	10 YR 3/3	6.5	No
			3: 10-15cm	Dark brown, silty loam	10 YR 3/3	6.5	No
			4: 15-20cm	Dark brown, soft friable loam	10 YR 3/3	6	No
			5: 20-25cm	Dark brown, soft friable loam	10 YR 3/3	6	No
			6: 25-30cm	Very dark brown, clayey moist soil, water building up at base	10 YR 3/2	6	No
			7: 30-35cm	Very dark brown, clayey moist soil, water building up at base	10 YR 3/2	6	No
37	4	30/11/2011	1: 0-10cm	Dark yellowish brown , soft friable loam. Clay at 10cm	10 YR 4/6	6.5	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
38	2	05/12/2011	1: 0-5cm	Dark brown , loamy clay with grass, root inclusions to 4cm, vehicle tracks present	7 YR 3/4	4.5	No
			2: 5-10cm	Dark brown , loamy clay with grass, root inclusions to 4cm	7 YR 3/4	4.5	No
			3: 10-15cm	Brown, loamy clay content, increasing with depth, sand base inclusions 20%	10YR 4/3	5	No
			4: 15-20cm	Brown, loamy clay content, increasing with depth, sand base inclusions 20%	10YR 4/3	5	No
			5: 20-25cm	Dark yellowish brown, clay with sandstone inclusions	10YR4/4	5.5	No
			6: 25-30cm	Dark yellowish brown, clay with sandstone inclusions	10YR4/4	5.5	No
			7: 30-35cm	Dark yellowish brown, clay with sandstone inclusions	10YR4/4	5.5	No
			8: 35-40cm	Dark brown , loamy clay with grass, root inclusions to 4cm, vehicle tracks present	7 YR 3/4	4.5	No
39	2	05/12/2011	1: 0-10cm	Dark yellowish brown , loamy clay with grass, root	10 YR 3/4	4.5	No
			2: 10-20cm	Dark greyish brown , loamy clay with grass, with sandstone inclusions	10 YR 3/2	4.5	No
			3: 20-30cm	Brown, dark yellowish brown clay with sandstone inclusions 2%	10YR 4/6	5	No
40	2	05/12/2011	1: 0-10cm	Dark yellowish brown , loamy clay with grass, root	10 YR 3/4	4.5	No
			2: 10-20cm	Dark greyish brown , loamy clay with grass, with sandstone inclusions	10 YR 3/2	4.5	No
			3: 20-30cm	Brown, dark yellowish brown clay with sandstone inclusions	10YR 4/6	5	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
				5%			
			4: 30-40cm	Dark yellowish brown, loamy clay with grass, root	10YR 4/6	5	No
41	2	05/12/2011	1: 0-10cm	Dark brown , loamy clay with grass, root	7YR 3/4	4.5	No
			2: 10-20cm	Brown, loamy clay with grass, with sandstone inclusions	10 YR 4/3	4.5	No
			3: 20-30cm	Brown, dark yellowish brown clay with sandstone inclusions 2%	10YR 4/4	5	No
			4: 30-40cm	Brown, dark yellowish brown clay with sandstone inclusions 2%	10YR 4/4	5	No
42	2	05/12/2011	1: 0-10cm	Dark brown , loamy clay with grass, root	10YR 3/2	4.5	No
			2: 10-20cm	Brown, loamy clay with grass, with sandstone inclusions	10 YR 4/3	4.5	No
			3: 20-30cm	Brown, dark yellowish brown clay with sandstone inclusions 2%	10YR 4/4	5	No
43	2	05/12/2011	1: 0-10cm	Very dark greyish brown , loamy clay with grass, root	10YR 3/2	4.5	No
			2: 10-20cm	Dark brown, silty loam with grass, with sandstone inclusions	10 YR 3/3	5.5	No
			3: 20-30cm	Brown, dark yellowish brown clay	10YR 4/4	4	No
44	2	05/12/2011	1: 0-10cm	Very dark greyish brown , loamy clay with grass, root	10YR 3/2	6	No
			2: 10-20cm	Dark brown, silty loam with grass, with sandstone inclusions	10 YR 3/2	5.5	No
			3: 20-30cm	Very dark greyish brown , silty friable loam, stone and tree roots	10 YR 3/2	4	No
			4: 30-40cm	Very dark grey, silty friable loam, stone	10YR 3/1	4	No

Test Pit	PAD	Date Excavated	Spit	Soil Description	Munsell	pH	Artefacts
			5: 40-50cm	Very dark grey, silty friable loam, stone	10YR 3/1	5.5	No
			6: 50-60cm	Very dark grey, silty friable loam, stone	10YR 3/1	5.5	No
			7: 60-70cm	Very dark grey, silty friable loam, stone	10YR 3/1	4	No
			8: 70-80cm	Brown, dark yellowish brown clay	10YR 3/4	4	No
45	2	05/12/2011	1: 0-10cm	Very dark greyish brown , silty loam grass, root	10YR 3/2	5	No
			2: 10-20cm	Very dark grey, silty clay, clay at base	10 YR 3/1	4.5	No
46	2	05/12/2011	1: 0-10cm	Brown, silty loam grass, root	10YR 4/3	4.5	No
			2: 10-20cm	Dark brown, silty clay	10 YR 3/2	5.5	No
			3: 20-30cm	Dark yellowish brown, clay at base	10YR 4/4	4.5	No

APPENDIX 3 – ARTEFACT CATALOGUE

Site	Location	Artefact Type	Material	Colour	Length	Width	Thickness	Platform	Termination	Retouch	Usewear	Tool Form	Cortex %	Negative Scars
Whytes Gully 1	Test Pit 3, spit 1	Medial Flake	Basalt	Black	20mm	16mm	6mm	N/A	N/A	N/A	N/A	N/A	N/A	4
Whytes Gully 2	Test Pit 23, spit 1	Core	Basalt	Black	23mm	11mm	1.5mm	Flat	N/A	N/A	N/A	N/A	N/A	6
Whytes Gully 2	Test Pit 24, spit1	angular fragment	Basalt	Black	20mm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Whytes Gully 2	Test Pit 34, spit 1	angular fragment	Chert	Black	21mm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

APPENDIX J2

Historical Heritage Assessment

BIOSIS
RESEARCH

Whytes Gully New Landfill Cell

Historical Heritage Assessment

Report to:

Golder Associates on behalf of Wollongong City Council

January 2012

BIOSIS
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Project no: ***12443***

Authors: Asher Ford

Reviewer: Peter Howard

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LGA: Wollongong City Council

DOCUMENT CONTROL SHEET

Project	Whytes Gully New Landfill Cell Expansion, Kembla Grange
Project No	12443
Report To	Golder Associates on Behalf of Wollongong City Council
Report Title:	Whytes Gully Historical Heritage Assessment
Author(s):	Asher Ford

Revision	Prepared	Internal Review	External Review	Amended
Draft A	Asher Ford	Peter Howard	Todd Robinson	13 Jan 2012
Draft B	Asher Ford	Peter Howard	Michael Herraman	24 Feb 2012
Final	Asher Ford			

Revision	Issued	Name	Signed
A	11 January 2012	Asher Ford	
B	13 January 2012	Asher Ford	
Final	24 February 2012	Asher Ford	

ACKNOWLEDGEMENTS

Biosis Research gratefully acknowledges the contributions of the following organisations in preparing this report:

- Golder Associates on behalf of Wollongong City Council; and,
- Wollongong City Library.

ABBREVIATIONS

AHC	Australian Heritage Council
EPA	Environmental Protection Agency
EP&A	Environmental Planning and Assessment Act 1979
EPBC	Environment Protection and Biodiversity Conservation Act 1999
HHA	Historical Heritage Assessment
LEP	Local Environmental Plan
LGA	Local Government Area
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
SHI	State Heritage Inventory
SHR	State Heritage Register
WGRRP	Whytes Gully Resource Recovery Park

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EXECUTIVE SUMMARY

This Historical Heritage Assessment (HHA) has been commissioned for the proposed Wollongong City Council's (WCC) Whytes Gully New Landfill Cell (the Project), at Kembla Grange NSW (the Study Area). WCC is seeking approvals for the project under transitional Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This HAA considers non-Indigenous heritage values in the Study Area, potential impacts to historical heritage values from the Project and potential mitigation measures.

One historical site has previously been recorded in the Study Area, Glengarry homestead, and is listed on the *Wollongong (West Dapto) Local Environmental Plan (LEP) 2010* (the LEP). A field survey of the Study Area did not identify any new Potential Archaeological Deposits (PADs) or sites. Glengarry homestead will not be impacted by the proposed development.

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Project Area and influenced by:

- Predicted impacts to historical cultural heritage;
- The planning approvals framework; and,
- Current best conservation practise.

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Cultural Awareness Induction*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about historical cultural heritage within the Study Area and information for the visual identification of historical relics.

1.0 INTRODUCTION

This HHA has been commissioned for the proposed WCC Whytes Gully New Landfill Cell (the Project), at Kembla Grange NSW (the Study Area). WCC is seeking approvals for the project under transitional Part 3A of the EP&A Act. This HAA considers non-Indigenous heritage values in the Study Area, potential impacts to historical heritage values from the Project and potential mitigation measures.

1.1 Project Background

WCC are proposing to develop a new landfill cell within the Whytes Gully Resource Recovery Park (WGRRP), which will include the staged construction and operation of a new landfill cell. The HHA for the proposed development area is being undertaken as part of the environmental assessment for the Project in accordance with the EP&A Act. The objectives of the investigation process are to:

- Conduct heritage register searches to identify previously recorded cultural heritage sites in or within the vicinity of the proposed Study Area. Searches will include the National Heritage List, Commonwealth Heritage List, Register of the National Estate, State Heritage Register, the LEP and National Trust heritage lists;

- Conduct additional background research in order to recognise any identifiable regional trends in site distribution and location and provide a site prediction model for the Study Area;

- Assess the heritage significance of all identified historical cultural heritage sites and places;

- Identify impacts to all identified historical cultural heritage sites and places based on potential ground disturbance from the proposed construction of the new landfill cell; and,

- Make recommendations to minimise or mitigate potential impacts of the new landfill cell to cultural heritage values within the Study Area.

1.2 Study Area

The proposed development is located at WGRRP, Kembla Grange, Wollongong, NSW (Figure 1 following). The Study Area includes the following lots:

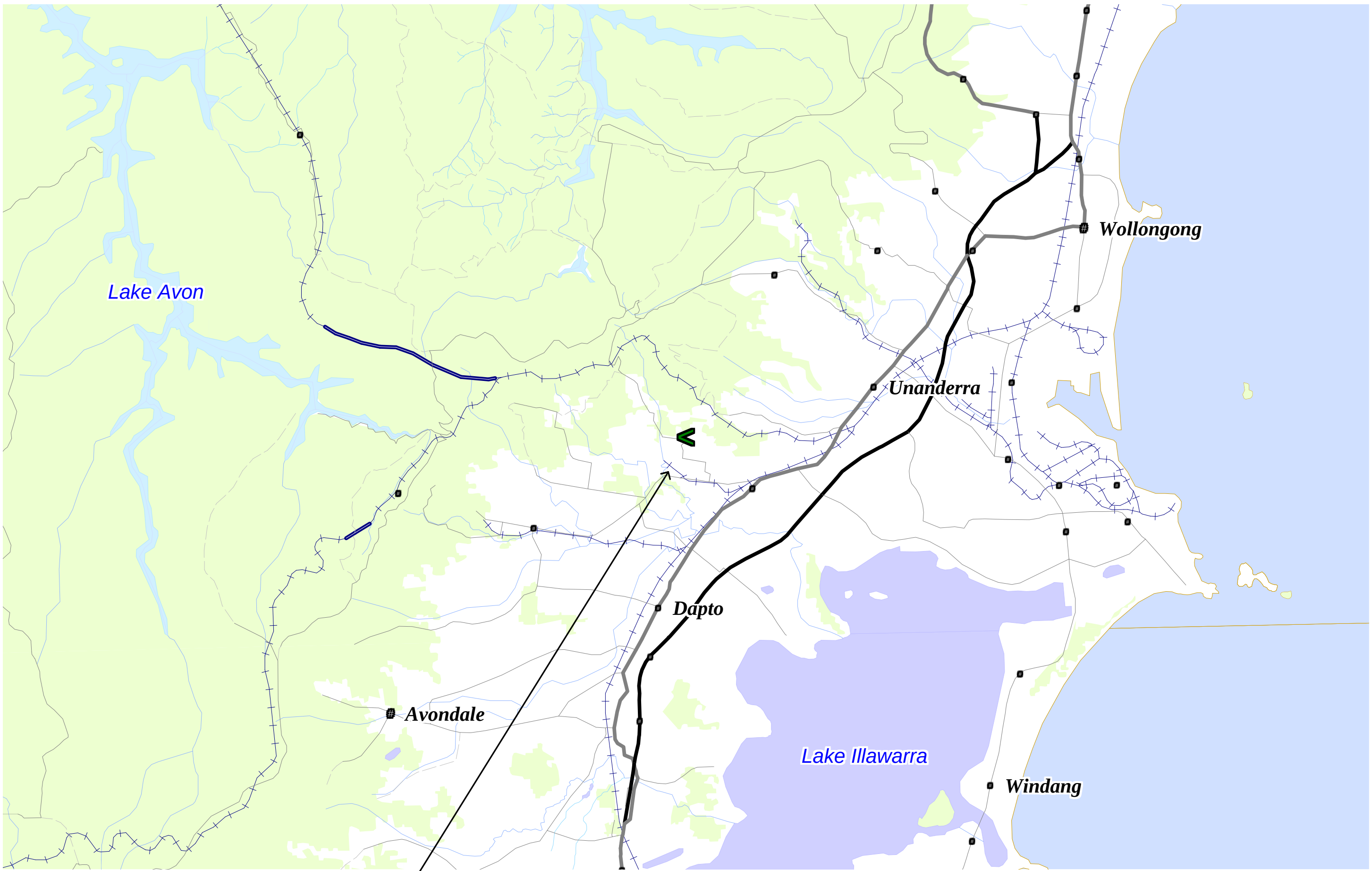
- Lot 501, DP 1079122;
- Lot 502, DP 1079122;
- Lot 2, DP 240557;
- Lot 51, DP 1022266;
- Lot 52, DP 1022266; and,
- Lot 53, DP 1022266.

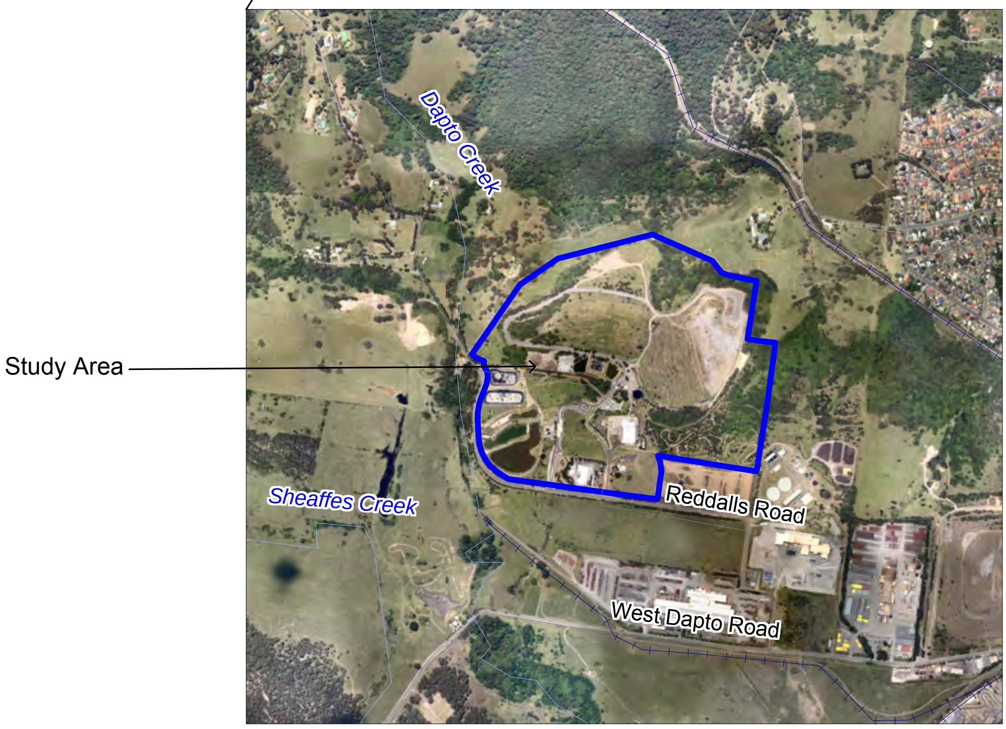
The site is bounded by Reddalls Road to the south, Dapto Creek to the west and grazing farm land to the north, northeast and also the east (Figure 2). The Study Area is located within the current boundary of the WGRRP.

1.3 Planning Approvals

The proposed development will be assessed under the transitional arrangements applying to the former Part 3A of the EP&A Act. This HHA is required under the Director Generals requirements (DGRs) for the Project issued on the 11th August 2011. The DGRs require that a *Environmental Assessment* for the Project be undertaken and includes a detailed assessment of non-Indigenous heritage. The DGRs also specify that the assessment must take into account relevant State technical and policy guidelines. While no specific guidelines for non-Indigenous heritage are specified in the DGRs,relevant legislation, planning instruments and guidelines that have informed the HHA include:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *ICOMOS Australia Burra Charter 1999* (the Burra Charter);
- *NSW Heritage Act 1977* (Heritage Act) (as amended 2010); and,
- *Wollongong (West Dapto) Local Environment Plan 2010* (LEP 2010).





Aerial Imagery - NearMap

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Figure 1: Location of the Study Area in a regional context

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Figure 2: Study Area.

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Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 2

1.4 Authorship

This HHA was prepared by Asher Ford and review undertaken by Peter Howard. Mapping was prepared by Ashleigh Pritchard.

1.5 Development Proposal

WCC are proposing to develop a new landfill cell within the WGRRP (Figure 2). The development will include the staged construction and operation of a new landfill cell and will involve the following activities that may potentially harm historical archaeological relics:

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- bulk earthworks, which will involve the removal of topsoil and subsoil.

2.0 HERITAGE REGISTERS

2.1 National Registers

2.1.1 The National Heritage List, Commonwealth Heritage List and Register of the National Estate

The EPBC Act establishes two mechanisms for the protection of heritage places of National or Commonwealth significance. The National Heritage List provides protection to places of cultural significance to the nation of Australia. The Commonwealth Heritage List comprises natural, Aboriginal and historical heritage places on properties owned and controlled by the Commonwealth and therefore mostly includes places associated with defence, communications, customs and other government activities.

Nominations to these two lists are assessed by the Australian Heritage Council (AHC), which also has compiled the Register of the National Estate, a list of places identified as having national estate values. The Register of the National Estate will be discontinued as a statutory register after February 2012, however it will remain as a non-statutory register after this date as a public archive. There are no statutory constraints associated with listing on the Commonwealth Heritage List or Register of the National Estate unless the proposal is initiated by a Commonwealth agency.

Application to the Study Area – National Heritage Registers

There are no items within the Study Area listed on the National Heritage List, the Commonwealth Heritage List or the Register of the National Estate.

2.2 State Registers

2.2.1 Heritage Act 1977 Registers

The NSW Heritage Branch, part of the Office of Environment and Heritage (OEH), maintains registers of heritage and archaeological items that are of state or local significance.

The State Heritage Register (SHR) contains items that have been assessed as being of State Significance to New South Wales. The State Heritage Inventory (SHI) contains items that are listed on Local Environmental Plans and/or on a State Government Agency's Section 170 registers that are deemed to be of local significance.

If an item or place does not appear on either the SHR or SHI this may not mean that the item or place does not have heritage or archaeological significance; many items have not been assessed to determine their heritage significance.

In addition, Section 170 of the NSW *Heritage Act 1977* requires that culturally significant items or places managed or owned by Government agencies be listed on departmental Conservation and Heritage Registers. Information in these Registers has been prepared according to NSW Heritage Office guidelines and should correspond with information in the SHI. There are no State Agency assets within the present Study Area.

Application to the Study Area – NSW State Heritage Register Listings

There are no items within the Study Area listed on the State Heritage Register. There is one item within the study area listed on the SHI:

- Glengarry – Homestead site

2.2.2 Environmental Planning and Assessment Act 1979 Registers

The EP&A Act includes provisions for local government authorities to consider environmental impacts in land-use planning and decision making. Such impacts are generally considered in relation to the planning provisions contained in the LEP. Each Local Government Area (LGA) is required to create and maintain an LEP that includes historical heritage items. Local Councils identify items that are of significance within their LGA, and these items are listed on heritage schedules in the local LEP and are protected under the EP&A Act and Heritage Act.

Application to the Study Area – Wollongong (West Dapto) LEP 2010

There is one item within the study area listed on the *Wollongong (West Dapto) LEP 2010*:

- Glengarry – Homestead site

2.3 Non-Statutory Registers

2.3.1 The National Trust of Australia (NSW)

The National Trust of Australia (NSW) is a community-based conservation organisation. The Trust maintains a Register of heritage items and places. Although the Register has no legal foundation or statutory power, it is recognised as an authoritative statement on the significance to the community of particular items, and is held in high esteem by the public. The National Trust lists items or places that have heritage or cultural value to the community and, as such, the Trust encourages and promotes the public appreciation, knowledge, and enjoyment of heritage items for future and present generations.

Application to the Study Area – National Trust of Australia (NSW)

There are no heritage items classified (listed) by the National Trust of Australia located within the Study Area.

2.4 Summary of Heritage Listings in the Study Area

A summary of the search results for Historic cultural heritage sites listed on statutory and non-statutory registers, planning instruments and management documents within the Study Area is provided (Table 1).

Table 1: Search results for cultural heritage items listed on statutory and non-statutory registers, planning instruments and management documents within the Study Area.

Sources	Listed Items within the Study Area
Register of the National Estate	None
Commonwealth Heritage List	None
National Heritage List	None
State Heritage Register	None
State Heritage Inventory	One
Wollongong (West Dapto) LEP 2010	One
National Trust of Australia (NSW)	None

3.0 DESKTOP ASSESSMENT

The desktop assessment includes a background review of previous archaeological work, the landscape context of the Study Area, the history of the local area, regional trends of historical site locations and a site prediction model.

3.1 Landscape Context

It is important to consider the local environment of the Study Area in any heritage assessment. Firstly the environment can influence human occupation and associated land use and consequently the distribution and character of cultural material. Secondly environmental processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly environmental features can contribute to the significance that places can have for people.

3.1.1 Topography and Drainage

The Study Area is dominated by two ridgelines, one ascending west to east along the northern boundary and the second descending south along the eastern boundary before swinging west into the lower southeast of the Study Area (Figure 2). These two ridgelines slope south and west into natural gullies that flatten out onto the alluvial floodplain surrounding Dapto Creek. Prior to the development of the landfill, water drained off the two ridgelines, down gullies and into a creek line running southwest across the floodplain into Dapto Creek (Plate 1). This creek line and the majority of natural drainage lines have been either removed or altered by subsequent landfill developments (Figure 2).

Plate 1: 1970 Aerial Photograph of the Study Area prior to development of the WGRRP.

3.1.2 Land Use History

The region surrounding the Study Area was initially colonised around 1815, with initial activity focused on timber clearing and mixed farming. Cedar cutters were the first to open up the Illawarra area as early as 1805. When they had exhausted the easily accessible timber by 1820, cattle grazing took over and the Coastal Plain was extensively cleared for pastoral estates and farms. Many early houses were built of rough slab or timber construction (Kass 2010: 66). The use of cattle for the production of beef and milk increased after 1887, when wheat was no longer considered a viable option for the region. Producers supplied various local butter and cheese factories located close by to the transport link provided by the railway. Dairying and beef production remain important local industries in the Dapto area today.

The southern portion of the Study Area was first surveyed by Knapp in 1829 as one of ten 100 acre lots set aside for veterans along Dapto Creek, with the southern lot being referred to as Veterans block No.2 (Rogers 1999: 14). Veterans block No.2 was granted to the veteran John Burnett who appears to have held it only briefly before selling to William Sutherland. Sutherland was issued a crown grant for the land in 1839 as Portion 9 of Kembla Parish. The northern half of the study area was granted to Robert Martin Cole in 1843 as Portion 8 of Kembla Parish (see Plate 2, *1906 Parish Map of Kembla Grange*).

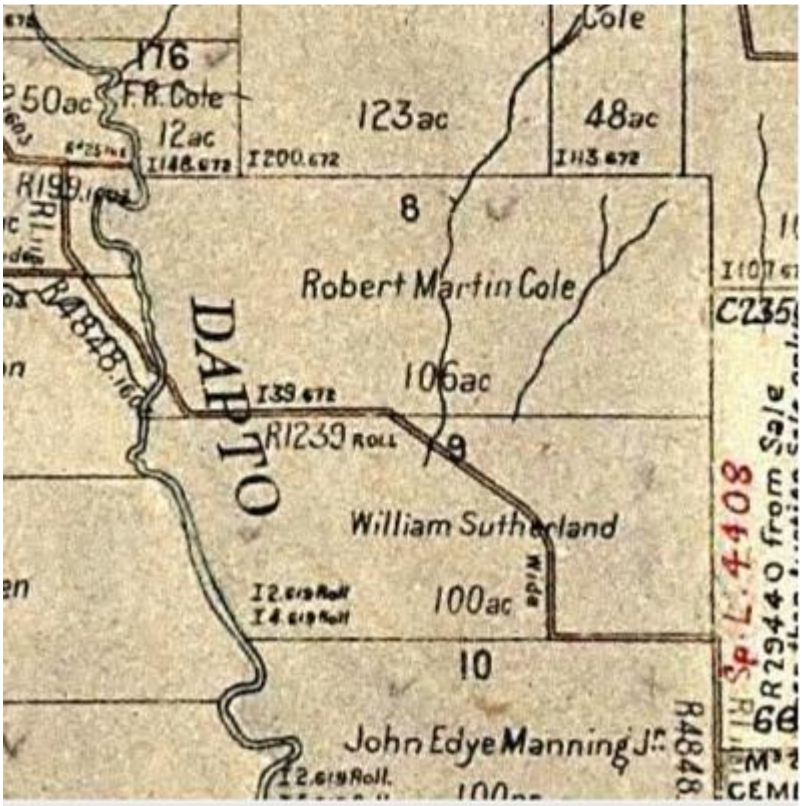

Plate 2: 1906 Parish Map showing Portion 8 and Portion 9 (Department of Lands 2012).

From the 1830's onwards, a range of agricultural improvements and practices were undertaken in the Study Area including dairying, grazing and cropping under a variety of different owners. A 1951 aerial photograph of the Study Area shows two homestead sites located on each Portion, the southern homestead known as "Glengarry" and the northern homestead belong to a Mr H Whyte and consisting of a farm house and several outbuildings (Scott and Furphy Engineers 1982: 7 see Plate 3). Rogers estimates that Glengarry was erected at sometime between 1841 and 1851 and continued to be in use as a farmhouse through to 1975 (Rogers 2000: 1).

The boundaries of Portion 8 and Portion 9 appear to have remained fairly consistent until the mid 1970's and 1980's when the local area was identified as an area suitable for future industrial land use. Portion 9 was acquired by the West Dapto Industrial Development Pty Ltd in 1975 and sections of Portion 8 were acquired by WCC for the first stage of the WGRRP undertaken in 1983. West Dapto Industrial Development Pty Ltd worked to rezone Portion 9 for industrial use and subdivided the Portion in 1983, gradually selling the smaller lots (Rogers 1999: 17). Portion 8 had been subdivided by 1982 (Scott and Furphy Engineers 1982).

Development of the WGRRP first began in 1983, with stage one being initially 25 hectares (Scott and Furphy Engineers 1982: 16) and included the development of roads and the initial landfill cell, clearly visible in Plate 4. The Whyte and Glengarry homesteads buildings are still visible in the 1984 aerial. The WGRRP underwent an expansion in the earlier 1990's that included all of the previous Portion 8 sections of the Study Area (see Plate 5). The buildings associated with Whyte's homestead appeared to have been removed at this stage and replaced by a road. Subsequent development has seen the addition of another landfill cell and ponds as part of a leachate collection system in the central and southwest sections of the Study Area (Plates 6).

The Glengarry Homestead remains on site and has been renovated for adaptive reuse as an office. Previous construction activities have involved significant earthworks that have completely removed surface soils, resulting in significant ground disturbance across the area. However undisturbed areas do remain predominately on the periphery of the current landfill areas, and are indicated in Figure 3.

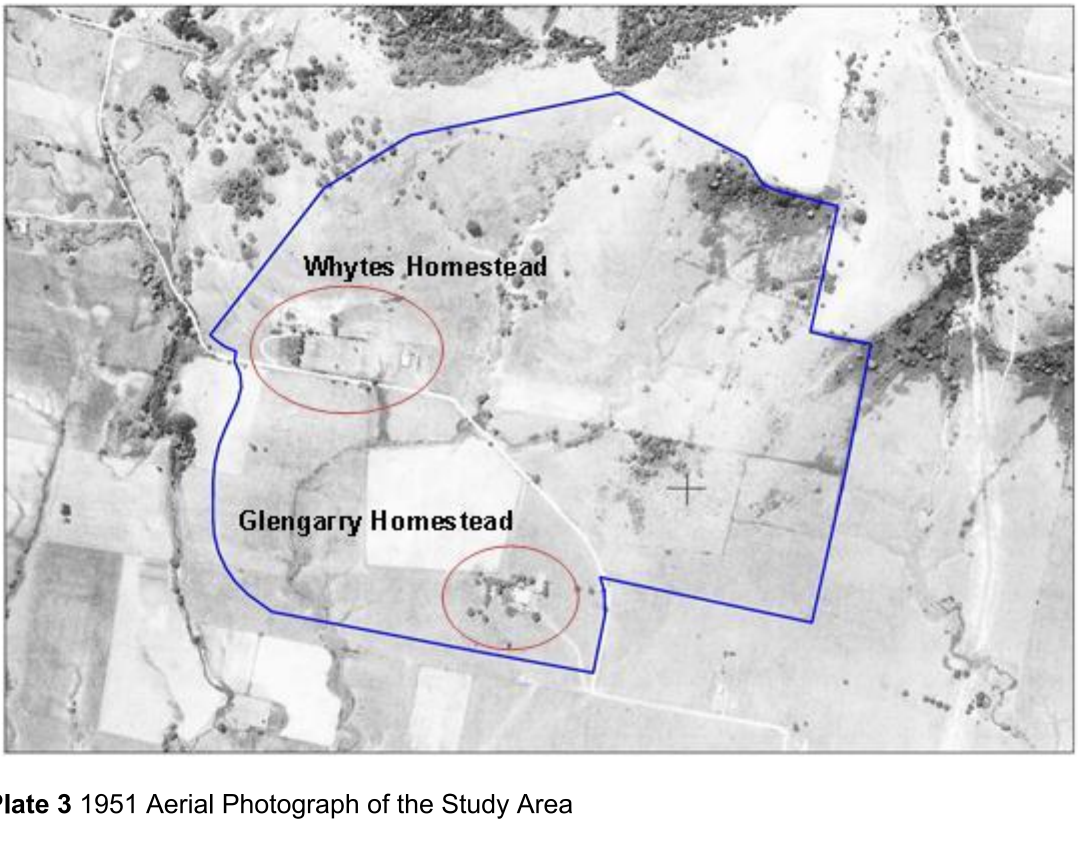

Plate 3 1951 Aerial Photograph of the Study Area

Plate 4 1984 Aerial Photograph of the Study Area

Plate 5: 1994 Aerial Photograph of the Study Area

Plate 6: 2005 Aerial Photograph of the Study Area

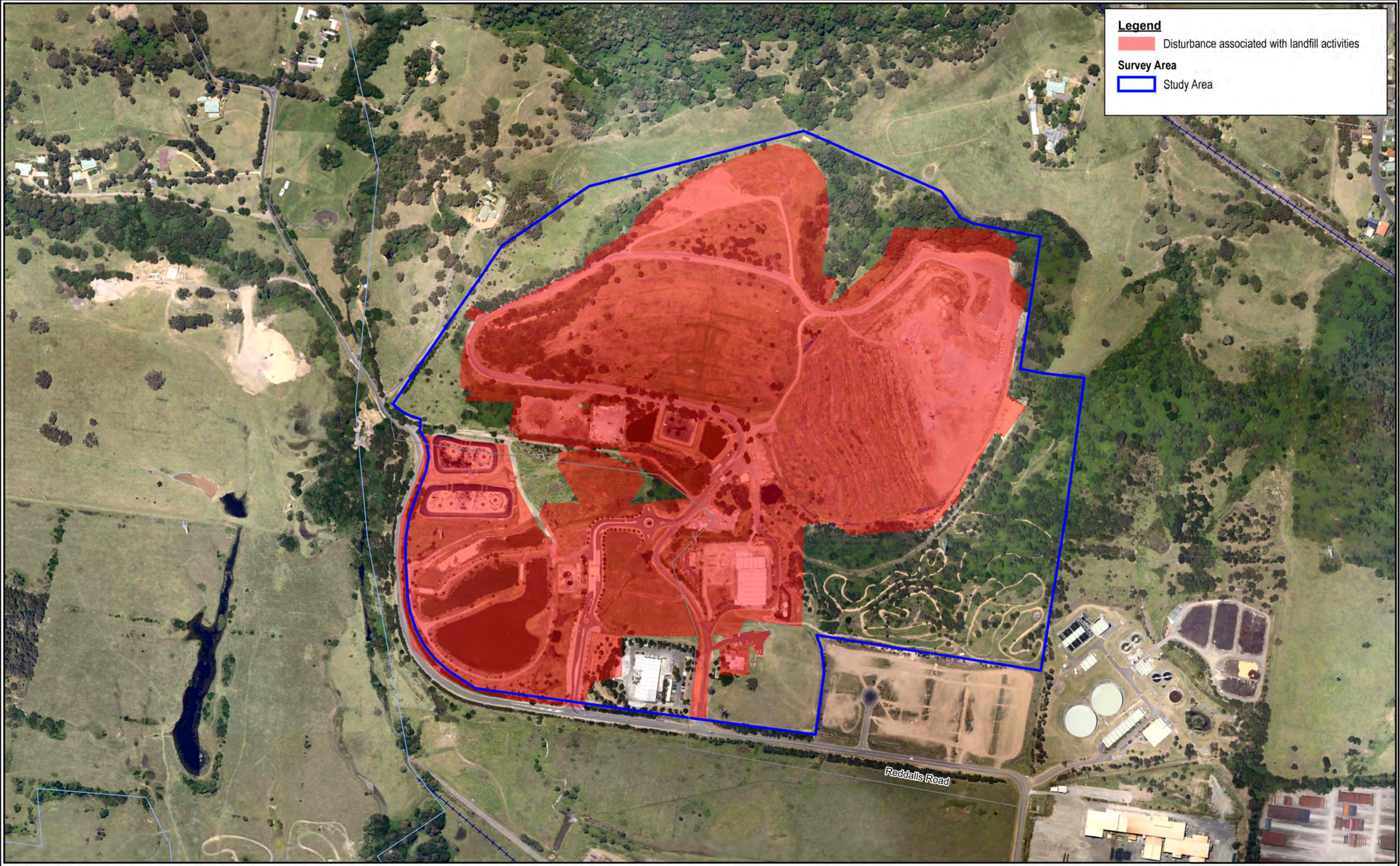

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Figure 3: History of Disturbance within the Study Area.

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Figure 3

3.2 Archaeological Context

The Study Area has been subject to a number of historical studies, predominately focussed on the Glengarry homestead site and the development of previous stages of the WGRRP. These investigations, briefly summarised below, include the following: Ali (1981), Scott and Furphy Engineers (1982 and 1983), McDonald McPhee Pty. Ltd (1991), Maunsell Pty. Ltd (1992), Williamson (1999), Rogers (1999 and 2000).

Ali (1981) compiled a register of historical buildings in the Illawarra region and provides a very brief description of Glengarry homestead.

Scott and Furphy Engineers (1982 and 1983) provided an Environmental Impact Statement (EIS) for the first stage of the WGRRP development. An archaeological survey of the development area was undertaken by Koettig to inform the EIS but historical heritage was not considered at this stage of the development.

McDonald McPhee Pty. Ltd (1991) undertook a heritage study for the entire Wollongong City Council. An Inventory sheet was provided for Glengarry homestead (see Appendix A) which was noted as having local significance values. Information for Glengarry homestead relies on information provided by Ali's 1981 register.

Maunsell Pty. Ltd (1992) provided an EIS for the expansion of the WGRRP, including areas over the Whytes homestead group. The EIS included an assessment of Aboriginal and historical heritage within the development area. The EIS concluded that no heritage items or issues where present in the develop area (Maunsell 1992: 6.19).

Williamson (1990) prepared a heritage assessment and conservation plan for the Glengarry homestead. The history of Glengarry and conservation plan is incomplete in this report but a general management for the building was provided to WCC.

Rogers (1999 and 2000) prepared a detailed history and archival recording of portions of the Glengarry homestead site. The history includes a full titles history and examination of past agricultural land uses associated with the homestead.

3.3 Glengarry Homestead

There is one historical heritage site listed in the study area, the Glengarry homestead site. The Glengarry homestead site was first recorded by Ali in 1981 and gazetted on the 7 January 2000. The site is currently listed on the *Wollongong (West Dapto) LEP 2010* as item No. 6432 (Figure 4).

3.3.1 Description

The Glengarry Homestead site was originally recorded as a brick house with a wide veranda and tin roof and the construction of the building has been dated at between 1841 and 1851 by Rogers (2000: 1). The house was made of local bricks in a Flemish bond with double sashed windows (McDonald McPhee 1991). The site includes surrounding gardens with two notable fig trees (see Plate 7). A full history of the occupiers is provided in Rogers' (1999) history of the site. Although known by a number of different names, the house and surrounding land where referred to as 'Glengarry Park' by the Waples family who owned and occupied the homestead from 1903 to 1975 and this is the name now commonly used to refer to the site (Rogers 1999: 16).

The house was unoccupied from 1975 after purchase by the West Dapto Industrial Development Pty Ltd and gradually deteriorated. WCC acquired the site and in 2001 relocated the site a short distance and refurbished the house for adaptive reuse as an education centre (WCC 2011). The building and remaining gardens are in good condition, although the majority of outbuildings have been destroyed.

Plate 7: 1990 Photograph of 'Glengarry' (McDonald McPhee 1991).

3.3.2 Significance

A number of significance assessments have been undertaken for the site. The 1991 Inventory card for the site provided a brief statement of significance noting that the site is "*a large and significant homestead and gardens representing the late Victorian Georgian style and the vernacular homestead in it's setting*" (McDonald McPhee 1991). The SHI assessment of significance lists the site as having aesthetic (Criteria C) and representative (Criteria G) values when assessed against the SHR criteria (Heritage Branch 2012). The 1999 conservation management plan by Williamson states that the site has regional significance based on the historical, aesthetic and construction characteristics and that it is a rare example of its type in the local area (Williamson 1999: 37).

The 1999 Conservation Management Plan for Glengarry does not establish a clear curtilage for the site. The site boundary as shown on the *Wollongong (West Dapto) LEP 2010* has been used in this assessment as an appropriate curtilage and is shown in Figure 4.

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Figure 4: Glengarry Homestead Location.

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3.4 Archaeological Site Type Definitions and Predictive Model

In general the land use history of the site indicates that most likely historical site types to be present would be associated with past agricultural and domestic activities. Beyond the Glengarry homestead site, it is unlikely that historical sites are present within the Study Area given the extensive development associated with the WGRRP which has involved large amounts of earthworks, landscaping and removal of topsoils. Previous heritage assessments did not identify the Whytes homestead cluster of buildings as having heritage value and a review of aerials indicates that these buildings have since been removed.

The archaeological predictive model has been formulated based on the results of the landforms, previously recorded historical sites and historical overview of the region. This information has been broken down into patterns that have been compared to the character of the Study Area to allow for an understanding of historical archaeological potential. Based on this information, the following predictive model for the Study Area has been developed, indicating the site types most likely to occur within the present Study Area. The historical activity and site types associated with this activity are described first and followed by the predicted likelihood of this site type occurring within the Study Area.

Table 2: Historical Site Prediction Model

Historical Activities	Associated Site Types	Potential
Past agricultural and pastoral practices	Homesteads, rubbish pits, fences, wells, farm infrastructure and domestic faunal remains.	**Low:** the Study Area has been extensively modified by the development of the WGRRP.

4.0 FIELD SURVEY

A field survey of the Study Area was undertaken on the 26 August 2011. Field Survey methodology, results and discussion are provided below.

4.1 Methodology

4.1.1 Aims of the Survey

The principle aims of the survey are to:

- To undertake a systematic survey of the Study Area targeting areas with the potential for historical heritage;
- Identify and record historical archaeological sites visible on the ground surface; and,
- Identify and record areas of potential archaeological deposits (PADs).

4.1.2 Survey Methodology

The survey methods were intended to assess the Study Area for historical sites. The survey effort targeted those portions of the Study Area that are undisturbed by the WGRRP, identified during the desktop phase of the assessment (Figure 3 previously). Formal transects were walked over these undisturbed areas, unless preliminary survey transects provided clear and obvious evidence that the landform had been substantially altered by earthworks. Due to dense vegetation and limited ground surface visibility, a full coverage survey was not undertaken. An informal survey of the former Whytes homestead location was undertaken.

4.2 Survey Results

A total of 16 transects were walked across two landform units in the Study Area (Figure 6). Generally the survey was hampered by poor ground surface visibility and narrow survey transects in some areas due to slope and dense vegetation. While these limitations reduced the overall effective survey coverage, each landform was able to be effectively sampled in order to determine areas of PAD.

An informal survey of the Whytes homestead area was undertaken and it was confirmed that all buildings had been removed by previous works. Disturbance to surface soils by earthworks had been extensive and no PADs were identified. No historical sites or areas of PAD were identified during the survey.

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Figure 5: Survey Effort.

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Map Projection: Transverse Mercator
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Figure 5

5.0 IMPACT ASSESSMENT

5.1 Proposed Development

The current proposal for the Project will include the following activities that could potentially impact upon historical heritage (Figure 4):

- heavy vehicle movement within the Study Area with potential compaction of surface soils; and,

- bulk earthworks, which will involve the removal of topsoil and subsoil.

These activities have the potential to partially or completely remove or disturb archaeological deposits and relics through earthworks and construction activities. The expected development footprint is shown in Figure 4.

