AQUIS RESORT AT THE GREAT BARRIER REEF PTY LTD

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2

CHAPTER 16

AIR QUALITY

16. AIR QUALITY

16.1 EXISTING SITUATION

16.1.1 Current Sources of Air Emissions

In general, air quality is not currently an issue of concern in the Cairns area. The majority of pollutants emitted from within the Cairns airshed are thought to originate from motor vehicles and industrial sources in the vicinity of the sea port, as well as from the airport. Particulate matter concentrations arising from non-motor vehicle sources, such as bushfires, may continue to result in elevated levels on occasions.

The key atmospheric determinant of air quality is the climate of prevailing winds (see also **Section 3.6.5**. In the winter months, Cairns is influenced by high pressure systems which cause cool, dry winds from the south-east. During the summer and early autumn months, the highs move southwards, bringing warm moist air and resulting in high rainfall.

Key sources of air emissions are (refer to **Figure 16-1** for locations of specific features):

- the Marlin Coast WWTP
- sugar cane farms (i.e. agrichemicals)
- sugar cane farms (cane firing)
- sugar cane farms (greenhouse gases)
- material depot (to east of WWTP)
- Smithfield (industrial) Estate
- aircraft jet fuel dumping
- road traffic
- controlled forest burns
- Smithfield waste transfer station.

16.1.2 External Receptors

SPP 2013 under *Planning for hazards and safety (Emissions and hazardous activities)* requires that development:

- (1) is designed to avoid or otherwise minimise adverse impacts from emissions that will affect the health and safety, wellbeing and amenity of communities and individuals, and
- (2) supports the achievement of the relevant acoustic and air quality objectives of the:
  - (a) Environmental Protection (Noise) Policy 2008, and
  - (b) Environmental Protection (Air) Policy 2008 (Appendix 5), and
- (3) does not compromise the viability of existing or future industrial development, including industrial land within a state development area, or an enterprise opportunity area or employment opportunity area identified in a regional plan.

In order to identify likely locations where the 'health and safety, wellbeing and amenity of communities and individuals' is relevant, the specialist air quality assessment (**Appendix R**) includes a map of what were described as 'sensitive receptors' – this is a term taken from the SPP (2013) with respect to noise and vibration and technically does not apply to air quality. However, it is a useful approach in considering sensitivity of external sites to air emissions. In order to avoid confusion, these sites are referred to in this chapter as 'external receptors'.

The nearest affected external receptors are shown on **Figure 16-1** and described in **Table 16-1**. In addition to those listed, aircraft pilots could be potentially affected if high concentrations of airborne dust reach flight paths and cause vision to be limited.

TABLE 16-1 LOCATION OF NEAREST EXTERNAL RECEPTORS

ID	NAME	TYPE	COORDINATES (GDA 55)	
			Easting (m)	Northing (m)
A	Yorkeys Knob State School	School	363850	8140388
B	21 Clinton Street	Residence	363672	8140222
C	410 Varley Street	Residence	363563	8139827
D	1 / 369 Varley Street	Residence	363444	8140024
E	1 Samuel Street	Residence	362396	8139946
F	Smithfield Estate	Residence	362453	8138169
G	22 Cattana Road	Residence	363128	8138499
H	233 Yorkeys Knob Road	Residence	362813	8138080
I *	[Deleted]			
J	154 Yorkeys Knob Road	Residence	361945	8137490
K	4 Robinson Road	Residence	363228	8137016
L	47 Walker Road	Residence	364966	8138265
M	72 Boronia Crescent	Residence	365126	8138813
N	30 Acacia Street	Residence	365162	8138969
O	Poinsettia Street Environmental Centre	Business & residential	363850	8140388
Ponds	Ponderosa Prawn Farm	Aquaculture	363384	8137741

Source: Appendix R (Table 2.1).

* Site I is no longer an external receptor as the residence now forms part of the Aquis Resort parcel and will be removed as part of development.

