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Report

Transmission Gully Project - Construction Air Quality Management Plan

Prepared for the NZ Transport Agency (NZTA)

By Beca Infrastructure Ltd (Beca)

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Revision History

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on behalf of	Beca Infrastructure Ltd		

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1 Introduction

The Transmission Gully Project (the Project) involves earthworks and construction activities which have the potential to generate dust and other air contaminants. The purpose of this Construction Air Quality Management Plan (CAQMP) is to facilitate the avoidance and mitigation of any adverse effects of air discharges generated during the course of construction and to promote proactive solutions to the control of dust and other air discharges from the site. The predominant discharge to air from the site will be dust with minor amounts of odour and emissions from vehicles. This CAQMP focuses primarily on dust discharges.

The CAQMP identifies the following:

- Environmental performance standards
- The various sources of dust and other air discharges that may be created during the construction project
- Dust mitigation and prevention methods
- Monitoring methods
- Methods for managing complaints regarding dust and other air discharges and keeping records related to compliance
- Key personnel responsible for implementing the CAQMP

The CAQMP forms part of the overall suite of management plans including the Construction Environmental Management Plan (CEMP) for the Project. The purpose of the CEMP and associated management plans is to provide the framework, methods and tools for how environmental effects should be managed during construction.

This CAQMP is a draft document that will provide an overall framework for managing air quality for the Project. The CAQMP focuses on the actions that will be carried out to manage air quality for the Project once a contractor is appointed.

The CAQMP is intended to be a working document and as such the information included is expected to be regularly reviewed and revised as the construction project proceeds. Should changes to the construction methodology occur for any reason, the air quality effects should be re-assessed and the appropriate mitigation measures adopted as required.

2 Environmental Performance Standards and Specifications

2.1 Dust Performance Standards and Specifications

The CEMP has been produced to outline the framework under which the Project will manage environmental effects during construction and give effect to the conditions of the designations and resource consents.

The dust discharges from the site, described by the CAQMP, are subject to the provisions of the Resource Management Act 1991, regional and district plans and resource consents. In addition the discharges from the site must be in accordance with the environmental policy of NZTA. It is the objective of this plan that all work will be undertaken in a manner that ensures compliance with all regulatory requirements.

There are no National Environmental Standards, national air quality guidelines or regional air quality guidelines relating to ambient levels of coarse particulate and dust. However, a number of 'trigger levels' are recommended by the Ministry for the Environment (MfE) in the *"Good practice guide for assessing and managing the environmental effects of dust emissions"* (MfE Dust GPG) (MfE, 2001).

The requirements of the statutes, regulations and resource consents have a common aim which is to prevent adverse effects on the environment, including nuisance effects and effects on amenity. In order to comply with this statutory requirement discharges are to be managed and controlled to avoid offensive or objectionable emissions beyond the boundary of the property where the discharge originates.

An example of such a requirement is contained in Rule 22 of the Wellington Regional Air Quality Management Plan, which governs road construction activities as a permitted activity subject to the following condition:

"The person(s) responsible for the activity shall ensure that … there is no discharge of particulate matter, smoke, odour, gas, aerosols or vapours from the process, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property."

2.2 Triggers Levels for Dust

Dust refers to large airborne particles, typically more than 50 µm in diameter that have the potential to settle on surfaces. These larger particulates are not generally associated with adverse health effects, although may have the potential to cause nuisance effects from dust settling on surfaces if emissions are not appropriately managed and controlled. Table 2.1 outlines the trigger levels for Total Suspended Particulate (TSP) and deposited particles, recommended by the MfE (2001) and the impact of dust emissions can be assessed with regard to these limits.

Table 2.1 - MfE recommended trigger levels for deposited and suspended particulate

Dust Type	Trigger Level
Deposited Dust	4 g/m^2/30 days (above background concentration)
Total Suspended Dust (TSP)	80 $\mu g/m^3$ (24 hour average) – sensitive area 100 $\mu g/m^3$ (24 hour average) – moderate sensitivity 120 $\mu g/m^3$ (24 hour average) – insensitive area

3 Environmental Influences

3.1 Environmental Factors Influencing Dust Generation and Transport

Environmental factors in and around and areas where dust generating activities are carried out can have a significant influence on the amounts of dust generated and the distance over which it is transported in the receiving environment. Relevant environmental factors include:

- **Wind speed across surfaces:** Dust emissions from exposed surfaces generally increase with increasing wind speed. However, dust pick up by winds is only significant at wind speeds above 5 m/s (11 knots or a Beaufort Scale number of 4 – refer Appendix A). Dust pick up and transport distances increases rapidly at wind speeds above 10 m/s (20 knots).
- **Moisture content of surface material:** Moisture binds surface particles together providing resistance to wind pick-up or mechanical disturbance. Moisture content is influenced by environmental factors such as rainfall and evapo-transpiration rates.
- **The proportion of fine particles in surface material:** The smaller the particle size of the material on an exposed surface the more easily the particles are able to be picked up and entrained in the wind. Soils with higher silt content typically have the higher potential to generate more dust. Moisture content of soil is generally a more important indicator of dust potential than the silt content.

The potential influence of these factors within in the Project area is discussed in sections 3.2 and 3.3.

3.2 Meteorology

3.2.1 Wind

Wind can have a significant effect on dust generation and transportation. Given the length of the Main Alignment and the variable terrain that it traverses, local wind flows are expected to vary throughout the Project area. Wind flows may be highly localised meaning different conditions are experienced in different locations. However, in general wind speeds in the Wellington region are typically higher than average and the prevailing wind direction along the Main Alignment is expected be north-northeast, with south-southwest winds also prevalent. The higher wind speeds in the area may increase the potential to generate dust.

Meteorological monitoring has been conducted in the Linden/Tawa area by GWRC (referred to as the GWRC Tawa site). The monitoring site is located at Duncan Park approximately 550m to the west of the proposed tie-in with existing SH1 at Linden. Meteorological measurements from this location are indicative of conditions likely to be experienced in the area of the tie-in at Linden and the Kenepuru Interchange (subject to variations in local topography).