5.2 Predicted Physical Impacts

There is one historical site within the Study Area identified as Glengarry homestead. However it is outside of the proposed development footprint of the Project and will not be impacted. Nor will the identified heritage curtilage be impacted upon.

5.3 Management and Mitigation Measures

There are no identified extant historical sites within the development footprint and there is a low potential for unidentified historical relics or sites to be encountered during construction. Prior to construction, appropriate cultural awareness induction and contingency plans should be provided to workers and contractors undertaking construction work as part of induction training.

6.0 RECOMMENDATIONS

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Study Area and influenced by:

- Predicted impacts to historical cultural heritage;
- The planning approvals framework; and,
- Current best conservation practise.

Prior to any impacts occurring within the Study Area, the following is recommended:

Recommendation 1: *Cultural Awareness Induction*

Due to the possibility that isolated cultural material may be encountered during construction, a cultural heritage induction should be incorporated within the general induction package for all people involved with the proposed works. The cultural heritage induction should include relevant information about historical cultural heritage within the study area and information for the visual identification of historical relics.

6.1 Contingency Plans

6.1.1 Discovery of unanticipated archaeological relics

All archaeological relics are protected under the *NSW Heritage Act 1977*. Section 146 of the *NSW Heritage Act 1977* requires that the Heritage Council be notified in the event that unexpected relics are encountered. Should any archaeological relics be encountered during works associated with this proposal, works must cease in the vicinity of the find and the NSW Heritage Branch notified. A qualified archaeologist may also be required to assess the find. It is an offence to disturb archaeological relics without a consent permit issued by the NSW Heritage Council.

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APPENDICES

APPENDIX A: HERITAGE INVENTORY SHEETS

GREATER WOLLONGONG HERITAGE STUDY

CONSULTANT TEAM			
Brian McDonald	BMcD	Catherine Macarthur	CM
Andrew Conacher	AC	Rob Gansl	RG
Don Fullerton	DF	Peter Smit	PS

ITEM: House "Glengarry" and gardens known as "The Homestead"

LOCATION: Reddall's Road, Kembla Grange

LAND TITLE:
PIN 46306
1051.10

LOT 202
DP 708258

LISTING	
National Estate	
Heritage Council	
National Trust	
RAIA	
LEP 1990	
REP	
REP Advis. List	X

INVENTORY NUMBER: **B14 - SW**

DESCRIPTION
Brick and corrugated metal roof. Made from local bricks, verandah on 3 sides. Flemish bond brickwork double sashed windows.
Fig trees.
c.1880

PRESENT USE: Residence

THEME: Agriculture/ residential

SIGNIFICANCE	STATE		REGIONAL	X	LOCAL	

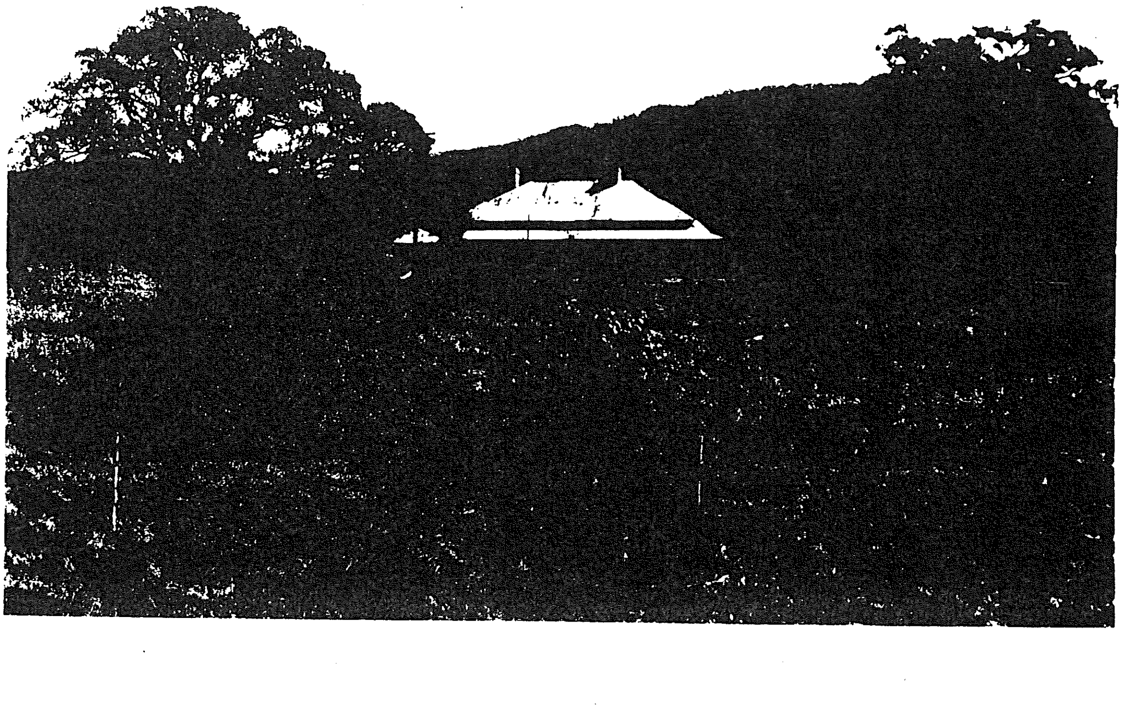
STATEMENT
A large and significant homestead and gardens representing the late Victorian Georgian style and the vernacular homestead in it's setting.

CONTEXTUAL VALUES		TYPE OF SIGNIFICANCE		landscape	X
rarity		historic		archaeological	
group value		scientific		architectural	X
landmark value	X	technological		townscape	
representative value	X	cultural		natural	
integrity	X	social		aesthetic	X

COMMENTS
Fair condition, currently being restored.

REFERENCES
Ann Ali
REP Advisory list.

MAP/PHOTO



AUTHOR	BMcD	AC	DF	PS	CM	RG	FILM NO.	NEG NO.	DATE
				X		X	1162	22	2.10.90

Glengarry

Item

Name of Item: Glengarry

Other Name/s: The Homestead, Glengarry Park,

Type of Item: Built

Group/Collection: Residential buildings (private)

Category: Homestead building

Primary Address: Reddalls Road, Kembla Grange, NSW 2530

Local Govt. Area: Wollongong City

Property Description:

Lot/Volume Code	Lot/Volume Number	Section Number	Plan/Folio Code	Plan/Folio Number

All Addresses

Street Address	Suburb/Town	LGA	Parish	County	Type
Reddalls Road	Kembla Grange	Wollongong City			Primary

Statement of Significance

A large and significant homestead and gardens representing the late Victorian Georgian style and the vernacular homestead in its setting. One of the veterans land grants.

Date Significance Updated: 04 Dec 00

Note: There are incomplete details for a number of items listed in NSW. The Heritage Branch intends to develop or upgrade statements of significance and other information for these items as resources become available.

Description

Physical Description: Brick and corrugated metal roof. Made from local bricks (heart shaped frog), verandah on 3 sides. Flemish bond brickwork double sashed windows. Fig trees.

Modifications and Dates: Curently being substantially modified internally for education centre.

Current Use: Education Centre

Former Use: Homestead

Historic Themes

Australian Theme (abbrev)	New South Wales Theme	Local Theme
3. Economy - Developing local, regional and national economies	Agriculture - Activities relating to the cultivation and rearing of plant and animal species, usually for commercial purposes, can include aquaculture	(none) -

Assessment of Significance

SHR Criteria c) [Aesthetic Significance]	The item has landmark, landscape, architectural and aesthetic value.
SHR Criteria g) [Representativeness]	The item has representative value.
Integrity/Intactness:	The item has integrity.
Assessment Criteria	Items are assessed against the **State Heritage Register (SHR) Criteria** to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan			07 Jan 00	1/2000	69

Study Details

Title	Year	Number	Author	Inspected by	Guidelines Used
City of Wollongong Heritage Study	1991	B14-SW	McDonald McPhee Rogers Conacher Fullarton	Rob Gansi, Peter Smit	No

References, Internet links & Images

None

Note: Internet links may be to web pages, documents or images.

(Click on Thumbnail for Full Size Image and Image Details)

Data Source

The information for this entry comes from the following source:

Name:	Local Government
Database Number:	2700558

Every effort has been made to ensure that information contained in the State Heritage Inventory is correct. If you find any errors or omissions please send your comments to the **Database Manager**.

APPENDIX B: LEGISLATION

COMMONWEALTH LEGISLATION

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

In January 2004 the Commonwealth *Australian Heritage Commission Act 1975* was repealed and in its place amendments to the EPBC Act were made. The amendments were contained in three new pieces of Commonwealth Heritage Legislation. The three new Acts are the:

1. Environment and Heritage Legislation Amendment Act (No. 1) 2003 which:

    (a) amends the Environment Protection and Biodiversity Conservation Act 1999 to include 'national heritage' as a new matter of National Environmental Significance and protects listed places to the fullest extent under the Constitution

    (b) establishes the National Heritage List

    (c) establishes the Commonwealth Heritage List

2. Australian Heritage Council Act 2003 which establishes a new heritage advisory body to the Minister for the Environment and Heritage, the Australian Heritage Council, and retains the Register of the National Estate.

3. Australian Heritage Council (Consequential and Transitional Provisions) Act 2003 which repeals the Australian Heritage Commission Act, amends various Acts as a consequence of this repeal and allows for the transition to the new heritage system.

Any place that has been nominated and assessed as having cultural heritage significance at a national level can be added to the National Heritage List.

Under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) an action requires approval from the Federal Environment Minister if the action will, or is likely to, have a significant impact on a matter of national environmental significance. Matters of national environmental significance relating to cultural heritage are:

- World Heritage Places, and
- National Heritage Places.

An action includes a project, development, undertaking, activity, or series of activities.

Actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land), and actions taken by the Commonwealth that are likely to have a significant impact on the environment anywhere in the world, may also require approval under the EPBC Act.

PROTECTION OF MOVABLE CULTURAL HERITAGE ACT 1986

Australia's movable cultural heritage is protected at both Commonwealth and State levels. This web site only provides information on the Commonwealth laws.

In 1970 the United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted the UNESCO Convention on the Means of Prohibiting the Illicit Import, Export and Transfer of Ownership of Cultural Property. Australia ratified the convention by passing the *Protection of Movable Cultural Heritage Act 1986* (the Act), giving the 1970 Convention force in Australian law.

The Act regulates the export of Australia's significant cultural heritage objects. It is not intended to restrict normal and legitimate trade in cultural property and does not affect an individual's right to own or sell within Australia.

It implements a system of export permits for certain heritage objects defined by the Act as 'Australian protected objects'. Australian protected objects are objects which form part of the movable cultural heritage of Australia and which meet the criteria established under the National Cultural Heritage Control List. The Control List is located in the Regulations to the Act, and divides Australian protected objects into two classes:

- Class A objects which may not be exported
- Class B objects which may be exported if granted a permit under the Act.

A person wishing to export a Class B object is required to apply for a permit in writing. Applications are processed in accordance with the legislative process established under section 10 of the Act.

Certificates of Exemption, granted under section 12 of the Act, allow Australian protected objects that are currently overseas to be imported into Australia and subsequently re-exported. This includes Class A objects.

The Act also includes provisions that allow Australia to respond to an official request by a foreign government to return movable cultural heritage objects that have been illegally exported from their country of origin.

The *Protection of Movable Cultural Heritage Act 1986* is administered by the Minister for the Environment and Heritage. This responsibility was transferred from the Minister for Communication, Information Technology and the Arts in November 2001.

The Movable Cultural Heritage Unit in the Department of the Environment and Heritage provides the Secretariat to the National Cultural Heritage Committee

STATE LEGISLATION

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The *NSW Environmental Planning and Assessment Act* will have relevance for all development projects because it requires that environmental impacts are considered in land-use planning and decision making. The definition of 'environment impacts' includes impacts on the cultural heritage of the Study Area. The Act has three relevant parts: Part III, which governs the preparation of planning instruments; Part IV, which relates to development where consent is required under an environmental planning instrument (EPI); and Part V, which relates to activity where development consent is not required but some other government approval assessments are needed.

Under the Act, local government authorities and The Department of Planning and

Infrastructure prepare local and regional environmental planning instruments (LEPs and REPs) to give statutory force to planning controls. These may incorporate specific provisions for conserving and managing archaeological sites.

Integrated Development Assessment (IDA) was introduced under the *Environmental Planning and Assessment Act 1979* so that all matters affecting a development application would be considered by the consent authority in an integrated way.

Integrated Development is one which requires development consent as one or more approvals from different government agencies. Such agencies may include the Environmental Protection Agency (EPA), OEH or the NSW Heritage Council. If a development is likely to impact a heritage item, the consent authority must refer it, to EPA & OEH (for Indigenous objects) or the NSW Heritage Council (for sites listed on the State Heritage Register) prior to approval determination.

HERITAGE ACT 1977

The *Heritage Act 1977* details statutory responsibilities for historic buildings and gardens, historic places and objects, historical archaeological sites, and historic shipwrecks. The Act is administered by the Heritage Council of New South Wales, through the NSW Heritage Branch.

The aim of the Act is to conserve the 'environmental heritage' of the state, which includes items such as buildings, works, relics, moveable objects or precincts significant for historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. A 'Place' is defined as an area of land, with or without improvements and a 'Relic' is defined as any:

> *deposit, object or material evidence:*
>
> *(a) which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) which is 50 or more years old.*

An excavation permit is required for any works, excavations or activities, associated with an archaeological site. Excavation permits are issued by the Heritage Branch of New South Wales in accordance with sections 60 or 140 of the *Heritage Act.*

It is an offence to disturb or excavate land to discover, expose or move a relic without obtaining a permit from the NSW Heritage Council.

> *139 Excavation permit required in certain cases*
>
> *(1) A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.*
>
> *(2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.*

Excavation permits are usually issued subject to a range of conditions that will relate to matters such as reporting requirements and artefact cataloguing, storage and curation. A permit may be required from the Heritage Council of NSW for works or activities associated with a registered place or object.

General queries about site issues and permit applications can be made to the archaeological officers at the Heritage Branch. The contact details are:

NSW Heritage Branch

3 Marist Place

PARRAMATTA NSW 2150

Ph: (02) 9873 8500

Fax: (02) 9873 8599

Consultation and discussion with the NSW Heritage Office should begin before lodging an application for a permit to disturb or destroy a historical archaeological site.

The Local Government Act 1993

Under the State Local Government Act, councils can prepare local approvals policies that set out specific matters for consideration in relation to applications to demolish, build or undertake works. Archaeological sites could be considerations under such policies.

APPENDIX K

Visual Amenity Assessment

WHYTES GULLY RESOUCE RECOVERY PARK

PROPOSED NEW LANDFILL CELL VISUAL IMPACT

ASSESSMENT REPORT

7 March 2012

prepared for

Golder Associates Pty Ltd

by

Corkery Consulting

Landscape Architecture • Urban Design
Suite 3, 38 Albany Street • St Leonards • NSW 2065
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Date	Issue	Status	Signed
13.12.11	Issue A	Preliminary Draft	
22.12.11	Issue B	Draft	
02.03.12	Issue C	Final Draft	
07.03.12	Issue D	Final	

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1.0 INTRODUCTION

Wollongong City Council (WCC) proposes to construct a new landfill cell at the Whytes Gully Resource Recovery Park (WGRRP) in order to meet future demand for landfill space. Council has engaged Golder Associates to prepare the Environmental Assessment for a Part 3A Application to the NSW Department of Planning. One of the Director General's Requirements is to assess the potential visual impact of the proposed new landfill cell on surrounding areas.

This Visual Assessment Report has been prepared by Corkery Consulting Landscape Architects working as specialist sub-consultant to Golder Associates. The Assessment has involved a field inspection (Nov. 2011) together with a comprehensive desktop analysis. A key component of the methodology is to identify mitigation measures that may be required to address any potential visual impacts identified by the Visual Assessment. The mitigation measures include planning of the operations to minimise the extent to which they will be visible from surrounding areas during the operation of the landfill. In addition a Landscape Strategy to minimise potential long term visual impacts is to be prepared.

The first step in the visual assessment process was to determine and describe the existing landscape character of the project site and surrounding areas. The assessment provides a baseline against which the potential visual impact of the proposed landfill extension can then be assessed.

The baseline component of the visual assessment addresses all of the existing elements of the current landfill infrastructure (leachate ponds and treatment plants, recycling facility, amenities and administration buildings, internal road network and other infrastructure) as well as the current landfill operations. The assessment identifies the extent to which the landfill operations are currently visible from public roads, residences, work places and recreational areas located in surrounding areas.

2.0 LANDSCAPE CONTEXT

The Whytes Gully Resource Recovery Park (WGRRP) is located within Wollongong local government area, approximately 12 kilometres southwest of Wollongong CBD. The existing topography of the area consists of coastal plains with the landscape character of the area defined by a system of valleys and streams flowing into Lake Illawarra with the forest-covered Illawarra Escarpment forming a visually prominent backdrop (**Figure. 1**)

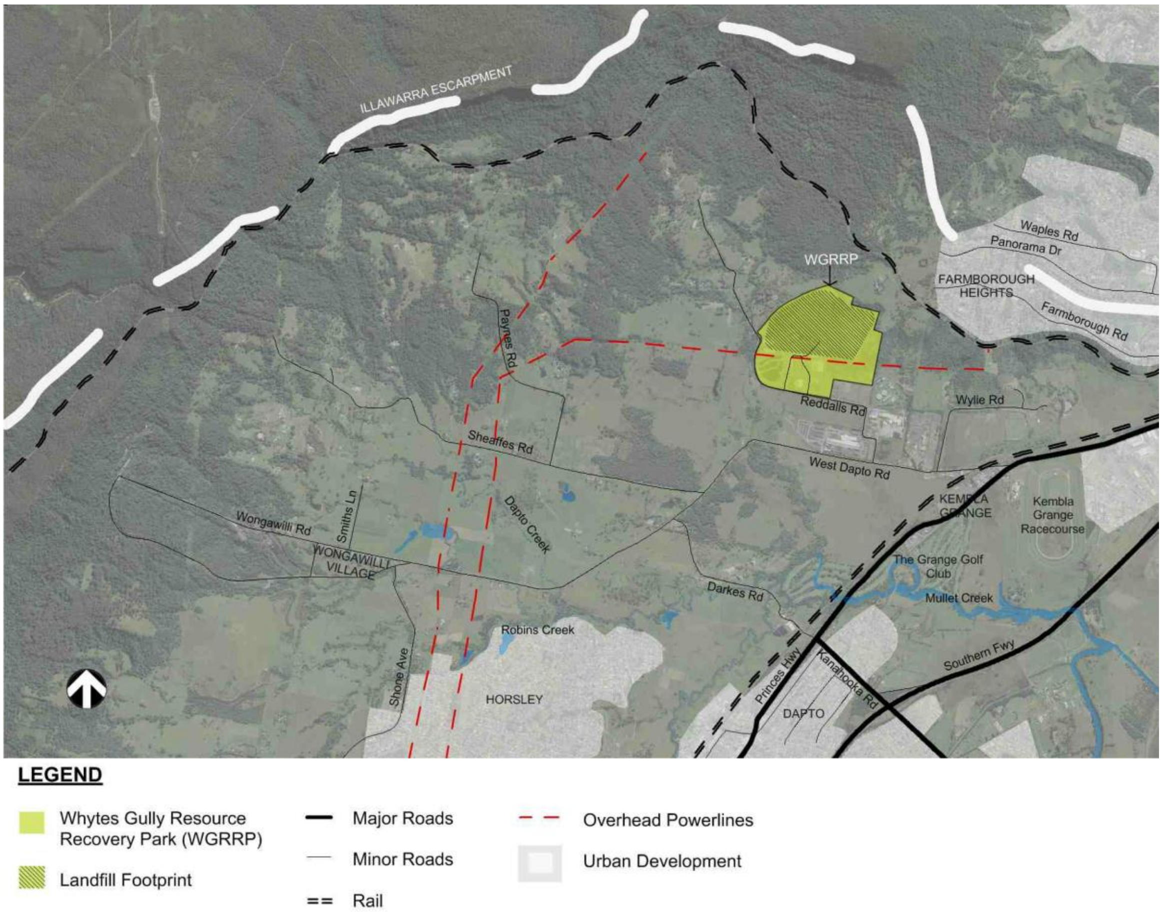

FIGURE 1 - REGIONAL CONTEXT

Covering an area of 65 hectares, the WGRRP is located on topography that rises from an elevation of approximately 20 metres RL along the southern edge to an elevation of approximately 100 m at the north east where the site adjoins one of the spurs of the Illawarra Escarpment. The existing visual elements of the site include the Western Gully and Eastern Gully landfill cells, leachate and surface water ponds, internal road network and associated buildings and vegetation. High voltage powerlines with steel lattice pylons run east west across the site. The site is predominantly cleared in the areas of operation with pockets of remnant and planted vegetation extending from the north east corner of the site to the edge of the existing landfill, along the north west corner and a ridgeline extending from the eastern boundary to the edge of the Eastern Gully Landfill. The most significant change to the visual landscape character of the project site has resulted from vegetation clearing and the landfill operations that have created grass covered slopes associated with the Western Gully and Eastern Gully landfill cells.

The area surrounding WGRRP contains land uses that include a mix of rural residential properties located upslope of the site and set amongst natural forest vegetation to the north and north west. Predominantly industrial facilities are located to the south and south east with scattered rural properties on low lying pastoral grassland and small patches of remnant vegetation to the south west. Creeks and associated floodplains occur over extensive areas of the coastal plain adjoining the WGRRP. Kembla Grange Racetrack is located south east of the WGRRP and residential development in the vicinity includes Horsley, Dapto, Farnborough Heights and the village of Wongawilli.

Substantial new urban development is proposed to take place within the visual catchment of the WGRRP in accordance with the West Dapto Structure Plan. The most significant development will occur to the south west of the WGRRP where predominantly rural land uses on small holdings will be developed for industrial and employment uses. Urban development will be predominantly residential and take place in the vicinity of West Dapto Road and Sheaffes Road. A view from the top of the existing landfill across the area of future industrial and residential development is presented in **Figure 2**.

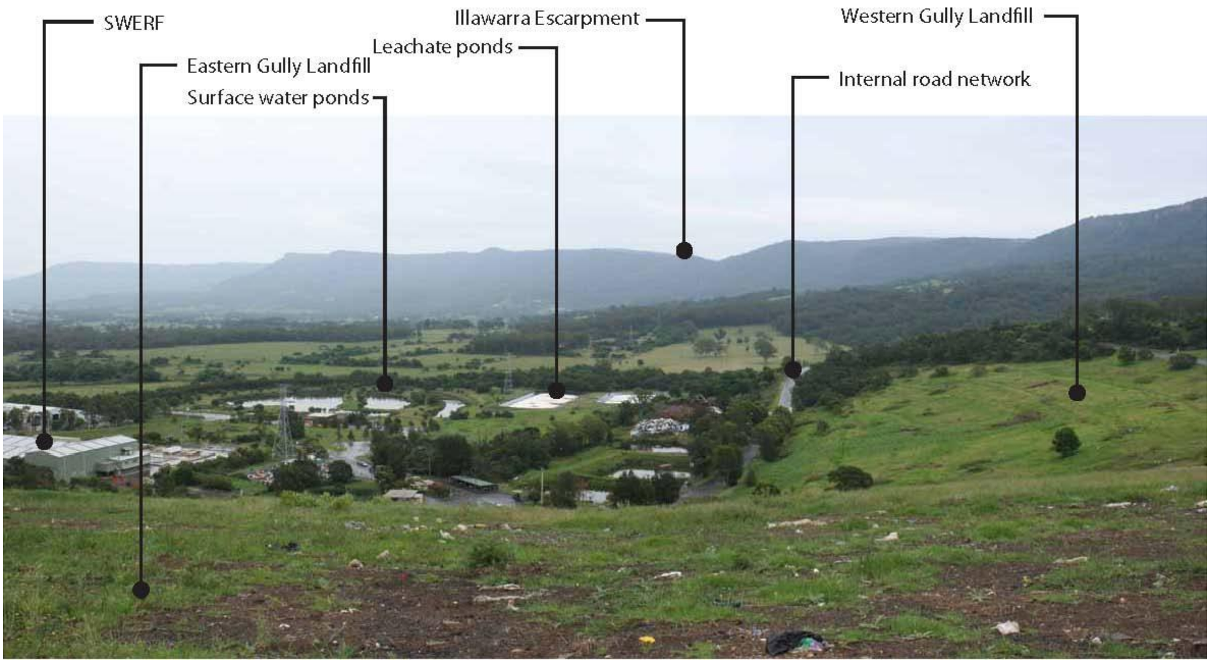

FIGURE 2 - VIEW FROM TOP OF EXISTING LANDFILL TO SOUTH WEST

3.0 VISUAL IMPACT ASSESSMENT METHODOLGY

The Methodology used to assess the significance of the potential visual impact of the proposed new cell of the WGRRP operations is illustrated in the following diagram.

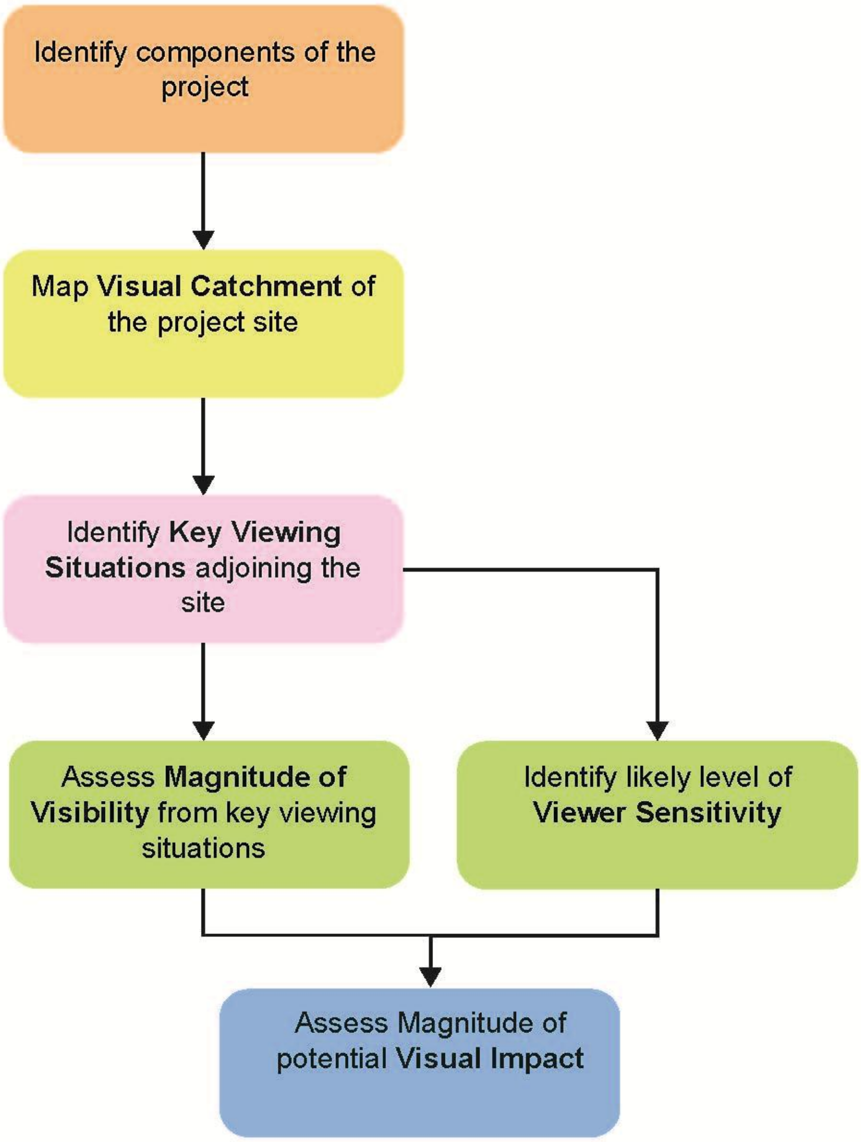

FIGURE 3 - VISUAL IMPACT ASSESSMENT METHODOLOGY

The Methodology involves identifying the extent to which the landfill operations would potentially be visible, which is referred to as the Primary Visual Catchment, key viewing situations, the **(Magnitude of Visibility)** from the Key Viewing Situation and the sensitivity of viewers who would potentially see the landscape changes resulting from the landfill operations **(Viewer Sensitivity).** These two components of Visibility and Sensitivity are then combined to determine the **Magnitude of potential Visual Impact** of the proposed landfill operations.

4.0 PRIMARY VISUAL CATCHMENT (VIEWSHED) ASSESSMENT

The approximate extent to which the landfill operations associated with the new cell will be visible from surrounding areas, referred to as the Primary Visual Catchment (Viewshed), is indicated on **Figure 4**. It should be noted that this is an approximate area in which the landfill landform will be partly or wholly visible. Also the top of the new landfill landform may be partially visible from some hill tops located beyond the Visual Catchment while lower slopes are not visible. Visibility of the landfill from a particular location within the Visual Catchment (Viewshed) may be partly or fully blocked by vegetation, structures or local landforms located close to the viewer.

The new landform to be created by the proposed landfill operations will form the primary visual component that will potentially be visible from surrounding locations. The landform is designed to reach a height that will approximately match the final height of the Eastern Gully landfill. The visual impact assessment is therefore focused on this component while considering the visibility of other elements associated with the proposed new landfill cell.

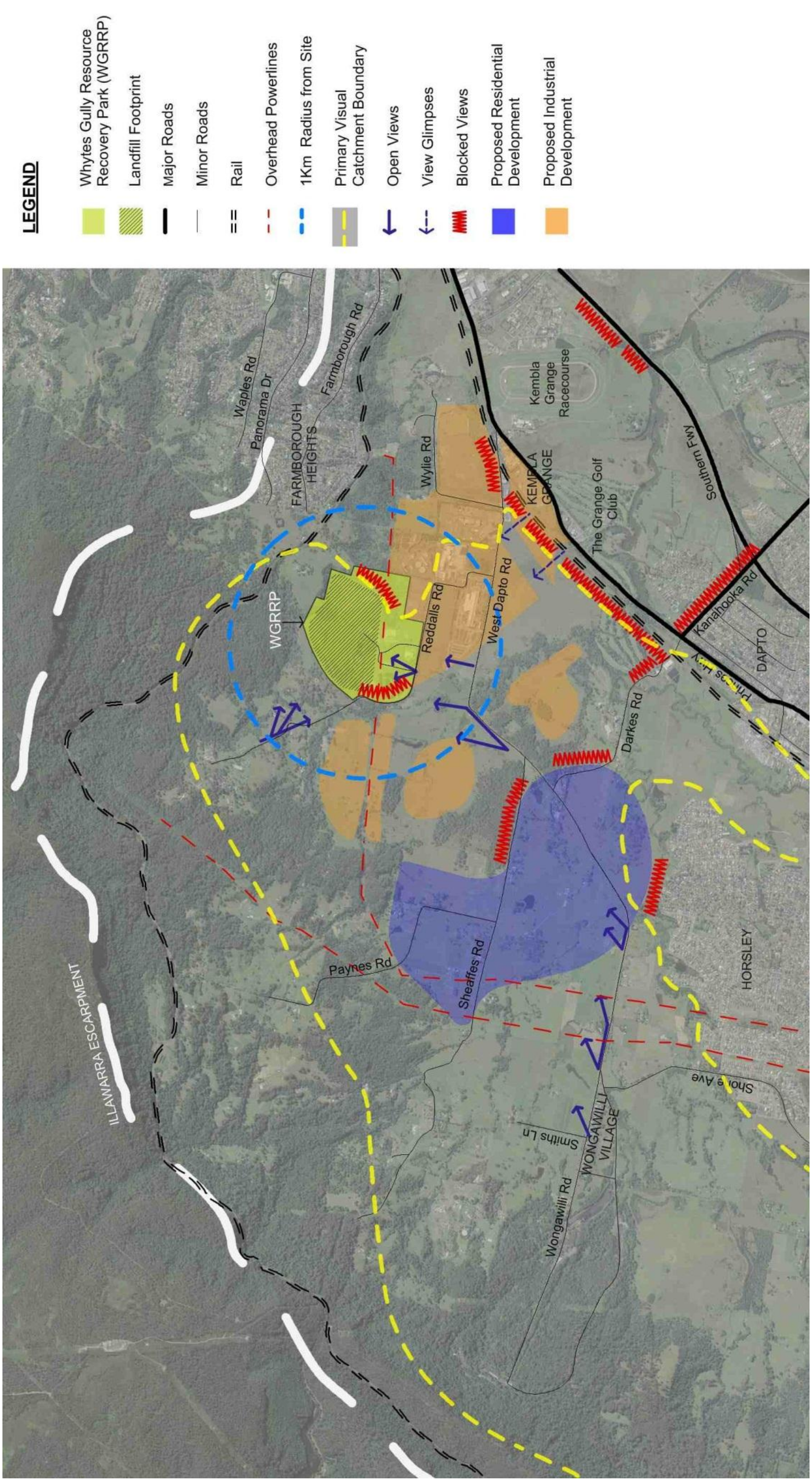

FIGURE 4 - VISUAL CATCHMENT ANALYSIS

5.0 VIEW SITUATIONS DESCRIPTIONS

The site inspection carried out as part of the Visual Assessment identified a number of View Situations from which the current landfill operations are either partly or fully visible. The assessment process involved analysis of views from public roads to identify the extent to which the existing landfill is visible. An assessment was also made of the likely extent of views from houses and other buildings adjoining the road where it was not feasible to visit the private residences to check the potential views. The potential extent of views from residences was cross checked by reference to panoramic photographs taken from the top of the existing landfill landform. View Situations are identified on **Figure 5**. and results of the visual analysis are presented in the following sections.

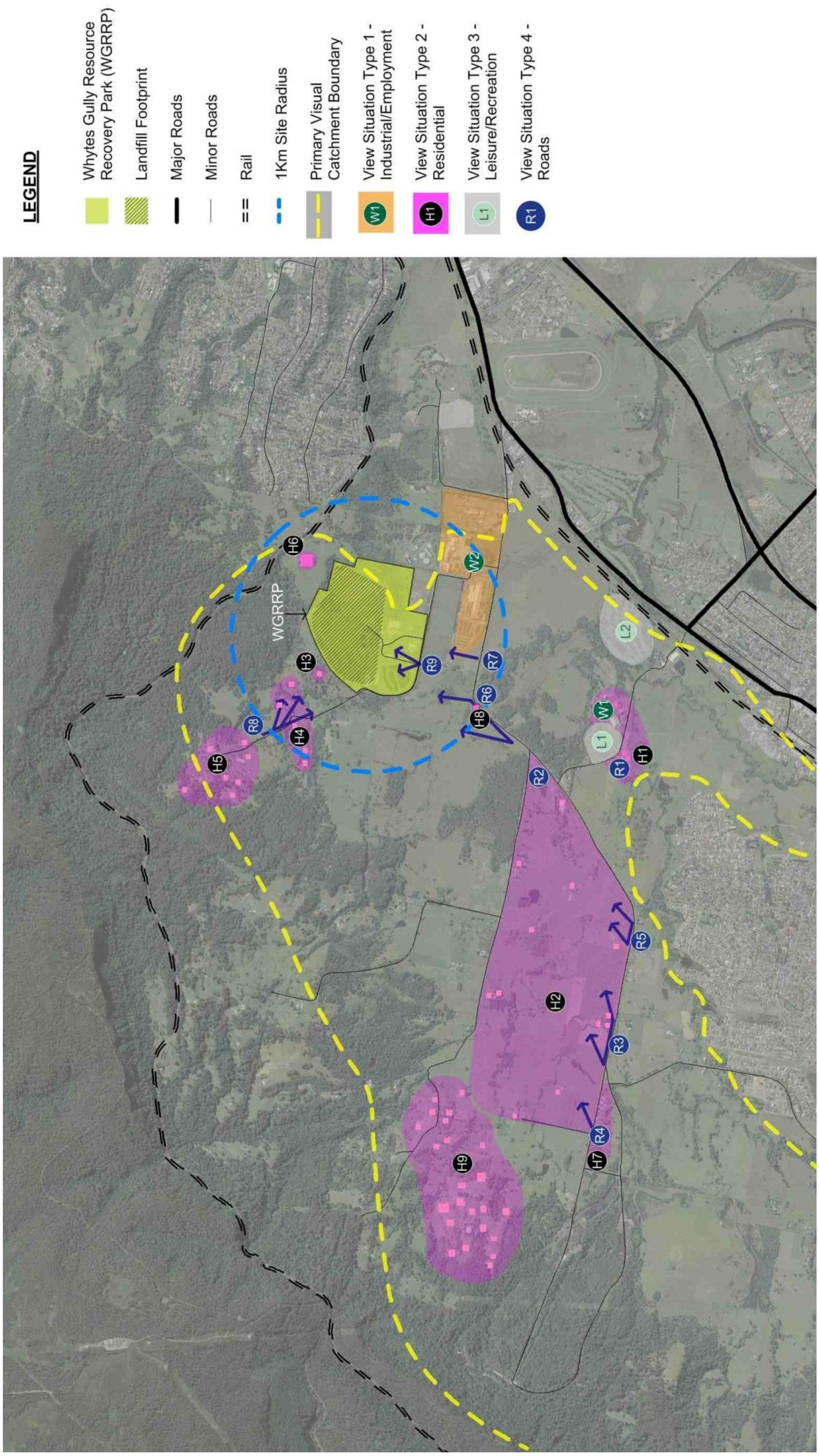

FIGURE 5 –VIEW SITUATIONS

View Situation R1 - Darkes Road south of WGRRP

Existing views include:

- view looking north east along Darkes Road towards the WGRRP which is visually screened by woodland vegetation in mid-distance;
- foreground views of open grassland and long distance views to ridgeline;
- overhead powerlines are visible along roadway;
- viewer categories include motorists (R1)

FIGURE 6 - VIEW NORTH EAST ALONG DARKES ROAD TOWARDS WGRRP

View Situation R2 - West Dapto Road approaching intersection of Darkes Road south west of WGRRP

Existing views include:

- down-slope view along West Dapto Road looking north east toward WGRRP;
- long distance views with glimpses of Illawarra Escarpment on skyline and WGL visually screened by trees;
- new concrete power poles and old overhead powerlines are prominent along both sides of the roadway;
- viewer categories include motorists (R2) and residents (H2).

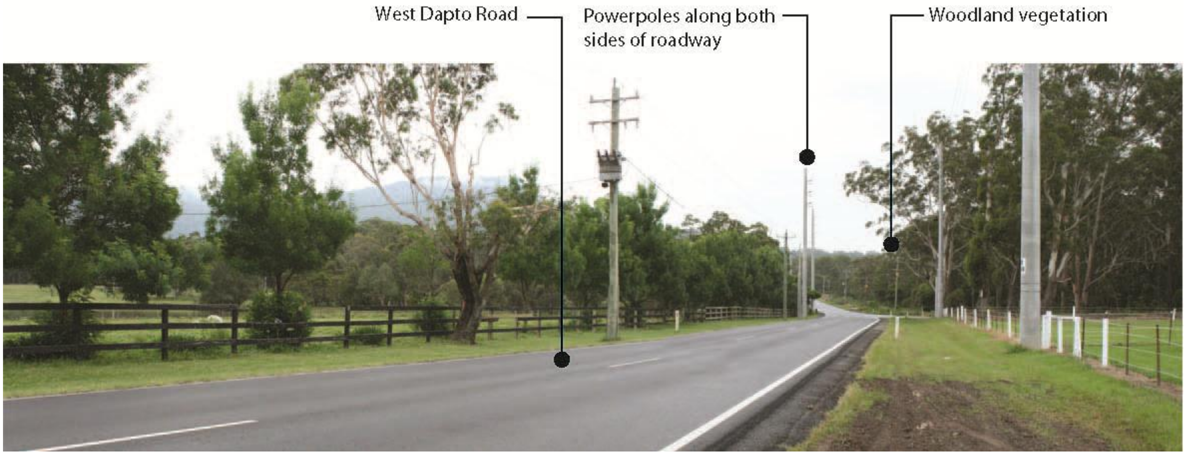

FIGURE 7 - VIEW NORTH EAST ALONG WEST DAPTO ROAD NEAR DARKES ROAD INTERSECTION

View Situation R3 – West Dapto Road east of intersection with Shone Avenue.

Existing views include:

- open views north east across low lying paddocks towards WGRRP;
- long distance views blocked by combination of landform and vegetation;
- high voltage powerlines are visible in the mid-ground;
- viewer categories include motorists (R3) and residents (H2).

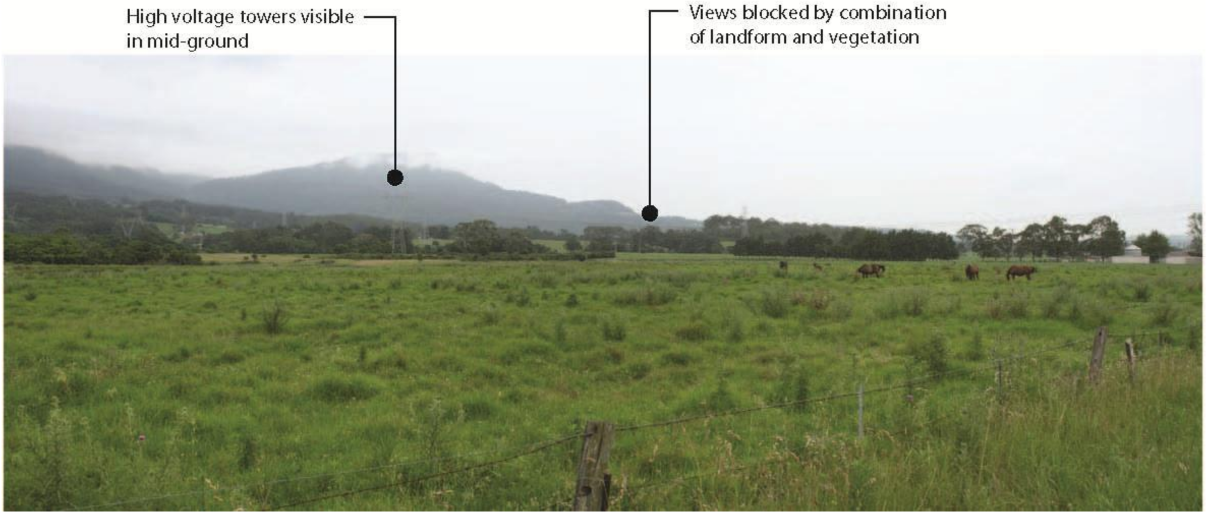

FIGURE 8 - VIEW NORTH EAST FROM WEST DAPTO ROAD / SHONE ROAD INTERSECTION TO WGRRP

View Situation R4 – West Dapto Road near Wongawilli Village

Existing views include:

- partial view of existing slopes of WGRRP with forest-covered Illawarra Escarpment on skyline ;
- partial view of landfill slope between tree canopies in mid-ground and long distance ;
- viewer categories include local motorists (R4) and residents (H7).