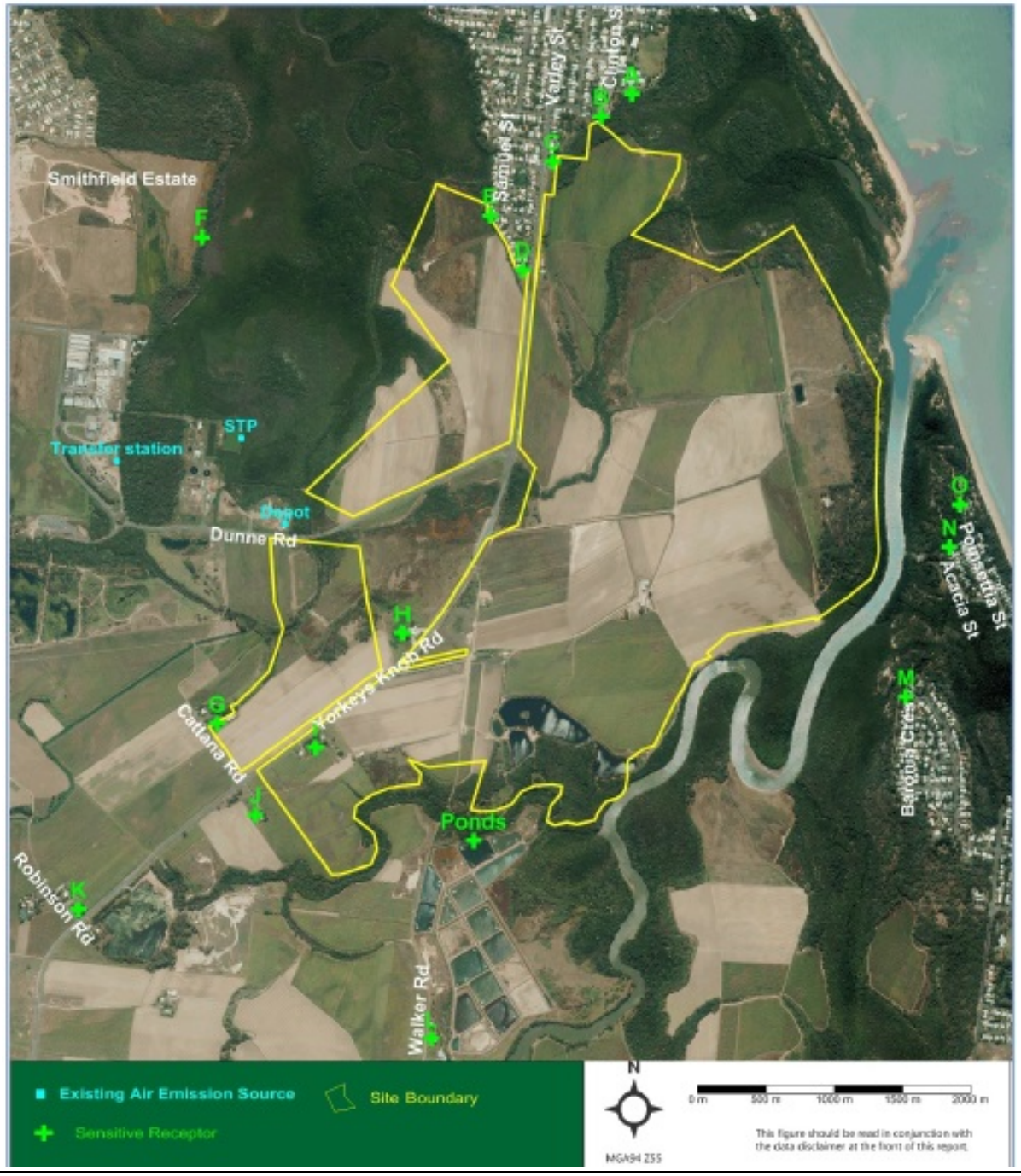

Figure 16-1 Location of existing air emissions and external receptors.

Source: Appendix R (Figure 2.3). Original figure and **Appendix R** refers to 'external receptors' as 'sensitive receptors' – this is technically incorrect as described above.

Reference to the above table and map shows that the main sensitive receptors are in the adjacent urban areas of Yorkeys Knob and Holloways Beach (across Richters Creek). Some rural receptors are located to the south and west.

16.1.3 Environmental Values

Environmental Values for the air environment as defined under the EPP (Air) are:

a) the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems

b) the qualities of the air environment that are conducive to human health and wellbeing

c) the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property

d) the qualities of the air environment that are conducive to protecting agricultural use of the environment.

