REPORT

CARISBROOK STADIUM TRUST

Air Quality Assessment of The Proposed Spectator Events and Education Zone

FINAL

Report prepared for:

CARISBROOK STADIUM TRUST

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Executive summary

The Carisbrook Stadium Trust proposes to seek rezoning of an area of land on the corner of Awatea Street and Ravensbourne Road, North Dunedin (the Site) as a Spectator Events and Education Zone (the Zone). The Zone would enable the development of a proposed multipurpose stadium linked with the University of Otago, with a building and associated facilities to be used as academic space, student support and services and recreational space for Unipol services.

The proposed Zone is located in an area of mixed land use including education facilities, commercial and industrial premises and sports fields.

Overall, the proposed activities within the Zone should be treated as sensitive to air quality because there may be people of all ages and health status present. However, for most of the activities undertaken (attending university, sporting and community events, etc), people will only be present for part of the day. The most sensitive activities in relation to air quality will be people undertaking physical activities, such as playing sport, in the stadium and recreational activities in the plaza area.

Ambient air quality monitoring has been undertaken by Otago Regional Council (ORC) at a location approximately 300 m from the proposed development. The monitoring methods used for nitrogen dioxide and sulphur dioxide do not allow for a direct comparison with the air quality standards because the monitoring is undertaken over a longer sampling time. However, the monitoring indicates that ambient concentrations of nitrogen dioxide, sulphur dioxide and carbon monoxide at the proposed development are expected to comply with the relevant air quality criteria.

Ambient particulate matter (PM_{10}) concentrations may exceed the ambient air quality standard on a few occasions each year. One exceedence each year is permitted under the National Environmental Standard for air quality. Elevated PM_{10} levels are primarily due to domestic heating emissions in Winter. The ORC has implemented measures to achieve the Ambient Air Quality Standards for PM_{10} by September 2013. To achieve this target the ORC proposed a change to the Regional Plan: Air which introduces, amongst other things, more stringent requirements for domestic heating appliances.

Existing boilers and industrial sites with discharges to air (such as the quarry, concrete batching plant and asphalt plant) in the vicinity of the proposed Zone hold resource consents which authorise these discharges and contain conditions to ensure that there are no significant adverse effects on air quality.

Potential effects on air quality associated with the proposed Zone have been identified as dust effects during construction, and effects of any increase in local traffic. Dust generated during the construction phase of the project will be controlled using recommended good practice measures.

A screening level traffic impact assessment shows that effects are less than minor during day-to-day activities. For major events, traffic is expected to increase, but is not considered significant based on the draft Ministry for the Environment Tier 1 assessment criteria for discharges to air from land transport.

1 Introduction

The Carisbrook Stadium Trust (CST) proposes to rezone an area of land on the corner of Awatea Street and Ravensbourne Road, North Dunedin (the Site) as a Spectator Events and Education Zone. The proposed Zone would enable the development of a multipurpose stadium linked with the University of Otago, with a building and associated facilities to be used as academic space, student support and services and recreational space for Unipol services. In this report, the proposed stadium and university building and associated facilities are collectively referred to as "the proposed development".

The site is currently zoned Industrial 1. CST proposes that the site be rezoned as a Spectator Events and Education Zone. CST is preparing the proposed plan change to the Dunedin City District Plan and has engaged Tonkin & Taylor (T&T) to prepare this air quality assessment report to accompany the plan change.

This report is based on the following information:

i. Aerial photographs, site plans and development plan provided by Arrow International,
ii. The Architect's Design Statement to accompany plan change by HOK/Jasmax,
iii. Pages 39, 4157, 118, 128 and 155 of the Transport Impact Assessment report by Beca,
iv. Communications with the Senior Transportation Planner at Beca,
v. Telephone communications with the Energy Manager for the University of Otago,
vi. A list of sites in the area that hold resources consents for discharges to air and copies of resource consents for sites in the vicinity from the Otago Regional Council;
vii. Ambient air quality monitoring reports prepared by the Otago Regional Council, and
viii. A site visit carried out on 7 November 2007.

This letter report has been prepared in accordance with our proposal dated 26 October 2007.

2 Site description and sensitivity to air quality

The site is currently zoned Industrial 1 under the Dunedin City Council District Plan. The site is surrounded by Residential 3 zone to the north, Industrial and Port areas to the east and south; and Campus zone to the west occupied by the Dunedin College of Education, the University of Otago and Otago Polytechnic.

Overall, the proposed Zone should be treated as sensitive to air quality because there may be people of all ages and health status present. However, students and staff at the educational facilities and people using the stadium are likely to be present for only part of the day. Similarly, major sporting events and other activities at the stadium are likely to take place during the weekends or after working hours. Patrons of the stadium are likely to be only present for short periods of time, typically much less than 24 hours.

