

## The New Carisbrook Development



### PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT

- Version01
- 21 December 2006



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## Contents

<b>1.</b>	<b>Introduction</b>	<b>1</b>
<b>1.1</b>	<b>Background</b>	<b>1</b>
<b>1.2</b>	<b>Approach</b>	<b>1</b>
<b>2.</b>	<b>Site Description</b>	<b>1</b>
<b>2.1</b>	<b>Past Site Conditions</b>	<b>1</b>
2.1.1	1872 to 1909	1
2.1.2	1921	2
2.1.3	1948	2
2.1.4	1957	2
2.1.5	1967	3
2.1.6	1978	3
2.1.7	1990	4
<b>3.</b>	<b>Current Site Conditions</b>	<b>6</b>
<b>3.1</b>	<b>Site Use and Information</b>	<b>6</b>
<b>3.2</b>	<b>Surrounding Land Use</b>	<b>7</b>
<b>4.</b>	<b>Review of Documented Information</b>	<b>8</b>
<b>4.1</b>	<b>Otago Regional Council</b>	<b>9</b>
<b>4.2</b>	<b>Dunedin City Council</b>	<b>10</b>
<b>5.</b>	<b>Discussion and Conclusions</b>	<b>14</b>
<b>6.</b>	<b>Recommendations</b>	<b>16</b>
<b>7.</b>	<b>Limitations</b>	<b>17</b>
<b>8.</b>	<b>References</b>	<b>19</b>
	<b>Appendix A</b>	<b>20</b>
	<b>Appendix B</b>	<b>22</b>



## Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Draft01	18 Dec 2006	D. Robotham	D. Robotham	20 Dec 2006	Internal
Draft02	20 Dec 2006	A. Reeve	A. Reeve	20 Dec 2006	Internal
Version01	21 Dec 2006				

## Distribution of copies

Revision	Copy no	Quantity	Issued to
Version01	1	1	Tom Halpin

<b>Printed:</b>	21 December 2006
<b>Last saved:</b>	21 December 2006 04:12 PM
<b>File name:</b>	I:\ZBLD\Projects\ZB00107\Technical\Contam Land Info\Carisbrook Phase 1 Environmental Investigation Version01.doc
<b>Author:</b>	Natalie Webster
<b>Project manager:</b>	Tom Halpin
<b>Name of organisation:</b>	Carisbrook Stadium Trust
<b>Name of project:</b>	Carisbrook Stadium Redevelopment
<b>Name of document:</b>	Preliminary Environmental Site Assessment
<b>Document version:</b>	Version01
<b>Project number:</b>	ZB00107.02



# 1. Introduction

## 1.1 Background

A new stadium is proposed to be constructed on behalf of the Carisbrook Stadium Trust on land currently occupied by industrial units in Ravensbourne, Dunedin. The proposed stadium site is generally bounded by Union Street East to the north east, Anzac Ave to the north west and the Leith canal to the south west, with the site extending approximately 100 meters east along Parry St. This area can be seen along with the development footprint on the site plan shown in Figure 1.

Sinclair Knight Merz (SKM) have been contracted to conduct a Preliminary Environmental Site Assessment (PESA) to collate historical and current environmental data regarding activities which could have impacted on the proposed stadium site ('the site') to form part of the consent submission to the Dunedin City Council (DCC) and the Otago Regional Council (ORC). This PESA has been carried out in line with Ministry for the Environment Contaminated Land Management Guidelines No. 1, "Reporting on Contaminated Sites in New Zealand" (Ref 1).

Included in the report is a review of the readily available information relating to the site and an assessment of the adequacy of previous investigations undertaken on the site from a soil contamination perspective.

