

IN THE MATTER

of the Resource Management Act 1991

AND

IN THE MATTER

of Resource Consents and Notices of Requirement for the Central Interceptor main project works under the Auckland Council District Plan (Auckland City Isthmus and Manukau Sections), the Auckland Council Regional Plans: Air, Land and Water; Sediment Control; and Coastal, and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

**STATEMENT OF EVIDENCE OF CHARLES ALEXANDER KIRKBY ON
BEHALF OF WATERCARE SERVICES LIMITED**

AIR QUALITY

1. INTRODUCTION

- 1.1 My name is Charles Alexander Kirkby. I am a Senior Air Quality Specialist at Beca Infrastructure Ltd ("**Beca**").
- 1.2 I have over twenty years' professional experience in the investigation and assessment of the effects of discharges of contaminants into air, on air quality and human health.
- 1.3 I hold a Bachelor of Science (Hons) degree in biochemistry from the University of York, United Kingdom. My background includes 12 years with a local authority in the United Kingdom, with sole responsibility for assessing applications for air discharge permits, four years in a senior role with the Air Consents team at the former Auckland Regional Council ("**ARC**") and five years in my present role at Beca.

- 1.4 Key experience relevant to this project includes:
- (a) Assessing numerous applications for air discharge permits for a wide range of industrial and waste disposal activities, both in New Zealand and the United Kingdom.
 - (b) Preparation of assessments of air quality effects for a range of infrastructure and industrial projects, involving discharges of odour and/or construction dust.
 - (c) Development of management plans for the control of construction dust from major infrastructure projects.
 - (d) Investigation of numerous complaints regarding dust and odour in the Auckland region, including some odour complaints in the vicinity of the Mangere Wastewater Treatment Plant ("**Mangere WWTP**").
- 1.5 Specific project examples I have been involved in include:
- (a) Undertaking an air quality (odour) assessment for the new Gisborne Wastewater Treatment Plant.
 - (b) Undertaking an assessment of air discharge consent applications for Watercare Services Limited's ("**Watercare**") Hobson tunnel ("**Project Hobson**").
 - (c) Determining air quality inputs into the Construction Environmental Management Plan for the Victoria Park Tunnel and ongoing monitoring of construction dust.
 - (d) Undertaking an air quality assessment for the construction and operation of the Waterview Connection Project, including twin 2.3km motorway tunnels, and the development of a draft Construction Air Quality Management Plan.
 - (e) Undertaking an air quality assessment for the construction and operation of the MacKays to Peka Peka Expressway, a new 18km four lane highway in the Kāpiti Coast, including the preparation of a draft Construction Dust Management Plan for the Notice of Requirement and the development of a detailed Construction Dust Management Plan for the project.

Involvement in the Central Interceptor Project

- 1.6 Watercare commissioned Beca to undertake an assessment of the potential odour effects associated with the Central Interceptor Project ("**Project**") in June 2011. I have been involved in the Project since that date, and am the principal author of the air quality assessment report titled *Central Interceptor – Odour Assessment* included as Technical Report H of Part D of the Central Interceptor Main Project Works Assessment of Effects on the Environment ("**AEE**") submitted to the Council, dated August 2012.

Code of Conduct

- 1.7 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Updated Practice Note 2011 which took effect on 1 November 2011. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

- 1.8 The purpose of my evidence is to outline the effects of potential discharges of:
- (a) odour from the operation of the Project; and
 - (b) dust generated during its construction.
- 1.9 The technical nature of the Project is comprehensively described in the evidence of Mr Cantrell and Mr Cooper. I will not repeat that description in my evidence except where it is directly relevant to assessing the potential effects of odour from the operation of the Project or dust from its construction.
- 1.10 My evidence is structured as follows:
- (a) Executive Summary;
 - (b) Description of methodology;
 - (c) Outline of receiving environments;

- (d) Assessment of odour effects of the Project;
- (e) Assessment of construction dust effects of the Project;
- (f) Response to submissions;
- (g) Response to the Council Pre-hearing Report; and
- (h) Conclusions.

2. EXECUTIVE SUMMARY

Odour

- 2.1 The Central Interceptor will collect wastewater from Watercare's wastewater network in Central and West Auckland and convey that wastewater to the Mangere WWTP for treatment. In wet weather conditions, the tunnel will operate in storage mode as has been explained in the evidence of Mr Cantrell.
- 2.2 This wastewater may be odorous, or have the potential to become odorous. The main tunnel is designed to prevent, as far as practicable, discharges of odour. This will primarily be achieved by sealing all access covers and operating the main tunnel under negative pressure. This allows the odorous air to be extracted and treated at the primary air treatment facility ("**ATF**") at the Mangere WWTP before being discharged.
- 2.3 During moderate to large wet weather events, which may only occur six to eight times per year on average, there may be discharges of air via the six proposed air intakes that are required for air flow balancing within the main tunnel. Such wet weather events are typically associated with meteorological conditions that are likely to lead to effective dispersion of odours, while the wastewater itself, being heavily diluted with stormwater, is likely to be much less odorous than during normal dry weather flows. As such, even on those few occasions, adverse odour effects will not be significant.
- 2.4 However, in the unlikely event that these intermittent discharges via air intakes were to cause significant adverse effects, provision has been made for additional air extraction and air treatment facilities to be installed at other key points along the main tunnel, so as to maintain the main

tunnel under negative pressure in all except very large wet weather events.

- 2.5 The Central Interceptor will potentially introduce discharges of odour at a few new locations (such as at Kiwi Esplanade). Conversely, there are a number of locations, such as Lyon Avenue and Pump Station 23, where the operation of the Central Interceptor will reduce discharges of odour – for example, by significantly reducing the number of (potentially odorous) overflows compared to the existing situation and by extracting odorous air to an ATF at the proposed Mangere Pump Station. In addition, I consider that any adverse effects caused by discharges to air from the operation of the main tunnel, including at those new locations, will only be minor.

Dust

- 2.6 The types of construction proposed for the Project, with the exception of tunnelling, are largely similar to those required for many other construction projects across Auckland.
- 2.7 Although most of the construction sites are located in close proximity to residential areas and other sensitive receptors, I consider that it is possible to avoid significant adverse effects from discharges of dust due to the construction of the Project through the use of best practice dust control measures.

Watercare's Proposed Conditions

- 2.8 Conditions have been proposed by Watercare for the designations (for dust) and consents (for odour and dust). I consider that compliance with these conditions will be sufficient to ensure adverse effects will be adequately mitigated.

Overall

- 2.9 In summary, it is my opinion that:
- (a) The adverse effects of discharges to air of odours arising from the operation of the Central Interceptor will be no more than minor and, in some cases, will be reduced when compared to the existing situation.
 - (b) The adverse effects of discharges to air of dust arising during construction will be no more than minor.

3. METHODOLOGY

Odour Generation

- 3.1 Wastewater odour is caused by a variety of chemical compounds, principally hydrogen sulphide (H₂S) and organic sulphur compounds (e.g. mercaptans). Concentrations of these compounds tend to increase with the age of the wastewater, especially under anaerobic conditions, which can commonly occur as a result of pump stations connected to long rising mains or where low flows result in long detention times in pipes.
- 3.2 In addition to the concentrations of odorous compounds in wastewater, the other key driver in odour generation is the turbulence of the wastewater itself. Increased turbulence, for example at junctions, drop shafts and pump stations, increases the rate of discharge of odour.
- 3.3 The extent of any effects arising from discharges of odour is affected by meteorological conditions at the time of the discharge, as well as by the frequency, intensity, duration and offensiveness (nature) of the discharge. In general, odour discharges from sources at ground level are less likely to cause adverse effects under turbulent air flow and high wind speeds than in calm conditions because any odour is dissipated more quickly.
- 3.4 Discharges to air from the Project will only arise at a limited number of discrete locations, such as intermittent discharges via air intakes during moderate to large wet weather events or temporary odour emission during the emptying of grit traps.

Odour Assessment

- 3.5 A qualitative approach was adopted for the odour effects assessment for the Project. The main reasons for taking this approach are:
- (a) In general, odour discharges from the Project are likely to be very intermittent, arising only during routine maintenance (e.g. during the emptying of grit traps) or moderate to large or very large wet weather events.
 - (b) Odour discharges from wastewater typically give rise to amenity effects (odour nuisance) rather than health effects.
 - (c) The Project is still at the concept design stage and is yet to go through detailed design.

- 3.6 My assessment makes use of the FIDOL factors which are routinely used in the assessment of odour discharges in New Zealand and internationally. These can be summarised as follows:
- (a) **Frequency** of exposure to a particular odour, for example one-off or very occasional incidents (e.g. odour associated with a major storm event) would be much less likely to be regarded as 'offensive or objectionable' than regular or frequent occurrences.
 - (b) **Intensity** or strength of the odour.
 - (c) **Duration** of a particular odour event.
 - (d) **Offensiveness** relates to the 'hedonic tone' of an odour – i.e. is it pleasant, neutral or unpleasant. For example, the odour of baking bread may generally be regarded as pleasant, while wastewater odour, especially that caused by discharges of hydrogen sulphide (H₂S), would generally be regarded as unpleasant or offensive.
 - (e) **Location** of an activity and sensitivity of the receiving environment – what may be considered offensive or objectionable in a residential area, may not necessarily be considered offensive or objectionable in an industrial area.
- 3.7 All five of the FIDOL factors are taken into account when undertaking odour assessments and a change to just one of the factors can be critical to the level of effect which occurs. For example, an odour of low intensity and moderate offensiveness that occurs daily or on several days over a limited period may be regarded as 'offensive or objectionable' (and therefore as a significant effect); whereas the same odour in the same location that only occurs once or twice a year may not be regarded as 'offensive or objectionable'.
- 3.8 Conversely, a highly unpleasant odour may be regarded as 'offensive or objectionable' even though it only occurs occasionally. For example, odour associated with the emptying and cleaning of grit traps could be regarded as a significant adverse effect unless mitigation measures are put in place.

