Technical Report 21

AECOM – Construction Air Quality Assessment

Wellington Airport Runway Extension
Wellington Airport
19-Apr-2016
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Wellington Airport Runway Extension Air Quality Assessment

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Wellington Airport Runway Extension Air Quality Assessment

Client: Wellington Airport

ABN: N/A

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Revision	Revision Date	Details	Authorised	
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A	25-May-2015	Draft	Andrew Curtis Technical Director	Andrew Curtis
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1.0 Introduction

Wellington International Airport Limited (**WIAL**) is proposing to build a runway extension at Wellington International Airport to achieve a minimum Take Off Runway Available (**TORA**) of 2,300 m.

AECOM Consulting Services (NZ) Limited (**AECOM**) (previously URS New Zealand Limited) has been engaged to undertake an assessment of the potential effects of discharges to air associated with the construction of the runway extension in order to support an application for the consenting process for the Project.

This assessment[1] is based on the Construction Methodology Report prepared by AECOM, dated April 2016[2].

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This report contains the following sections:

Section 2 Background Information

Section 3 Proposed Activities

Section 4 Assessment Methodology

Section 5 Proposed Mitigation Measures

Section 6 Assessment of Environmental Effects

Section 8 Conclusion

Section 9 Limitations

A draft of this document along with proposed consent conditions was provided to Greater Wellington Regional Council (**GWRC**) and the public for comment. Set out in **Appendix A** is a memo which sets out AECOM's responses to the air quality comments.

[1] This assessment does not consider the air quality effects associated with transporting fill or construction materials to site on public roads, or air quality effects associated with the quarrying, extraction or manufacture of those materials

[2] AECOM Consulting Services (NZ) limited – Wellington Airport Runway Extension Construction Methodology Report –April 2016.

2.0 Background Information

2.1 Site Location

The Wellington International Airport is located on a 110-hectare site in Rongotai, within 8 km of the centre of Wellington City. The airport is largely bordered by residential areas to the east and west, Evans Bay to the north and Lyall Bay to the south.

The nearest residential dwellings relative to the proposed construction works are located approximately 200 m to the east on Moa Point Road.

The Airport is shown in **Figure 1** along with the approximate location of the construction zone.

Figure 1 Wellington International Airport Location

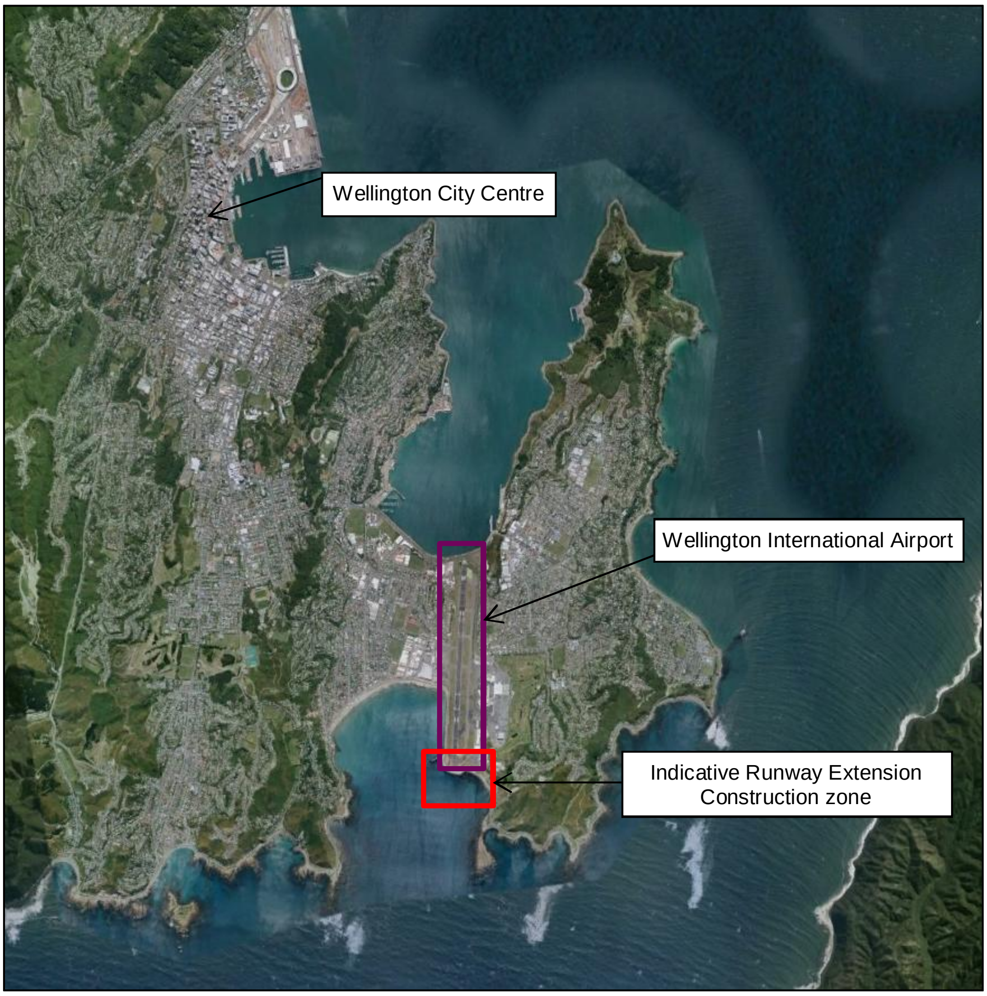


Image Source Google Earth™ 2015 DigitalGlobe

2.2 Topography

The Project is situated within a north - south oriented open valley. There is approximately 150 m difference in elevation between the valley floor and surrounding ridges. The maximum height of the ridges to the east are approximately 150 m RL, and to the west approximately 160 m RL.

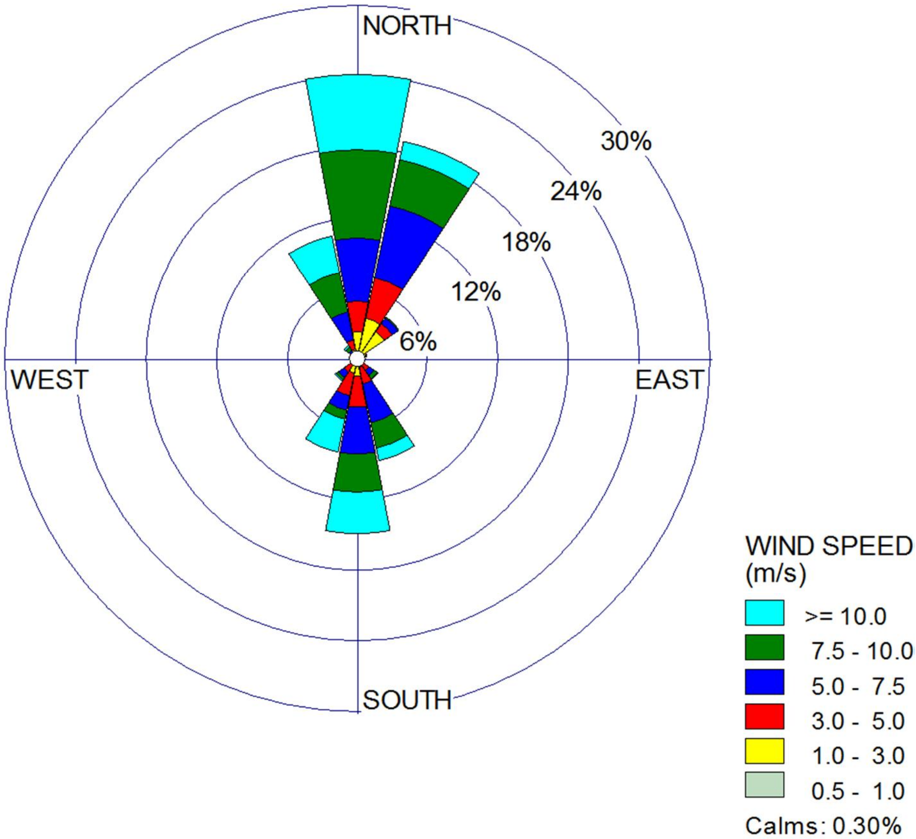
The valley has a significant effect on the local meteorology as it assists with funnelling winds in a north south direction, as shown below in **Figure 2**.