## 1.2 Approach

The approach taken for the assessment has been determined by the existing data and the end point for the project as discussed with the client. The procedure was to review current and historical aerial photographs, maps, Land Information Memorandum's (LIM's) and easily accessible information on the internet for all sites within the proposed development area. This information was reviewed in order to ascertain, where possible:

- What activities may have been carried out on site in the past, or are currently carried out, and where;
- Are past or current industrial activities carried out on site likely to have contributed contaminants to the soils on site;
- Have any hazardous substances ever been stored on these sites, and if so, what were they and what were the quantities;
- Where and how were any hazardous substances stored;
- Have any spills of potentially hazardous substances occurred, and if so, how were they dealt with;

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- Information on waste disposal practices;
- Have any herbicides or pesticides ever been used on site; and
- What activities have been carried out in areas neighbouring the site.

This information was sourced from both the DCC and the ORC.

Figure 1: Site location showing development footprint



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## 2. Site Description

The proposed site of development is in an industrial area of Ravensbourne, Dunedin. The site is located on the harbour edge where the Leith River discharges into the harbour via a canal. The area to be developed is shown in Figure 1 above. The addresses of the sites involved in the proposed stadium development area are listed below and the legal descriptions and site sizes are listed in Table A1 in Appendix A.

- 1 Awatea St
- 2 Awatea St
- 5 Awatea St
- 8 Awatea St
- 9 Awatea St
- 58 Parry St
- 64 Parry St
- 77 Parry St

The geology of the area as described by the available geological maps indicates that the site is located on imported fill material used to reclaim the harbour. This fill material is described in the Institute of Geological and Nuclear Sciences (IGNS) 'Geology of the Dunedin Area' (Ref 2) as being composed of an unconsolidated and unsorted mixture of sand, mud, mine tailings, domestic and industrial waste, construction material and excavated volcanic rocks. The fill is underlain by quaternary stream alluvial deposits and two types of basalts of the Dunedin Volcanic Group.

Topographically the site is generally flat.

### 2.1 Past Site Conditions

#### 2.1.1 1872 to 1909

Examination of historical maps shows that the site is situated on reclaimed land. Figure B1 in Appendix B shows a map of the current harbour shoreline overlain by the shoreline of the harbour in 1872. It can be seen that a large area of the harbour has been reclaimed. The majority of this reclamation occurred between 1872 and 1909.

The IGNS publication, 'Geology of the Dunedin Area' (Ref 1) indicates that a wide variety of materials were used to reclaim the land where the site is located. The reclamation materials included mine tailings and industrial and domestic wastes which were sourced from mining operations, reclaimed embankments and landfills. Materials such as mine tailings and industrial and domestic waste in particular may have contributed contamination to the ground on site. The



exact nature and extent of any contamination cannot be known at this stage without intrusive investigations.

Figure B2 in Appendix B, an historical map of the Dunedin from 1909, shows that the area where the site is located had been reclaimed by this time. However, an area to the north of the site identified in the 1909 map as 'Pelichet Bay Lake Logan' remains unclaimed. Figure B2 also shows that the outlet of the Leith River into the harbour has not yet been canalised in 1909 and that the present railway line that runs to the south of the site has been proposed but not constructed. Division of the reclaimed land into lots has begun at the southern end of the reclamation.

### **2.1.2 1921**

Figure B3 in Appendix B is an historical map of Dunedin from 1921. It shows that the site and the area surrounding it has not changed significantly since 1909, except that the Leith outlet has been canalised. Pelichet Bay remains to the north of the site. Figure B3 also shows that by 1921 much of the reclaimed area has been divided into lots for development. The area where the site is located has not yet been divided into lots. The only site where development had occurred at this time was on 64 Parry St, as indicated by the LIM for this site. The site use is not stated however, so it is unknown what business was conducted. The railway deviation to the south of the site has been created.

### **2.1.3 1948**

The earliest historical aerial photograph available was taken in 1948, and is shown in Figure B4 in Appendix B. The photograph is marked with the boundary of the site, within which little development has taken place. The only significant industrial unit present is the building currently occupied by NZ Wool Handlers Ltd at 64 Awatea St. The LIM for 64 Parry St indicates that development began on the site as early as 1906 with the building of a shed. By 1949 the property was in use by Donald Reid and Co as a wool storage facility. The site is still used for this purpose today.