The distribution of hourly average wind speeds and directions recorded at the GWRC Tawa site for the years 2008 and 2009 is shown in Figure 1. Wind speeds greater than 5.5m/s, when there is higher potential for adverse dust effects, occur for approximately 8% of the time and blow predominantly from the north north-east. Receptors to the south-west of dust emission sources are likely to be those most affected.

It should be noted that wind flows at the Tawa site are strongly influenced by the valley location of the monitoring site. Topography will similarly have a significant effect on channelling wind flows at other locations along the route.

The GWRC Tawa site is located in an urban valley location (i.e. at low elevation and where surrounding buildings tend to reduce surface wind speeds). In more open, pastoral areas and at elevated locations (e.g. ridgelines) along the Project area, wind speeds may be higher than those recorded at the GWRC Tawa site. Therefore the frequency of winds in excess of 5.5m/s occurring in these more rural areas is likely to be higher than the 8% observed at Tawa.

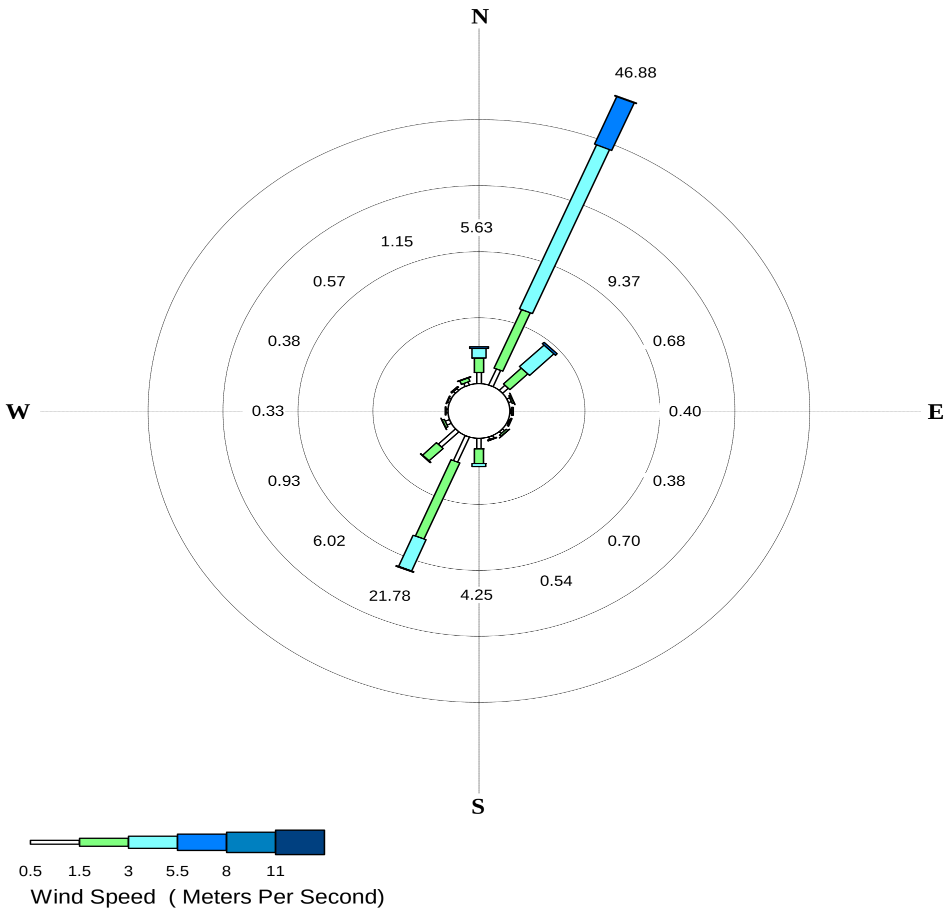

Figure 1: Wind speed and wind direction distribution at the GWRC Tawa monitoring site for 2008-2009 (1-hour average data)

3.2.2 Rainfall

As described above, rainfall increases surface moisture content and reduces the potential for dust generation.

Monthly average data for rainfall and average wet days (days of over 1 mm rainfall) as measured at Judgeford, approximately 3 km to the east of the Main Alignment at the intersection with SH58 is illustrated in Figure 2. These measurements are indicative of rainfall likely to be experienced over much of the Main Alignment.

The average annual rainfall of 1230 mm indicates that a moderate amount of rainfall can be expected over the Project area. Rainfall and the frequency of wet days in the area is increased in winter and spring months (May – October), and soil moisture content is likely to be high over these periods.

Particular attention to soil watering requirements needs to be paid over the driest period from January to April (inclusive).