The most sensitive activities in relation to air quality will be people undertaking physical activities, such as playing sport, in the stadium and recreational activities in the plaza area. It is noted that there are other sporting facilities in the vicinity including Logan Park to the immediate north which has tennis courts, netball courts and cricket pitches.

Further north there is a running track, Logan Park High School and the Botanic Gardens adjacent to the school.

The proposed Zone will not increase the sensitivity of the receiving environment as it is consistent with existing educational facilities and sports fields in the vicinity.

3 Local meteorology

Otago lies in a zone of strong moist westerly winds. The Otago Regional Council (ORC) publishes climate data for several locations in the Otago region. The closest meteorological station to the Site is at the Dunedin Airport, approximately 25 km to the south west of the proposed development. Figure 1 shows a wind rose diagram for hourly wind observations at Dunedin Airport.

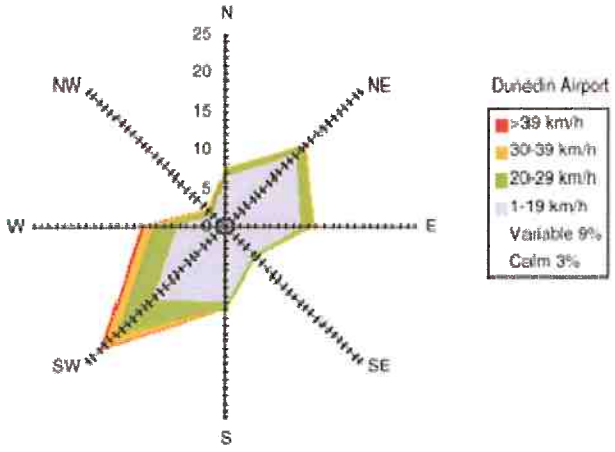

Figure 1. Wind rose for Dunedin Airport[1].

The predominant wind direction recorded at the airport is from the south west. South westerly winds dominate strong to moderate wind strengths. Lower wind speeds are predominantly from the south west or north easterly directions.

Dunedin experiences a mean temperature of 11 °C. Over 1971 to 2000, the maximum temperature was approximately 36 °C with a minimum of -8 °C[2].

4 Air quality monitoring data

4.1 Introduction

The ORC monitors ambient air quality at several locations in the Otago Region. The closest ambient monitoring site to the proposed zone is at Albany Street approximately 300m from the site. The Albany Street monitoring site is surrounded by a mixed use area (residential/ industrial/ campus). The air quality at Albany Street will be similar to air quality at the proposed zone.

Particulate matter[3] (PM_{10}), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) are monitored at the Albany Street site. Carbon monoxide (CO) is not monitored at Albany Street however it is monitored at a commercial premise at George Street, approximately 1.2 km from the proposed development.

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[1] Source: Otago's Climate. Otago Regional Council website: www.orc.govt.nz
[2] Source: Climate summaries. NIWA website: www.niwa.co.nz
[3] Fine particles in the air with an aerodynamic diameter less than 10 micron (0.000001 m)

A National Environmental Standard (NES) for Air Quality was passed into legislation under the Resource Management Act in 2004. The NES has set ambient air quality standards (AQQS) for each of the contaminants listed above. The NES came into force on 1 September 2005. Many parts of New Zealand do not currently comply with the AAQS for PM_{10}, and the NES requires these areas to implement a strategy to achieve the AAQS by 2013.

The NES requires that air quality be managed by airshed and that ambient air quality monitoring programs be maintained for each airshed. Otago has four airsheds gazetted. The monitoring sites and proposed development is located in Airshed 3 (as shown in the Proposed Plan Change 2 of the Regional Plan: Air for Otago).

4.2 Description of Albany Street monitoring site

The Albany Street monitoring site is located at the back of a radio station carpark on Albany Street. North of the monitoring site across Albany Street is the Gregg's coffee manufacturing plant that operates a boiler and has a resource consent to discharge products of combustion and odour. To the north east of the monitoring site is the Otago Polytechnic School of Art. Directly to the east is a small building and not far along is Anzac Avenue, which forms State Highway 88. Further down Albany Street towards the City is a row of residential terrace houses followed by the university buildings. Opposite the row of houses along Albany Street are two printing companies, Flint Ink and UniPrint.

4.3 Monitoring data quality assurance

All monitoring sites in the region have been operated by the ORC since 1997. Council staff are responsible for manual sample collection, routine maintenance and some calibration of equipment, and providing quality assured data. Checks of PM_{10} instruments include calibration by external contractors, as well as regular inspections by Council staff. The Hi-Vol sampler is the standard method for measuring particulate matter in many parts of the world, and meets the relevant Australian Standard (AS2724.3).