Two smaller structures can be seen on the northern boundary of the site near Union Street East at 8 Awatea St and the corner of 77 Parry St. At this time, the LIM's for these properties indicate that 8 Awatea St was in use as a milk supply and treatment station. 77 Parry St was in use as a saw mill.

### **2.1.4 1957**

The aerial photograph shown in Appendix B in Figure B5 was taken in 1957. The photograph does not show the entire site, but does show that most areas are in use by this time. 77 Parry St can be seen to have been developed for use. The LIM for this property indicates that from approximately 1948 the site was used as a timber storage yard. The rectangular shapes covering the yard that can be seen in the aerial photograph are wood stacked on the yard.



Figure B5 shows that 8 Awatea St has also been developed further by 1957. The LIM for this property indicates that it is still in use as a milk treatment station. 2 Awatea St has begun to be developed. The LIM for this property indicates that this location was first in use in 1950, also as a milk treatment and supply station. It was still used for this function in 1957.

The 1957 aerial photograph shows that 9 Awatea St had also been partially developed. The LIM for this property indicates that development of this site began in 1950, and from this time to 1957, the site was used by the NZ Apple and Pear Marketing Board as fruit store. A new cool store facility was constructed in 1957.

A building can be seen on the site of 1 Awatea St in 1957. The LIM records that this property is being used as a 'vehicle testing station'. This site use began in 1954 and continued until at least 1962.

#### **2.1.5 1967**

Figure B6 in Appendix B shows an aerial photograph of the site taken in 1967. The photograph shows that the site is becoming more densely developed. More buildings have been erected on 77 Parry St. The LIM indicates that the new buildings were used as storage facilities for wood and wood products such as board, and for carrying out milling processes. Wood can still be seen stacked on the yard in the aerial photograph.

58 Parry St can be seen to be in use in 1967. The LIM indicates that the site and building was used as a storage area. The aerial photograph shows what could be timber stacked on this site, but the LIM does not state what the specific land use was at this time. 5 Awatea St has also begun to be developed at this time. The LIM states that a fumigation plant was erected on this site in 1965 by the Ministry of Agriculture and Fisheries (MAF). However, the LIM does not indicate what was being fumigated in these premises.

The properties at 8 Awatea St and 2 Awatea St remain essentially the same as they appear in 1957, and their uses are the same also. The property at 9 Awatea St appears to have been further developed, with the addition of more buildings and infrastructure. The site use, as indicated on the LIM, remains the same.

#### **2.1.6 1978**

Figure B7 in Appendix B shows an aerial photograph taken in 1978. In general, the site as a whole can be seen to have been further developed. In particular, many more buildings have been added on the property at 9 Awatea St. The LIM shows that these new buildings were additional cool stores and non-refrigerated stores, administration buildings and amenities blocks. From 1967 to 1978, several of the new buildings were constructed on the property at 37 Parry St, which became



incorporated into the title of 9 Awatea St. The site is still in use by the NZ Apple and Pear Marketing Board at this time.

The development on site at 5 Awatea St does not appear to have been extended by 1978, and the LIM records that the site is still used by MAF at this time. The last consent recorded as issued in the LIM is in 1988, also to MAF. The LIM does not record any activity on the site of 1 Awatea St in 1978. A building is demolished on the site in 1982, and a new building is erected in 1986 for use by Irvine Plumbing and Heating Services Ltd.

Further development has also occurred on the sites at 8 Awatea St and 2 Awatea St. Cool rooms, a cool store, a laboratory and foundations for a milk silo were added to the property at 8 Awatea St between 1967 and 1978. Buildings were also extended at 2 Awatea St. Both properties were still operating as milk treatment and supply stations at this time.

Figure B7 shows that a building has been erected on the site of 58 Parry St by 1978. The LIM records that building consent to erect a store building was issued in 1972. This consent was issued in the name of 'McKinlay Brothers', however, the LIM does not state what this property was used for at this time.