These values are protected by standards as described below.

a) Dust Deposition

While there are no quantitative limits specified in legislation, there are guidelines designed to avoid nuisance caused by dust deposition fallout onto near horizontal surfaces.

EHP normally includes, in license conditions, the guideline that insoluble deposited matter should not exceed 120 mg / m^2 / day (3.6 g / m^2 / month). This is in accordance with the *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (Department of Minerals and Energy 1995). It should be noted that this value is a guideline for the level that may cause nuisance at an external receptor such as a residence or external commercial land use. It is not normally necessary to achieve this level at the boundary, but boundary measurement can assist in the assessment of whether there is risk of nuisance occurring or not.

b) Suspended Contaminants

The relevant air quality criteria are those specified in the Queensland *Environmental Protection (Air) Policy 2008* (EPP (Air)) as summarised in Table 4.1 of **Appendix R**. The odour criterion is specified in the Queensland odour guidelines (Environmental Protection Agency 2004). Note that the EPP (Air) has incorporated the goals nominated within the *National Environmental Protection (Ambient Air Quality) Measure* (NEPM). Criteria used fall into one of the following categories:

- aesthetic environment
- ecosystems
- health & wellbeing.

16.1.4 Greenhouse Gas Emissions

The *National Greenhouse and Energy Reporting Act* 2007 (NGER Act), the *National Greenhouse and Energy Reporting Regulations* 2008 (NGER Regulations), and the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Determination) establish the legislative framework for a national greenhouse and energy reporting system. Referring to the NGER Act and associated guidelines and regulations:

- The NGER Technical Guidelines provide additional guidance and commentary to assist in estimating greenhouse gas emissions for reporting under the NGER system. The emission factors used in these guidelines are consistent with those specified in the National Greenhouse Accounts Factors
- The NGER Act makes reporting mandatory for corporations whose energy production, energy use, or greenhouse gas emissions meet certain specified thresholds. These thresholds are detailed in the NGER Regulations.

- The NGER Determination provides methods, and criteria for methods, for the estimation and measurement of the following items arising from the operation of facilities:
  - greenhouse gas emissions.
  - the production of energy.
  - the consumption of energy.

Greenhouse gas emissions are defined in Section 2.23 of the NGER Regulation as:

> (2) *Emissions of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of 1 of the following:*
>
> *(a) an activity, or series of activities (including ancillary activities) that constitute the facility (scope 1 emissions);*
>
> *(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (scope 2 emissions).*

Coverage of scope 1 emission sources is given in Section 1.3 (4) of the NGER Determination by the following categories:

> *(b) fuel combustion, which deals with emissions released from fuel combustion; and*
>
> *(c) fugitive emissions from fuels, which deal with emissions mainly released from the extraction, production, processing and distribution of fossil fuels; and*
>
> *(d) industrial processes emissions, which deal with emissions released from the consumption of carbonates and the use of fuels as feedstock or as carbon reductants, and the emission of synthetic gases in particular cases; and*
>
> *(e) waste emissions, which deal with emissions mainly released from the decomposition of organic material in landfill or wastewater handling facilities.*

Also of relevance is that:

- Scope 2 emissions are generally emissions that result from activities that generate power off-site for consumption on-site. The largest contributor to scope 2 emissions is consumption of electricity or steam.
- Scope 3 emissions are those produced during the off-site processing or consumption of products. It is not compulsory to report these under NGER.

An analysis of farm records which reveal that the average area under cane over the period 2007 to 2012 was 187 ha with an annual production of 13,300 tonnes. This equates to approximately 71 t / ha. This is consistent with the average yield for Wet Tropics sugar cane of 80 t / ha reported by Renouf and Wegener (2007).

Running the FullCAM model (Department of Climate Change and Energy Efficiency 2012a; b) for a year of sugar production gives an increase in carbon mass on-site of approximately 962 tonnes, equivalent to approximately 3,527 tonnes of CO_2 sequestered. This does not account for emissions from the sugar mill, which are Scope 3 emissions under NGER, but are expected to be a similar quantity. At the mill, some carbon would be lost back to atmosphere via bagasse waste material, but bagasse could potentially be used to generate net electricity. Ultimately the carbon in sugar is also likely to be released back to the atmosphere as CO2 so the net greenhouse gas emissions of the sugar cane growing are expected to be minor if any.