2.3 Meteorology

AECOM has reviewed local meteorological data measured by the Airport weather station to help understand the prevailing wind conditions. Data from the station, was obtained from the National Institute of Water and Atmospheric Research (**NIWA**) CliFlo data base[3], a web based system that provides access to New Zealand's national climate database.

The data from the meteorological station for the three year period, 1 January 2010 to 31 December 2012, is presented as a windrose in **Figure 2**. The windrose shows that the predominant winds are from the north, north northeast and southerly directions.

Figure 2 Wellington Airport Meteorological Data (2010 – 2012)



[3] National Institute of Water and Atmospheric Research National Climate Database

2.4 Sensitive Receptors

A sensitive receptor is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution e.g. retirement villages, aged care facilities, hospitals, schools, early childhood education centres, marae, cemeteries, residential properties other cultural facilities, and sensitive ecosystems.

Using aerial photography, AECOM determined that there are a number of residential properties, located near to the project, with the closest of these being approximately 200 m from the runway construction activities, and 30 m to the east of Moa Point beach remediation, which will not include any significant construction activities.

AECOM has selected 10 residential receptors within 850 m of the Project which are considered to be representative of the surrounding communities. These residential receptors are presented in **Table 1** and shown on **Figure 3**. The approximate extent of the reclamation is shown on Figure 3 as the blue shaded polygon. The construction zone, defined as the area within which the majority of construction activities will be undertaken, is shown on **Figure 4** as a red shaded polygon.

As well as the residential properties, there are a range of recreational activities[4] (surfing, fishing, cycling and walking) which occur close to the site (refer to the Recreation Effects Report) which have the potential to be affected by dust.

In addition to the above dust emissions also have the potential to cause damage/increased wear on aircraft engines during take-off and landing. Aircraft on approach and take-off have therefore also been considered as sensitive receptors in this assessment.

Table 1 Location of Sensitive Residential Receptors

Receptor No.	Address	Receptor Location (UTM, Zone 60)		Approximate Distance from Construction Activity (m)	Direction
		Easting (m)	Northing (m)		
R1	33 Moa Point Road	316743	5421575	200	East
R2	36 Moa Point Road	316773	5421539	220	East
R3	39 Moa Point Road	316799	5421501	250	East
R4	41 Moa Point Road	316829	5421459	280	East
R5	46 Moa Point Road	316875	5421393	330	East
R6	52 Kekerenga Street	317073	5421488	520	East
R7	48 Kekerenga Street	317037	5421572	480	East
R8	76 Raukawa Street	317213	5421824	700	Northeast
R9	66 Raukawa Street	317241	5422001	780	Northeast
R10	21 Bunker Way	317206	5422159	830	Northeast

[4] TRC Wellington International Airport Proposed Extension Assessment of Effects on Recreation

Figure 3 Sensitive Residential Receptor Locations

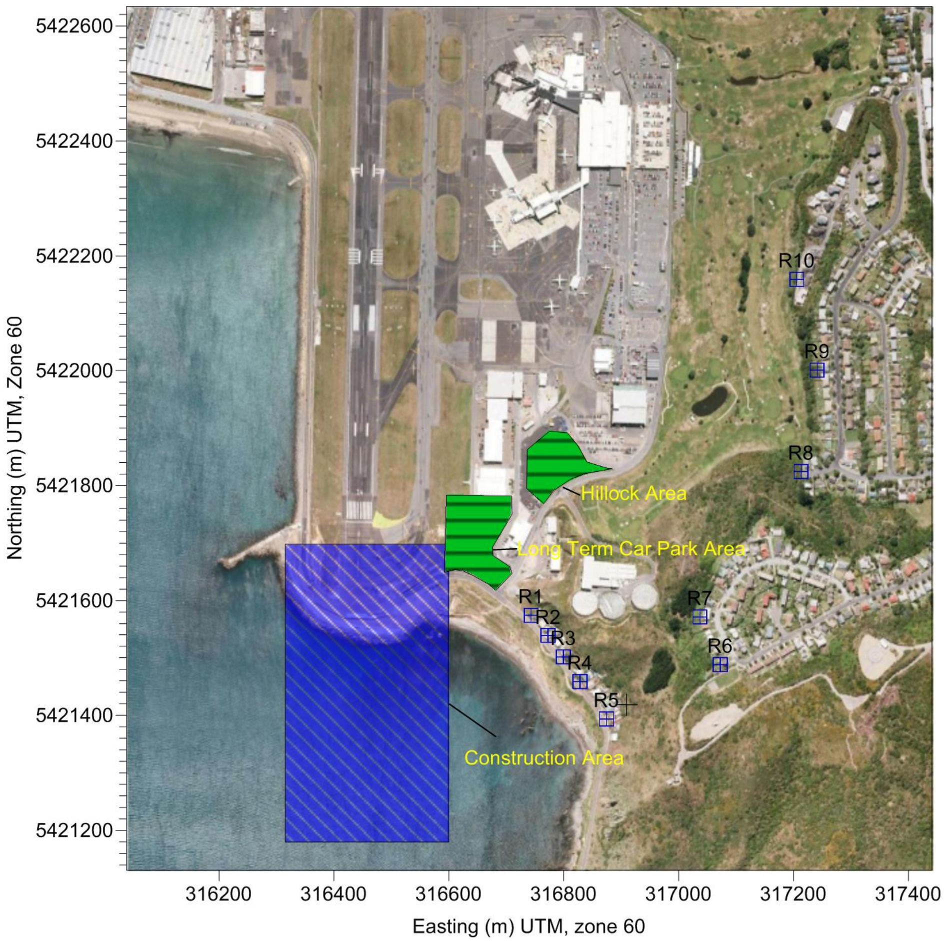


Image Source Google Earth™ 2015 DigitalGlobe

3.0 Proposed Activities

3.1 Project Overview

The Airport has a single, 1,945 m long runway, with 90 m Runway End Safety Areas (**RESA**) at each end of the runway, and is bordered by water at either end. Operational restrictions apply due to the limited area and location of the Airport relative to the surrounding high terrain and residential areas. The Airport operates with a night-time curfew for scheduled aircraft due to restrictions on aircraft noise.

Some specific aircraft types such as the Boeing 777-300ER variants and Airbus A330 are unable to land at their maximum landing weight. These restrictions limit the growth capability of WIAL. In addition, smaller aircraft such as the Boeing 737 or Airbus A320 regularly face operating restrictions due to runway length, particularly on warm, still days.

The design criteria of the extended runway is based on providing a minimum 2,300 m TORA and 90 m RESA. The longitudinal profile of the Runway for the southern extension option maintains the grade of the existing runway to the new proposed end of the runway (including the RESA).

The project consists of constructing a rock dyke around the perimeter of the runway extension and building a reclaimed land platform within the dyke. The source of fill materials for the reclamation will either be from in-water sources (dredging sites) or land-based borrow sites depending on the availability of materials.

The reclaimed land platform will undergo settlement before the runway and taxiway is built upon it. The settlement process may be accelerated by placing, then removing a surcharge fill as well as the construction of wick drains, and/or using ground improvement methods (e.g. vibro-compaction methods).

It is anticipated that the runway extension will be constructed using a combination of land and marine based plant and equipment.

As far as practicable construction works will occur during the day, however due to the potential for equipment to penetrate the Obstacle Limitation Surface (**OLS**)[5] some construction activities will be confined to the airport curfew period of between 1 am and 6 am.

The geometry of the runway/taxiway has been designed to include a new temporary taxiway connector. This feature has been included to facilitate airfield operations during construction periods when the runway may need to be temporarily shortened to facilitate construction activities.

In addition to the runway extension, the existing tunnel at the southern end of the runway will be extended with either a new separate bridging structure, or an extension of the existing tunnel.

Construction of the runway extension is expected to take between three and four years to complete.