New structures have been built on the property at 77 Parry St, which has also had extensions and alterations made to existing buildings on site. The site is still in use as a timber storage and processing facility. The aerial photograph shows that less timber is stored on the yard at this time than has been seen in previous photographs. The LIM records that consents are issued to Fletcher Timber Co until 1980, at which time the use of the site changes to industry associated with tanning and wooll scouring and the name in which consents are issued changes to R F Woollscour.

### **2.1.7 1990**

Figure B8 in Appendix B shows an aerial photograph of the site taken in 1990. This photograph shows that the site in 1990 appears very similar to the site as it is today. Further development of the site has taken place at 9 Awatea St with the addition of a shed and workshop on the 37 Parry St lot, and further stores buildings at 9 Awatea St. The LIM indicates that in 1994, one new building was to be used for 'wool testing'. In 1996, the final building consent recorded in the LIM was for a structure for use in 'produce for export'.

The LIM shows that the property at 2 Awatea St was in use as a milk treatment and storage facility until 1983, when consents for the buildings, plumbing and drainage for the site begin to be issued to 'Skeggs Foods Ltd', a fishery company. The LIM for the property at 8 Awatea St also shows that this site is in use as a milk station until 1983. At this time, Skeggs Foods Ltd appear as consent holders on site. However, by 1991, consents for the site are issued to 'Highgate Holdings'



for leatherwork purposes. This site remains in use for the purposes of leatherwork and tanning today.

The sites at 5 Awatea St and 1 Awatea St do not appear to have been developed further by 1990, and the LIM's for these sites do not record any further building consents after 1988.

The site at 77 Parry St appears to have had little development between 1978 and 1990. The LIM does not record any building consents issued in the 1990's. The last recorded building consent for the site was issued in 2002 for a building to be used as a wool store. The use of the site as recorded on the LIM in 1993 was as a woolscour plant and offices.

Figure B8 shows that little development has taken place on the site at 58 Parry St also. The LIM records that in 1994, building consents began to be issued to Nitron NZ Ltd, a liquid fertilizer supplier.



### 3. Current Site Conditions

The site is currently occupied by several industrial premises located on Awatea St and Parry St. The business conducted on these premises is outlined briefly below.

#### 3.1 Site Use and Information

1 Awatea St is occupied by Central Radio Services Ltd. This business conducts communications equipment sales and service.

2 Awatea St is occupied by The Gourmet Ice Cream Company Limited who manufacture and distribute ice cream.

5 Awatea St is occupied by Technical Glass Products Ltd. This business manufactures and distributes glass ware.

8 Awatea St also incorporates 12 Awatea St, 2 Ravensbourne Rd and 157 Union St in its title. The site is occupied by Logan Point Lambskins Ltd, who are tanners producing sheep skin rugs etc.

9 Awatea St is occupied by Fonterra (formally NZ Milk Products Ltd). This is a large site and also incorporates 37, 37A and 37B Awatea St and 1 Magnet St. The majority of the site is used for cold storage of dairy products. The lots addressed as 37A and 37B Awatea St are identified in the DCC rates database as being used as an industrial depot or yard and a single residential unit respectively. The 'residential unit' is likely to be office space and the industrial depot or yard is likely to be used for storage and service of site vehicles and equipment.

58 Parry St is occupied by Nitron Australasia Ltd who supply liquid fertilizer. The LIM report for this property also covers 54, 58A, 58B and 60 Parry St.

64 Parry St is the oldest building on the site and is occupied by NZ Wool Handlers Ltd. The available information suggests that the business operating on this site is a wool store.

77 Parry St is occupied by Icon Logistics Ltd. Activities carried out on site include container unloading, storage and distribution of goods.

The large proportion of the total area of the proposed stadium site is covered by businesses involved in storage and distribution of goods. These types of industrial activities do not generally contribute contaminants to ground from the storage activities, however, contaminants may be present if vehicle fleets are refuelled, washed or serviced on site. If vehicles are refuelled on site, Underground Storage Tanks (UST's) are likely to be present. UST's can be a source of hydrocarbon contamination of the soil and groundwater, and any current or historical tank locations should be investigated further.