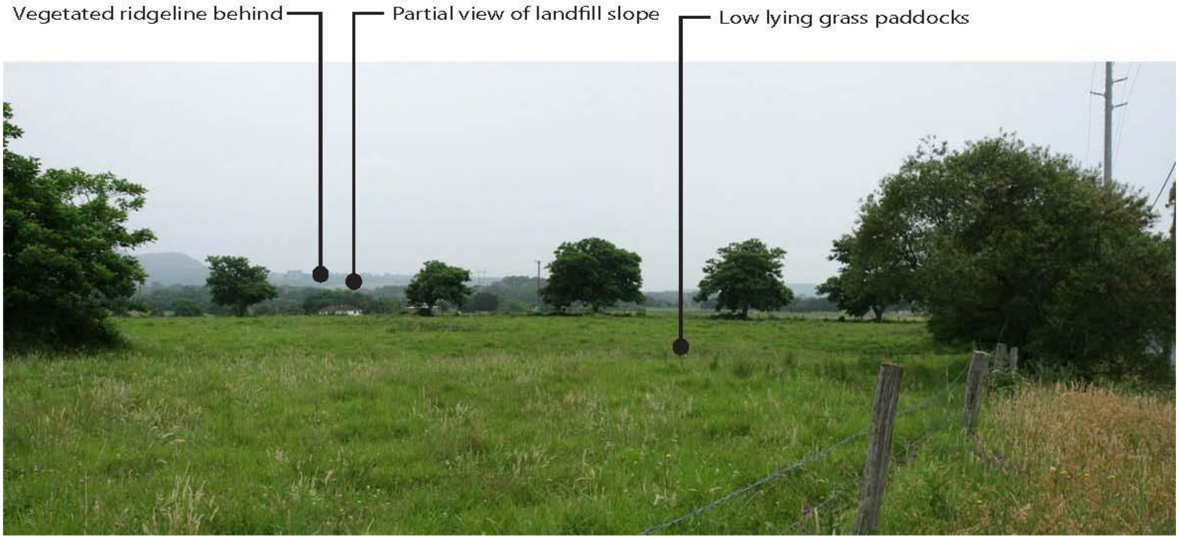

FIGURE 9 - VIEW NORTH EAST TOWARDS WGRRP FROM WEST DAPTO ROAD AT WONGAWILLI VILLAGE

View Situation R5 – West Dapto Road travelling east towards Darkes Road

Existing views include:

- view to north east across gently undulating paddocks towards WGRRP with existing landfill slope partially visible and forest-covered Illawarra Escarpment on skyline;
- trees in mid-ground and long distance partially block view of landfill slope;
- viewer categories include motorists (R5) and residents (H2).

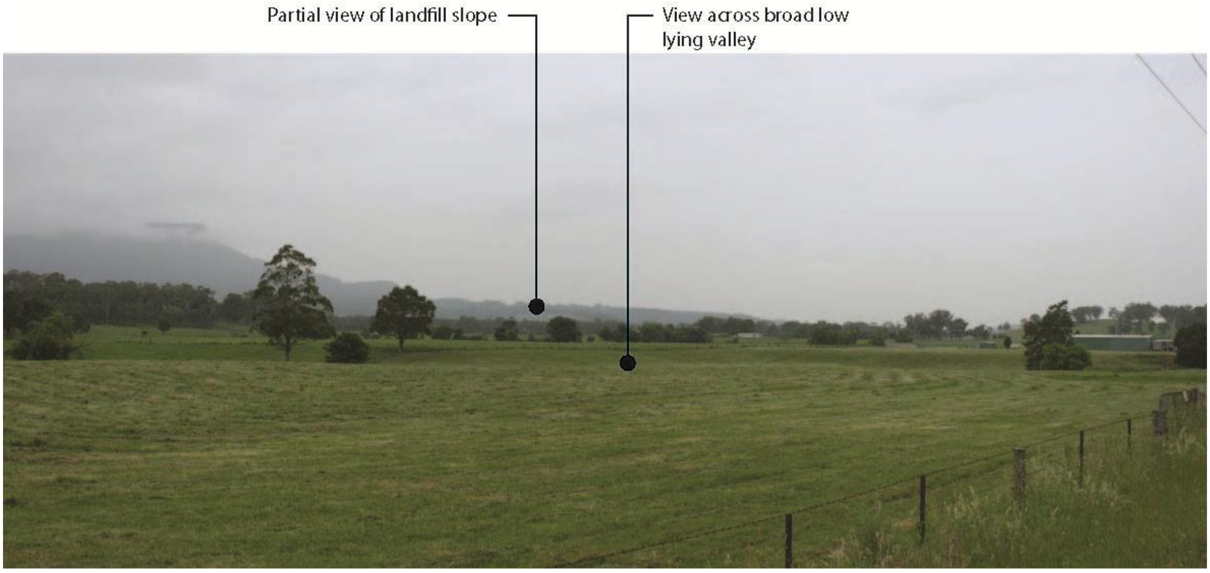

FIGURE 10 - VIEW NORTH EAST TO WGRRP FROM WEST DAPTO ROAD NEAR SHEAFFES ROAD

View Situation R6 – West Dapto Road travelling north east towards Reddalls Road

Existing views include:

- view along roadway to north east towards with upper portion of WGRRP landform visible and forest-covered Illawarra Escarpment on skyline;
- new concrete and old power poles visually prominent along both sides of the roadway;
- viewer categories include motorists (R6) and residents (H8).

FIGURE 11 - VIEW NORTH EAST FROM WEST DAPTO ROAD TOWARDS WGRRP

View Situation R7– West Dapto Road travelling east near One Steel plant

Existing views include:

- view to north from roadway towards WGRRP with upper portion of landfill slope visible and forest-covered Illawarra Escarpment on skyline;
- mix of large canopy trees, buildings and materials storage at One Steel plant are visible in mid-ground;
- high voltage powerline steel lattice pylon visible on spur adjoining the WGRRP site;
- viewer categories include motorists (R7) and One Steel workers (W2).

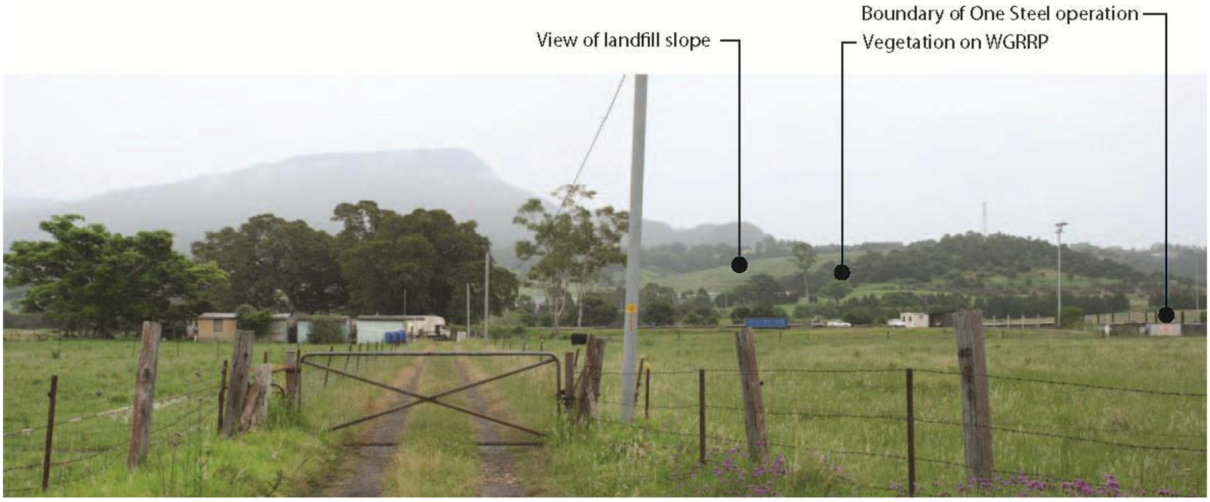

FIGURE 12 - VIEW NORTH FROM WEST DAPTO ROAD APPROACHING ONE STEEL SITE TOWARDS WGRRP

View Situation R8 – Reddalls Road

Existing views include:

- elevated view looking south east towards WGRRP is generally blocked by tree-covered spur, but top of landfill slope partially visible;
- rooftop of One Steel plant visible in long distance;
- viewer categories include local motorists travelling along Reddalls Road (R8) and residents (H5).

FIGURE 13 - VIEW SOUTH EAST ALONG REDDALLS ROAD TOWARDS WGRRP SITE

View Situation R9 – Reddalls Road at WGRRP Entrance

Existing views include:

- short distance view looking north to grass-covered landfill slope with clumps of trees and shrubs and forest-covered Illawarra Escarpment on skyline;
- foreground views include wide entrance road with kerb & gutter, weighbridge and signage;
- overhead high voltage powerlines visible;
- forest-covered ridge and Illawarra Escarpment on skyline;
- viewer categories include motorists (R9).

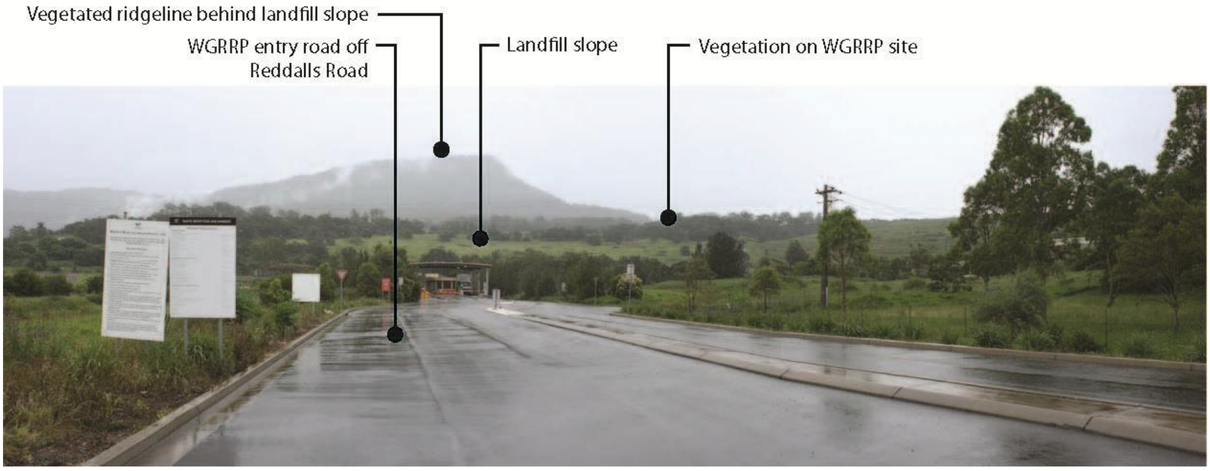

FIGURE 14 - VIEW NORTH FROM ENTRY TO WGRRP FROM REDDALLS ROAD

6.0 MAGNITUDE OF VISIBILITY

The Visibility of the proposed landfill operations associated with the new cell will be influenced by a combination of factors that include:

- the extent of areas from which the components of the landfill operations are visible;
- number and type of viewers of the landfill operations;
- distance of the view;
- duration of the view;
- scale of change to the view resulting from the landfill operations (i.e. proportion of the view occupied by the proposed development); and
- the degree of contrast between the visible portion of the landfill operations and the existing landscape elements in terms of form, scale, line, height, colour and texture.

The various criteria used to assess the level of visibility are summarised in **Table 1**.

TABLE 1 - VIEW SITUATION ASSESSMENT CRITERIA

Criteria	Definition
View Distance	
Long	> 5km
Medium	2-5km
Short	1 – 2 km
Very short	<1 km
Period of View	
Long term	>2 hrs
Medium term	1 minute to 2 hrs
Short term	<1 minute
Number of Viewers	
High	>5,000 people per day
Moderate	1,000-5,000 people per day
Low	100-1,000 people per day
Very low	<100 people per day

The combination of relevant criteria from Table 1. for a particular viewing situation is used to determine The Magnitude of Visibility for that viewing situation from **Table 2**.

TABLE 2 - MAGNITUDE OF VISIBILITY MATRIX

	Long Distance			Medium Distance			Short Distance			Very Short Distance		
Period of View L=long, M=medium, S=short	**L**	**M**	**S**	**L**	**M**	**S**	**L**	**M**	**S**	**L**	**M**	**S**
No. of viewers – High	M	L	L	H	M	M	H	H	M	H	H	H
No. of viewers - Medium	L	L	N	M	M	L	H	M	M	H	H	M
No. of viewers – Low	L	N	N	M	L	L	M	M	L	H	M	M
No. of viewers – Very Low	N	N	N	L	N	N	L	L	L	M	L	L

Visibility Magnitude: N= negligible L= low M=medium H= high

The four categories of Magnitude of Visibility are defined below.

- **Negligible (N)** - very minor loss or alteration to one or more key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that are not uncharacteristic to the existing landscape (i.e. approximating the 'no change' situation).
- **Low (L)** - minor loss of/or alterations to one or more key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that are not uncharacteristic of the existing landscape.
- **Medium (M)** - partial loss of or alteration to one or more key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic of the existing landscape.
- **High (H)** - total loss of key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements considered to be totally uncharacteristic of the existing landscape.

The relevant criteria defined in Table 1. are applied to each View Situation to determine the Magnitude of Visibility of the proposed landfill and are presented in **Table 3**.

TABLE 3 - MAGNITUDE OF VISIBILITY OF PROPOSED WGRRP EXPANSION

View Situation	View Distance to WGRRP	Category of Viewers	Approx. Period of View	Relative No. of Viewers	Magnitude of visibility
ROADS					
(R1) Darkes Road south of WGRRP	Medium 2.3 km	Motorists	Short	Med	Low
(R2) West Dapto Road toward intersection of Darkes Road , south west of WGRRP	Short 1.9 km	Motorists	Short	Med	Medium
(R3) – West Dapto Road travelling east from intersection with Shone Avenue , south-east of WGRRP	Medium 3.5 km	Motorists	Short	Mod	Low
(R4) – West Dapto Road travelling east through Wongawilli Village	Medium 3.7 km	Motorists	Short	Mod	Low
(R5) - West Dapto Road travelling east towards Darkes Road	Medium 3.2 km	Motorists	Short	Mod	Low
(R6)– West Dapto Road travelling north east towards Reddalls Road	Short 1.3 km	Motorists	Short	Mod	Medium
(R7) – West Dapto Road travelling east approaching One Steel site	Very Short 1 km	Motorists	Short	Mod	Medium
(R8)– Reddells Road travelling south	Short 1.2 km	Local Motorists	Short	Very Low	Low
(R9) - Reddalls Road at entry road to WGRRP	Very Short 0.3 km	Motorists including WGRRP related traffic	Medium	Mod	Medium
HOUSES					
(H1) Residences (4) along Darkes Road	Medium 2.2 km	Residents	Long	Very Low	Low
(H2) Residences (12) between West Dapto Road & Sheaffes Road	Medium 2.1 km - 3.9 km	Residents	Long	Very Low	Low
(H3) Lucas Residence	Very Short 0.1 km	Resident	Long	Very Low	Medium
(H4) Residences (6) on Reddalls Road less than 1 km from WGRRP	Very Short 0.4-0.9 km	Residents	Long	Very Low	Medium
(H5) Residences (7) on Reddalls Road more than 1 km from WGRRP	Short 1.1 to 1.3 km	Residents	Long	Very Low	Low
(H6) Farnborough Farm	Very Short 0.2 km	Resident	Long	Very Low	Medium

View Situation	View Distance to WGRRP	Category of Viewers	Approx. Period of View	Relative No. of Viewers	Magnitude of visibility
(H7) Residences of Wongawilli Village	Medium 2km -4.1 km	Residents	Long	Low	Medium
(H8) Residence on West Dapto Road	Short 1.1km	Resident	Long	Very Low	Low
(H9) Residences (23) west of Smiths Lane & Sheaffes Road	Medium 4.2- 4.7km	Residents	Long	Very Low	Low
WORK PLACES					
(W1) Employment Place (Darkes Road Automotive)	Medium 2.2 km	Workers	Medium	Very Low	Negligible
(W2) Industry in West Dapto Road and Reddalls Road including One Steel	Very Short 1 km	Workers	Medium	Low	Medium
RECREATION & PUBLIC PLACES					
(L1) Integral Energy Recreation Park and Motor Museum, Darkes Road	Medium 2.2 km	Visitors to Motor Museum and recreation users	Medium	Low	Low
(L2) The Grange Golf Course	Short 2km	Players	Medium	Low	Medium
(L2) Soccer Fields & amenities in Wylie Road	Short 1.4km	Players and spectators	Medium	Low	Medium

7.0 VIEWER SENSITIVITY

Viewer Sensitivity is defined as the extent to which a viewer is able and/or willing to accept the change to the existing view that would result from the proposed new landfill cell, without perceiving it as an adverse impact on the existing landscape character or visual quality. Viewer Sensitivity is influenced by a combination of:

- location and context of the view (e.g. residences, workplaces, recreation/open space areas, roads/highways);
- expectations and activities of the viewer (e.g. resident relaxing at home, people engaged in work activities, motorists travelling, people participating in recreation/sporting activities); and
- importance of the view (e.g. is it identified as a regional scenic resource, referenced in tourist maps/guides, numbers of people deliberately seeking the view, reference to the view in literature and media).

Those with the highest levels of Viewer Sensitivity are generally considered to include:

- residents with views affected by the proposed landfill operations;
- users of public open space where their attention is focused on visual landscape values (e.g. scenic lookouts, natural landscape areas with attractive views); and
- communities in which the proposed landfill operation would result in changes to the landscape setting of views that are valued by the community.

Those with the lowest Viewer Sensitivity are likely to be:

- workers who are focused on work activities;
- motorists whose attention is focused on driving; and
- participants actively engaged in outdoor sporting activities.

The main categories of potential viewers relevant to the proposed new landfill cell project are motorists travelling on public roads, residents, workers at employment places, participants and spectators at sporting and recreation facilities located in the vicinity of the WGRRP. While residents are generally considered to have a high Viewer Sensitivity the visual assessment has determined that views of the proposed landfill will be generally blocked or only partially visible from homes situated more than 1 km from the landfill due to visual screening by existing vegetation, buildings and/or landforms. Residents with a high Viewer Sensitivity would be those located close to WGRRP. Motorists, travelling on public roads and workers are generally considered to have a low level of Viewer Sensitivity.

8.0 VISUAL IMPACT ASSESSMENT

The landform that will be created by the proposed new landfill cell will form the primary visual change to the landscape. The potential Magnitude of Visual Impact that is predicted to result from the new landfill cell has been determined by combining the Magnitude of Visibility with the level of Viewer Sensitivity in accordance with the Matrix in **Table 4**.

TABLE 4 - VISUAL IMPACT MAGNITUDE MATRIX

Magnitude of Visibility	Viewer Sensitivity		
	Low	Medium	High
High	Moderate	Moderate/High	High
Medium	Low/Moderate	Moderate	Moderate /High
Low	Low	Low/Moderate	Moderate
Negligible	Negligible	Negligible/Low	Low

The Magnitude of Visibility and Viewer Sensitivity assessed for each View Situation are listed in **Table 5**. together with the Visual Impact Magnitude that was determined in accordance with **Table 4**.

The various levels of 'Visual Impact Magnitude' applied in the assessment process are defined below. These definitions have been adapted from those presented in 'Guidelines for Landscape and Visual Impact Assessment' prepared by The Landscape Institute and Institute of Environmental Management and Assessment in the UK (Landscape Institute, 2002).

- **Negligible Visual Impact** - only a very small part of the new landfill cell would be discernible and/or it would be located at such a distance that it would be scarcely visible;
- **Low Visual Impact** - the new landfill cell would constitute only a minor component of the wider view and might be missed by the casual observer; awareness of the development would not have a marked effect on the overall quality of the view;
- **Moderate Visual Impact** - the new landfill cell may form a visible and recognisable new element within the overall scene and may be readily noticed by an observer; and
- **High Visual Impact** – the new landfill cell would form a significant and immediately apparent part of the view that would affect and change its overall character (the change may be positive or negative).

TABLE 5 - VISUAL IMPACT ASSESSMENT FOR VIEW SITUATIONS

View Situation	Magnitude of Visibility	Viewer Sensitivity	Visual Impact Magnitude	Comments
ROADS				
(R1) Darkes Road south of WGRRP	Low	Low	Low	Potential views of proposed landfill will generally be blocked by woodland vegetation
(R2) West Dapto Road toward intersection of Darkes Road , south west of WGRRP	Low	Low	Low	Potential views of proposed landfill will generally be blocked by woodland vegetation
(R3) – West Dapto Road travelling east from intersection with Shone Avenue , south-east of WGRRP	Low	Low	Low	Potential views of proposed landfill will be blocked by combination of landform and vegetation
(R4)– West Dapto Road travelling east through Wongawilli Village	Low	Low	Low	A portion of proposed landfill will be visible but partially blocked by mid-ground vegetation.
(R5) - West Dapto Road travelling east towards Darkes Road	Low	Low	Low	Portion of proposed landfill will be visible but partially blocked by vegetation in mid-ground and long distance
(R6)– West Dapto Road travelling north east towards Reddalls Road	Low	Low	Low	View of proposed landfill slope will be visible will have backdrop of well vegetated ridgeline
(R7) – West Dapto Road travelling east approaching One Steel site	Medium	Low	Low/Mod	Close upslope potential view of proposed landfill will have backdrop of well vegetated ridgeline
(R8)– Reddalls Road travelling south	Low	Low	Low	Potential distant view of the top of new landfill slope but most of view will be blocked by tree covered spur.
(R9) - Reddalls Road at entry road to WGL	Medium	Low	Low/Mod	Proposed landfill landform will be visible
HOUSES				
(H1) Residences (4) along Darkes Road	Low	Medium	Low/Mod	Potential views of proposed landfill will generally be blocked by woodland vegetation
(H2) Residences (18) between West Dapto Road & Sheaffes Road	Low	Medium	Low/Mod	Slope of proposed landfill will generally be visible but vegetation in mid-ground and long distance will provide partial screening
(H3) Lucas Residence on Reddalls Road	Medium	High	Mod/high	Proposed landfill landform will be highly visible from house currently viewing the existing landfill.

View Situation	Magnitude of Visibility	Viewer Sensitivity	Visual Impact Magnitude	Comments
(H4) Residences (6) on Reddalls Road less than 1 km from WGRRP	Medium	High	Mod/high	Proposed landfill landform will be visible from houses currently viewing the existing landfill.
(H5) Residences (4) on Reddalls Road more than 1 km from WGRRP	Low	Medium	Low/Mod	Proposed landfill landform will mostly be blocked by tree covered spur in the mid-ground. Top of the landfill may be partially visible from houses currently viewing the existing landfill.
(H6) Farnborough Farm	Medium	High	Mod/high	Proposed landfill landform will be visible from the house.
(H7) Residences of Wongawilli Village	Medium	Medium	Mod	Distant View of proposed landfill will be visible but partially blocked by mid-ground vegetation.
(H8) Residence on West Dapto Road	Low	Medium	Low/Mod	Proposed landfill landform will be visible from house currently viewing the existing landfill.
(H9) Residences (23) west of Smiths Lane & Sheaffes Road	Low	Medium	Low/Mod	Distant View of proposed landfill partially blocked by vegetation
WORK PLACES				
(W1) Employment Place (Darkes Road Automotive)	Negligible	Low	Negligible	Proposed landfill will be barely visible from the workplace
(W2) Industry in West Dapto Road and Reddalls Road including One Steel	Medium	Low	Low/Mod	Proposed landfill will be visible
RECREATION & PULIC PLACES				
(L1) Integral Energy Recreation Park and Motor Museum, Darkes Road	Low	Low	Low	Potential views of proposed landfill will generally be blocked by woodland vegetation
(L2) The Grange Golf Course	Medium	Low	Low/Mod	Potential view of proposed landfill will generally only be visible from the portion of the course on northern side of the Princes Highway. The other portion will be screened by vegetation adjoining the northern side of the Princes Highway.

Summary of Potential Visual Impacts

The components of the proposed landfill operations associated with the new cell will involve similar operations to those currently being carried out. However, the project will result in changes to the existing site with the largest visible component of the project being the new landform to be developed over the existing landfill. While the proposed development will minimise the potential footprint of the new landfill, it will be considerably larger and higher than the existing two landfill cells. The current top of the landfill is approximately 85 m RL near the eastern end of the site. The proposed landfill will involve extending from east to west across the site and raising the height of the existing landfill cells to a maximum of approximately 110m RL. The proposed new landfill will involve reconfiguring and /or upgrading of existing infrastructure, including the leachate ponds, leachate treatment plant and surface water ponds.

Clearing of existing vegetation will contribute to the visual impact. However, the most visible component of the landfill operations will result from the contrast in colour between the unvegetated landfill cover material and the adjoining vegetated slopes. This contrast will decrease as vegetation cover is progressively established on the landfill slopes and the visual character becomes similar to grass covered slopes on adjoining areas. The Magnitude of Visibility will therefore decline over time as the revegetation cover is established.

The visual screening currently provided by vegetation and landform results in the WGRRP generally not being fully visible from most of the public roads in the vicinity of the site. While the landfill will be visible from sections of public road closer to WGRRP (R7), the views from most sections of public road are blocked by a combination of buildings associated with existing light industry and landforms and trees. The highest visibility from a public road will occur at the entry road to WGRRP (R9).

9.0 PHOTOMONTAGE

Results of the Visual Impact Assessment indicate that a low to moderate potential impact will occur on a relatively short section of West Dapto Road (R7). To illustrate how the existing view from this location would change as a result of the proposed new landfill cell the following photomontages have been prepared.

Three images are presented; the first shows the existing situation, the second shows the proposed landfill landform after completion and revegetated with a grass cover and the third shows it re-vegetated with mix of grass cover and shrubs and small trees in accordance with the Landscape Strategy. It should be noted that only a small proportion of the landfill slope will be un-vegetated at any one time and rehabilitation will be carried out progressively as each 'lift' of the landfill has been completed.

The photomontage does not take account of the potential screening effect that would be created by construction of new industrial buildings and growth of tree and shrub vegetation in the foreground area between the road and WGRRP. It is likely that the view from this section of road towards WGRRP will be blocked by proposed industrial development and associated landscape works.

FIGURE 15 - EXISTING SITUATION (R7)

FIGURE 16 - PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AFTER INITIAL GRASS COVER

FIGURE 17 - PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AFTER REVEGETATION

10.0 PROPOSED MITIGATION MEASURES

The overall potential visual impact of the proposed new cell at WGRRP has been assessed as generally low to moderate subject to the following mitigations measures being implemented to ensure the visual impact will be kept to a minimum.

- minimise the area of un-vegetated landfill slope, both permanent and temporary, by staging the operations and progressively establishing a vegetation cover on each section of slope as they are completed;
- implement a Landscape Strategy that includes establishment of clumps of shrubs and trees on portions of the upper slopes and top of the new landform combined with areas of grass that maintain open views from the top of the landform and visually integrates the site with the surrounding topography and landscape character;
- design drainage channels on landfill slopes to minimise their visibility by using dark coloured stone;
- adopt dark toned colours for structures to minimise their visual contrast with surrounding landscape; and
- consult with adjoining residents (H3, H4 & H6) to discuss the potential for planting to be carried out close to their houses to screen potential views of the new landfill cell.

11.0 CONCLUSION

This visual assessment of the proposed new landfill cell at WGRRP concludes that the visual impact on surrounding areas will generally be low but in a limited number of situations the impact is predicted to be medium to high. The potential visual impact results from a combination of factors that include:

- the limited number of situations from which the proposed new landfill cell will be visible from public roads due to the visual screening generally provided by existing vegetation, landform and buildings;
- the limited number of houses within 1km of the site that will have views of the proposed landfill operations due to the visual screening provided by existing landform and vegetation;
- relatively moderate to low traffic flows along the sections of public road from which the WGRRP site is visible, combined with the relatively short periods of view;
- the generally low elevation and gently undulating valley in which a large portion of the viewers of the WGRRP will be located, which results in long distance views often being screened by vegetation, buildings or local landforms in the foreground and mid distance and prominent vegetation covered ridgeline against the skyline;
- the elevation and shape of the landform to be created by the new landfill cell that will be visually compatible with the existing landforms that occur in the adjoining areas;
- establishment of vegetation on the landfill slopes as part of the site rehabilitation program will progressively reduce the visual contrast between the landfill operations and the surrounding rural landscape; and
- where the new landfill slopes will be visible, they will appear as an extension and expansion of the existing landform and vegetation cover.

WHYTES GULLY RESOUCE RECOVERY PARK

PROPOSED NEW LANDFILL CELL VISUAL IMPACT ASSESSMENT

SUPPLEMENTARY REPORT

22 June 2012

prepared for

Golder Associates Pty Ltd

by

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Date	Issue	Status	Signed
13.06.12	Issue A	Preliminary Draft	
20.06.12	Issue B	Draft	
22.06.12	Issue C	Final	

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1. Introduction

This Supplementary Report provides additional information to Appendix K, Visual Amenity Assessment of the Environmental Assessment prepared by Golder Associates for the proposed new landfill cell at the Whytes Gully Resource Recovery Park (WGRRP). The information presented has been prepared in response to a request from the NSW Department of Planning for additional graphic material to illustrate the potential visibility of the proposed works in relation to residents at locations H3, H4 and H6, which were identified as moderate/high impact potential in Appendix K. The Department indicated that photomontages would be appropriate to illustrate the potential visibility of the works from these residences.

In order to obtain photographs suitable for use in preparing photomontages, permission for access to the properties was requested in letters sent by Golder Associates to the occupants.

The owner of the Lucas Residence on Reddalls Road (View Situation H3) agreed to allow access. Although there are 6 residences within View Situation H4, only the owner of 216 Reddalls Road responded within the nominated time frame and agreed to allow access. The owner of 231 Reddalls Road responded and agreed after the additional site inspection had been carried out by Corkery Consulting. The owner of Farmborough Farm (H6) did not respond and consequently this property could not be accessed. A review of the Visual Impact Assessment was conducted for Viewing Situations H3, H4 and H6 as documented in the following sections.

2. Visual Assessment

An additional site visit was carried out by Noel Corkery and Terry Boyle from Corkery Consulting on 7 June 2012. The two properties that had provided access approval within the timeframe were visited and photos taken. Where properties could not be accessed, photos were taken from the nearest section of public roadway. The locations of properties covered in this Supplementary Report are shown in Figure 1.

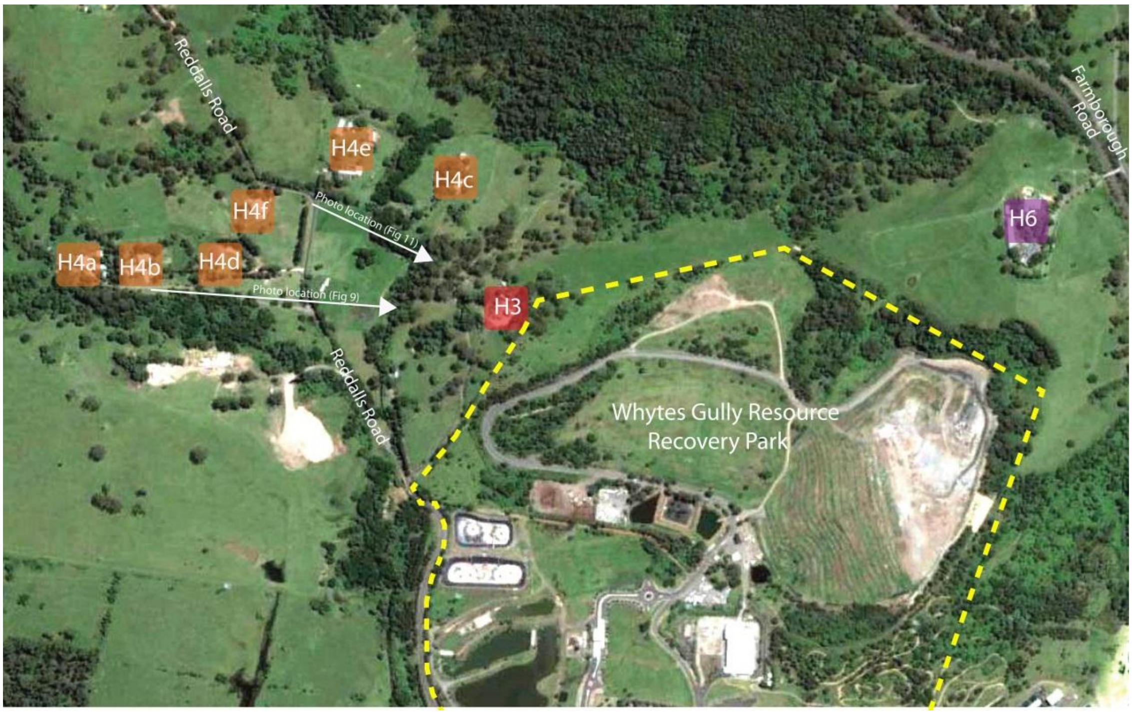

FIGURE 1- LOCATION OF PROPERTIES H3, H4 & H6

View Situation No.	Address
H3	Lucas Residence, Reddalls Road
H4-a	218 Reddalls Road
H4-b	216 Reddalls Road
H4-c	231 Reddalls Road
H4-d	220 Reddalls Road
H4-e	238 Reddalls Road
H4-f	233 Reddalls Road
H6	Farmborough House, Farmborough Road

2.1 Viewing Situation (H3) Lucas Property

Description

The residents of the Lucas property (H3) were home at the time of the site visit during which photographs were taken. The property on Reddalls Road adjoins the western boundary of WGRRP with the outdoor area at the rear of the residence located approximately 30m from the boundary fence (Fig. 2).

The driveway to the residence runs parallel to the western boundary of WGRRP. The two-storey residence is sited on a western slope and is generally oriented to the west to take advantage of views across a wide valley to the Illawarra Escarpment. While the residence is oriented away from WGRRP the view from the outdoor living area at the back of the house extends up the slope to the skyline within the WGRRP (Fig 2). The boundary fence would also be partly visible from windows along the eastern side of the residence. The slope between the residence and the WGRRP boundary fence is covered with pasture grasses and a number of large mature Eucalypt trees (Fig. 2). Views from the driveway at the front of the residence are generally screened by vegetation and the boundary fence is only partially visible (Fig. 3).

FIGURE 2 - VIEW UPSLOPE FROM OUTDOOR AREA OF LUCAS RESIDENCE TOWARDS WGRRP BOUNDARY

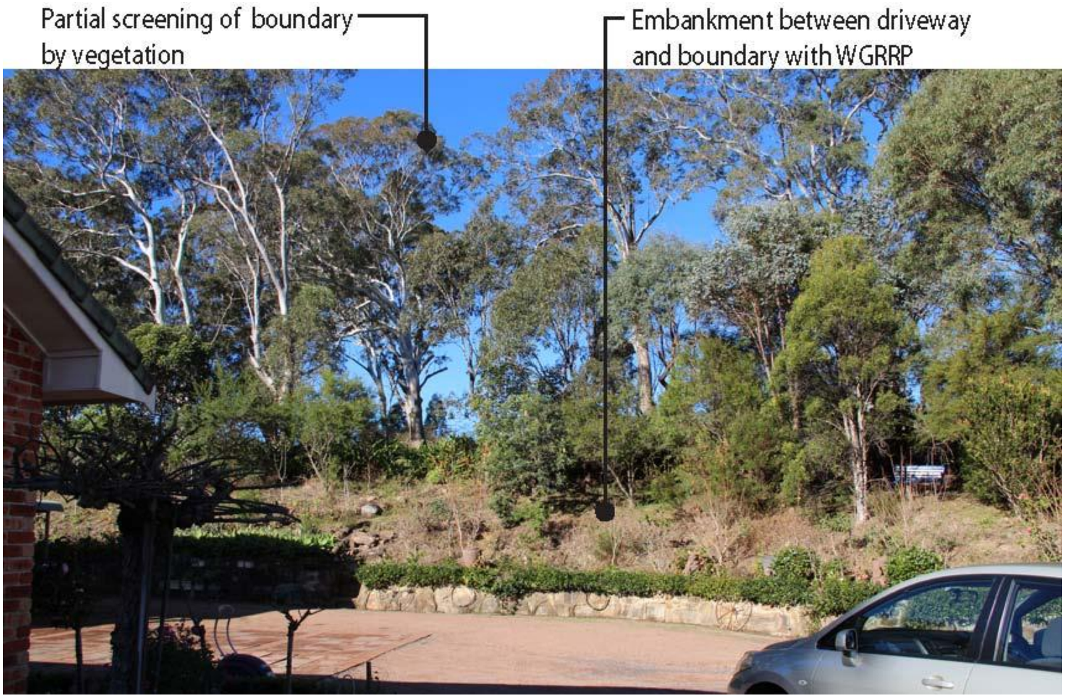

FIGURE 3 - VIEW FROM DRIVEWAY AT THE FRONT OF THE LUCAS RESIDENCE LOOKING TOWARDS WGRRP

Summary of Potential Visual Impact

While the current landfill operations are not visible from the Lucas residence the proposed landform to be created by the new cell will in time become visible above the existing landform along the boundary. The house and adjoining outdoor areas are at RL 70m whilst the RL levels along the boundary fence range between 80m to 85m RL. Therefore the current landfill top level of approximately 85m RL at the eastern end of the site cannot be seen. While the proposed new landfill landform will reach a maximum height of approximately 105m RL closer to the property boundary, the slope gradient of the new landform will be similar to the existing slope between the residence and the property boundary. Consequently, the new landfill slope will appear as an extension of the exiting natural slope when viewed from the Lucas residence.

Proposed Mitigation Measures

The Landscape Strategy presented in Appendix K recommends that vegetation be established along the WGRRP boundary (Fig.4) to provide screening from the adjoining properties which include the Lucas residence. To ensure the vegetation is well established and provides visual screening to the landfill operations by the time they reach the area adjoining the Lucas residence, planting should be initiated early in the project. An indication of the effectiveness of vegetation in screening views is provided by the existing scattered young trees located near the boundary fence.

FIGURE 4 - BOUNDARY BETWEEN WGRRP AND LUCAS PROPERTY UPSLOPE OF THE RESIDENCE

Photomontage

Results of the Visual Impact Assessment (Appendix K, Table 5) indicated that a moderate to high potential impact may occur at the Lucas Residence (H3). To illustrate how the existing view from the outdoor area adjoining the house would change as the proposed new landfill cell is developed, a photomontage has been prepared.

Three images are presented;

- The first shows the current view from the rear of the house (Fig. 5)
- The second shows the new landform created by the proposed landfill at completion with a vegetation cover of grass (Fig. 6) that would be visible if no screen planting was carried out.
- The third shows the view with screen planting established along the boundary within WGRRP (Fig. 7).

The third photomontage illustrates that views of the landfill operations and new landform will be blocked by screen planting along the boundary fence in accordance with the proposed mitigation measures.

It should also be noted that only a small proportion of the landfill slope will be un-vegetated at any one time and rehabilitation will be carried out progressively as each ‘lift’ of the landfill has been completed. The photomontage does not take account of the potential screening that would be created by additional vegetation planting that may be carried out closer to the Lucas residence.

FIGURE 5- CURRENT VIEW FROM BACK OF RESIDENCE (H3)

FIGURE 6 – PHOTOMONTAGE OF COMPLETED LANDFILL SLOPE AFTER REVEGETATION WITH GRASS COVER AND WITHOUT ANY SCREEN PLANTING

FIGURE 7 - PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AND SCREEN PLANTING ESTABLISHED ALONG BOUNDARY FENCE

2.2 Viewing Situation (H4)

There are 6 properties within Viewing Situation (H4), which is located less than 1km from WGRRP. The properties are generally located in a valley with a tree covered spur running along the western boundary of the WGRRP that blocks views of the landfill operations from residences in Viewing Situation (H4) which are generally surrounded by dense vegetation.

While the initial visual assessment identified a moderate potential visual impact from Viewing Situation (H4) the more detailed assessment carried out as part of the supplementary study has confirmed the potential visual impact would be negligible. Details of the assessment relating to each of the six residences in Viewing Situation (H4) are presented below.

216 Reddalls Road (H4-a)

The residents of 216 Reddalls Road were not home at the time of the visit. The property is situated at the end of a 350m long private driveway from Reddalls Road that also provides access to 218 Reddalls Road.

Summary of Potential Visual Impact

Observations from the front of the residence confirmed that dense tree and shrub cover adjoins the house, particularly on the side facing towards the WGRRP. Photographs were taken from the front veranda of the house on the basis that the resident had agreed to the assessment. Due to the existing screening vegetation it was not possible to prepare a photomontage to illustrate a view of the proposed landfill operations.

Although the property is less than 1km from WGRRP, field observations confirm that the extensive and dense tree cover blocks views of the WGRRP site (Fig. 8) and would also screen views of the proposed new cell of WGRRP. The potential visual impact of the proposed new landfill cell is therefore assessed as negligible.

FIGURE 8 - VIEW FROM FRONT OF RESIDENCE AT 216 REDDALLS ROAD LOOKING TOWARDS WGRRP WITH VEGETATION BLOCKING THE VIEW

218 Reddalls Road (H4-b)

Assessment of Visual Impact could not be made from the residence at 218 Reddalls Road as access was not available. However, a photograph was taken from the adjoining roadway (Fig. 9) near the entry driveway looking east towards WGRRP.

FIGURE 9- VIEW FROM PRIVATE ACCESS ROAD IN FRONT OF 218 REDDALLS RD. LOOKING EAST TOWARDS THE WGRRP SITE.

Summary of Potential Visual Impact

The photograph presented above, which is taken from the driveway adjacent to the residence, illustrates that the dense tree cover extending to the skyline blocks views of the WGRRP site (Fig. 9). The vegetation would also screen views of the proposed new cell of WGRRP. The potential visual impact of the proposed new landfill cell at this viewing situation is therefore predicted to be negligible.

