Raglan Wastewater Treatment Plant Technical Odour Assessment

Prepared for Waikato District Council
Prepared by Beca Limited

31 October 2019

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Contents

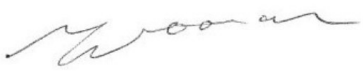
Appendices

Appendix D – Location of Sensitive Receptors for Risk Assessment

Revision History

Revision Nº	Prepared By	Description	Date
1	**Mathew Noonan & Suzanne Cawood**	1st Draft	09 October 2019
2	**Suzanne Cawood**	Final	31 October 2019

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Mathew Noonan and Suzanne Cawood**		31 October 2019
Reviewed by	**Mathew Noonan**		31 October 2019
Approved by	**Garret Hall**		31 October 2019
on behalf of	Beca Limited		

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Executive Summary

Background

The Waikato District Council (WDC) operates the Raglan Wastewater Treatment Plant (WWTP), located on Wainui Road, Raglan, Waikato. The WDC currently holds a resource consent to discharge contaminants to air for the existing WWTP (Resource Consent Number 971392) which is will expire on 14 February 2020. WDC is therefore applying for a short-term resource consent, which will allow for the continued operation of the WWTP while the long-term treatment and discharge option is investigated and confirmed.

In the context of that application it is necessary to consider the potential for odour nuisance effects. WDC has commissioned Beca Ltd (Beca) to undertake a technical assessment of the effects of the discharges to air in support of the application for a short-term resource consent.

Emissions to Air

During the proposed consent period the WDC does not propose to vary the operations at the WWTP. Similarly, no significant additional loading on the WWTP is expected to occur during the proposed short-term consent period. Therefore, the expected emissions to air over the proposed consent period will be similar to those which currently occur at the site.

Odours are discharged to the atmosphere during the treatment, storage and transfer of wastewater. Odours are generated through the decomposition of organic material (i.e. carbohydrates, fats and proteins) present in the wastewater and generate from the treatment process.

The sources of greatest odour potential within the WWTP include the inlet works, anaerobic treatment ponds and aerated treatment ponds. These processes are all located at the southern end of the site, and away from Raglan's residential areas.

The inlet works screen is enclosed, which minimise any odour discharges to the atmosphere. Generally, any odour emitted from the inlet works is generally localised and would not be observed outside the site boundary.

The anaerobic ponds can potentially be a significant odour source. However, a layer of oxygenated water is maintained by surface aerators (i.e. an 'odour cap') has been installed in the ponds which minimise the emission of odorous compounds.

The four aerated treatment ponds are all aerated from bottom deployed aerators. The aerator maintains a positive dissolved oxygen concentration in the ponds which prevent anaerobic conditions from occurring when high compounds may form. During normal operating conditions only low levels of odour are generated by the aerated treatment ponds. Typically, the odours from the aerated ponds have an earthy character. These odours are usually only observed in the immediate vicinity of the sources and would not be expected to be observable outside the site boundary.

Only low levels of odour are generated by the other site treatment processes (i.e. day holding pond, roadside storage pond, pumps station and UV disinfection processes) at the site.

During normal operating conditions only low levels of odour are expected to be emitted from the site. However higher odour emissions that have on occasion occurred in the past could occur during abnormal conditions.

Assessment of Effects

The surrounding land use is primarily used for pastoral agriculture uses and is considered to have a low sensitivity to odours. Receptors located near the site with a high sensitivity to odour include nearby rural dwellings, the Poihakena Marae and Medical Centre, and a café and child care centre to the north west of the site.

The separation distance between the site processes and these high sensitivity receptors is such that no adverse effects are expected to occur at these receptors during normal operating conditions. These receptors are located either at higher terrain elevation than the WWTP or separated from the WWTP by intervening hills. These topographical features would also tend to channel any odour emitted from the site away from the receptors, particularly during worst-case dispersion conditions (i.e. low wind speeds and stable atmospheric conditions).

A worker's cottage is located approximately 160 m to the south of the WWTP and may on occasional experience odours emitted from the site. However, this dwelling is located in close proximity to other farming activity which emits odour and dust (e.g. dairy milking shed) therefore a lower air quality amenity can be expected at this location.

The comparatively low number of complaints received by the WDC and the WRC since 2011 (only three of which are attributable to WWTP operations) would also suggest that the level odour experienced by the community as a result of the WWTP is generally acceptable.

The potential discharges of odour from the WWTP is considered to be adequately avoided or mitigated such that any odours will not be offensive or objectionable. Any effects will be no greater than those associated with the current consent for the WWTP.

1 Introduction

1.1 Background

Waikato District Council (WDC) operates the Raglan Wastewater Treatment Plant (WWTP), which is located at Wainui Road in Raglan, Waikato District. The WWTP consists of inlet work screens, anaerobic ponds, aerobic ponds, a treated wastewater day storage pond, holding ponds, a UV disinfection facility and an ocean outfall to the Whāingaroa (Raglan) Harbour.

WDC currently holds a resource consent (Resource Consent Number 971392) which permits the discharge to air of contaminants from the WWTP, subject to consent conditions. The consent is due to expire on the 14th February 2020.

WDC is currently investigating long-term treatment and discharge options for the wider Raglan Wastewater Scheme, however these investigations are ongoing. WDC is therefore applying for a short-term resource consent which allows for the continued operation of the WWTP while these investigations are completed and a longer-term consent application can then be progressed.

The WWTP discharges contaminants into the air including odours and aerosols. The primary matter for consideration is the potential for odour nuisance effects. WDC has commissioned Beca Ltd (Beca) to undertake a technical assessment of the effects of the discharges to air in support of the application for a short-term resource consent.

1.2 Scope of the Report

This report is intended to accompany an application for a short-term resource consent for air discharges from the Raglan WWTP. This report describes the activity and the environmental effects of the discharges and includes:

- A description of the WWTP;
- A description of the nature of the discharges to air;
- An assessment of the receiving environment in terms of potential influences on the environmental effects of the emissions to air from the site;
- An assessment of the effect of the discharges to air on the receiving environment; and
- A summary of conclusions and findings of the investigation.

1.3 Existing Resource Consent

The discharge of odours and other air contaminants from the Raglan WWTP is currently permitted by resource consent number 971392 issued by the Waikato Regional Council (WRC) on the 14th February 2005. The existing consent is due to expire on the 14th February 2020. A copy of the consent is attached Appendix A.

1.4 Reference Documents

This report has been prepared in accordance with the guidance provided by the Ministry for the Environment *Good Practice Guide for Assessing and Managing Odour* (2016) (GPG Odour)[1].

[1] Ministry for the Environment, 2016. *Good Practice Guide for Assessing and Managing Odour*. ISBN: 978-0-908339-74-7

1.5 Limitations

This report has been prepared by Beca for Waikato District Council (WDC). Beca has relied upon the information provided by WDC in completing this document. Unless otherwise stated, Beca has not sought to independently verify the information provided. This document is, therefore, based upon the accuracy and completeness of the information provided and Beca cannot be held responsible for any misrepresentations, incompleteness, or inaccuracies provided within that information. Should any new or additional information become available, this report will need to be reviewed accordingly.

2 Receiving Environment

2.1 Site Location

Figure 2-1 shows the location of the Raglan WWTP and the surrounding areas. The WWTP site is located on Wainui Road, Raglan, Waikato. The WWTP is located to the south-west of the Raglan township. The boundary of the WWTP site is shown as a red shaded area in the figure. The outfall is located approximately 1 km to the north of the site at the mouth of the Whāingaroa Harbour near Wainamu Road.

The site is zoned Rural under the operative Waikato District Plan (WDP)[2], and Rural under the Proposed Waikato District Plan (PWDP). Under the WDP the site is also designated for Wastewater Treatment purposes (designation M52). The WDC is the requiring authority of the designation.

The main wastewater treatment processes (i.e. inlet works, anaerobic ponds and aerated ponds) are located toward the southern end of the site. The day storage pond, overflow storage ponds, and UV disinfection facility are located at the northern end of the site.

WDC's application for a short-term resource consent does not include any variation of the current WWTP treatment processes or the existing site boundary.

[2] The WDP became operative on 5 April 2013

Figure 2-1. Location of the Raglan WWTP site (red outline), and surrounding area (aerial photograph sourced from Waikato District Council Intramaps)

2.2 Surrounding Land Use

Figure 2-2 shows the zoning of the surrounding land use under the operative WDP. The land to the south, east and west of the site is zoned Rural under the operative WDP. This land is predominately used for pastoral agriculture purposes (e.g. animal grazing). However, rural dwellings are also located within these Rural zoned areas. The closest of these dwellings is located more than 200 m from any of the wastewater treatment processes and storage ponds.