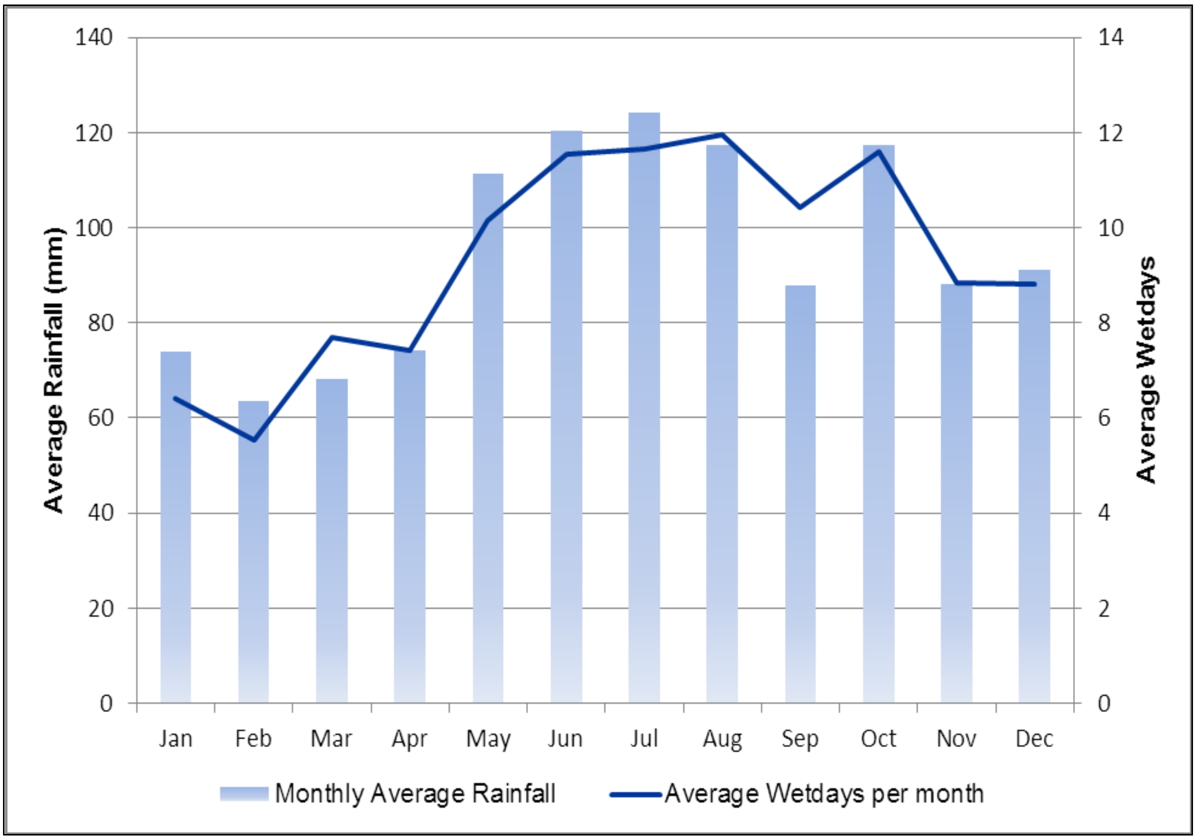

Figure 2: Monthly Average Rainfall and Wet Days (>1mm) measured at Judgeford, 1979-2010

3.3 Soil Characteristics

As described above, silt content of surface material (as an indicator of the proportion of fine particles) can influence dust generation and the distance over which dust may be transported.

Soil characteristics over the project alignment are described in the Geotechnical Assessment Report for the project.

In general, geology of the Project area, including the Linden area is predominantly composed of greywacke. As such, the particle size distribution analysis of bore hole and test pit samples indicates that silt contents likely to be encountered over much of the alignment are generally low (for instance the silt content measured in the area of the Linden on-ramp was 6%).

Despite the predominance of larger particles in surface material, extra care should be taken when fine material is encountered or where pulverisation of particles increases the proportion of fine particles in exposed surface material (e.g. along heavily trafficked unpaved roads and surfaces and where heavy machinery is operating).

4 Sensitivity of Receiving Environment

Surrounding land uses in the vicinity of the Project that are potentially sensitive to airborne dust and other air contaminants include (but are not limited to):

- Residences
- Schools and hospitals
- Rivers and creeks
- Sensitive commercial, agricultural or industrial uses
- Network utilities, including electricity substations and transmission lines

The proposed Main Alignment of 27 km in length traverses a range of receiving environments with varying land use from the tie-in with SH1 at Linden in the south to the tie-in with SH1 at MacKays Crossing in the north. The Main Alignment has been divided into nine sections for reference purposes (Figure 3). The general sensitivity of each area to dust nuisance effects is described in Table 4.1. The table also identifies the relative sensitivity of areas located near the Waitangirua Link Road and Whitby Link Road.

It should be noted that Table 4.1 does not identify streams and creeks which may be affected by dust generated by construction. The location and sensitivity of water bodies to dust deposition is discussed in the Construction Erosion and Sediment Control Plan (CESCP).

The most sensitive areas to nuisance dust effects are those located in Linden (Section 9), and near the intersection of the Waitangirua Link Road with Warspite Avenue. In both areas a comparatively high number of sensitive receptors will be located near construction activities. The Linden area is expected to be the most sensitive due to the length of the construction period in this area (up to three years), the scale of the proposed construction programme and the number of potentially affected receptors.

Initial access to the Kenepuru site office will be from Ranui Heights. Residential areas near the entrance to the access road of the site may be affected by vehicles movements. However, the existing pine plantation will be retained wherever possible and this will act as a buffer zone for dust nuisance effects. The retained plantation forest will also provide a wind break and visual shield from dust generating activities. Early in the construction phase a new site access road from SH1 will be developed. This access road will relieve pressure on the Ranui Heights entrance and reduce the potential dust effects on residents.

Other sensitive receptors include residential housing and the Pauatahanui Substation near the SH58 interchange and the Takapu Road Substation. During the initial phases of construction Bradey Road will be used to afford access to the southern abutment of Bridge 14 and for access south towards James Cook Interchange.

A number of residential properties are proposed along an extension of Endeavour Road in the Silverwood subdivision. Some of these properties may be located within 100m from the main alignment. However, the Endeavour Road extension is located along a ridge above the main alignment and these residential properties will be of a higher elevation than the main alignment. As such, although some of the proposed properties within the Silverwood subdivision are in close proximity to the main alignment, the elevation of these properties and the likely prevalent wind flows up and down the valley that the alignment follows, the transport of dust emissions from the construction activities towards the subdivisions are unlikely to be significant. The residential properties proposed in this area are therefore considered to be of medium sensitivity (refer Section 1).