The majority of NO_2 and SO_2 monitoring undertaken by the ORC has been with passive samplers that produce monthly average values (i.e. 12 results for the year). ORC acknowledges that the methods used to monitor NO_2 and SO_2 do not comply with existing recommended monitoring methods, and all results in their ambient air quality reports are likely to be indicative only.

The method used to monitor CO at the George Street site conforms to Australian Standard (AS 2695-1984).

4.4 Particulate matter

The main source of PM_{10} emissions in urban areas are domestic heating, motor vehicles and industrial combustion (such as boilers).

The health effects of PM_{10} range from minor nose and throat irritations, to more serious effects such as aggravation of existing respiratory and cardiovascular disease, and premature death. Children, adults with obstructive lung disease, asthmatics and elderly people are most sensitive to particle pollution.

The AAQS for PM_{10} is 50 micrograms per cubic meter ($\mu g/m^3$) over a 24 hour period, and should not be exceeded more than once a year. Results of ambient PM_{10} monitoring at Albany Street are summarised in Table 1 below (taken from ORC, 2005a, ORC, 2006a and

ORC, 2006b). Samples taken from the monitoring site are 24-hour averages, and are taken on every 6th day throughout the year.

Table 1: Ambient PM_{10} monitoring summary at Albany Street, North Dunedin

	Maximum Concentration ($\mu g/m^3$)	Winter Average Concentration Note 1 ($\mu g/m^3$)	Number of Exceedances (over 50 $\mu g/m^3$)
Winter 2006	61	29	2
Winter 2005	52	30	1
2004	57	22	1
2003	48	28	0
2002	48	21	0
2001	60	31	2
2000	48	21	0
1999	59	24	2
1998	71	38	1
1997	65	26	1

Note 1: Winter is defined as the period 1 June to 31 August.

Results from the Albany Street monitoring station show that maximum PM_{10} levels have exceeded the AAQS of 50 $\mu g/m^3$ on one or two occasions for 7 of the last 10 years. The actual number of exceedences may be higher because the monitoring is only undertaken on one day in six.

The average winter PM_{10} level has generally remained steady at 20 – 30 $\mu g/m^3$ since records began, with the exception of 1998, when the maximum recorded reading of 71 $\mu g/m^3$ pushed the winter average to 38 $\mu g/m^3$.

Winter months are expected to experience the highest PM_{10} levels during the year as a result of the combination of poor weather conditions for dispersion and smoke produced from home heating (open fires and log burners). However, the air quality at Albany Street is significantly better than in other parts of Otago, such as Mosgiel and Alexandra.

The 2006 ambient air quality report for PM_{10} reported results from continuous monitoring at Albany Street during the winter of 2006. The continuous monitor is located at the same place as the high-volume sampler and according to the report has shown to have close agreement. Results show that there were 6 exceedences at the Albany Street monitoring site in the winter of 2006, with a maximum PM_{10} concentration of 86 $\mu g/m^3$.

Figure 2 shows a graph of average PM_{10} concentration on a typical winter's day at the Albany Street monitoring site (reproduced from ORC 2006b). PM_{10} levels at the Albany Street site increase between 8am and 9am, remaining high throughout the day, and then gradually declining from 6pm until midnight. Industrial and vehicle sources are likely to be the main sources of PM_{10} during the day, while emissions from home heating are likely to keep PM_{10} levels raised into the early evening.

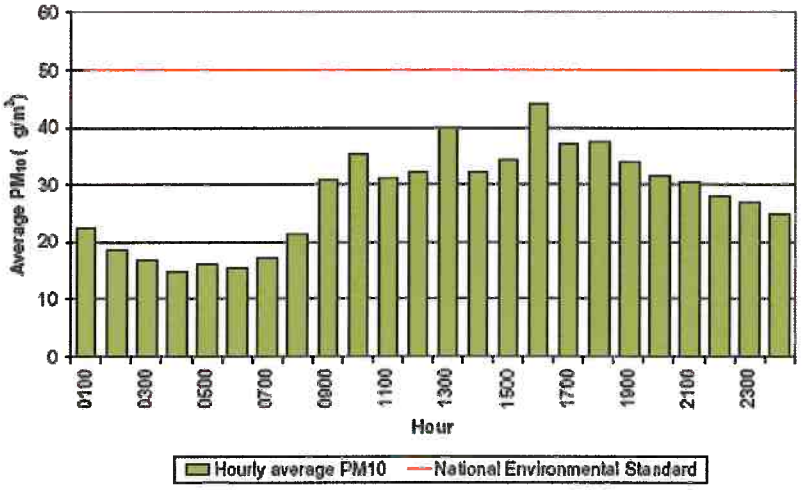

Figure 2. Diurnal PM_{10} trends.