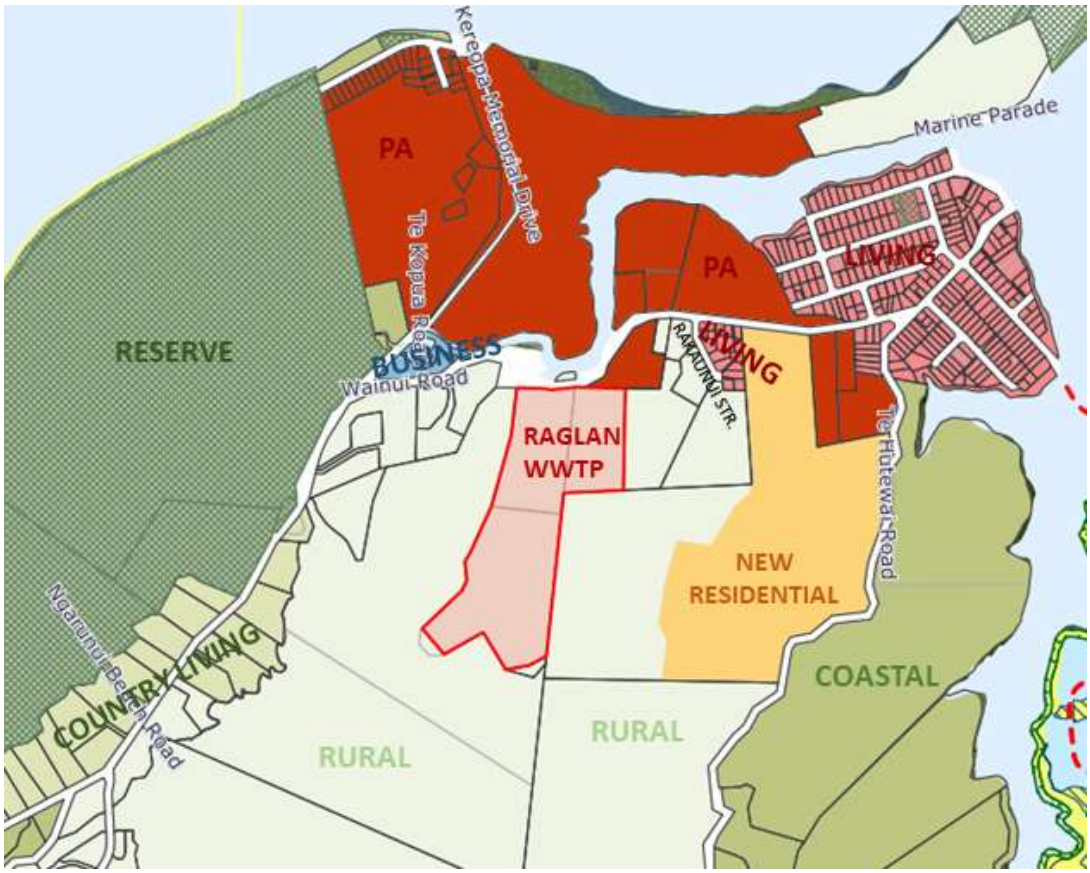

Figure 2-2. Map showing the WDP zoning of the Raglan WWTP and surrounding area (source Waikato District Council Intramaps)

Farm buildings are also located to the south of the WWTP. These buildings appear to be used for farming and/or milking purposes but also include a worker's cottage (Location 1 in Figure 2-3). The cottage is located approximately 163 m from the nearest of the wastewater treatment ponds.

Other rural dwellings are located to the west of the site, on Wainui Rd, in the area zoned Rural Living under the WDP (Location 2.1 and 2.2 in Figure 2-3). The closest of these dwelling is located approximately 220 m from the nearest wastewater treatment ponds.

The land immediately to the north of the site is predominantly zoned Pā under the WDP. Land use in these areas includes dwellings, a marae and a medical centre (Location 6 in Figure 2-3). The Poihakena Marae is located is approximately 220 m to the north of the site's northern boundary and more than 350 m from the treated wastewater storage ponds (Location 6 in Figure 2-3). The Poihakena (Raglan) Medical Centre is located on the same property as the Marae (216 Wainui Road).

A small area of land at the corner of Wainui Rd and Riria Keropa Memorial Drive is zoned Business. This area incorporates a child care centre, a café, and a vehicle repair and service business (Location 7 and 8 in Figure 2-3). However, a line of hills separates these activities from the WWTP which would tend to channel any potential odour from the site away from these receptors. The closest of these businesses, the café, is located approximately 260m to the north west of the treated wastewater storage ponds (Location 7 in Figure 2-3).

The nearest residential area to the site is located approximately 220 m to the northeast of the WWTP site on Rakaunui St (Location 5 in Figure 2-3). This area is zoned Living under the WDP. The closest dwelling in this area is located more than 300 m from the treated wastewater storage ponds. Other areas zoned Living are located further to the east of the WWTP. The nearest of these residential areas is located more than 470 m from the WWTP site.

A comparatively large area of land is located to the east of the site which is zoned New Residential under the WDP and Residential under the PWDP (Location 3 in Figure 2-3). This area is currently undeveloped but future residential development is expected to occur in this area. However, this area is unlikely to undergo any significant development over the duration of the short-term consent sought by WDC. Any dwellings in this area would be more than 295 m from any of the wastewater treatment processes.

Other land use in the vicinity of the site includes a large natural reserve (Wainui Reserve) located approximately 500 m to the west of the site (Location 9 in Figure 2-3).

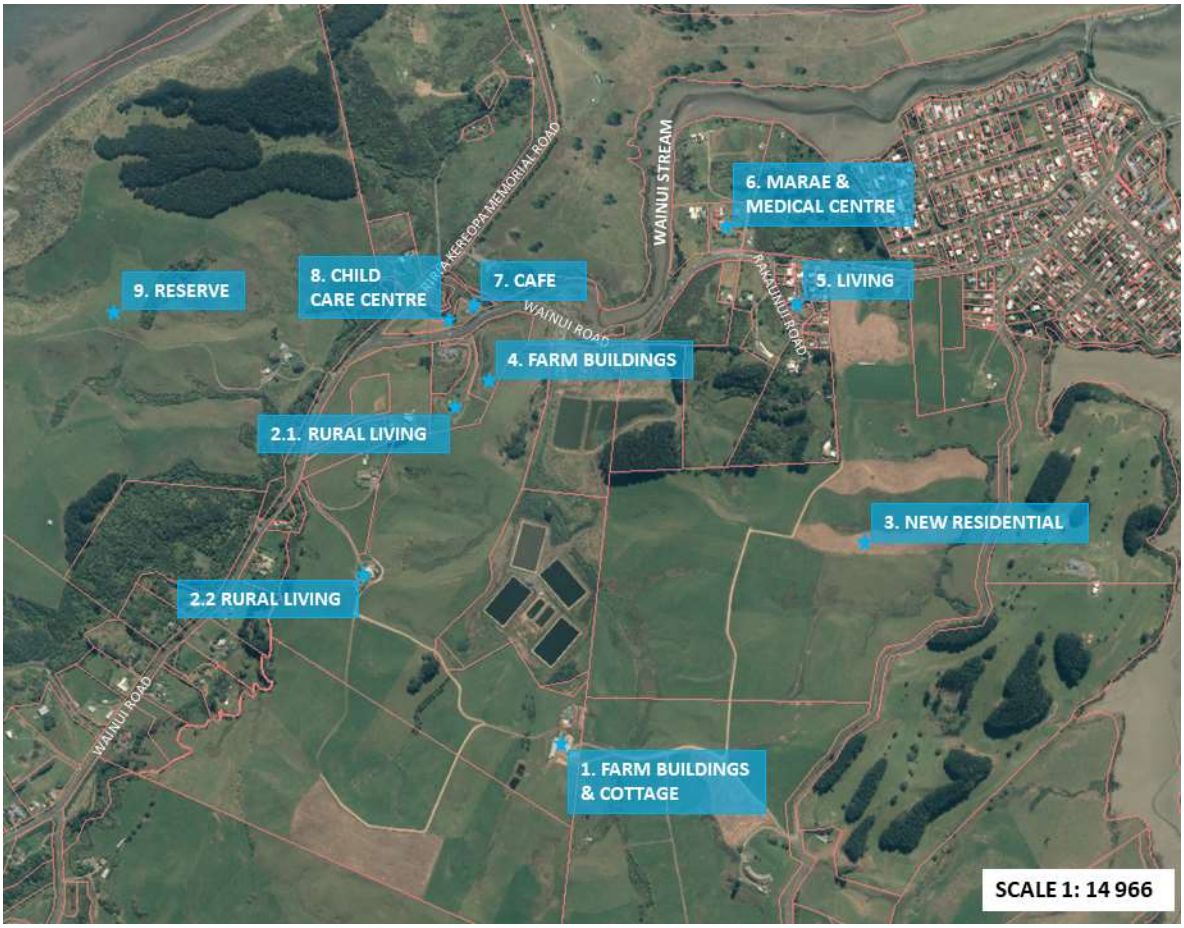

Figure 2-3. Map showing the location of sensitive receptors surrounding the Raglan WWTP (source Waikato Regional Council LocalMaps)

2.3 Topography

The topography of an area influences wind and airflow, and therefore the dispersion of contaminants emitted from the site. Elevated terrain in proximity to an emission source may lead to impingement of emission plumes at lower locations and a potential for lower concentrations than at higher elevations.

The topography of the site and surrounding area is shown in Figure 2-4. The WWTP site and the surrounding areas are located on gently undulating terrain. The WWTP is located in a valley which slopes from the southern end of the site down to the northern end of the site. The elevation of the anaerobic and aerated ponds is approximately 9 m above sea level (asl) compared to the elevation of approximately 3 m asl at the storage ponds at the northern end. The Wainui Stream runs to the north of the site, forming a shallow gully (at 1 to 2 m asl).

The surrounding rural dwellings and farm structures are located at higher elevations than the WWTP. The closet rural dwellings which are located to the west of the site have elevations of between approximately 25 to 30 m asl and are least 11 m higher than the WWTP. Similarly, the farm building and worker's cottage located approximately 150 – 160 m to the south of the aerated ponds are located at an elevation of approximately 30 m asl.

The dwellings located to the northeast of the site on Wainui Rd and Rakaunui St are located at an elevation of between 5 m and 30 m asl. However, these dwellings are separated from the WWTP by a line of hills. The intervening hills would tend to channel any odour emitted from the WWTP away from these receptors. Similarly, the café and child care centre located to the northwest of the site are shielded from the site by a line of hills.