231 Reddalls Road (H4-c)

Approval to access the property had not been received by the time the site visit was carried out. The residence is located approximately 200 metres north west of the Lucas residence and is accessed by a private driveway from Reddalls Road.

Summary of Potential Visual Impact

The photograph taken from the western boundary of WGRRP looking west across the Lucas property towards 231 Reddalls Road (Fig 10) illustrates the screening effect of the existing tree cover. In addition the photomontage of the view from the Lucas residence (Fig. 7) illustrates that the new landform will not be visible after screen planting is carried out along the site boundary. Given that the residence at 231 Reddalls Road is located at a lower elevation and further away than the Lucas residence, the new landfill landform will not be visible from it.

FIGURE 10 VIEW FROM WESTERN BOUNDARY OF WGRRP LANDFILL LOOKING WEST ACROSS LUCAS PROPERTY TOWARDS 231 REDDALLS RD.

In order to confirm that the proposed new cell of WGRRP will not be visible from 231 Reddalls Road a cross section was prepared to allow analysis of the view line from the residence to the proposed new landform. Cross section A-A presented in Figure 11 shows the existing natural landform as well as the proposed new landfill landform. The potential view line shown on the cross section illustrates that the proposed new landfill would not be visible from the property even if there was no vegetation between the residence and the WGRRP landform. However, extensive tree cover exists on the slope between the residence and the western boundary of the WGRRP.

The potential visual impact of the proposed new landfill cell is therefore predicted to be negligible.

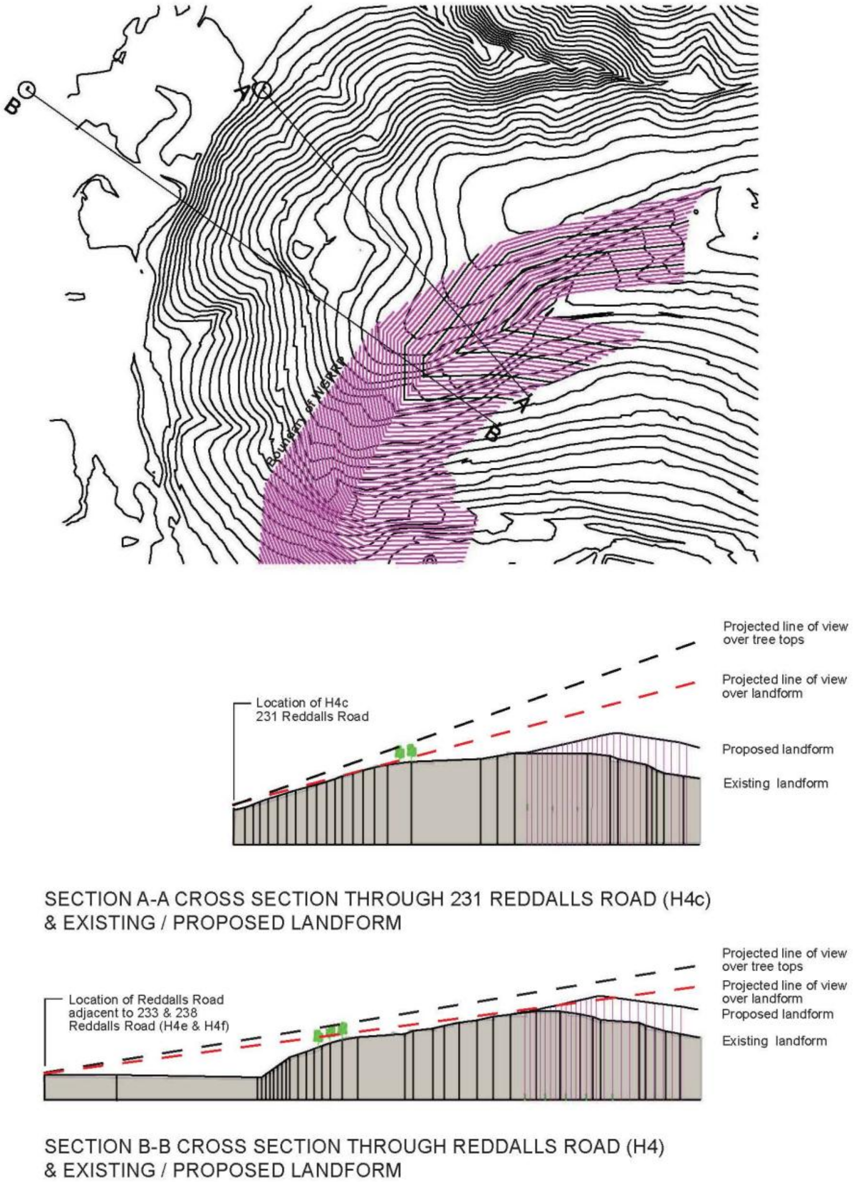

FIGURE 11 - CROSS SECTIONS A-A & B-B

220 Reddalls Road (H4-d), 233 Reddalls Road (H4-e) & 238 Reddalls Road (H4-f)

Permission to access these three properties was not obtained by the time of the site visit. Consequently, the following photograph (Fig. 12) was taken from the nearest location on Reddalls Road looking towards WGRRP beyond the Lucas property. The photograph illustrates the visual screening provided by mature trees growing on the slope adjoining the western boundary of the WGRRP.

FIGURE 12 - VIEW FROM REDDELLS RD NEAR H4D, H4E & H4F SHOWING EXTENSIVE TREE COVER SCREENING VIEWS OF THE LANDFILL OPERATIONS

Summary of Potential Visual Impact

The photograph presented in Figure 12 illustrates the extensive cover of mature trees on the slope adjoining the western boundary of the WGRRP.

Cross section B-B presented in Figure 11 illustrates how potential views of the proposed new landfill cell will be blocked by the existing tree cover on the slope located on the western slope of the WGRRP. The potential visual impact on residences H4-d, H4-e and H4-f is predicted to be negligible due to the combination of landform and vegetation blocking views of the landfill operations.

2.3 Viewing Situation (H6) Farmborough House

As access to Farmborough Farm residence was not available the potential views of the WGRRP from the nearest section of public road were assessed. Views towards the landfill site from Farmborough Road, which is the closest public road to Farmborough Farm residence, are generally blocked by vegetation along the adjoining railway corridor. Views towards the landfill site from the road bridge over the railway, which provides access to Farmborough Farm, are generally blocked by tree planting at the front gate and around the homestead buildings. It was therefore not possible to take a photo that would have allowed a credible assessment of the potential visual impact from the Farmborough Farm residence. However, an indication of the potential visibility of the landfill operations from the residence is provided by photographs taken from the top of the current landfill.

Summary of Potential Visual Impact

A photograph taken from the top of the existing landfill looking towards Farmborough Farm (Fig. 13) shows that a portion of the current landfill is visible from part the residence, while existing trees block a substantial proportion of the potential views of the landfill.

Given that the elevation of the landfill is proposed to increase from 85 RL to 105RL, the future landfill operations on part of the northern slope will be visible from part of Farmborough Farm residence, which is at approximate 120 RL, unless measures are taken to screen the view. In the longer term the completed landfill will create a low visual impact as a result of the low visual contrast between the vegetation-covered landfill slope and the surrounding landscape. The new landfill landform is not expected to block the distant regional views from Farmborough Farm due to the elevation difference between the residence and proposed top of the landfill.

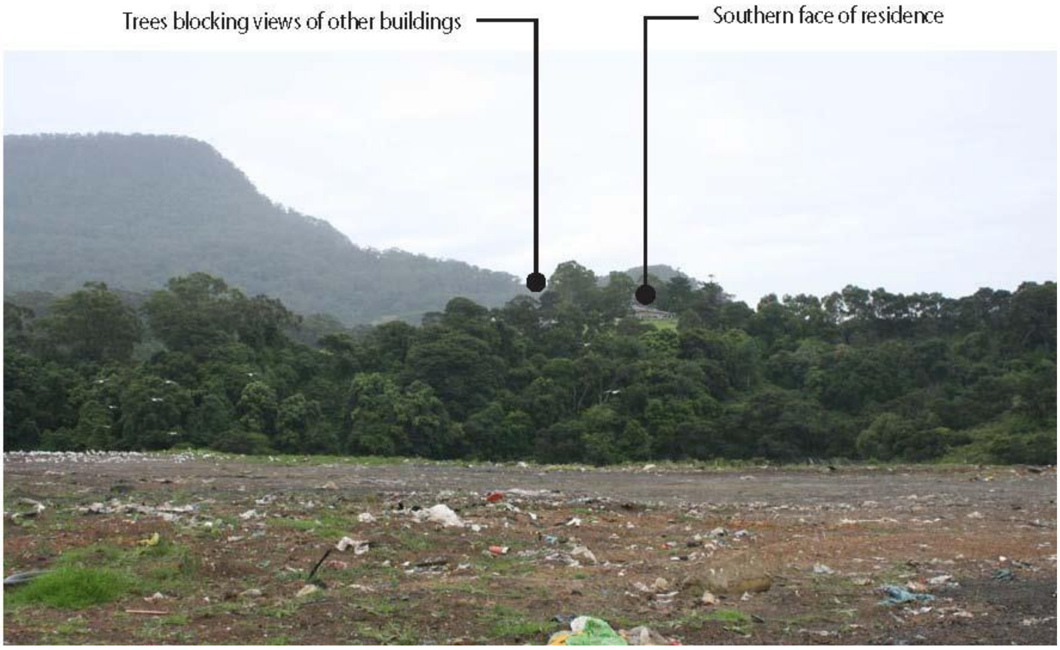

FIGURE 13-VIEW FROM TOP OF EXISTING LANDFILL LOOKING NORTH WITH A PORTION OF FARMBOROUGH FARM RESIDENCE VISIBLE AND THE BALANCE SCREENED BY TREES

APPENDIX L

Preliminary Hazard Analysis

March 2012

ENVIRONMENTAL ASSESSMENT

Whytes Gully New Landfill Cell - Preliminary Hazard Analysis

Submitted to:
Wollongong City Council

REPORT

Report Number. 117625003_129_R_Rev0

Distribution:

Wollongong City Council

Golder Associates

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1.0 INTRODUCTION

1.1 Report Context and Aim

Wollongong City Council (Council) is proposing to construct and operate a new landfill cell at Whytes Gully Resource Recovery Park (RRP) (the Project) located at Kembla Grange within the Wollongong Local Government Area (LGA).

This report has been prepared by Golder Associates Pty Ltd (Golder) as part of the environmental assessment of the Project. Specifically this report assists in addressing the hazards and risk assessment requirements in accordance with Schedule 6 “transitional Part 3A” of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Director Generals Requirements (DGRs) of the Project.

The aim and purpose of this PHA is to:

- Identify and analysis potential hazards associated with the project;
- Assess the risks against relevant risk criteria guidelines; and
- Identify mitigation and management opportunities to reduce hazard and risk and make recommendations as appropriate.

1.2 Project Outline

The Project includes staged construction of a new landfill cell at Whytes Gully RRP that proposes to “piggyback” over the existing landfill cells of the eastern and western gully of the site. This landfill cell would provide for landfill capacity for Wollongong LGA’s Municipal Solid Waste (MSW) to enable landfill activities to continue at Whytes Gully RRP in addition to maintaining and upgrading existing infrastructure of the site including:

- Internal roadway;
- Weighbridge;
- Materials Recycling Facility;
- Small Vehicle Transfer Station;
- Leachate and Surface Water Ponds and drainage lines;
- Leachate Treatment Plant;
- Small Vehicle Recycleables Drop off; and,
- Recoverables Drop Off and Buy Back.

The Project does not seek to alter or change such aspects as fuel storage facilities and/or dangerous goods storage and/or use. Whytes Gully RRP is surrounded by industrial areas to the south and rural residential land use areas to the west and north.

Refer to Chapter 8 of the Environmental Assessment for “Whytes Gully New Landfill Cell” (February 2012) for a full description of the Project.

1.3 Location of the Project

The site of the Project is Whytes Gully RRP. Located at Kembla Grange, Whytes Gully RRP is approximately 50 hectares in size and has operated with landfill capacity since 1983. The site is located centrally within Wollongong LGA and is approximately 12 kilometres from the Wollongong central business district.

Whytes Gully RRP is shown in Figure 1.

1.4 Statutory Requirements

The DGRs require a PHA for the Project. *SEPP No. 33 Hazardous and Offensive Development* (SEPP 33) aims to ensure that development that is deemed a 'hazardous' or 'offensive' industry is identified and assessed appropriately including identifying of appropriate mitigation measures.

Clause 12 of SEPP 33 specifies that a PHA must be prepared for development that is a 'potentially hazardous industry' to determine the risk to human health, life or property or the biophysical environment. Should such risk exceed the criteria of acceptability, the development is classified as a hazardous industry and may not be permissible dependent upon the suitably of their location and ability to demonstrate a Project can be constructed and operated with an adequate level of safety and pollution control.

This PHA has been prepared addressing the requirements of SEPP 33 and "Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines" (January 2011) (Applying SEPP 33) and in accordance with the general principles of risk evaluation and assessment and documentation as outlined in the Department of Planning's "Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6 (2011)" (Guidelines for Hazard Analysis). Assessed risks are compared to the qualitative risk assessment criteria developed in accordance with Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 *Risk Management* (AS/NZS 4360:2004).

In accordance with "Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 3" (Department of Planning, 2011), it is considered the PHA will be re-addressed as the Project progresses through construction and operation.

2.0 METHODOLOGY AND ASSESSMENT

A hazard and risk screening of the Project has been conducted in accordance with SEPP 33 and Applying SEPP 33.

2.1 Risk Screening

The risk screening procedure is based on five factors including:

- The properties of the substance(s) being handled or stored;
- The conditions of storage or use;
- The quantity involved;
- The location with respect to the site boundary; and
- The surrounding land use.

Potentially hazardous substances/materials are defined within the "Australian Code for Transportation of Dangerous Goods by Road and Rail" (seventh edition 2007) (Australian Dangerous Goods Code), which may include storage, transport, use or production associated with the Project and the distance of these materials from the site boundary.

A list of the types and storage quantities of materials that are to be used for the Project are included in Table 1. It should be noted the same quantities and materials are used as part of the existing Whytes Gully RRP operations.

Table 1: Hazardous Materials at Whytes Gully RRP

Plant Area / Use	Chemical/Product	Approximate anticipated use/storage Qty	Screening Threshold Class (Australian Dangerous Goods Code)
Leachate Treatment Plant Use	Sodium Hydroxide Solution	1000 litres (equivalent to 1 tonne)	Class 8 5 tonne (packing group I) 25 tonne (packing group II) 50 tonne (packing group III)
Chemicals for maintenance / repair work and clean up	Chemicals used in workshops	Various minor quantities of chemicals, managed through standard processes.	NA
Transformers	Insulating oil	Minor quantities stored in separate bunded area	C1 combustible liquid NA.
Recyclable Drop off area	LPG gas bottles, car batteries, florescent tubes, waste oil,	Minor quantities of chemicals removed from site at regular intervals in accordance with standard processes.	NA

As can be noted in Table 1, the hazardous materials utilised for the Project do not exceed any screening thresholds in accordance with Applying SEPP 33.

Sodium hydroxide associated with the Leachate Treatment Plant may store up to approximately 1000 litres, which is five times under the appropriate screening threshold. The sodium hydroxide would be stored in a central location of Whytes Gully RRP (in proximity to the Leachate Treatment Plant), which is considered to not be near a sensitive receiver and/or the site boundary.

Further chemicals utilised at the site are to present in very low quantities. In addition while insulating oil would be used in small quantities for transformers located on the site, in accordance with Applying SEPP 33, if class C1 combustible liquids (such as diesel and/or oil for generators) are present on the site and are stored within a separate bund or within a storage area where they are the only combustible liquid they are not considered potentially hazardous (diesel fuel for site vehicles is sourced off site).

The Project will not introduce potentially new hazardous materials to Whytes Gully RRP with the staff at the site familiar with the potential hazards associated with these materials and operate with existing technical and management safeguards in accordance with existing conditions of consent.

2.2 Analysis and Assessment Levels

The PHA includes a systematic and analytical approach to the identification and analysis of hazards and the quantification of risks. As identified in the Guidelines for Hazard Analysis, a multi-level risk assessment is utilised to identify the appropriate level of risk assessment to be undertaken for the Project.

The appropriate level of risk assessment is based on the results of the risk screening, risk classifications, prioritisation and the potential for off-site consequences as a result of potential Project hazards. The level of risk assessments are as follows:

- **Level 1 Qualitative Assessment** using descriptions to approximately assess and rank risks. This process is used based on the findings of the risk screening, including quantities of potentially hazardous materials and distance of these materials to the site boundary.
- **Level 2 Semi-Quantitative Assessment** utilising the hazards identified in the qualitative assessment and provides quantification of key potential off site risks to demonstrate that the risk criteria will be attained.
- **Level 3 Quantitative Assessment** undertaken whenever the scale and nature of the activity creates a significant risk of a major hazard incident. A quantitative assessment should also be completed if semi-quantification cannot sufficiently demonstrate that relevant criteria will be met.

Where preliminary hazard analysis indicates significant risk impacts (level 2 or level 3), a more detailed level of analysis is completed, which focuses on land use safety and risk tolerability. With the low level of risk associated with the Project (identified in Section 2.1), this PHA provides a Level 1 Qualitative Assessment and no quantification of risks has been conducted.

2.3 Level 1: Qualitative Analysis

The objective of the Level 1 Qualitative Analysis is to identify and develop an understanding of the hazards and risks associated with the Project and demonstrate that the activity does not pose a significant risk with recommendations of safety management controls. As identified within Applying SEPP 33, the assessment basis for qualitative assessment includes:

- All key scenarios thoroughly examined;
- Realistic estimates of risk;
- Relevant qualitative criteria met;
- Proposed measures appropriate and sufficient; and
- Compliance with all relevant codes and standards.

Each of these points are addressed in the following section.

3.0 POTENTIAL HAZARDOUS SCENARIOS

The identification of potential hazardous incidents and scenarios is a key step in identifying potential hazards and risk. As identified in Table 2 this process lists potential causes and consequences in addition to safeguards and management measures to mitigate the potential impact of the Project upon people, property and/or the environment on site or off site at Whytes Gully RRP. This identification process enables the establishment of the adequacy and relevancy of proposed safeguards and mitigation should they be required.

The following potential scenarios are identified for the Project. None of these incidents are new to the existing site and have been managed (as required) since the commencement of operations at Whytes Gully RRP in 1983 using appropriate procedures and systems that will continue to be in place for the Project.

- Loss of containment, fuel or oil leading to environmental pollution and possible fire if an ignition source is present.
- Fire at the landfill (waste and/or gas).
- Fire in site vehicles, infrastructure and/or buildings.
- Bush fire at site boundary.
- Gas extraction issues (including flare operation).
- Delivery and/or processing of waste not licenced to be accepted at Whytes Gully RRP.
- Particulate generation (including dust and odour) and noise.
- Loss of containment of leachate and/or stormwater from storage ponds.
- Stormwater impacts (flooding).
- Biological hazards (including spread by litter, vermin and pests).
- Injury to public (accessing unauthorised areas).
- Disruption to Services.
- General Occupational Health and Safety Hazards.

Results of the hazard identification for each of the potential scenarios identified above are provided in Table 2. It is considered that the scenarios and the hazard identification completed in Table 2 do not identify any significant hazards or major off site consequences with identified safeguards, mitigation and management.

In addition to the prevention and protection measures identified in Table 2, reference is made to measures identified within other documentation produced for and within Golder Associates (2012k) “Whytes Gully New Land Cell Environmental Assessment” (the EA) for the Project. As such, this documentation should be read in conjunction with this PHA to implement preventative and protection measures for potential scenarios. These include:

- Golder Associates (2012h) “Whytes Gully New Landfill Cell Project: Bushfire Report” (Bushfire Report)
- Golder Associates (2012g) “Draft Landfill Environmental Management Plan” (LEMP).

Table 2: Hazard Identification Scenarios

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Loss of containment, fuel or oil Possible fire if ignition source is present.	Mechanical failure of site or public vehicles Loss of containment of hydraulic oil from equipment	Environmental damage if spill is not contained Risk of Fire Personnel hazard and damage to property	■ Regular inspections and maintenance ■ Any spills cleaned up immediately. Spill kits located at appropriate location on site with staff appropriately trained in their use. ■ Spill containment to be managed in accordance with AS 1940. ■ Site emergency response plan including emergency contact numbers provided within management system for the site. ■ Fire protection (including fire extinguishers, separation distances etc. provided and inspected periodically. Distances in accordance with AS 1940 and as advised within the Bushfire Report. ■ No smoking around plant equipment.
Fire at the landfill (waste or gas)	Decomposition of solid waste in anaerobic conditions can generate heat, methane and other gases. Possible ignition of combustible materials. Waste relocation works	Fire on landfill Environmental damage if spill is not contained. Risk of fire Personnel hazard and damage to property	■ Covering waste (refer to LEMP for proposed methods of cover) ■ Waste compaction. ■ No smoking at landfill. ■ Ongoing monitoring by operators to ensure potential fire situations are identified and addressed appropriately. ■ Fire management strategy (as outlined in the LEMP). ■ Water carts available at the site. ■ Gas monitoring and alarms. ■ Training to site personnel. ■ Site emergency response plan including emergency contact numbers provided within management system for the site.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Fire in site vehicles, infrastructure and/or buildings	Overheating of combustible materials. Ignition of flammable material or combustible material	Damage to property/vehicles Personnel hazard Fire may develop to further areas	■ Appropriate training to operators. ■ Appropriate maintenance of vehicles. ■ No smoking outside of designated areas. ■ Fire suppression systems serviced and inspected periodically. ■ Training and procedures in place for fire. ■ Site emergency response plan including emergency contact numbers provided within the LEMP for the site. ■ Regular maintenance/housekeeping of buildings. ■ Spillage of flammable materials to be cleared up immediately. ■ Appropriate measures to reduce the threat of fire spreading including mitigation and management identified within the Bushfire Report. This includes: ▪ An asset protection zone of 10 metres would be maintained around existing site buildings. ▪ The site vegetation (landscaping) should not exceed a fuel load of 2 t/ha. ▪ Planted trees that are retained on the site are to have the lower branches trimmed (cut off) to a height of 2 m above the ground.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Bush fire at site boundary	External cause	Threat to people, property and environment on site	■ Measures as identified within the Bushfire Report including: ▪ A perimeter firebreak cleared of all vegetation is to be established around the entire site (roads and access tracks may be utilised to form the fire break) and around buildings ▪ Wind-blown litter is to be controlled. ▪ Flammable materials must be removed from site fencing.
Fire or explosion from Gas extraction risks	Leak of flammable gas which ignites.	Material damage, personnel injury potential and/or potential for spread to other areas	■ Gas (installation) construction plan as part of the provision for landfill gas capture at the site. This would include adequate piping material and appropriate construction materials and methods. ■ Monitoring of gas flow and quantity. ■ Fire protection system available on site to reduce damage from fire. ■ Hazard and Operability (HAZOP) study techniques or other similar methodology would be required to assess the potential impact of implemented gas extraction systems to ensure that the risks associated with the methane handling is reduced to As Low As Reasonably Practicable levels. ■ Emergency response plans and procedures.
Delivery and/or processing of waste not licenced to be accepted at Whytes Gully RRP.	This may include delivery and/or processing of Special waste (includes clinical waste and waste tyres), Liquid waste, Hazardous waste and/or Restricted solid waste.	Generation of toxic fumes Personnel exposure to toxic substances	■ Waste screening Strategy (refer to LEMP). ■ Operational procedures for management of waste (refer to LEMP).
Particulate generation (dust and odour)	Generation of dust and odour from operation of heavy equipment.	Personnel hazard and potential offsite impacts.	■ Maintaining equipment and plant appropriately. ■ Dust would be controlled with water carts and by using sealed roads on site. ■ Covering waste (refer to LEMP for proposed methods of cover). ■ Further measures as identified within relevant chapters of the EA.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Noise generation	Generation of noise from operation of heavy equipment.	Personnel hazard and potential offsite impacts.	■ Maintaining equipment and plant appropriately. ■ Adhering to existing hours of construction and operation. ■ Use of Personal Protective Equipment. ■ Further measures as identified within the LEMP.
Loss of containment of leachate and/or surface water from storage ponds	Leak or overflow at storage	Surface water and/or groundwater contamination if not contained appropriately.	■ Management and mitigation in accordance with the LEMP.
Biological hazards	Exposure Risk of infection such as tetanus from cuts and abrasions. Pathogen containing putrescibles wastes.	Threats to people and the environment, on site personnel and/or spread of disease offsite	■ Not allowing the general public access to the landfill. ■ Compacting waste and applying cover material at regular intervals. ■ Waste screening (refer to LEMP). ■ Litter control. ■ Vermin and pests continue to be controlled as outlined in the draft LEMP. ■ Hygiene practices and Personal Protective Equipment. ■ Implementation of a site OH&S plan.
Injury to public (accessing unauthorised areas)	Entry/access of unauthorised persons to site areas	Potential injury to person on site.	■ Security of the site would be maintained during operation and construction including security fencing, which is locked after hours of operation. ■ Not allowing unauthorised persons access to areas of the site including the landfill. ■ Appropriate signage and controls to direct unauthorised people appropriately.
Disruption to Services Hazards	Disruption of underground or overhead services (electricity, and telecommunications) during construction.	Impact upon people and property.	■ Services would be located on site prior to construction. Where appropriate services would be relocated prior to construction to ensure potential disruptions are reduced.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
General occupational health and safety hazards to workers during construction and operation	Working in proximity to industrial equipment and workplaces	Personnel hazard	■ Operational maintenance procedures and training (refer to LEMP). ■ Implementation of a site OH&S plan in accordance with the LEMP).

4.0 CONCLUSIONS AND RECOMMENDATIONS

It is considered the Project is not a “Hazardous industry” as when the measures proposed to reduce impacts of the Project are employed there will not be a significant risk to human health, life or property or the biophysical environment.

As identified within Applying SEPP 33, the threshold screening values for dangerous goods are not exceeded by proposed materials to be stored, transported, used or produced by the Project. The hazard and risk assessment identifies that the Project does not introduce new hazards to the Whytes Gully RRP site and existing hazards are all well known and understood by the Whytes Gully RRP staff.

The PHA did not identify significant hazards with the potential for offsite impacts that will not be controlled. Adequate safeguards and mitigation and management measures (as identified in Table 2 and relevant chapters and reports referenced and provided within the EA) are required to ensure the risk scenarios that were identified are contained or controlled to an acceptable level. This includes a Hazard and Operability (HAZOP) study prepared for the potential impact of implemented gas extraction systems, to ensure that potential risks associated with methane handling are reduced to acceptable levels.

It is recommended that all safeguards identified in the hazard identification process including the HAZOP are identified and implemented within a comprehensive safety management system included within appropriate environmental management plan documents including the construction environmental management plan and landfill environmental management plan for the Project.

5.0 REFERENCES

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Golder Associates (March 2012k) “Whytes Gully New Land Cell Environmental Assessment”

Golder Associates (January 2012h) “Whytes Gully New Landfill Cell Project: Bushfire Report”

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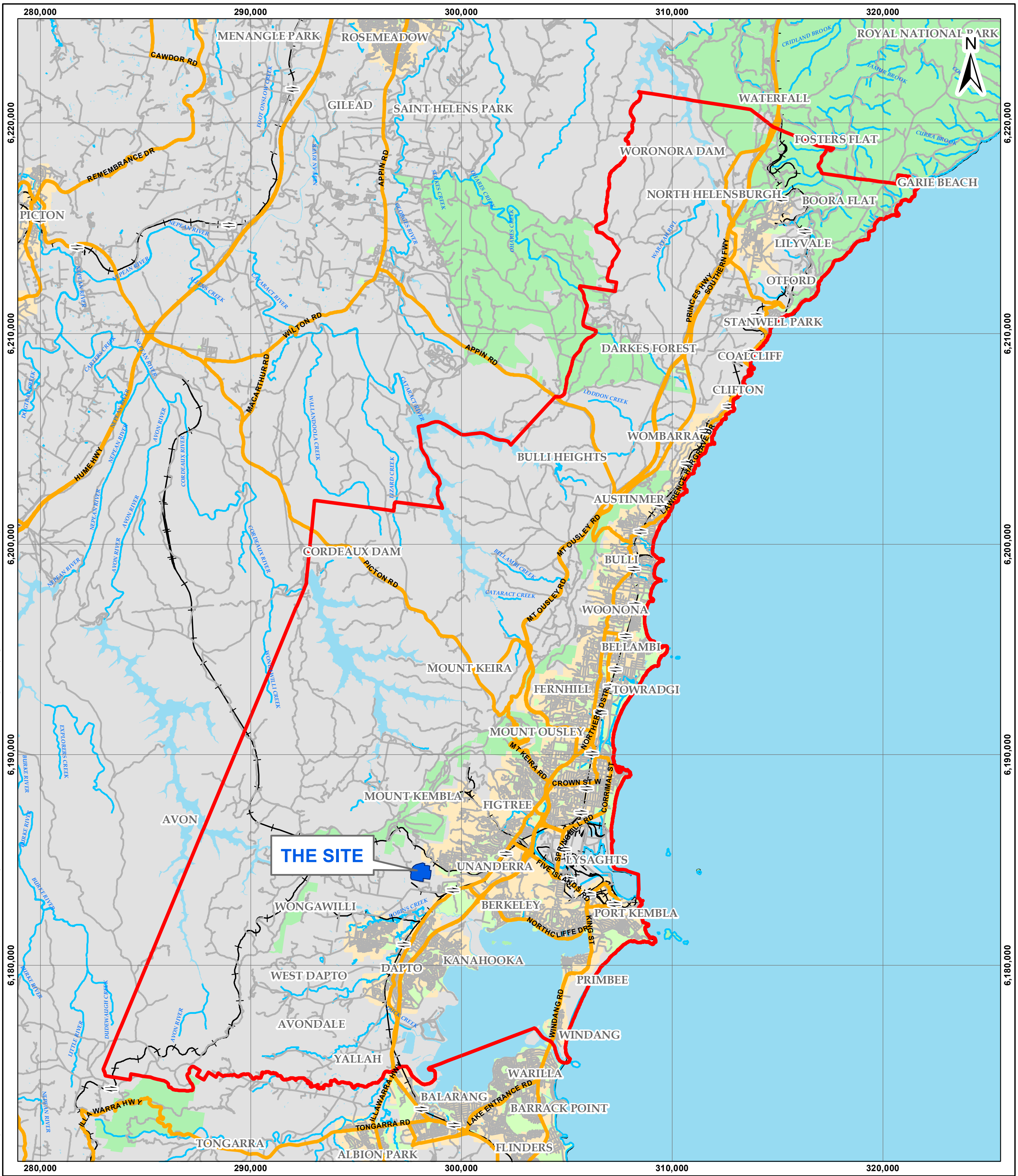
State Environmental Planning Policy No. 33 (Hazardous and Offensive Development) (SEPP 33)

FIGURES



ENVIRONMENTAL ASSESSMENT

Wollongong City Council

REGIONAL AREA

LEGEND

- Site Location
- Wollongong Local Government Area Boundary

0 1 2 4 6 8 Kilometres

SCALE (at A4) 1:250,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT:	117625003
DATE:	14/12/2011
DRAWN:	FA
CHECKED:	JMc

FIGURE 1

Golder Associates

Report Signature Page

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http://aupws/117625003wollongongcitycouncilnewcellwhytesgully/project doc/405 environmental assessment/draft ea/part d1 - environmental assessment - key issues/chapter 19 - hazards and risk/117625003_129_r_rev0.docx

APPENDIX M

Bushfire Risk Assessment

March 2012

WHYTES GULLY NEW LANDFILL CELL PROJECT

Bushfire Report

Submitted to:
Wollongong City Council

REPORT

Report Number. 117625003_141_R_Rev0

Golder Associates

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GLOSSARY OF TERMS & ABBREVIATIONS

Assets	In the context of this report, anything valued within Whytes Gully Resource Recovery Park and surrounds by stakeholders which may include fire fighting infrastructure, threatened species, areas of cultural significance and the components of the environment that may be at risk from bush fire.
APZ	Asset Protection Zone.
BAL	Bushfire Attack Level. AS 3959 (2009) describes six levels of risk of bushfire attack including BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ and are based upon the the potential exposure to heat flux thresholds, expressed as kW/m^2.
Bushfire	A general term used to describe fire in vegetation, including grass fire and forest fire.
Bushfire Hazard	The potential severity of a bushfire, which is evaluated by fuel load, fuel arrangement and topography under a given climatic condition.
Bushfire Management	A systematic process that recognises assets assesses assets and provides a range of treatments that contribute to the well being of communities and the environment, which suffer the adverse effects of wildfire/bush fire.
BFCC	Bush Fire Coordinating Committee.
BFRMP	Bush Fire Risk Management Plan.
BMP	Bush Fire Management Plan.
Bushfire Risk	The chance of a bushfire igniting, spreading and causing damage to the environment, community or the assets.
Bushfire Threat	Potential bush fire exposure of an asset due to the proximity and type of a hazard and the slope on which the asset is situated.
Consequence	Outcome or impact of a bush fire event.
Clearance	The physical removal of vegetation.
CRC	Cooperative Research Centre.
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
DEM	Digital Elevation Model.
DEH	Department for Environment and Heritage, South Australia.
DGRs	Director General's Requirements.
DP	Deposited Plan.
EPA	Environment Protection Authority.
EP&A Act	NSW *Environmental Planning and Assessment Act* 1979.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
FDI	Fire Danger Index.
Fire Fighting Authorities	The NSW Rural Fire Service, NSW Fire Brigades the National Parks and Wildlife Service and Forests NSW.
GIS	Geographic Information System.
Golder	Golder Associates Pty Ltd.
ha	Hectare, 1ha = $10,000m^2$
IBFMC	Illawarra Bush Fire Management Committee.
km	Kilometre, 1km = 1000metres
Likelihood	The chance of a bush fire igniting and spreading.
m^2	Square metres, $1m^2$ = the area formed within a square 1m long and 1m wide.
Major Bush Fire	A bushfire which requires the attendance of multiple brigades, or causes damage to property or injury to one or more persons.
MRF	Materials Recovery Facility.

GLOSSARY OF TERMS & ABBREVIATIONS

MSW	Municipal Solid Waste.
NSW RFS	NSW Rural Fire Service.
Recovery Costs	The capacity of an asset to recover from the impacts of a bush fire. This includes costs associated with the economy, time and resources.
Risk Acceptance	An informed decision to accept the consequences and the likelihood of a particular risk.
Risk Analysis	A systematic process to understand the nature of and to deduce the level of risk.
Risk Assessment	The overall process of risk identification, risk analysis and risk evaluation.
Risk identification	The process of assessing what, where, when, why, and how something could happen.
Risk Treatment	The process of selection and implementation of measures to modify risk.
SWERF	Solid Waste and Energy Recycling Facility.
t/ha	Tonnes per hectare.
WCC	Wollongong City Council
WGRRP	Whytes Gully Resource Recovery Park.
WoNS	Weed of National Significance.

EXECUTIVE SUMMARY

Wollongong City Council proposes to develop a new landfill cell within the existing facility that it owns and operates, Whytes Gully Resource Recovery Park, Kembla Grange. The purpose of this report is to meet the Director General's Requirements under the New South Wales *Environmental Planning and Assessment Act* 1979.

Parts of the site are zoned as Bushfire Prone Land - Vegetation Category 1 or as buffer zone within the Wollongong Local Environment Plan 2009 (Wollongong City Council 2009).

This Bushfire Report has been prepared in accordance with the New South Wales Rural Fire Service Planning for Bush Fire Protection (2006 and 2010), the *Rural Fires Act 1997* and the New South Wales *Environmental Planning and Assessment Act 1979*. A desktop review and site visit were conducted to assess bushfire hazards and associated risks.

The assessment of bushfire risk was conducted using the following information:

- Characterisation of the bushfire weather region
- Topographical assessment including the calculation of slope and aspect through the creation of a digital elevation model
- Vegetation assessment as conducted by Biosis (2011) and by a site visit
- Water supply, access and surrounding land use

The Illawarra Bush Fire Management Committee (2008) rated the likelihood of a fire occurring at Whytes Gully Resource Recovery Park as *'Unlikely'* with a consequence of *'Low'* to produce an overall risk rating of *'Low'.* It is considered that the greatest threat to Whytes Gully Resource Recovery Park from bushfire is from a fire originating in the west, northwest or north. The very steep, vegetated slopes beyond the northern perimeter associated with the creek line that flows towards Dapto Creek and also between the Western and Eastern Gully landfills may act to funnel fire towards Whytes Gully Resource Recovery Park, as these slopes are also northwest / north in aspect increasing the risk of fire spreading rapidly towards the site.

Strategies were proposed to mitigate bushfire risk (recommendations) with the key recommendations being the development of a comprehensive site Fire Management Plan for Whytes Gully Resource Recovery Park, including the development and implementation of weed and litter control programs.

The bushfire protection measures incorporated into the proposed development comply with the aims and objectives of Planning for Bush Fire Protection (2006 and 2010) and the acceptable solutions of the performance criteria identified in *4.3 -Planning Controls for Infill and Other Developments on Bush Fire Prone Land.* The proposed development does not include the construction of buildings and therefore elements of Planning for Bush Fire Protection (2006 and 2010) do not apply.

The proposed development would not alter the bushfire risk, although the removal of existing vegetation would reduce the fuel load and the likelihood of a fire igniting and spreading, largely through the removal of lantana, a Weed of National Significance that adds greatly to the fuel load present at Whytes Gully Resource Recovery Park.

1.0 INTRODUCTION

Wollongong City Council (WCC) is developing a new landfill cell within the existing facility that it owns and operates, Whytes Gully Resource Recovery Park (WGRRP), Kembla Grange (the Site). This new landfill cell will be the final cell constructed within the WGRRP and will meet WCC's needs for a period of 20 - 50 years. Approximately 6 million cubic metres of additional storage capacity will be created by this project. The waste management footprint will be minimised by developing additional landfill capacity above existing contained wastes by using a "piggy back" design. The type of material to be accepted by this facility remains Municipal Solid Waste (MSW).

1.1 Purpose of the Report

WCC has engaged Golder Associates Pty Ltd (Golder) to prepare the environmental assessment for the proposed development of a new landfill cell at the WGRRP. The Bushfire Report is a component of that environmental assessment, and aims to assess potential bushfire risks and identify measures to help mitigate the threat of fire occurring within or impacting upon the WGRRP.

1.2 Objectives of the Report

Specific objectives of the Bushfire Report are:

- Description of the proposed project and surrounding area.
- Documentation and assessment of bushfire hazard for the Whytes Gully New Landfill Cell and surrounding area.
- Preparation of bushfire risk mitigation measures in accordance with NSW Rural Fire Service 'Planning for Bush Fire Protection' (2006 and 2010), relevant legislation and AS 3959-2009 'Construction of Buildings in Bushfire Prone Areas'.

1.3 Legislative Context

1.3.1 Rural Fires Act 1997

Under Section 63 of the *Rural Fires Act* 1997 owners and land managers have a duty to prevent the occurrence and spread of bushfires on their land. This duty applies to WCC as the owner and operator of the WGRRP.

A Bush Fire Management Committee is required to be formed in each area of the state that is subject to bushfire risk. The Illawarra Bush Fire Management Committee (IBFMC) is constituted by the Bush Fire Coordinating Committee (BFCC) in accordance with the *Rural Fires Act* 1997 and is required to develop a Bush Fire Risk Management Plan (BFRMP). The identification of fire prone land by the Illawarra BFRMP within WCC also triggers actions under the New South Wales *Environmental Planning and Assessment Act* 1979 (EP&A Act) as described in the following section.

1.3.2 Environmental Planning and Assessment Act 1979

The EP&A Act is the primary legislation for establishment of controls on land use planning, establishing the framework for environmental planning and assessment in NSW.

This proposed development has been declared a major project under Part 3A of the EP&A Act.

An assessment of the potential bushfire risks of the project is provided as a component of the environmental assessment in accordance with the Director General's Requirements (DGRs) as required under the EP&A Act.

1.4 Location

1.4.1 Whytes Gully Resource Recovery Park

The Site is located 12 km to the south of Wollongong central business district and is approximately 50 ha in size. Access to the WGRRP is via Reddalls Road to the south of the facility, as shown in Figure 1.

The WGRRP is owned by WCC and is comprised of:

- Part Lot 501, DP 1079122
- Lot 502, DP 1079122
- Lot 2, DP 240557
- Lot 52, DP 1022266
- Lot 53, DP 1022266
- Lot 51, DP 1022266.

The site is zoned as IN2 Light Industrial under the 'Wollongong Local Environment Plan – (West Dapto) 2010 (LEP 2010).

The existing layout of the WGRRP is provided in Figure 2.

The existing surface water ponds, leachate ponds, Materials Recovery Facility (MRF) and Solid Waste and Energy Recycling Facility (SWERF) are all located in the southern portion of the site.

