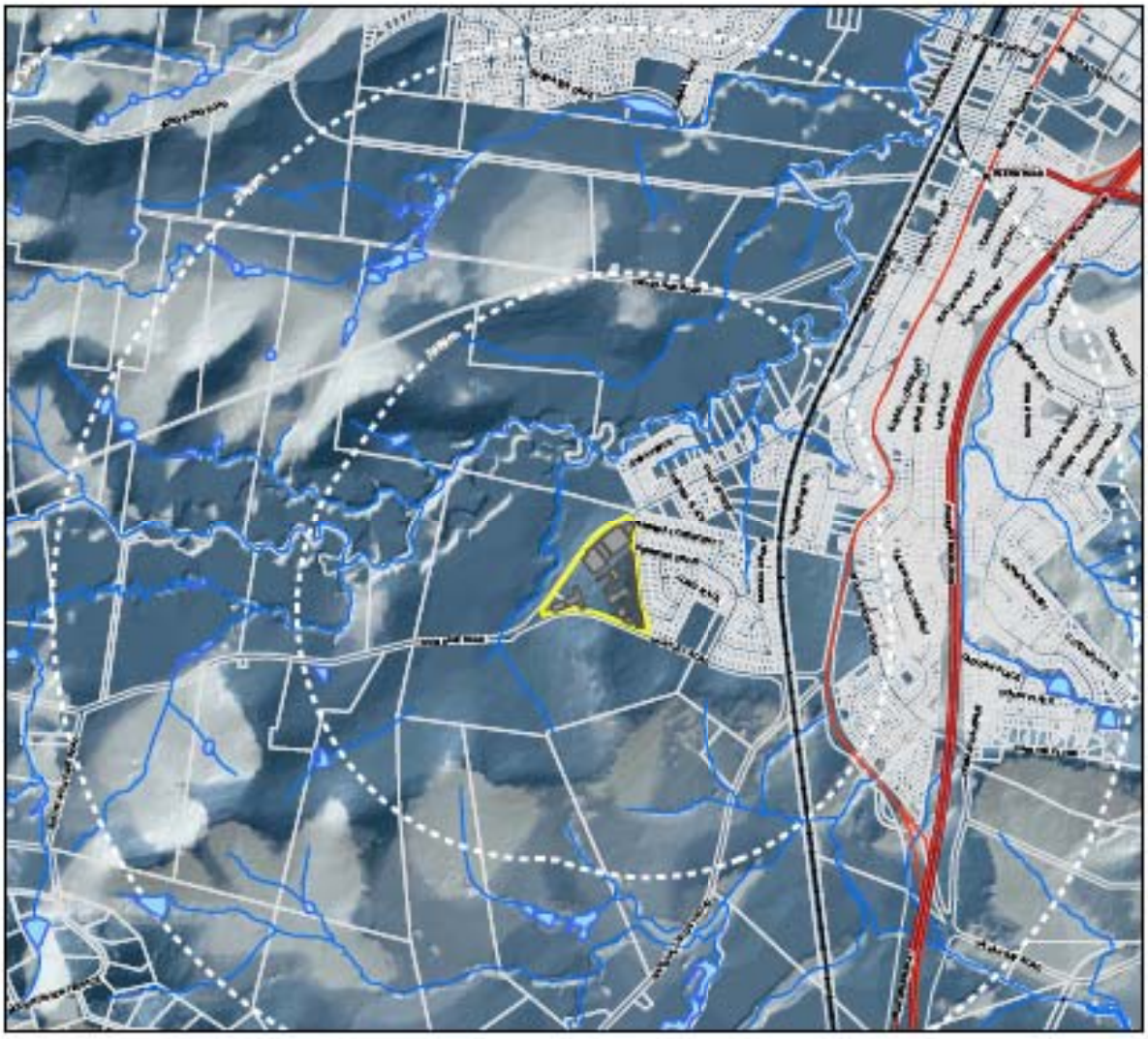


Illawarra international health precinct

Dedicated to Your Health

Visibility of Precinct Buildings

PENROSE

Legend

FIGURE 26b

Scale 1:10,000 (at A3)