16.1.5 Impact of Current Local Land Uses on Environmental Values

The likelihood of adverse impacts on local air quality values arising from emissions from current sources (see **Section 16.1.1**) are summarised in the following table. Further details are available in **Appendix R**. Refer to Appendix B of that document for an explanation of terms used in this table.

TABLE 16-2 SUMMARY OF AIR QUALITY ISSUES CONSIDERED

SOURCE	KEY POLLUTANT	LIKELIHOOD OF CRITERIA EXCEEDANCE
Marlin Coast WWTP	Odour	Low
Sugar cane (general farming)	Pesticide and fertiliser application, PM_{10}	Low
Sugar cane (firing)	PM_{10} with smaller quantities of NO_x	Moderate
Sugar cane (greenhouse gas production)	Carbon dioxide (CO_2) and methane (CH_4) greenhouse gases	N / A. Net greenhouse gas emissions of the sugar cane growing are expected to be minor if any.
Material depot	Dust, TSP, PM_{10}	Low
Smithfield Estate	Dust	Low to moderate
Jet fuel dumping	VOCs and odour	Very low (see Note 1)
Road traffic	Nitrogen oxides (NO_x), carbon monoxide (CO) and particulates represented by those less than 10 microns (PM_{10})	Very low
Controlled forest burns	PM_{10}, NO_x	Low
Waste transfer station	PM_{10}, odour	Low

Source: Appendix R (combination of Tables 5.1 and 5.5).

Notes: 1. Fuel dumping at Cairns International Airport is a rare event and is certainly not a common practice. If aircraft do need to dump fuel, they do so over water (in most cases the fuel evaporates before it reaches the ocean). Many aircraft cannot even dump fuel and instead burn it in the exhaust. Further, the Commonwealth Government (CASA) has undertaken monitoring that demonstrates that dumping is not a common practice. The release of fuel 2000 m above ground and dispersed over considerable distance is only likely to reach the ground level in trace amounts below odour detection thresholds and health criteria. Based on this advice it appears that fuel dumping is not a risk to air quality for the resort.

There are no government air monitoring stations in the Cairns airshed (the nearest is at Townsville).

Concentrations of PM_{10} and $PM_{2.5}$ in the region may occasionally exceed goals due to controlled forest and sugar cane fires. Although there are likely to be fires at some locations every year, rainfall is high and recirculation patterns are not expected to be common. Therefore exceedances of goals are not expected to be of high frequency.

Combustion gases and VOCs are not expected to exceed criteria as traffic volumes are low compared to the city, there are no large industrial facilities in the region, and meteorological dispersion at the site is high due to the sea breeze compared to other parts of the airshed.

Dust fallout and odour are highly site-specific. Sugar cane farming is likely to have the largest impact on the site but is not considered likely to exceed criteria. The Marlin Coast WWTP is the only known source of odour this is located 500 metres from the site and would have little impact.

Overall, the existing air environment is characterised by common emission sources that can be managed by adequate buffer zones.

16.2 IMPACTS

16.2.1 Impact Avoidance / Minimisation

Generally, no current air quality issues apply to the site, although some parameters may occasionally exceed targets due to controlled forest and sugar cane fires. Combustion gases and VOCs are not expected to exceed criteria because:

- traffic volumes are low compared to the city
- there are no large industrial facilities in the region
- meteorological dispersion at the site is high due to the sea breeze compared to other parts of the airshed.

The Marlin Coast WWTP is the only known nearby source of odour. As this is located 500 m from the site, it can be expected to have little impact on current air quality.

External receptors exist in the adjacent urban areas of Yorkeys Knob and across Richters Creek to Holloways Beach (see **Figure 16-1**). Some rural receptors are located to the south and west.

No high level design solutions have been identified to limit air quality impacts, although as noted later, there are many detailed design initiatives that can be expected to improve performance. Overall, the existing air environment is characterised by common emission sources that can be managed by adequate buffer zones.

16.2.2 Characteristics of Emissions

a) Construction Emissions

Earth-Moving Activities

It is estimated that 2.8 million cubic metres of earth will be excavated to form the lake. A small proportion of this earth is to be used as fill on-site, with the remainder being exported as outlined in the description of the construction methodology (**Chapter 4**). In general, all earth-moving activities other than dredging will generate dust.