- 3.9 In my assessment, I have evaluated the potential for odour discharges from the various surface structures associated with the Project – i.e. the frequency, intensity, duration and offensiveness of those discharges – and then considered the sensitivity of the receiving environment (location) for each of the 19 sites where construction works are proposed to take place.

Dust Assessment

- 3.10 I have also adopted a qualitative approach to the assessment of dust discharges associated with the construction of the Project. This considers the potential for dust discharges, the sensitivity of the various receiving environments and the mitigation measures which are proposed.

- 3.11 This approach is supported by Ministry for the Environment guidance, as follows:

Modelling of dust effects is generally not suitable for large area sources (e.g. quarries, earthwork sites and unpaved surfaces), nor is it suitable for predicting the effects of dust where the source is primarily due to on site management techniques or the emissions are fugitive in nature.

The key point to recognise with most fugitive dust sources is that nuisance effects will almost certainly occur if the sources are not adequately controlled. Rather than spending time and money on extensive (and expensive) theoretical predictions of the possible effects, it is likely to be more appropriate to put the effort into the design and development of effective dust control procedures.¹

- 3.12 And from the former Auckland Regional Council:

Rather than spending considerable time and effort on predicting the possible off site effects, [the] ARC will be more likely to require adequate and appropriate dust control measures that are in line with BPO, minimisation and best practice.²

- 3.13 I have evaluated the potential for dust discharges from the various construction activities required for the Project, the sensitivity of the receiving environment (location) for each of the 19 construction sites and

¹ Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions. Ministry for the Environment, 2001.

² Technical Publication 152: Assessing Discharges into Air (Draft), Auckland Regional Council, 2002.

then outlined the proposed or recommended dust control measures required for each site to adequately mitigate potential dust effects.

4. RECEIVING ENVIRONMENTS

- 4.1 **Appendix A** provides a brief description of the receiving environment at each of the 19 sites where construction works associated with the Project are proposed.
- 4.2 With the exception of the Mangere Pump Station site, the sites are located in areas that are moderately to highly sensitive to both odour and construction dust. This is because they are all in public open space areas and/or within 10 - 100 metres of residential dwellings.
- 4.3 The Auckland Council has defined four Air Quality Management Areas ("**AQMA**"s) across the Auckland region under the *Auckland Council Regional Plan: Air Land and Water* ("**ACRP: ALW**"). These are intended to facilitate management of air discharges that is appropriate to the general nature of the area. Most of urban Auckland is within an Urban AQMA, with the exception of specific areas that are zoned for heavy industry (Industrial AQMAs).
- 4.4 Chapter 3 of the ACRP: ALW sets out the purpose and management approach for the different AQMAs. For example:
- (a) The purpose of the Urban AQMA is to *"ensure a high level of amenity ... and to protect human health, particularly for sensitive sectors of the population from the adverse effects of air discharges."*
 - (b) The management approach for the Coastal Marine AQMA, set out in Chapter 3 of the ACRP: ALW, is *"to maintain the existing high level of amenity"*.
 - (c) The management approach for Industrial AQMAs seeks to *"avoid issues of reverse sensitivity and conflicts between incompatible and competing land uses"*.
 - (d) The purpose of the Rural AQMAs *"is to enable 'rural' activities to exist whilst maintaining appropriate levels of amenity"*.

- 4.5 With the exception of the Mangere Pump Station site and part of the Pump Station 23 (Frederick Street) site, the proposed construction sites are all located within an Urban AQMA.
- 4.6 Of note, although most of the Pump Station 23 site is within the Urban AQMA (as are adjacent residential premises), part of the site is within the Coastal Marine AQMA.
- 4.7 The Proposed Mangere Pump Station is located within an Industrial AQMA, is part of the Mangere WWTP site and is within the odour boundary of the Mangere WWTP. Chapter 3 of the ACRP: ALW states that this area has been included within the Industrial AQMA to "*allow for the continued operation of the Mangere Wastewater Treatment Plant and associated activities*".

5. ASSESSMENT OF ODOUR EFFECTS

- 5.1 In this section of my evidence I explain the key odour control measures for the Project. I then outline the potential for odour from each type of surface structure proposed as part of the Project, followed by a site-by-site evaluation of the likelihood of odour effects at each of the 19 proposed sites.

Negative pressure

- 5.2 For the Project as a whole, the key odour control measure is maintaining the system under negative pressure – by pumping out wastewater at the Mangere WWTP and extracting air (via ATFs) at the proposed Mangere Pump Station and Pump Station 23 site. The pump station and ATFs have been designed to maintain the system under negative pressure for 95-98% of the time.
- 5.3 As a secondary measure, access covers to most surface structures will be kept sealed to prevent air egress, e.g. during moderate to large and very large wet weather events when the system may not be under negative pressure.
- 5.4 In this context, 'negative pressure' means that the air pressure inside the main tunnel is lower than the atmospheric pressure outside, so air tends to be drawn into the system. This is a standard approach adopted for building ventilation where the aim is to prevent fugitive (i.e. uncontrolled)

discharges of contaminants (refer to Proposed Consent Condition 7.7 attached to Ms Petersen's evidence).

- 5.5 This approach has also been adopted for the Hobson Bay tunnel, which is maintained under negative pressure with an air intake at Victoria Avenue, while air is drawn out via a biofilter at Pump Station 64.
- 5.6 However, this mode of operation is not standard across Watercare's wastewater network, including existing interceptors. These generally operate with passive ventilation, with the potential for odour discharges at numerous locations. Therefore, the odour control system proposed for the Central Interceptor main tunnel represents an improvement over the current situation.

Surface structures

- 5.7 Odour discharges can only occur from a wastewater system where there are surface structures. For the Project, the surface structures are: drop shafts, access shafts, control chambers, grit chambers, air intakes, pressure relief air vents, a pump station and ATFs.
- 5.8 As mentioned above, **Appendix A** lists the main surface structures to be located at each of the 19 proposed sites. Before assessing each of the sites, it is useful to briefly discuss the various surface structures and the potential for such structures to discharge odour.

Pump station

- 5.9 The proposed pump station at the Mangere WWTP will incorporate air extract ventilation via a primary ATF.
- 5.10 During moderate to large wet weather events, when the volume of wastewater entering the system exceeds the capacity of the pump station, the main tunnel will start to fill and the main air extraction system at the pump station will shut down (because the level of wastewater is such that it covers the air extraction point at the pump station). The frequency of such events is only up to six - eight times per year, and their duration is unlikely to exceed more than a few hours. In addition, the pump station wet well will be sealed and limited air extraction via the biofilter will be maintained during wet weather events to prevent fugitive air discharges.

- 5.11 I consider that these measures are sufficient to avoid offensive odour discharges from the pump station and the main tunnel of the Central Interceptor under normal operation.

Air treatment facilities

- 5.12 A primary ATF will be installed at the proposed Mangere Pump Station site, drawing air from the whole of the main tunnel and creating negative air pressure throughout the entire tunnel. The use of negative air pressure is a significant improvement for a major conduit in Auckland and represents a key measure to manage odour. This has been proven with Project Hobson, where the primary ATF is located adjacent to the Orakei Pump Station (Pump Station 64).
- 5.13 A secondary ATF will be installed at Pump Station 23, where there have been issues with odour in the past due to industrial flows from the Onehunga Branch Sewer.
- 5.14 If, after a period of operation, it becomes apparent that there are odour issues associated with the operation of the Central Interceptor, then the following staged options will be considered to supplement the odour management:
- (a) The installation of an additional primary ATF at May Road³ to extract and treat air from Link Sewer 3 and the tunnel between Western Springs and May Road.
 - (b) Depending on requirements, a primary or secondary ATF may be installed at Pump Station 25 (Miranda Reserve) to treat air from Link Sewer 3.⁴
 - (c) A secondary ATF may be installed at Western Springs to ventilate Link Sewer 1 and the upstream end of the main tunnel.⁵
- 5.15 The need for any additional air treatment facilities will be determined on the basis of odour complaints that are confirmed to be associated with discharges to air from the Central Interceptor tunnel. If odour issues are

³ Refer pages 90 - 101 of the Hearing Drawing Set.

⁴ Refer pages 183 - 193 of the Hearing Drawing Set.

⁵ Refer pages 21 - 37 of the Hearing Drawing Set.

significant in terms of frequency and duration (assessed both from complaints and from monitoring), the appropriate treatment system designed for that shaft location will be implemented.