Metres

0 125 250 500 750

Cardno Forbes Rigby

Table 6.5 – Visual Impact Assessment

Criteria	Potential Visual Impacts	Photographic Evidence
Visual Character		
Topography	• The existing topography rises from Goolagong Street towards the middle of the site where the plateau is located. The proposed development follows this topography by locating the two store buildings (seniors' accommodation, nursing home, education centre, obstetric unit and surgical centre) towards the eastern part of the site. This would maintain a visual consistency along the streetscape at Goolagong Street. The height and scale of the proposed development will step up, following the contours towards the hill. • The proposed development involves a small level of cut to allow adequate levels for access purposes. The development will not significant alter the topography of the site. The existing small rise will still maintain, and the location will be used to support a 2-3 storey aged care facility. The minimal height of this building on the hill top seeks to minimise potential visual intrusion onto the general landscape. • The potential impacts due to these proposed topographic alterations are not significant. Due to the small extent of changes in the levels the modification in the topography of the site will not be visually obvious.	 Image showing the topographical relationship with the existing residential developments at Goolagong Street. The height of the proposed development will maintain at 2 storey along Goolagong Street to minimise the impacts on the existing streetscape.
Land Use	• The subject site is cleared, sustaining limited grazing activities. The existing land use is characterised by low density residential development the east of the site, and rural properties surrounding the site to the north, west and south. • Under the West Dapto plan, the site will be surrounded by low to medium scale residential development. The land use character of the locality will change as the West Dapto plan is realised. The proposed development is consistent with the future urban land use character of the locality.	
Current Vegetation Pattern	• The proposed development will include landscaping to maximise the visual amenity of the users. • As a result of the West Dapto urban release developments, the existing vegetation pattern will change from the current rural character to a suburbia character. The current vegetation pattern will be significantly augmented as a result of the West Dapto development. This proposed development will constitute one of the major developments within this release area. From key public vantage points, the view to the subject site will be complimented by landscaping that is properly managed. This will significantly improve the character of the existing unmanaged cleared grassland. • The landscape masterplan has included landscaping around the perimeter of the site to minimise visual bulk of the development. Once West Dapto is completed, the proposed development will contribute to the establishment of an urban streetscape that will provide a unique modern character to the locality.	
Visual Catchment		
	• The existing visual catchment is characterised by expansive are of rural lands, framed by an existing low density Huntley subdivision. • The proposed development will affect the existing visual catchment. In the early stages, development will mainly be two storey buildings and they will form a linear expansion from the existing urban area at Huntley. When the development is completed, the proposed development will altered the visual catchment by blocking some views to the escarpment for some existing local residents. This visual impact has been foreseen in the existing West Dapto masterplan which envisages an urban character with varying density in the WDRA. • From Avondale Road viewing south-west, the visual corridor towards the escarpment will be retained along Avondale Road. The proposed development will form a new urban streetscape that acts as a gateway to the new urban area at West Dapto. The extensive setback from Avondale Road towards the north-eastern section of the site can create a gradual transition from the existing low density residential development at Huntley to the proposed 8 storey hospital. • From Goolagong Street viewing south west, the existing visual catchment includes the subject grassland on the foreground and the escarpment on the background. The design of the proposed development seeks to maintain the existing character of the residential streetscape by providing extensive vegetation buffer along the site frontage and locating 2 storey senior accommodation along Goolagong Street. The senior accommodation has been designed to complement the existing built form of the dwellings along Goolagong Street. The frontages of these accommodation will have a • Other hospital components (the education facility, aged care centre and nurses/medical officer accommodation, will still be visible from Goolagong Street in the middle ground of the view. This view will be largely blocked by the tall vegetation that has been planned for the development. Due to the topography of the site, the aged and disability centre, and the education facility will be located on the hill and will be visible from Goolagong Street. The bulk of these buildings have been located towards the western part of the site, away from the existing residents. This will avoid the direct visual and amenity impacts on the existing residents. The top part of the buildings and the roofs will be visible to the residents and the buildings will block the existing view towards the escarpment. While detail design has not been completed for these buildings, it is envisaged that the design would complement the existing and future character of West Dapto. • From Huntley Road viewing north, the existing visual catchment consists of expansive area of rural land. The proposed development will modernise the existing character. Under the West Dapto masterplan, the land uses will be surrounded by future residential development. The proposed buildings along Huntley Road are planned for Stages 5 and 6. By the time of these developments, the rest of West Dapto would have commenced construction and the character of these lands will be gradually transformed from the existing rural lands to a more suburbia character. More detail assessment on the future applicants will be undertaken as part of the project application. • The view shed analysis (Figure 20) shows the locations in the region from where the proposed development can be seen. The proposed development is visually prominent from Cleveland Road from the north and the escarpment from the west. To the south, the development is not visually significant. Visibility level drops towards the eastern side of the site at Huntley, due to the lower scale of the development. As	 *Existing topography is dominated by a small hill. This image is taken from the western side of the site, looking towards the ridgeline and the electric tower. This area will accommodate the future hospital proper.*

Criteria	Potential Visual Impacts	Photographic Evidence
	discussed, the views for the existing residents at Huntley will be affected, but extensive areas of landscaping has been incorporated into the design to soften the development and improve the visual amenity of the residents.	
Visual Sensitivity		
Distance to Site, Frequency of View, Composition of View	The visual sensitivity is assessed from the following public vantage points: Goolagong Street, Avondale Road, Huntley Road and Princes Highway. Photomontages of the development are provided in the separate volume • From Goolagong Street, the current foreground view on a clear rural paddock and the background view towards the escarpment are likely to be affected by proposed 2 storey residential care facility on Goolagong Street, and the proposed aged and disability centre and education facility, which are located behind the residential care accommodation: - The distance to the development is approximately 10m. The view is direct, and the developments could be viewed from the existing houses. - The frequency of the view is long and permanent. - The composition of the view will be characterised by public road reserve area at the front of the senior living units. Tall trees are proposed in front of these units to improve the existing streetscape of Goolagong Street. The proposed senior living units will be partially blocked by the proposed landscaping along the road. The units will be designed in the highest architectural quality, complementary to the existing housing style. • From Avondale Road, the current view towards the existing rural land will be significantly changed: - The distance to the development is approximately 10m. - The frequency of view is temporary as the main users are the motorists along the road. - The composition of the view will be characterised by the facades of the various buildings facing Avondale Road. These buildings will be designed in a modern style that represents the future character of West Dapto. No parts of the building will extend onto the road corridor and the buildings will not incorporate illuminated elements that distract the view of motorists. The design of the buildings will ensure the safety of motorists. In the background, the existing view towards the escarpment is still retained. • From Huntley Road, the current view corridor towards the escarpment will be partly obscured by the proposed development. - The distance of the view corridor is mainly restricted to pedestrian and motorists on the road. - The frequency of view is temporary as the main users are motorists along the road. They are likely to concentrate on the road conditions. - The composition of the view consists of the facades of the various buildings fronting Huntley Road. The scale and height of these buildings have been designed to allow a transition in scale from the existing residential scale in Huntley to the medium density aged care facility towards the eastern part of the site, to a more higher density hospital development. Extensive landscaping will be provided along the immediate boundary of the site fronting Huntley Road to provide high quality streetscape. No illuminated elements have been proposed, which can affect the view and safety of motorists.	 *View from Huntley Street towards the site. The proposed development will change the view from the current predominately rural character to a modern urban environment.* 

6.9 Heritage Assessment (European & Aboriginal)

DGR's Requirements

Heritage Conservation

- *Assess and address any impacts of the development on flora and fauna, including potential indirect impacts such as water quality, and the management of these;*
- *Assess the impacts on and management of any potential archaeological items;*
- *The EA should address and document the information requirements set out in the draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation involving surveys and consultations with the Aboriginal community;*
- *Identify the nature and extent, if any, of impacts on Aboriginal cultural heritage values across the project area;*
- *Describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values.*

La Vie Developments commissioned Biosis Research to undertake an assessment to consider the potential impacts on Aboriginal heritage as a result of the proposed development.