[5] The airspace surrounding an airport that must be protected from obstacles so aircraft flying in good weather during the initial and final stages of flight, or in the vicinity of the airport, can do so safely.

3.2 Potential Air Emissions

Emissions from the project fall into two categories: particulate or dust; and combustion emissions from vehicle exhausts.

3.2.1 Dust

Particulate matter in the environment generally falls into two categories: suspended and deposited particulate.

Suspended particulate matter is dust or aerosol which stays suspended in the atmosphere for significant periods of time. Its exact definition is dependent on the monitoring procedure adopted. The term Total Suspended Particulate (**TSP**) is commonly used to describe the total amount of suspended particulate in the atmosphere at any one time.

Deposited particulate matter is dust or aerosol which because of its aerodynamic diameter and density, falls from the air. In general terms deposited particulate has a diameter of greater than about 20 µm. It is generally associated with nuisance effects such as soiling.

Suspended and deposited particulate arise from many natural and man-made sources. The most important sources globally are volcanoes and wind-blown dust, whilst on a local level, stationary and mobile combustion sources, road dust, wind-blown soil, pollen, and emissions from industrial processes are important.

3.2.2 Combustion Emissions

Combustion products are those compounds that arise as a result of combustion processes. The most common combustion products are particulate matter with an aerodynamic diameter <10 µm (PM_{10}), nitrogen oxides (**NO_x**)[6], carbon monoxide (**CO**), and sulphur dioxide (**SO_2**). NO_x and CO arise from virtually all combustion processes. SO_2 only occurs from those combustion processes where the fuel (e.g. diesel and coal) contains sulphur.

These combustion compounds are associated with a range of health and environmental effects including nitrogen oxides being involved in the formation of photochemical smog.

3.3 Potential Sources of Air Emissions

The project will have the same type of effects as any large earth moving project; that is there is the potential for dust to be generated by a number of site activities. These include:

- Initial site establishment, including construction of haul and access roads and removal of topsoil;
- Placement and compaction of fill material;
- Operation of vehicles on the access/haul roads;
- Wind erosion of working areas; and,
- Rehabilitation of completed areas.

Figure 4 presents the construction envelope which on the eastern side extends approximately 100 m from the runway extension, and encompasses an area on the foreshore where beach remediation will occur.

[6] Primarily a mixture of nitrogen oxide (NO) and nitrogen dioxide (NO_2).

3.3.1 Site Establishment

Earthworks associated with the establishment of construction offices and compounds have the potential to create fugitive dust emissions and will require mitigation measures to be undertaken to minimise dust nuisance effects.

- The area of airport land between Moa Point Road and the beach area at the southern end of the existing runway east of the existing road underpass (Beachfront Area);
- The space created between the southern end of the existing long term car parking area and the realigned Moa Point Road after the construction of the new road underpass;
- The area created by flattening a small hillock that lies between Stewart Duff Drive and Freight Drive (Hillock Area); and,
- The existing long term carpark accessed from Freight Drive.

Figure 4 Site Offies and Compounds

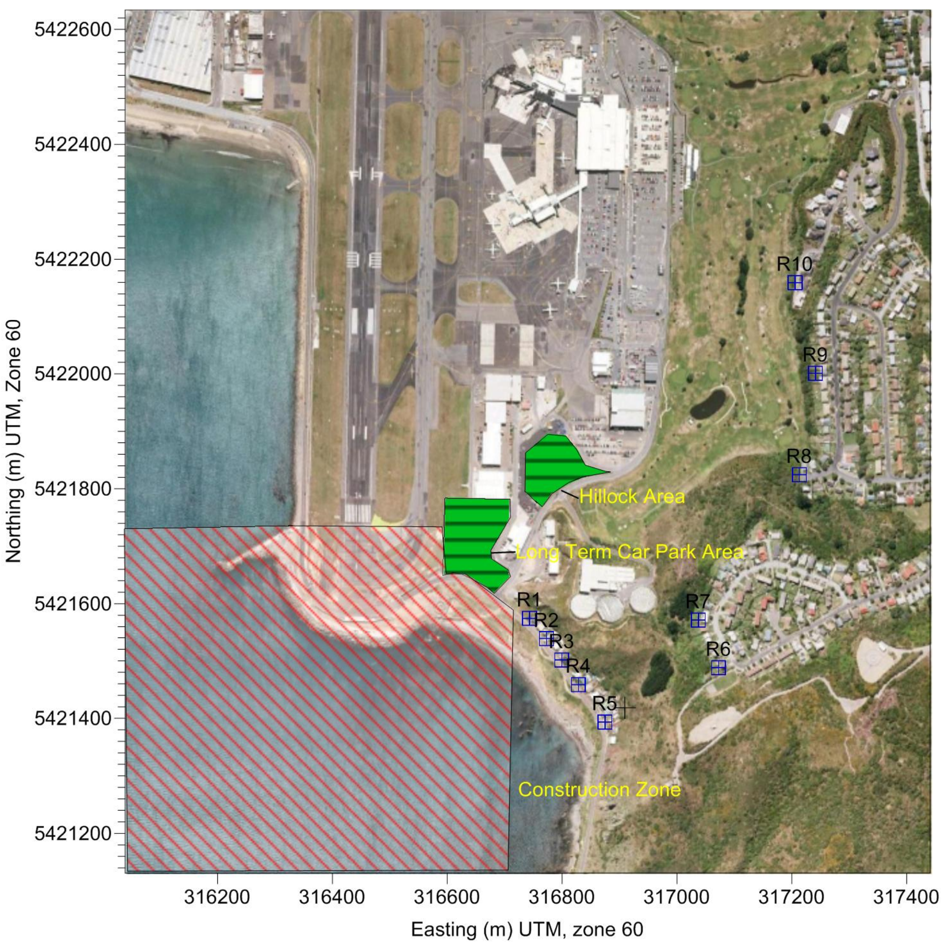


Image Source Google Earth™ 2015 DigitalGlobe

In addition to the above locations, it is proposed that a section of vacant airport land off Kingsford Smith Street / Tirangi Road to the west of the airport will be used for site offices. Given the low dust potential from this location, as it is expected to be sealed, it has been excluded as a source of dust emission from this project and not considered any further in this report.

3.3.2 Construction of Stone Columns

During the early phases of the project it may be necessary to construct stone columns under the rock dyke to improve ground conditions. This work would be undertaken using a barge fitted with a crane rig or similar. Given that the pilings are below sea level there is no potential for nuisance dust effects from this activity. There is however the potential for small quantities of combustion emissions from the barge and crane, however providing that the engines are appropriately tuned there is virtually no potential for these sources to cause any adverse effects on sensitive receivers.

3.3.3 Construction of the Rock Dyke and Armouring

The majority of the rock dyke is located below sea level and will be constructed from damp quarry run which contains a range of material including small fines (typically <10% silts) which have the potential to result in air discharges. However during the construction of the below sea level sections of the rock dyke there will be limited potential for dust emissions to occur.

The armouring will consist of a combination of large rock, selected aggregates and concrete accropodes which are unlikely to generate any significant dust emissions whilst being placed, especially as the majority of this work will be below sea level.

3.3.4 Reclamation Fill

The placement of fill material has the greatest potential to create dust emissions, especially if the material is placed dry. However given that the area behind the rock dyke is below sea level it is likely to contain sea water, therefore it is unlikely that the material will be placed dry. Once the fill is above sea level there is greater potential for dust to be generated during the placement process, particularly if land sourced material is used.

The movement of excavators and compactors over the surface of the fill also has the potential to cause dust emissions from the wheels and tracks of the vehicles. Again the greatest potential for dust emissions is when the material is dry.

There is also the potential for dust emissions associated with stockpiling construction materials and stripped top soil.

3.3.5 Haul/Access Roads

Trucks travelling on unsealed access roads or surfaces have the potential to cause dust emissions.

During the establishment of the site a sealed entranceway will be constructed allowing access from Freight Drive. During this construction process there is the potential for emissions of dust from the placement and compaction of base course as well as some potential for dust and volatile organic compounds (**VOC**) associated with the laying of bitumen to form the road.