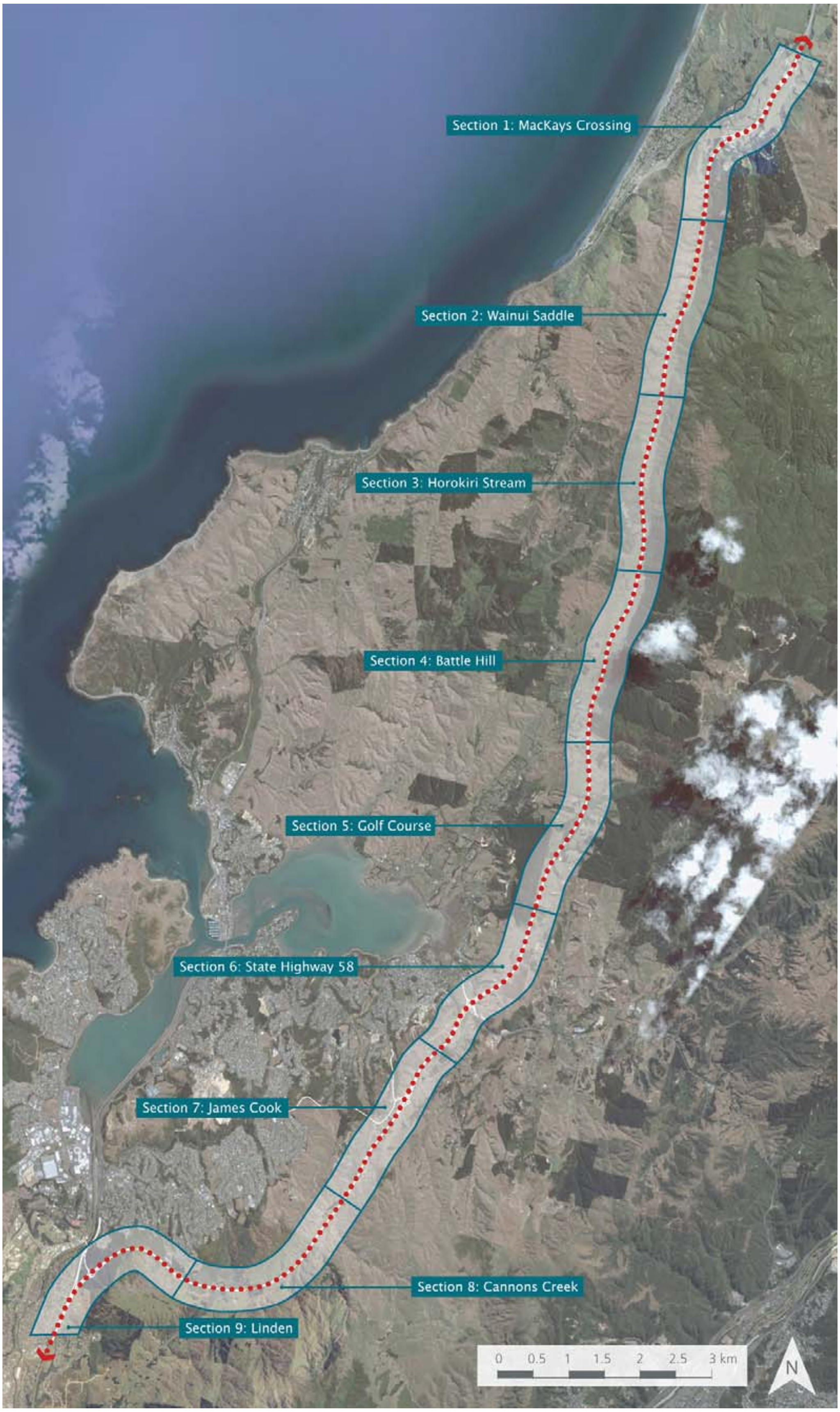

Figure 3: Location of Main Alignment Sections

Table 4.1- The general sensitivity of sections of the Main Alignment to dust nuisance effect and sensitive receptors

Location	General Sensitivity	Sensitive Receptors
All sections	Medium	Electricity transmission lines
Section 1: MacKays Crossing	Mixed	Rural residential properties located on the existing SH1
Section 2: Wainui Saddle	Low	None
Section 3: Horokiri Stream	Low	None
Sections 4 and 5: Battle Hill and Golf Course	Low	Sparsely distributed rural/residential properties on Paekakariki Hill Road and recreational users of Battle Hill Farm Forest Park and Pauatahanui Golf Course. All residential dwellings outside the proposed designation area are located more than 100m from the Main Alignment.
Section 6: State Highway 58	Mixed	Sparsely distributed rural residential properties on Bradey Road and SH58 (Paremata Haywards Road). It is proposed that Bradey Road will initially be used to afford access to the southern abutment of Bridge 14 and for access south towards James Cook Interchange. Proposed future residential properties located at the end of Endeavour Road. The Transpower Pauatahanui Substation is located within 200m of the main alignment and 100m of the connecting road to the existing SH58 Pauatahanui roundabout.
Section 7: James Cook	Mixed	Sparsely distributed rural/residential properties on Bradey Road.
Section 8: Cannons Creek	Mixed	The area is predominantly rural, although a small number of commercial properties, and a playing field located near the Main Alignment could be affected by dust. The nearest residential property is approximately 200m from the Main Alignment. The Transpower Takapu Road Substation is located within 150m of the main alignment and may potentially be affected.
Section 9: Linden Kenepuru Link Road	High	Linden Primary School and residential properties adjacent to SH1, Kenepuru Community Hospital, commercial areas located near the Kenepuru Interchange all represent areas of increased sensitivity. The residential area in Ranui Heights may also be affected by vehicle movements on the site access road.
Waitangirua Link Road	High	Maraeroa Marae, North City Apostolic Church, residential properties at and around the intersection of Warspite Avenue and Niagara Street, and some residential properties on Corinna Street.
Whitby Link Road	Medium	Existing and future residential properties on James Cook Drive, Semaphore Lane and Navigation Drive.

5 Activities and Potential Sources of Dust and Other Air Contaminants

5.1 Potential Dust Sources

The principal air quality issue in relation to road construction is the discharge of dust. Construction activities associated with the Project have the potential to generate significant quantities of dust if not properly controlled.

The discharge of dust from construction of the Project has the potential to have effects on two scales. The first is individually from a source where the effects of dust discharges are localised in the immediate area surrounding the construction area. Secondly, cumulative effects may be observed where the dust generated from all nearby dust sources combine to affect the air quality of the area.