- 5.16 The specific treatment system to be installed will be determined on a case-by-case basis having regard to recent operational experience at other sites and the latest technology which is available at the time if that helps to optimise the performance and/or cost.

Air intakes

- 5.17 Air intakes are required to balance air flows within the main tunnel under the negative air pressure operating regime
- 5.18 In normal operation, air will be drawn into the main tunnel through these intakes and as such, discharges of odour at these locations are unlikely. During wet weather events when the main tunnel fills, displaced air will continue to be extracted via the ATFs at the proposed Mangere Pump Station and Pump Station 23 sites until these pathways are blocked by the rising water level. Once this has happened, air, which may be odorous, will begin to be discharged at other specified locations (i.e. the air intakes or, if they are installed, other secondary ATFs). Based on the hydraulic modelling for the Project, I understand that discharges of air via the air intakes may only occur six to eight times per year (on average).
- 5.19 On occasions when wet weather flows cause air discharges via the air intakes, the 'first flush' of diluted wastewater will already have been removed via the proposed Mangere Pump Station and the associated odorous air will be extracted via the ATFs there and at Pump Station 23, while the remaining wastewater in the Central Interceptor tunnel is likely to be heavily diluted with stormwater. In these circumstances, there is little opportunity for anaerobic conditions to develop in the wastewater and therefore, while discharges to air via the air intakes may be moderately odorous, they are unlikely to be offensive in nature.

Pressure relief air vents

- 5.20 Two pressure relief air vents (at Kiwi Esplanade and Pump Station 23) will be required to vent air pockets that could potentially become trapped between May Road and the proposed Mangere Pump Station during certain large wet weather events. Based on the hydraulic modelling, this

will be very infrequent (twice in the five year period used for the model runs) and of short duration (less than 10 minutes). As with air vented via air intakes, discharges to air via the pressure relief air vents may be moderately odorous, but are unlikely to be offensive in nature due to the high level of dilution of wastewater with stormwater during these events.

Drop shafts, access shafts and control chambers

- 5.21 While drop shafts, access shafts and control chambers have the potential to cause odour effects, they will be designed to avoid venting to the atmosphere (air), except at designated locations (i.e. air intakes) where periodic air releases may occur when the tunnel fills during moderate to large storm events. In addition, access covers will be sealed except when maintenance access is required. Similar structures are currently located across Watercare's wastewater network, on the Hobson Bay Tunnel, for example, where they operate without noticeable discharges to air.
- 5.22 Overall, based on the proposed design, I consider that the drop shafts, access shafts and control chambers associated with the Project have a low potential for discharges of offensive odour.

Grit chambers

- 5.23 As with drop shafts, access shafts and control chambers, there are a number of grit chambers currently located at key points across Watercare's wastewater network. During normal operation, grit chambers are unlikely to be significant sources of odour. The potential for odour emissions is only increased while they are being emptied and cleaned, which normally occurs about four times a year.
- 5.24 Watercare utilises a number of management controls to minimise the effects of odour discharges during the cleaning of grit traps, including:
- (a) prior notification to nearby potentially affected parties;
 - (b) undertaking the operations at times that minimise disruption to neighbouring households and/or businesses;
 - (c) keeping the duration and frequency of maintenance and cleaning operations to a minimum; and

- (d) transporting material removed from grit chambers in enclosed skips.

5.25 These control measures appear to be effective in mitigating the effects of discharges of odour from cleaning and maintenance operations. For example, I understand from discussions with Mr Chris Harbour, Transmissions Manager, that Watercare has received very few complaints regarding odour effects associated with grit chambers, even in sensitive locations.

Site by Site Assessment of Odour Effects

5.26 **Appendix A** identifies the 19 sites where construction associated with the Project will be located, the structures to be located at each site, the proximity of each site to sensitive receptors, and the consequent sensitivity of the receiving environment.

5.27 In my opinion, nine of the 19 proposed sites have a very low risk of discharges of odour. These are:

- Mount Albert War Memorial Reserve (both the Reserve site and the Car Park site);
- Haverstock Road;
- Walmsley Park;
- Keith Hay Park;
- Western Springs Depot;
- Norgrove Avenue;
- Miranda Reserve;
- Whitney Street; and
- Dundale Avenue.

5.28 The surface structures to be located at these sites include access shafts, drop shafts and control chambers. As explained in paragraph 5.21 of my evidence, these structures have a low risk of producing offensive odours (due to covers being sealed and the Central Interceptor tunnel operating under negative pressure). Although all of these sites are located in moderately or highly sensitive receiving environments, close to residential premises, I am satisfied that the operation of the Central Interceptor will

have negligible effects on amenity values associated with odour at these locations. For this reason, I will not set out the site specific assessment undertaken for these sites.

5.29 I assess the remaining 10 sites below.

Western Springs

5.30 The two main potential air discharge points at this site are a grit chamber (during routine cleaning) and displaced air vented via an air intake (six to eight times a year on average).

5.31 Although no odour issues are expected at the site, provision has been made for the site to be used for a secondary ATF for wet weather ventilation of the main tunnel and/or for general ventilation of the link sewer from Motions Road (which would also avoid the intermittent discharges of untreated air via the air intake). As previously discussed, this ATF would be installed at a later date if required, once the Central Interceptor is operational.

5.32 Given that the Central Interceptor as a whole operates under negative pressure, the relatively infrequent emptying of the grit chamber (coupled with appropriate mitigation measures), and the infrequency of air discharges via the air intake, with provision for the installation of a suitable ATF if required at some point in the future, I consider that adverse effects due to odour discharges at the Western Springs site will be only minor.

Lyon Avenue

5.33 Lyon Avenue is the site of an existing combined sewer overflow which discharges via a large spillway channel immediately adjacent to the apartment complex. Historically, there have been a number of odour issues at this site, partly from the spillway, but predominately due to the large opening at the overflow outlet. Aside from short-term odours during 'first-flush' via the overflow, I understand from Watercare that these adverse odour effects have already been reduced through construction of a parking deck over the spillway and installation of a flexible curtain across the discharge point from the existing sewer. With the commissioning of the Project, this overflow opening and spillway will be replaced by a culvert opening directly into the Meola Creek (which will

operate at a significantly lower frequency than the existing overflow), while odours from dry weather flows will be avoided by the connection to the new tunnel.

- 5.34 An air intake will be installed in the main access shaft at this site at the time of construction, and will be manually adjusted during commissioning. As previously noted, the intention is to operate the main tunnel under negative pressure. Therefore, discharges via the air intake should only occur very occasionally for very short periods during moderate to large and very large wet weather events if the main tunnel fills and normal air extraction routes are unavailable (i.e. six to eight times a year on average).
- 5.35 Given the overall operation of the main tunnel under negative pressure and the infrequency of air discharges via the air intake, I consider that adverse effects due to odour discharges at the Lyon Avenue site will be no more than minor and are likely to be a further improvement when compared to the current situation.

May Road

- 5.36 An air intake will be installed in the main access shaft at this site at the time of construction, and will be manually adjusted during commissioning. As previously noted, the intention is to operate the main tunnel under negative pressure. Therefore, discharges via the air intake should only occur very occasionally for very short periods during moderate to large wet weather events if the main tunnel fills and normal air extraction routes are unavailable (i.e. six to eight times a year on average).
- 5.37 Although odour problems are not expected, provision has been made for an ATF to be installed at this site at a later date if required, once the Central Interceptor tunnel is operational. If an ATF is installed at this site, untreated air discharges via the air intake will also be avoided.
- 5.38 Given the overall operation of the main tunnel under negative pressure and the infrequency of air discharges via the air intake, I consider that adverse effects due to odour discharges at the May Road site will be no more than minor. Similarly, if installation of an ATF is required at some point in the future, this would control odour discharges from the main tunnel at this location and avoid any adverse odour effects.

Pump Station 23

- 5.39 There is an existing pump station at this site (Pump Station 23) which is used to pump wastewater from the Onehunga branch sewer, via a rising main, to the Western Interceptor. I understand that the Onehunga branch sewer is a recognised source of odour at the Pump Station, and that this site has been a cause of occasional complaints to Watercare for a number of years. In response, Watercare installed an ozone-based ATF. I understand from Mr Chris Harbour that this has been reasonably effective in controlling the odour issues at the site.
- 5.40 Once the Central Interceptor is commissioned, the Onehunga branch sewer will connect to the main Central Interceptor tunnel via a drop shaft. This means that Pump Station 23 and its associated ATF can be removed.
- 5.41 Because of the known odour issues with the Onehunga branch sewer, it is intended that a secondary ATF and a pressure relief air vent be installed at this location for use during wet weather flows. At the same time, there will also be a pressure relief vent for use as a 'back-up' to that proposed at Kiwi Esplanade Reserve.
- 5.42 Air ventilation during moderate to large wet weather events and the 'first flush' of extreme wet weather events will be via the secondary ATF, with the pressure relief vent only operating during very large wet weather events. The operation of the secondary ATF should avoid the occasional untreated discharges via the air intake that may occur at other locations during moderate to large wet weather events.
- 5.43 There is an existing penstock (to control wastewater flow) at this site, which is, at present, checked fortnightly. This penstock is to be replaced by a new, remotely managed, control chamber. Odour is only likely to be discharged from control chambers when opened for inspection and maintenance, and the new control chamber is unlikely to require more frequent inspection and maintenance than the existing penstock. Therefore the odour from this source should be no greater than the current situation, and in all likelihood should be less.
- 5.44 Overall, I consider that the Central Interceptor will reduce the potential for adverse effects due to odour discharges at Pump Station 23.