The ORC has a target to achieve the AAQS for PM_{10} by September 2013. To achieve this target the ORC has proposed a change to their regional air plan (Proposed Plan Change 2). The changes introduce more stringent requirements for domestic heating appliances (Policy 9.1.6) and seek to decline any application for resource consent to discharge significant amounts of PM_{10} to the air where the discharge is likely to cause the proposed air shed to breach its reduction targets (Policy 9.1.2).

4.5 Nitrogen dioxide

The main source of nitrogen dioxide resulting from human activities is the combustion of fossil fuels (coal, gas and oil), especially from motor vehicles.

The main health effect of nitrogen dioxide is on the respiratory system. Inhalation of nitrogen dioxide by children increases their risk of respiratory infection and may lead to poorer lung function in later life. NO_2 can decrease the lungs' defences against bacteria, making them more susceptible to infections, and can also aggravate asthma.

The AAQS sets the maximum allowable concentration for NO_2 at 200 µg/m³ of air, expressed as a 1-hour mean, with 9 exceedences allowable in any 12 month period. The ambient air quality guidelines and standards for NO_2 that apply in Otago are summarised in Table 2.

Table 2: Ambient air quality guidelines and standards for NO_2

Otago Goals µg/m³	AAQS µg/m³	MfE Ambient Air Quality Guideline µg/m³	WHO Guideline Level µg/m³	Averaging Time
200	200	200	200	1 hour
60	-	100	-	24 hours
-	-		40	Annual mean

Ambient NO_2 monitoring has been carried out at the Albany Street monitoring station since 1997. Table 3 summarises the annual average and maximum NO_2 levels recorded (ORC, 2005b).

Table 3: Results of NO_2 monitoring at Albany Street (1-month average)

Year	Maximum Concentration ($\mu g/m^3$)	Annual Average Concentration ($\mu g/m^3$)	Winter Average Concentration[Note 1] ($\mu g/m^3$)
2004	23.9	15.3	18.5
2003	28.4	13.6	11.7
2002	20.4	12.5	16.6
2001	23.9	13.6	13.1
2000	18.0	13.2	16.3
1999	26.0	17.2	19.7
1998	23.0	15	21.3
1997	29.0	Insufficient data	22.7

Note 1: Winter defined as June to August.

There are no New Zealand guideline values for monthly average levels of NO_2. ORC conservatively compares monthly results with the WHO annual average guideline of 40 $\mu g/m^3$. The monitoring shows that NO_2 levels are below the annual guideline value.

A small number of 24-hour average concentrations have been measured at Albany Street using wet chemical methods from 1997 to 1999. These results indicated that NO2 concentrations were significantly less than the ORC 24-hour average guideline value of 60 $\mu g/m^3$.

Based on these results, it is expected that NO_2 concentrations will comply with the AAQS.

4.6 Sulphur dioxide

Sulphur dioxide (SO_2) is produced mainly from the combustion of fossil fuels that contain sulphur, such as coal and oil (for example, coal being burnt in a home fireplace for heating and diesel-powered vehicles). SO_2 is also produced from some industrial processes, such as fertiliser manufacturing, aluminium smelting and steel making.

SO_2 can cause respiratory problems, such as bronchitis, and can irritate the nose, throat and lungs. It may cause coughing, wheezing, phlegm and asthma attacks. Healthy children, adults with lung disease and asthmatics are all sensitive to SO_2. SO_2 can form secondary particles (sulphates) that cause haze and reduce visibility.

The ambient air quality standards for SO_2 that apply in Otago are summarised in Table 4. The AAQS sets the maximum allowable concentration for SO_2 at 350 $\mu g/m^3$, expressed as a 1-hour mean, with 9 exceedences allowable in any 12 month period. The Regional Plan: Air for Otago sets a regional air quality goal for SO_2 of 66% of the AAQS.