For the purposes of this assessment it has been assumed that the majority of vehicle movements will enter the site via Stewart Duff Drive and exit via Moa Point Road and Lyall Parade during the day, and Freight Drive during the night and therefore emissions from these sources accessing or leaving the site will not have a significant effect on the residential receptors located on Moa Point Road which are all well to the east of Freight Drive.

3.3.6 Site Vehicles

There will also be engine combustion emissions associated with on-site vehicles and the trucks delivering material to the site. However providing that the mitigation measures presented in Section 5 are implemented there is limited potential for off-site effects.

4.0 Assessment Methodology

This assessment has been undertaken in accordance with MfE guidance for assessing and managing the environmental effects of dust emissions[7] (**MfE GPG Dust**).

As is common practice in New Zealand, a qualitative assessment of the potential effects associated with the construction of the Project has been undertaken. This assessment has involved reviewing the activities that are being undertaken at a particular location, and determining the potential for these activities to generate nuisance dust that might affect the local community. In determining whether there is the potential for nuisance to occur, consideration has been made of:

- The nature of the activity being undertaken;
- How long the activities are likely to occur;
- The nature of the soils or other material being or placed;
- Whether mitigation measures can be implemented to control the potential for effects (e.g. use of water carts, covering stockpiles etc);
- How close receptors are to the works;
- The nature of the receptors and their sensitivity to dust; and
- The prevailing meteorological conditions.

4.1 Total Suspended Particulate Matter and Deposited Particulate Matter

The MfE GPG Dust provides recommendations on what are acceptable levels of dust emissions. These are presented in **Table 2**. The MfE has recently undertaken a review of the GPG Dust and proposed in a draft released for comment 24 hour average guideline values which are lower than those set out in **Table 2**. Given that this draft has not been finalised and is still subject to change, the revised values have not been presented. In addition, based on AECOM's experience there are some locations where the proposed sensitive guideline value of 60 µg/m^3 is exceeded without any evidence of nuisance effects occurring. Therefore AECOM is not comfortable with supporting the lower guideline value.

That having been said the revised document has recommended moving to a rolling 24 hour average, and AECOM consider that this is appropriate, as it provides greater scrutiny of the effects of any emissions that might occur.

However as AECOM is undertaking a qualitative assessment, it is more practical to use the qualitative assessment criteria set out in Section 4.2. The values in **Table 2** have been used as the basis for developing short-term (1-hour average) trigger levels that can be used to assess the effectiveness of the mitigation measures implemented as part of this project.

Table 2 Ministry for Environment Total Suspended Particulate Guideline Values

Dust Type	Sensitivity[8]	Guideline Value (µg/m³)	Averaging Period
Total Suspended Dust	Sensitive	80	24-hours
	Moderately sensitive	100	24-hours
	Insensitive	120	24-hours

[7] MfE Good Practice Guide for Assessing and Managing the Environmental Effects of Dust emissions, September 2001
[8] A sensitive area typically has significant residential development, whereas a sparsely populated rural area may be relatively insensitive to some discharges.

4.2 Comparison with Assessment Results

The assessment criteria used in the Wellington Regional Air Quality Management Plan is that

"Any discharge shall not result in dust …, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property."

As this is an objective standard AECOM has undertaken a qualitative assessment to predict the effects from construction activities using the (Frequency, Intensity, Duration, Offensiveness and Location (**FIDOL**) assessment tool, as discussed later is this report.

The FIDOL factors are explained in greater detail below:

- Frequency; relates to how often an individual is exposed to dust. Factors determining this include the frequency that the source releases dust (including its source type, characteristics and the rate of emission of the compound or compounds); prevailing meteorological conditions; and topography.
- Intensity: is the concentration of dust at the receptor location.
- Duration: is the amount of time that a receptor is exposed to dust. Combined with frequency, this indicates the exposure to dust. The duration of dust emissions, like its frequency, is related to the source type and discharge characteristics, meteorology and location. The longer the dust detection persists in an individual location, the greater the level of complaints that may be expected.
- Offensiveness: is a subjective rating of the unpleasantness of the effects of nuisance dust. Offensiveness is related to the sensitivity of the 'receptors' to the dust emission. i.e. industrial premise may be more tolerant to dust concentrations than residential properties.
- Location: is the type of land use and the nature of human activities in the vicinity of a dust source. The same process in a different location may produce more or less dust depending on local topography and meteorological conditions. It is also important to note that in some locations certain higher dust concentrations may be more acceptable than in others.

While FIDOL assessments are typically undertaken for odour, they are also commonly used to assess dust impacts and in fact are recommended by some regulatory authorities (eg ECAN in Canterbury) for this purpose.

5.0 Proposed Mitigation Measures

This section of the report presents the mitigation measures that will be used to control the effects of discharges to air during the construction of the Project.

5.1.1 General Activities

The construction activities associated with the Project have the potential to generate significant quantities of dust if unmitigated. Therefore, it is necessary to consider the mitigation measures that will be used to control the emissions, and then make an assessment of the potential effects based on the controlled emissions.

The mitigation measures that are contained in the following sections are consistent with the current and proposed MfE GPG Dust. Ultimately these, and other measures, will form the basis of the Construction Air Management Plan for the project.

The general measures that are recommended to assist in the mitigation of air quality effects include but are not limited to the following:

- Installation of a dust monitor to ensure compliance with the dust trigger values, as set out in Section 4;
- Having a comprehensive complaints procedure; and,
- Having a community liaison person who is available to deal with any concerns or complaints.

It is also recommended that data from the Airport weather station is made available to provide wind data which can be used to assist with scheduling activities that have the potential to create significant dust emissions, and to assist in the verification of any dust nuisance complaints.

5.1.2 Earthworks

There will be considerable quantities of material placed to construct the rock dyke, armouring, reclamation platform and surcharge. The following management measures are recommended to minimise dust emissions:

- Unsealed access roads should have speed limits of 20 km/hr;
- Develop guidelines for the operation of construction vehicles in areas close to sensitive receptors;
- Develop guidelines to prevent the placement of fill material, such as sand and silts at locations close to sensitive receptors;
- Any material that is placed in temporary stockpiles that should not be disturbed for more than three months will be vegetated or covered with hydroseed or mulch as soon as practicable;
- Stockpiled material should be placed outside of the OLS as far as practicable;
- Procedures for minimising the potential for dust from fill placement;
- Watercarts should be available to control dust within the construction envelope;
- Wheel washes should be installed to prevent the transportation of material onto sealed surfaces where the material can become a source of dust emissions;
- Sealed surfaces should be regularly swept; and
- Use the monitoring set out in Section 5.2.

5.1.3 Stockpiled Material

As the Project is constructed, there could be quantities of stockpiled material located within the construction zone and compounds. The following management measures are recommended to be used to minimise dust emissions from stockpiles:

- Develop guidelines for the removal and stockpiling of topsoil during windy conditions;
- The size and height of stockpiles should be kept to a minimum;
- Using water and chemical stabilisers to control dust where practicable and appropriate through the use of sprinklers and or truck mounted water cannons;
- Stockpiled material should be placed outside of the operational flight envelope as far as practicable;
- Installation of wind breaks around large stockpiles; and
- Locate stockpiles as far as practical from sensitive receptors.

5.1.4 Construction Compounds

There are a number of construction compounds associated with the Project which are all likely to be metalled. Depending on the activity being undertaken in them, there may be the need to use water carts on occasions, or place fresh clean metal to control the potential for dust.

5.1.5 Construction Vehicles

While there are unlikely to be significant emissions associated with the construction vehicles, it is possible through the use of appropriate maintenance to minimise vehicle-related emissions. The measures that would typically be used include, but are not limited to:

- Appropriate and regular engine maintenance;
- Ensuring that tyres are inflated to the correct pressure;
- Ensuring that haulage distances are kept as small as possible;
- Ensuring that the haul and access roads are appropriately maintained; and
- Ensuring vehicles are not overloaded.