1.4.2 Surrounding Area

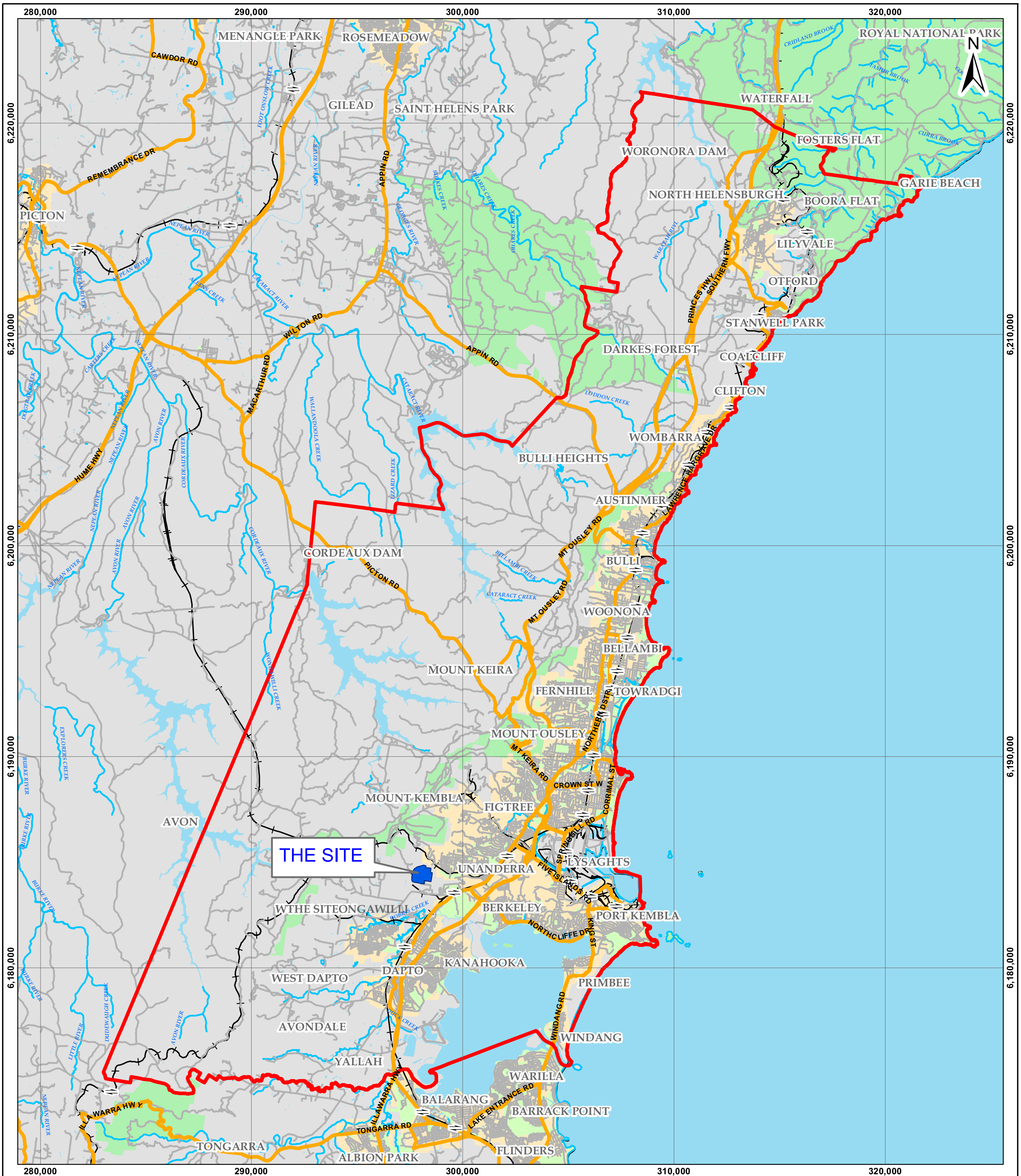
The land immediately south of the site is zoned Heavy Industrial (IN3), while to the immediate east of the site it is zoned Light Industrial (IN2). To the west of the site a corridor of land zoned Environmental Management (E3) approximately 200 m wide is aligned along Dapto Creek and separates the site from further land zoned Light Industrial. Land further to the west includes Environmental Conservation (E2) land, with some areas zoned E3.

Land immediately north-west of the site is zoned Rural Landscape (RU2) while land north of the site is zoned National Parks and Nature Reserves (E1) (WCC 2009). The land to the north and west of the site includes the Illawarra Escarpment State Conservation Area and Kembla State Forest, Figure 3.

1.5 Proposed Development

The internal site layout is proposed to be reconfigured to support the staging of proposed landfill activities. This includes alteration of the internal road layout and may include reconfiguration of leachate and surface water ponds. The waste management footprint will be minimised by developing additional landfill capacity above existing contained wastes by using a "piggy back" design. The type of material to be accepted by this facility remains Municipal Solid Waste (MSW). The proposed configuration of the site is shown in Figure 4.

This proposed development does not include the construction of additional site buildings and therefore there is no requirement to apply AS3959-2009 – Construction of Buildings in Fire Prone Areas or the Building Code of Australia.



WHYTES GULLY NEW LANDFILL CELL PROJECT - BUSHFIRE REPORT

Wollongong City Council

REGIONAL AREA

LEGEND

- Site Location
- Wollongong Local Government Area Boundary

0 1 2 4 6 8 Kilometres

SCALE (at A4) 1:250,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT:	**117625003**
DATE:	**16/06/2011**
DRAWN:	**AJW**
CHECKED:	**TR**

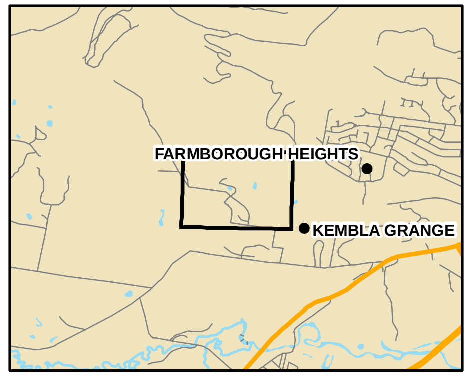
FIGURE 1

Golder Associates

WHYTES GULLY NEW LANDFILL CELL PROJECT - BUSHFIRE REPORT

WOLLONGONG CITY COUNCIL

EXISTING SITE LAYOUT



LEGEND

Site Boundary

NOTES

Historic locations digitised by Golder from reports supplied by Wollongong City Council

Google Earth Pro 2010. Image Dated 28/09/2009 supplied and sourced under license from Google Earth Pro on 31/05/2011. Image georeferenced by Golder and intended for indicative purposes only.

0 15 30 60 90 120 150 metres

SCALE (at A3) 1:3,800

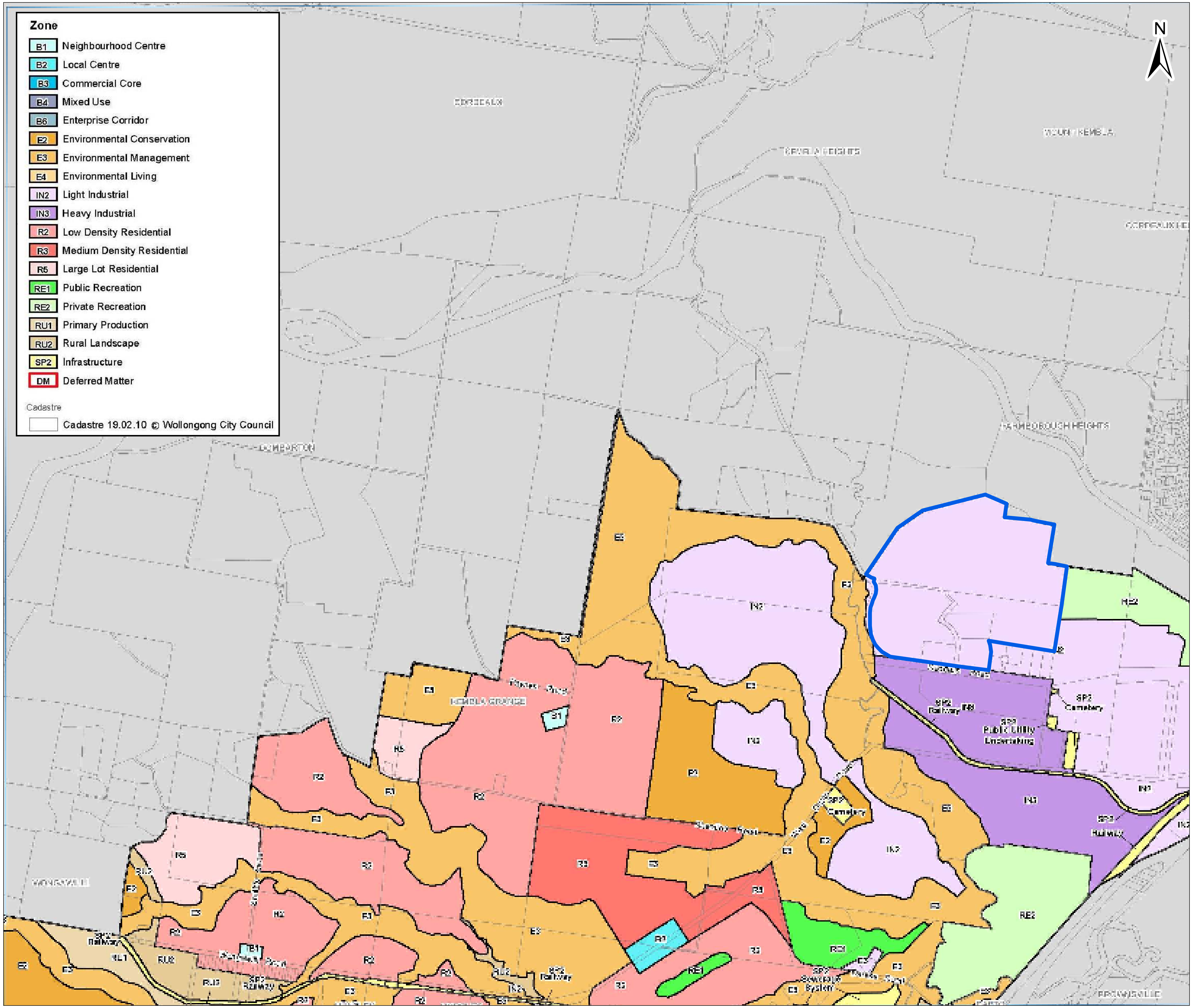
Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 16/06/2011
DRAWN: AJW
CHECKED: TR

FIGURE 2

Golder Associates

File Location: S:\Enviro Jobs\Interstate\2011\117625003 - Whytes Gully\PDF\117625003_TMP_F0002_Rev0.pdf



WHYTES GULLY NEW LANDFILL CELL PROJECT - BUSHIRE REPORT

WOLLONGONG CITY COUNCIL

SURROUNDING AREA

LEGEND

Site Boundary

COPYRIGHT

Base image sourced from LEP (West) Dapto, Wollongong City Council, sourced August 2011

SCALE (at A3) N.T.S

PROJECT: 117625003
DATE: 01 SEP 2011
DRAWN: KB
CHECKED: GF

FIGURE 3

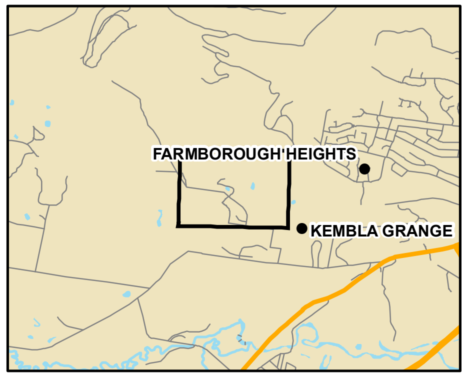
Golder Associates

File Location: S:\Enviro Jobs\Interstate\2011\117625003 - Whytes Gully\Project\Deliverable\Production Fig\117625003-TMP-R-F0003-Rev0.mxd

WHYTES GULLY NEW LANDFILL CELL BUSHFIRE REPORT

WOLLONGONG CITY COUNCIL

PROPOSED SITE LAYOUT



LEGEND

- Site Boundary
- Final Landfill Footprint
- Approximate Extent Of Waste

NOTES

Historic locations digitised by Golder from reports supplied by Wollongong City Council

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

0 12.5 25 50 75 100 125 metres

SCALE (at A3) **1:3,800**

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **16/01/2012**
DRAWN: **FA**
CHECKED: **GF**

FIGURE 4

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_114_R_F0002_General_Site_Details.mxd

2.0 SCOPE AND METHODOLOGY

2.1 Process

This assessment is generally conducted in accordance with the requirements of the *Rural Fires Act* 1997, *EP&A Act* 1979 and the specifications and requirements of *Planning for Bush Fire Protection* (NSW Rural Fire Service 2006).

This assessment has included consultation, a desktop assessment and a field investigation.

2.1.1 Desktop Assessment

The desktop assessment included the collation and analysis of the following documentation:

- Illawarra Bushfire Management Committee (2008) Bushfire Risk Management Plan. NSW Bush Fire Coordinating Committee. NSW Rural Fire Service
- WCC (2009) Wollongong Local Environmental Plan 2009
- Wollongong Local Environmental Plan (West Dapto) 2010
- NSW Rural Fire Service (2006) Planning for Bush Fire Protection. Government of New South Wales
- Biosis Research (2011), Whytes Gully New Landfill Cell Development Terrestrial Flora and Fauna Assessment.

Additional reference material was obtained from a variety of sources including the Bureau of Meteorology (BOM), NSW Rural Fire Service and the Bushfire Co-operative Research Centre.

2.1.2 Field Assessment

The field assessment involved a site walkover by a Senior Environmental Scientist and a Senior Environmental Engineer from Golder and was conducted on 22 August 2011.

2.2 Consultation

Consultation was undertaken with the NSW Rural Fire Service and staff of the WCC.

3.0 BUSHFIRE HAZARD IDENTIFICATION

3.1 Weather

The WCC area is within the Illawarra/Shoalhaven NSW Fire Area which has a Fire Danger Index (FDI) of 100, assumed as a 1:50 year event (NSW RFS 2006).

Fire danger is the total of factors that affect the initiation, spread, and difficulty of control of fires, and the damage they cause. Fire Danger is calculated separately for forest and grassland areas on a daily basis and is expressed as a numerical index on a scale from 0 – 100 and is known as the Forest Fire Danger Index (FFDI) and Grass Fire Danger Index (GFDI).

Where an area has both forest and grassland both indices will be evaluated and the higher value is utilised. The vegetation at the site can be considered as forest for the purposes of calculating the Fire Danger Index. It is acknowledged that Fire Danger Indices are utilised to set the fire danger on a regional scale.

The following factors are used in the calculation of the FDI:

- Seasonal dryness – this is indicated by a drought index, or a soil dryness index for forests;
- Temperature;
- Relative humidity of the air;
- Wind speed;
- Rainfall (volume and duration); and
- Fuel load.

A low fire danger rating indicates that a fire may not burn, be slow to spread and that it can be easily controlled. An index value of 100+ indicates that a fire would burn readily and so fast and hot that it would be unlikely that it could be controlled. The fire danger indices are therefore a measure of how destructive a fire can be and how difficult it may be to extinguish a fire.

As from October 2009, the FDI was modified nationally with the Extreme category (50+), divided into three levels - Severe, Extreme and Catastrophic (Code Red) following recommendations of the Victorian Black Saturday Bushfire Royal Commission (Victorian Bushfires Royal Commission 2009).

The national fire danger rating system is presented in Table 1 and explained in greater detail within APPENDIX A.

- Severe fire danger occurs when FFDI/GFDI is between 50 and 74;
- Extreme fire danger occurs when FFDI/GFDI is between 75 and 99; and
- Catastrophic (Code Red) fire danger occurs when FFDI/GFDI is 100 or above.

Fire weather warnings issued by the BOM on a daily basis relate to Fire Danger Ratings of Severe, Extreme or Catastrophic (Code Red).

Severe, extreme and catastrophic weather conditions are likely to be associated with northerly, north-westerly and westerly winds and less frequently south-westerly regimes.

Table 1: Fire Danger Index (CFS 2009)

FIRE DANGER RATING	
CATEGORY	**FIRE DANGER INDEX**
CATASTROPHIC (Code Red)	**100+**
EXTREME	**75 - 99**
SEVERE	**50 - 74**
VERY HIGH	**25 - 49**
HIGH	**12 - 24**
LOW - MODERATE	**0 - 11**

3.1.1 Rainfall

The average annual rainfall (1870 to 2002) recorded at the Wollongong Post Office weather station is 1130 mm, Table 2. The Wollongong Post Office weather station (station number 068069) is located approximately 10 km to the northeast of the WGRRP at an elevation of 30 m above sea level. The highest rainfall period typically falls between January and July. The lowest mean rainfall was recorded in August. The bushfire season therefore may extend through until the period of summer rains, commencing typically in the December - January months. Lower than average rainfall or a delay in the occurrence of summer rains can extend the bushfire season through summer and into autumn.

3.1.2 Temperature

Temperature data (1950 to 1976) from the Port Kembla Signal weather station, located approximately 11 km east of the Site, shows that warm weather at Port Kembla typically begins in October and extends through to the end of April. The hottest months (greater than 30ºC) of the year at Port Kembla are between October and January (BOM, 2011[b]). The mean number of days of high temperature across a potential bushfire season is presented in Table 3.

3.1.3 Wind

Wind roses of direction versus wind speed (km/h) collected from the Port Kembla Signal weather station long term data from 1957 to March 1976 are presented in APPENDIX B. The Port Kembla Signal weather station is located approximately 11 km to the east of the WGRRP site at an elevation of 11 m above sea level. The wind speed is approximately 7 km/hr stronger in the afternoon (3 pm) than in the morning (9 am) with this trend holding for the majority of the year (the mean increase is slightly lower in May and June) (BOM 2010). Strong winds of greater than 40 km/hr in strength are a feature of wind speed at this location throughout the year.

Days of extreme fire danger are typically associated with strong winds from the west to north-west. For the site, the distribution of rural land and forest in the surrounding area indicates that a bushfire is likely to pose the greatest threat to the site from the west, north-west or north and to a lesser extent the southwest. Therefore, winds from the west, north-west or north pose the greatest fire danger, followed by wind from the south-west.

While the statutory bushfire danger season commences on 1 October through to 31 March (NSW RFS 2011[1]) within WCC the fire danger season commences in August/September and extends through to the commencement of summer rains. Wind roses for August to December are discussed as this represents the typical fire season.

Table 2: Mean rainfall data (mm) recorded at the Wollongong Post Office weather station between 1870 and 2002 (BOM, 2011).

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	105.8	110.4	118.6	129.3	117.2	106.8	91.9	61.1	65.4	67.0	72.0	85.7	1130.0
Lowest	1.8	1.3	3.3	3.8	0	0	0	0	0	5	2	0	524.5
10th percentile	27.3	14.8	23.5	29.8	10	8.7	7	6	5.7	15.1	13.6	11.9	721.4
Median	77.4	78.6	93.3	97.3	82.4	57.4	63.6	37.3	48.6	52.8	68.1	68.2	1096.1
90th percentile	229	258.7	225.6	259.4	260.6	261.8	207.9	141	139.8	134.4	131.5	173.2	1499.4
Highest	577.2	519.6	673.6	705.8	731.9	443.4	471.3	371.7	239.5	349.1	393.6	432.8	2285.7

Table 3. Mean temperature data (mm) recorded at the Port Kembla Signal weather station between 1950 and 1976 (BOM, 2011).

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean max.	24.1	24.4	24.1	22.4	19.4	17.5	16.7	17.3	19.2	20.7	22.4	23.4	21
Mean min.	18.4	18.7	18	15.7	12.7	10.9	9.8	10.3	11.8	13.7	15.3	17.1	14.4
10th percentile	21.1	21.7	21.1	19.4	16.7	15	14.4	14.7	15.7	17.2	18.3	20	n/a
90th percentile	26.4	26.7	26.7	25.2	22.5	20	19.4	20	23.3	25.4	26.7	26.7	n/a
Mean No days ≥ 30^{o}C	1.1	0.4	1.2	0.4	0	0	0	0	0.3	1	1.7	1.5	7.6
Mean No days ≥ 35^{o}C	0.4	0.1	0.2	0	0	0	0	0	0.1	0.1	0.5	0.4	1.8
Mean No days ≥ 40^{o}C	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1

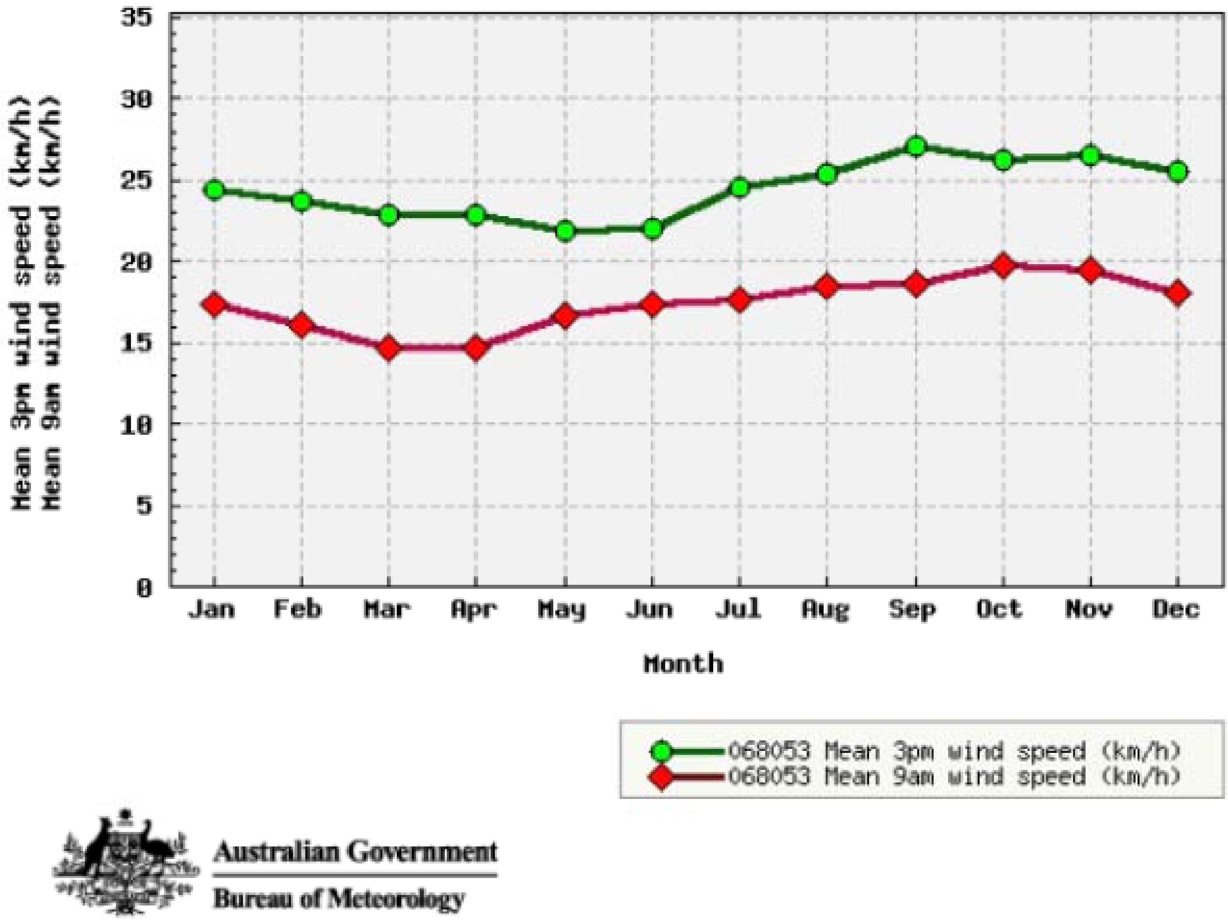


Figure 5: Comparison of 9 am and 3 pm mean monthly wind speed at Port Kembla Signal weather station (BOM 2010)

August

The 3pm August wind rose indicates that wind direction is from the west 19% of the time and that approximately 6% of wind is > 40 km/hr in strength and a further 3 % of wind is ≥ 30 and < 40 km/hr. Westerly winds in August are frequently strong winds that increase the bushfire risk. In August 5% of wind is from the north-west and a further 5% from the north. The north-west winds also have a strong wind speed component with 2% of wind ≥ 30 km/hr. The dominant winds during August are from the south, west and north-east.

September

In September the 3pm north-east and southerly wind components are well established and wind from the west is reduced to approximately 13%, although 5% of wind remains > 40 km/hr in strength with a further 3% of wind ≥ 30 and < 40 km/hr. Wind from the north-west occurs approximately 6% of the time and includes a strong wind component, approximately 3% of wind ≥ 30 km/hr. Wind from the north occurs 5% of the time. Unfavourable wind from a bushfire perspective occurs approximately 29% of the time in September and strong wind remains a feature of wind from these directions (south-west, west, north-west and north).

October

The north-east (32%) and southerly (21%) 3 pm wind direction pattern remains dominant. Wind from the west is reduced in frequency to 9.5% of the time with approximately 5% of wind > 40 km/hr in strength with a further 2% of wind from the west ≥ 30 and < 40 km/hr. Approximately 4% of wind is from the north-west, a reduction of approximately 2% from the preceding month while the northerly wind component has increased slightly to 6%.

November

The trend over the preceding months of a reduction in percentage of wind from the west continues through November (7%), although the strong wind component remains with 3% of wind > 40 km/hr in strength and 5% of wind from the west ≥ 30 km/hr, that is 71% of westerly winds are ≥ 30 km/hr in strength. Only 2% of wind is from the north-west and 7% from the north, with strong winds a feature of wind from these directions.

December

In December the westerly and north-westerly wind components are reduced further, although are characterised by strong winds when they do occur. Wind from the north remains consistent with the previous month. North-easterly winds remain dominant (37%) and occur approximately twice as frequently as winds from the south (20%).

There is very little wind from the west or north-west in January or February reducing the fire risk over these months considerably.

3.1.4 Humidity

Low humidity, that is, hot dry air is associated with days of severe to catastrophic fire danger. In the local area these conditions are associated with winds from the west and north-west that have blown across the inland, heating and drying as they do so. Low relative humidity (less than 20%) dries out fuel (timber and grass) increasing flammability. The mean monthly relative humidity, as shown in Table 4, is lowest between August and September, corresponding to the period of lowest rainfall.

Table 4: Mean Relative Humidity at the Wollongong Post Office weather station

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean 9am RH*	72	73	73	72	73	74	72	67	64	65	67	70
Mean 3pm RH#	71	73	72	71	68	68	65	63	64	66	68	71

* Mean 9 am relative humidity (%) for years 1907 to 1950
\# Mean 3pm relative humidity (%) for years 1909 to 1950

3.2 Topography

The WGRRP is located within the suburb of Kembla Grange, an area of sandstone that comprises the lower slopes of the Illawara escarpment to the west. The area is situated on predominantly Mount Kembla Sandstone, with underlying sedimentary rocks of the Permian age, as well as Quaternary talus on the higher slopes (Maunsell Pty Ltd, 1992).

Lake Illawarra is approximately 4 km south-east of WGRRP with the Tasman Sea beyond and to the east. These features afford the site some protection from bushfires from the east and south-east. Mount Kembla is located immediately to the north of the site, approximately 2 km away, although native forest occurs within 300 m of the site and extends beyond Mount Kembla. The Site is located in one of numerous gullies that intersect the foothills at the base of the Illawarra escarpment. It is possible that the Site could come under ember attack from a fire burning up the slope of Mount Kembla to the north or the Illawarra escarpment through to the west of the site under certain weather conditions.

3.2.1 Slope

Slope can have a large impact upon the behaviour of a bushfire, with fires burning faster up slope than down slope, in particular when aligned with the prevailing wind direction. A fire burning up a 10 degree slope will generally spread at double the rate of a fire on level ground (Bushfire CRC 2009). Likewise a fire burning up a 20 degree slope will generally spread at a rate that is four times the rate of spread across level ground (Bushfire CRC 2009).

The majority of the land within 140m of the Site perimeter to the southeast, south, southwest and northeast is either Flat or has a Gentle slope of between 5 - 10 degrees, Figure 6. There are areas with greater slope to the north and east of the Site, including Very Steep slopes > 45 degrees. The Very Steep slopes beyond the northern perimeter are associated with the creek line that flows towards Dapto Creek and between the Western and Eastern Gully landfills.

The slopes within the Site have been calculated using 0.5 metre contour intervals within ArcView Spatial Analyst to produce a digital elevation model (DEM) that enabled the slope to be calculated in degrees. Slope was classified into five categories, as presented in Table 5.

Table 5: Slope Categories

Description	Slope Category
Flat	Flat – 5 degrees
Gentle	6 – 10 degrees
Moderate	11 – 15 degrees
Steep	16 – 20 degrees
Very Steep	21 – 30+ degrees

The presence of the Very Steep slopes to the north of the site that are predominantly northwest or north facing in aspect may act to funnel fire towards the site when a strong westerly wind is blowing. This would direct fire towards the vegetated gully that divides the Western and Eastern Gully landfills. There is no separation of vegetation at this location between the on-site vegetation and that within the 140 m buffer area. The grade of these slopes would facilitate the rapid movement of fire within this area under strong winds.

Within the 140 m buffer zone to the west of the Site along Dapto Creek there is an area of rising ground aligned with the course of Dapto Creek. This area also has Steep slopes that are west, northwest and north in aspect, potentially facilitating the rapid movement of fire from a westerly direction towards WGRRP and the property that is located within the 140 m buffer area to the northwest of the Site.

Within the Site there are Very Steep rising slopes associated with the vegetated Western Gully landfill (16 – 20 degrees) which has a southerly aspect and the Eastern Gully landfill (21 - 25 degrees) that has been terraced and has a predominantly west to southwest aspect.

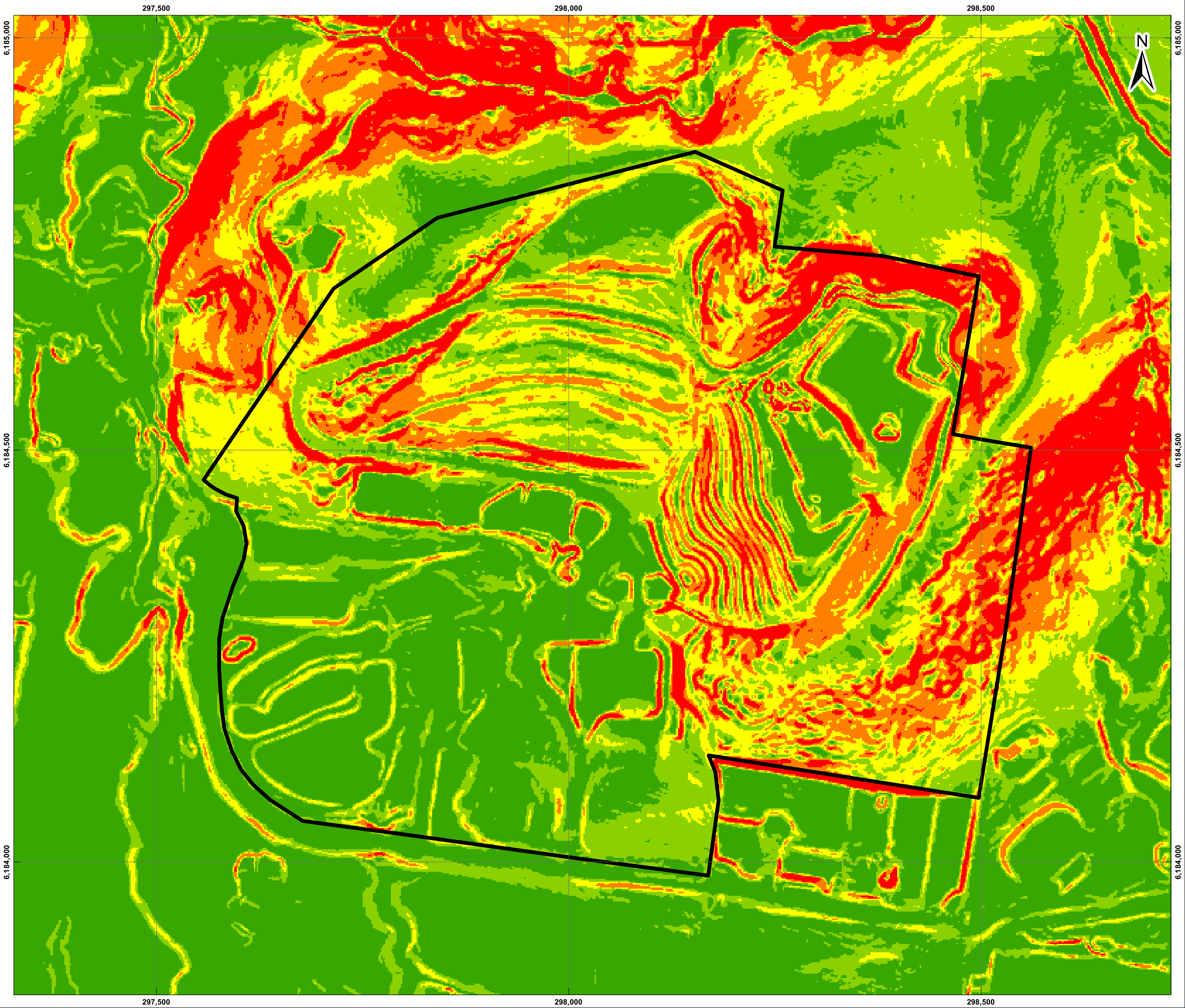
The proposed piggy back design would act to increase the overall slope of the landfill and increase the area of the landfill that had Steep or Very Steep slopes.

3.2.2 Aspect

Aspect also affects bushfire behaviour. North facing slopes receive more solar radiation, drying surface fuel faster than on south facing slopes (Bushfire CRC 2009). Later in summer and during drought, fuels may become uniformly dry across slopes with different aspects, at which stage orientation of the slope to prevailing wind becomes a more important factor (Bushfire CRC 2009).

As indicated above, the greater fire danger is associated with winds from the north, northwest and west of the site. The slopes to the north of the site are rising towards the site and largely northwest and north in aspect, increasing the risk of fire spreading rapidly towards the site. The northwest buffer area is dominated by west and southwest aspect slopes and includes small pockets of northwest aspect slopes that rise towards the site again increasing the risk of fire spreading and moving rapidly towards the site. These slopes are associated with the eastern rising ground of Dapto Creek, with southeast and east aspect rising ground to the west of Dapto Creek.

The existing surface water ponds, leachate ponds Materials Recovery Facility (MRF) and Solid Waste and Energy Recycling Facility (SWERF) are all located in the southern portion of the site. These facilities have been built upon a levelled pad or have retaining banks and are obvious within Figures 6 and 7.



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WOLLONGONG CITY COUNCIL

SLOPE - WGRRP AND SURROUNDS

LEGEND

Site Boundary

Slope

- Flat - 5 degrees
- 6 - 10 degrees
- 11 - 15 degrees
- 16 - 20 degrees
- 21 - 30+ degrees

0 25 50 100 150 200 metres

SCALE (at A3) 1:4,500

DATUM GDA 94, PROJECTION MGA Zone 56

PROJECT: **117625003**
DATE: **01 SEP 2011**
DRAWN: **KB**
CHECKED: **GF**

FIGURE 6

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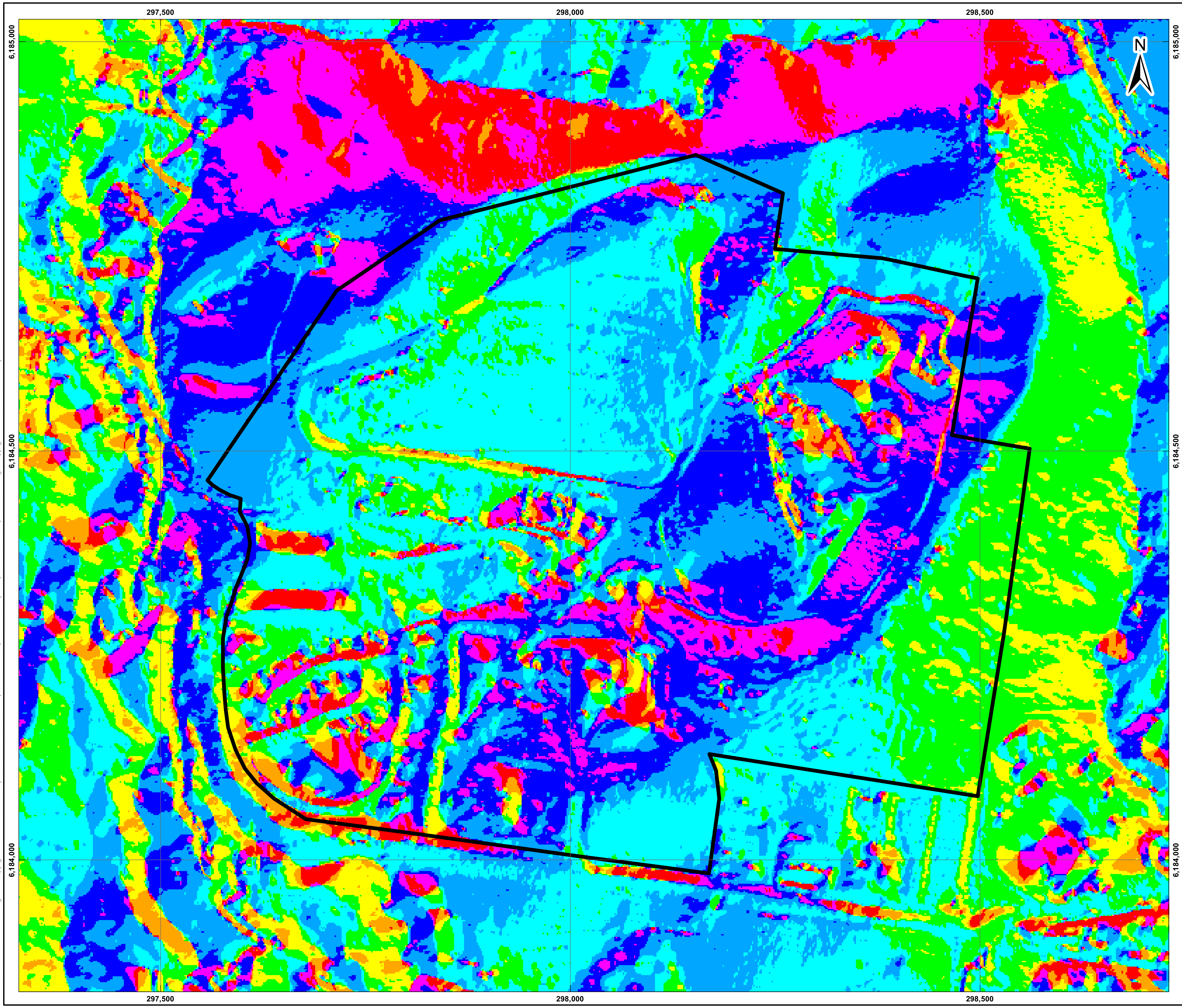

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WOLLONGONG CITY COUNCIL

ASPECT - WGRRP AND SURROUNDS

LEGEND

Site Boundary

Aspect

- Flat (-1)
- North (0-22.5)
- Northeast (22.5-67.5)
- East (67.5-112.5)
- Southeast (112.5-157.5)
- South (157.5-202.5)
- Southwest (202.5-247.5)
- West (247.5-292.5)
- Northwest (292.5-337.5)
- North (337.5-360)

0 25 50 100 150 200 metres

SCALE (at A3) **1:4,500**

DATUM GDA 94, PROJECTION MGA Zone 56

PROJECT: **117625003**
DATE: **01 SEP 2011**
DRAWN: **KB**
CHECKED: **GF**

FIGURE 7

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3.3 Vegetation

The vegetation at the site was assessed by Biosis Research Pty Ltd (2011) and the distribution of vegetation associations across the site is provided in Figure 11 (Biosis 2011).

The majority of the site is covered by closed exotic grassland comprised largely of *Pennisetum clandestinum* (Kikuyu Grass), Figure 8.

Figure 8: Closed Exotic Grassland

Acacia scrub mixed with exotics, in particular *Lantana camara* (Lantana, shown in Figure 9) is also common across the site. Lantana, a Weed of National Significance (WoNS) (CRC Weed Management 2003) is highly flammable (Carter Berry et al 2009) and significantly increases the fire risk within the site. The flammability of Lantana facilitates its spread into vegetation where fire intolerant species are present (Fensham et al. 1994; Gentle & Duggin 1977). Lantana Figure 9 typically increases the risk of fire due to the density of the stands that it forms and the accumulation of ground surface and near surface fuels.

The eastern boundary of the site and immediately beyond is a Forest-Redgum Open Forest/Woodland which also occurs along a gully in the north of the site.

A small band of Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest is located in the northeast corner of the site.

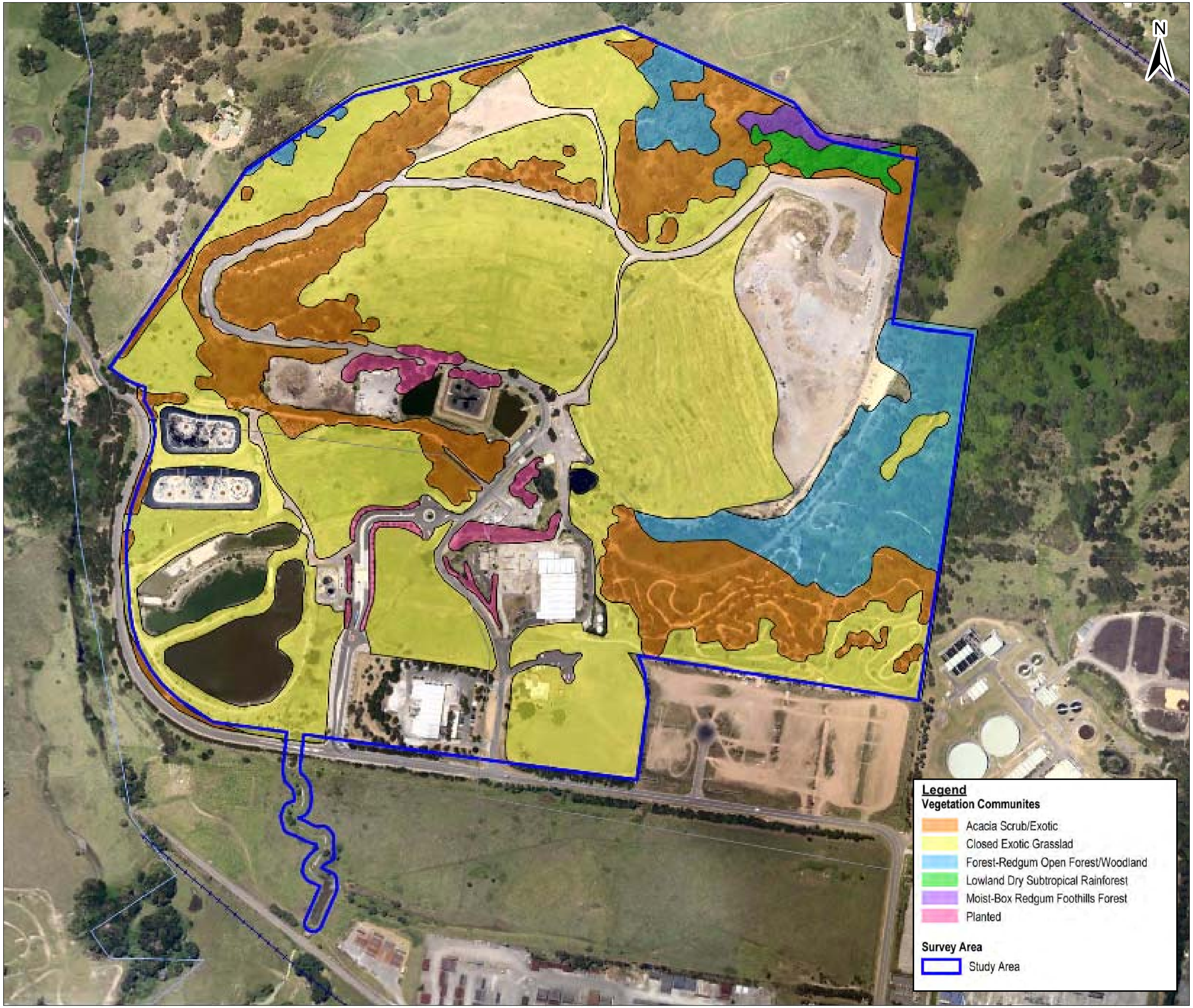
In accordance with NSW RFS (2006) the vegetation formations that surround the site for a distance of 140 m were assessed following Keith (2004). The area that surrounds the majority of the site is classified as Grassland and is assigned a rate of spread [F(r)] = 6 and a total fuel load F(t) = 6 t/ha.