At the main excavation site for the lake, the presence of vegetation along the creeks between the site and external receptors will enhance deposition of dust and reduce suspended particulates. Provided that dust emissions are kept to a minimum by spraying working areas during dry weather, the particulate concentrations reaching external receptors should be well within health criteria. Similarly, dust deposition beyond the vegetated areas should be well within the nuisance guideline.

Generation of dust clouds sufficient to limit visibility of airline pilots or vehicles on Yorkeys Knob Road is considered unlikely. Particularly poor site management might lead to dust clouds crossing the road, but it is highly unlikely that these would limit the vision of pilots. Application of water sprays should prevent visible dust crossing the site boundaries.

The golf course is proposed for the vicinity of receptors G, H and J. A 40 m buffer zone is proposed on the boundary near receptor G. Appropriate water spraying during earth-moving should prevent impacts at these receptors.

Any earthworks near residences not sheltered by vegetation, such as receptor D, will need to be carefully managed. Earthworks likely to take more than three months will need to be monitored with a dust deposition gauge.

Excavated Earth

Excavated earth from low-lying coastal ground may emit odour typically associated with decomposition of biological material in exposed swamp ground. The process of treating acid sulphate soils with lime will help to reduce this odour, provided that treatment areas are not located close to residences or Yorkeys Knob Road.

Mobile Plant Exhausts

Although mobile plant will exhaust combustion gases and particulates, there are reasonable buffer distances to residents. The number and size of vehicles is not considered likely to be significantly different from other construction projects. For these reasons and considering the anticipated low background concentrations of gases and particulates, emissions are not likely to contribute to exceedances of criteria.

Drilling

Drilling (for piles) will generate dust. However this activity is likely to be necessary in the Resort Complex Precinct. Vegetation and distance to residences should adequately reduce the amount of particulates emitted from drill rigs. Water sprays should be used in conjunction with any dry drilling.

Wind

Strong wind will generate dust from exposed surfaces during dry weather. This should be mitigated by application of water sprays to surfaces that are both un-vegetated and unsealed. The potential for nuisance to occur will accumulate over time, and the likelihood of complaints may accelerate. This should be avoided by rapid treatment of surfaces by re-vegetation or sealing.

Concrete Batching Plant

The proposed concrete batching plant(s) will emit dust and suspended particulates from cement, sand and gravel. This will require an adequate buffer distance to residences, taking into account the presence of any vegetation. Wind breaks around storage bunkers and water sprays will also help to minimise dust emissions.

A summary of construction phase emissions are summarised in **Table 16-3** below. Likely impacts and suggested mitigation is discussed in **Section 16.2.3** and **Section 16.3** respectively.

TABLE 16-3 SUMMARY OF AIR EMISSIONS – CONSTRUCTION

PROPOSED SOURCE	PARAMETERS	POLLUTANTS
Earthmoving activities	Dust	Particulates
Excavated earth	Odour	Chemicals
Mobile plant exhausts	Exhaust emissions	Combustion gases and particulates
Drilling	Dust	Particulates
Wind (mobilisation of dust from exposed surfaces)	Dust	Particulates
Concrete batching plant	Dust and suspended particulates from cement, sand and gravel	Particulates
Various (see **Section 16.2.1c)**)	Greenhouse gas emissions	Carbon dioxide (CO_2) and methane (CH_4) greenhouse gases

Source: Appendix R (summary of Section 6.1).

b) Operation Emissions

Key operation phase emissions are as follows (external receptors referred to are shown on **Figure 16-1**):

- It is proposed that Class A recycled water be purchased from the nearby Marlin Coast WWTP (shown on **Figure 16-1** as 'STP') and be used partly for golf course irrigation. Class A treatment requires no detectible levels of pathogens. It is anticipated that this water will not produce odour.
- Pesticides, both insecticides and herbicides, may be applied to the golf course during establishment and operation. These may potentially impact on residences and aquaculture ponds.
- Motor vehicle traffic is not expected to reach volumes that would cause exceedances of criteria as the area is well ventilated in the absence of street canyons.
- Ventilation stacks for sewage pumping stations should not be located near existing residences (i.e. near external receptors C, D & E) in Yorkeys Knob township or receptors G and I.
- Odour from restaurant cooking is considered unlikely to cause nuisance provided exhaust stacks emit 3 m above the roof, if within 10 m of residences.