Table 4: Ambient air quality guidelines and standards for SO_2

Otago Goals $\mu g/m^3$	AAQS $\mu g/m^3$	MfE Ambient Air Quality Guideline $\mu g/m^3$	WHO Guideline Level $\mu g/m^3$	Averaging Time
330	-	-	-	10 mins

Otago Goals µg/m³	AAQS µg/m³	MfE Ambient Air Quality Guideline µg/m³	WHO Guideline Level µg/m³	Averaging Time
230	350	350	-	1 hour
80	-	120	20 Note 1	24 hours
-	-	-	50	Annual mean

Note 1: WHO has recently released an update of risk assessments carried out for SO_2 (WHO, 2006). Based on the preliminary findings of the assessment, WHO has reduced the 24-hour guideline value from 120 to 20 µg/m³. At present, this lower standard has no regulatory status in New Zealand

Ambient SO_2 monitoring has been carried out at the Albany Street monitoring station since 1997. Table 5 summarises the average and maximum SO_2 levels recorded (ORC, 2005b).

Table 5: Results of SO_2 monitoring at Albany Street (1-month average)

Year	Maximum Concentration (µg/m³)	Annual Average Concentration (µg/m³)	Winter Average Concentration[Note 1] (µg/m³)
2004	24.9	16.1	17.9
2003	25.7	18.1	22.5
2002	44.5	18.6	18
2001	48	22.4	19.4
2000	45	25.4	24.3
1999	31	21.4	21.3
1998	30	16.4	23.7
1997	18	Insufficient data	15.7

[1] Winter defined as June to August.

As for NO_2, ORC conservatively compares monthly results with the WHO annual average guideline of 50 µg/m³. The monitoring shows that SO_2 levels are below the annual guideline value.

Other methods used at this site to monitor SO_2 include an ultraviolet fluorescence instrument and using wet chemical methods producing 24-hour measurements. Results from both these methods show SO_2 levels well below the 24-hour average SO_2 guideline value of 80 µg/m³.

The ORC report also presents a plot of all monthly values recorded at Albany Street, which shows a slight seasonal trend with higher SO_2 readings during the winter.

Studies show that levels of SO_2 may be increasing around busy roads because of the increased use of diesel vehicles. Ambient concentrations of SO_2 are expected to decrease as a result of the introduction of lower sulphur diesel.

Based on these results, it is expected that SO_2 concentrations will comply with the AAQS.

4.7 Carbon monoxide

Carbon monoxide (CO) is produced from the incomplete combustion of fossil fuels such as motor vehicles, and from the combustion of wood and coal, which is commonly burnt in fires for home heating. Tobacco smoke and indoor gas fires are also common sources of carbon monoxide. Carbon monoxide levels are generally highest in urban areas along or close to busy roads.

CO reduces the amount of oxygen that the body tissues receive, which can particularly affect the brain and heart and general health. Low exposure to carbon monoxide can cause dizziness, nausea, a feeling of being confused and disoriented. The effects worsen as the level of carbon monoxide in the blood stream increases.

The ambient air quality standards for CO that apply in Otago are shown in Table 6. The Otago guideline values for CO are 66% of the AAQS.

Table 6: Ambient air quality guidelines and standards for CO

Otago Goals mg/m³	AAQS mg/m³	MfE Ambient Air Quality Guideline mg/m³	Averaging Time
20	-	30	1 hour
6	10	10	8 hour

CO was monitored continuously from 1997 to 1999 at the George Street monitoring site (ORC, 2005b). The ORC reports that for more than 99.9 % of the time, one-hour average concentrations of CO were below the Otago guideline level of 20 mg/m³, while for 97% of the time eight-hour averages were below the Otago guideline level of 6 mg/m³. The AAQS was breached only twice for the entire monitoring period. The highest CO concentrations occurred in the winter months and readings show a strong seasonal pattern of concentrations for eight-hour averages for the monitoring period.

4.8 Conclusions

Measured PM_{10} levels in the vicinity of the proposed development have typically exceeded the AAQS for one or two days each year. Measured PM_{10} in concentrations in Dunedin are better than in many other urbanised areas of New Zealand. In addition, PM_{10} levels in Dunedin are also significantly better than other locations in Otago that are currently being monitored. The NES allows for one exceedence of the AAQS each year. Successful implementation of Plan Change 2 of the Regional Plan: Air is aimed at ensuring the air shed meets the AAQS by 2013, as required by the NES.

Monitoring of NO_2, SO_2 and CO at the Albany Street monitoring site between 1997 and 2004, shows that the levels of these contaminants were generally low, and were well below the relevant guideline levels for the averaging time of the sampling method. It is expected that ambient concentrations of these contaminants will comply with the AAQS.

5 Local sources of air pollution

The surrounding land users are dominated by commercial and industrial activity. The aerial photograph in Figure 3 shows the site bounded in red and identifies the surrounding land users.

A quarry and concrete batching plant is located directly opposite the Site to the north east. Other sources of air pollution in the area include an asphalt plant to the east, sandblasting operation to the west, and various boilers for heating purposes at the university to the northwest. Figure 3 also shows the location of the monitoring site on Albany Street and the Gregg's coffee manufacturing plant.