It is acknowledged that beyond the required 140 m assessment distance Dry sclerophyll Forest occurs which has higher assigned F(r) and F(t) levels. This is an important factor when developing the fire management strategies for WGRRP as ember attack can arise from this vegetation zone away from the site boundary.

Figure 9: Lantana presence increase fire risk.

It is understood that the proposed development will involve the removal of vegetation, Figure 4 in the western and northern areas of the site, although the remnant Moist Box Redgum Foothills Forest and Lowland Dry Subtropical Rainforest vegetation associations shown in Figure 10 will be retained.

Figure 10: Lowland Dry Subtropical Rainforest.



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WOLLONGONG CITY COUNCIL

DISTRIBUTION OF VEGETATION (BIOSIS 2012)

LEGEND

Site Boundary

SCALE (at A3) N.T.S

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DRAWN: KB
CHECKED: ???

FIGURE 11

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3.4 Surrounding Land Use

There are several sensitive receptors to fire located within 1 km of the proposed WGRRP development, including:

- Farmborough Heights residential area (north-east)
- Water Treatment plant (south east)

The closest residential area to WGRRP is the suburb of Farmborough Heights, which is located approximately 400 m to the north-east site boundary. There are scattered rural properties located to the west of the site. The majority of the land immediately adjacent to the facility is rural in character with industry occupying land immediately adjacent to the southeast corner of the site.

3.5 Access

The principal access to the WGRRP is via Reddalls Road that joins West Dapto Road to the south of the site. Reddalls Road does not present a viable escape route from the site to the west. West Dapto Road is aligned north-east to south-west and facilitates access to the Princes Highway, and via Northcliffe Drive to the Southern Freeway. The escape route from WGRRP is therefore to the south-east, also facilitating access to the coast, and Tasman Sea or to Lake Illawarra and Wollongong to the north-east.

On Site access roads will be required to be re-aligned around the proposed cells.

Reddalls Road forms a fire break around the south and western sides of the site, while Dapto Creek may form a natural barrier to the west of the site depending upon weather conditions and fuel loads.

3.6 Water Supply

The site has a mains water supply and outlets dedicated to fire fighting, although these are typically associated with the presence of the former SWERF and MRF.

The surface water ponds could also be accessed in the event of an emergency.

Figure 12: Fire Fighting Outlet at SWERF & Water Storage Tank.

4.0 BUSHFIRE RISK ASSESSMENT

4.1 Bushfire Prone Land

Bushfire prone land is defined as land that is either capable of supporting a bushfire or is subject to bushfire attack, including ember attack (WCC 2009). Bushfire prone land is classified in accordance with the type of vegetation present:

- Vegetation category 1 is land that supports forests, heathlands, woodlands, pine plantations or wetlands. Where land is classified as vegetation category 1, a 100 m buffer is applied.
- Vegetation category 2 is land that supports grasslands, scrublands, rainforests, open woodlands or mallee. Where land is classified as vegetation category 2, a 30 m buffer is applied.

The WGRRCP contains areas that are classified as fire prone (vegetation category 1), and as buffer. It also contains land that is not fire prone, that is, no vegetation category 1 or 2 is present (refer to Figure 13) (WCC 2009).

To the north and west of the site are large tracts of land associated with Kembla State Forest and the Illawarra Escarpment State Conservation Area that are classified as vegetation category 1 bushfire prone land. The southern boundary of the WGRRP, along Reddall's Road is the only boundary of the site that is not classified as fire prone land.

4.2 Bushfire Season

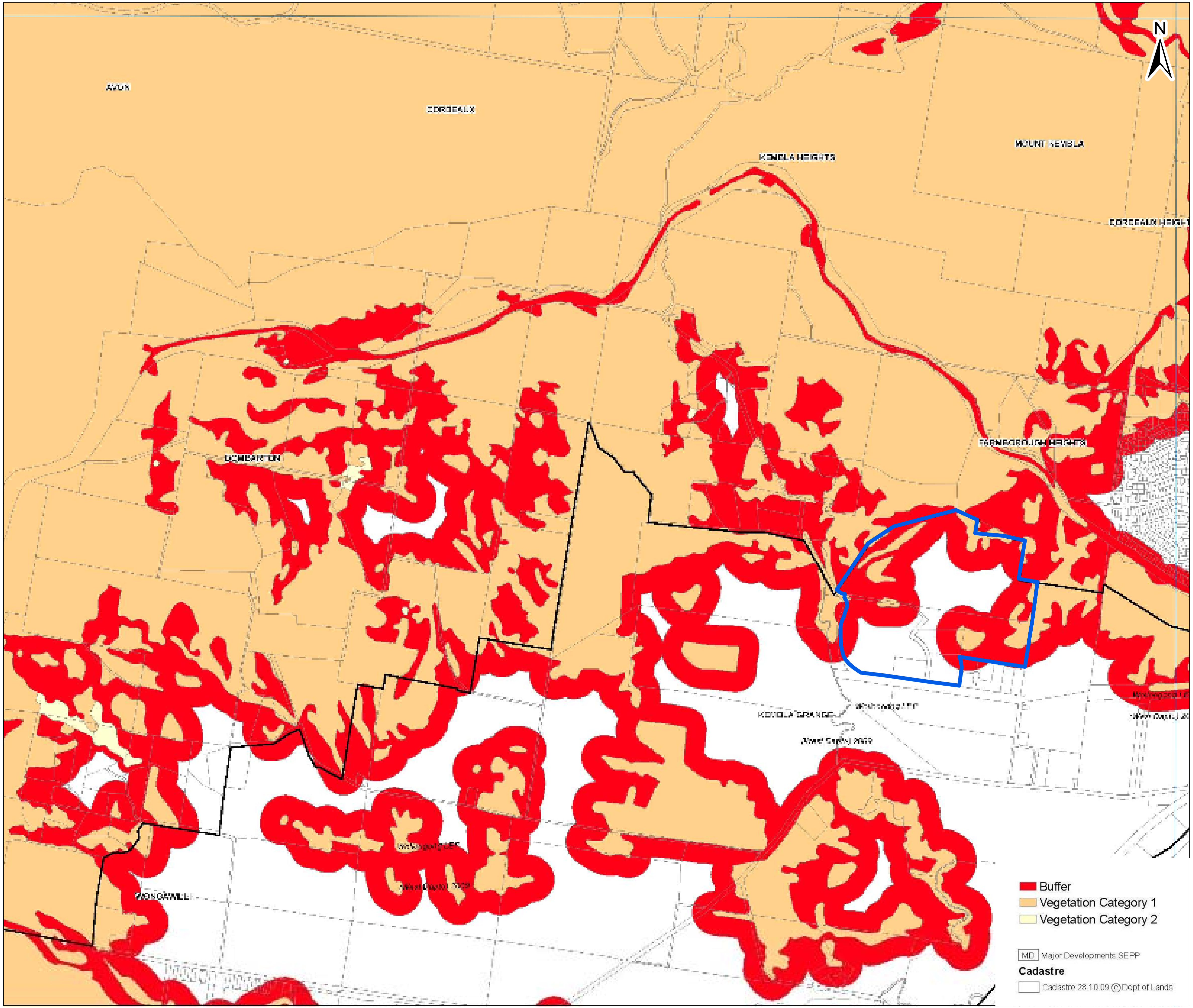
The site is located within the Rural Fire Service East Region within the Illawarra Zone. This zone includes the Kiama, Shellharbour and Wollongong local government areas.

The closest fire stations to the site are:

- Farmborough Heights Rural Fire Station, Cordeaux Road, Farmborough Heights, NSW 2526.
- Mount Kembla Rural Fire Station, Cordeaux Road, Mount Kembla, NSW 2526
- Calderwood Fire Station, Calderwood Road, Albion Park, NSW 2527
- Dunmore Rural Fire Station, Shellharbour Road, Dunmore NSW 2529

While the statutory bushfire danger season commences on 1 October through to 31 March (NSW RFS 2011[1]), within WCC the fire danger season commences in August/September and extends through to the commencement of summer rains. In a dry summer period the bushfire season may extend through summer to early autumn (Illawarra Bushfire Management Committee 2008).

High fire danger can typically exist when there is a strong low pressure system located near Tasmania directing strong dry westerly winds across the interior of the continent to the coastal regions of New South Wales (BOM 2009).



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DISTRIBUTION OF FIRE PRONE LAND (WCC 2009)

LEGEND

Site Boundary

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FIGURE 13

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4.3 Bushfire History

No evidence of bushfire was observed on the site when visited on 22 August 2011.

NSW RFS (2011[2]) indicate that major fires burnt in the Wollongong area in the 1968-1969 fire season and these fires destroyed 33 homes and five other buildings. IBFMC (2008) indicate that there has been a single fire in the area of the site since 1968, (refer to Figure 15) and it is difficult to assess if this fire burnt to the boundary of the site or burnt part of the site.

The Kembla Grange, Farmborough Heights, Mount Kembla and Kembla Heights suburbs are included in the area classified as 25+ years since the last fire, as shown in Figure 16, which indicates that the last recorded fire within the area occurred sometime prior to 1983, as mapping was undertaken in 2008.

IBFMC (2008) indicate that a portion of the site is above the fire threshold and another portion is fire intolerant, (refer to Figure 17). The fire intolerant vegetation would coincide with the presence of the Moist Box Redgum Foothills Forest and Lowland Dry Subtropical Rainforest vegetation associations.

WCC is unaware of any instance in which a bushfire has threatened or burnt the WGRRP [A. Clifford and T. Crinnion, WCC pers comm. 29 August 2011], although there have been incidents of fires on the tipping face of the landfill [T. Crinnion, WCC pers comm. 29 August 2011].

4.4 Ignition Cause

4.4.1 Arson & Human Activity

The major causes of bushfire within the NSW Rural Fire Service East Region - Illawarra Zone are arson and malicious/suspicious activity, with this category including fires associated with burning stolen vehicles (IBFMC 2008). Hoctor (2009) reported that an arsonist was thought to have lit several fires within the Illawarra area over a weekend, with approximately 12 fires fought in the area near Mount Kembla. The dumping and burning of stolen vehicles is a major cause of fires and is more likely to occur within the urban bush interface zone (IBFMC 2008). The site is located within the urban bush interface zone and as such is a likely area for malicious/suspicious activity. It is important to note that small fires of less than 1 ha may not be mapped and that other fires may not be classified as bushfires if they are restricted to the abandoned vehicle, therefore the absence of bushfires in the IBFMC (2008) mapping may not accurately reflect the complete fire history. Therefore, managing for this eventuality remains warranted and a prudent course of action.

Other causes of fire include fire escaping from legal and illegal burning activity. A worker using a grinder and welding on a day of high temperature and strong winds caused a grass fire in Wollongong (Shaw 2009) and demonstrates how readily a bushfire can be triggered and spread out of control.

The presence of high voltage and other electrical transmission power lines across the site, seen in Figure 14, increases the risk of a fire igniting due to wires arcing in high winds. This is a known cause of fires in the Illawarra Zone (IBFMC 2008).

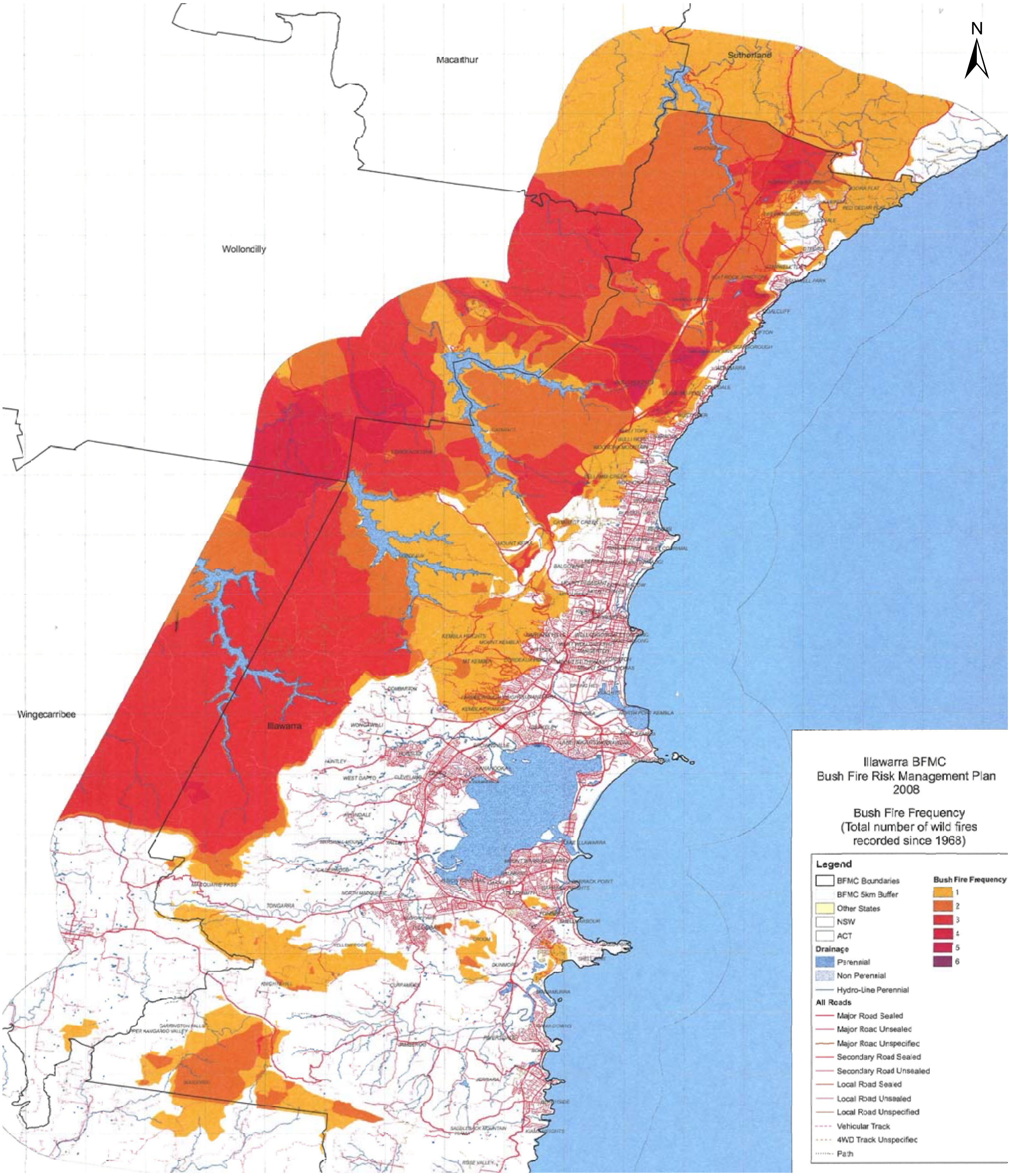
Figure 14: High Voltage Electrical Power Transmission Lines at WGRRP.

4.4.2 Lightning

The average annual lightning ground flash density (Ng) map shows that the Wollongong area experiences 1 to 2 lightning strikes per km^2 per year (Commonwealth of Australia 2010). This indicates that a circular area (78.5 km^2) with a radius of 5 km around the WGRRP may receive between 79 - 157 lightning strikes each year. While the actual site occupies approximately 50 ha (0.01 km^2) and would be expected to receive 0.5 - 1 lightning strikes per year, the risk of lightning as a potential source of fire ignition within the WGRRP is still considered to be low, as lightning strikes may often be associated with rainfall events. The risk of a lightning strike causing a fire remains present and must be managed. Lightning strikes started a number of bushfires on the South Coast in 2009 to the south west of Kiama (Anon 2009).

The presence of the high voltage transmission lines across the site may act to increase the likelihood of lightning strikes. Generally, lightning strikes can be expected to be more frequent on top of the escarpment than within the foothill or plains areas of the region (IBFMC 2008). Thunderstorm activity generally occurs late in spring or summer (IBFMC 2008).

Lightning strikes to the west or northwest of the site on days of extreme fire danger pose a threat to the site.



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FREQUENCY OF FIRES
IBFMC (2008)

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FIGURE 15

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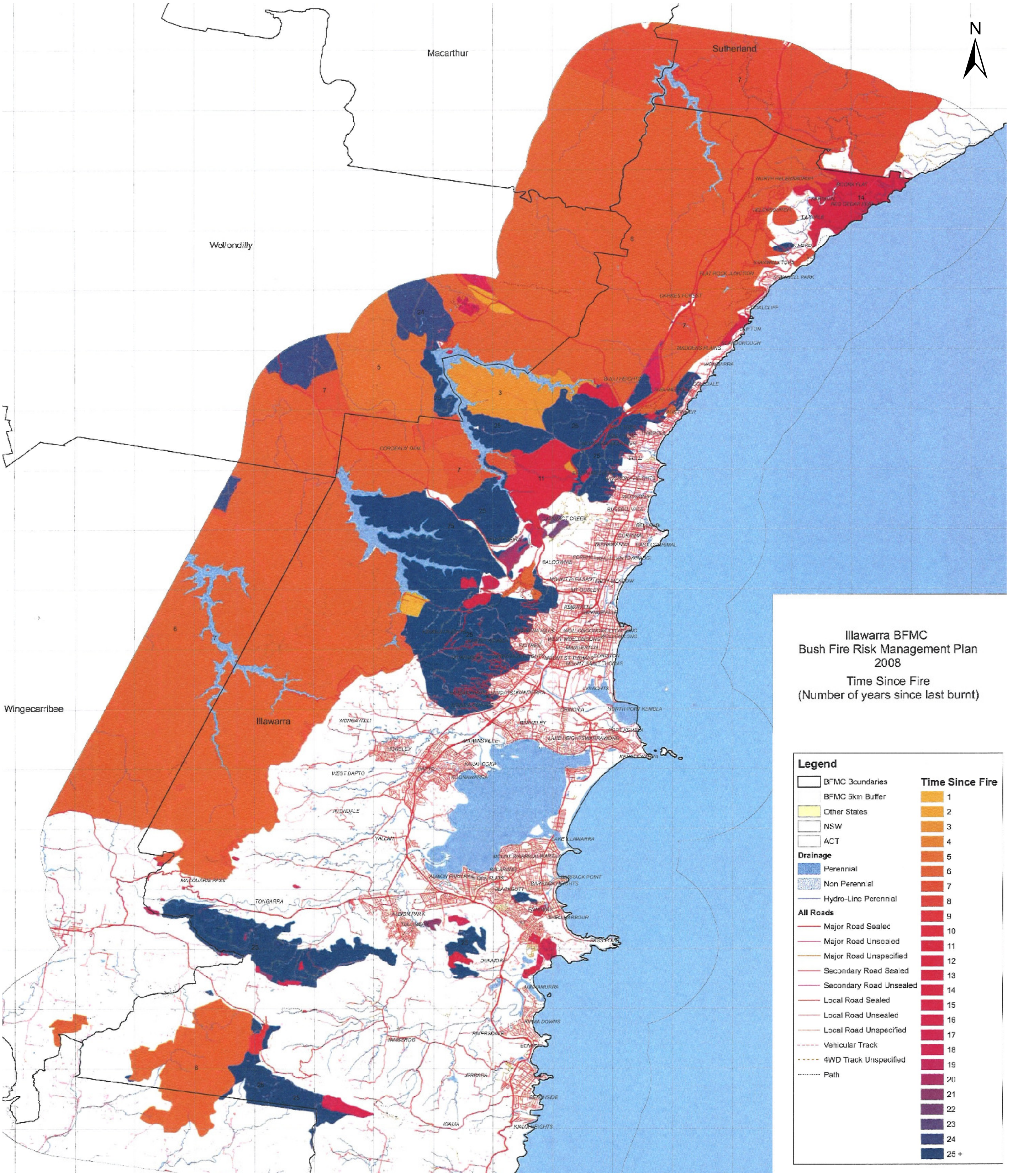

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TIME SINCE LAST FIRE
IBFMC (2008)

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FIGURE 16

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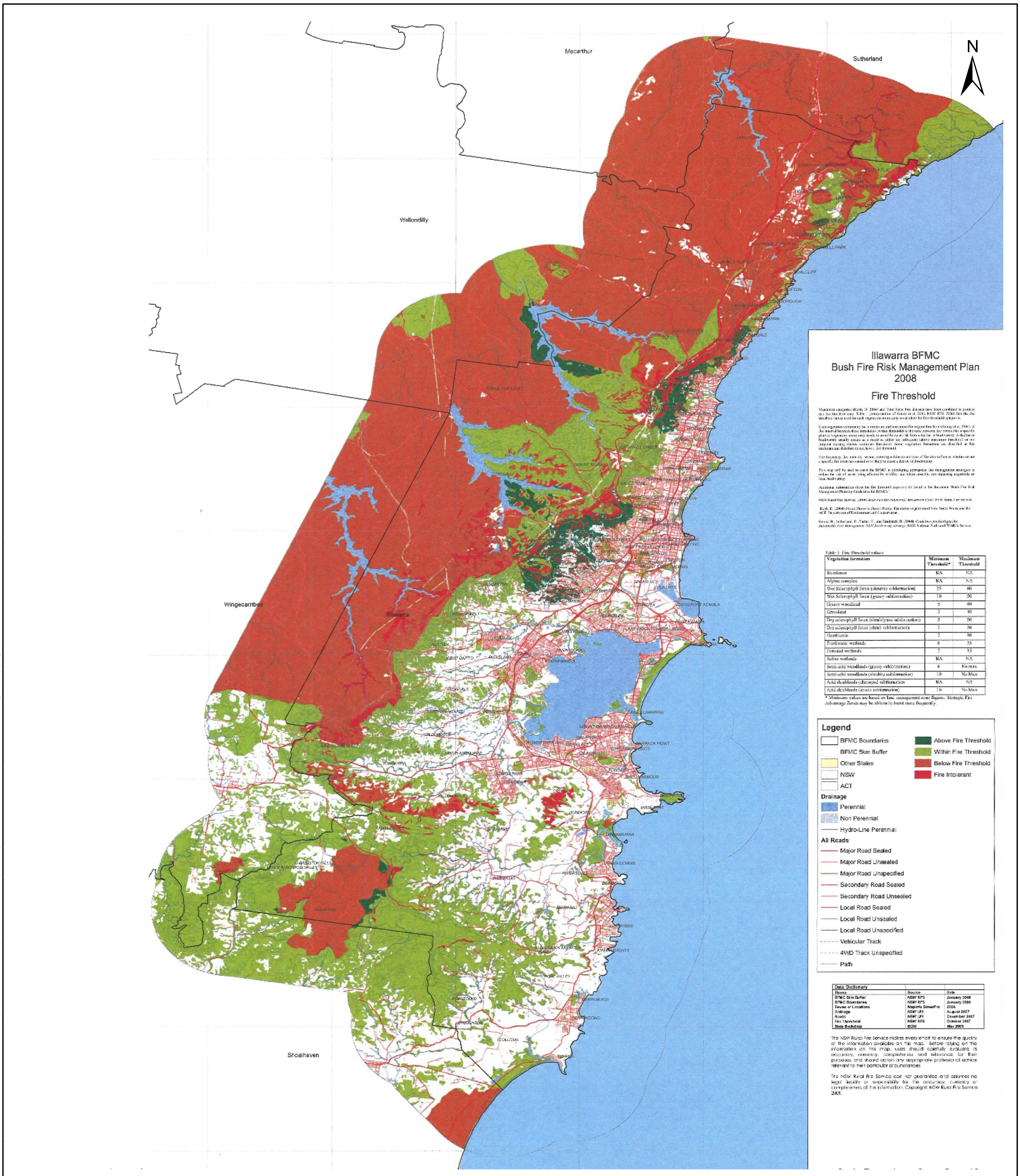

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FIRE THRESHOLD
IBFMC (2008)

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Base image sourced from "Illawarra Bush Fire Management Committee - Bush Fire Risk Management Plan", 2008 New South Wales Rural Fire Service, Government of New South Wales, Accessed 17 August 2011, www.rfs.nsw.gov.au/file_system/.../Attachment_20100510_815FC22D.pdf

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FIGURE 17

4.4.3 Fuel load

Fuel comprises material that can be ignited and sustain a fire, and can include grass, leaf litter and live vegetation. Fuel is categorised according to the layer in which it occurs, including the surface, near surface, elevated (shrubs and understorey), bark and canopy.

A ‘spot’ determination of the overall fuel load in the WGRRP was made using the DEH (2008) Overall Fuel Hazard Guide for South Australia, on the southern side of the Eastern Gully landfill within an area Biosis Research (2011) described as Acacia scrub/Exotic vegetation association. The vegetation in this area comprised a ground layer of Kikuyu Grass, shrub layer of Lantana and a sparse canopy of *Acacia melanoxylon* (Blackwood) and *Olea europaea* (Olive).

The vegetation present at this location is shown in Figure 18, and the presence of Lantana adds considerably to the elevated fuel level present. Utilising the DEH (2008) classification methodology the overall fuel hazard of this area would be classified as ‘High’ and an overall fuel load of 12 t/ha. This overall fuel hazard suggests that a ‘first attack’ fire fighting effort would be successful on days of Extreme FFDI (50-100) in 96-64% of instances (DEH 2008). First attack is defined by DEH (2008) as:

- direct attack with a 50kW bulldozer (D3/4 class) and a small 1-4 type fire unit (400 l capacity) and crew
- a single fire
- within 30 minutes of detection/ignition
- burning on level terrain with good access
- when the McArthur FFDI Drought Factor is 10
- the wind speed is 20 km/h (at 10m in the open).

This value is provided as a guide only as the first attack capacity by local RFS Brigades will vary from that defined by DEH (2008) and the criteria that this calculation is based upon may also vary.

As fuel load increases the rate of spread and fire intensity increase, increasing the risk to the site, workers and fire fighters, as well as diminishing fire suppression options.

Figure 18: Fuel load assessment - Acacia scrub/Exotic vegetation association.

Windblown litter has accumulated beyond the litter fence above the Eastern Gully Landfill in the northeast corner and extends along to the eastern boundary of the site. This increases the fuel available and the risk of a fire igniting. Litter has accumulated in areas along the perimeter access track reducing the overall effectiveness of this track as a fuel break and in areas of accumulated litter actually constitutes a significant fuel load.

Litter has also spread beyond the site boundary and occurs at ground level through to the tree canopy, increasing the vertical fuel load. The properties of this fuel, (light and flammable) increases the likelihood of it being a source of fire spotting when ignited in strong winds.

As discussed the distribution and density of lantana present at the site increases the fuel load and potential intensity of a fire at the site. The cover of grass over the Western Gully Landfill, Figure 8 and over the contoured slope of the Eastern Gully Landfill also presents considerable fuel load and risk of a grass fire when cured.

4.5 Bushfire Risk

The IBFMC has rated the likelihood of a fire occurring at WGRRP as 'Unlikely' with a consequence of 'Low' to produce an overall risk rating of 'Low'. WGRRP is not considered a priority asset by the IBFMC (2008) and no specific fire prevention measures are recommended by the IBFMC for this economic asset. The site does not have a specific classification under IBFMC (2008).

The proposed development involves the removal of existing infrastructure including leachate ponds, weighbridge and site buildings, the buildings that will remain post development include the Materials Recovery Facility (MRF), Solid Waste and Energy Recycling Facility (SWERF) and administration building (Glengarry Cottage). These facilities are presently located east of the surface water ponds and the main entrance sealed road that act as fire breaks, as shown in Figure 2, and that are located more than 100 m from a vegetation hazard beyond the site perimeter. These buildings are considered to have a Low Bushfire Attack Level (BAL) and are likely to experience minimal attack from radiant heat or flame. The Low BAL threat level does not warrant specific construction requirements, although some attack from burning debris is possible. This is of particular importance as these facilities can include outdoor areas of stored flammable material such as cardboard, plastics and paper. The proposed development of additional cells does not alter the present separation distances of these facilities.

It is important to note that the vegetation at the site can be a hazard if not managed appropriately. It is noted that the proposed development will involve the removal of vegetation including large areas of Lantana thereby reducing the fuel load and associated fire risk.

A bushfire is most likely to approach the facility from the west, northwest or north on days of severe to catastrophic fire danger. There are areas along this site perimeter where there is no effective separation distance from managed pasture (exotic grassland) or Forest Redgum Open Forest/Woodland. This is of concern in the north where forest extends through to the Illawarra Escarpment State Conservation Area and Mount Kembla.

Figure 19: Mount Kembla - Forest to the north-northwest of WGRRP

The risk posed by a fire originating within the landfill, in particular at the tipping face remains and has occurred several times in the past [T. Crinnion, WCC pers comm. 29 August 2011]. The lack of a specific fire management plan and accumulation of high fuel loads within WGRRP increases the risk of a fire originating within WGRRP becoming established and spreading beyond the site boundary.

5.0 BUSHFIRE MITIGATION MEASURES

The bushfire risk reduction measures are divided into managing the physical bush fire hazards (Hazard Management) and the behaviours that contribute to bush fire and the safety of personnel (Risk Management). The NSW RFS (2006) planning for bushfire document has no specific construction requirements for a landfill cell, however the proposed development must comply with Section 4.3 - Performance Criteria and Acceptable Solutions. Bushfire mitigation measures are focussed upon the proposed development of the new landfill cells, in the knowledge that a fire management plan is recommended to be developed for the site.

5.1 Bushfire Hazard Management

5.1.1 Asset Protection Zone

i) An asset protection zone (APZ) of 10 m should be maintained around existing site buildings.

5.1.2 Firebreak

i) A perimeter firebreak cleared of all vegetation is to be established around the entire site (roads and access tracks may be utilised to form the fire break). Reddalls Road may be considered to serve this purpose provided access to the site is maintained. Where a road is utilised it must be constructed to comply with AS 2890.2 – 2002. (The remnant Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest vegetation associations are to be protected).

ii) The firebreak is to be **5 m wide** and is to be constructed by an approved method or combination of methods (ploughing, cultivating, scarifying, raking, burning, chemical spraying) so as to remove flammable matter within that 5 metre wide firebreak to a height of **5 metres**.

iii) The firebreak is to be inspected monthly and maintained clear by physical or herbicide removal of weeds and plant material including litter.

iv) A firebreak 5 m wide is to be maintained around temporary site buildings during construction of the new cells or site infrastructure.

5.1.3 Access

i) A two way sealed road is recommended to be constructed around the perimeter of the proposed cells to enable all weather access by Category 1 fire fighting vehicles. Road construction must be in accordance with BFCC (2007). As a minimum roads (or fire trails) provided must enable safe access and egress and defendable space for emergency services.

ii) A secondary site access and egress should be considered in the redevelopment of the road network, the site road adjacent to Glengarry Cottage is adequate for this purpose.

iii) Fire hydrant outlets at the site are to be cleared of vegetation so as to facilitate unrestricted access.

5.1.4 Fuel reduction

i) Planted trees that are retained on the site are to have the lower branches trimmed (cut off) to a height of **2 m** above the ground. (The remnant Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest vegetation associations are to be protected and are not subject to this requirement). The tree trimming works may be staged with priority given to the protection of assets and fuel load reduction adjacent to roads.

ii) The canopy of any tree retained at the site is to be not less than **10 m** from any building, where this separation distance cannot be achieved by trimming branches consideration is to be given to the removal of the tree. Advice may be sought on a case by case basis taking into consideration the building construction, location and purpose.

iii) A vegetation management plan (including weed management) should be developed to ensure that grass cover on landfill cells is kept mowed or slashed so as not to exceed a fuel load of 2 t/ha. It is preferable that slashed or mown material is removed (this can be mulched on site). Weeds are to be managed at the site by a control program to ensure that they do not constitute a fire hazard. Lantana (and any WoNS) is to be removed.

iv) Wind-blown litter is to be controlled.

v) Roadside vegetation adjacent to internal site access roads is to be slashed or mown for at least a distance of 1 m up slope and 4 m down slope and maintained cleared during the declared bushfire season.

5.1.5 Landscaping

i) The site vegetation (landscaping) should not exceed a fuel load of 2 t/ha.

ii) Tree planting within 20 m of buildings should be minimal and vegetation screening should be avoided.

iii) Trees planted within 20 m of a building should be spaced so as to ensure that crowns are no closer than 10 m apart.

iv) Trees planted must be more than 10 m away from a building at their closest point when mature i.e. crown no closer than 10 m when mature.

v) Tall shrubs are not to be planted in clumps within close proximity of a building.

vi) Landscaping plants used close to a building (within 20 m) should be low in profile.

vii) Coarse or inorganic mulch should be utilised and moisture should be retained by irrigation.

viii) The overall canopy cover within 20 m of a building should be no more than 15%.

5.1.6 Watering

i) Retained vegetation at the site should be irrigated or watered regularly during the declared bushfire season so as to retain moisture (be kept as green as possible).

5.1.7 Fencing

i) Flammable materials must be removed from site fencing.

ii) Holes in site fencing are to be repaired.

5.1.8 Services (Water, Electricity and Gas)

i) Vegetation within the vicinity of power lines and tower lines that extend across the site must be trimmed in accordance with 'Vegetation Safety Clearances' (AUSGRID 2010).

ii) Services should be placed underground where practicable.

5.2 Bushfire Risk Management

5.2.1 Fire Management Plan

i) A comprehensive fire management plan for the period of construction of the new cells and operation of WGRRP must be prepared and implemented for the site. This fire management plan will encompass all activities undertaken.

5.2.2 Declared Catastrophic Fire Danger

i) On days of declared Catastrophic Fire Danger for the district only essential staff should be present at site.

ii) Site works will be conducted in accordance with those activities permitted under a Total Fire Ban – an exemption must be obtained from the NSW RFS to permit Hot Works.

iii) Staff shall comply with the WGRRP Emergency Management Plan.

5.2.3 Vehicle Use

i) Motor vehicles shall not drive over long dry grass and shall remain within defined parking and trafficable areas.

ii) During a **Total Fire Ban** vehicles are not to be operated in bushland.

iii) Site vehicles will be fitted with a water fire extinguisher.

5.2.4 Security

As arson is the major cause of bush fires in the area and within the state, site security is a significant issue.

i) It is recommended that WCC secure the site to prevent unauthorised access and arson attack.

ii) It is recommended that a security presence is maintained at the site and that the site is actively patrolled after hours during the bushfire season. As a minimum WCC is to establish a regular site inspection schedule during the bushfire season to ensure perimeter security is maintained. Unauthorised access is to be reported and corrective actions (including maintenance) are to be enacted in a timely manner.

6.0 CONCLUSION

The proposed development involves the establishment of new landfill cells within the existing WGRRP. This will involve the relocation of some facilities and the removal of areas of vegetation. Two areas of vegetation, the remnant Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest have been identified for conservation and this is to be incorporated into the overall design of the new cells.

The bushfire protection measures incorporated into the proposed development, as set out in Section 5.0 Bushfire Hazard Management comply with the aims and objectives of the NSW RFS (2006 and 2010) Planning for Bush Fire Protection and the acceptable solutions of the performance criteria identified in *4.3 Planning Controls For Infill And Other Developments On Bush Fire Prone Land.* The proposed development does not include the construction of buildings and therefore elements of NSW RFS (2006 and 2010) do not apply.

The development and implementation of a comprehensive site fire management plan for WGRRP would further reduce the risk of fire. The site fire management plan must address weed management, litter control and general landscaping and landscape maintenance practices.

The IBFMC (2008) rated the likelihood of a fire occurring at WGRRP as ‘Unlikely’ with a consequence of ‘Low’ to produce an overall risk rating of ‘Low’. Two bushfires have been recorded in the area since 1968, although several small fires have occurred on the tip face of the landfill. It is considered that the economic and social impacts of a fire becoming established within a landfill cell at WGRRP may be higher than that attributed by IBFMC (2008) and a higher level of risk mitigation may be warranted. Fires once established within landfill cells can be difficult to extinguish and are associated with significant recovery costs.

Bushfire is most likely to occur during extreme weather conditions and is likely to approach from the west, northwest and north of the site. The very steep, vegetated slopes beyond the northern perimeter associated with the creek line that flows towards Dapto Creek and also between the Western and Eastern Gully landfills may act to funnel fire towards WGRRP, as these slopes are also northwest / north in aspect increasing the risk of fire spreading rapidly towards the site.

The proposed development would not alter the bushfire risk, although the removal of existing vegetation would reduce the fuel load and the likelihood of a fire igniting and spreading, largely through the removal of lantana, a WoNS that adds greatly to the fuel load present at WGRRP.

It is considered this report adequately provides an assessment of the potential bushfire impacts of the Project.

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Report Signature Page

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http://aupws/117625003wollongongcitycouncilnewcellwhytesgully/project doc/3066 bushfire report and site specific fire management plan/117625003_141_r_rev0 bushfire report.docx

APPENDIX A

Fire Danger Index (NSW RFS 2009)

A FIREWISE INITIATIVE

NSWRFS INFORMATION LINE

1800 NSWRFS

1 8 0 0 6 7 9 7 3 7

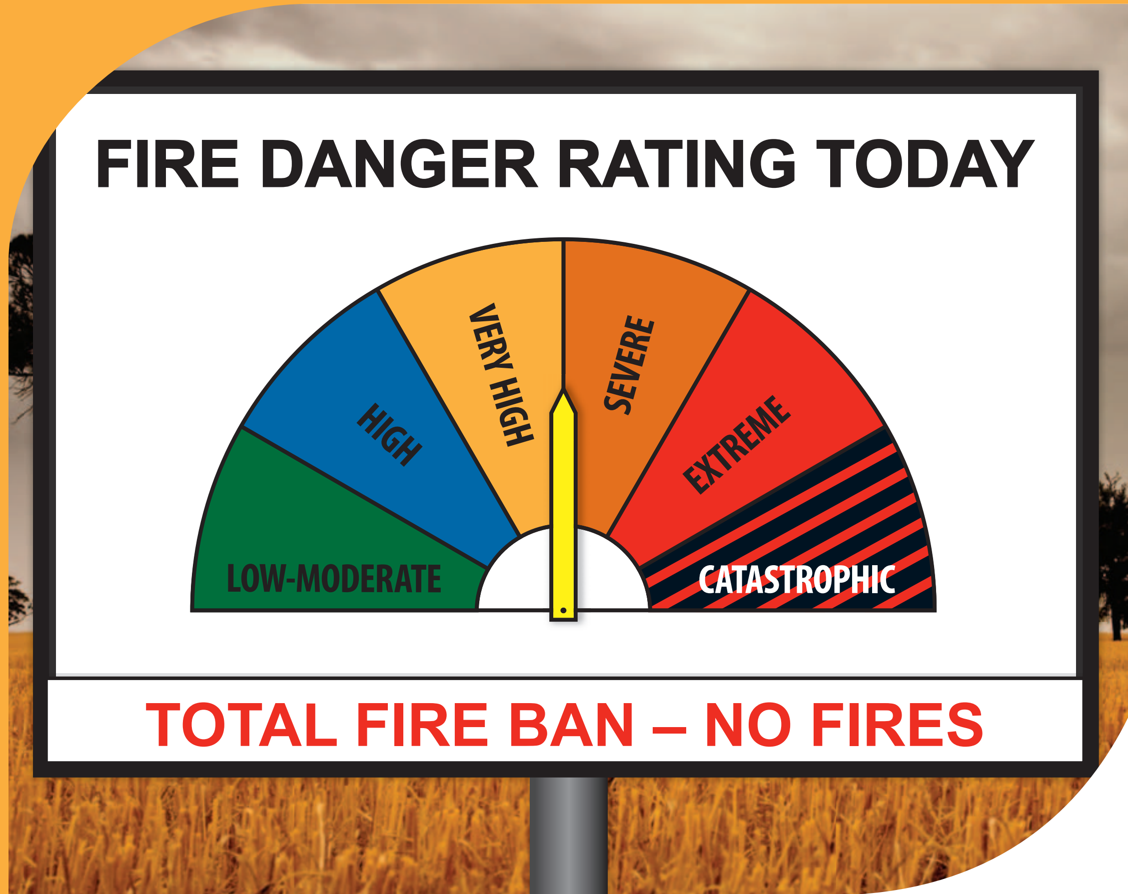
www.rfs.nsw.gov.au

NSW GOVERNMENT

www.fire.nsw.gov.au

www.rfs.nsw.gov.au

FIRE DANGER RATING



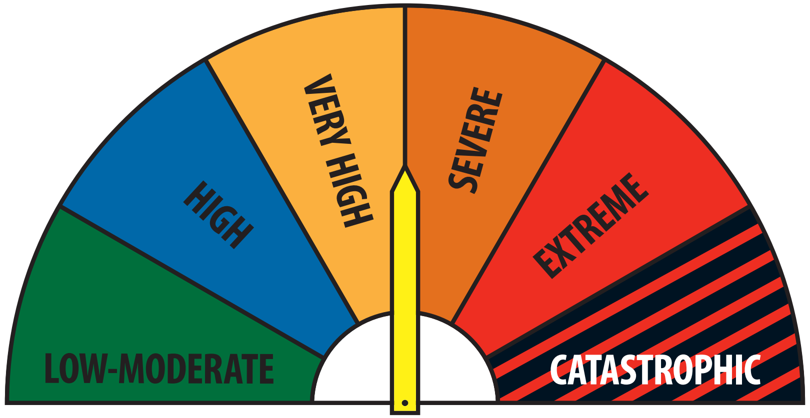
The Fire Danger Rating is an early indicator of potential danger and should act as your first trigger for action.

Fire Danger Rating

The Fire Danger Rating (FDR) is an assessment of the potential fire behaviour, the difficulty of suppressing a fire, and the potential impact on the community should a bush fire occur on a given day.