Furthermore, the site is located approximately 1.5 km east of the coast and 0.8 km to the south of Raglan Harbour. Wind flows at site are therefore also expected to be influenced by coastal influences, such as land and sea breezes.

Figure 2-4. Map showing the topography of the area surrounding the Raglan Wastewater Treatment Plant (source Waikato Regional Council LocalMaps)

2.4 Meteorological Conditions

Air pollutant levels are highly influenced by meteorological conditions. The most important of these parameters are wind speed, wind direction and the thermal stability of the atmosphere. Worst case dispersion conditions for WWTP emissions are typically associated with low wind speeds (< 1.5 m/s) and high stability atmospheric conditions. These conditions are typical of cool calm winter nights and early morning periods.

The topography of the area surrounding the site is expected to have a significant effect on channelling local wind flows and the dispersion of any odours emitted to air from the WWTP. The hills which surround the site are expected to channel wind flows in approximately a northerly and southerly direction along the gully.

Drainage flows of the cooler denser air from the top of the hills down towards the WWTP are also expected to occur during cool stable night-time conditions, when worst-case dispersion conditions also occur. The drainage flows would tend to transport any odour emitted from the WWTP in a northly direction along the

valley towards the Whāingaroa Harbour. Land and sea breezes would also be expected to influence local wind flows.

As noted in Section 2.3, the nearby worker's cottage and farm structures tend to be located at higher elevations than the WWTP. During worst-case dispersion conditions wind flow conditions and odour emitted from the site would also tend to be transported in a northerly direction away from these receptors.

The coastal location would also be expected to influence wind flows and dispersion conditions. Land and sea breeze conditions can be expected at the site. Winds flows are also likely to be channelled along the Whāingaroa inlet in an east/west direction.

The closest meteorological monitoring stations to the WWTP site are the Whatawhata AWS meteorological monitoring station, which is located approximately 20 km to the northeast of the site, and the Port Taharoa meteorological monitoring station, which is located approximately 40 km to the southwest of the WWTP.

The locations of the two meteorological monitoring stations are shown in Figure 2-5. The figure also shows the distribution of hourly wind speeds and directions (windrose) observed at each of the monitoring stations. The windrose for the Whatawhata AWS meteorological monitoring station corresponds to the years 2014 – 2018. The wind rose for the Port Taharoa meteorological monitoring station corresponds to the years 2008 – 2012[3]. Both windroses are shown in Appendix B of this report.

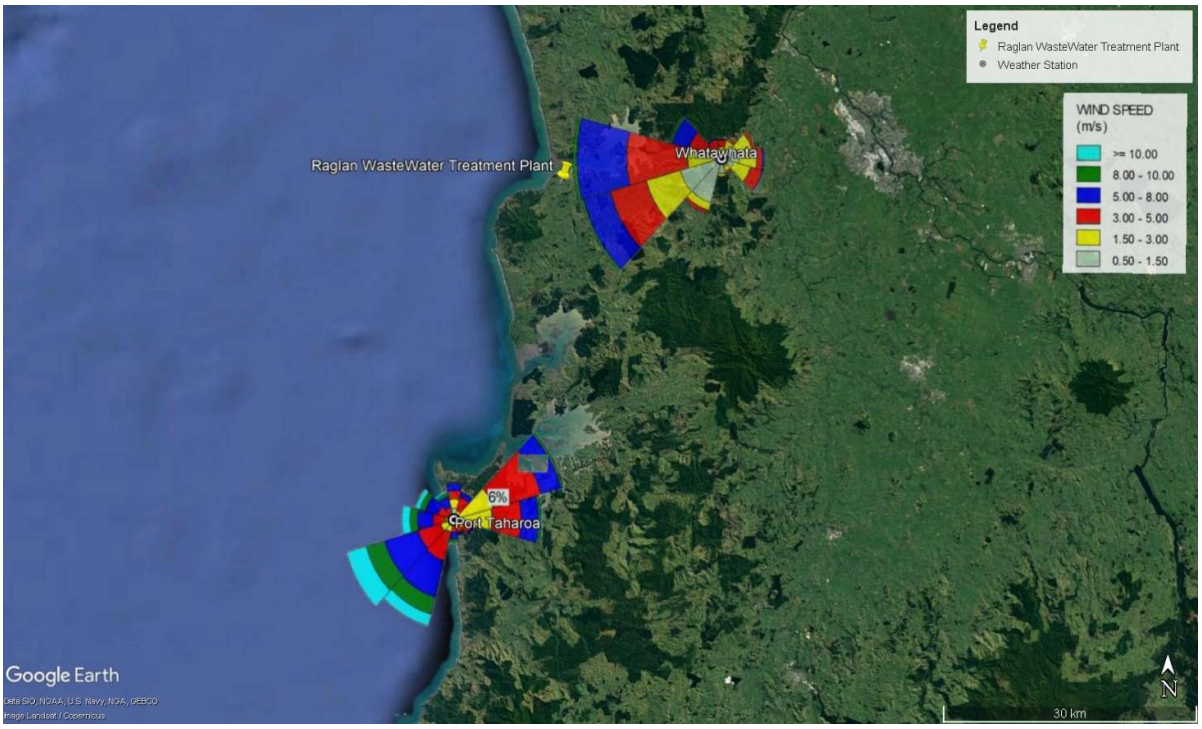

Figure 2-5. Wind speed and wind direction at the Whatawhata (2014 – 2018) and Port Taharoa (2008 – 2012) meteorological stations for all hours.

Due to the inland location of the Whatawhata meteorological monitoring station and the complex terrain which separates the monitoring station from the WWTP, the wind flows observed at the monitoring station are generally not expected to be representative of conditions at the WWTP.

[3] Meteorological data after 2012 was not publicly available

The wind flows observed at the Port Taharoa meteorological monitoring station are expected to provide a more accurate indication of wind flows condition at the WWTP due to comparable coastal locations of the monitoring station and site. However, wind flows at both the Port Taharoa monitoring station and the WWTP will be influenced by the topography that surrounds each site. In addition, meteorological conditions can also be expected to vary over the 40 km which separates the monitoring station and the WWTP site.

The Port Taharoa windrose clearly shows the predominance of winds from the southwest and northeast. The average wind speed observed at the meteorological station was 4.7 m/s during the period 2008 - 2012. The relatively high average wind speed observed at the site is likely due to the exposed coastal location of the station. Low wind speed (<1.5 m/s) were observed to occur for approximately 14.2 % of the time.

2.5 Background Air Quality

The WWTP is located in a rural coastal environment. Typical odours associated with agriculture activities are expected in the surrounding areas which are used for farming or are located adjacent to farms. These may include decomposition of organic material, fertiliser application, animal odour and potentially wastewater pond odours.

Typical odours associated with coastal land, such as the decomposition of seaweed are also likely to be experienced in areas close to the waterfront at times.

Odour emitted from the existing WWTP will also contribute to the current air quality levels in the vicinity of the site. However, the contribution from the WWTP to ambient air quality levels outside the site boundary is generally expected to be low, based on the number of odour complaints received that are attributable to the WWTP (refer to Section 4.6) and the separation distance between the WWTP and nearby sensitive receptors (refer to Section 4.8).

3 Description of the Activities and Discharges to Air

3.1 Overview of the Wastewater Treatment Plant

The existing Raglan WWTP is a biological treatment plant utilising a natural treatment system rather than mechanical processes. The current wastewater discharge consent allows for discharge of up to 2,600 m³/day of treatment wastewater to the Whāingaroa Harbour. The WWTP currently serves a population of approximately 4,300, with seasonal population variation. During the proposed consent period the number of people serviced by the WWTP is not expected to increase in any significant manner from existing population levels including the seasonal population variation.

The WWTP incorporates the following treatment processes:

- Inlet works (screens);
- Two anaerobic ponds
- Four aerated treatment ponds (mechanically aerated);
- Day holding pond for the treated wastewater;
- Two roadside holding ponds (a treated wastewater holding pond (western pond), and a sludge storage holding pond (eastern pond));
- Tertiary ultraviolet (UV) treatment facility;
- Outfall pump station
- Whāingaroa Harbour outfall

The layout of the WWTP is shown in Figure 3-1.

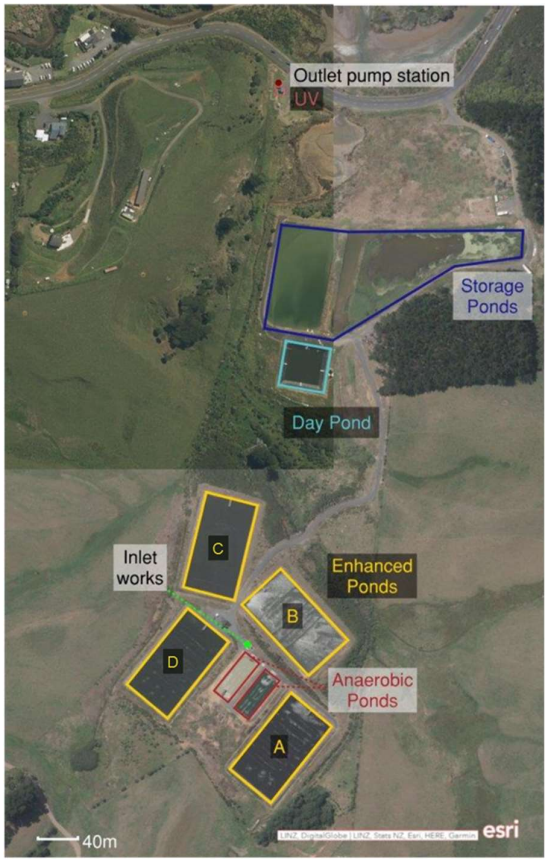

Figure 3-1. Layout of the Raglan Wastewater Treatment Plant

An overview of the treatment process is shown in Figure 3-2. Wastewater is received at the inlet works (screen) which remove the large solids, and some of the Biological Oxygen Demand (BOD) of the wastewater. The inlet work also protects downstream process units from accumulation of large floating or heavy matter. The extracted screening material is washed and stored in bins before being transported off site for disposal.