The Ravensdown Fertiliser Works is located approximately 1 km east of the site on the other side of Black Jacks Point. The Fertiliser Works is not visible from the proposed zone and no detectable odours from the works were experienced at the time of the site visit.

A list of resource consents for discharges to air within a 2 km radius from Awatea Street has been obtained from the ORC. There are 39 air discharge permits within this radius. Key sources of discharges to air in the immediate vicinity (within a 1km radius) are summarised in Table 7.

Table 7: Summary of consented discharges to air in the vicinity

Business	Nature of discharges to Air	Resource consent conditions
Allied Concrete	Dust from concrete batching plant	No visible dust downwind from premises to the extent that it has an adverse effect
Blackhead Quarries	Dust from quarrying	No visible dust downwind from premises to the extent that it has an adverse effect
Cerebos Gregg's	Products of combustion and odours from processing instant coffee	No visible emissions, no odour and no emissions of coffee grounds or husks that is objectionable or offensive or beyond the site boundary. Particulate emissions to not exceed 3 kg/hr.
Fulton Hogan	Products of combustion, particulates and odour from producing asphalt	Particulates to not exceed 50mg/m^3. Fugitive dust minimised using best practicable options. No dust or odour that is offensive or objectionable downwind of the activity.
Logan Park High School	Products of combustion from the burning of coal in 2 boilers with a combined heat capacity of 1.5MW.	No visible emission of smoke, odour or ash that is offensive or objectionable or beyond the boundary of the site. No alteration of fuel burnt that will increase emissions of sulphur dioxide. To achieve a reduction of PM_{10} and submit a program by 2004.
Otago Polytechnic, Albany Campus	Product of combustion from building heating and domestic hot water purposes.	No visible emission of smoke or odour that is offensive or objectionable downwind of the site. No alternation to the fuel burnt that will increase

Business	Nature of discharges to Air	Resource consent conditions
		emissions of sulphur dioxide or other contaminants.
Sandblasting Specialists 2006	Dust from dry abrasive blasting in a booth at Parry Street.	Limits particulate emissions from the booth to 125 mg/m^3
University of Otago	Product of combustion for the purposes of heating	No visible emission of smoke or odour that is offensive or objectionable downwind of the site. No alternation to the fuel burnt that will increase emissions of sulphur dioxide or other contaminants.

During the site visit on 7 November, there was a 10-15 knot south westerly wind. Wind blown dust at the Allied Concrete site was not observed beyond the boundary except for wheel entrained dust carried onto the road from trucks leaving the concrete loading area. Standing at the site opposite Logan Park, no offensive or objectionable odours or discharges to air were experienced. Directly opposite the site across Anzac Avenue is Logan Park, a large sports field where people were playing cricket at the time. Tennis courts are also located in this area. The site is surrounded by other educational facilities such as the College of Education, Otago Polytechnic and slightly further away, the Logan Park High School on Butts Road.

There are existing boilers and industrial activities in the vicinity of the proposed Zone that generate discharges to air. These activities hold resource consents issued by the ORC that limit discharges to air and prevent offensive and objectionable discharges beyond the boundary of their site. The resource consents include conditions to ensure that there are no significant adverse effects on air quality

The closest activity visible to the site is a concrete batching plant operated by Allied Concrete on the edge of the quarry. Effects of this activity to the proposed Zone are considered no more than minor. In addition, the open space areas of the proposed Zone such as the Plaza in front of the main university building are located on the northwest end of the site, approximately 150 metres away from the concrete batching plant. This provides an appropriate separation distance to protect amenity.