Kiwi Esplanade

- 5.45 A pressure relief air vent will be installed at this location. As with the pressure relief air vent at Pump Station 23, this would only operate during very large wet weather events (i.e. once or twice every five years). During these very large wet weather events the air is not treated.
- 5.46 The main pressure relief air vent at this site will incorporate a small bypass fitted with a passive carbon filter to remove odour. A passive carbon filter is proposed to be installed at this site because air discharged at this location has more potential to be odorous than air discharged higher up the system, due to the site's proximity to the downstream end of the main tunnel and its location downstream of the inflow from the Onehunga Branch Sewer. The passive carbon filter cannot be used for the very large wet weather events, but will be used during moderate to large wet weather events (i.e. six to eight times a year on average).
- 5.47 Experience in New Zealand and overseas indicates that adverse odour impacts tend to occur as a result of poor dispersion during periods of very low wind speed – typically less than 0.5m/s. I have reviewed the meteorological conditions that are likely to occur at the times when the pressure relief air vent may operate.⁶
- 5.48 My analysis indicates that hourly average wind speeds were greater than 2m/s during all but one of the heavy rainfall events during the modelled year.⁷ On this basis, it is my opinion that the very large wet weather events that may cause the pressure relief air vent at Kiwi Esplanade to operate are highly unlikely to coincide with periods of low wind speed and poor air dispersion.
- 5.49 The hydraulic modelling also indicated that the duration of discharges via the pressure relief air vent is likely to be short – approximately 10-30 minutes – and the wastewater in the main tunnel is likely to be heavily diluted with stormwater and, hence, much less odorous than during normal dry weather flows.

⁶ This review was based on the results of hydraulic modelling for the 1999 modelling year, which I understand to have been based on actual rainfall data for the year. Although this did not include any occasions when the emergency air vents would have been required to operate, it does include historic periods of high wastewater flow due to heavy rainfall.

⁷ Based on wind speeds recorded at the Onehunga and Wiri meteorological monitoring sites.

- 5.50 Given the infrequency and short duration of air discharges, the installation of a passive air filter, the likely good air dispersion during air discharges and the dilution of wastewater by stormwater, I consider that adverse effects due to odour discharges at Kiwi Esplanade will be no more than minor.

Proposed Mangere Pump Station

- 5.51 During normal operation, air extraction from the main tunnel and the pump station will be via a primary ATF (proposed to be through a biofilter), which will effectively control discharges of odour. As previously noted, this air extraction will shut down if the main tunnel fills with wastewater (i.e. during moderate to large wet weather events), although there will still be air extraction via the ATF from the wet well headspace during such events.
- 5.52 Given the location of the pump station and proposed works, well within the odour boundary of the Mangere WWTP (and over 300 metres from the nearest sensitive receptor), and the operation of the ATF, I consider that discharges to air from the main tunnel at this location will not noticeably add to the odour already being discharged. In addition, it will not cause adverse odour effects beyond the immediate vicinity of the facility or beyond the odour boundary of the Mangere WWTP.

Motions Road and Rawalpindi Reserve

- 5.53 At Motions Road and Rawalpindi Reserve, the only structures with a potential for odorous discharges to air are grit chambers.
- 5.54 The grit chamber at Rawalpindi Reserve is an existing grit chamber that is being retained for the Project. There will be no increase in adverse effects caused by odour discharges at this site.
- 5.55 The grit chamber at Motions Road is a new structure.
- 5.56 Provided that the covers on these chambers are sealed when they are in use and appropriate odour control and management measures are implemented during cleaning (such as those outlined above), adverse effects caused by odour discharges from these sites should be only minor.

Pump Station 25

- 5.57 The two main potential air discharge points at the site are a grit chamber (during routine cleaning) and displaced air vented via an air intake (six to eight times a year on average).
- 5.58 There is an existing pump station at the site (Pump Station 25) that is part of the Western Interceptor. I understand that there have been a number of issues regarding odour effects at this location in the past, but that these have been resolved through the installation of a biofilter. When I visited this site in July 2011, I could not detect any wastewater-related odour in the vicinity of the pump station or biofilter.
- 5.59 Once the Central Interceptor is commissioned, the Western Interceptor will connect to the new main tunnel via a drop shaft. As a result, Pump Station 25 is no longer required and it, together with its associated biofilter, will be removed. Discharges to air at this site will be largely avoided by air extraction through the main tunnel to the ATF at the proposed Mangere Pump Station.
- 5.60 An air intake will be installed in the main access shaft at this site at the time of construction, and will be manually adjusted during commissioning. As previously noted, the intention is to operate the main tunnel under negative pressure. Therefore, discharges via the air intake should only occur very occasionally for very short periods during moderate to large wet weather events if the main tunnel fills and normal air extraction routes are unavailable (i.e. six to eight times a year on average).
- 5.61 Although odour problems are not expected, provision has been made for an ATF to be installed at this site at a later date if required, once the Central Interceptor is operational. Depending on the final ventilation configuration for the Central Interceptor this may be either a primary ATF for general ventilation, or a secondary ATF for wet weather ventilation of Link Sewer 3 from May Road. If an ATF is installed at this site, untreated air discharges via the air intake will be avoided.
- 5.62 Given the location of the site, surrounded by residential dwellings, appropriate odour control measures will be required during cleaning of the grit chamber, including the scheduling of such cleaning during weekdays when nearby residents are less likely to be present.

- 5.63 Given the overall operation of the main tunnel under negative pressure, the relatively infrequent emptying of the grit chamber (coupled with appropriate mitigation measures) and either the infrequency of air discharges via the air intake or the mitigation of those discharges if an ATF is installed, I consider that adverse effects due to odour discharges at the Pump Station 25 site will be minor or less.

Haycock Avenue

- 5.64 An air intake will be installed in the access shaft at this site at the time of construction, and will be manually adjusted during commissioning. As previously noted, the intention is to operate the main tunnel under negative pressure. Therefore, discharges via the air intake should only occur very occasionally for very short periods during moderate to large wet weather events if the main tunnel fills and normal air extraction routes are unavailable (i.e. six to eight times a year on average).
- 5.65 Because of the proximity of the air intake to residential premises at this site (less than 15 metres), if odorous air is discharged via the air intake, there is the potential for it to affect these immediately adjacent premises. In practice, I consider that it is unlikely that this will give rise to adverse effects that are anything other than minor, largely due to the relative infrequency of such discharges (up to six - eight times a year on average) and because they are likely to coincide with higher wind speeds and consequent good dispersion. However, there is sufficient space at the site to install a small ATF (such as a passive carbon filter) if those discharges do give rise to adverse effects on neighbouring properties.
- 5.66 Overall I consider that, given the overall operation of the main tunnel under negative pressure and the infrequency of air discharges via the air intake (whether or not a passive filter unit is installed), adverse effects due to odour discharges at the Haycock Avenue site will be minor.

Air Treatment Facilities

- 5.67 As discussed previously, ATFs will be installed at designated active ventilation sites – i.e. the proposed Mangere Pump Station and Pump Station 23 - while provision has been made to install additional ATFs at other locations should odour from the main tunnel become a significant problem. Mr Cantrell has described the ventilation strategy for the Project in detail in his evidence, including preferred locations for ATFs and air

intakes. For that reason I will limit my evidence to a brief comment on the effectiveness of the different treatment options proposed.

Biofilters

- 5.68 Biofilters have been proven to be highly effective in controlling wastewater odour discharges at numerous locations across Watercare's wastewater network. Examples of this effective operation include the existing biofilters at Pump Station 25 and at the Mairangi Bay Pump Station. At both these sites odour complaints were received before a biofilter was installed; however there have been no odour complaints at these sites since the biofilters were installed (i.e. since 2005). A biofilter has also been successfully installed at Pump Station 64 (Orakei Domain) as part of Project Hobson (Figure 1). I visited that site on 7 June 2013, at which time there was no odour from the biofilter other than a very mild, 'earthy' smell, similar to fresh garden soil, which was only detectable when standing almost on top of the biofilter.



Figure 1 – Biofilter at Pump Station 64

- 5.69 In biofilters, the odorous gas stream is passed through a bed comprised of soil, bark, compost or any mixture of these components, laid over an inert support. Naturally occurring micro-organisms in the bed material break down organic compounds into carbon dioxide, water, mineral salts and other harmless products.

- 5.70 Biofilters have relatively low capital and operational costs, but can be slow to respond to rapid changes in load and are sensitive to higher concentrations of H₂S. They require relatively large sites but have the advantage of having a low vertical profile.

Activated Carbon Filters

- 5.71 Activated carbon filters are also effective in controlling discharges of organic vapours. They are commonly used for the treatment of wastewater related odours, including tunnel shaft vents, but are much more expensive to maintain than biofilters. Figure 2 shows an example of a relatively large capacity (3-4 m³/s) activated carbon filter unit in a residential area.