The wastewater then flows to one of the two anaerobic ponds (stabilisation ponds) which are used to reduce the organic content, nutrients and pathogen from the wastewater by biological anaerobic processes (i.e. bacteria which function in the absence of free oxygen to break down organic waste). The top layer of the ponds is aerated through diffused air lines. The aerated layer is used to minimise the discharge of odorous compounds from the ponds.

The wastewater is then piped to the either of the primary aerated treatment ponds (i.e. pond A or pond D), where additional treatment of the wastewater occurs. From these ponds the wastewater flows secondary aerated ponds (i.e. pond B or pond C). The aerated ponds remove additional organics and nutrients from the wastewater.

All of the aeration ponds (ponds A, B, C and D) are fitted with the 'AquaMats'. The AquaMats provide additional surface area on which biomass can grow which increases the level of rate treatment[4][5]. All four ponds are aerated from bottom deployed air diffusers.

Additional AquaMats and aeration were installed in the aerated ponds in 2017. The upgrade increased the treatment capacity of the ponds.

If required, the aerated pond system can provide the required level of treatment for the wastewater allowing for the treatment by the anaerobic ponds to be bypassed. The WWTP operators have adopted this approach in recent years.

After passing through the aeration ponds, the treated wastewater then flows under gravity to the day holding pond where it is held until it is discharged to the marine outfall. If the holding capacity of the day holding pond is exceeded, the treated wastewater is then transferred to the road side holding ponds. The day holding pond was commissioned in 2015.

From the day pond, the treated wastewater is pumped via an enclosed inline tertiary UV treatment facility to the Whāingaroa Harbour outfall. The site pump station and UV treatment facility are co-located at the northern end of the site.

Discharge from the outfall pipe is only permitted to occur for a maximum of 5.5 hours per outgoing tide, commencing no earlier than 0.5 hours before high tide and ceasing no later than 1 hour before low tide. However, the discharge duration may exceed this after extreme weather but not for more than 20 days per year.

[4] Ratsey estimated the total nitrogen removal rate increased by approximately 52% as a consequence of the AquaMats.

[5] Ratsey, H., 2016, Upgrading Waste Stabilisation Ponds: Reviewing the Options, The New Zealand Water and Wastes Association.

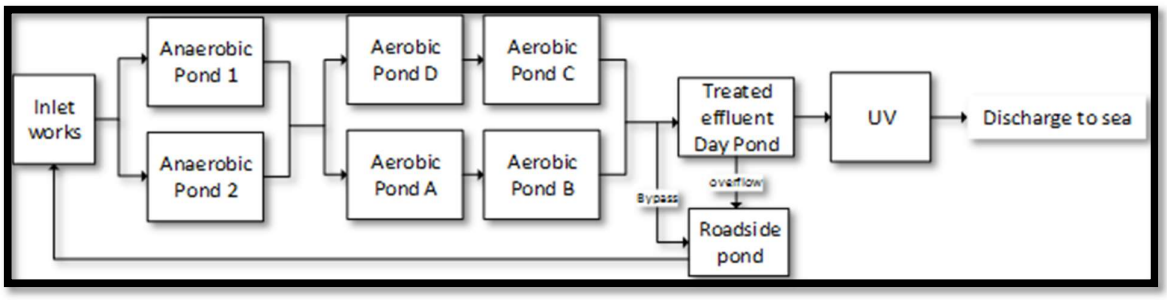

Figure 3-2. Overview of the Wastewater Treatment Process

3.2 Discharges to Air from the Wastewater Treatment Plant

Odours are discharged to the atmosphere during the treatment, storage and transfer of wastewater. Odours are generated through the decomposition of organic material (e.g. carbohydrates, fats and proteins) present in the wastewater and generated from the treatment process.

WDC does not propose to vary the operations of the WWTP during the proposed short-term consent period. Similarly, no significant additional loading on the WWTP is expected to occur during the proposed short-term consent period. Therefore, the existing emission of odours from the site is expected to be comparable to those which will occur over the proposed consent period.

Discharges to air will continue to be managed and monitored in accordance with the site's Management and Contingency Plan (MCP). This plan will be reviewed and updated as required.

The WWTP processes with the greatest to odour potential are considered to be the following:

- Inlet works (screens)
- Anaerobic treatment ponds
- Aerated treatment ponds

These processes are all located at the southern end of the site. The inlet works screen are enclosed which minimise any odour discharges to atmosphere from this process. Generally, any odour emitted from the inlet works is generally localised and would not be observed outside the site boundary.

The anaerobic ponds can potentially be a significant odour source. The anaerobic digestion processes which occur toward the bottom of these pond produces highly odorous compounds (e.g. hydrogen sulphide (H_2S), ammonia and mercaptans) which may be released to the atmosphere. The complaint record indicates that odours from the anaerobic ponds have on occasion had an adverse nuisance effect historically outside the WWTP boundary.

Surface aerators (bubblers) have been installed in the anaerobic ponds to minimise the emission of these odours. The aerators maintain a layer of oxygenated wastewater on the top layer of the ponds. This layer, also called an 'odour cap', minimises the emission of odorous compounds from the ponds. As the reduced sulphur compounds rise towards the surface, they are oxidised in the odour cap to form largely non-odorous compounds. However, odorous compounds may at times still be emitted from the anaerobic ponds when the odour cap is disturbed, or if not all of the odorous compounds generated by the anaerobic processes are oxygenated in the odour cap.

During normal operating conditions only low levels of odours are generated by the aerated treatment ponds. The odours emitted from the ponds will vary with regards to the changes in the nutrient loading in the ponds and the meteorological conditions at the site. However, the diffused aeration of the ponds inhibits anaerobic conditions from occurring where more odorous compounds are generated.

Typically, the odours from the aerated ponds have an earthy character. These odours are usually only observed in the immediate vicinity of the sources during normal operating conditions and would not be expected to be observable outside the site boundary.

However, higher odour emission rates can potentially occur if anaerobic conditions develop in the ponds (i.e. when there is insufficient dissolved oxygen (DO) in the wastewater for aerobic conditions to occur). During these periods odours could be observable outside the site boundary and would generally be less pleasant in character. Possible causes include the loss of aeration to the pond (e.g. mechanical failure of the blower, power loss).

However, even during equipment malfunction some of the oxygen will be naturally transferred from the atmosphere to the surface of ponds helping to maintain a positive DO concentration in the wastewater. Standby blowers are also provided for at the site which can maintain aeration to the pond in the event of equipment failure.

Generally, only lower levels of odour would be expected to be emitted from the treated wastewater day holding pond and the roadside holding ponds due to the oxygenated nature and the lower nutrient concentration levels of the wastewater discharged from the aeration ponds. The wastewater in these ponds is also only retained for a short period of time[6] which further minimises the risk of anaerobic conditions from occurring.

The pump station and UV disinfection processes are both enclosed. These processes are expected to be a negligible source of odours during normal operating conditions.

Some additional odours may be generated during the periodic desludging of the anaerobic and aerated ponds. However, no desludging of the ponds is planned to occur during the proposed consent period. Therefore, no additional odours will be generated as a consequence of these activities.

3.2.1 Odour Emissions under Abnormal Wastewater Treatment Plant Operation Conditions

Higher odour emission rates could occur during abnormal operating conditions. Possible events when higher odour emission rates could occur include the following:

- Organic overloading of the biological process in the anaerobic and aerated ponds;
- Wastewater toxicity disrupting the plant biological processes;
- Loss of the oxygenated surface layer in the anaerobic ponds (e.g. through the loss of the diffused surface aeration, and through pond turnovers);
- Loss of aeration to the biological process in the aerated ponds;
- Loss of electrical power;
- Mechanical failure (such as loss of aeration capacity, or outfall pump failure);

The frequency, duration and effect of these conditions will be managed through a combination of:

- System redundancy (e.g. additional aerator blowers for the aerated ponds, stand-by pump for the outfall pump)
- Plant design (a weir system prevents overfilling of the anaerobic and aerobic ponds and spills, the system is not dependent on power)
- The ability to by-pass the anaerobic ponds if odorous conditions occur
- Enclosing the inlet works
- Operator training;
- Plant management, maintenance and contingency planning;

[6] Discharge of the treated wastewater from the day holding pond occurs on every tidal event.

- Monitoring of critical operating parameters;
- Documentation of standard response procedures to upset conditions;

3.3 Summary of Emissions to Air

Table 3-1 identifies the main odour sources from the WWTP and provides an assessment of the effectiveness of the proposed odour control measures and the potential environmental significance of the odour discharges.