The potential for the generation and transport of dust from construction activities is linked to two main activity factors:

- **Mechanical disturbance of exposed surfaces (e.g. through excavation or vehicle movements):** Excavation of soil provides direct mechanical disturbance and agitation of dust particles. Vehicles travelling over exposed surfaces tend to pulverise surface particles. Particles are lifted and dropped from rolling wheels and the surface. Dust is also sucked into the turbulent wake created behind moving vehicles. Dust generation by truck and machinery movements in dry conditions is a function of vehicle speed, number of wheels and vehicle size.
- **The area of exposed surface:** Wind and air movement over exposed surfaces may generate dust. The larger the area of exposed surfaces the more potential there will be for dust emissions. However, vegetated surfaces are less prone to wind erosion than bare surfaces.

Potential sources of dust which are liable to cause nuisance beyond the site boundary during adverse conditions if adequate controls and mitigation measures are not adopted are:

- Dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions
- Excavation and disturbance of dry materials
- Loading and unloading of dusty materials to and from trucks
- Stockpiling of materials including material placement and removal

In addition, the following activities will be undertaken in specific locations:

- Construction of sediment control ponds
- Contractor yards
- Concrete batching and rock crushing
- Bridge construction
- Deep excavation

5.2 General Methods of Dust Control

Dust control methods are generally associated with either reducing the potential for dust generation and transport associated with the activity factors described in section 5.1 or augmenting the environmental factors described in section 3.1 that may reduce dust generation and transport potential.

General measures that may be employed to control dust from construction activities include:

- **Limiting wind speed across exposed surfaces**: The use of windbreaks, vegetation, surface stabilisation or existing topographical features can all reduce surface wind speeds and the dust generation that may result. Limits on vehicle speeds also reduce surface wind speeds.
- **Limiting disturbance of soil or dusty materials**: Design of earthworks to minimise cut and fill volumes reduces dust emissions. Reduction in vehicle movements and speeds and the use of lighter vehicles will also reduce disturbance and dust generation.
- **Limiting area of soil exposure:** Staging of works and minimisation of soil exposure in works areas will reduce the potential for wind erosion.
- **Stabilisation of completed earthworks areas:** Rapid stabilisation upon completion of works or of unused stockpiles and spoil areas will reduce the area of soil exposure. Temporary stabilisation of unpaved roading surfaces or yard areas through the use of dust suppressants can also provide an alternative to wet suppression as a dust control method.
- **Maintenance of surface moisture content:** Watering or wet suppression is used to maintain dry or dusty exposed areas. Watering of exposed surfaces and materials that may be disturbed is a primary method of control. Water should be applied at a rate that maintains exposed surfaces in damp condition but so that no pooling or run-off of water occurs. The MfE Dust GPG states that the typical water requirements for dust suppression in most parts of New Zealand are up to 1 $l/m^2/h$ (1mm/h) [1]. However, experience from other large-scale earthworks projects indicates that actual water requirements for dust control might range upwards from 0.5 mm/h. The NZTA Draft Erosion and Sediment Control Field Guide for Contractors[2] indicate that the minimum watering rate for dust control should be 5 mm/day. Watering of surfaces is most effective when the water is applied prior to strong winds occurring and prior to particularly dusty activities commencing (which therefore requires that weather forecasts are checked on a daily basis).
- **Abatement of dust from point sources:** Although most construction dust sources are diffuse in nature, some construction activities (such as the discharge of cement dust from storage silos), are point discharges that may be controlled or abated through filtration or other methods.

Specific dust control measures are identified for the construction phase of the Project in section 1.

5.3 Discharges of Other Air Contaminants

In addition to dust generating activities, other emission sources associated with the construction phases of the Project will have the potential to impact on air quality. These emissions sources include:

- Exhaust emissions from construction vehicles
- Odours/gases released during the disturbance of organic or contaminated materials or during sealing of roads

Specific measures to control emissions from these sources are identified for the construction phase of the Project in sections 7.5 and 7.6.

[1] Section 8.2 of the “Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions”, Ministry for the Environment, 2001.

[2] Section 4.1.7.4 of the “Draft Erosion and Sediment Control Field Guide for Contractors”, NZ Transport Agency. 2010.

6 Risk of Air Quality Impacts

6.1 Spatial Classification of Risk

For the purposes of tailoring the proposed methods of emission control the project area has been divided and classified into three broad categories specifying the level of risk that project activities have of causing adverse effects in each area.

The three risk categories of high, medium and low dust risk have been determined based on the sensitivity of the receiving environment (as discussed in section 1) and also the influence of the environmental factors discussed in section 3.

6.2 High Risk Areas

High Risk Areas occur in close proximity to where air emissions may have the greatest impact (or where exposure or handling of contaminated soil material may lead to additional adverse environmental impacts). The greatest attention must be paid to controlling or preventing dust emissions in these areas.

High Risk Areas have been defined as any area where dust generating activities are to be undertaken in any of the following conditions:

- Within 100m of a residential area, dwelling or a sensitive receptor such as those listed in Table 4.1; or
- Where the potential for adverse dust impacts has otherwise been identified though inspection, monitoring or complaint investigation

6.3 Medium Risk Areas

Medium Risk Areas occur where highly sensitive areas are located close to construction areas where dust may be generated infrequently or where construction activities are located in close proximity to areas of moderate sensitivity. The moderate sensitivity of these areas and/or the proximity of these areas of high sensitivity mean that dust control measures need to be robustly implemented but that measures need not be as stringent as those required in High Risk Areas.

Medium Risk Areas have been defined as any area where dust generating activities are to be undertaken in any of the following conditions:

- Within 250 m of a residential area; or
- Within 100 m of non-residential urban areas, electricity transmission lines or any watercourse

6.4 Remaining Areas (Low Risk)

In the remaining areas, over the majority of the Project area, the sensitivity of the receiving environment is relatively low (made up generally of pasture or forest). Given the reduced sensitivity and risk of adverse effects due to dust emissions, lower levels of dust control are appropriate in these areas.