Photo: Sydney Water

Figure 2 – Example of an activated carbon filter unit

- 5.72 In activated carbon filters, odorous compounds are removed from the air stream by adsorption onto the activated carbon. Over time the carbon will become saturated and must be replaced, otherwise odours will 'break through' and be discharged to air.

Biotrickling Filters

- 5.73 While I have no operational experience of biotrickling filters for odour control, I have undertaken a review of literature on their use at other

wastewater facilities, including by Melbourne Water. This review indicates to me that they should be effective for this purpose, with the advantages of more effective removal of H₂S and a smaller footprint than biofilters. I understand that, if used for the main tunnel, biotrickling filters would be combined with activated carbon to provide an additional level of control.

- 5.74 Biotrickling filters are typically used in situations where the air extraction rates and/or H₂S loads may exceed the capacity of a biofilter. However, they are much more expensive and more visually noticeable than biofilters due to the vertical height of the structures which can be in the order of 10 metres.

Routine Maintenance

- 5.75 I have previously mentioned that Watercare employs a number of management tools to minimise the effects of odour discharges during the cleaning of grit chambers (see paragraph 5.24 of my evidence).
- 5.76 I understand that a similar approach is taken to managing or avoiding effects during routine maintenance of other wastewater infrastructure and is intended to be implemented for routine maintenance associated with the structures proposed for the Project.

Watercare's Proposed Conditions

- 5.77 Proposed Consent Conditions 7.1 to 7.10 provide for discharges to air. Where I refer to the wording of specific Conditions, this wording is set out in the marked up Designation and Consent Conditions attached to Ms Petersen's evidence.
- 5.78 Proposed Consent Conditions 7.2 and 7.3 require that odour discharges are kept to the minimum level practicable (condition 7.2) and any odour discharges from the normal operation of the Central Interceptor does not cause adverse effects at any private property (residential or otherwise) that are offensive or objectionable (condition 7.3).
- 5.79 Proposed Consent Condition 7.8 requires remedial action to be taken in the event of ongoing elevated levels of odour at any of the sites where surface structures associated with the Central Interceptor tunnel are located. This remedial action may include the installation of additional ATFs as discussed above.

- 5.80 I have reviewed Watercare's Proposed Conditions and confirm that I support the conditions as proposed and do not require or recommend any changes be made.

Summary of odour assessment

- 5.81 Overall, I consider that there may be short-term, localised impacts of air discharges associated with the cleaning of grit chambers and during moderate to extreme wet weather events. However, when the frequency, intensity, duration, offensiveness and locations of the discharges, and the mitigation and control methods required by Watercare's Proposed Conditions, are considered, these are unlikely to give rise to effects that are classified as 'offensive or objectionable'. As such, I consider that any adverse odour effects associated with the Central Interceptor tunnel can be effectively mitigated. Furthermore, at locations such as Lyon Avenue and Pump Station 23, the potential for adverse odour effects will be reduced.

6. ASSESSMENT OF CONSTRUCTION DUST

- 6.1 I have undertaken an assessment of the potential effects of discharges of dust associated with the construction of the Central Interceptor.
- 6.2 Because the Project is at the Concept Design stage, a detailed construction methodology has not yet been developed. As a result, any assessment of effects of discharges of construction dust must, necessarily, be somewhat generic. It is important to note, however, that the types of construction proposed for the Project, with the exception of tunnelling, are similar to those required for many other construction projects across Auckland. Similarly, most of the proposed construction sites are similar in area to those for many commercial sites or medium scale residential developments, which are, in almost all cases, undertaken without significant dust effects.
- 6.3 The greatest potential for dust discharges at all sites is associated with the initial earthworks required to establish the sites and from vehicle movements during construction, particularly during periods of very dry weather. The following construction activities associated with the Project have the potential to cause dust discharges:

- Dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions.
 - Excavation and disturbance of dry material.
 - Handling and storage of spoil from the Tunnel Boring Machine ("**TBM**") and Micro Tunnel Boring Machine ("**MTBM**") operations (if the spoil is allowed to dry out).
 - Loading and unloading of dusty materials to and from trucks.
 - Stockpiling of materials, including material placement and removal.
 - Storage and handling of bentonite and cement.
- 6.4 Tunnel boring, deep excavations and building construction, in themselves, are not generally major sources of dust. The main risks with these activities relate to the associated handling of spoil if it is allowed to dry out from its normally wet state, and vehicle movements.
- 6.5 There are a number of key factors which influence the potential for dust to be generated from construction. These are:
- The moisture content of that material.
 - Wind speeds across the exposed surfaces.
 - The percentage of fine particles in exposed surface material.
 - The area of exposed surfaces.
 - Mechanical disturbance of material, including excavation and filling, loading and unloading of materials and vehicle movements.
- 6.6 In general, systems for controlling dust emissions and associated effects include:
- Methods that modify the condition of the materials so that it has a lesser tendency to lift with the wind or through disturbances such as vehicle movements, wet suppression, mulching of exposed earthwork areas and stockpiles of soil and the metalling or sealing of roadways.
 - Methods that reduce the velocity and turbulence of the wind at the surface, such as enclosures, minimising stockpile heights, low vehicle speeds and installing windbreak fencing.

- 6.7 Proposed Designation Condition CM.2 (attached to Ms Peterson's evidence) requires that the Construction Management Plan(s) ("**CMPs**") include procedures for "*controlling ... dust and the removal of soil, debris, demolition and construction materials (if any) from public roads or places adjacent to the work site.*"
- 6.8 General dust control measures to be incorporated in the CMPs for all sites are proposed to include:
- Minimising the exposed surface area of earthworks and keeping exposed areas damp.
 - Metalling or sealing roadways.
 - Regular vacuum sweeping of sealed roadways and use of water sprays on unsealed and metalled roads.
 - Mulching all other areas of exposed earthworks.
 - Limiting vehicle speeds on site to 10kph on unsealed surfaces.
 - Limiting the size and height and managing the moisture content (e.g. through use of sprinklers or similar) of any soil stockpiles.
- 6.9 A high standard of dust control will be required due to the proximity of sensitive receptors at many locations which means, effectively, that the controls identified above must all be implemented and adhered to.
- 6.10 Wheel washes are also proposed for all sites to minimise the tracking of dirt and mud from the sites onto nearby public roads.
- 6.11 At most of the 19 sites, the duration of active construction activities should be no more than approximately 12-18 months, although the sites may be occupied for a longer period, with intermittent activity depending on progress at other sites. When sites are inactive for extended periods, the potential for dust discharges can be minimised by covering, mulching or metalling stockpiles and exposed areas of soil.
- 6.12 Active construction is likely to be taking place throughout the construction phase of the Project at the three primary sites: Western Springs, May Road and The proposed Mangere Pump Station. At the May Road and Western Springs sites this duration is largely associated with TBM launch and retrieval operations, while the proposed Mangere Pump Station is both a TBM launch site and the location for the only Pump Station on the

Project. Of these sites, May Road is located in the most sensitive receiving environment, with houses and food distribution operations on three sides of the site.

- 6.13 TBM launch operations (and, to a lesser extent, MTBM launch operations) involve the handling and temporary storage of considerable amounts of spoil, which, if allowed to dry out, has significant potential for generating dust discharges. In practice, it is unlikely to remain on site long enough to dry out. In addition TBM spoil handling at the May Road and Western Springs primary construction sites is proposed to be carried out within temporary enclosures to contain dust. An enclosure is not considered to be necessary at the third primary construction site, Mangere WWTP, due to the less sensitive location and nature of the site.
- 6.14 By way of comparison, the access shaft and 3km of tunnelling from the Rosedale WWTP was successfully undertaken in a commercial area without an enclosure, whereas a full enclosure was used for Project Hobson, which had residential neighbours adjacent to the site.

7. RESPONSE TO SUBMISSIONS

- 7.1 I have read the submissions lodged in relation to the Project that raise air quality concerns. These submissions relate to five of the 19 surface construction sites: Mount Albert War Memorial Reserve, Lyon Avenue, Haverstock Road, May Road and Keith Hay Park. Because the submissions all raise similar issues, where there are a number of submissions related to one site I will address the concerns raised on a site by site basis rather than addressing each submission individually.
- 7.2 A number of submitters raised concerns around the deposition of dust on houses. I leave comment on construction practices related to dust to Mr Cooper. However, in practice, I do not consider that significant dust deposition on houses is likely to occur as a result of the Project.

Mount Albert War Memorial Reserve

- 7.3 There are eight submissions from residents of properties close to the original Mount Albert War Memorial Reserve site that express concerns

regarding construction dust and/or odour.⁸ One submitter (Laurel France) also expresses concerns regarding exhaust fumes from construction vehicles.

Odour

- 7.4 As shown in **Appendix A**, the only surface structures to be located at the Mount Albert War Memorial Reserve site are a drop shaft, access shafts and a control chamber. These are all set flush with the ground. Although there is a potential for discharges of odour from these, in practice, because of the operation of the main tunnel under negative pressure, and provided covers are kept tightly closed, this is highly unlikely.