Table 3-1. Summary of the existing odour emission sources

Process	Odour Potential	Proposed Mitigation	Residual Odour Emissions to the Atmosphere
Inlet works	High	▪ Screenings and grit are covered in a bin prior to being removal from the site ▪ Screenings are washed to remove potentially odorous organic matter ▪ Screening processes are enclosed	Negligible (possibly some fugitive emissions may occur)
Anaerobic Ponds	Medium - High	▪ Surface aeration of the ponds to maintain an oxygenated 'odour cap' ▪ A weir system prevents overfilling of the ponds (not dependent on a power supply to avoid spills) ▪ Anaerobic ponds can be by-passed if required	Medium
Aerated Ponds	Low (high odour emissions during upset condition)	▪ A low odour potential due to the diffused aeration of the wastewater ▪ Lower organic loading after passing through anaerobic ponds ▪ Stand-by blowers for aeration ▪ Monitoring and maintenance of the AquaMats ▪ Oxygen will be naturally transferred from the atmosphere to the surface of ponds helping to maintain a positive DO content in the wastewater and aerobic conditions. ▪ A weir system prevents overfilling of the ponds (not dependent on a power supply to avoid spills)	Low
Day holding pond	Low	▪ The treated wastewater will have a low odour potential as it will be aerated with low organic concentrations. ▪ The storage times will be as minimised as practical ▪ The stored wastewater will be discharged during the tidal flow hours	Low
Roadside holding ponds	Low	▪ The treated wastewater will have a low odour potential as it will be aerated with low organic concentrations. ▪ Oxygen will be naturally transferred from the atmosphere to the surface of ponds helping to maintain a positive DO content in the wastewater and aerobic conditions. ▪ Storage times are as minimised as practical.	Low
Outfall pump station and UV treatment facility	Low	▪ The treated wastewater will have a low odour potential as it will be aerated with low organic concentrations. ▪ The processes are enclosed minimising the discharge of odours ▪ Duty and standby pump arrangement	Negligible (possibly some fugitive emissions)

4 Assessment of Odour Effects

4.1 Introduction

In accordance with section 104 of the RMA, when considering an application for a resource consent, the consent authority must, subject to Part 2, have regard to any actual and potential effects on the environment of allowing the activity.

The WWTP will discharge aerosols and odours into the atmosphere. The emission of odour from the WWTP is the primary environmental concern.

4.2 Assessment Method

For this assessment, the potential odour nuisance effects from the WWTP have been based on the following:

- The sensitivity of the receiving environment;
- Consideration of separation distances[7][8] and meteorological influences on pollutant dispersion;
- A review of the odour complaint register;
- The strength and character of the odour emitted from the upgraded WWTP and the odour control methods;

The assessment approach is consistent with the MfE GPG Odour guidance on methods for assessing the effects of odour.

4.3 How Odour Causes Adverse Effects

The effects of odour discharges depend on several features of the odour exposure which are collectively known as the “FIDOL” factors:

■ Frequency	How often an individual is exposed to odour
■ Intensity	The strength of the odour
■ Duration	The length of an event
■ Offensiveness/character	The character relates to the “hedonic tone” of the odour, which may be pleasant, neutral or unpleasant
■ Location	The type of land use and nature of human activities in the vicinity of an odour source.

Different combinations of these factors are important when assessing adverse effects. Depending on the severity of an event, one single occurrence may be significantly adverse, and this is known as an “acute” effect. However, in other situations, where there is a higher frequency of events, the threshold level would be lower. This longer-term impact is known as a “chronic” effect.

4.4 Sensitivity of Receiving Environment

Different locations have different sensitivities to odour and can be classified as having high, moderate or low sensitivity. The degree of sensitivity in any location is based on characteristics of the land use, including the

[7] South Australia Environment Protection Authority, Evaluation distance for effective air quality and noise management, August 2016

[8] Victoria, Australia, Environmental Protection Authority, Recommended separation distances for industrial residual air emissions, March 2013

time of day and the reason people are at the location (e.g. for work, home living or recreation). In a residential area, an acceptable odour frequency is likely to be much lower than would be expected in a rural or industrial area.

4.4.1 Sensitivity to Odour in Residential Environments

People living in residential-zoned areas typically have a high sensitivity to both rural and non-rural odours, because of the following factors:

- People with high sensitivity to odours can be exposed;
- People can be present at all times of day and night, both indoors and outdoors;
- People tend to carry out activities at residences which are highly sensitive to non-rural odours, such as dining, entertaining, outdoor living, sleeping;
- Visitors to the area who are unfamiliar with an odour are more likely to be sensitive to odours they are not familiar with and may raise awareness of a problem;
- People usually expect a high level of air quality including the absence of odours and have a low tolerance of even typical rural odours.

Amenity conflicts between residential and industrial zones, in terms of incompatible neighbouring land uses and odour presence, are recognised as an issue in many district and regional plans in New Zealand.

The GPG Odour defines residential areas as having a high sensitivity to odour.

4.4.2 Sensitivity to Odour in Rural Residential/Countryside Living Environments

People in rural residential and/or countryside living areas generally have a moderate to high sensitivity, while the opportunity to be adversely affected is lower. People of high sensitivity may be exposed in these areas at all times of the day and night.

Often people move to these areas for a healthier lifestyle and can be particularly sensitive to amenity issues or perceived health risks.

The GPG Odour defines rural residential/countryside living environments as having a moderate to high sensitivity to odour.

4.4.3 Sensitivity to Odour in Rural Areas

People in rural areas generally have a low sensitivity for rural activities, while they can have moderate to high sensitivity for other activities.

Populations within rural areas are lower than in residential areas, which means there is a decreased risk of people being adversely affected by odour. People living in and visiting rural areas generally have a high tolerance for rural activities and their associated effects. Although these people may be desensitised to rural activities, they may still be sensitive to other types of activities, such as wastewater treatment plants.

The GPG Odour defines rural areas as having a low sensitivity to odour from rural activities and moderate to high sensitivity to odours from other (non-rural) activities.

4.4.4 Sensitivity to Odour in Commercial Areas

Like residential areas people of high sensitivity can be exposed to odour in commercial areas. However, the occupancy rates of these areas would tend to be higher during the day compared to night time, which can moderate the sensitivity of these areas to odour during these periods. Generally, a high level of amenity value is expected in commercial areas and they are classified as being of high sensitivity in the GPG Odour.

4.4.5 Odour Sensitivity of Areas Surrounding the WWTP

The farmland which immediately surrounds the site is predominantly used for pastoral agricultural purposes and is appropriately zoned Rural under the WDP. These areas are considered to have low sensitivity to odour due to the low occupancy of these areas, particularly during the night.

Receptors, which are considered to have a high sensitivity include

- Nearby rural dwellings;
- Residential areas located to the north east of the site (i.e. the area zoned Living under the WDC);
- Poihakena Marae and Poihakena (Raglan) Medical Centre; and
- The café and childcare centre located to the west of the site.

The sensitivity of the café and childcare centre to the west of the site (i.e. located in the Business zoned area) will be higher during the day when there is a higher occupancy of these area.

The area to the east of the site which is zoned New Residential is currently undeveloped. At present the area is predominantly agricultural fields and is considered to have a low sensitivity to odour. However, once developed this area would have a high level of sensitivity to odour nuisance effects.

A worker's cottage is located approximately 163 m to the south of Aeration Pond A. This is the closest dwelling to the site. However, the cottage is co-located with the farm's milking shed, two wastewater ponds, and a silage storage area. Given the proximity of the dwelling to farming activities that generate odour and dust, a lower level of air quality amenity can be expected at the cottage in comparison to other nearby rural dwellings. Overall the dwelling is considered to have moderate sensitivity to odour from WWTP.

The air quality at other rural dwellings are to some extent also likely to be impacted by existing agricultural activities. However, a relatively high level of air quality amenity would still be expected at these locations. These dwellings are therefore considered to have a high sensitivity to odour nuisance effects.

The nearest farm shed to the site is located approximately 145 m to the west of the roadside holding ponds. A higher occupancy of these buildings would be expected during the day than at night. Overall, these farm buildings are considered to have a low to moderate sensitivity to odour from the WWTP.

Overall the sensitivity of the receiving environment has not changed to any substantial extent since the granting of the existing resource consent. Based on the land use zoning in the WDP, the sensitivity of the receiving environment is also not expected to change over the proposed short-term consent period.

4.5 Recommended Separation Distances and Meteorological Conditions

Odours emitted from the WWTP will disperse and dilute with increasing distance downwind from the treatment processes. Therefore, the potential nuisance effect of any emitted odours from the site will also decrease with increasing downwind distance.

A number of Australian environmental protection authorities (EPA) and New Zealand agencies provide recommendations on separation distances between industrial land uses and sensitive locations in order to prevent land use conflicts occurring. No separation distances are defined for WWTPs in the Waikato Regional Plan.

Separation distances are not intended to replace the need for good pollution control but acknowledge that there may be unintended emissions at times, which should be allowed for. Separation distances are intended to minimise the effects of these unintended emissions.

Published separation distances do not consider site specific treatment and odour control technologies. Separation distances are also applied in all directions and do not consider the influence that meteorological

conditions and topography may have on the dispersion potential of any odours, or the relative odour potential of different site operations.

Separation distances are generally considered to be conservative and therefore often are used as an initial screening method for assessing whether an activity is likely to have an adverse nuisance effect.

Separation distances published by the Victoria Environment Protection Authority (Vic EPA) are widely used in New Zealand[9]. Using the Vic EPA methodology, a recommended separation distance of 162 m can be calculated for the Raglan WWTP[10]. A comparable recommended separation distance of 200 m for a WWTP servicing a population of up to 5000 people is published by the South Australia Environment Protection Authority (SA EPA)[11].

A summary of the minimum separation distances between the WWTP treatment processes and nearby sensitive receptors is shown in Table 4-1. The location of the receptors is shown in Appendix D of this report.