These operation phase emissions are summarised in **Table 16-4** below.

TABLE 16-4 SUMMARY OF AIR EMISSIONS – OPERATION

PROPOSED SOURCE	PARAMETERS	POLLUTANTS
Golf course spraying	Treated water Pesticides	Odour [1] Chemicals
Motor vehicles on roads	Exhaust emissions	NO_x, CO, PM_{10}
Sewage pump stations	Emission from ventilation stack	Odour
Restaurants	Cooking	Odour
Various (see **Section 16.2.1c)**)	Greenhouse gas emissions	Carbon dioxide (CO2) and methane (CH4) greenhouse gases

Source: Appendix R (summary of Section 6.2).

Notes: 1. Odour should not be produced if Class A recycled water is used.

c) Greenhouse Gas Emissions

A detailed assessment of greenhouse gas emissions for both the construction and operation phases was undertaken. Estimated quantities of greenhouse gases released by the project are provided in **Table 16-5**. This uses terminology described in **Section 16.1.4**.

TABLE 16-5 ESTIMATED ANNUAL GREENHOUSE GAS EMISSION INVENTORY

SOURCE	MATERIAL QUANTITY	EMISSION FACTOR	EMISSION RATE CO2-E (kt/a)
Scope 1 Construction mobile plant	250,000 litres diesel	2.68 t CO_{2-e}/kL	0.7
Scope 2 Concrete consumption production	28,000 tonnes clinker	0.544 t CO_{2-e} / t clinker	15.2
Scope 2 Motor vehicles on roads	6,700 litres petrol	2.29 t CO_{2-e}/kL	0.02
Total Construction	**-**	**-**	**17.4**
Scope 2 Motor vehicles on roads	6,700 litres petrol	2.29 t CO_{2-e}/kL	0.02
Scope 2 Grid power consumption	25 MW x 8760 hours	0.86 t CO_{2-e} /MWh	188.3
Scope 2 Additional aircraft required to deliver customers	655,200 litres avgas	2.21 t CO_{2-e}/kL	1.5
Total Operation	**-**	**-**	**189.8**

Source: Appendix R (Table 6.5).

16.2.3 Impacts of Emissions on Environmental Values

The potential impacts of the development on external receptors shown on **Figure 16-2** are summarised in **Table 16-6** below.

TABLE 16-6 SUMMARY OF AIR EMISSIONS AND POTENTIAL IMPACTS

POLLUTANT & SOURCE	EXTERNAL RECEPTORS	LIKELIHOOD OF EXCEEDANCES
Dust from earth-moving	H, J, G, D	Low to moderate
Odour from excavated earth	Residences or Yorkeys Knob Road	Low
Mobile plant exhausts	H, J, G, D	Very low
Dust from drilling	H	Very low
Dust from wind over uncovered ground	H, J, G, D	Low to moderate
Dust from concrete batching plant	Residences	Low to moderate
Odour from effluent watering of golf course	H, J, G	Very low
Chemical spray from golf course	H, J, G, ponds	Low
Particulates and combustion gases from increased traffic on roads	Residences	Very low
Odour from sewage pump stations	Residences	Low
Restaurants	Residences	Low
Greenhouse gas emissions	N/A	See Note 1 over page

Source: Appendix R (Table 9.1)

Note 1 from previous page: The total greenhouse gas emissions in 2011-2012 from corporations that had to report to NGER was 435.9 megatonnes (Mt) CO2-e. Based on the total emissions for 2011-2012, unmitigated emissions from the construction and annual operation of the resort would be respectively 0.004% and 0.042% of Australian NGER emissions.

The key conclusions from the assessment are:

- nuisance dust from earthmoving, uncovered ground, and a concrete batching plant require buffers and / or appropriate management practices
- odour from excavated earth, sewage pumping stations and restaurants require appropriate buffers
- the only source potentially posing a direct human health risk is chemical spray from the golf course, which will be mitigated by the proposed vegetation buffers, and is not likely to differ substantially from the existing spraying of sugar cane
- other emissions do not require any specific mitigation measures
- unmitigated, the project is estimated to contribute 17 kilotonnes of CO_2-e per annum during construction and 190 kilotonnes of CO_2-e per annum during operation (this operation exceeds the 25 kilotonne threshold, requiring Aquis Resort to report to the NGER system).