Dust

- 7.5 This is a relatively large site (5,400 m²) where active construction is anticipated to last for 12-18 months within a 3½ year 'occupation' period.⁹ I recognise that there are a number of houses in close proximity to the site, and that as a result, a high standard of dust control will be required.
- 7.6 The Erosion and Sediment Control Plan (ESCP-2.1, Rev D) for the site notes that the accessway and internal site road will be sealed and a wheelwash installed at the site exit. Both measures will help minimise dust discharges from the site.
- 7.7 In their submission Sally Kedge and Peter Kerridge have specifically requested the siting of a dust monitoring device at their property (65 Asquith Avenue). On most construction sites of this size, the main form of monitoring is visual. It may become appropriate for a continuous monitoring instrument to be used if there are significant ongoing concerns regarding dust management at the site or if considerable dust effects occur. However, I do not expect such effects to occur, so I would not recommend continuous dust monitoring from the outset or as a routine approach.

⁸ Hamish and Michelle Archer; Anne and Robin Boyd; Nicola Craig; Toby Curnow and Helen Hume; Laurel France; Dorina Jotti and Janet Eades; Sally Kedge and Peter Kerridge; and Innes Mellor.

⁹ Part B of the AEE states: "The "occupation" period indicates the total timeframe within which the project works would be completed at the site. Over this timeframe actual site construction works may be intermittent due to construction staging or sequencing, and the need to undertake connection and commission works at the site after other parts of the project are completed elsewhere. It is expected that active construction works on the site will occur for around 12 – 18 months."

- 7.8 Innes Mellor has expressed concerns regarding the effects of construction activities on produce grown in her garden. While there may be some dust deposition from the site onto her garden, this is unlikely to be different in nature from existing dust deposition from other soil disturbances in the area and will be less harmful than particulate matter from Auckland's traffic. Normal washing of produce (which I would recommend for anyone growing their own produce in Auckland) should be sufficient to remove any potentially harmful deposited material.

Vehicle exhaust emissions

- 7.9 I have not undertaken a detailed assessment of effects of vehicle exhaust emissions associated with the construction of the Project. However, I can make more general comments based on my experience with other major construction projects.
- 7.10 Most of the construction traffic will be heavy trucks entering or leaving the site, along with construction machinery (e.g. earth moving equipment and a crawler crane) operating at the site for extended periods. All of these will be diesel-powered. Diesel engines tend to emit larger quantities of air pollutants such as PM₁₀, PM_{2.5} and nitrogen oxides than the general vehicle fleet (which is mostly petrol driven).
- 7.11 Although exhaust emissions (fumes) from these vehicles may be annoying, I do not consider that they are likely to give rise to adverse health effects. Dispersion modelling that I undertook for another project (the MacKays to Peka Peka Expressway) indicated that, at a location with over 500 heavy vehicle movements per day arising from construction traffic, 24-hour average concentrations of fine particulate matter (PM₁₀) were predicted to increase by less than 0.6 µg/m³, which is not a significant increase.

Mount Albert War Memorial Reserve – Car Park site

- 7.12 18 submissions¹⁰ have been received that express concerns regarding the effects of dust discharges from the alternate Car Park site,¹¹ 17 of which are largely pro-forma submissions.

¹⁰ Rosy X Wei, Mr and Mrs PS & MI Chapman, Anvi Ved and Sharokh Bharucha, Emily and Wayne Hall, Denise Laraman, Stuart Jones, Dorina Jotti and Janet Eades, Loral France, Joy Burnett and Ian Cole, Sally Kedge and Peter Kerridge, Stephanie and Jeffrey Boyle, Gary and Katrina Stark, Bruce Colloff, Gemma Louise Henrys, Pip, Tony and Alexandra McAlwee, Robin and Anne Boyd, Mrs Innes Mellor, Melanie Sannum, Hamish and Michelle Archer, Community of Refuge Trust, Kenneth Webb and Louise Gordon, Vicki Dolon.

- 7.13 All of these 18 submissions request that sheds be erected over the shaft excavation sites to minimise dust (and noise). One submission (from Kenneth Webb and Louise Gordon) considers that the effects of works at this alternate site (including dust discharges) could make certain houses unliveable for the construction period.
- 7.14 This is also a sensitive site, due to its location in close proximity to the community centre and residential premises. However, most of the proposed works will be further from the majority of those residential premises than would works at the Reserve site and the proposed site area is smaller (3,400 m²) than that proposed for the Reserve site.
- 7.15 Construction activities and fixed structures proposed for the Car Park site are basically the same as those proposed for the Reserve site, although the site layout would be different. These would, therefore, have the same potential for discharges of odour (negligible) and dust (moderate).
- 7.16 I accept that this alternate site is much closer to houses at 3, 5 and 9 Wairere Avenue and to the Community of Refuge Trust properties at 2/9, 3/9 and 4/9 Wairere Avenue than the Reserve site. However, as with the Reserve site, I consider that dust discharges associated with the Car Park site are unlikely to have significant effects on neighbouring properties.
- 7.17 With respect to shaft excavations, once shafts are excavated to more than 2-3 metres below ground level, the potential for dust discharges from the excavations themselves is very low. Therefore, in relation to dust discharges, there is little advantage in enclosing or covering the shafts.
- 7.18 The draft Erosion and Sediment Control Plan for the Car Park site (ESCP-2.1A, Rev A) notes that the accessway and internal site road will be sealed and a wheelwash installed at the site exit. Both measures will help minimise dust discharges from the site.
- 7.19 Overall, I consider that the alternate Car Park site offers slight advantages over the Reserve site with respect to the potential effects of dust discharges, due to the reduced number of residential dwellings in the immediate proximity of the construction area.

¹¹ Refer pages 49 and 50 of the Hearing Drawing Set.

Lyon Avenue

- 7.20 The submissions from the St Lukes Garden Apartments Body Corporate and the St Lukes Gardens Apartments Progressive Society Incorporated express concerns regarding both dust and odour at the Lyon Avenue site. Specifically, the submissions express concern regarding odour effects during construction and from the proposed vent.

Odour

- 7.21 Surface structures proposed to be located at the Lyon Avenue site include a drop shaft, access shaft and an air intake. The likelihood of discharges of odour via the air intake is minimised by the operation of the main tunnel under negative pressure (discharges from wastewater vents on other parts of Watercare's network tend to occur as a result of pressure build-up or passive flow). I understand that the results of hydraulic modelling indicate that air discharges via the air intake are likely to occur about six to eight times a year on average.
- 7.22 As discussed by Mr Cantrell in his evidence, the existing overflow at Lyon Avenue operates upwards of 60 times a year. With the increased capacity provided by the main tunnel, the overflow would only operate very occasionally (approximately six to twelve times a year) – certainly at a much lower frequency than the current overflow. For that reason the odour effects experienced at this site are likely to be improved with the implementation of the Central Interceptor.

Dust

- 7.23 This is a fairly large site (3,920 m²) where active construction is anticipated to last for 12-18 months within a 3 year 'occupation' period. There are a large number of residential dwellings in close proximity to the site, as well as the retail premises to the east, so a high standard of dust control will be required, as set out in paragraph 6.9 of my evidence.
- 7.24 I agree with the submission that dust control measures should be continued throughout the entire occupation period and this is proposed to occur. During extended periods when there is no active construction occurring, all areas of exposed soil that have not been grassed or replanted are proposed to be mulched and fresh metal should be applied to unsealed access ways to minimise the potential for dust discharges.

With these measures in place, wet suppression should not be required during these periods.

- 7.25 A wheel wash is also proposed to be located at the exit from the site to Morning Star Place. I consider that these measures will be appropriate to mitigate the potential for adverse dust effects.

Haverstock Road

- 7.26 Submissions from Plant and Food Research and the Institute of Environmental Science and Research express concerns regarding odour control at the Haverstock Road site. The specific concern expressed in both submissions is that the issue of ventilation has been insufficiently addressed.

- 7.27 The ventilation design of the Central Interceptor tunnel has been described in the evidence of Mr Cantrell. As noted in **Appendix A**, the only surface structures proposed to be located at the Haverstock Road site are a drop shaft, access shaft and a direct connection of the overflow to the tunnel via a drop shaft. There is no intention or requirement to locate ventilation structures (such as air intakes or vents) at this site.

- 7.28 Although there is potential for discharges of odour from the access and drop shafts, in practice, because of the operation of the main tunnel under negative pressure, and provided covers are kept tightly closed, this is highly unlikely.

- 7.29 As noted by Mr Cantrell in his evidence, the existing overflow at this site operates upwards of 60 times a year and currently discharges directly to the Meola Creek. With the increased capacity provided by the main tunnel, although the proposed overflow will still discharge into the Meola Creek and may cause odours, it will only operate very occasionally and certainly at a much lower frequency than the current overflow. For that reason, if anything, the odour effects experienced at this site are likely to be improved with the implementation of the Central Interceptor.

May Road

- 7.30 There is one submission from Foodstuffs (Auckland) Limited ("**Foodstuffs**") in relation to the May Road site, which expresses concerns regarding construction dust and/or odour. I understand that

Foodstuffs (and its associated companies) own and operate most of the businesses to the north and east of this site.