5.2 Dust Monitoring

5.2.1 General Monitoring

There are a range of simple monitoring activities that can be regularly used to ensure that dust is being appropriately controlled for this Project. These monitoring measures are regularly used at most large construction sites and are typically incorporated into site management plans, and AECOM recommends that these measures are adopted for this project..

Table 3 Visual Dust Monitoring Programme

Monitoring Activity	Frequency
Check weather forecasts for strong winds and rainfall to plan appropriate work schedule and dust management response.	Daily
Inspect land adjacent to the site, construction exits and adjoining roads for the presence of dust deposition.	Twice daily
Observe weather conditions including wind and rain via observations and data outputs from weather stations.	Daily and as conditions change
Inspect all exposed surfaces for dampness and to ensure that the exposed un-stabilised area is minimised.	Daily and as conditions change
Inspect any stockpiles to ensure that they are not subject to wind	Daily and as conditions change

Monitoring Activity	Frequency
erosions. Ensure stockpile height is less than 3 m where possible or appropriate.	
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas	Weekly

5.2.2 Instrumental Monitoring

Given that the area around the construction is considered sensitive to dust effects, it is recommended that, in addition to the monitoring measures set out in Section 5.2.1, a continuous total suspended particulate (TSP) monitor is installed to determine whether the proposed mitigation measures are effective at controlling dust emissions, and allow construction workers to quickly respond to any significant increases in ambient dust concentrations.

At this stage there is no information available on the ambient concentrations of TSP in the area, and therefore it is difficult to set exact trigger values at this stage.

AECOM therefore recommends the following trigger levels, which will be additional to the existing background TSP concentrations.

Trigger Level 1 - (120 µg/m^3 as a 1 hour average) - To identify that dust concentrations have reached a point where dust nuisance is likely to occur if action is not taken to implement mitigation measures. It would not be expected that dust concentrations would reach this level unless there are adverse weather conditions in conjunction with a failure of mitigation.

Trigger Level 2 – (150 µg/m^3 as a 1 hour average or 80 µg/m^3 as a rolling 24 hour average) - If this trigger is exceeded it indicates that dust concentrations have reached a level which is unacceptable, and dust nuisance will occur. All activities that have the potential to generate dust on site, apart from dust mitigation, must cease until such time as dust concentrations drop below Trigger Level 1.

If an investigation identifies that site activities are not responsible for the high dust concentrations, site activities may resume prior to concentrations dropping to below Trigger Level 1.

In terms of the effects on aircraft, AECOM considers that as long as TSP concentrations are kept below the trigger levels set out above then there will be no appreciable effect on engine wear, as dust concentrations below this would be in the typical range experienced during typical aircraft operation.

The monitoring will also provide feedback to construction workers as to the effectiveness of the mitigation measures employed to control dust.

In order to determine the background concentrations, AECOM recommends that the TSP monitor be installed at least three months prior to construction commencing.

5.2.2.1 Instrument Location

AECOM considers the best location for the dust monitor is to the east of the construction zone, between the beachfront area and the long term car park area. Monitoring at this location will determine whether dust concentrations at receptor locations (R1-5) and on final approach are below the relevant trigger levels. However until final design work is carried out it is not possible to be specific about the exact location as it is preferable that the monitor is not relocated during the works, and until design is complete, AECOM is unable to specify a location which meets this objective at this time, but this matter is easily conditioned.

As far as is practicable the monitor will be located in accordance with AS/NZ 3580.1.1:2007 Method for Sampling and Analysis of Ambient Air – Guide to Siting Air Monitoring Equipment; and AS 3580.14 -2011 Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications.

5.2.2.2 Instrument Type

At this stage it is not possible to be definitive about what TSP monitoring equipment will be used but some examples of the types of units that might be used are:

- Continuous particulate monitoring in accordance with United States Code of Federal Regulations, Title 40-Protection of Environment, Volume 2, Part 50, Appendix O-R Reference Method for the Determination of Coarse Particulate Matter as PM in the Atmosphere (e.g. Beta- Attenuation Monitor); and,
- Light scattering instruments with gravimetric calibration for example an E-Sampler.

5.2.3 Other Monitoring Options

There are two other dust monitoring options set out below that are sometimes used to provide additional information or allow further analysis in some situations. At this stage it is not proposed to use these techniques, but they can be used if situations arise in the future and these techniques are considered appropriate.

5.2.3.1 Time lapsed Video/Camera

This provides a method for visual monitoring of dust-producing activities over extended periods of time. It can be used to specifically identify which activities on a site are causing dust nuisance.

5.2.3.2 Dust Deposition

Dust Deposition gauges collect dust over a 30 day period, and are useful in demonstrating long term changes in dust levels.

5.3 Wind Monitoring

As part of the monitoring programme, real time meteorological data will be provided to the construction team, which will be used to trigger mitigation measures. If it is not possible to get data from the existing airport weather station, then any specific weather station would be located at the southern end of the runway, on a short (2 – 3 metre) high mast, to ensure that it does not intrude into the OLS.

5.4 Nitrogen Dioxide Monitoring

While it is considered that that effects of traffic related vehicle emissions will be negligible, AECOM consider that there is merit in undertaking some passive nitrogen dioxide monitoring. This monitoring will be undertaken using the same methodology[9] that the New Zealand Transport Agency (**NZTA**) for its ambient monitoring network. This involves using passive diffusion tubes which are exposed for a 30 day period, and then compared against the WHO guideline of 40 µg/m3.

There is already an NZTA monitoring site on the corner of Kilbirnie Crescent and Wellington Road, and it is proposed to put two additional monitoring sites along the proposed heavy traffic route, one on Onepu Road and the other on the Calabar Road section of State Highway 1. In order to determine the impacts of the traffic associated with the project, this monitoring should begin at least six months before construction commences.

[9] See Section 3 of the NZTA Ambient air quality (nitrogen dioxide) monitoring network Annual Report 2007 - 14

6.0 Assessment of Environmental Effects

This section provides an assessment of the potential emissions resulting from the Project. This assessment has conservatively been made on the basis that all of the fill material will brought into the site from a quarry or other site, as this material has the greatest potential to generate dust. If marine sediments are used, the potential for dust effects are significantly reduced as these materials are essentially wet, when placed and do not generate dust.

6.1 Dust Emissions

The most significant potential effect from the Project is nuisance associated with dust deposition. These activities are discussed in Section 3.2.

There are four main factors that are important to understand when determining whether any nuisance is caused by dust emissions from cleanfilling activities.

These are:

- Particle size;
- Particle density;
- Wind speed; and
- Wind direction.

These factors are all interrelated, and it is how they combine that determines the potential for an effect to occur.

In general, however, it is possible to make the following statements:

- Heavier and larger particles require more wind (speed) to become airborne;
- Large particles will deposit faster than small particles (of a similar density);
- More dense particles will deposit more rapidly than less dense particles (of a similar size); and
- Particles will travel further before depositing with a strong wind blowing than with a light wind blowing.

Despite this range of variables, the MfE Good Practice Guide[10] states that dust nuisance effects are generally only experienced within 300 m of **unmitigated** dust sources. The Project will employ various forms of mitigation to control dust discharges and is thus not considered to have unmitigated dust discharges.

AECOM considers that the most common type of materials that have the potential to generate dust emissions from the Project are the fine sands and silts which are likely to be associated with marine sediments if dry. Dust from land based fill material is typically denser and consequently does not travel as far. **Figure 5** depicts the distance potentially travelled by dry marine sediments for a range of wind speeds based on a particle diameter of 50 µm. This is a reasonable assumption based on AECOM's experience with dust nuisance. The release height in the figure is also typical of the height that dust is released from for a range of construction activities.

Given that the sediments would be placed wet, and essentially at ground level, this figure will overestimate the potential for effect from this source.

The wind direction has an obvious impact on the potential for a source to be affected, especially those downwind in a predominant wind direction.