16.3 MITIGATION AND MANAGEMENT

Recommended mitigation includes three specific categories:

- buffers to be incorporated into the design to handle a range of air-borne pollutants
- a number of design and construction management initiatives
- specific actions to reduce net greenhouse gas emissions.

a) Recommended Buffers

Based on early advice from the air emissions investigation, the Concept Land Use Plan includes a 40 m vegetated spray buffer along the interface between the site and rural land along the southern boundary, in cases where natural buffers do not exist. Other buffers need consideration based on EHP guidelines that define the following buffer distances, within which planning investigations are required:

- medium impact industry: 250 m
- high impact industry: 500 m.

These industry categories are defined as (Department of Infrastructure and Planning 2010):

- Medium impact industry: *Premises used for industrial activities that have off-site air, noise and odour emissions*. Despite mitigation measures these activities would still have noticeable impacts on non-industrial uses. The primary emitting aspects of the use are indoors.
- High impact industry: *Premises used for industrial activities that have significant off-site impacts on non-industrial uses including air, noise or odour emissions that are not easily controlled*. These uses may operate outdoors.

Table 16-7 below shows the recommended buffers to existing and proposed sources of air emissions and refers to **Figure 16-2**.

Figure 16-2 External receptors and recommended buffers to protect Aquis from cane firing.

Source: Appendix R (Figure 7.1)

TABLE 16-7 AIR EMISSIONS SOURCES (EXISTING AND PROPOSED) AND APPLICABLE BUFFER ZONES

SOURCE	CATEGORY	RECOMMENDED BUFFER ZONE (m) 1
Marlin Coast WWTP	High impact from odour	500
Sugar cane farms	Medium impact from occasional burns and spraying	250
Materials depot	Medium impact from minor emissions of dust	250
Forest burns	Medium impact from occasional burns managed by closing air intakes	250
Waste transfer station	Medium impact from minor dust and odour	250
Concrete batching plant	Medium impact from dust	250
Golf course spraying	Medium impact from spraying	250

Source: Appendix R (Table 7.1).

Notes: 1. These buffer zones assume that no other mitigation measures such as vegetation are in place.

The only buffer zone that impinges significantly on the proposed site is that for sugar cane farms. The 40 m vegetated buffer included in the Concept Land Use Plan along the interface between the site and rural land along the southern boundary—in cases where natural buffers do not exist—will be adequate to protect the site from sugar cane spray drift, and to protect the existing residences from golf course spray drift. However the larger buffer (250 m) is recommended to reduce impacts of the occasional cane firing on the amenity of Aquis Resort guests.

A smaller buffer is recommended around site sewage pumping stations to protect guests from odour. Given the well-ventilated nature of the site, a vegetated buffer of 10 m or an open buffer of 40 m would suffice.

With these buffers in place:

- the sugar cane farm to the south of Yorkeys Knob township is being replaced with a golf course (a lower impact land use) and on the eastern side of Varley St, by a vegetation buffer (also a lower impact land use)
- the 40 m vegetation buffer proposed for the south-western boundary of the site will prevent issues arising from spray drift, provided that it meets spray drift guidelines.

b) Other Mitigation and Management

Other recommended mitigation measures not already included in the Concept Land Use Plan are as follows:

- Ventilation stacks for sewage pump stations should not be located within 40 m of residences, or 10 m if the buffer zone is vegetated.
- Restaurant exhaust stacks should have 3 m stacks if located within 10 m of residences.
- Any concrete batching plant should be located at least 250 m from residences.
- Water sprays should be used for all earth-moving activities during dry weather and for dry ground drilling.
- Wind breaks and water sprays should be used at the concrete batching plant.