Notwithstanding the reduced sensitivity and risk in these areas, care should be taken to control and minimise dust emissions in these areas.

6.5 Contaminated Soil

A Stage 1 and 2 land contamination investigation was conducted for the Transmission Gully Highway Project. A report of findings was prepared, along with a Contaminated Soil Management Plan (CSMP). Areas with contamination present above risk-based guideline values, as well as any potentially contaminated areas identified during construction works, should be addressed in accordance with the CSMP. Additional dust control measures should be put in place as appropriate when contaminated soil is disturbed so that dust does not adversely impact neighbouring properties.

The investigation showed that the Porirua Gun Club had lead and polycyclic aromatic hydrocarbons levels above human health risk-based guideline values in the upper 0.3m of soil across much of the site. Therefore, soil should be adequate wetted and dust controlled during any removal of the contaminated soil. Several sites also had contaminants present above ecological risk-based guideline values, typically in the upper 0.3m of soil. It is likely that this upper layer of soil will be removed; dust control measures should take potential contamination into consideration and precautions put in place to assure that contaminants are not discharged from the site. Once the contaminated soil is removed, standard construction dust control measures should be applied.

7 Mitigation and Control Measures and Procedures

7.1 Control of Dust Emissions

The scale of dust prevention methods required in a particular area will be dependent on the degree of risk that the dust would cause adverse effects on the surrounding area. The dust control methods for the various degrees of risk are described below.

7.2 Methods of Dust Control – All Areas

The dust prevention methods outlined in Table 7.1 are applicable to all areas of the Project. The list is not exhaustive and additional methods may be found to be effective.

Note that all methods of control for concrete batching or rock crushing activities are to be utilised regardless of the dust risk at that location.

Table 7.1 - Potential dust sources and controls methods

Source of dust	Control
Vehicle movements on unsealed surfaces (including roads and yard areas)	▪ Cover unsealed roading surfaces with hardfill material where practicable ▪ Compact all unconsolidated roading surfaces where practical ▪ Regularly maintain unsealed roads by grading and the laying of fresh gravel ▪ Install and operate wheel wash equipment to remove mud and soil from vehicles exiting the site from unpaved surfaces
Vehicle movements on sealed surfaces	▪ Clear all spillages on sealed roading surfaces as soon as is practicable ▪ Regularly clean sealed surfaces. The use of dry rotary brushes is expressly prohibited except where their use is preceded or accompanied by sufficient wetting to limit the dust emissions. The use of blower devices is expressly prohibited
Earthmoving, excavation and construction	▪ Limit the area of soil exposed by earthworks at any one time as far as practicable ▪ Limit the extent of earthworks carried out during dry, windy conditions as far as practicable. Particularly adjacent to sensitive receptors ▪ Retain as much vegetation as is practicable ▪ Stabilise exposed areas not required for construction, access or for parking and completed fill and spoil areas as soon as practicable. Stabilisation methods may include metalling, grassing, mulching or the establishment of vegetative cover in accordance with the Erosion and Sediment Control Plan

Source of dust	Control
Loading, unloading and transport of dusty materials	■ Minimise travel distances through appropriate site layout and design ■ Limit load sizes to avoid spillages ■ Cover loads of fine materials and loads of soil to be transported off-site ■ Inspect uncovered loads before leaving the site to avoid spillage or dust generation ■ Minimise mud and dust being tracked out from unsealed areas to sealed areas by using wheel cleaning facilities at site exits to sealed roads
Stockpiling	■ Limit drop heights when loading or stockpiling materials ■ Limit the height and slope of stockpiles to reduce wind entrainment. Stockpiles exceeding 3 m in height have a higher risk of discharging dust ■ Locate and orientate stockpiles to maximise wind sheltering as much as possible ■ Vegetate, stabilise, cover or enclose stockpiles of soil material that are to be left undisturbed for more than three months
Concrete batching and rock crushing	■ Locate concrete batching and rock crushing plants in areas as far as practicable from sensitive receptors ■ Install and maintain windbreak fences around plants ■ Minimise drop heights into hoppers and loading chutes ■ Utilise sprinklers or water sprays on rock crushing and aggregate handling hoppers, conveyors and at other transfer points ■ Vent pneumatic conveyer systems for cement transfer to suitable filtration equipment ■ Fully enclose cement silos and fit with suitable filters and high fill alarms ■ Fully enclose mixing drums or truck mixer fill points and extract air to suitable filtration equipment ■ Bunker or cover stockpiles of fine materials

7.3 Further Methods of Dust Control – Medium and High Risk Areas

Medium risk areas require a greater level of dust control and attention to dust suppression. The methods outlined in Table 7.2 should be implemented in addition to the methods outlined in Table 7.1 in any areas presenting a medium dust risk.

As above this list is not exhaustive and other methods may also be employed to control dust.

Table 7.2 - Potential dust sources and controls methods for medium risk areas

Source of dust	Control
Vehicle movements on unsealed surfaces	▪ Limit vehicle speeds on unsealed surfaces ▪ If winds are predicted in excess of 8m/s (16 knots or Beaufort Scale factor 5), maintain unsealed road surfaces in regular use in damp condition through surface watering (e.g. with water carts or fixed irrigation) ▪ Where a suitable water supply is not available for surface watering, synthetic dust suppressants may be used as an alternative. The use of recycled oil-based suppressants is expressly prohibited
Loading, unloading and transport of dusty materials	▪ Limit loading or unloading during windy conditions that cause dust to be emitted beyond the site boundary ▪ Limit vehicle speeds on unsealed surfaces
Stockpiling	▪ Bunker or cover stockpiles of fine, dry materials

7.4 Further Methods of Dust Control –High Risk Areas

The greatest attention to dust control should be paid in high risk areas and this is reflected in the further control measures outlined in Table 7.3. These methods should be employed in addition to the measures outlined in Table 7.1 and Table 7.2 in areas identified as posing a high dust risk.