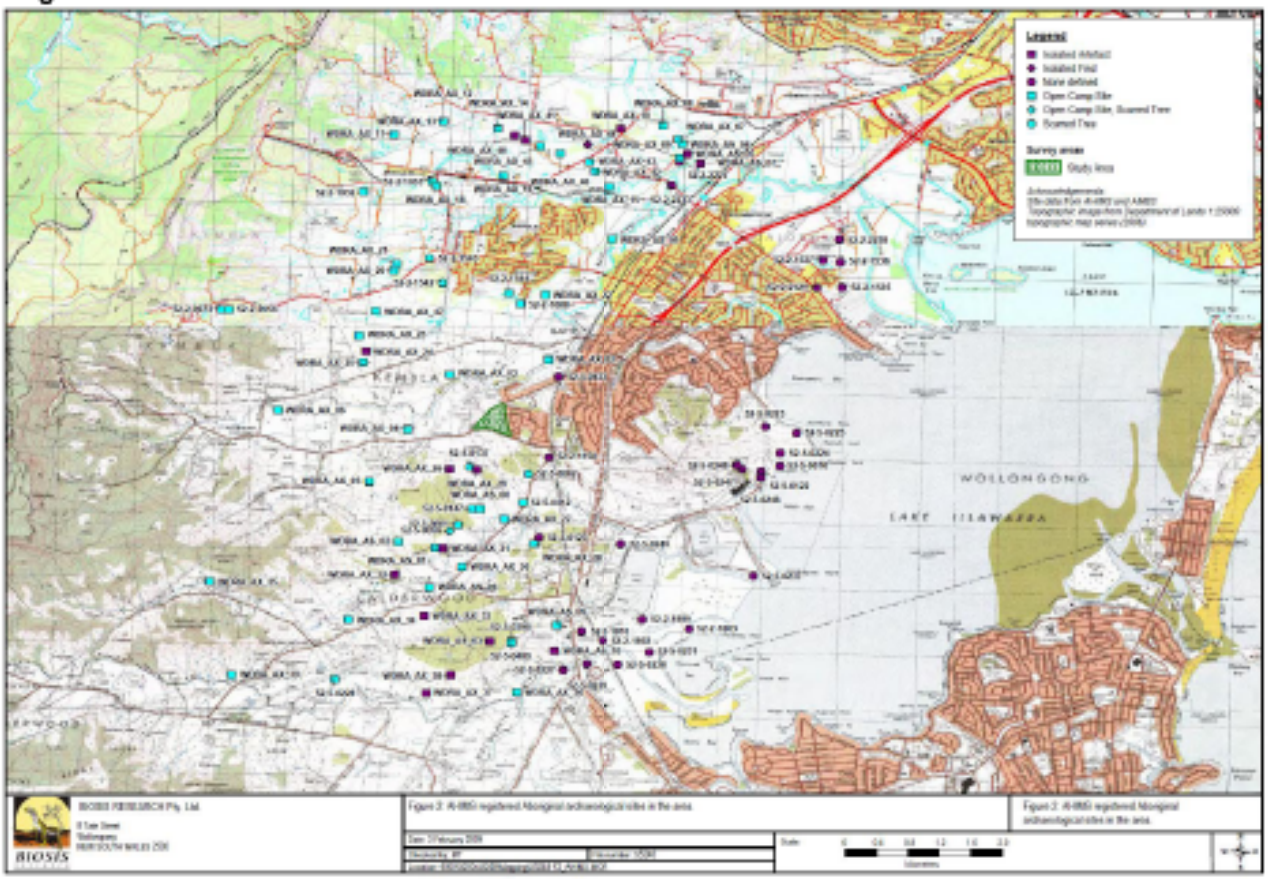
The full report is provided in **the separate volume**. The following provides a summary of the assessment.

6.9.1 Existing Environment

AHIMS Database Search

Biosis conducted a search of the DECC Aboriginal Heritage Information Management System (AHIMS). No previously recorded Aboriginal sites were identified within the Study Area. A 5 x 4 km database search of the greater area located 46 previously recorded Aboriginal archaeological sites, including one duplicate. No known sites are registered within 500m of the study area. This is shown in **Figure 30**.

Figure 29 – AHIMS Database Search



Of the 46 sites identified within the search area, open camp sites with artefacts occurrences are predominant, comprising 35 sites. Within this overall grouping, there were four registered open camp sites with artefacts and shell, four open camp sites with shell, one open camp site with Potential Archaeological Deposit (PAD), two scarred trees, one isolated artefact and one open camp site with scarred tree. Table 6.6 provides descriptions of these items and the probability of these sites to occur in the study area.

Table 6.6 – Probability of Archaeological Items Occurs in the Study Area

Archaeological Items	Probability of Occurring in the study area
Open campsites, artefact scatters, isolated finds and PAD	These sites are likely to be the most prevalent site types and are most likely to occur on level, well-drained ground adjacent to sources of freshwater. Due to the predicted levels of site disturbance through European occupation, settlement and development, the probability of such sites surviving is moderate to low.
Middents	Sites containing midden shell and lithic material have been known to occur on elevated ground adjacent to wetlands such as low gradient basal colluvial slopes, terminal spur line crests and alluvial terraces, or valley floor drainage corridors and sand bodies such as beach dune systems. It is unlikely middens will be identified in the Study area given the topography of the area and its distance from Lake Illawarra.
Scarred Trees	Scarred trees are likely to occur in all topographies where old growth trees survive. Given the land clearing and general ground disturbance that has occurred in the Study Area, it is unlikely that such trees remain in the Study Area.

Archaeological Items	Probability of Occurring in the study area
Burials	Burrial sites are generally situated within deep, soft sediments such as Aeolian sand or alluvial silts. Burials tend to become visible where there has been some disturbance of sub-surface sediments or where erosion processes have exposed them. Burials may occur within the Study area where deep deposits of alluvial soils have been identified along major creek lines such as Mullet Creek.
Grinding Grooves	Grinding grooves are often found on large open relatively flat areas of sandstone shelving and outcrops in close proximity to water. As the study area is in close proximity to water, grinding grooves may be identified in areas of suitable outcropping stone.
Aboriginal Ceremony and Dreaming Sites	These types of highly significant sites tend to occur at places where the connections and pathways between the physical and spiritual worlds are realised. They tend to be associated with unusual or distinct features in the landscape. Distinct landscape features such as ridge tops and waterholes found within the study area may have represented ceremonial sites.
Post-Contact Sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area. This site type is usually known from historical records or knowledge preserved within the local community. It is considered unlikely that any additional, unregistered post-contact sites will be present within the Study Area.
Aboriginal Places	Aboriginal *places* may be of cultural, spiritual or historic significance. The consultation with the Aboriginal community will determine if Aboriginal places of cultural significance occur in the Study area.
Landscapes	The landscapes that have been identified to have potential higher aboriginal archaeological sensitivity include: • Creeks and water sources – dry elevated and level ground near creek lines may contain the remains of campsites, such as hearths and artefacts scatters. • Ridge and rolling hills – The crests of moderate foothills, which extend into and across valley floor flats are likely to be a focus for short term occupation due to their well drained and elevated context in close proximity to a range of exploitable environments. There is one moderate rise above a water course within the Study Area that may have been used for this purpose.

Field Survey

Biosis has undertaken field survey with representatives of the Illawarra Local Aboriginal Land Council to identify any Aboriginal Archaeological artefacts on site. No new Aboriginal Archaeological artefacts were identified.