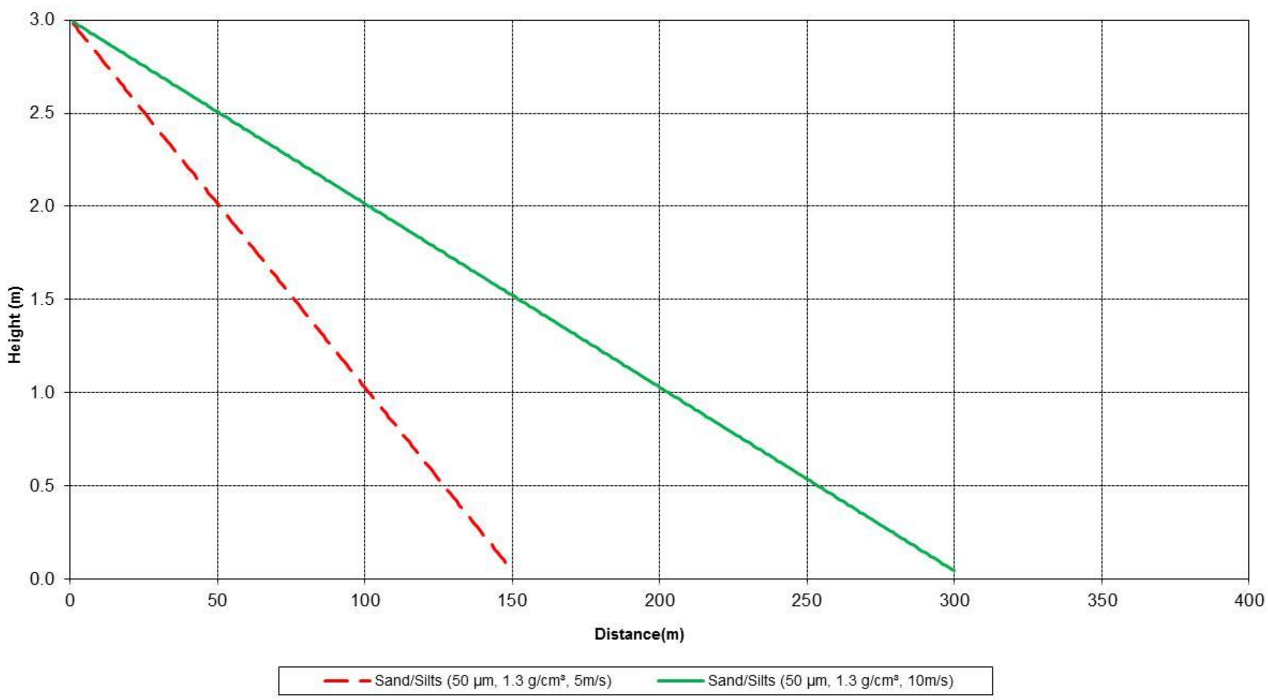
[10] MfE Good Practice Guide for Assessing and managing the environmental effects of dust emissions, September 2001.

Based on the above discussion, 300 m has been used in this assessment to conservatively indicate the distance within which some level of dust effects may be experienced if no form of mitigation is used. Properties located at least or further than 300 m from the site are unlikely to be affected by dust during any wind speed condition. Effects on properties R6-R10 have therefore not been considered any further in this assessment.

There is also the potential for effects on recreational users such as cyclists or other recreational users and aircraft if appropriate mitigation is not used.

As this Project will use the various forms of mitigation described in Section 5 to reduce and control the potential for dust emissions the distance in which effects could occur will reduce significantly. Based on the types of activities that will be undertaken and guidance provided in US EPA technical documents[11], with mitigation in place it is likely that effects will only occur within 50 m of sources that are located at ground level.

Figure 5 Difference in Particle Travel with Wind Speed



[11] AP 42, Fifth Edition, Volume I Chapter 13 Miscellaneous Sources, Section 2.4 - Aggregate Handling and Storage Piles

Figure 6 shows the area where there is the potential for dust nuisance effects from unmitigated dust emissions. This area is shown on the figure as a blue shaded polygon and extends 300 m from all potential dust sources (unmitigated) associated with this project. Given that the construction envelope extends well beyond any construction activities, apart from the beach remediation, the figure overestimates the area within which worst case dust effects might occur.

Figure 6 Area of Potential Dust Nuisance Effects from Unmitigated Dust Emissions

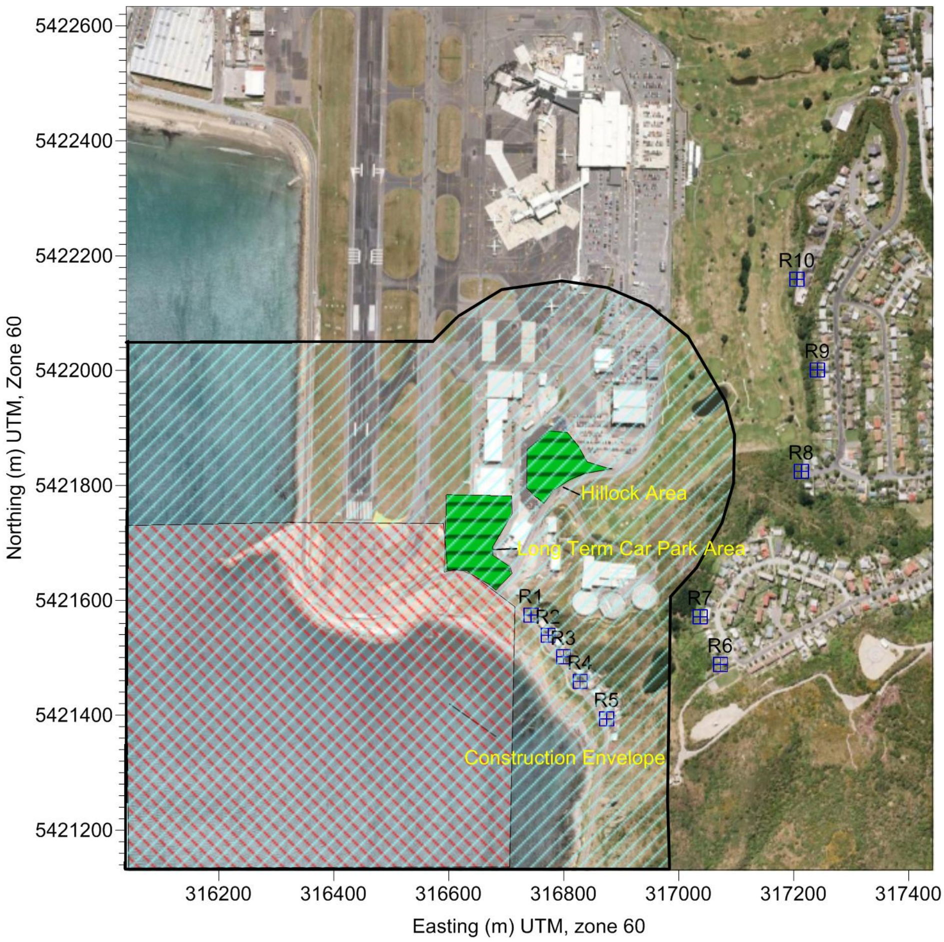


Image Source Google Earth™ 2015 DigitalGlobe

6.2 Assessment of Effects from the Project

AECOM has undertaken a FIDOL assessment, as described in Section 4.2, to assess the potential for dust nuisance effects. This assessment is presented in the following sections.

6.2.1 Frequency

Frequency relates to how often dust discharges have an effect on sensitive receptors. This is influenced by the frequency in which dust discharges occur and when suitable meteorological conditions exist. To determine the frequency, three parameters need to be established: the direction of sensitive receptors - relative to construction activities, the frequency at which the wind blows in this direction with sufficient strength that dust can be carried and the frequency of dust discharges. Based on the information contained in Section 6.1, AECOM considers that only winds above 5 m/s have the potential to cause dust nuisance effects to the nearest sensitive receptors if the mitigation measures mentioned in Section 5 are **not** implemented.

Five receptors (R1-R5) are located within the 300 m of potential dust sources, where effects could occur if no mitigation is implemented. All of these receptors are located to the east of the construction envelope at a distance of between 200 and 300 m from the nearest potential dust source.