Table 4-1. Summary of separation distances between the Raglan WWTP's processes and nearby receptors

Receptor No#	Receptor	Sensitivity	Separation Distance from the nearest wastewater treatment ponds (m)
1	Worker's cottage to the south of aeration ponds	Moderate	163 m
2.1	Closest rural dwelling	High	220 m
2.2	Rural living	High	264 m
3	Area zoned New Residential	High (future)	297 m
4	Farm building to the west roadside holding ponds	Low - Moderate (Low at night)	145 m
5	Residential areas to east of site	High	220 m
6	Poihakena Medical Centre and Marae	High	374 m
7 & 8	Café and child care centre	High (Low at night)	262 m

The table shows that the receptors which are considered to have a high sensitivity to odour nuisance effects are located more than 220 m from any of the WWTP treatment processes. The separation distances are greater than the 162 m – 200 m recommended by the Vic EPA and SA EPA. Therefore, any odour emitted from the WWTP would not be expected to have an adverse effect at these receptors during normal operation conditions.

The nearby receptors with a high odour sensitivity are also located either at higher terrain elevation or separated from the WWTP by inventing hills. Both topographical features would tend to channel any odour emitted from the site away from these receptors, particularly during worst case dispersion conditions (i.e. low wind speed and stable atmospheric conditions).

[9] Victoria Protection Authority. 2013. Recommended separation distances for industrial residual air emissions. Publication number 1518 March 2013.

[10] Separation distance calculated for a Mechanical/biological wastewater plants (including aerated ponds) for a population of 4,300. 162m = 10 x $(4300)^{1/3}$.

[11] South Australia Environment Protection Authority. 2016. Evaluation distances for effective air quality and noise management.

The worker's cottage located to the south of the WWTP, is closer to the WWTP than any of the high sensitivity receptors. Therefore, higher odour concentration would be expected to occur at this dwelling compared to the high sensitivity receptors.

The separation distance between the cottage and WWTP is approximately the same as the Vic EPA recommend separated distance, but less than the SA recommend separated distance. Due to the proximity of the cottage to the site, odour may on occasion be observed at the cottage.

However, the wind flows observed at the Port Taharoa meteorological monitoring station (refer Figure 2-5) indicates that the cottage would only infrequently be downwind of the WWTP and therefore potentially exposed to any emitted odours. The higher terrain elevation of the cottage relative to the WWTP would also tend to channel wind flow from the cottage during poor dispersion conditions.

Based on the separation distances, wind channelling effects of the local topography and moderate sensitivity of the receptor to odour, during normal operating conditions it is considered unlikely that this dwelling would be adversely impacted by the odour emitted from the site.

Other farm buildings are located approximately 145 m west from the roadside holding ponds. However, the ponds have low odour potential (i.e. wastewater is aerated and has a low nutrient concentrations). Therefore, although the buildings are located closer than the recommended separation distance any emitted odour from the WWTP is not expected to have an adverse nuisance effect at these receptors.

4.6 Odour Complaint Record

The WDC and the WRC maintains a record of received odour nuisance complaints. WDC is required to maintain the record as condition of the exiting resource consent (Condition 3).

Between 2007 and 2018 a total of 10 complaints have been received by either the WDC or WRC with regards to odour emitted from the site. The number of complaints received by year is presented in Figure 4-1. One of the complaints received was attributed to a sewer vent pipe on Wainui Rd and may not be directly attributed to the operation of the WWTP. Several complaints noted that nuisance odours were observed for extended periods (i.e. over multiple days).

The figure shows the frequency of odour complaints has decreased over time. The higher number of complaints received before 2010 may be attributed to the initial commissioning of the WWTP. The anaerobic ponds were identified as a source of odour during this period. Changes were made to the WWTP including the incorporation of surface aeration ('odour cap') and reduced loadings.

However, since 2011 only three odour complaints have been received by the WDC or WRC which can be attributed to the WWTP operations.

Overall the complaint record indicates that nuisance odours are on occasion observed by the surrounding community. However, since 2011, after the initial commissioning period, the number of complaints received has been relatively low (i.e. less than one every two years).

Overall the complaint record suggests that currently the odour emitted from the WWTP is generally acceptable to the surrounding community during normal operating conditions. However, odours are on occasion generated by the site's processes which can have a nuisance effect outside the WWTP boundary, but these occur infrequently.

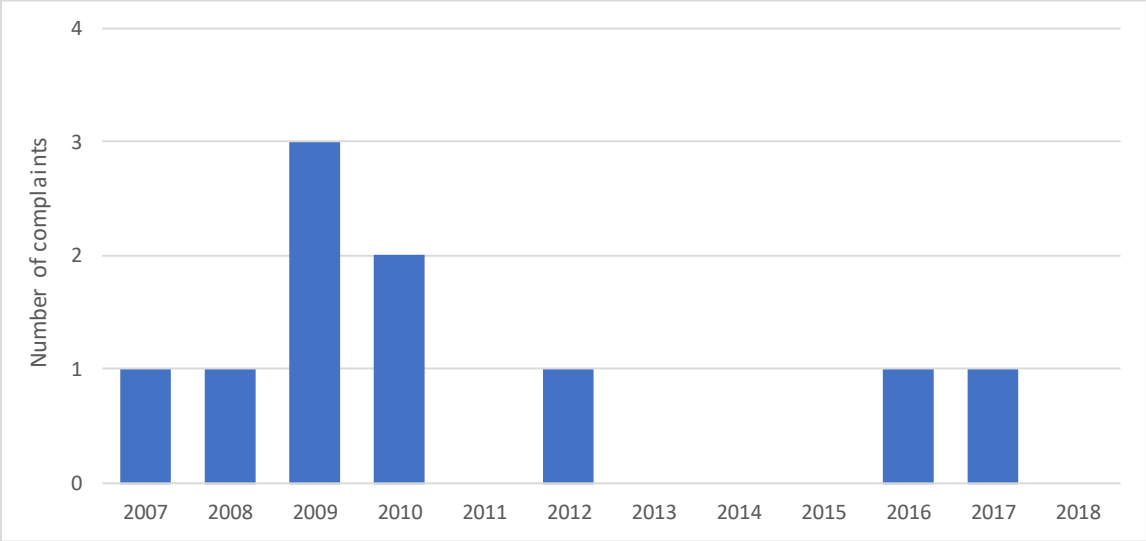

Figure 4-1. The number of complaints received by WRC and WDC with regards to odour emitted from the Raglan WWTP between 2007 and 2018

The frequency that nuisance odours are reported since 2010 also suggests that generally the odour generated by the existing processes are appropriately controlled at the site. The odour generated from the site during the proposed consent period will be controlled using similar emission control and management procedures as currently implemented.

4.7 Management, Monitoring and Contingency Procedures

WDC is required to maintain a Management Plan (MP) as a condition of the existing resource consent (Condition 4). Discharges of odour to air from the site operations are required to be managed in accordance with the MP.

The MP and the associated Operations and Maintenance Manual (O&M Manual) include the following;

- The management and operation procedures at the WWTP;
- Resource consent responsibilities;
- Inspections and maintenance procedures;
- Contingency methods for plant malfunctions;
- Complaint investigation and resolution procedures;
- Reporting procedures; and
- Training procedures for operators regarding the methods to be used to control odours.

Since October 2019 Watercare Waikato (Watercare) has assumed the management of the WWTP on behalf of WDC. Watercare will revise and update the MP.

4.8 Summary Assessment of Odour Effects

Only low levels of odours are currently observed at the WWTP during normal operating conditions. These odours are typically observed in the immediate vicinity of the treatment processes. The complaint record indicates that nuisance odours can at times be observed outside the site boundary, but these events occur infrequently.

Therefore, during normal operation conditions, the odours emitted from the existing site treatment processes are considered to be appropriately controlled by the existing mitigation methods. Should the proposed short-term consent by granted by the WRC, WWTP odour will be controlled using similar methods to those

currently used at the site. Therefore, the odour discharges from the site would be expected to be comparable to odour currently observed at the site.

The Raglan WWTP is located in a predominantly rural area. The pastoral agricultural land which immediately surrounds the site is considered to have low sensitivity to odour nuisance effects. The closest receptor with a high sensitivity is located more than 200 m from the site.

The separation distances between the high sensitivity receptors and the WWTP processes, are greater or comparable than those recommended by the Vic EPA and SA EPA, which would also mitigate any emitted odours. Therefore, the separation distances between the site and these high sensitivity receptors are considered sufficient to minimise any odour effects which may be experienced at these locations.

The surrounding topography, including the greater terrain elevation of the nearby dwellings and the shielding and channelling effect of the surrounding hills, is also expected to minimise any likely exposures to odours emitted from the WWTP during worst-case dispersion conditions.

A farm worker's cottage is located approximately 163 m to the south of the site. This cottage is considered to have a moderate sensitivity to odour based on the proximity of the dwelling to other rural sources of odour. It is therefore possible that odour will on occasion be experienced at this location. However, predominant wind flow directions and the topography of the area are expected to minimise any exposure to odour from the WWTP at this location.

Any odour observed outside the site boundary is only likely to occur infrequently and be of an intensity (strength) which is currently experienced and unlikely to be considered offensive or objectionable. Overall, when assessed against the FIDOL factors (i.e. Frequency, Intensity, Duration, Offensiveness and Location) discharges from the WWTP are considered unlikely to have an adverse nuisance odour effect.

Higher odour emissions from the site could potentially occur during abnormal operation conditions. To avoid these conditions developing, a range of methods to minimise the generation of adverse odours from the site are employed. Mitigation methods include the installation of stand-by blowers and critical pumps, monitoring and maintenance procedures and WWTP design features.