As above this list is not exhaustive and other methods may also be employed to control dust.

Table 7.3 - Potential dust sources and controls methods for high risk areas

Source of dust	Control
Vehicle movements on unsealed surfaces	▪ Maintain unsealed road surfaces in regular use in damp condition through surface watering in all wind conditions
Earthmoving, excavation and construction	▪ Maintain surfaces of active earthworks areas in damp condition. This should include pre-watering of earthworks surfaces, prior to excavation allowing enough time for moisture to penetrate the soil ▪ Utilise windbreak fences around earthworks areas and stockpiles where practicable
Stockpiling	▪ Maintain active stockpiles in damp condition with regular watering. ▪ Dampen inactive stockpiles if they are producing visible dust emissions ▪ Utilise windbreak fences to protect stockpiles where practicable.

7.5 Control of Odour Emissions

Construction activities are unlikely to generate odour except where land contaminated with organic or chemical wastes (e.g. closed landfills) are to be disturbed.

Where odorous material is disturbed the following measures should be implemented:

- Cessation of disturbance of odorous material until material is identified and removed
- Temporary covering or enclosure of material prior to removal
- Management of material removal to facilitate rapid removal to an appropriate disposal facility with minimal discharge of odour during handling and transport
- Use of chemical odour suppressants in High Risk Areas

7.6 Control of Vehicle Exhaust Emissions

Poorly maintained vehicle engines discharge many times the amount of air pollutants than well maintained engines unnecessary idling of vehicle engines while parked can also cause significant local effects. As a consequence, the following key actions should be carried out to minimise emissions:

- All construction machinery used on the site must be maintained in accordance with manufacturers' requirements, as a minimum
- Where excessive exhaust smoke is identified from any construction vehicle or machinery, that vehicle should be serviced as soon as is practicable and taken out of use until such maintenance has been completed
- Construction vehicles must not be left idling while parked or unattended for extended periods. Switch off engines when not in use

8 Monitoring Requirements

8.1 Dust Monitoring

The overall approach to dust control is based on a primary reliance on visual monitoring in combination with good management of the construction areas and a rapid response to any complaints received. Good practice focusing on pre-emptive measures will aid in the avoidance of significant dust emissions, or in the case of dust emissions, the subsequent mitigation or remediation of any adverse effects.

8.2 Visual Inspection and Monitoring Methods

General visual monitoring of all construction areas should be undertaken on a daily basis or potentially more frequently, if conditions change. This type of monitoring relates to the control measures described in Section 1 and should include pre-emptive measures to avoid dust emissions. Table 8.1 below describes the monitoring programme.

Table 8.1 – Visual Dust Monitoring Programme

Monitoring Activities	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 surface exposure is minimised.	Daily and as conditions change
Inspect stockpiles to ensure enclosure, covering, stabilisation or dampness. Ensure stockpile height is less than 3 m where possible or appropriately stabilised.	Daily and as conditions change
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
Monitor dust generating activities and water application rate.	In winds over 5.5 m/s (11 knots of Beaufort Scale number of 3 (see Appendix A))
Inspect wheel wash equipment to ensure effective operation.	Weekly

8.3 Monitoring of Concrete Batching and Crushing Plants

Rock crushing will take place at various places along the alignment, depending on what type of material is being excavated. However, it will be restricted to sections of the Main Alignment which are predominantly rural and well separated from houses. No rock crushing is proposed within the Linden section of the Project, which is the area of greatest urban density.

To avoid any unnecessary dust emissions from concrete batching and rock crushing activities more specific monitoring will be required including:

- Monitoring of hoses and connections between tankers and silos during the unloading of bulk cement
- Seating of pressure relief valves checked at least once each week and whenever they are operated
- Operation of high fill alarms checked at least once every six months as part of routine maintenance of the batching plant
- Filter units fitted to silos, cement weigh hoppers and mixer drums inspected at least once a month, in accordance with manufacturer's instructions. Replace filter media at least annually.
- Operation of water sprays checked at least daily

The yard areas surrounding the concrete batching plant will be a high traffic area. Hence it will be important to control the dust from the yard using the methods outlined in sections 5 and 7. In addition, wind break fences around the plant could be implemented to control dust should additional measures be required.

8.4 Instrumental Monitoring

Real-time, continuous monitoring of Total Suspended Particulate (TSP) concentrations in High Risk Areas will provide a further measure to assess the adequacy of dust control measures on an on-going basis.

The area identified as having the greatest potential for dust to cause adverse effects is at Linden (Section 9) due to the proximity of residential areas to the construction area and high density of proximate sensitive receptors, the scheduled construction period in this area (up to three years), and the scale of the proposed excavation and construction activities.

Instrumental monitoring for the project should include:

- Simultaneous instrumental monitoring at up to two sensitive locations chosen on the basis of prevailing wind conditions and the expected areas of greatest impact
- Continuous monitoring of TSP concentrations. Calculation of 10 minute, 1 hour and 24 hour average concentrations from real-time monitoring data
- Continuous monitoring of meteorological parameters (including wind direction, wind speed and temperature) in close proximity to TSP monitors. Calculation of 1 minute, 10 minute, 1 hour and 24 hour averages from real-time monitoring data
- The use of mobile monitoring equipment to allow relocation within the project area, as construction progresses or as areas of high risk and potential impact are identified
- Remote display of real-time TSP and meteorological data (e.g. via internet)
- Provision for alarms on 24-hour and 1-hour concentration and wind measurements (visual and/or via internet, email and mobile phone)
- Recording/logging of monitoring data

- Location of monitors 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 2923:1987 Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications, as far as is practicable

Examples of continuous TSP monitors that could be employed include:

- 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 (eg. Beta-Attenuation Monitor)
- Optical analysis methods with gravimetric calibration (eg. E-Sampler)

The existing meteorological station located at the Greater Wellington Regional Council (GWRC) Tawa ambient air monitoring site may suffice, as the wind fields recorded at this site are likely to be representative of most locations within the Tawa Valley including the southern tie-in at Linden and the Kenepuru Link Road.