In particular, the activities and site management practices at Icon Logistics Ltd at 77 Parry St should be investigated further. Loading and unloading of containers can often result in spills or leaks of materials which may have contributed contamination to the ground on this site. The goods imported in containers may also include hazardous substances, which may then require storage on site prior to transport. The transport and distribution aspect of this business indicates that vehicle refuelling and vehicle and equipment washing and servicing are likely to occur on site. These are all activities that can contribute contaminants to the ground. The likelihood of current or historical UST's on this site is also high.

Other sites with an increased likelihood of causing ground contamination are the liquid fertilizer supplier at 58 Parry St and the tannery at 12 Awatea St. This is due to the products that are used, handled and stored by these businesses. For example, chemicals used in liquid fertilizer may be compounds of potassium, nitrogen, phosphorus, calcium, magnesium, sulphur and some metals such as copper, zinc and manganese. Chemicals used in the process of tanning may be trivalent chromium (usually as a salt such as chromium sulphate), ammonia, oils, organic solvents, dyes, resins and lacquers.

Chemicals such as these may cause contamination of the ground due to spills or leaks during loading, unloading, storage or when in use.

### **3.2 Surrounding Land Use**

The site is bordered to the south by the railway and Dunedin Harbour. The port and associated industrial activities including a number of large storage tanks are located to the south west. Sports fields and a quarry are located to the north of the site. To the east of the site there is further industrial development, including more large storage tanks adjacent to the harbour edge.

In terms of the potential contribution of contamination of these surrounding sites to the proposed stadium site, the most likely source would be from the large storage tanks situated to the east and south west of the site. Contamination of the ground may exist in the vicinity of these tanks due to spills or leaks from the tanks themselves or during transfer of liquids to and from the tanks. The way in which any contaminants would reach the site is likely to be via groundwater flows. Therefore, groundwater depth and flow direction in the area would need to be ascertained to judge whether contaminants from off site may have been transported to the site of the proposed development.



## 4. Review of Documented Information

Readily available information was gathered from DCC and ORC to gain a better understanding of the site and what future development problems maybe encountered. Table 1 below summarises the findings of Section 4 and includes the past and present land uses for all the sites, indicating those which have been identified as posing a risk of ground contamination.

**Table 1: Past and Present Site Uses and Risk of Contamination**

Address	Past Site Uses	Current Site Use	Risk of Contamination
1 Awatea St	1954 – Vehicle testing station 1986 – Plumbing and heating services	Radio and communications equipment supply and service	Moderate – from vehicle testing activities
2 Awatea St	1950 – Milk treatment and supply station 1984 – Fisheries processing and distribution	Ice cream manufacture and distribution	Low
5 Awatea St	1965 – MAF fumigation plant	Glassware manufacture and distribution	Moderate – from fumigation activities
8 Awatea St	1946 – Milk treatment and supply station 1983 – Fisheries processing and distribution 1991 – Leatherwork and tanning processes	Leatherwork and tanning processes	High – from leatherwork and tanning processes
9 Awatea St	1950 – Cool storage of fruit and / or vegetables 1994 – Wooltesting 1996 – Cool storage of dairy products	Cool and chilled storage of dairy products	Low unless ‘wooltesting’ processes included scouring or tanning
58 Parry St	1947 – Pumphouse 1948 – Substation 1972 to 1994 – site use unknown 1994 – Liquid fertilizer supply	Liquid fertilizer supply	Moderate – depending on type of fertilizer chemicals stored and used on site
64 Parry St	1906 to 1949 – Site use unknown 1949 - Wool storage	Wool storage UST on site	Moderate due to UST on site. Risk will be high if woolsouring or tanning have been carried out on site
77 Parry St	1943 – Sawmill, timber processing and storage 1980 – Woolsouring and tanning processes	Container unloading and goods distribution	High – from timber, tanning and container unloading processes



#### 4.1 Otago Regional Council

Otago Regional Council (ORC) was contacted regarding records for the site. Files pertaining to pollution incidents and contaminated land issues were reviewed by council staff.