4.8.1 Odour Risk Assessment

The potential odour impacts from the WWTP have also been assessed using the qualitative risk-based method recommended by the Institute of Air Quality Management (IAQM)[12].

The IAQM recommends using a stepped approach to analyse the effects of an odour source and provides a risk matrix to apply to specific receptor locations. The methodology is based on the following considerations:

- The odour potential of the emission source (i.e. magnitude of the odour emitted from the source);
- Pathway effectiveness (i.e. the risk of a receptor being exposed to an observable odour based on local topography, meteorological conditions and the separation distance between the source and receptor); and
- The relative sensitivity of the receptor to nuisance odours.

The odour potential and pathway effectiveness are first used to evaluate the 'risk of odour exposure' at a receptor. The 'risk of odour exposure' is then compared against the sensitivity of the receptor to assess the magnitude of the odour effects. The IAQM assessment matrices are included in Appendix C.

[12] Institute of Air Quality Management. 2018. Guidance on the assessment of odour for planning. Version 1.1 - July 2018

Based on the guidance provided by the IAQM, the odour potential of the WWTP has been classified as being 'Medium' as it is considered a small WWTP.

For all the nearby high sensitivity receptors the pathway effectiveness has been classified as 'Ineffective Pathway', since the separation distance between the WWTP and these receptors is greater than distances recommended by the Vic EPA and SA EPA, and the topography of the area would also tend to channel any odour from the WWTP away from these receptors during poor dispersion conditions.

However, the pathway effectiveness has been considered to be a 'Moderate Pathway' for the worker's cottage located to the south of the site (i.e. Location 1 in Figure 2-3) since the dwelling is located closer than the SA EPA's recommended separation distance.

The risk of odour exposure at the nearby sensitive receptors has been assessed using the IAQM methodology as being 'Negligible Risk', while at the worker's cottage the risk has been classified as 'Low Risk'.

All of the nearby dwellings, the marae, and café have been classified as being 'High Sensitivity' receptors. The nearby worker's cottage has been considered to a 'Medium Sensitivity' receptor (refer Section 4.4.5).

Using this IAQM method, the potential odour impact of discharges from the WWTP was assessed to be negligible for all the nearby high and medium sensitivity receptors. The results of odour risk assessment using the IAQM methodology for each high sensitivity receptors in is summarised in Table 4-2.

Overall the results of the IAQM indicate that emission from the WWTP would not have an adverse effect during normal operation conditions.

Table 4-2. Assessment of potential odour impact of discharges from the WWTP using the IAQM risk-based method

Receptor Number	**Receptor details and location**	**Source Odour Potential**	**Pathway (Transport Effectiveness)**	**Risk of Odour Exposure (Impact)**	**Receptor Sensitivity**	**Likely Odour Effect**
1	Farm building/dwelling located approximately 163 m south of Pond A	Medium ▪ Small WWTP	Moderately Effective Pathway for Odour Flux to Receptor ▪ Separation distance similar to the Vic EPA recommended separation distance but less than the SA EPA recommended separation distance ▪ Not located in the prevailing downwind direction of the site	Low Risk	Medium sensitivity receptor	Negligible Effect
2.1	Residential dwelling located approximately 220 m west of the storage ponds	Medium Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Upwind during worst case dispersion conditions ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA EPA recommendations	Negligible Risk	High sensitivity receptor	Negligible Effect

Receptor Number	Receptor details and location	Source Odour Potential	Pathway (Transport Effectiveness)	Risk of Odour Exposure (Impact)	Receptor Sensitivity	Likely Odour Effect
2.2	Residential dwelling located approximately 264 m west of Pond D	Medium ▪ Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Upwind during worst case dispersion conditions ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA EPA recommendations	Negligible Risk	High sensitivity receptor	Negligible Effect
3	New Residential area located approximately 290 m east of Pond B	Medium Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Upwind during worst case dispersion conditions ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA EPA recommendations	Negligible Risk	High sensitivity receptor	Negligible Effect
5	Residential dwelling located approximately 200 m northeast of the storage ponds	Medium ▪ Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Upwind during worst case dispersion conditions ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA EPA recommendations	Negligible Risk	High sensitivity receptor	Negligible Effect
6	Poihakena Marae and Medical Centre	Medium ▪ Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA EPA recommendations	Negligible Risk	High sensitivity receptor	Negligible Effect
7 & 8	Café and child care centre	Medium ▪ Small WWTP	Ineffective Pathway for Odour Flux to Receptor ▪ Located at higher elevation compared to the WWTP ▪ Separation distance greater than Vic & SA	Negligible Risk	High (Low at night) sensitivity receptor	Negligible Effect

Receptor Number	Receptor details and location	Source Odour Potential	Pathway (Transport Effectiveness)	Risk of Odour Exposure (Impact)	Receptor Sensitivity	Likely Odour Effect
			EPA recommendations			

5 Assessment of Aerosol Discharges

Aerosols or water droplets may be generated from the open surfaces of the anaerobic, aerated, and holding ponds during strong winds. The larger droplets generated from the surface of the ponds would be deposited close to the ponds and are not expected to be transported off-site. The concentration of any residual wastewater droplets and aerosols in the air would also decrease rapidly with increasing downwind distance due to droplet deposition and dispersion in the atmosphere. The strong winds which are necessary to generate the aerosols would also assist in their dispersion in the environment.

Due to the separation distance between the ponds and nearby sensitive receptors, and the sheltering effect of the valley location of the site, the emission of aerosols from the WWTP are expected to have a negligible effect on the surrounding environment.

6 Summary

The principal air quality issue to be considered in the context of this application for short-term consents relating to the continued operation of the WWTP is the potential for odour nuisance effects from the treatment process.

The WWTP will use the same wastewater treatment technologies and odour emission controls as those currently used on site if the proposed short-term consent is granted. Therefore, emissions of odour from the site will be comparable to current odour emissions.

Based on the current operations, only low levels of odour are expected to be emitted from the WWTP during normal operating conditions. Higher odour emissions than normal could occur during WWTP abnormal conditions. However, operational history of the site, and existing management procedures, indicate these events are expected to occur infrequently, thus minimising the risk of an adverse odour event occurring.

Generally, the surrounding land use is considered to have a low sensitivity to odours. The distances between high sensitivity receptors and the WWTP are such that no adverse odour nuisance effects are expected at these receptors during normal operation as well as during malfunctions and worst-case dispersion conditions. The topography of the area will also tend to channel any odours away from sensitive land uses.

The potential discharges of odour from the WWTP is considered to be adequately avoided and mitigated such that any odours will not be offensive or objectionable. Any effects will be no greater than those associated with the current consented for the WWTP.

A

Appendix A – Air Discharge Consent

Resource Consent Certificate

Resource Consent Number: 971392

File Number: 60 66 83A

Pursuant to the Resource Management Act 1991, the Waikato Regional Council hereby grants consent to:

Waikato District Council

Private Bag 544

NGARUAWAHIA 2171

(hereinafter referred to as the Consent Holder)

Consent type:	Discharge permit
Consent subtype:	Discharge to air
Activity authorised:	Discharge odour to the air associated with all aspects of the existing and proposed treatment system
Location:	Wainui Rd - Raglan (Raglan Wastewater)
Map Reference:	At or about NZMS 260 R14:729-751
Consent duration:	Granted for a period expiring 15 years from the date of commencement of consent as defined in section 116 of the Resource Management Act 1991

Subject to the conditions overleaf:

CONDITIONS

1. The wastewater treatment system shall be operated and maintained in general accordance with the documents titled **"Resource Consent Application and Assessment of Environmental Effects, Volume 1 – Report" Resource Consent Application and Assessment of Environmental Effects, Volume 2 – Report", and "Raglan Wastewater Treatment and Disposal System, Request for Further Information " dated 15 September 1998, unless superseded by the following document "Raglan Wastewater Treatment Upgrade Assessment of Environment Effects"** dated October 2002, or consistent with the resource consent conditions below, which shall prevail.

   This condition shall not preclude the Council from modifying the design or layout of elements of the Raglan Wastewater Treatment and Disposal System to incorporate other treatment technologies which may prove beneficial for the treatment process or environmental outcomes, provided that it meets the conditions of this consent.

2. There shall be no odour as a result of the activities authorised by this resource consent that causes an objectionable or offensive effect beyond the boundary of the site, being that land defined by:
   - Gazette Notice, 1974, page 2548 (Land taken for Sanitary Works situated in Block I, Karioi Survey District, described as part lot 1, DP 13913, and Part Rakaunui 1C2A2 Block);
   - Gazette Notice, 1999 page 3849 (Land acquired for Wastewater Treatment described as Part Lot 1, DP 13913 (part C.T/ 47C/740).

Complaints register

3. The consent holder shall maintain and keep a complaints register for all odour complaints in respect of the wastewater treatment facility received by the consent holder. The register shall record:

   (i) the date, time and duration of the event/incident that has resulted in a complaint;

   (ii) the location of the complainant when the event/incident was detected;

   (iii) the possible cause of the event/incident

   (iv) the weather conditions and wind direction at the site when the odour event allegedly occurred;

   (v) any corrective action undertaken by the consent holder in response to the complaint.

   The register shall be made immediately available to the Waikato Regional Council upon request.

   Any event/incident with the potential to cause emissions resulting in adverse effects on the environment shall be reported to the Waikato Regional Council as soon as practicable and in any event within 24 hours of the incident occurring.