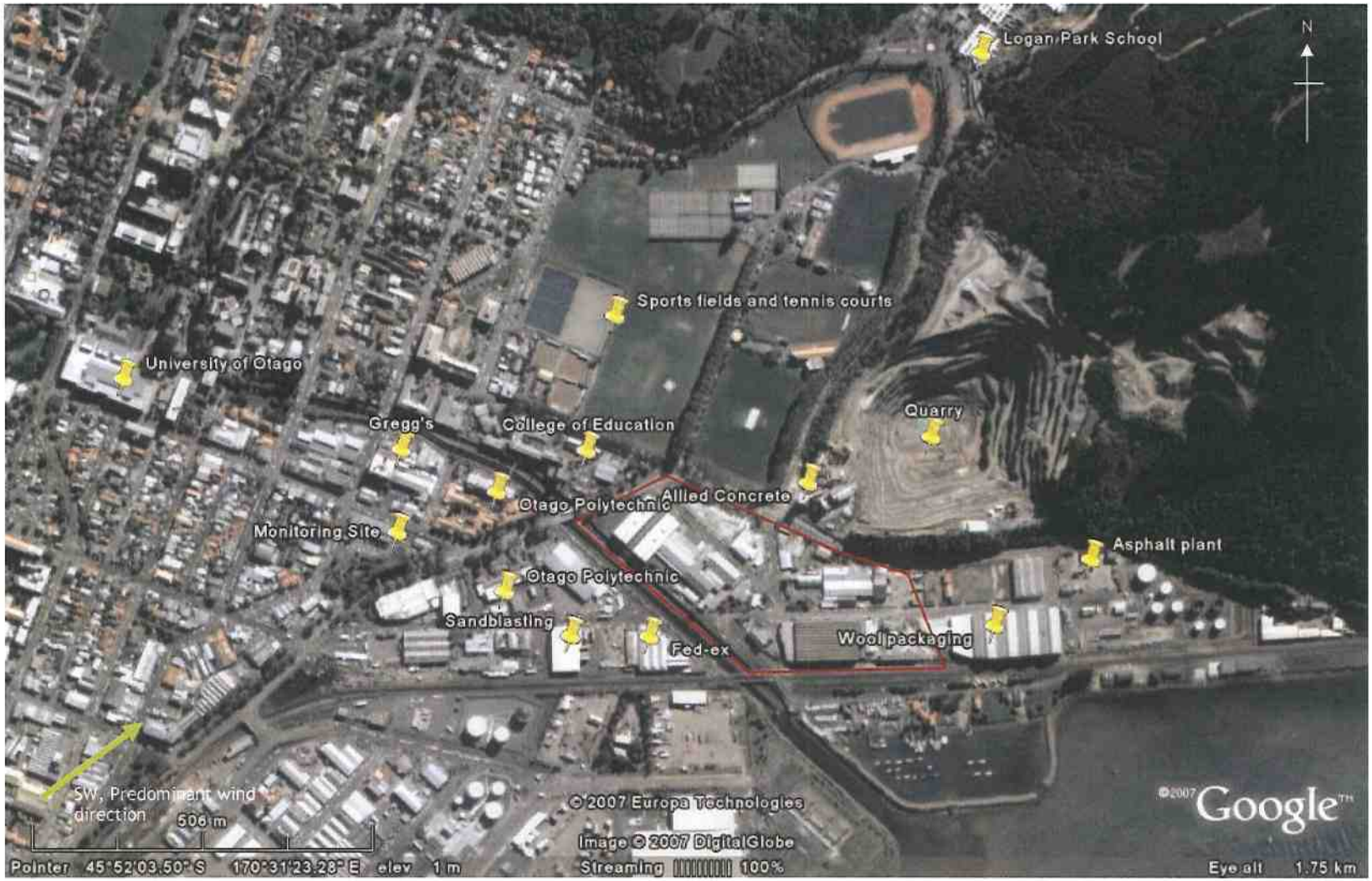

Figure 3. Aerial photograph of the site and surrounds. (Sourced from Google Earth Pro)

6 Potential air quality effects of the proposed zone

6.1 Introduction

Potential effects on air quality associated with the proposed zone have been identified as dust effects during construction of buildings, and effects of any increase in local traffic as a result of activities within the Zone. We understand from verbal communications with the Energy Manager at the university that the proposed university building will be using electrical heating appliances (rather than boilers) and no other discharges to air have been identified from the proposed development. If boilers were used as heating in the Zone then these would either meet the permitted activity requirements of the Regional Plan: Air or require a resource consent from ORC. In either case, the boilers would be required to be designed and operated to ensure that there were no significant adverse effects.

6.2 Construction activities

Dust is likely to be generated at the site temporarily when construction works are carried out and during roading works for the realignment of SH88. Dust can arise, particularly during dry, windy conditions, during the construction earthworks phase of a development. The environmental effects of dust are primarily associated with nuisance and can include unwanted deposition of dust on property, reduced visibility and diminished amenity values. Good management practices to control dust include (MfE, 2001):

- Regular watering of exposed surfaces,
- Use of wind breaks,
- On-site speed limits for trucks and other vehicles; and
- Re-vegetation of exposed surfaces as soon as practicable.

Users of the sports fields and the College of Education and Otago Polytechnic near the site would be sensitive to dust generated during construction works. A Dust Management Plan should be prepared prior to any works being undertaken. Good management practices adopted for the site during construction works should prevent any offensive or objectionable offsite discharge of dust.

6.3 Traffic

6.3.1 Introduction

The majority of contaminants from motor vehicles are discharged into air as exhaust fumes. These emissions include nitrogen oxides, carbon monoxide, carbon dioxide, unburned hydrocarbons, and volatile organic compounds such as benzene and formaldehyde. Fine particles are also emitted from brake and tyre wear.