- Open ground should be vegetated or sealed as soon as practical.
- Dust deposition monitoring should be undertaken when earth-moving activities are in the proximity of receptors H, J and D.

c) Greenhouse Gas Mitigation

A number of design, construction, and operation recommendations for reducing greenhouse gas emissions are included in **Appendix R**. These have been collated for inclusion into the Sustainability Strategy as described provided in **Section 23.3.2**. The following is an outline of major opportunities:

- Design:
  - Plant native vegetation on-site to act as a greenhouse gas sink. Preliminary modelling for a 6 ha area consisting of the recommended spray buffers, and an additional 4 ha area adjacent to the Yorkeys Knob township (part of the 61 ha of planned restoration) for the first year of growth following planting, gives an increase in carbon mass on-site of approximately 6188 tonnes, equivalent to approximately 22 690 tonnes of CO_2 sequestered. For the full 55.6 ha the figure is 126.3 kilotonnes (about 67% of the annual CO_2 production during operation).
  - Maximise use of natural lighting and ventilation in design of buildings.
  - Ensure appropriate design of water management systems to minimise consumption and pumping, use variable speed drives on large pumps.
  - Design buildings to 5/6 star standards for energy conservation. Include light and motion sensors and timers to switch on lighting, energy efficient light bulbs, solar hot water, solar / electric panels, reticulated gas network and centralised chilled water generators for air-conditioning, purchase energy efficient and water efficient appliances, and install programmable thermostats.
- Construction:
  - As far as practical, obtain construction materials and ongoing consumables from local suppliers to reduce fuel consumption.
  - Where practically available, use maximum size of earth-moving equipment to minimise trip numbers.
- Operation:
  - Design all operations to meet the standards applicable to a sustainable tourism facility from a third party such as Green Globe (http://greenglobe.com).
  - Maintain equipment to retain energy efficiency. This has potential for reductions in electricity demand.
  - Where suitable, use local personnel in order to reduce transport emissions. This has potential for reductions in transport fuel consumption.
  - Training should be provided to all staff in energy management specific to their roles.
  - Purchase grid electricity from renewable sources such as wind or solar.
  - Adopt energy audits to provide a breakdown of energy use by activity, profiles of energy load across key plant items, analysis of energy efficiency initiatives, trending of energy usage over time, and addressing energy usage in procedures.
  - Track carbon footprint and other environmental practices using a system such as Green Hotels Global.

d) Monitoring and Auditing

The EMP (Planning)((see **Section 23.4**) includes an outline of the required monitoring and auditing, as well as actions required to be undertaken during design, construction, and operation.

The design of a monitoring and auditing system will be addressed in detail in the EMP (Construction). This will involve ensuring that all activities will be consistent with best practice environmental management and comply with any government plan in place at the time.

16.4 RESIDUAL IMPACTS

16.4.1 Human Health and Amenity

The existing air quality is likely to be well within health and amenity criteria for most of the time. The only potential exception is concentrations of PM_{10} and $PM_{2.5}$ during sugar cane firing, which may occur every four to six years. The project elements all have a substantial buffer to the remaining adjacent sugar cane farms including vegetation buffers, so this potential impact is considered to be well-managed within the project proposal.

The main potential impacts on air quality at external receptors during construction activities include dust from earth-moving, uncovered ground, and concrete batching. These should be carefully managed with buffers, water sprays, wind breaks, and revegetation and be subject to monitoring throughout the construction phase. Other construction impacts such as odour are unlikely and it is expected they will be well-managed by buffer distances.

There are few potential impacts on air quality at external receptors during the operation phase. These include odour and chemical spray drift, which are unlikely and it is expected they will be well managed by buffer distances.

The project is estimated to contribute 17 kilotonnes of CO_2-e per annum during construction and 190 kilotonnes of CO_2-e per annum during operation. With the recommended mitigation the net annual figure is about 63.5 kilotonnes. This exceeds the 25 kilotonne threshold requiring Aquis Resort to report to the NGER system. It may be possible to sequester additional carbon in external sites if required.

Mitigated emissions from the operation of the resort will be approximately 0.012% of Australian NGER emissions. This represents a small contribution to Australia's emission inventory. All practical measures to reduce these emissions should be implemented. Various commercial and non-for-profit organisations exist to undertake this work.

16.4.2 Cumulative Impacts

It is not possible to estimate the cumulative impact of Aquis Resort emissions in association with wastes or emissions produced by other activities. However, the assessment reveals that air emissions are unlikely to be a serious issue for this development on this site. In addition, the development will involve a cessation of cane harvesting and thereby remove a major source of occasional emissions.

The design and operation of the Aquis Resort will be in accordance with the EPP (Air) and this will ensure that nuisance is minimised.