Management Plan

4. The consent holder shall provide the Waikato Regional Council with a management plan which details the procedures that will be implemented to operate in accordance with the conditions of this resource consent and the procedures that will be put into place avoid the potential for the discharge of odours that cause an offensive and objectionable effect beyond the boundary of the Raglan Wastewater Treatment site. This plan shall be lodged with the Waikato Regional Council within 12 months of the date of commencement of the consent as defined in section 116 of the Resource Management Act 1991.
   1. a description of the entire treatment system facility, including

      - the filter treatment system, facultative, maturation and holding ponds, and ultra- violet (UV) disinfection unit,

      - discharge pumps

- discharge pump activation/deactivation and monitoring systems, including a back-up system to ensure failsafe operation of the discharge pumps on the outgoing tide; and

- discharge and outfall pipeline.

2. a description of routine maintenance procedures to be undertaken;
3. an outline of the methods to be utilised to monitor the treatment plant in an operational sense including;

- monitoring of influent waste water;

- monitoring of treatment performance

4. specific management procedures for operation of the wastewater treatment system, discharge and outfall pipeline;
5. procedures for recording routine maintenance and all repairs that are undertaken;
6. contingency measures in place to deal with unusual events;
7. other actions necessary to comply with the requirements of this resource consent;
8. procedures for improving and/or reviewing the management plan.

The consent holder shall provide an opportunity to the Tainui Hapu to have the draft management plan presented and explained to it and shall consider any comments made by the Tainui Hapu prior to lodgement of the management plan with the Waikato Regional Council for approval.

The consent holder shall on submitting the management plan for approval, provide the Waikato Regional Council with a commentary on the above discussions with Tainui Hapu for the Council's consideration.

The management plan shall be reviewed and updated by the consent holder as a minimum at 1-year intervals. The consent holder shall provide opportunities to the Tainui Hapu to comment on any proposed changes to the plan. Any proposed changes to the plan shall be submitted in writing for approval by the Waikato Regional Council.

The consent holder shall undertake the treatment and disposal of wastewater in accordance with the approved management plan.

Review

5. The Waikato Regional Council may in within six months of the commissioning of the treatment system (including filter treatment system, facultative maturation and holding ponds, and UV disinfection unit) in September 2006, September 2008, September 2010, September 2012 and September 2014, and after consultation with the consent holder serve notice on the consent holder under section 128 (1) of the Resource Management Act 1991, of its intention to review the conditions of this resource consent for the following purposes:
   (i) to review the effectiveness of the conditions of this resource consent in avoiding or mitigating any adverse effects on the environment from the exercise of this resource consent and if necessary to avoid, remedy or mitigate such effects by way of further or amended conditions; or
   (ii) to review the adequacy of and the necessity for monitoring undertaken by the consent holder.

   Note: Costs associated with any review of the conditions of this resource consent will be recovered from the consent holder in accordance with the provisions of section 36 of the Resource Management Act 1991.

6. The consent holder shall pay to the Waikato Regional Council any administrative charge fixed in accordance with section 36 of the Resource Management Act 1991, or any charge prescribed in accordance with regulations made under section 360 of the Resource Management Act.

B

Appendix B – Windroses

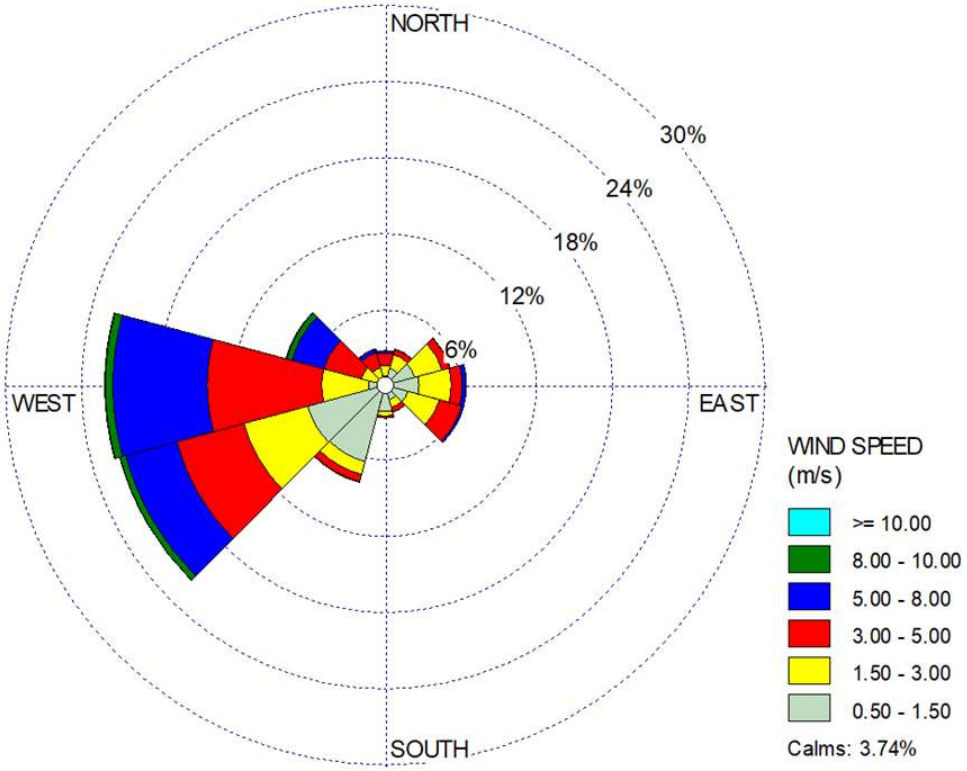

Figure B-1. Wind speed and wind direction at the Whatawhata meteorological stations for all hours (2014 – 2018)

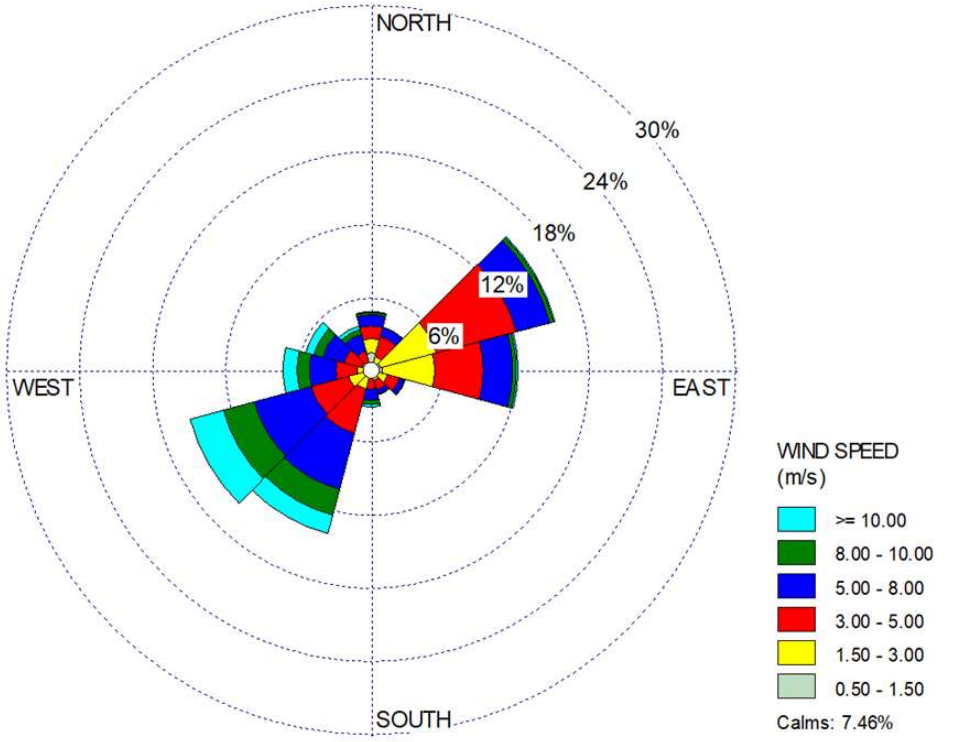

Figure B-2. Wind speed and wind direction at the Port Taharoa meteorological stations for all hours (2008 – 2012)

C

Appendix C – IAQM Odour Risk Matrix

Excerpts from the Institute of Air Quality Management (2018), Guidance on the assessment of odour for planning, Version 1.1: Predictive Assessment Tools.

Table C-1. Receptor sensitivity to odours (IAQM, 2018)

For the sensitivity of people to odour, the IAQM recommends that the Air Quality Practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

High sensitivity receptor	Surrounding land where: • users can reasonably expect enjoyment of a high level of amenity; and • people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptor	Surrounding land where: • users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low sensitivity receptor	Surrounding land where: • the enjoyment of amenity would not reasonably be expected; or • there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

Table C-2. Risk of odour exposure at the specific location (IAQM, 2018)

		Source Odour Potential		
		Small	**Medium**	**Large**
Pathway Effectiveness	**Highly effective pathway**	Low Risk	Medium Risk	High Risk
	Moderately effective pathway	Negligible Risk	Low Risk	Medium Risk
	Ineffective pathway	Negligible Risk	Negligible Risk	Low Risk

Table C-3. Likely magnitude of odour effects at a specific location (IAQM, 2018)

Risk of Odour Exposure	**Receptor Sensitivity**		
	Low	**Medium**	**High**
High Risk of Odour Exposure	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium Risk of Odour Exposure	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
Low Risk of Odour Exposure	Negligible Effect	Negligible Effect	Slight Adverse Effect
Negligible Risk of Odour Exposure	Negligible Effect	Negligible Effect	Negligible Effect

D

Appendix D – Location of Sensitive Receptors for Risk Assessment

Figure D-3. Map showing the location (and distance) of the Sensitive Receptors in the vicinity of the site around the WWTP