6.9.2 Potential Impacts

Biosis report concluded that:

As no archaeological evidence was identified within the present Study Area, no assessment of scientific significance will be required.

6.9.3 Mitigation Measures

The Biosis report provides the following recommendations:

- *The Illawarra Local Aboriginal Land Council have requested that a representative from the Aboriginal community be onsite during the initial scraping of topsoil across the rise (area of archaeological sensitivity) to observe if any cultural material is exposed.*
- *Should any previously unidentified Aboriginal objects or places be identified during excavation and construction, all works must cease in the vicinity of the find and the following be notified:*
  - *NSW Department of Environmental and Climate Change*
  - *A qualified archaeologist*
  - *Aboriginal stakeholders*

The Illawarra Local Aboriginal Land Council provides the following recommendations to the proposed development:

- *Any excavation work 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 Developer should enter into discussion with the Aboriginal community regarding Employment opportunities created throughout this project.*

These recommendations will be incorporated as part of the Statement of Commitments.

6.10 Electricity Transmission Lines & Health

DGR's Recruitments

Amenity Impacts

- *Address potential health concerns related to the transmission lines traversing the site.*

6.10.1 Existing Conditions

There has been a general community concern in relation to the possibility that long-term proximity to high voltage electricity transmission lines (identifiable by the large steel pylons) or lower voltage electricity distribution lines (identifiable by the wooden poles often along road easements) can cause cancer. This commenced due to a 1979 study in the USA by Wertheimer and Leeper in which a statistical correlation between the incidence of childhood leukaemia and proximity to electrical wiring was demonstrated. In the past, this concern has received significant media coverage as the cancer threat to children, in the form of leukaemia, has been highlighted.

The concern focuses on the extremely low frequency (ELF) 50 Hz electromagnetic fields (EMF) that electricity lines generate and the effect of these on the human body. The concern is also that children are at a higher risk than adults as their bodies are still developing and that this results in a greater possibility of the EMF interaction with the body causing cancer. The community concern intensified because transmission and distribution lines travel through urban areas, close to houses, schools,

community centres and the like. This makes it almost impossible for the public to avoid long-term exposure to the EMF from the power lines.

The media coverage of these concerns, especially the emphasis on cancer and children, resulted in high levels of community concern for a number of years. The response from the Australian Government and industry bodies was to conduct scientific research into the concern and provide advice to the community in accordance with the results.

The level of community concern in relation to health impacts from power lines has reduced over time. The likely reasons for this is that the scientific research has found no strong evidence that long-term public exposure to EMF from power lines has a detrimental health impact and because the media have lost interest in the story resulting in the community focusing on other issues.

This section of the EA assesses the concern of detrimental health impacts to humans from long-term public exposure to EMF generated by high power distribution lines, as there is such a line through the subject site. This assessment uses Australian Government guidance, information from the electricity companies and information from international Governments and organisations to identify current scientific evidence in relation to risk levels.

6.10.2 Potential Impacts

As identified above, the potential impact from the existence, and retention, of the high voltage transmission lines on the subject site is the possibility that the EMFs from this line may have a detrimental impact on the health of persons at the proposed Illawarra International Health Precinct.

Research on this matter identifies that current scientific evidence is that there is no established link between detrimental health impacts and long-term public exposure to EMFs from power lines. This statement is based on the following information.

World Health Organisation (WHO)

The WHO has authority to direct and co-ordinate health related matters in the United Nations system. Amongst other matters, WHO takes responsibility for providing leadership on global health matters, settings norms and standards and articulating evidence-based policy.

In accordance with the WHO responsibility to public health and the growing community concern WHO initiated the International EMF Project in 1996. According to the WHO website, the remit of this is "to assess the scientific evidence of possible health effects of EMF in the frequency range of 0 – 300 GHz".

In June 2007 the WHO published fact sheet No. 322 titled 'Electromagnetic Fields and Public Health'. **Appendix G** of this report contains a copy of this fact sheet. This summarises the WHO's findings from the International EMF Project and their ongoing understanding in accordance with related research from all around the world.

Fact sheet No. 322 discusses the possible long-term effects on human health from ELF EMF and identifies that these are possibly carcinogenic to humans. The cancer effect is rated as 'possible' because there is limited evidence of ELF EMF causing caner in humans and less than sufficient evidence for these emissions causing cancer in test animals. Additionally, there are no biophysical mechanisms that suggest low-level exposure to ELF EMF cause cancer.

In essence, this fact sheet advises that existing scientific research provides weak evidence that establishes a link between the ELF EMF and cancer. However, the scientific studies are not proof of this link because it is so weak and there are concerns and issues in the study methodology. This conclusion from the WHO strengthens the case that there is a possible health impact associated with ELF EMF from the electricity transmission lines that are within the application site.

Australian Radiation Protection & Nuclear Safety Agency (ARPANSA)

ARPANSA is part of the Australian Federal Government's health portfolio and has the responsibility to protect people and the environment from harmful effects of both ionising and non-ionising radiation. In this role, ARPANSA has the responsibility of undertaking or co-ordinating scientific studies into the potential effects of EMFs from power lines on the public. Additionally, ARPANSA scientists review studies from other Governments and organisations on this issue and advise the Australian Government to inform policy makers or the distribution of public information.

This role results in ARPANSA being the primary Australian organisation for scientific research and information in relation to the potential impacts from power line EMFs on the human body. ARPANSA publish numerous fact sheets in relation to different radiation impacts to inform the public. These are available on their website (http://www.arpansa.gov.au/RadiationProtection/Factsheets/index.cfm).

Two fact sheets relate directly to this assessment, these are:

- Electricity & Health
- Magnetic & Electric Fields from Power Lines.

These two fact sheets are in **Appendix G** of this EA. The Electricity & Health fact sheet commences with the following text:

> *"The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health".* (ARPANSA, Electricity & Health Fact Sheet)

The Fact Sheet goes on to advise, "current science would suggest that if any risk exists, it is small" (ARPANSA, Electricity & Health Fact Sheet). This Fact Sheet supports these claims through an explanation that several types of scientific study have been undertaken on this topic. These include:

- Cell studies using rats and mice
- Melatonin studies
- Epidemiological studies.

The Fact Sheet in **Appendix G** provides further detail on these studies and states that the cell and melatonin studies form no evidence of harmful effects from 50 Hz magnetic fields and the epidemiological studies only found weak evidence between childhood leukaemia and magnetic fields.