A search was conducted of records held on the ORC's "Database of Selected Landuses". This database identifies sites where activities have occurred that are known to have the potential to contaminate land. The ORC notes that the record of a property in the database does not necessarily imply contamination, only that the listed activity is known to have the potential to cause contamination. The ORC was provided with the area within which information was required. The sites listed in the database and the land use for which they have been identified are presented in Table 2 below.

**Table 2: Sites listed in the ORC Database of Selected Sites**

Site Location	Business Name	Period of Operation	Land Use
Union St	Holmes and Co	1910	Chemical manufacture and formation
Parry St	Dominion Sales Corporation Ltd	1951	Asbestos production and disposal
Union St	Union Garage	1956	Service station
Union St	Road Materials Ltd	1961	Chemical manufacture and formation
77 Parry St	Fletcher Industries Ltd	1965-1971	Chemical manufacture and formation
77 Parry St	Fletcher Industries Ltd	1971-1975	Asbestos production and disposal
Crn Leander St and Ravensbourne Rd	Fletcher Insulation and Acoustic Services	1980	Asbestos production and disposal
77 Parry St	R F Wooldscour	1985	Tanning and associated trades
8-12 Awatea St	Natural Fleece Processors Ltd	1997	Tanning and associated trades

Table 2 shows that in particular, 77 Parry St has been the site of several industries that have the potential to cause contamination over the last 40 years. This is confirmed by a review of the LIM for the site, as discussed further in Section 4.2 below. According to the OCR register, the site has been used for chemical manufacture, asbestos manufacture and disposal and tanning and associated trades. Examination of historical aerial photographs, as discussed in Section 2.1, also indicates that the site was used for storage of timber. The site identified as being located on the corner of Leander and Ravensbourne Rd is also likely to be a part of the land parcel now known as 77 Parry St.



The current land use was also identified as posing a risk of ground contamination in Section 3.1 above. Therefore, 77 Parry St should be investigated thoroughly prior to any development of the area.

Although specific street addresses are not indicated, the area of the site along Union Street has also been used by several industries that could potentially have contributed contamination. Chemical manufacture and a service station are recorded as being situated in this area from 1910 to 1961.

Another site in the vicinity of Union Street East is 2 -12 Awatea St, identified as carrying out tanning and associated activities both historically and today. The area of the site between Union Street East and Awatea St should therefore be investigated further prior to any development.

A further site on Parry St is identified as having carried out asbestos production and disposal in 1951.

#### **4.2 Dunedin City Council**

DCC staff and LIM reports for the sites included in the potential stadium development site were consulted regarding the history of the site. The results of these investigations are discussed by site below.

1 Awatea St has been used as a vehicle testing station from 1954 to at least 1962. The LIM does not record the use of the site between 1962 and 1986, when a plumbing and heating services business took over the site. The site is now used for communications equipment service and supply. The use of the site as a vehicle testing station has the potential to contribute contaminants to ground, however, the LIM states that there are no records of any hazardous contaminants on site. There are no resource consents issued for this site.

2 Awatea St has been used as a milk treatment and supply station from 1950 to at least 1980. From 1983 to at least 1993, the site was used by a fisheries company. The site is now used for ice cream manufacture and supply. None of these site uses poses a high risk of contamination, and the LIM confirms that there are no records of any hazardous contaminants on site. There have been several sub-division consents issued for this site from 1993 to 2001.

5 Awatea St has been used as a MAF fumigation building from 1965 to at least 1988. Depending on the fruit or vegetables fumigated, the type of fumigation chemicals used may have included ethylene dibromide, methyl bromide and chlorine. Stocks of these chemicals would have been required to be stored on site. The site is currently occupied by a glassware manufacture and supply business.

Contamination of the soil from fumigation chemicals has the potential to have occurred via spills or leaks while in storage or transport, or when in use. However, the LIM for this site states that there



are no records of any hazardous contaminants on site. The only resource consent issued for this site was for an overseas investment certificate in 2000.