Odour

- 7.31 Foodstuffs is concerned that odour from the operation of the Central Interceptor will potentially adversely affect the amenity currently enjoyed by the surrounding properties.
- 7.32 There are a number of surface structures to be installed at the May Road site, of which the only one with any significant potential to discharge odour is an air intake. As I have previously stated, the likelihood of discharges of odour via the air intake is minimised by the operation of the main tunnel under negative pressure. As a result, discharges to air are only likely to occur up to six - eight times a year on average, and are unlikely to cause adverse effects since wastewater flows at these times would be heavily diluted with stormwater and they are likely to coincide with good atmospheric dispersion conditions.
- 7.33 Should odour be a problem during operation then Watercare has made provision to add an ATF at this site. This would be designed to mitigate discharges of odour and would only be installed if odour problems arise. A discussion of the effectiveness of the different ATF options is set out in further detail in paragraphs 5.67 to 5.76 of my evidence. I do not consider it likely that significant odour problems will occur and, if they do, an appropriately designed and operated ATF will be sufficient to mitigate any such adverse effects.

Dust

- 7.34 Foodstuffs considers that insufficient regard has been given to measures to mitigate discharges of dust from the site. In my experience, without a reasonably detailed construction methodology, which cannot be prepared until actual construction is proposed, it is not possible to fully describe the most appropriate mitigation measures to be implemented. However, as I noted previously (refer paragraph 6.2 of my evidence), I have reviewed the available information regarding construction activities proposed to be undertaken at each site (including May Road), and recommended suitable (albeit somewhat generic) mitigation measures which, if implemented, will mitigate any potential adverse dust effects.

- 7.35 The construction site at May Road is a large site (15,000 m²) where active construction is anticipated to last for up to five years. As well as the operations of Foodstuffs and its related companies to the north and east of the site, there are a number of houses in close proximity to the west of the site, so a high standard of dust control will be required, and is described in paragraph 6.9 of my evidence.
- 7.36 In addition to those measures, a noise enclosure is proposed for spoil handling and overnight storage of spoil associated with tunnelling operations.
- 7.37 Cement and bentonite may be delivered to the site as fine powders in bulk and may be stored in bulk silos. Standard practice with handling such materials is for displaced air to be discharged via static filters to remove dust and for all handling of dry material to be fully enclosed (i.e. within enclosed pipes, enclosed screw conveyors and enclosed weigh hoppers and mixers).
- 7.38 The draft Erosion Sediment Control Plan (ESCP-6.1, Rev D) for the site indicates that a wheel wash is proposed to be located at the site end of the metalled access road to Roma Road and that the access road will be chip sealed rather than just metalled. This will minimise the potential for dust discharges from vehicle movements on the access road (which is in very close proximity to the adjacent food wholesale and distribution operations). I consider that a similar approach should be adopted if the access road is to connect directly to May Road (i.e. between 101-103 and 105-109 May Road).
- 7.39 By way of comparison, the May Road site is similar to the Pump Station 64 site used for TBM launch operations for Project Hobson, both in terms of site area and the types of operations being undertaken (although not in duration). Construction operations for Project Hobson were undertaken without significant problems due to dust discharges, despite the Pump Station 64 site being in a well-used public reserve and within 40 metres of residential dwellings.
- 7.40 Based on the currently proposed construction methodology, I consider that adverse effects of dust discharges from construction activities at the May Road site can be adequately minimised.

Keith Hay Park

- 7.41 Two submitters, Paul and Maria Puertollano and George and Maureen Whitehead have expressed concerns regarding construction dust at the Keith Hay Park site.
- 7.42 This is a moderately sized site (2,900 m²), with three smaller sites for MTBM operations, where active construction is anticipated to last for 12-18 months within a five year 'occupation' period.
- 7.43 Given the nature of operations at this site, the greatest potential for discharges of dust occurs from vehicle movements throughout the construction period, during the initial earthworks to establish the site and at the commencement of shaft excavation. There are several houses (including the submitters') in very close proximity to the site, so a very high standard of dust control will be required to minimise potential effects of dust discharges.
- 7.44 During extended periods when there is no active construction occurring, all areas of exposed soil that have not been grassed should be mulched and metal should be applied to unsealed access ways to minimise the potential for dust discharges. With these measures in place, wet suppression should not be required during these periods.
- 7.45 Specific dust control measures, which are captured in the draft Erosion and Sediment Control Plan for the site (ESCP 7.1 Rev D) include sealing the site accessway from Arundel Street, installation of a wheelwash at the site exit to the accessway and stabilisation (e.g. metalling) of the vehicle route within the site.

Kiwi Esplanade

- 7.46 Although not specifically addressed in its formal submission, I am aware that the Mangere Bridge Residents & Ratepayers Association has, through regular consultation meetings with Watercare, expressed concerns regarding potential discharges of odour via the proposed pressure relief air vent and the air intake at the Kiwi Esplanade Reserve site.

- 7.47 As I noted previously, the pressure relief air vent at this site will incorporate a small bypass to allow air to be discharged during moderate to large wet weather events (i.e. six to eight times a year on average), without activating the main vent. This bypass is proposed to be fitted with a passive carbon filter to remove odour so that during moderate to large wet weather events, the air will be treated. A passive carbon filter is considered necessary on this bypass vent because air discharged at this location has more potential to be odorous than air discharged higher up the system, due to the site's proximity to the downstream end of the main tunnel and its location downstream of the inflow from the Onehunga Branch Sewer.
- 7.48 The very large wet weather events (about twice in five years on average) that would cause the pressure relief air vent at this site to operate tend to be associated with relatively high wind speeds and good conditions for dispersion, while the wastewater itself will be heavily diluted with stormwater and have a much lower potential to generate odour. Given these factors, coupled with the proposed vent being located over 70 metres from the nearest houses (as shown on **page 126** of the Hearing Drawing Set), I do not consider that the occasional air discharges via this vent are likely to give rise to significant adverse effects on those residential areas.
- 7.49 Discharges via the pressure relief air vent are likely to be much more noticeable for people in the immediate vicinity of the vent and toilet block. However, the weather conditions that would lead to the pressure relief air vent operating (i.e. heavy rain) are also likely to mean that very few people would be making use of the toilet block or the Kiwi Esplanade Reserve at the time. Therefore, I consider that the occasional air discharges via this vent are unlikely to give rise to significant adverse effects on users of the reserve.
- 7.50 For these reasons, I also consider that an ATF to treat the occasional discharges via the pressure relief vent is not necessary or appropriate.
- 7.51 Given the operation of the main tunnel under negative pressure, the sealing of access covers, the operation of the carbon filter and the infrequency of operation of the main pressure relief air vent, I consider that odour effects at this location will be minimal.

8. RESPONSE TO COUNCIL PRE-HEARING REPORT

- 8.1 I have read the Council's Pre-hearing Report and the supporting technical memorandum prepared by Jared Osman of the Auckland Council's Natural Resources and Specialist Input unit. The overall conclusions of both assessments in relation to discharges of odour and construction dust agree with my findings and conclusions:¹²

The level of information provides a reasonable understanding of the nature and scope of the proposed activity as it relates to the relevant regional plan.

The extent and scale of any adverse effects on the environment are able to be assessed.

The assessment...does not identify any reasons to withhold consent...subject to the imposition of consent conditions, it is considered that the effects on the receiving environment are no more than minor...any adverse effects...can be effectively mitigated and avoided...

Odour

- 8.2 The Pre-hearing Report notes that that the AEE does not appear to address the potential odour effects at Kiwi Esplanade and highlights the concern of both the Mangere-Otahuhu Local Board and Council Parks Sports and Recreation ("**PSR**") about dust effects at that site.¹³ It also notes PSR's statement that measures undertaken to minimise such effects will be required prior to the grant of landowner approval.
- 8.3 I have already addressed the potential for odour effects on residents of Kiwi Esplanade in my evidence above. In relation to potential effects on users of the Kiwi Esplanade Reserve, Mr Osman notes, generally as follows:¹⁴

Although odour discharges may occur from air intakes during large wet weather events...the higher flows and the more dilute nature of the wastewater in such circumstances, along with the relatively low frequency of such events, would not result in significant adverse effects. Meteorological conditions during such (storm) events are also likely to result in effective and rapid dispersion of any odour. At worst, any odour concerns would be limited to the "first flush" which would be largely managed by the secondary ventilation facilities provided. Further...the very heavy rainfall events that are required to trigger discharges from the intake vents [sic] would also be expected to reduce foot traffic in these reserve areas with a subsequent reduction in public exposure to any odours."

¹² Auckland Council Technical Memorandum - Natural Resources and Specialise Input Unit, Jared Osman, 14 June 2013.

¹³ Council Pre-hearing Report at 9.2.8, page 80.

¹⁴ Section 4.1.1 of his memorandum, and reflected in section 9.2.8(c) of the Council Pre-hearing Report, page 81.