Health Protection Agency (UK)

The Health Protection Agency (HPA) website advises it "is an independent United Kingdom (UK) organisation that was set up by the government in 2003 to protect the public from threats to their health from infectious diseases and environmental hazards". The HPA has merged with the UK Government National Radiological Protection Board (NRPB). Prior to joining the HPA the NRPB provided advice to the UK Government in relation to matters such as the effect of living near power lines on human health.

Due to public interest in the effects of non-ionising radiation on human health, in 1990 the NRPB set up the independent Advisory Group on Non-Ionising Radiation (AGNIR) under the chair of Sir Richard Doll. AGNIR remains operational today and reports directly to the HPA on matters relating to extremely low frequency (ELF) magnetic fields (such as the 50 Hz magnetic field from power lines), radio frequency fields and radiation.

The independence, remit, knowledge and experience of the NRPB and AGNIR put them is a strong position to provide guidance on the potential health impacts from high voltage transmission lines.

In March 2001 AGNIR, through the NRPB, published a report entitled 'ELF Electromagnetic Fields and the Risk of Cancer'. This is commonly known as the 'Doll Report', an extract from the conclusion follows:

> *"Laboratory experiments have provided no good evidence that ELF electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is however some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields, is associated with a small risk of leukaemia in children. In practice, such levels of exposure are seldom encountered by the general public in the UK. In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify the firm conclusion that such fields cause leukaemia in children. Unless, however, further research indicates that the finding is due to chance or some currently unrecognised artefact, the possibility remains that intense and prolonged exposures to magnetic fields can increase the risk of leukaemia in children".*
> (AGNIR, 2001, ELF Electromagnetic Fields and the Risk of Cancer)

Further detail on AGNIR and the methodology for the Doll Report can be found on the HPA website by using the following link: http://www.hpa.org.uk.

Continued research by the AGNIR and monitoring of related studies by others result in AGNIR making the following statement on the HPA website:

> *"The AGNIR view is that recent large and well-conducted studies have provided better evidence than was available in the past on childhood leukaemia and exposure to EMF. Taken together they suggest average exposures of 0.4 μT or more are associated with a doubling of the risk of leukaemia in children under 15 years of age. The evidence is however, not conclusive. In relation to adults AGNIR says that there is no reason to believe that residential exposure to EMF is involved in the development of cancer" (AGNIR, HPA website).*

Electricity Industry

In both Australia and the UK, provision of electricity and ownership of associated infrastructure is by private companies. These companies responded to the previous significant levels of public interest in the potential for harmful human effects due to long-term exposure to the ELF EMF by working with Government agencies or making information publically available. Some companies in the electricity industry still provide information relating to potential health impacts from power lines.

A review of industry websites identifies the following:

- Energy Australia (Aus) – advise of the notion of 'prudent avoidance' of ELF EMF and that ARPANSA provide guidance on EMF matters and recommend precautionary measures relating to EMF exposure to minimise risk.
- Integral Energy (Aus) – advise that the company is a member of Energy Supply Association of Australia and adopts their policy, which includes a commitment to ongoing monitoring of engineering and scientific research relating to ELF EMF and a commitment to the policy of 'prudent avoidance' of ELF EMF regarding the location of electricity infrastructure and magnetic fields.
- National Grid (UK) – provide thorough advice on ELF EMF matters on their company website, also maintain a website completely related to EMF and health, the company considers community concerns in relation to EMF during the location of transmission lines, and has a specialist EMF team to provide information to the public.

This research identifies that electricity companies are aware of the community concern and the scientific evidence. This provides further confirmation that there is a possibility of impact to human

health from long-term exposure to EMF generated by the type of electricity transmission line that traverses the subject site for the proposed Illawarra International Health Precinct.

Cardiac Pacemakers

As the development proposal is for a hospital use it is relevant to consider the potential effect of the ELF EMF from the transmission lines on cardiac pacemakers. Internet research has not identified any specific guidance on this issue from the WHO, ARPANSA or HPA. This research has identified information on this topic from individual scientists, a cardiac pacemaker manufacturer and the Victorian State Government. A summary of this research is:

- John E Moulder Ph.D & Medical College of Wisconsin – pacemaker function can be affected by ELF EMF but interference from a powerline EMF would be unlikely. Evidence indicates that each pacemaker model may react differently and that the wearer should discuss these impacts with their doctor and pacemaker manufacture.
- Medtronic (Australasia) – manufacture pacemakers, their website advises that "fields of energy around certain types of equipment that use electricity and magnets may affect the normal operation of [an] implanted heart device". The advice continues that most EMFs are weak and do not affect the heart device but that a person with a cardiac pacemaker should consult their doctor for further information.
- Better Health Channel – was founded by the Victorian State Government in 1999 to provide health related advice for the community. The Better Health Channel website advises that household electrical appliances, mobile phones and portable phones will not affect a pacemaker. However other electrical appliances may have an effect and patients should contact their doctor for further advice.

The results of this research show there is a low possibility that cardiac pacemakers may be affected by the ELF EMF from the electricity distribution lines within the subject site.

Summary

This review of information and guidance regarding the potential for detrimental human health impacts from long-term public exposure to ELF EMF from electricity transmission lines indicates that there is a potential concern because the balance of scientific research demonstrates a weak link between these EMF's and childhood leukaemia. There is only very weak evidence to suggest that public exposure to the ELF EMF from the distribution lines have detrimental health impacts for adults.

This balance of evidence results in the WHO and various Governments to recommend mitigation measures to limit the potential for detrimental health impacts.

6.10.3 Further Assessment & Mitigation

As there is significant amounts of scientific research and guidance from advisory organisations and Governments that there is a possibility of detrimental health impacts from long-term public exposure to ELF EMF from electricity distribution lines it is reasonable for the development proposed in this EA to incorporate appropriate measures to mitigate against this minimal risk.

The proposed mitigation conforms to guidance from WHO, ARPANSA and HPA by proposing a precautionary approach (also known as prudent avoidance). This is the idea of putting in place measures to reduce the potential for the problem to occur even though there is no proof that a problem may exist. The definition of a precautionary approach from the 1992 Rio Declaration on the Environment is:

"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

The implementation of a precautionary approach to the issue of human health impacts from ELF EMF from WHO is to explore low cost ways to design new facilities or equipment to reduce exposure, however polices of arbitrary low exposure limits are not warranted (WHO Fact Sheet No. 322). ARPANSA support this approach as their 'Magnetic and Electric Fields from Power Lines' fact sheet advises, "there are currently no Australian standards regulating exposure to these [ELF] fields".