The FDR is determined by the Fire Danger Index (FDI). The FDI is a combination of air temperature, relative humidity, wind speed and drought.

An FDI of 1 (Low-Moderate) means that fire will not burn, or will burn so slowly that it will be easily controlled, whereas an FDI in excess of 100 (Catastrophic) means that fire will burn so fast and so hot that it is uncontrollable.



When a Fire Danger Rating is advised, you need to take it seriously and be prepared to act.

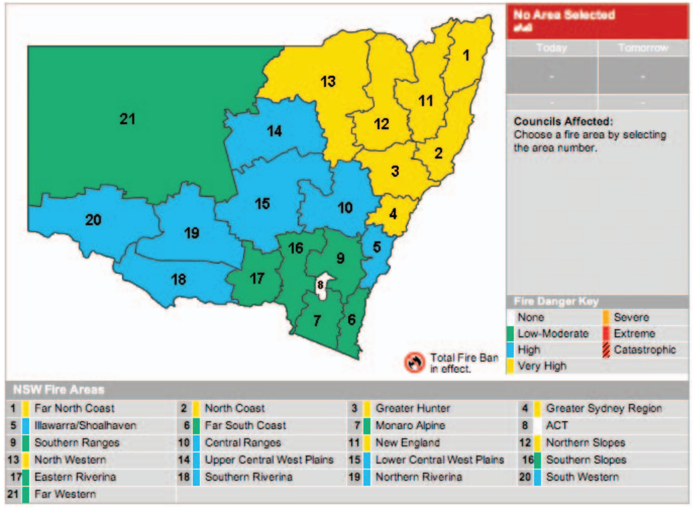
Your survival may depend on it.

Do you have adequate home and contents **insurance** should the unthinkable happen?

Total Fire Ban

The RFS may declare a Total Fire Ban for days of increased fire danger, based on advice from the Bureau of Meteorology (BOM).

For more information go to www.rfs.nsw.gov.au or www.bom.gov.au. Alternatively you can contact the local RFS Fire Control Centre or NSW Fire Brigades station.



Rules During Total Fire Bans

No fire may be lit in the open and all Fire Permits are immediately suspended. This includes the use of incinerators and solid fuel barbecues.

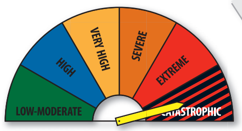
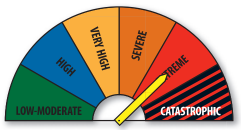
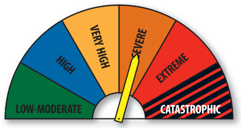
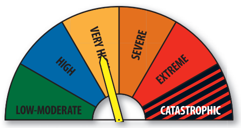
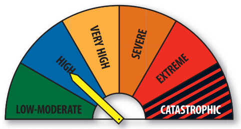
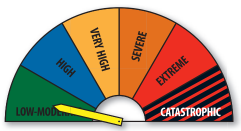
You may use a gas or electric barbecue, but only if:

- It is on a residential property within 20 metres of the house **or**
- It is a permanent fixture within a picnic area managed by Council National Parks or Forests NSW

and

- It is under the direct control of a responsible adult
- There is a clear area for 2 metres around the barbecue
- You have an immediate and continuous supply of water

Penalties for lighting a fire on a day of Total Fire Ban include a maximum fine of $100,000 and 14 years imprisonment.

Fire Danger Rating	Fire Danger Index	Potential Fire Behaviour	Impact Potential	Your Action	FDR
CATASTROPHIC 	100	**• Fires will likely be uncontrollable, unpredictable and very fast moving with highly aggressive flames extending high above tree tops and buildings. • Thousands of embers will be violently blown into and around homes causing other fires to start and spread quickly up to 20km ahead of the main fire.**	**• Fire can threaten suddenly, without warning and be incredibly hot and windy making it difficult to see, hear and breathe as the fire approaches. • People in the path of the fire will almost certainly die, or be injured and significant numbers of homes and businesses destroyed or damaged. • Even well prepared and constructed homes will not be safe. • Expect power, water and phone networks to fail as severe winds bring down trees, power lines and blow roofs off buildings well ahead of the fire. • In the event of a fire, firefighting resources will be stretched to their limit and will not be available to help all properties.**	**• Ensure that your survival is the primary consideration in any decision. • The safest option is for you and your family to leave early, hours or the day before a fire occurs. • Under no circumstances will it be safe to Stay and Defend. • Ensure you stay well informed of current fire activity by monitoring local media and regularly checking for updates on the RFS website or Information Line.**	CATASTROPHIC
EXTREME 	99 75	• Fires will likely be uncontrollable, unpredictable and fast moving with flames in the tree tops, and higher than roof tops. • Thousands of embers will be blown around and into homes causing other fires to start and spread quickly up to 6km ahead of the main fire.	• Fire can threaten suddenly, without warning and it will be very hot and windy making it difficult to see, hear and breathe as the fire approaches. • There is a likelihood that people in the path of the fire will die, or be injured and many homes and businesses destroyed or damaged. • Only very well prepared, constructed and actively defended homes are likely to offer any degree of safety. • Power, water and phone networks are likely to fail as strong winds will bring down trees, power lines and blow roofs off buildings well ahead of the fire. • In the event of a fire, firefighting resources will be stretched and are highly unlikely to be available to help all properties.	• Ensure that your survival is the primary consideration in any decision. • Leaving early (hours before) will always be the safest option for you and your family. • If your Bush Fire Survival Plan includes the decision to Stay and Defend, only do so if your home is well prepared, specifically designed and constructed for bush fire and you are currently capable of actively defending it. • Stay well informed of current fire activity by monitoring local media and regularly checking for updates on the RFS website or Information Line.	EXTREME
SEVERE 	74 50	• Fires will likely be uncontrollable and fast moving with flames that may be higher than roof tops. • Expect embers to be blown around and into homes causing other fires to start and spread up to 4km ahead of the main fire.	• Fire can threaten suddenly, without warning and be very hot and windy which will make it increasingly difficult to see, hear and breathe as the fire approaches. • There is a chance lives may to be lost and people injured and expect that some homes and businesses will be destroyed or damaged. • Well prepared, constructed and actively defended homes are likely to offer safety during a fire. • Power, water and phone networks may fail. • In the event of a fire, firefighting resources are unlikely to be available to help all properties.	• Ensure that your survival is the primary consideration in any decision. • Leaving early (hours before) is the safest option for you and your family. • Follow your Bush Fire Survival Plan. • If your Bush Fire Survival Plan includes the decision to Stay and Defend, only do so if your home is well prepared, and you are currently capable of actively defending it. • Stay informed of current fire activity by monitoring local media and regularly checking for updates on the RFS website or Information Line.	SEVERE
VERY HIGH 	49 25	• Fires can be difficult to control and present a very real threat. • Embers may be blown around homes causing other fires to occur up to 2km ahead of the main fire.	• Fire can threaten suddenly, without warning and it may be hot and windy and it may become difficult to see, hear and breathe as the fire approaches. • Loss of life or injury is unlikely though some homes and businesses may be damaged or destroyed. • Well prepared homes that are actively defended can offer safety during a fire. • Power, water and phone networks may fail. • In the event of a fire, firefighting resources may not be available to help all properties.	• Ensure that your survival is the primary consideration in any decision. • Be prepared to implement your Bush Fire Survival Plan. • Stay informed of current fire activity by monitoring local media and regularly checking for updates on the RFS website or Information Line.	VERY HIGH
HIGH 	24 12	• Fires can be controlled but still present a threat. • Embers may be blown ahead of the fire and around homes causing other fires to occur close to the main fire.	• Fire may threaten suddenly and without warning. • Loss of life is highly unlikely and damage to homes and businesses limited. • Well prepared homes that are actively defended can offer safety during a fire.	• Ensure your family, home and property is well prepared for the risk of bush fire. • Review and practice your Bush Fire Survival Plan. • Monitor local media for fire activity and regularly check the RFS website or Information Line.	HIGH
LOW / MODERATE 	11 0	• Fires can be easily controlled but can still present a threat.	• Little or no risk to life or homes	• Ensure your family, home and property is well prepared for the risk of bush fire. • Review and practise your Bush Fire Survival Plan. • Refer to the RFS website or Information Line for changes in fire activity.	LOW / MODERATE

FDI

APPENDIX B

Wind roses - Port Kembla Signal Station (BOM 2010)

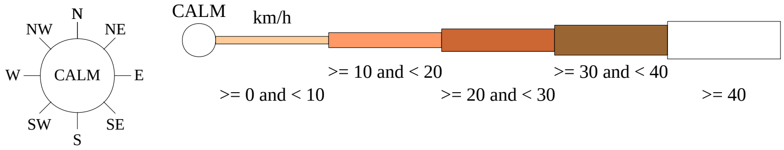
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

PORT KEMBLA SIGNAL STATION

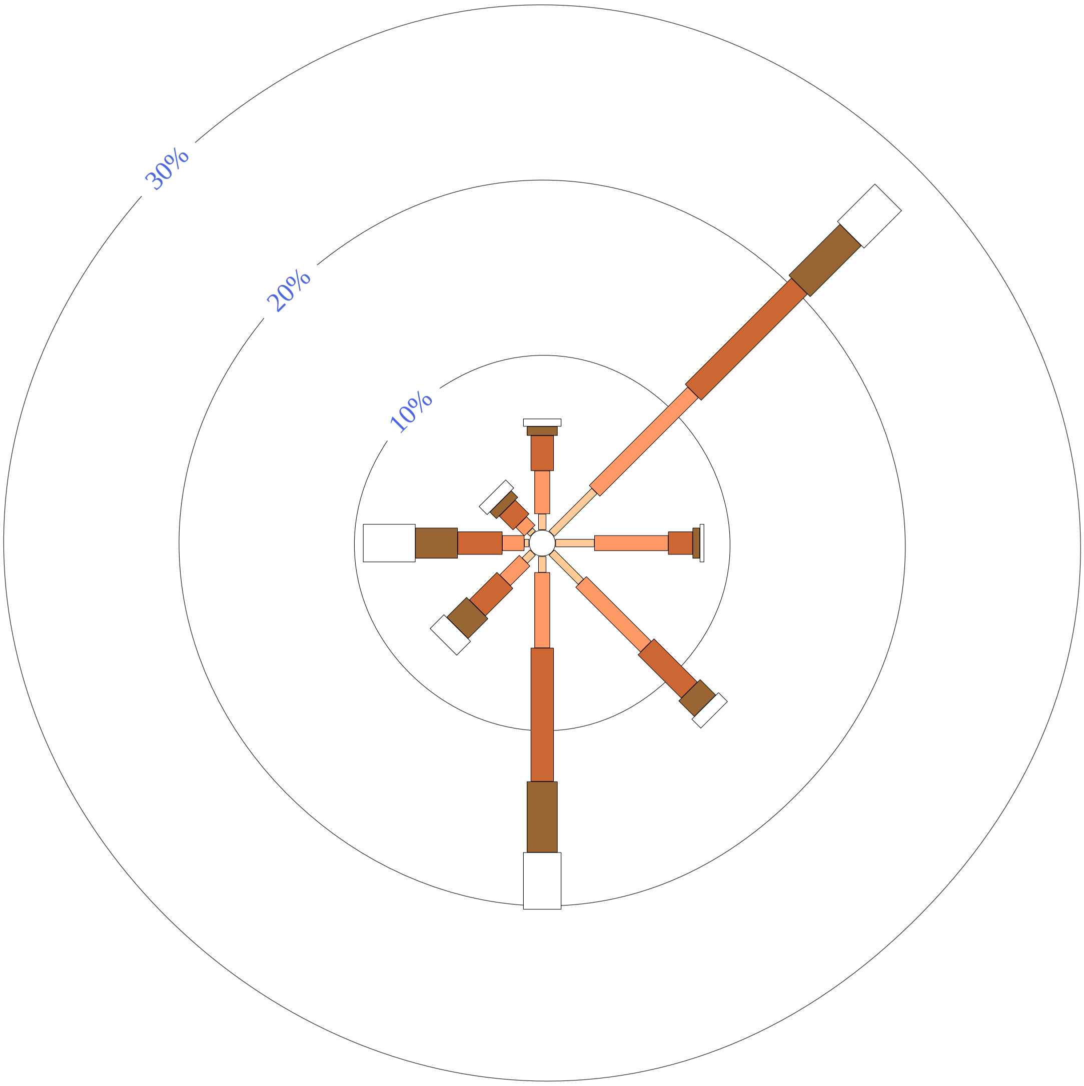
Site No: 068053 • Opened Jan 1950 • Still Open • Latitude: -34.4772° • Longitude: 150.9131° • Elevation 11m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
6828 Total Observations

Calm 4%



Prepared by National Climate Centre of the Bureau of Meteorology.
Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email on webclim@bom.gov.au

Australian Government
Bureau of Meteorology

Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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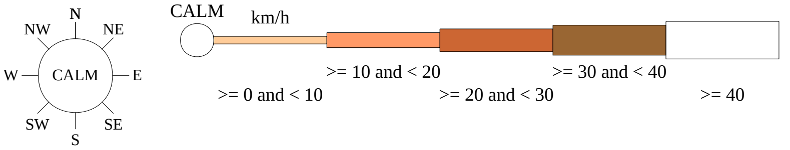
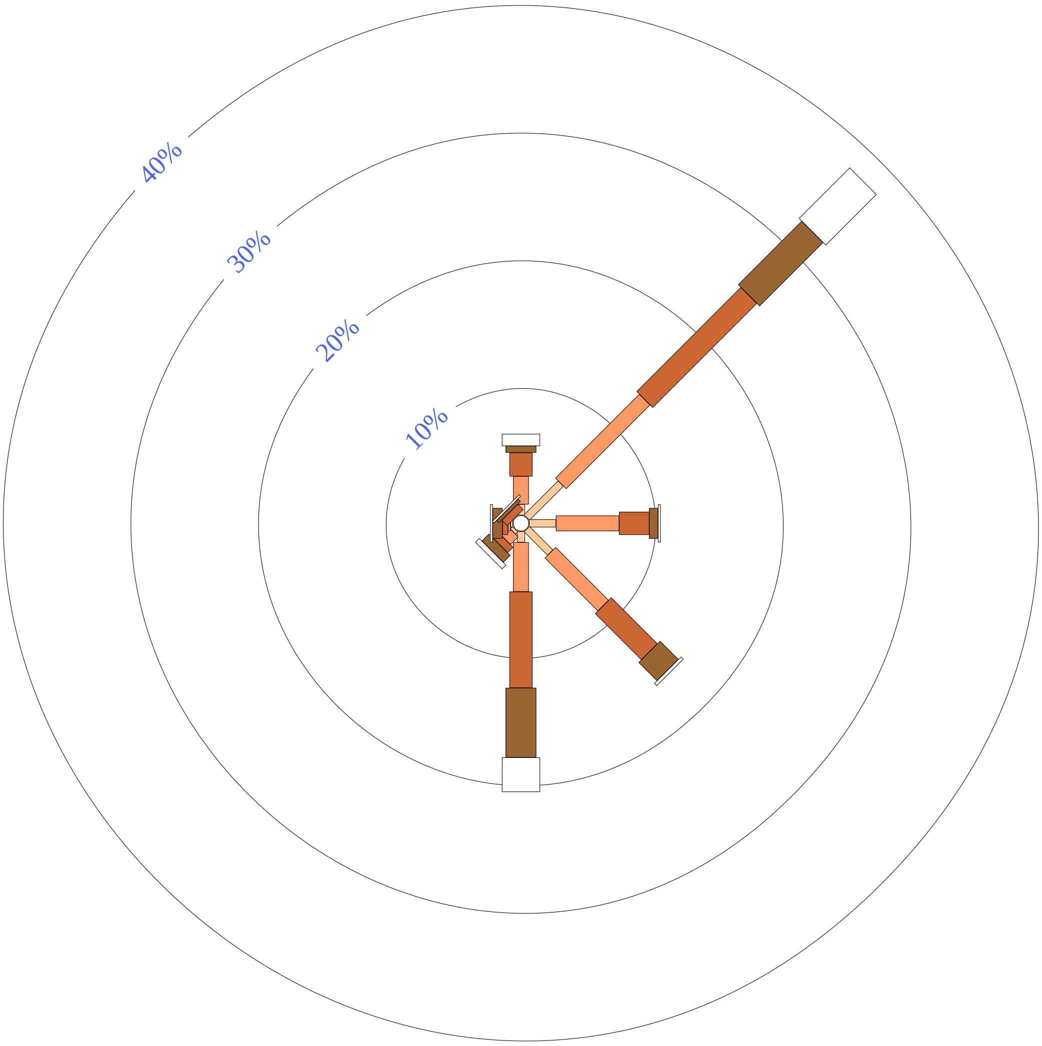


3 pm Jan
588 Total Observations

Calm 3%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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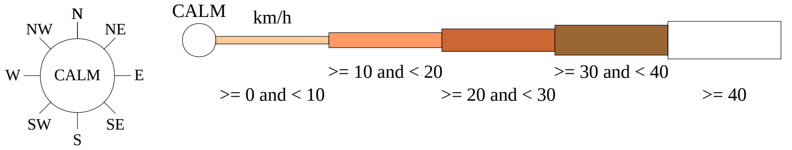
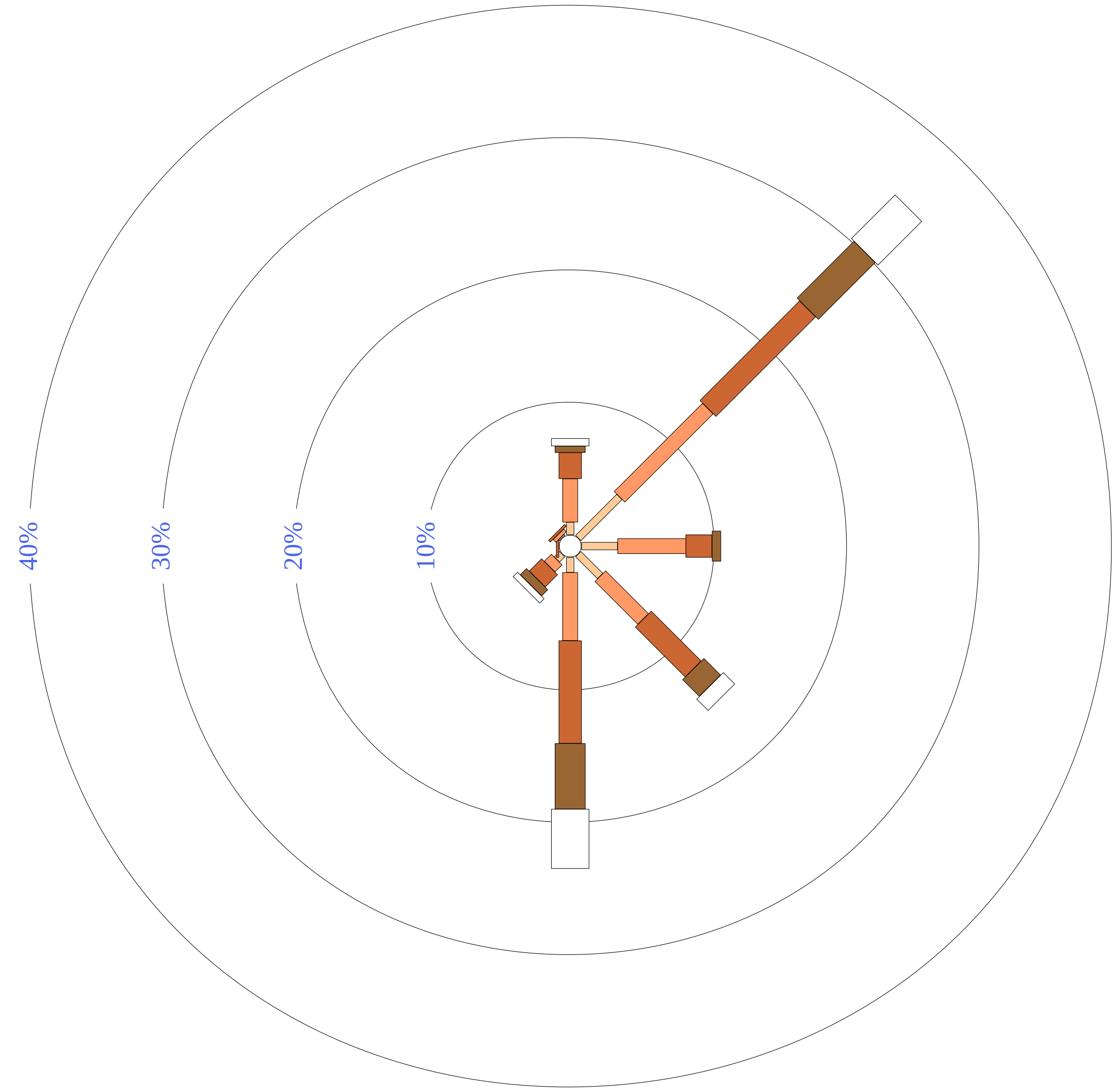


3 pm Feb
536 Total Observations

Calm 4%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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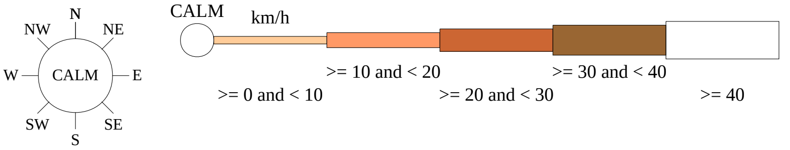
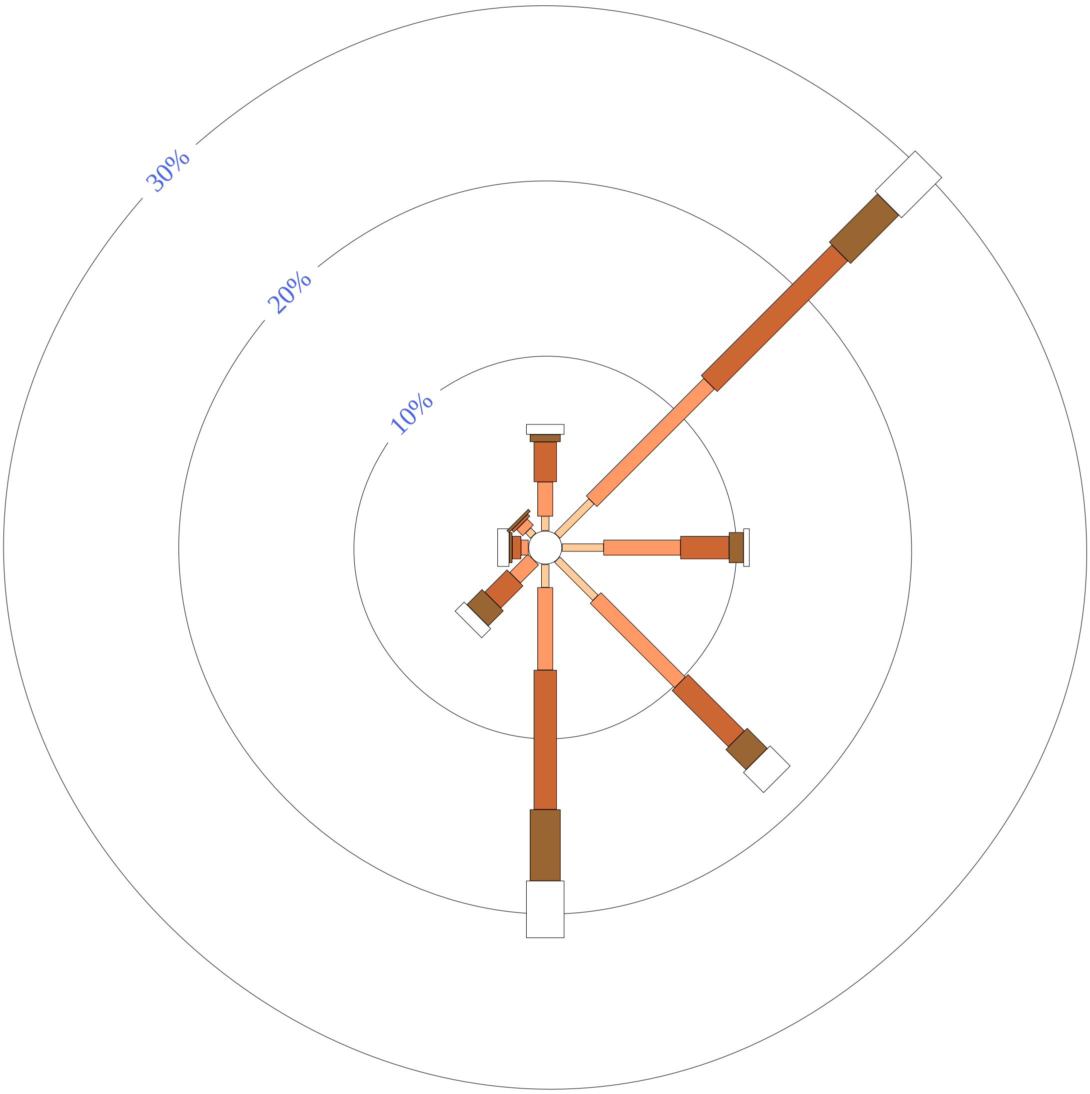


3 pm Mar
606 Total Observations

Calm 5%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

PORT KEMBLA SIGNAL STATION

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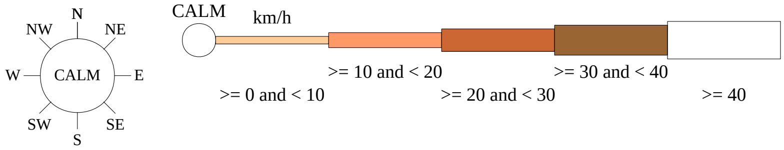
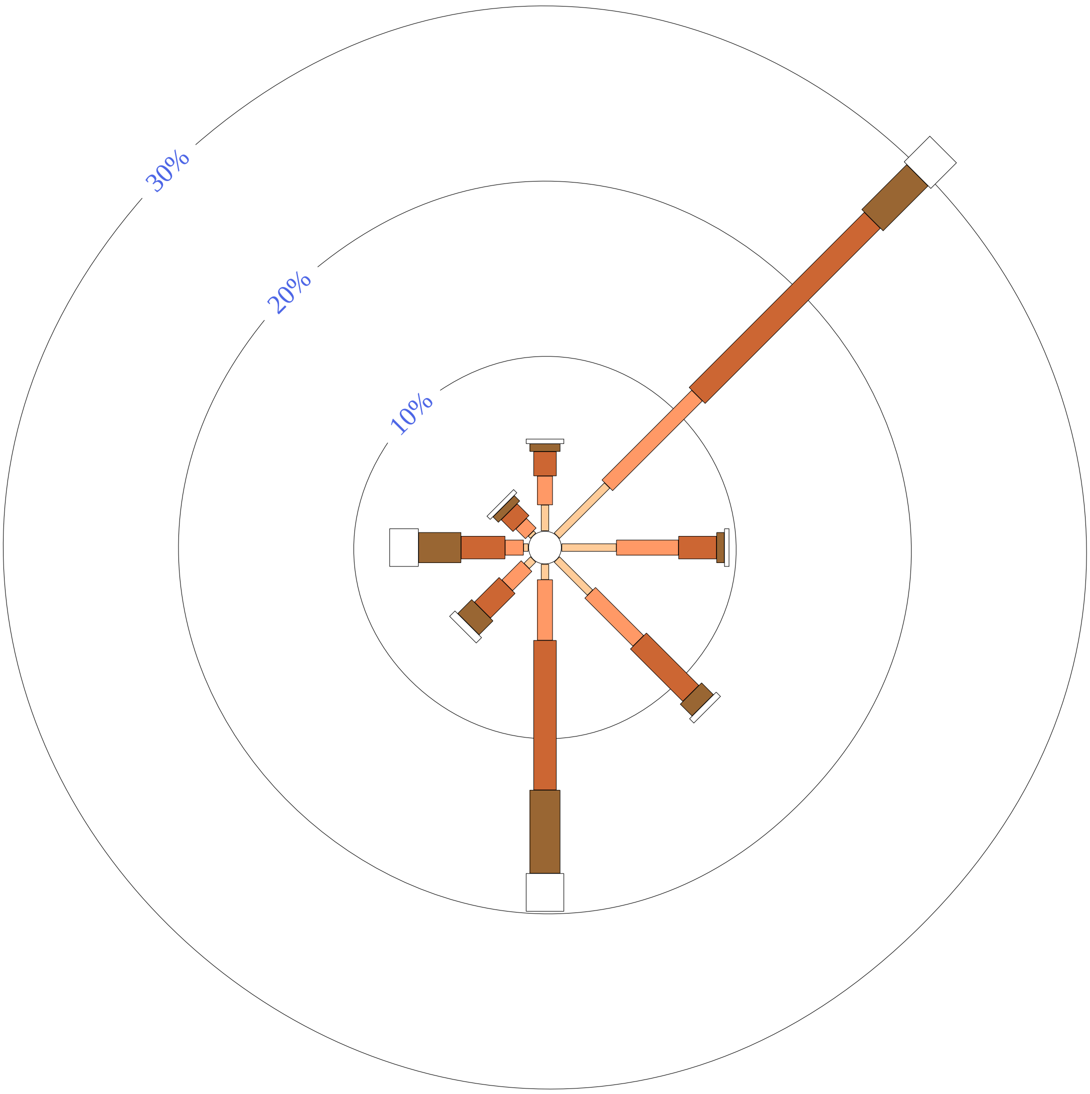


3 pm Apr
570 Total Observations

Calm 5%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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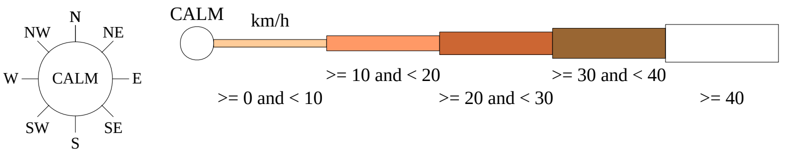
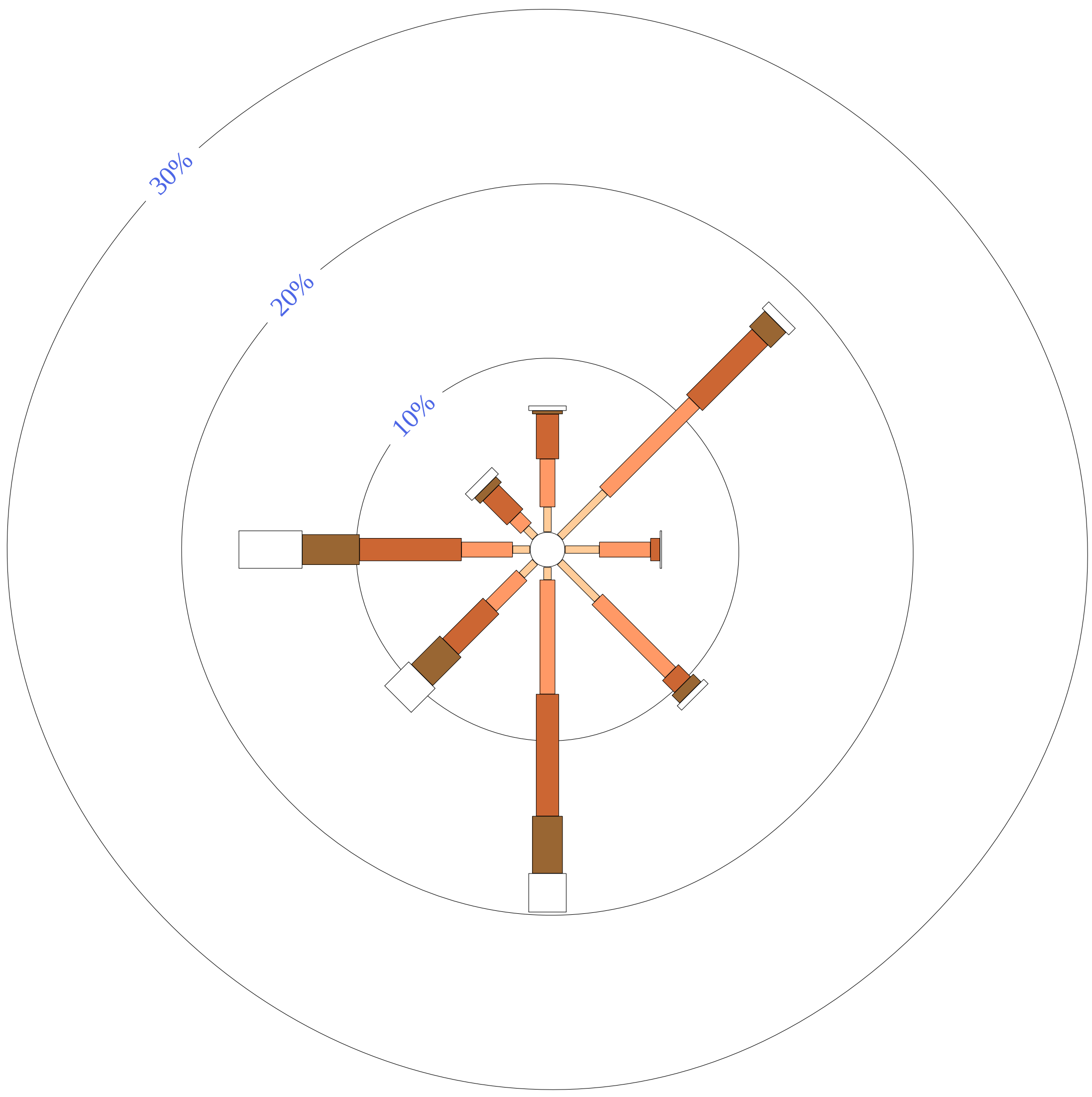


3 pm May
556 Total Observations

Calm 5%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

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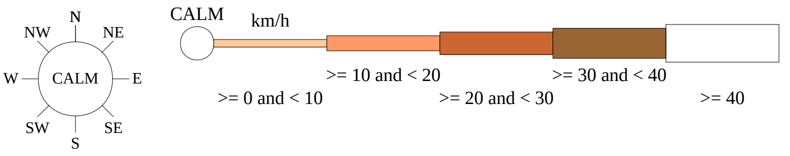
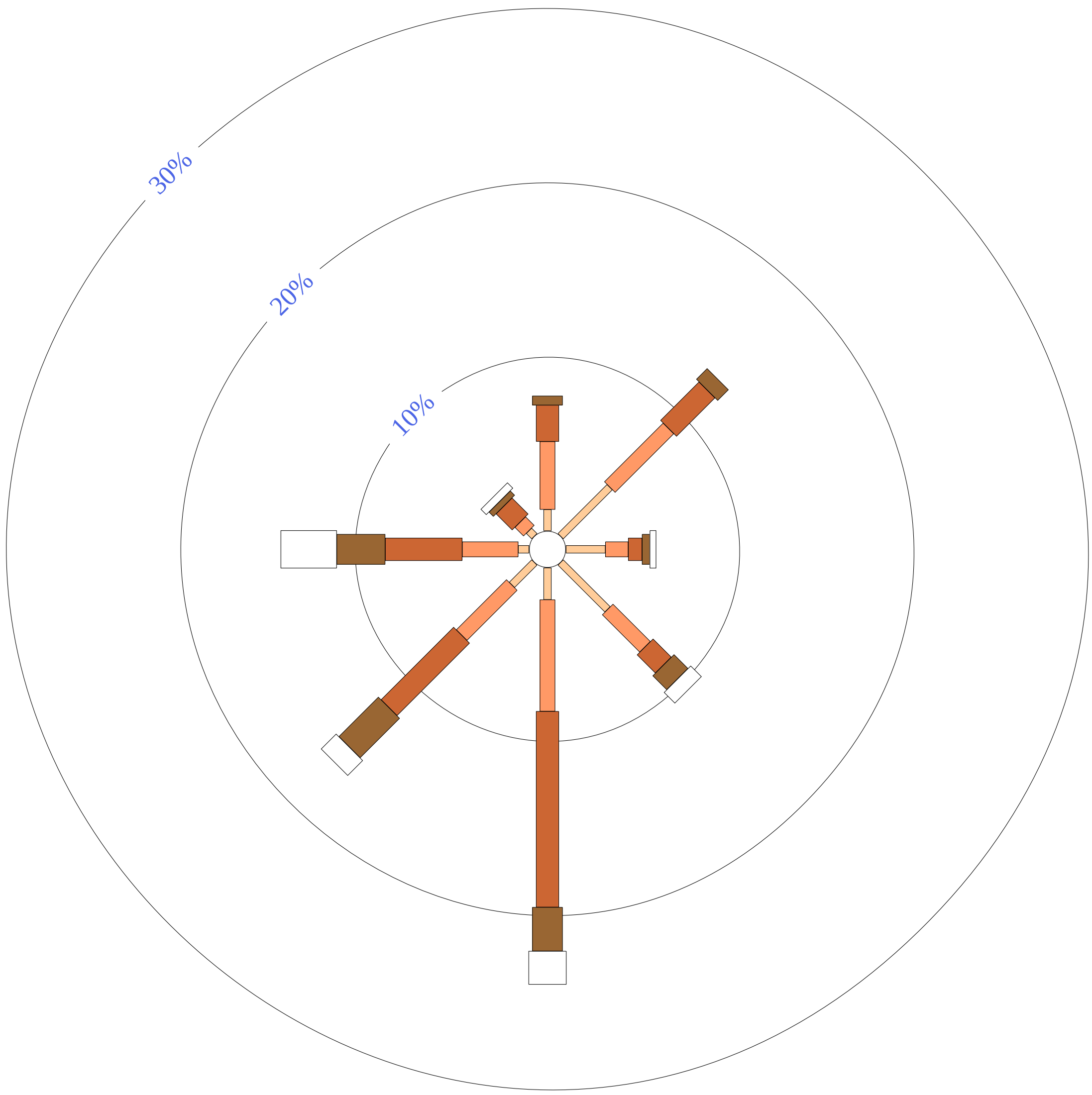


3 pm Jun
569 Total Observations

Calm 5%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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PORT KEMBLA SIGNAL STATION

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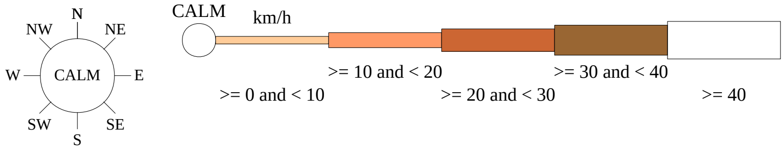
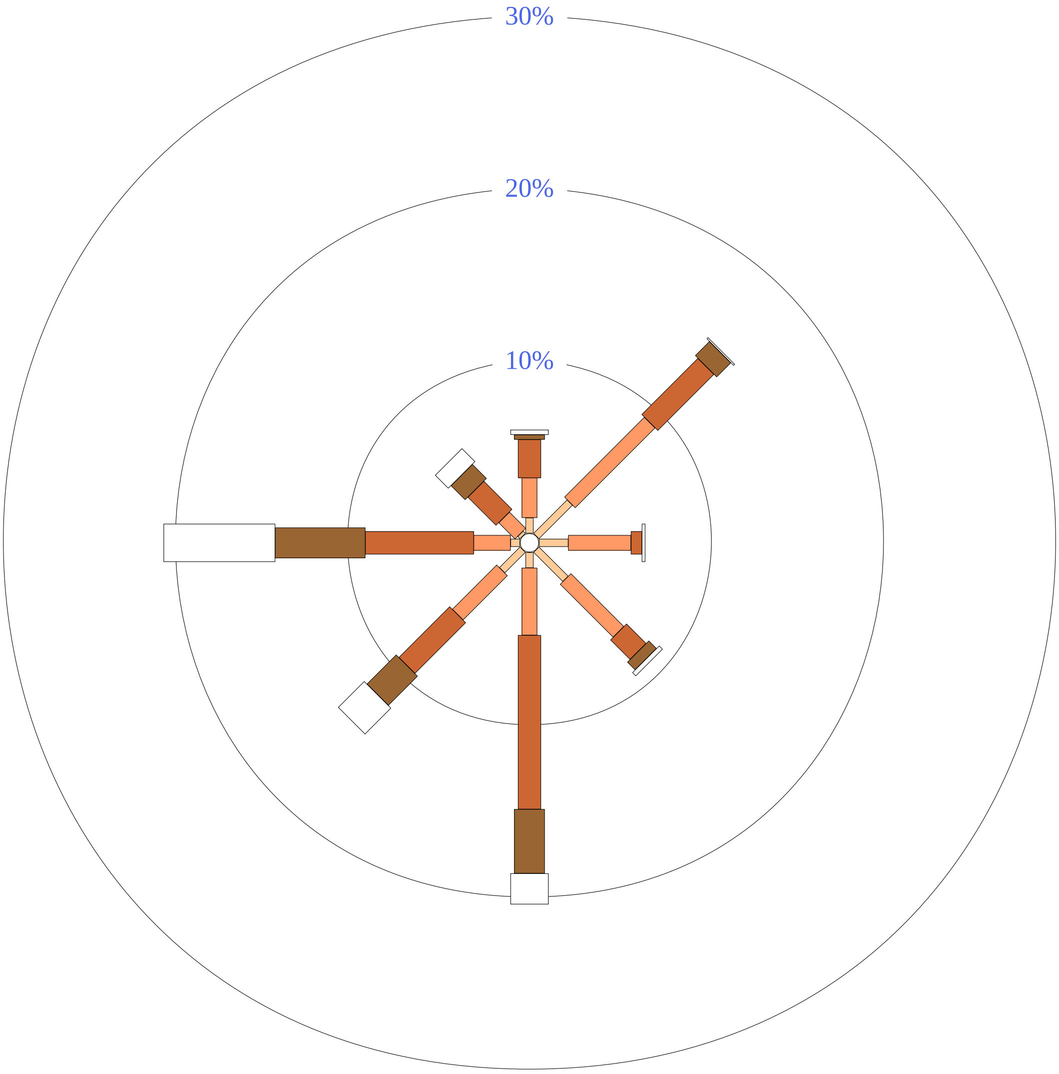


3 pm Jul
565 Total Observations

Calm 3%



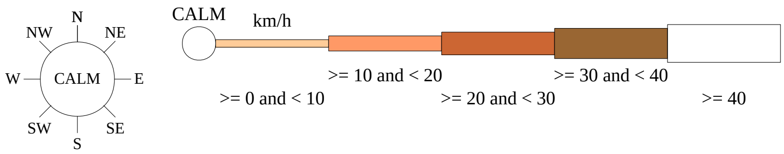
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