Table 3 shows the wind speed frequency distribution measured by the Airport meteorological station. The data shows that the frequency of winds above 5 m/s from the southwest, west and northwest, which have the potential to blow dust towards the main working areas to residential receptors located to the east, is 2.4%, 0.3% and 3.6%, respectively. Winds from the north, which have the potential to blow dust from the construction compounds (Hillock Area and Long-term Carparking) towards Receptors 1-5 are expected to occur 33.6% of the time.

The frequency with which recreational users might be affected will depend where the activity is being undertaken but could be similar times to those discussed above.

Table 4 Wind speed Frequency Distribution

Direction	Wind Speed (m/s)		Total (%)
	0 - 5.0	>5.0	
North	9.5	33.6	43.0
Northeast	8.1	4.5	12.6
East	1.2	0.0	1.2
Southeast	2.7	3.6	6.3
South	7.4	18.1	25.6
Southwest	3.1	2.4	5.5
West	0.7	0.3	0.9
Northwest	1.2	3.6	4.9
Total	33.9	66.1	100.0

The frequency of dust discharges is also related to vehicle movements and the types of activities undertaken onsite. As far as practical construction works will be undertaken during day light hours,

however given the constraint of the OLS and operational requirements of the airport, some construction activities will need to be undertaken during the airport curfew period of 1 am and 6 am.

The construction of the rock dyke and armouring is expected to take approximately 14 months to complete and the construction of the reclamation platform (bulk fill) is expected to take between 5 and 18 months depending on whether marine based plant and fill can be used. As construction could be undertaken at most times throughout the day and over a period of three to four years, wind conditions will be the primary factor (other than the effectiveness of the mitigation) determining the frequency of dust emissions.

Given all of the above, AECOM considers that there is limited potential for off-site dust nuisance associated with works undertaken within the main construction envelope to occur with any significant frequency. This is based on the mitigation measures that will be implemented, distance to the nearest sensitive receptors, and the low frequency of winds that have the potential to cause dust nuisance.

In terms of emissions from unsealed areas within the construction compounds, while the frequency of winds from the north >5 m/s are relatively high at the 33.6% of the time, the potential for dust emissions from these sources is very low, especially if unsealed areas are regularly dampened using a water cart and replenished with fresh metal.

Aircraft approaching from the south and taking off from the north have the greatest potential to be affected by nuisance dust from the project as they fly directly over the construction zone, particularly as winds from the north above 5 m/s occur 33.6% of the time. When winds are from the south, aircraft taking-off would typically be expected to have climbed well above the construction area and therefore are unlikely to be affected by nuisance dust. Aircraft landing from the north during southerly winds will have completed the landing and would only move through the dust effect zone during the taxi back to the gate where engines are close to idle. They therefore are unlikely to ingest significant quantities of dust.

However AECOM recommends that dust monitoring is undertaken for the duration of the project to ensure concentrations are within normal ranges and will not cause dust nuisance effects on residences, aircraft operations or recreational users.

6.2.2 Intensity

Intensity relates to the concentration of dust that is likely to be experienced at any potential receptor. Given that the nearest residential sensitive receptors is at least 200 m from the main construction works the intensity is likely to be low to moderate and similar to existing background concentrations for the majority of the time.

It is possible that recreational parties, who are located extremely close to the works (less than 50 m) may experience more intense concentrations of dust than at the sensitive receptors, but these concentrations should be less than the trigger values set out in Section 5.

AECOM considers that any dust potential from the Project can be mitigated using the measures mentioned in Section 5, so that off-site concentrations will not cause any adverse effects. This can be monitored through the use of the dust monitor.

6.2.3 Duration

Duration relates to the length of time that dust discharges are likely to occur. In this case it is the time taken to mitigate dust discharges, should they arise. AECOM considers that at worst the duration would be limited to a period of less than 2 hours at any one time, being the time to recognise that dust

emissions are occurring and to implement mitigation. However based on the monitoring proposed, mitigation should be able to be implemented significantly quicker than this, and consequently the duration of any dust event should be short (less than 30 minutes).

6.2.4 Offensiveness

AECOM considers that dust emissions are unlikely to result in any off-site offensive or objectionable effects. This is based on the limited frequency of suitable meteorological conditions, the activities undertaken, distance to sensitive receptors and mitigation measures that will be implemented.

6.2.5 Location

Residential Receptors 1 to 5 have the greatest potential to be affected by dust discharges as they are located within 300 m of the dust generating activities. However as previously mentioned, the frequency of winds which have the potential to carry nuisance dusts from the main construction areas is low and a range of mitigation measures will be implemented. The potential for dust nuisance at these locations is therefore low.

There are also locations adjacent to the works at the end of the runway where recreational users may be present from time to time.

Aircraft approaching from the south and taking off from the north have the potential to be affected by dust emissions as they will fly directly over the construction zone.

AECOM considers that providing that the mitigation presented in this report is implemented there is limited potential for off-site effects to occur at any residential location or to aircraft.

Even with mitigation in place there is potential that some dust effects may be experienced by recreational users such as fishermen or plane spotters, who are likely to be present for longer periods of time than cyclists or walkers, and be undertaking their past time immediately adjacent to a work area. However the dust should not be at levels that give rise to nuisance effects.

6.2.6 Conclusion

Having assessed the proposed construction activities that have the potential to cause dust discharges against the FIDOL factors, AECOM considers that it is unlikely that there will be any exceedance of the MfE dust nuisance trigger values at any of the off-site sensitive receptor locations or on the airport approaches.

There is some potential for some dust effects to be experienced by recreational users if they are very close to work areas.

6.3 Vehicle Emissions

Based on the use of the mitigation measures proposed and the existing traffic volumes in the area, AECOM considers that it is extremely unlikely that there will be any measureable changes in vehicle related combustion emissions.

7.0 Conclusions

AECOM's assessment concluded that there is some potential for unmitigated air discharges from the Project to cause off-site effects, primarily at locations within 300 m of the site and on aircraft approaching and taking off from the south. However the Project will utilise a number of mitigation measures that, if appropriately implemented, will minimise dust emissions to within 50 m of the source.

AECOM recommends that dust monitoring is undertaken for the duration of the project to ensure ambient concentrations are within normal ranges and will not cause nuisance effects on residences, aircraft operations or recreational users of the area.

Providing that the mitigation measures presented in Section 5 are appropriately implemented, AECOM considers that there is limited potential for dust nuisance effects from the project.

8.0 Limitations

AECOM Consulting Services (NZ) Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Wellington International Airport Limited and only those third parties who have been authorised in writing by AECOM to rely on the report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated April 2015.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This report was prepared in April 2016 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners

Appendix A

Response to GWRC Comments

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Memorandum

To	Claire Hunter, Mike Brown	Page	1
CC			
Subject	Response to Greater Wellington Regional Council Comments on Draft Air Quality Assessment		
From	Andrew Curtis		
File/Ref No.	42041044	Date	15-Mar-2016

I have set out in this memo a response to the comments made by Greater Wellington air quality staff on the draft assessment of effects, and the draft conditions proposed by WIAL (in bold). In this memo I have indicated whether we have accepted the comments and made changes, or if not why we have not.

1.0 Comments on Assessment of Effects

Ministry for the Environment has revised the 2001 Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions. The updated version is due out in a matter of weeks. I recommend the applicant checks whether the TSP guidelines used in the application are still relevant and whether there is any other updated guidance that could inform the application.

The Ministry for the Environment revised Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions (Dust GPG) is still in draft form, and has undergone a further round of public comments, therefore it is uncertain whether the proposed values will be retained. In general the TSP values in the draft are similar but lower than those contained in the existing Dust GPG. AECOM consider that these lower values and in particular that for the High Sensitivity receiving environment will be challenging for activities to achieve in some environments. Additionally based on monitoring that we have carried out for other projects, dust concentrations can approach the trigger value without any evidence (such as complaints or evidence of dust build-up) that nuisance effects have occurred. Therefore we have not adopted the revised values in our assessment, or proposed that they are used as triggers for actions.