8.5 Monitoring of Vehicle Exhaust Emissions

The following monitoring requirements will apply to all construction vehicles used on the Project:

- Daily visual inspection to ensure no visible emissions from vehicles
- Monthly check of vehicle logs to ensure that servicing and maintenance checks of vehicles are undertaken when they are due and any additional maintenance that has been required has been carried out

9 Complaint and Incident Procedures

Complaints may be referred by one or more of the regulatory authorities, a member of the public or a member of the construction team. Procedure details for managing public enquires and complaints are described in the CEMP.

It is the responsibility of the contractor to respond to and follow up all complaints regarding dust. The contractor is responsible for ensuring that suitably qualified personnel are available to respond to complaints at all times.

Actions to be taken as soon as possible by the contractor:

- Fill out a complaint form (refer Appendix D of the CEMP)
- Note the time, date, identity and contact details of complainant. Wind direction and strength and weather conditions are to be recorded. Note if the complaint has been referred from a consent authority. Ask complainant to describe the dust emission; is it constant or intermittent, how long has it been going on for, is it worse at any time of day, does it come from an identifiable source.
- As soon as possible after receipt of a complaint undertake a site inspection. Note all dust producing activities taking place and the dust mitigation methods that are being used. If the complaint was related to an event in the recent past, note any dust producing activities that were underway at that time, if possible. Order any remedial action necessary.
- As soon as possible visit the area from where the complaint originated to ascertain if dust is still a problem
- If it becomes apparent that there may be a source of dust other than the construction project causing the dust nuisance it is important to verify this. Photograph the source and emissions.
- As soon as possible after the initial investigations have been completed contact the complainant to explain any problems found and remedial actions taken. Initiate a dust damage assessment if required.
- If necessary update any relevant procedures to prevent any recurrence of problems
- Complete a complaint form and file on the complaint register

Follow up actions:

- Advise the project management and regulatory authority as soon as practical that a complaint has been received and what the findings of the investigation were and any remedial actions taken
- Advise staff and contractors that a complaint has been received and what the findings of the investigation were and any remedial actions taken

10 Training

As detailed in the CEMP, all new staff are required to go through an induction training session when they commence work and then regular (annual as a minimum) refresher courses.

Environmental induction will include information on the following aspects of this Plan:

- Information about the construction activities and the operation of the concrete batching and rock crushing activities which may cause dust, stormwater and noise impacts within the construction area
- Consent requirements and other requirements relating to the construction activities and the operation of the concrete batching and rock crushing plants
- Complaints management procedures
- Mitigation measures and monitoring undertaken related to controlling and responding to dust emissions from the site
- Dust, stormwater, and noise monitoring and management procedures
- Related environmental sub plans and relevant parts of the CEMP

11 Responsibilities

The CEMP details the roles and responsibilities associated with the construction of the Project.

The Environmental Manager has the responsibility for supporting the implementation of all required monitoring and mitigation associated with the construction activities and the operating of the concrete batching and rock crushing plants. The Environmental Manager should also lead the review of results with appropriate communication of issues to the Project Management Team and the NZTA. The Site Manager and nominated personnel will implement the requirements of the CAQMP and ensure all personnel are appropriately trained and aware of the requirements of the CAQMP.

All personnel working on the Project, including contractor employees and subcontractors are responsible for following the requirements of the CAQMP.

12 Consultation

The NZTA will consult with neighbours within 100m of construction activities to inform them of any issues regarding dust control at the site that may be of interest to the community. The NZTA should supply community groups with contact numbers to be used in the case of a complaint. The NZTA should also maintain regular contact with relevant Councils to ensure compliance with conditions and to address any dust control issues which may arise over the course of the Project.

13 CAQMP Review Procedure

The CAQMP is intended to be a living document that shall be reviewed regularly for the duration of the Project.

14 References

Aurecon, 2011. “Contaminated Soil Management Plan: Transmission Gully”.

Beca Infrastructure Ltd. 2011. ”Transmission Gully Air Quality Assessment – Technical Report 17”.

Greater London Authority/London Councils. 2006. “The control of dust and emissions from construction and demolition - Best Practice Guidance”.

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

NZ Transport Agency. 2010. “Draft Erosion and Sediment Control Field Guide for Contractors”.

NZ Transport Agency. 2010. “Work Package 12: Water Quality Measurement, Modelling Assessment and Mitigation Design - Construction Erosion and Sediment Control. Draft v. 2.

Opus International Consultants. “Geotechnical Assessment Report. Transmission Gully 233PN” 2010.

Appendix A

Beaufort Wind Scale

Appendix A: Beaufort Wind Scale

Beaufort scale	Wind speed			Label	Observations on land
	m/s	Knots	km/h		
0	0 - 0.2	1	1	Calm	Calm. Smoke rises vertically.
1	0.3-1.5	1-3	1-5	Light Air	Wind motion visible in smoke.
2	1.6-3.3	4-6	6-11	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	3.4-5.4	7-10	12-19	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	5.5-7.9	11-15	20-28	Moderate Breeze	Dust and loose paper raised. Small branches begin to move.
5	8.0-10.7	16-21	29-38	Fresh Breeze	Branches of a moderate size move. Small trees begin to sway.
6	10.8-13.8	22-27	39-49	Strong Breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	13.9-17.1	28-33	50-61	Near Gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	17.2-20.7	34-40	62-74	Gale	Twigs broken from trees. Cars veer on road.
9	20.8-24.4	41-47	75-88	Severe Gale	Larger branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	24.5-28.4	48-55	89-102	Storm	Trees are broken off or uprooted, saplings bent and deformed, poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	28.5-32.6	56-63	103-117	Violent Storm	Widespread vegetation damage. More damage to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	32.7-36.9	64-71	118-133	Hurricane	Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.