The precautionary approach to this issue at the Illawarra International Health Precinct development is to reduce exposure levels to EMF from the powerlines in the hospital buildings to persons that the scientific evidence identifies are most at risk. This is to be achieved by following the WHO guidance and implementing low cost options in the design and layout of the property.

The electricity transmission line through the site has a 40m wide (20m each side of the centre line) easement for servicing and to prevent the possibility of electricity arching. Buildings are not permissible in this easement. This easement results in the hospital wards and beds being set back from the electricity cables and associated EMF. As the strength of the EMF decreases as the distance from the source increases this setback reduces exposure levels to all persons within the buildings.

The scientific evidence relating to cancer from ELF EMF identify that children are most at risk in the form of leukaemia. Additionally, there is evidence to suggest that persons with a cardiac pacemaker may be at risk from health affects due to interference with the device from the powerline EMFs. In order to specifically protect these two groups, the arrangement of the hospital wards will serve to locate such patients in areas of the hospital buildings that are not adjacent to the transmission line easement. This will put greater distance between these two groups and the powerline EMF resulting in a further decrease in exposure levels.

Actual Impacts

The scientific research and guidance from Governments and specialist organisations indicate that there is only weak evidence to demonstrate a risk of detrimental human health impacts associated with ELF EMF form electricity powerlines. As science cannot confirm there is no risk the guidance is to take a precautionary or prudent avoidance approach to limit expose times and levels.

The actual impacts to persons at the Illawarra International Health Precinct are seen to be low because:

- Scientific studies only identify a weak link of any detrimental health impact from long-term public exposure to ELF MEF from transmission lines
- The development implements impact mitigation measures in the design
- People at the development are unlikely to reside there on a long-term basis, which limits their exposure to the EMF from the onsite transmission lines.

For the reasons above there is believed to be no justifiable impact to any person at the Illawarra International Health Precinct in relation to ELF EMF from the electricity transmission line that crosses the site.

6.11 Greenhouse Gas (GHG) Assessment

6.11.1 Introduction

The greenhouse gas (GHG) assessment in this section of the Environmental Assessment has been undertaken using methodology outlined in the National Greenhouse Accounts (NGA) Factors (2008) and using emissions factors tabulated in that document and industry best practice.

The NGA Factors DECC (2008) workbook was produced by the Department of Climate Change, and replaces the AGO Factors & Methods Workbook (2006). All methodologies are underpinned by frameworks outlined in documents produced by the Intergovernmental Panel on Climate Change

(IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) with due regard to the Kyoto Protocol.

Policies devised by the IPCC and UNFCCC are accepted as the internationally-spanning frameworks designed for intergovernmental efforts to tackle the challenges posed by climate change.

Appendix H contains a description of methodology and calculations used in this GHG assessment.

6.11.2 Greenhouse Gas Assessment Definitions

Consistent with the protocols of IPCC, UNFCCC, and NGA Factors (2008), three scopes of GHG emissions have been defined for this project. These include Scope 1, Scope 2, and Scope 3 emissions, each of which is defined below.

- **Scope 1** – Scope 1 emissions include direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes.
- **Scope 2** – Scope 2 emissions include indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate electricity, steam, or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.
- **Scope 3** – Scope 3 emissions include all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation. Examples of Scope 3 emissions include indirect emissions associated with the extraction/production of fuels used onsite fuel extraction and line loss associated with the consumed electricity, transport of product outside the organisation, and emissions associated with end use of product.

The *Greenhouse Gas Protocol* (WBCSD & WRI) *2004* considers reporting of Scope 3 emissions to be optional in the GHG inventory calculation of a project, as they are produced by third party organisations and form part of the GHG inventories of those third parties. Also, reporting Scope 3 emissions can result in double-counting of emissions and can potentially make comparisons between organisations and projects problematic, and yield emission values higher than the true value.

Notwithstanding the above, we have included Scope 3 emissions in this study from as many sources as practical, and from sources where data were available as a review of previous Part 3A applications determined in NSW show a strong desire from DoP for this information to be included in GHG assessments for proposed developments.
There are several different types of greenhouse gases (eg. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), etc.) and each type of greenhouse gas has a different effect on the atmosphere.

To allow a quantitative comparison between the emissions of different types of gases, the IPCC has defined a universally comparable unit referred to as the Global Warming Potential, which are provided in Appendix 1 of NGA Factors (2008). The GWP is the equivalent of non-carbon dioxide gas emissions given in tonnes of carbon dioxide equivalent (CO_2-e). Emissions from non-carbon dioxide gases are converted to t CO_2-e by multiplying the emission of each non-carbon dioxide gas by its GWP (e.g., 1 t CH_4 = 21 t CO_2-e).

6.11.3 Greenhouse Gas Emissions Sources

This assessment considers emissions associated with both the development and ongoing operation phases of the project. Scope 1 emissions have been defined as point source emissions that occur within the development site or operator controlled activities. Scope 1 emissions include:

- Combustion of diesel fuel during earthworks and building construction (incl. machinery engines and onsite power generators);
- Combustion of diesel fuel during transportation of construction materials;
- Combustion of diesel fuel during onsite maintenance activities (incl. landscaping etc.);
- Combustion of petrol fuel during employee travel (incl. during both construction and the ongoing operational phase of the project); and
- Combustion of natural gas used for energy.

Scope 2 emissions defined in this assessment include direct point source combustion emissions associated with the generation of purchased electricity used at the site during the ongoing operational phase of the project.

The assessment assumes that electricity consumed during the construction phase of the project will be supplied by onsite diesel generators, and this has been accounted for in Scope 1 emissions.

Scope 3 emissions in this assessment include:

- Indirect extraction emissions associated with combustion of diesel and petrol fuel (incl. all sources listed above in Scope 1 emissions);
- Indirect extraction emissions associated with the generation of purchased electricity used onsite (these emissions occur during the extraction of coal/fuels used for generation of electricity);
- Diesel combustion and methane generation during transportation and disposal of onsite generated waste to tips, landfill and recycling facilities;
- Indirect extraction emissions associated with combustion of natural gas; and
- Indirect emissions associated with offsite wastewater treatment.

6.11.4 Greenhouse Gas Inventory

Table 6.7 summarises the various Scope 1, 2, and 3 GHG emissions associated with the project and included in this GHG assessment.