AECOM does agree with the suggestion in the Dust GPG that dust concentrations should be reported as rolling averages and consider that this provides more certainty to all parties that any dust events will be appropriately monitored, and action taken to control any effects. AECOM has adopted the suggested change in the trigger averaging time.

I recommend that the application consider PM10 in addition to TSP. Deposition monitoring might also be useful for quantifying nuisance effects such as soiling at local properties.

Given that this site is immediately adjacent to Cook Strait it is likely that there will be high concentrations of marine aerosols which typically comprises high concentrations of $PM_{10.}$ In addition there will be contributions in the local area from aircraft emission. In comparison to these emissions, any contribution from construction vehicles will be negligible. Consequently AECOM does not consider that there is any value in undertaking PM_{10}.

In any event the TSP concentrations measured will include any $PM_{10.}$ IIn the past dust deposition was used extensively to assess dust nuisance effects, however with the advent of affordable real time monitoring, it has become less favoured. This is primarily because of the historical nature of the dust deposition results, which are collected over 30 days, and therefore do not allow construction staff to assess the source of any effects, or proactively control any emissions.

AECOM's experience with dust deposition is also that comparison with the guideline values is not necessarily a good indicator of whether nuisance will occur, as it is generally the rate of dust deposition (fast verses slow) or the type dust (coal verses soil) which causes nuisance, rather than the total mass that deposits.

Despite these reservations AECOM has modified the Assessment to potentially allow for this type of monitoring to be used, amongst the other preferred techniques if it is considered to be of value.

AECOM

Given the long duration of the project and the uncertainty about existing levels of PM10 and TSP in the area I would recommend that the applicant consider extending the proposed pre-construction 3-month monitoring period so as to capture a wider range of meteorological conditions and/or seasonal effects.

A longer period of baseline monitoring data would help the design of robust and appropriate trigger values(both magnitude and duration) for dust nuisance (TSP) and dust health effects (PM10) arising from the contribution of construction activities. The key question is what is the background level of PM10 at sensitive receptors and what is the necessary trigger level for concentrations arising from site activities to ensure that PM10 levels at the receptors do not exceed health guidelines or a "nuisance" threshold.

It is possible that a longer period of monitoring may be undertaken, and the three months proposed is the minimum that might occur. However, if monitoring only occurs for three months, it will be undertaken during summer which is generally the time of year when the greatest potential for dust exists.

It is accepted that there is some risk with this approach as it does not allow for the triggers proposed to accommodate background, however based on our experience with the construction of the Memorial Park general background levels of TSP in Wellington are relatively low and therefore the risk that we will not be able to meet the triggers proposed is considered to be low.

As indicated earlier AECOM is not proposing to monitor for PM_{10} as any contributions from the construction works will be negligible when compared to those which occur from existing sources such as marine aerosols and aircraft emissions.

Given that PM_{10} is a subfraction of TSP, any PM_{10} that is present will be measured, and the monitoring and control measures proposed for the TSP will ensure that any PM_{10} emissions that may be emitted by the overall construction process is also minimised, as the control measures are the same.

***The applicant will need to provide details of proposed monitoring instrumentation and data acquisition system. Co-located wind speed and direction would also be useful as the Metservice station might not capture local variations. A webcam or camera that is triggered by a concentration threshold recorded by the monitoring instrument could help with source attribution. A high PM reading may be due to non-site activities or could help pinpoint reasons for high values and inform mitigation responses*.**

At this stage it is not possible to be specific about what monitoring equipment will be used as that will be controlled by the contractor. However the assessment has been updated to indicate that the type of equipment that will be used will be consistent with the guidance provided in the draft Dust GPG.

We agree that there is merit in having on-site wind monitoring equipment and typically operate this in conjunction with the dust monitor. The assessment has been updated to incorporate this.

Our experience with the use of cameras to capture dust events is somewhat mixed, as it is often difficult to get a camera angle that is not affected by sunstrike at some stage in the day. It is also of little use in identification of smaller size fractions such as PM_{10} because of the particle size. Therefore it is not proposed that this is installed, and no change is proposed to the assessment. However, it is a monitoring technique which could be incorporated into the management plan to be implemented if required in specific circumstances, and a comment to that effect has been added to the assessment.

Consideration could also be given to passive NO2 monitoring (before and after) to quantify the impact (or lack of impact) of construction vehicles (& crane etc) on air quality.

AECOM agree that there is some merit in monitoring NO_2 at a couple of locations along the traffic route but do not consider that there is any merit in monitoring near the construction location because of the exposed location and the fact that the main source in the area will be aircraft exhaust emissions. A change to the assessment has been included to deal with this.

***Marine aerosol is likely to be a significant source of PM10 in the area*.**

Agree that this will be a significant source but as indicated earlier we expect there will also be a contribution from aircraft exhaust emissions. No Action required.

There will need to be a good recording system for the visual dust monitoring programme.

A check sheet will be developed to ensure that the monitoring is undertaken correctly.

AECOM

2.0 Comments on Proposed Conditions

Construction Management

It is preferable if background monitoring has been done so that it can inform the AEE, and the consent conditions relating to monitoring location(s)/methods and trigger levels. If this is not possible then we will need to see more detail in the consent application e.g. a pre-construction baseline monitoring plan. The applicant should also provide justification of the three month monitoring period (i.e. is it going to capture conditions where background dust is expected to be highest and will this coincide with the period of the year where construction dust is expected to be highest (either due to emissions or meteorological effects).

This comment has been addressed above. Additional information has been included in the air quality assessment on the monitoring proposed.

There is a need to know baseline levels of PM/TSP before consent is granted to assess the appropriateness of the proposed trigger levels. For example it's possible that 24-hour TSP could be 80 ug/m^3 on some days – just as an existing baseline.

While it is accepted that it is possible that TSP concentrations could be high, AECOM experience from working on the Memorial Park is that this is not the case in Wellington. Therefore AECOM does not agree that baseline data is necessary before consent is granted, and if any risk exists, it is to WIAL and its construction programme as it will be required to meet the proposed condition.

While it would be possible to have a condition which provided an exemption to the limit in circumstances where ambient concentrations were high, (this would typically involve having additional monitoring equipment in place to provide upwind and downwind monitoring data) WIAL is not proposing this at this stage.

Trigger levels

The 24-hour limit of 80 ug/m^3 TSP is consistent with the 2015 draft MfE guidance for moderate sensitivity environment. The limit reduces to 60 µg/m^3 for a high sensitivity receiving environment. Residential areas are considered to be high sensitivity. The applicant will need to justify why they have used 80 and not 60. Also MfE guidance is a 24-hour rolling average not a fixed average. This needs to be clarified with applicant.

See the response in the section above. It is not considered that the limit should be reduced to 60 µg/m^3. It is agreed that a rolling 24 hr average is appropriate and change has been made in the assessment to reflect this.

The 1-hour limit of 150 ug/m^3 is the same as the 1-hour limit for PM10 in the MfE guidance. The MfE TSP figure is higher 200 ug/m^3. Applicant should explain how the proposed 1-hour trigger level of 150 ug/m^3 was derived.

The 150 µg/m^{3}1 hour limit was derived by using the power law relationship to convert the 24 hour trigger value to a 1 hour value. Essentially this meant that the 24 hour value (80 µg/m^3) was divided by a factor of 0.52, giving the 1 hour limit of 150. I am not sure what the MfE limit was derived from, but the value we are proposing is more conservative.

Good to see that they will start taking action at 120 ug/m^3.

No comment necessary.

The applicant should consider monitoring PM in more than one size fraction (eg, TSP and PM10). What instrument method is the applicant considering? Quite important to know as measurement method, just as important as trigger level as PM measurements are "method-dependent".

As indicated above it is not intended to monitor PM in more than one size faction, as the majority of any dust effects that might occur will be from the large TSP size fraction. As indicated above the smaller PM_{10} size faction will be dominated by activities (aircraft and marine aerosols) which the construction process will have no influence over, and therefore there is no point in monitoring them, unless Greater Wellington is willing to offer a dust limit that excludes these smaller particulate fractions.

As mentioned above the assessment has been modified to discuss the monitoring methodology.

AECOM

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