The Ministry for the Environment has produced a draft good practice guide to assess discharges to air from land transport (MfE, 2006). It prescribes three levels of assessment for projects that will have an impact on transport. The Tier 1 assessment is a screening assessment of basic traffic and land-use information to determine whether changes in air discharges are likely to have a significant effect and require further assessment.

6.3.2 Tier 1 assessment of air quality effects of transport

The development plan describes the following provisions and changes to traffic in the area:

- Provides for 336 car parking spaces. Entry from a single point along Ravensbourne Road.
- SH 88 realignment redirecting traffic to the south and east sides of the stadium and will reduce traffic flow along Anzac Avenue.
- Proposed transport node located on Minerva Street allows for coaches and shuttle buses to drop off patrons.
- Taxis pick up and drop off to be restricted to Anzac Avenue south of the Water of Leith.

A traffic impact assessment has been prepared for the proposed plan change (Beca, 2007). A range of scenarios were assessed ranging from the day-to-day use of the facilities proposed for the Zone to major sporting events or concerts. Their report concludes that the changes to the level of service in the area from the day to day operations of the new development would be less than minor. The university building is expected to be used as student health facilities, foundation studies, Unipol and other sporting club offices with an estimate of around 1,500 students and staff using the new facilities.

A major event that fills the capacity of the stadium (35,000 people) is expected to occur once or twice each year. For such an event, an influx of traffic will be expected to the area. With the stadium being approximately 1.5km from the Octagon, it is anticipated that up to 70% of patrons would be accessing the stadium via Anzac Avenue, Union Street East and Albany Street. For the biggest event, 7,500 vehicles are expected in the area spread over a 1.6km radius from the stadium. This is the estimated number of car parking spaces available in the area.

There are no particular links or intersections in the area that will exceed the screening criteria set out on the good practice guide (i.e. busy road and intersections with more than 7,000 cars per day, congested roads with greater than 3,000 cars per day, or links where there are likely to be more than 500 heavy vehicles per day).

The only major link in the vicinity is a proposed roundabout on the east of the site redirecting traffic onto SH 88. Beca has estimated that there would be a maximum of 735 vehicles entering the roundabout from the eastern side of Ravensbourne Road during the morning peak of a day-to-day scenario. The majority of vehicles would be travelling south along SH 88. Far fewer vehicles are estimated to enter the roundabout from the south of the proposed stadium or from Anzac Avenue.

The surrounding land users in the immediate vicinity include staff and students at the College of Education, Otago Polytechnic and users of Logan Park. Major events typically occur during after work hours or during weekends when studies would have concluded for the day. There are no locations in the area within 5 metres from the roadside where members of the public might be exposed to traffic emissions for 1-hour or 24-hours continuously.

With the realignment of SH88, traffic in the area will be redirected away from Anzac Avenue, where users of Logan Park and the education centres are located, to the south and east parts of the stadium. No significant increase in traffic count or an increase in the number of heavy vehicles is predicted from the realignment.

The site and surrounds is relatively flat with wide open spaces in the immediate vicinity and is subject to sea breezes being close to the harbour. The topography of the site is unlikely to accumulate traffic emissions that will lead to adverse environmental effects.

6.3.3 Conclusions

The conclusions of the Tier 1 assessment are as follows:

- There is not expected to be any significant increase in traffic in the area during day to day use of the university building.
- An increase in emissions from motor vehicles is expected during a major event at the stadium. The increase in traffic is not considered significant based on a Tier 1 assessment.
- Based on the findings of the Tier 1 assessment, a more detailed (Tier 2) assessment is not considered necessary.

7 Overall conclusions

Based on air quality monitoring data and a review of local sources of air pollution, the only existing air quality issue in the Zone is fine particle (PM_{10}) pollution, which is primarily due to domestic heating emissions in Winter. This issue is being addressed by the ORC through proposed changes to the Regional Plan: Air which will introduce, amongst other things, more stringent requirements for domestic heating appliances.

The proposed activities in the Zone are consistent with existing activities in the area and will have a similar sensitivity to air quality effects. There are not expected to be any significant adverse effects from air quality on activities that would be provided for in the Zone.

The effects on air quality associated with the proposed Zone have been identified as dust effects during construction, and effects of any increase in local traffic. Provided they are appropriately managed, the effects of dust during construction will be no more than minor. The effects of changes to local traffic on air quality will be negligible.

8 References

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9 Applicability

This report has been prepared for the benefit of Carisbrook Stadium Trust with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

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