Table 6.7 – Scope 1, 2 & 3 Emissions from Illawarra International Health Precinct Project

Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
• Diesel consumption during earthworks and building construction (direct combustion); • Diesel consumption during transportation of construction materials (direct combustion); • Employee travel fuel consumption (direct combustion); • Diesel consumption for onsite maintenance activities (direct combustion); and • Onsite gas consumption (direct combustion).	Consumption of purchased electricity (combustion generation).	• Diesel consumption during earthworks and building construction (indirect extraction); • Diesel consumption during transportation of construction materials and construction waste (indirect extraction); • Employee travel fuel consumption (indirect extraction); • Onsite gas consumption (indirect extraction); • Consumption of purchased electricity (fuel extraction and line loss); • Transportation and disposal of onsite generated waste to landfill and recycling facilities (incl. construction, municipal waste, and green waste); and • Offsite treatment of wastewater.

6.11.5 Methodology

The methodology used for this greenhouse gas assessment is described in **Appendix H**. The assessment protocols, methodologies, and greenhouse gas estimates were derived primarily from the *NGA Factors (DECC 2008)*, with due consideration given to the following reference documents:

- *Tracking to the Kyoto Target, Australia's Greenhouse Emissions Trends, 1990 to 2008-2012 and 2020*, Department of Climate Change, Australia
- *State and Territory Greenhouse Gas Inventories 2005*, Australian Greenhouse Office, Department of the Environment and Water Resources, Australia
- *NSW Greenhouse Plan*, November 2005, New South Wales Greenhouse Office, Australia
- *Greenhouse Gas Protocol 2004*, The World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI)
- *Projected Changes in Climatological Forcing For Coastal Erosion in NSW*, A Project Undertaken for the NSW Department of Environment and Climate Change, McInnes et al., CSIRO 2007
- *Economic Impact of Climate Change Policy: The Role of Technology and Economic Instruments*, ABARE, July 2006.

It is noted that some of the GHG emissions associated with the project are difficult to estimate because there is no sound methodology for estimating them, or it is difficult to define an accurate quantity at this conceptual phase. In all such instances, this GHG assessment has taken a

conservative approach by over estimating GHG emissions and quantities rather than underestimating. This rule has been applied generally across quantity and GHG emissions estimation, and in particular the following emissions have been estimated conservatively in this way:

- Recyclable transportation, and processing – there is no sound methodology for estimating Scope 3 emissions associated with transportation and processing of recyclable waste. Therefore, recyclable waste has been included in the waste quantity for municipal waste in this GHG assessment (i.e., municipal waste quantity = municipal general waste + recyclable waste). In line with NGA Factors (2008), this approach is conservative as diversion of waste material from landfill to recycling facilities reduces GHG emissions. Therefore, the GHG emissions associated with waste transport and disposal as estimated in this assessment are likely to be higher than the actual values.
- Transport emissions from staff travel – it is difficult to accurately predict the number of staff travelling by car and exact travel distances travelled by each staff member at this conceptual stage. Therefore, this GHG assessment has conservatively assumed that all staff members will drive to and from work with an average travel distance equivalent to a return trip from Wollongong (ie, 15km each way = 30km total). This is conservative as a significant proportion of staff members will be housed onsite and it is likely that a large proportion of staff members will use mass public transport or car pooling, which will further reduce per capita GHG emissions associated with transport. Therefore, the GHG emission associated with staff transport estimated in the assessment are likely to be higher than the actual values.

6.11.6 Results

The Scope 1, Scope 2, and Scope 3 GHG emissions associated with the construction and operational phase of the project are summarised in **Table 6.8, Table 6.9 & Table 6.10**. A detailed breakdown showing each emissions source and calculations is provided in **Appendix H**.

Table 6.8 – Summary of Construction Phase GHG Emissions for Stage 1

Emission Scope	GHG Emissions (t CO_2-e)
Scope 1	966
Scope 2	NA
Scope 3	323
Scope 1 + Scope 2	966
Scope 1 + Scope 2 + Scope 3	**1,289**

Table 6.9 – Summary if Construction Phase GHG Emission for all remaining Stages (ie. Stage 1-8b)

Emission Scope	GHG Emissions (t CO_2-e)
Scope 1	8,383
Scope 2	NA
Scope 3	92,007
Scope 1 + Scope 2	8,383
Scope 1 + Scope 2 + Scope 3	**100,390**

Table 6.10 – Summary of On-Going Operational Phase GHG Emissions (All Stages)

Emission Scope	GHG Emissions (t CO_2-e / yr)
Scope 1	13,273
Scope 2	42,459
Scope 3	20,184
Scope 1 + Scope 2	55,732
Scope 1 + Scope 2 + Scope 3	**75,916**

The total of all emissions (Scope 1, Scope 2, and Scope 3) yields a value of 1,289 t CO_{2-e} for the construction phase of Stage 1 of the project, 100,390 t CO_{2-e} for the construction phase of all other stages of the project (ie, Stage 2-8b), and 75,916 t CO_{2-e} per year for the ongoing operational phase of the project (incl. all stages). In the development phases, Scope 3 emissions make up approximately 90 % of the total emissions, while in the operational phase Scope 3 emissions make up 27 % of all emissions.

The inclusion of Scope 3 emissions, in total emissions, yields values higher than the actual emissions directly resulting from operations associated with the project. Therefore, the Scope 1 and Scope 2 emission total (55,732 t CO_{2-e}/yr) is a more appropriate indicator of the projects ongoing GHG emission contribution and has been used in this assessment for comparison with State, National, and Global totals. Exclusion of Scope 3 emissions is consistent with international frameworks on GHG emissions developed by IPCC and UNFCCC.

6.11.7 State, National, & Global Emissions Comparisons

The 2005 total GHG emissions from New South Wales have been reported to be about 158.2 Mt CO2-e, and likely to be approximately this value in 2008-2009. When compared to this figure, the Health Precinct GHG emissions (incl. Scope 1 and Scope 2) will contribute to 0.035 % of NSW total emissions.

The total Australian GHG emissions in 2005 were estimated to be 559.1 Mt CO2-e and increasing to over 560 Mt CO2-e in the current period. The GHG emissions associated with the project equate to 0.01 % of the total national emissions.

The world total greenhouse gas emissions is predicted to increase to 41,825 Mt CO2-e in 2010. The annual GHG emissions associated with the project equate to approximately 1.33 x10-4 % the global emissions total.

6.11.8 GHG Minimisation Measures

A number of mitigation measures will be implemented to reduce the GHG emissions resulting from the Illawarra International Health Precinct project. As a general rule, the following sustainability measures will be implemented reduce GHG emissions:

- **Green building design**: Potential energy savings by designing buildings which, due to their design (good orientation, shading, good ventilation, glazed doors, use of day-lighting / skylights, well-insulated walls and floors), reduce electricity use. Building design will also incorporate energy efficient lighting and automatic shutdown of HVAC and lighting in unoccupied building spaces. This will improve lighting and heating efficiency and reduce waste energy, which will reduce GHG emissions. Use of recycled building products will also reduce upstream emissions associated with materials manufacturing.
- **Waste management**: A waste management plan will be developed to ensure industry best practice waste manage procedures are implemented including waste minimisation and separation of recyclable materials. This will reduce the amount of waste to landfill and associated GHG emissions.