- 8.4 I concur with these comments and note that this would also apply to the discharges to air from the pressure relief air vent at Kiwi Esplanade Reserve.
- 8.5 The Pre-hearing Report also recognises that:
- (a) Watercare has extensive experience in managing odour and operates numerous comparable air treatment facilities and grit traps across the wastewater network, with measures in place to minimise odour effects;¹⁵ and
 - (b) it is not necessary that the exact type of ATF be specified in the consent conditions, rather, that the performance standard (in this case that there are no offensive and objectionable odours at off-site locations) is of more importance.¹⁶

Proposed Consent Conditions

- 8.6 With regard to consent conditions, I consider Watercare's Proposed Consent Conditions relating to air emissions will adequately provide for the management of any potential odour effects associated with the Project.
- 8.7 The advice note that has been proposed by the Council for Condition 7.3 to provide reasonable clarification of the intent of the condition is supported.¹⁷
- 8.8 However, I am less certain of the value in the additional requirement to notify the council of any odour complaints received within 7 working days, proposed to be inserted into Consent Condition 7.9.
- 8.9 The Council and Mr Osman have also recommended the deletion of Watercare's Proposed Consent Condition 6.9 relating to additional remedial actions. Their reasoning is that the condition weakens Conditions 7.3 and 7.8 and any consequences arising from a breach of conditions is a matter for the Council to determine. 'I do not consider that the response to frequent or multiple odour complaints is solely a matter for the Council to determine. Watercare, as the operator of the Auckland

¹⁵ Council Pre-hearing Report at page 80.

¹⁶ Council Pre-hearing Report at page 81.

¹⁷ The advice note reads: Note: the storage and transfer of wastewater within the Central Interceptor as well as scheduled maintenance activities, and any discharges into air arising from this, are considered part of the normal operation of the tunnel.

wastewater network, including the Central Interceptor, also has a key role in determining the operational response to such issues (i.e. process modifications and network upgrades, such as installing additional odour treatment). Retaining the proposed condition provides a degree of certainty, both for Watercare and for affected parties (including submitters) as to a specific approach in response to such odour complaints. However, I understand that Watercare does not oppose the deletion.

- 8.10 The Pre-hearing Report concludes that Watercare's proposed conditions relating to air quality are generally agreed to, except as discussed above, and that based on the implementation of those conditions it is considered that any adverse odour effects arising from the operation of the Central Interceptor will be no more than minor.¹⁸ I agree with this conclusion, and support the version of Watercare's Proposed Conditions attached to the evidence of Ms Petersen.

Dust

- 8.11 The Council Pre-hearing Report and Mr Osman reach the following conclusions in relation to the management of potential dust effects:¹⁹

[Mr Osman] concludes that any ... dust effects arising as a result of the construction and operation of the Central Interceptor can be adequately avoided remedied or mitigated by way of consent conditions and/or procedures in the CMP to an extent that effects on air quality arising from the proposal are no more than minor.

- 8.12 In relation to the potential effects of construction dust, Mr Osman has also considered the potential effects of blasting (which may be required for shaft excavation at a number of sites) and of dust discharges on transmission lines.
- 8.13 While I have not considered these matters directly, I concur with Mr Osman's conclusions that the effects of dust discharges from blasting can be suitably minimised by appropriate controls; and that, provided appropriate site-wide mitigation measures are in place, it is "*unlikely that any significant amount of dust from the construction sites could rise to a height that would affect the transmission lines.*"²⁰

¹⁸ Council Pre-hearing Report at page 82.

¹⁹ Council Pre-hearing Report at page 128-129.

²⁰ Cited in the Pre-hearing Report at page 130.

Proposed Consent Conditions

- 8.14 In addition to Watercare's Proposed Condition 1.7(f), requiring procedures for controlling dust to be included in any CMP, the Council, based on Mr Osman's recommendations, has proposed a number of additional conditions in relation to the control of dust. It is also proposed that dust mitigation measures be implemented in accordance with the Ministry for the Environment Good Practice Guide as previously agreed to by Watercare.
- 8.15 I consider that Proposed Condition 1.7(f) sufficiently provides for the control of dust and that the Council's proposed Conditions 1.12 to 1.19 are unnecessary and inappropriately restrictive, and should therefore be deleted. However, Watercare has agreed to accept proposed Conditions 1.12 and 1.13, set out below, as well as an additional Condition to reflect the need for mitigation to be in accordance with the Good Practice Guide as follows:
- 1.12 All processes on site shall be operated in accordance with the Construction Management Plan submitted and accepted in accordance with condition 1.7 of this consent.
- 1.12A The Consent Holder shall ensure that dust management during excavation works generally complies with the Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, MfE (2001).
- 1.13 Beyond the boundary of the site, there shall be no dust caused by discharges from the site, which in the opinion of an enforcement officer, is noxious, offensive or objectionable.
- 8.16 The Council's remaining proposed conditions in relation to dust, 1.14 to 1.19, are not accepted by Watercare. As set out above, I consider that Condition 1.7(f), as well as now 1.12, 1.12A and 1.13, are more than sufficient to ensure any potential dust effects are adequately controlled, avoided and mitigated. The remaining conditions proposed by the Council are simply not necessary.
- 8.17 It is also noted that dust related conditions are proposed to be included by the Council in the Contaminated Land Consent Conditions (see Conditions 8.28 and 8.29). These are not considered to be appropriate. As set out above, the management of dust has already been provided for in other conditions and this duplication is unnecessary and inappropriate. These proposed conditions are not supported.

Proposed Designation Conditions

- 8.18 The Council has recommended a new designation condition in relation to Transpower, which includes a requirement that the CMP include measures to appropriately manage the effects of construction activities, including dust, on the Mt Roskill substation and overhead transmission lines. The purpose behind this proposed condition is accepted. However, I agree with Watercare's suggested approach of putting these amendments in Watercare's Proposed Condition CM.2, rather than through an entirely new condition. I am confident that Watercare's amendments address the concerns of both Council and Transpower.
- 8.19 In summary, the Pre-hearing Report concludes as follows in relation to the management of dust:

In summary, the measures proposed by the applicant to control dust are considered to be appropriate, subject to the additional conditions proposed by Mr Osman, and will ensure that any dust generation effects on properties adjacent to construction areas will be no more than minor.

9. CONCLUSIONS

Odour

- 9.1 I have evaluated the potential for odour discharges from the various surface structures associated with the Project – i.e. the frequency, intensity, duration and offensiveness of those discharges – and the sensitivity of the receiving environment (location) for each of the 19 sites where surface structures are proposed to be located.
- 9.2 Key measures in the design and operation of the Central Interceptor to minimise the likelihood of odour discharges include: the operation of the main tunnel under negative pressure; the discharge of extracted air via ATFs to remove odour; and sealing of all access hatches. These measures have been successfully adopted for Project Hobson, resulting in no odour complaints since it was commissioned in 2010.
- 9.3 Although occasional odour discharges may occur via air intakes at a small number of locations during moderate to large wet weather events, I consider that these are unlikely to give rise to significant adverse effects, for two reasons:

- wastewater in the main tunnel at these times is likely to be diluted with stormwater and, therefore, less odorous than in dry weather; and
- such discharges are highly likely to occur during meteorological conditions that will give rise to effective dispersion of any odour.

- 9.4 If ongoing odour problems do occur that are associated with discharges to air from the main tunnel, provision has been made to install additional air extraction and treatment facilities to assist in maintaining the system under negative pressure during wet weather events and thereby avoiding the potential for untreated air to be discharged at the air intakes.
- 9.5 Occasional discharges of odour may also occur during the routine cleaning of grit chambers. The management controls used by Watercare appear to be effective in mitigating the effects of discharges of odour from cleaning and maintenance operations.
- 9.6 The only location where air discharges will occur during normal conditions (dry weather and slight to moderate wet weather flows) is at the Proposed Mangere Pump Station. The location of the discharge is well within the odour boundary for the Mangere WWTP, with all air discharges via an ATF.
- 9.7 I also consider that the secondary ATF proposed at the Pump Station 23 site, where air discharged during moderate to large wet weather events has most potential to be odorous, will be sufficient to avoid adverse effects as a result of discharges to air at that location, despite the proximity of the discharge point to residential properties.
- 9.8 Although most of the sites where surface structures associated with the Central Interceptor will be located are in close proximity to residential areas and other sensitive receptors, I consider that the proposed control measures will be sufficient to avoid and/or adequately mitigate adverse effects of discharges to air.
- 9.9 There are a number of locations, such as Lyon Avenue and Pump Station 23, where the operation of the Central Interceptor will reduce discharges of odour – for example, by significantly reducing the number of (potentially odorous) overflows and extracting odorous air to an ATF at the Mangere Pump Station.

- 9.10 In conclusion, I consider that any adverse effects caused by discharges to air from the operation of the Central Interceptor tunnel will only be minor. Watercare's Proposed Conditions are appropriate and should be confirmed.

Dust

- 9.11 The types of construction proposed for the Project, with the exception of tunnelling using a TBM, are similar to those required for many other projects across Auckland.
- 9.12 Tunnelling using a TBM does not itself result in dust discharges, as most of the spoil removed will be wet. In sensitive locations, spoil handling will be fully enclosed to further reduce the potential for dust discharges.
- 9.13 Similar construction projects, such as Project Hobson, have been undertaken in sensitive areas with minimal effects arising from discharges of dust.
- 9.14 Although most of the construction sites are located in close proximity to residential areas and other sensitive receptors, I consider that, through the use of appropriate dust control measures and compliance with Watercare's Proposed Conditions, adverse effects from discharges of dust from the construction of the Project will be minor or less.

Charles Alexander Kirkby

12 July 2013