PORT KEMBLA SIGNAL STATION

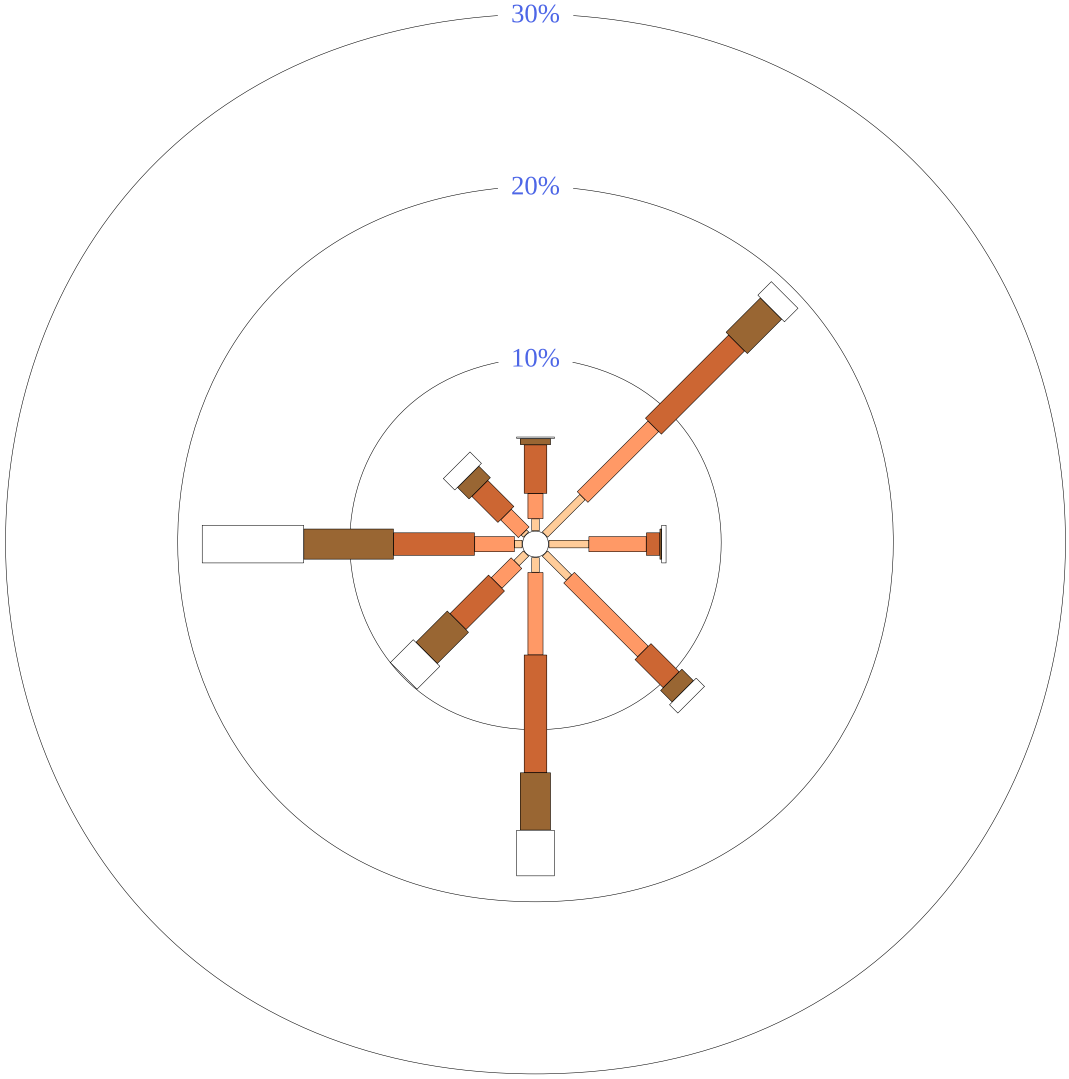
Site No: 068053 • Opened Jan 1950 • Still Open • Latitude: -34.4772° • Longitude: 150.9131° • Elevation 11m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Aug
586 Total Observations

Calm 4%



Australian Government
Bureau of Meteorology

Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

PORT KEMBLA SIGNAL STATION

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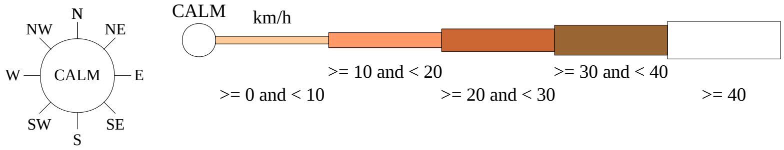
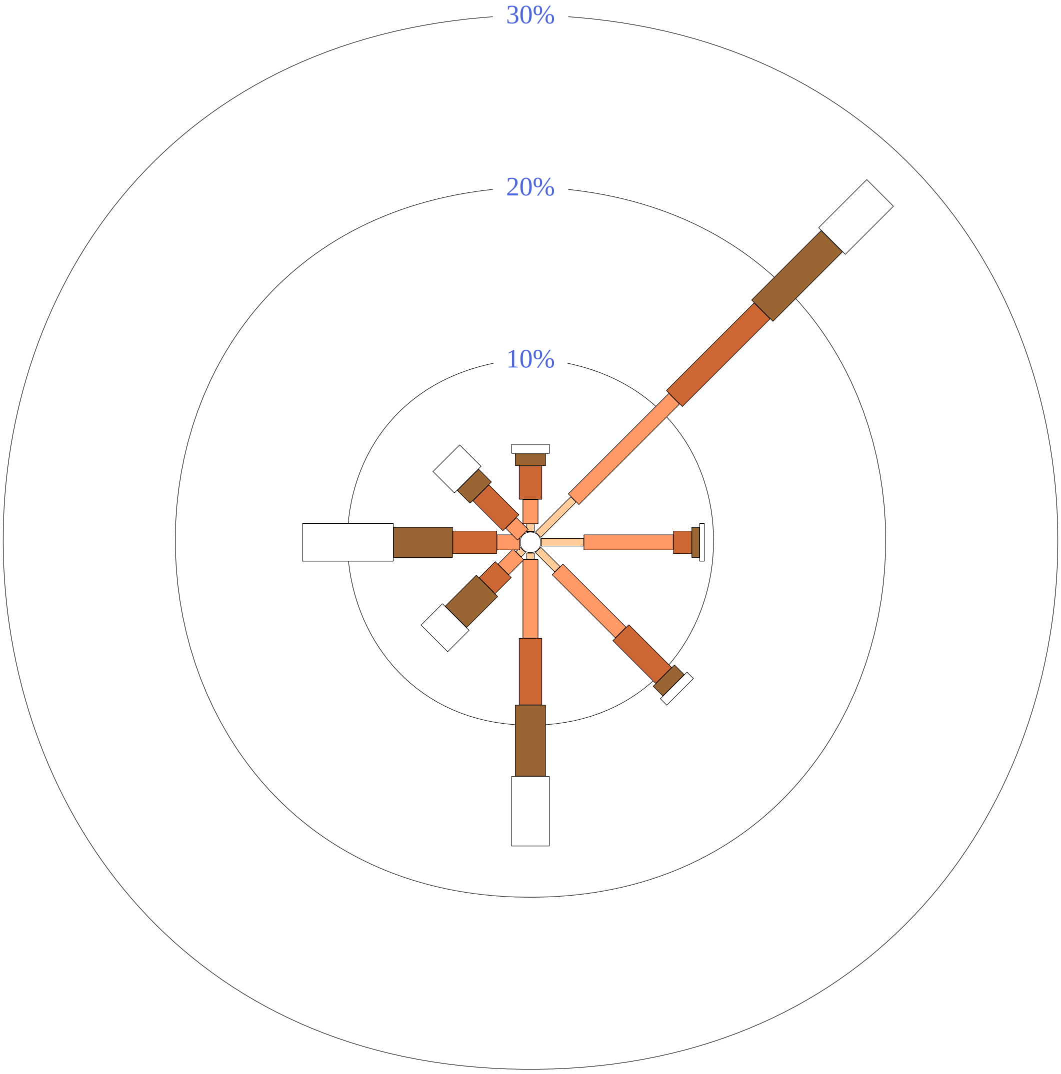


3 pm Sep
569 Total Observations

Calm 3%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

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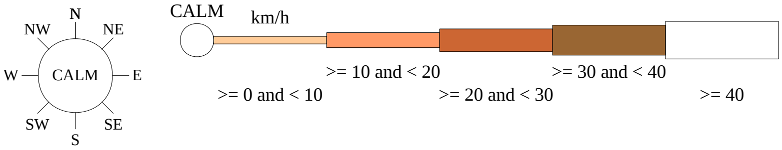
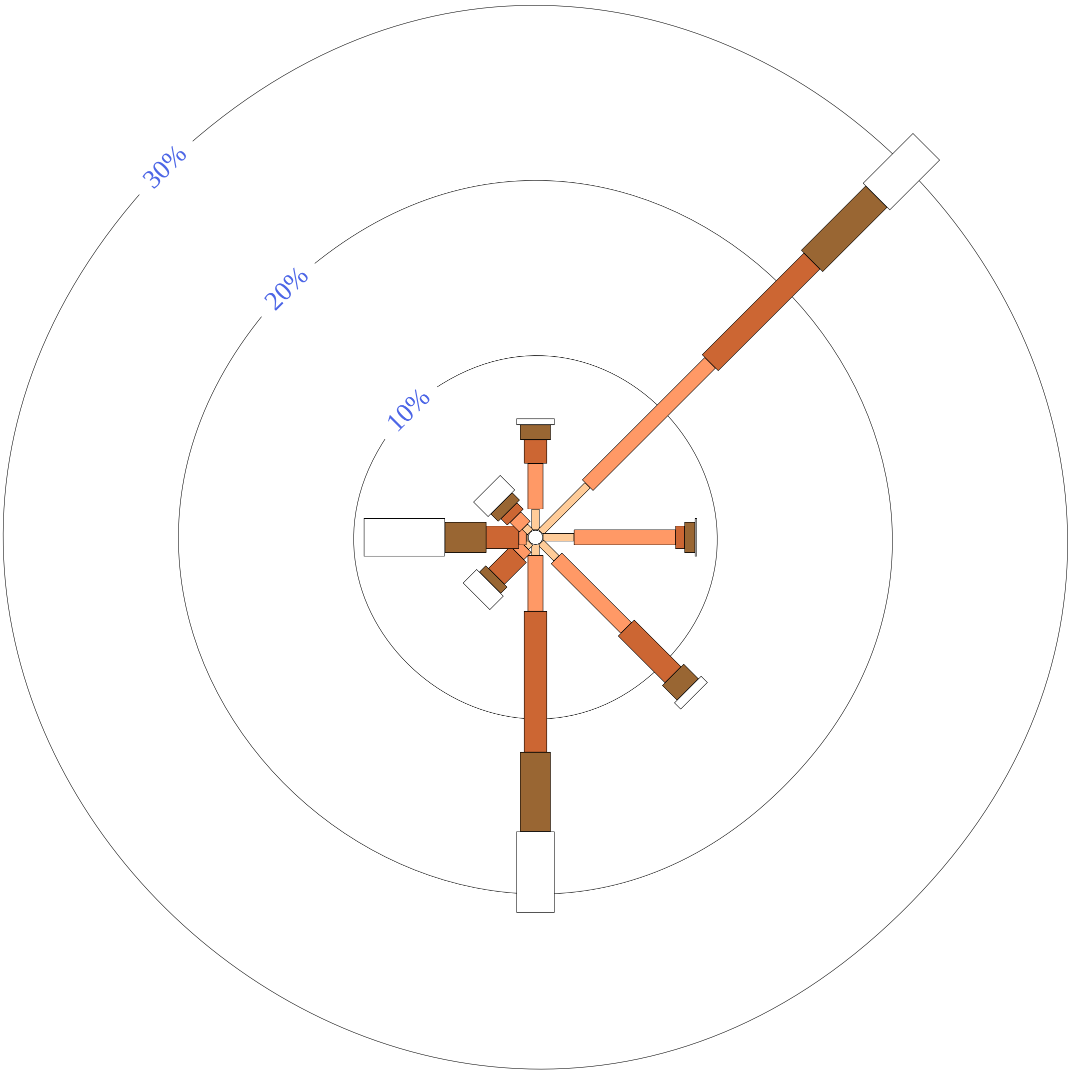


3 pm Oct
587 Total Observations

Calm 2%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

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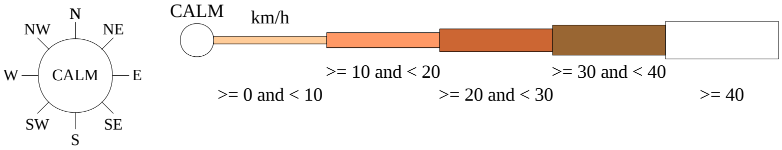

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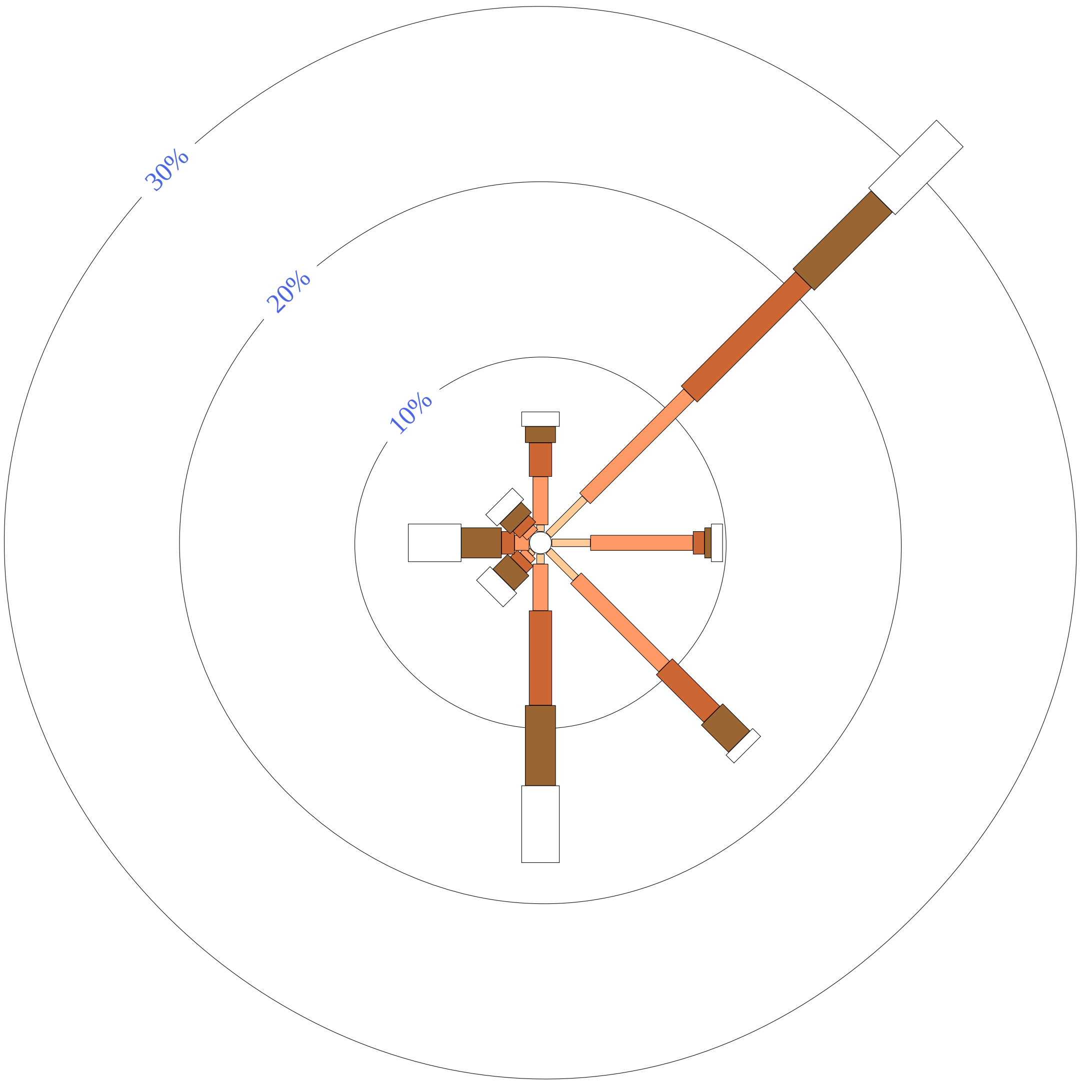
538 Total Observations

Calm 3%



Prepared by National Climate Centre of the Bureau of Meteorology.
Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email on webclim@bom.gov.au
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Australian Government
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Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 19 Mar 1976)

Custom times selected, refer to attached note for details

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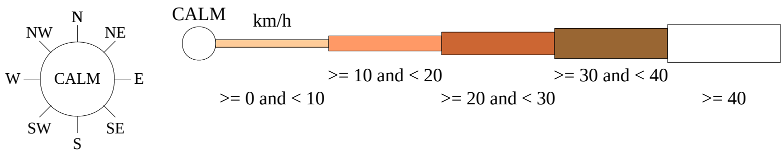
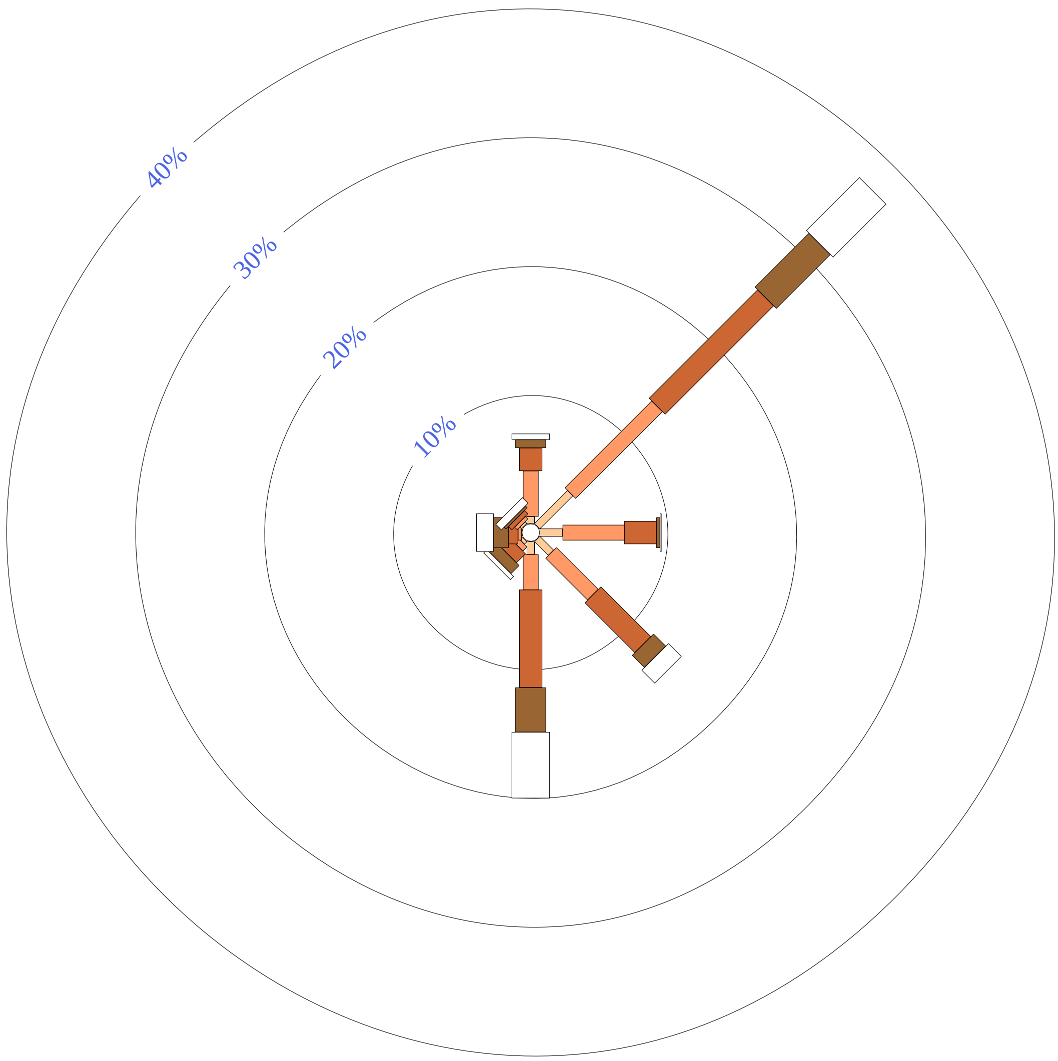


3 pm Dec
558 Total Observations

Calm 3%



APPENDIX C

Limitations

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APPENDIX N

Landscape Strategy

WHYTES GULLY RESOUCE RECOVERY PARK

LANDSCAPE STRATEGY

SUMMARY REPORT

7 March 2012

prepared for

Golder Associates Pty Ltd

by

Corkery Consulting

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Date	Issue	Status	Signed
23.01.12	Issue A	Preliminary Draft	
28.02.12	Issue B	Final Draft	
07.03.12	Issue C	Final	

CONTENTS

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2.0 Key Components 1

3.0 Plant Selection 2

4.0 Planting Types 2

5.0 Landscape Maintenance 7

6.0 Landscape Strategy Plan and Cross Sections 8

1.0 OBJECTIVES AND PRINCIPLES

The Landscape Strategy presented in this Report provides the basis for planning and design of the post-completion landscape at the Whytes Gully Resource Recovery Park (WGRRP). The Landscape Strategy will guide the transition from the operational stage of the new landfill to the post completion stage by addressing the recommendations of the Visual Impact Assessment carried out as part of the Environmental Assessment prepared by Golder Associates.

The Strategy aims to create a landscape that is both robust and visually compatible with the character of surrounding areas while requiring minimum maintenance once it is established. The Strategy takes account of the operational requirements of the Landfill, which includes staging of the landfill operations, slope stability, stormwater management, maintenance access and bushfire management.

The proposed plant species and planting structure will establish vegetation that forms a sustainable ecosystem similar to the adjoining areas of remnant vegetation providing wildlife habitat and contributing to the ecological values of the region.

The proposed landscape works will also add value to the site by creating potential public open space recreation opportunities following completion of the landfill operations and closure of the site.

2.0 KEY COMPONENTS

The Landscape Strategy incorporates the following Key Components:

- staging of the revegetation will aim to ensure the area of un-vegetated landfill slope is minimised by progressively establishing a vegetation cover on each section of slope as it is completed;
- existing vegetation on the portions of site not required for landfill, particularly mature remnant trees, will be retained wherever possible to provide visual screening and contribute to the landscape character of the site;
- vegetation to be established on the landfill slopes will include a mix of shrubs and small trees with areas of grass that will create a landscape character similar to adjoining rural areas;
- the top of the new landform will be visually modified to ensure it is visually compatible with the surrounding topography;
- views to the coast will be maintained from the potential lookout area on the landfill ridgeline and from properties upslope of the site;
- screen planting with dense tall tree planting on natural ground will be used to block views to the site, particularly from adjoining residences;
- biodiversity and habitat values will be maintained and increased where possible by planting a range of indigenous species;
- the potential will be created for future public open space facilities such as a lookout and passive recreation areas with access provided by upgrading the maintenance track to the top of landfill landform;
- the visibility of drainage channels on the slopes will be minimised by design options that could include the use of dark coloured stone and native grasses;
- provision of a maintenance program that includes regular removal of identified weed species;
- coordination of vegetation planting with bushfire management requirements that include access tracks and fuel management zones.

3.0 PLANT SELECTION

The selection of plant species to be used in implementing the Landscape Strategy has taken account of various considerations that include:

- visual and landscape character of surrounding areas;
- growing conditions including soils, aspect and drainage;
- functional requirements that include visual screening, erosion control, weed management and minimising maintenance;
- ecological and biodiversity values of the site and adjoining areas;

In selecting the plant species to be used in the various locations the following planting types have been identified and are referred to on the Landscape Strategy Plan:

Type 1 - Screen planting along site boundary

Type 2 - Tree planting on natural ground

Type 3 - Shrub and small tree planting on landfill

Type 4 - Grass planting, native and exotic on landfill including drainage channels

In identifying the mix of species to be used in each Planting Type reference has been made to the Whytes Gully New Landfill Cell Development Flora & Fauna Assessment Report, 2011 by Biosis Research for Golder Associates. Particular reference was made to Section 3.1 Vegetation Communities and Appendix 1, Flora Studies Inventory.

Existing remnant plant communities include Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest occurring on the WGRRP site are to be retained and protected.

Planted vegetation is to be retained wherever possible subject to the bushfire mitigation measures described in the Bushfire Report Section 5.0, which include:

- the canopies of retained trees are to be a minimum of 10m from any building;
- planted trees are to have lower branches trimmed to a height of 2m above the ground.

The Bushfire Report recommends that fuel load formed by vegetation should not exceed 2t/ha.

4.0 PLANTING TYPES

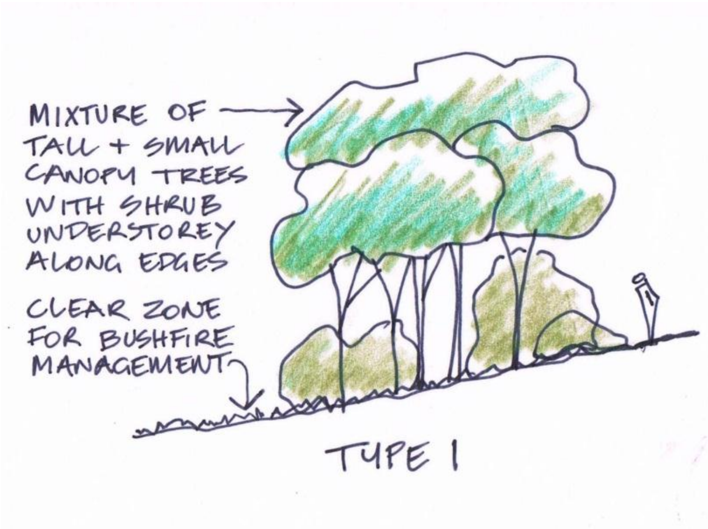
The Landscape Strategy includes four recommended Planting Types that respond to different growing conditions and aim to achieve specific landscape objectives. Each of these Planting Types are described in terms of their objective and implementation requirements.

Type 1 - Screen planting along boundaries

The proposed planting along sections of the site boundary is intended to provide visual screening of the landfill operations from adjoining properties. In order to fulfil this function the planting will need to be carried out in advance of the landfill operations. A minimum of 5 years growth will be required to provide the intended visual screening.

Mixture of tall and small canopy trees combined with shrub understorey along the edges is proposed to provide visual screening and to form a closed canopy that will minimise the growth of weeds.

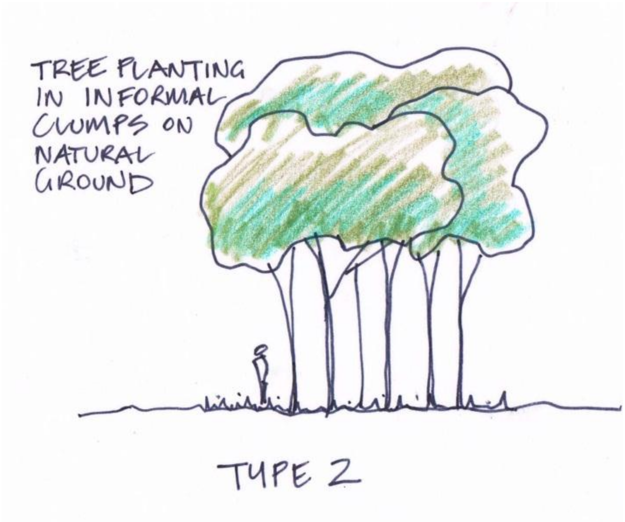
Detailed design of the planting will need to take account of access tracks and fuel load levels required for bushfire management.



Site preparation is to include ripping to a minimum depth of 300mm to create suitable soil profile for tree root growth. Coarse wood chip mulch is to be applied to maintain soil moisture and reduce weed growth. Tree guards are to be installed to protect the plants from rabbits and other animals while providing an improved microclimate for the plant and protection from wind.

Type 2 - Tree planting on natural ground

The objective of this Planting Type is to provide additional visual screening to views of the landfill operations from public roads and areas adjoining the site. Trees are to be planted in informal clumps to create an appearance similar to the remnant clumps of trees occurring on the site and adjoining areas. Spacing between 1.5 and 3m centres is recommended, depending on species.



The locations identified for this Planting Type have natural soil profiles that generally provide good growing conditions. Ground preparation should include deep ripping to a minimum of 300mm and removal of existing grass and weeds using a non-residual herbicide such as Roundup.

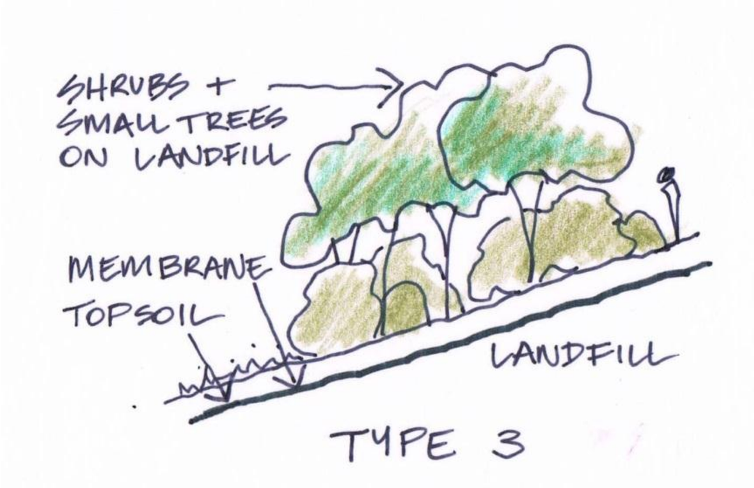
Trees to be planted should be supplied in 5 litre container sizes.

Tree guards are to be installed to protect the plants from rabbits and other animals while providing an improved microclimate for the plant and protection from wind.

Coarse wood chip mulch is to be placed over the soil surface to maintain soil moisture and reduce weed growth.

Type 3 – Shrubs and small trees on landfill

The objective of this Planting Type is to establish areas of vegetation consisting of shrubs and small tree to reduce the visual prominence of the landfill landform by creating a landscape character similar to adjoining rural land use areas. It will also create visual variation in the apparent height of the ridgeline to be created by the proposed landfill operations.



Requirements for ongoing maintenance will be reduced by creating a continuous canopy cover that will suppress weed growth.

The dense layered vegetation structure will resemble the ecosystems within the remnant vegetation adjoining the landfill, enhancing wildlife habitat and biodiversity.

The recommended species are suitable for the limited soil depth that will be provided on top of the impermeable membrane over the landfill cells. Planting of tubestock is recommended to allow plants to adapt to these growing conditions. Plant roots should be pruned in the nursery to encourage lateral root development prior to planting.

Dense planting in an informal layout will create a closed canopy relatively quickly to minimise weed growth and visually relate the new vegetation to existing vegetation adjoining the landfill.

A minimum depth of 1 metre will be required to allow adequate root growth to ensure plant survival during periods of low rainfall. If shallower soil depths are adopted the final vegetation height may be reduced and some of the trees and shrubs may die during prolonged dry periods unless irrigation is adopted.

The growing medium will need to contain adequate nutrients and organic matter for adequate plant growth. As soil to be used as the growing medium is likely to come from various sources there is likely to be significant variation from one area to another. Regular Soil Testing will therefore need to be carried out in a testing laboratory and recommended treatments implemented.

Site preparation is to include removal of existing grass and weeds using a non-residual herbicide such as Roundup and ripping to a minimum depth of 300mm

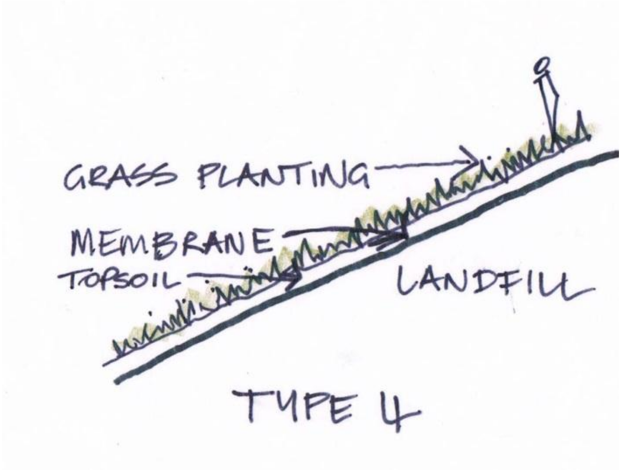
Coarse wood chip mulch is to be applied to the soil surface to minimise weed growth and associated maintenance requirements.

If areas of slope are steeper than 1:3 or greater occur then 'Jute mesh' or similar should be applied to provide erosion control.

Type 4 - Grass planting on landfill

The objective of this Planting Type is to establish a grass cover on the final landfill slopes that is visually compatible with the landscape character of adjoining rural land use areas and requires minimum maintenance.

A combination of native grasses and pasture species is recommended. The pasture species are to be established on the side slopes of the landfill which are generally 1:4 gradients. Areas of native grass are proposed on the gentler slopes on top of the final landform of the landfill. Native grass species are also recommended for use along the drainage ways where moist growing conditions occur and soil-binding grasses are required.



The grass cover is to be established progressively as each section of landfill is completed to protect the slope from possible soil erosion.

Soil depth of 800mm is recommended to allow the development of deep roots that will assist survival during periods of low rainfall. Soil depth of 500mm may be adequate but the vigour of grasses is likely to be reduced in drought periods due to the reduced available soil moisture provided by 500mm unless irrigation is adopted.

The quality of soil used will need to be monitored to ensure adequate nutrients and organic matter content for healthy growth of the grass. Soil preparation should include cultivation to minimum depth of 150mm and removal of existing weeds using a non-residual herbicide such as Roundup.

Maintenance will include periodic slashing as required for bushfire management and spot spraying of weeds with a non-residual herbicide.

Planting Plans

The Indicative Plant Schedule presented on the following page lists recommended species to be used in each Planting Type. These species are to be used in preparing detailed Planting Plans that will be required for implementation of the Landscape Strategy. The Planting Plans will need to be coordinated with detailed layout of infrastructure elements including roads, tracks, surface drainage and gas well heads. A Landscape Maintenance Schedule will also need to be prepared that is coordinated with the landfilling operations and landfill closure plan.

INDICATIVE PLANT SCHEDULE - Whytes Gully Recovery Park

BOTANICAL NAME	COMMON NAME	Type 1 Screen Planting along Boundary	Type 2 Tree Planting on Natural Ground	Type 3 Shrub & Small Tree Planting on Landfill	Type 4 - Grass planting on landfill
Tall Canopy Trees					
Acacia melanoxylon	Black Wattle				
Angophora floribunda	Rough-barked Apple				
Casuarina glauca	Swamp Oak				
Diploglottis australis	Native Tamarind				
Cryptocarya glaucescens	Jackwood				
Eucalyptus botryoides x saligna	Blue x botryoides Gum				
Eucalyptus crebra	Narrow-leaved ironbark				
Eucalyptus quadrangulata	White-topped Box				
Eucalyptus tereticornis	Forest Red Gum				
Ficus rubiginosa	Port Jackson Fig				
Syzygium australe	Brush Cherry				
Toona australis	Red Cedar				
Small Trees					
Acacia mearnsii	Black Wattle				
Acacia implexa	Hickory Wattle				
Acmena smithii	Lilly Pilly				
Alphitonia excelsa	Red Ash				
Backhousia myrtifolia	Grey Myrtle				
Brachychiton populneus	Kurrajong				
Diospyros australis	Black Plum				
Glochidion ferdinandi	Cheese Tree				
Melaleuca linariifolia	Snow in Summer				
Melaleuca stypheliodes	Prickly-leafed Tea Tree				
Notelaea longifolia	Large mock-Olive				
Streblus brunonianus	Whalebone Tree				
Shrubs					
Acacia binervata	Two Veined Hickory				
Acacia falcata	Sickle Wattle				
Acacia longifolia	Sydney Golden Wattle				
Breynia oblongifolia	Coffee Bush				
Clerodendrum tomentosum	Hairy Clerodendrum				
Dodonaea viscosa	Common Hop Bush				
Bursaria spinosa	Blackthorn				
Hakea salicifolia	Willow-leafed Hakea				
Kunzea ambigua	Tick Bush				
Grasses Native (Dry Zones)					
Astrodanthonia monticola	Small-flower Wallaby Grass				
Imperata cylindrica	Blady Grass				
Lomandra longifolia	Spiny-headed Mat Rush				
Microlaena stipoides	Weeping grass				

BOTANICAL NAME	COMMON NAME	Type 1 Screen Planting along Boundary	Type 2 Tree Planting on Natural Ground	Type 3 Shrub & Small Tree Planting on Landfill	Type 4 - Grass planting on landfill
Poa labillardieri	Tussock Grass				
Themeda australis	Kangaroo Grass				
Fimbristylis dichotoma	Common Finge-sedge				
Grasses Native (Wet Zones)					
Carex appressa	Tall Sedge				
Gahnia sieberiana	Red Fruited Saw Sedge				
Juncus continuus	Rush				
Lepidosperma laterale	Variable Sword Sedge				
Oplismenus imbecillis	Basket Grass				
Pasture Grasses					
Austrodanthonia richardsonii	Wallaby Grass				
Cynodon dactylon	Unhulled Couch				
Microlaena stipoides	Weeping grass				
Themeda australis	Kangaroo Grass				
Cover Crop					
Echinocloa itilis (Sept-Mch) or Secale cereale (Apr-Aug)	Japanese Millet or Rye Corn				
Lolium multiflorum	Eclipse Rye				
Trifolium pratense	Red clover				

5.0 LANDSCAPE MAINTENANCE

The Landscape Strategy incorporates measures to minimise maintenance requirements which will decline as the new vegetation is established in particular areas. However, there will be a need for some ongoing landscape maintenance to ensure it achieves the objectives of the Landscape Strategy and fire management requirements.

The main ongoing maintenance will involve weed management. The primary objective will be to minimise the introduction of weeds to the site and control those that currently occur.

The following general recommended measures should be incorporated into Maintenance Schedules as part of Detailed Planting Plans:

- ensure plant stock as well as wood chip mulch are free of weeds;
- carry out regular inspections of the site to identify the presence of weeds and implement appropriate control measures;
- remove dead vegetation and replace failed plantings;
- replace areas of failed grass sowing to ensure continual cover of vegetation over the landfill ground surface;
- check and repair or replace tree guards if damaged or missing;
- fertilise plants during the growing season;
- prune trees and shrubs to meet bushfire mitigation requirements;
- check for pests and diseases and implement control measures;
- maintain an adequate depth of mulch;
- slash and / or mow grasses to maintain a fuel load that does not exceed 2t/ha.

6.0 LANDSCAPE STRATEGY PLAN AND CROSS SECTIONS

LEGEND

- Site boundary
- New landfill boundary
- Proposed contours (5m intervals)
- Existing trees to be retained
- Proposed screen planting along boundary
- Proposed small tree & shrub planting on landfill
- Proposed tree planting on natural ground
- Proposed grass on landfill slopes
- Existing ponds retained
- A Potential lookout area
- B Potential passive open space recreation area
- Existing industrial buildings on site
- Existing residential buildings adjoining site

1:4000 @ A3

Project
Whytes Gully Resource Recovery Park

Client
Golder Associates Pty Ltd

Drawing Title
Landscape Strategy Plan

Drawing No	Rev
LS-001	C

Date
7 March 2012 FINAL

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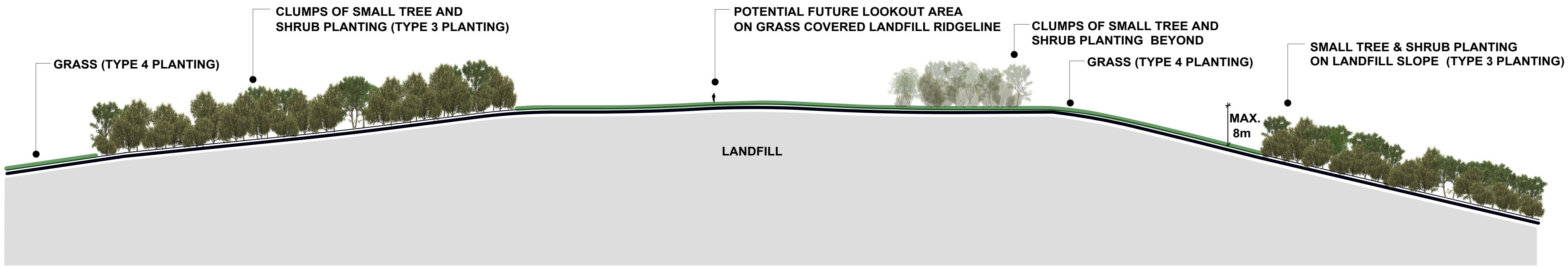
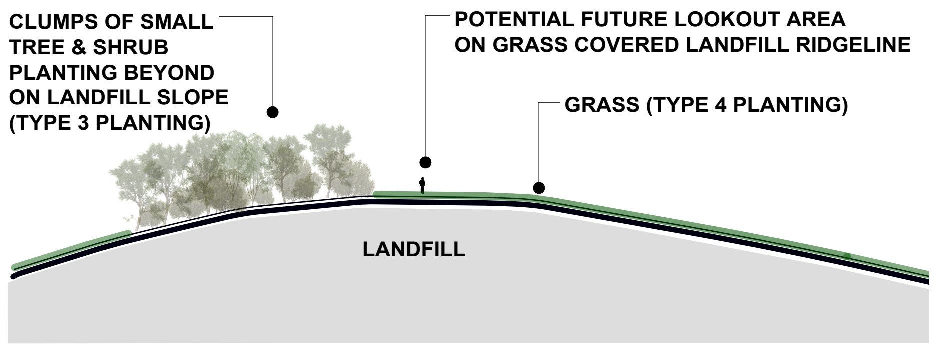


1 Section 1-1 Through Potential Lookout
1:1000 @ A3



2 Section 2-2 Through Potential Lookout Area
1:1000 @ A3

Project
Whytes Gully Resource Recovery Park

Client
Golder Associates Pty Ltd

Drawing Title
Landscape Cross Sections

Drawing No	Rev
LS-002	C

Date
7 March 2012 FINAL

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