- **Sustainable traffic measures**: The development is within in close proximity to mass public transport, and will be designed with good pedestrian access, limited car parking spaces, and bicycle storage facilities. This will encourage users of the facility to use alternative methods of transport including car pooling, mass public transport, cycling, and walking, which will further reduce transport GHG emissions.
- **Water efficiency**: The development will implement water recycling and efficient use of water, including installation of rain water tanks and practical water re-use for toilet flushing and landscaping where possible. This will reduce GHG emissions by reducing the load on potable water supply and wastewater treatment. High level of water savings in IIHP will also be achieved by installation of showerheads with a minimum rating of 3-star in all showers, a toilet flushing system with a minimum 3-star rating in all toilets, kitchen-sink and bathroom basin taps of minimum 5-star rating in kitchens and bathrooms.
- **Use of state-of-the-art energy technologies**: High level of energy savings by using low energy efficient appliances, which may include solar (electric-boosted) water heater with a performance of 31 - 35 RECs (Renewable Energy Certificates) or better, 3-phase air conditioning / heating (Energy Efficiency Rating (EER) of 3.5 – 4.0), and low-energy fluorescent or LED lighting in conjunction with natural lighting.
- **Use of renewable energy sources**: The development will further reduce its energy usage and associated GHG emissions by use of solar hot water where practical and purchasing green energy from the grid.

6.11.9 GHG Assessment Conclusions

This assessment identifies possible GHG emissions from the Illawarra International Health Precinct project, classifies these emissions as Scope 1, Scope 2, or Scope 3, and estimates the maximum likely GHG emission from each source in accordance with the NGA Factors (DECC 2008), industry best practice, and sound scientific principles. Opportunities and strategies in the proposal for reductions in energy consumption and waste minimisation have been identified and the extent to which these energy savings will provide environmental benefits have been explored. This investigation has revealed:

- Strategies to minimise greenhouse gas emissions in the proposal by use of energy efficient electrical appliances are pragmatic and consistent with ecologically sustainable principles;
- Greenhouse gas emission point sources have been identified as fuel (diesel, natural gas, fuel) consumption, purchased electricity usage, offsite treatment of wastewater, and transportation and disposal of waste;
- The estimated value of annual greenhouse gas emissions from this development represents 0.01 % of the total national emissions, and 1.33 $x10^{-4}$ % of the world emissions that that will reached in the middle of the 2008-2012 Kyoto period
- It should be noted that the estimated greenhouse emissions from land clearing for the development should be negligible, as there is little vegetation on the site. Also, the calculations do not take into consideration any carbon sequestration associated with the revegetation of core riparian corridors. Rehabilitation of a portion of the disturbed areas with vegetation will offset some of the emissions from land clearing and fuel / electricity consumption noted above. However, it is difficult to quantify the extent of this offset, as this requires estimates of the amount of the carbon sequestered in biomass and soils. The amount of carbon sequestered is a parameter which cannot be determined with any great accuracy. It is dependent on vegetation type, geography and climate, and hence cumbersome to determine. We conservatively do not report this value, as estimates may not be accurate, and emissions calculated using these estimates will have large uncertainty values associated with them.

6.12 Noise

DGR's Requirements

Noise

- *The EA must include a comprehensive assessment of the predicted noise impacts associated with the project in accordance with relevant policies. Special consideration should be given to the proposed helicopter pad.*

La Vie commissioned Wilkinson Murray to undertake a noise assessment on the proposed flight path and the construction of IIHP. This is available in **the separate volume.**

6.12.1 Existing Environment

The ambient noise levels have been established based on typical background noise levels in Australian Standard AS1055.2 (1997) Acoustics – Description and measurement of environmental noise. This is provided in **Table 6.11.**

Table 6.11 – Indicative Background Noise Level

Period	Day 07:00-18:00	Evening 18:00-22:00	Night 22:00-07:00
Background Noise Levels	45	40	35

(Source: Wilkinson Murray (2009))

6.12.2 Receivers and Noise Criteria

The nearby surrounding receivers include:

- **East** – Suburban Residences in Penrose the nearest of which are in Goolagong Street at a distance in the order of 340 m from the helipad.
- **South East** – A single residence to the south of the site on Huntley Road at a distance of 250 m from the helipad.
- **West** – A single residence to the south of the site on Huntley Road at a distance of 680 m from the helipad.

In assessing the potential noise impacts as a result of the Helipad, Wilkinson Murray (2009) used the following noise criteria:

- **Ground Based Noise** – 40dBA (based on DECC Industrial Noise Policy)
- **Noise Generated in the air** (based on Air Service Australia *"Environmental Principles and Procedures for Minimising the impact of aircraft noise"*)
    - *Noise is not considered significant when selecting noise preferred options if exposure amount to less than 40L_{eq24} and there are less than 50 overflights per day.*

- *No residential area should receive more than 60 L_{eq24}, ie. no residential area should receive more noise exposure than that which is considered "unacceptable" for residential housing under Australia Standard AS2021.*

- **Sleep Disturbance** (based on DECC's *Environmental Criteria for Road Traffic Noise"*
  - *Maximum external noise levels below 60-65 dBA are unlikely to cause sleep awakening reactions.*
  - *One or two noise events per night, with maximum external noise levels of 75-80dBA, are not likely to affect health and well being significantly.*

6.12.3 Potential Impacts

Helicopter Ground Based Noise

Wilkinson Murray predicted the following likely noise level for different receivers (refer **Table 6.12**):

Table 6.12 – Noise Levels from a Helicopter on the Proposed Helipad

Receiver	Predicted Noise Level dBA	Night Noise Criterion dBA
Location 1 – Goolagong Street Residences	46	40
Location 2 – SE Residence	46	40
Location 3 – Western Residence	37	40

(Source: Wilkinson Murray (2009))

The assessment indicated that:

> *A marginal 1 dBA exceedance is predicted for the evening period whilst a greater exceedance of night noise criteria at surrounding residences to the south east and east is indicated. Such an exceedance during the night period is not unexpected considering the likely low ambient noise levels of this area.*

Figure 30 is the noise contours from the operation of a helicopter at the helipad.