8 Awatea St has been used as a milk supply and treatment station from 1946 to at least 1980. The site was then occupied by a fisheries company until 1991, when it was taken over for use in leatherwork and handling of fleece products. The site is still in use for this purpose today. This most recent use of the site has the potential to contribute contamination to the ground from tanning and scouring processes. The types of chemicals associated with this type of industry are chromium, acid, methylene chloride, ammonium, solvents, oils and caustic substances.

The LIM records that a Dangerous Goods Licence was held for the site, for two over-ground storage tanks of 9000L and 200L for the storage of a Class 3B flammable liquid. As the LIM does not specify which sub-class of flammable liquids are stored, the tanks could have been used for storage of any flammable liquid, for example: petrol, kerosene, diesel, mineral turpentine or thinners. The LIM indicates that these tanks have now been removed, that the property no longer holds a dangerous goods licence, and that there are no records of any hazardous contaminants on site.

Resource consents held for this site are for an overseas investment certificate and sub-division of the property.

9 Awatea St has been used as a storage facility for foodstuffs from 1950 to the present day. The LIM indicates that fruit was stored on site from 1950 until at least 1991. More recently and at present, the facility has been used for storage and distribution of chilled dairy products. These site uses carry a low risk of ground contamination. The LIM does not record any past or present dangerous goods licences held for the property, and states that there are no records of hazardous contaminants on site.

Resource consents held for this site are for an overseas investment certificate and subdivision of the property.

58 Parry St has been in use since 1947, first as a pump house, and then in 1948 as a substation but there is little other information in the LIM about the use of the site from 1948 to the present day. By 1972 a building was erected on the site, but the LIM does not state the nature of the industry carried out. The site was used by a business called 'McKinlay Brothers' in 1975 and 1976. Resource consents began to be issued in the name of Nitron NZ Ltd in 1994, and this company still use the site today.

Nitron are suppliers of liquid fertilizers and therefore products containing elements including Zn, Cu, B, Fe, Mn, Ca, Mg, S, N, K and P will be stored on site. The LIM records that up to 5 tonnes of Class 5A oxidising substances are stored on site, and that Nitron are in the process of complying



with HSNO requirements for this material. Class 5A oxidising substances include peroxides, nitrates, bromates, permanganates, chlorates and chlorites. Some of these elements and substances have the potential to cause ground contamination if spilled or leaked, however a site visit will be required to ascertain the exact nature of the Class 5A substance stored on site. The LIM also confirms that there are records of hazardous contaminants on site.

An overseas investment certificate is the only resource consent held for this site.

64 Parry St was first occupied in 1906, when a shed was built for purposes unspecified in the LIM. In 1911, consents for the property were issued in the name of the 'Empire Carrying Co' but again, the nature of this business is not specified in the LIM. By 1949, the building was in use as a woolstore. The site has remained in use for this purpose to the present day.

This land use does not in itself pose a high risk of ground contamination, however, the LIM records that an Underground Storage Tank (UST) is present on site. The LIM states that a 20,000L diesel UST is still in place on site, and that the dangerous goods licence for this tank expired in 2003. The LIM notes that the tank is required to be removed from site by an appropriately qualified contractor, and that validation testing must be carried out following the tank removal to ensure that contamination of the ground has not occurred.

The LIM states that there are no records of any hazardous contaminants on site and that there are no resource consents issued for this property.

77 Parry St has been in use since 1943 when it was a stores building for the Department of Housing. By 1948, the site was in use as a sawmill. Timber storage and processing took place on the site from 1948 until 1980, when the site was taken over for use for woolscouring and wool storage. The site is currently used for container unloading and goods distribution, but the LIM does not state when this activity began on site.

Of these site uses, both timber processing and storage, and woolscouring have the potential to have caused contamination of the ground. The LIM does not state whether timber treatment took place on site, however this should not be ruled out. Storage and processing of treated timber can result in contamination of the ground via leaching of the treatment chemicals from the wood into the soil. These chemicals include copper, chrome and arsenic, and by-products of timber treatment processes such as PCP's and dioxins. Contaminants associated with woolscouring and tanning processes include chromium, acid, methylene chloride, ammonium, solvents, oils, dyes, laquers and caustic substances.

Accordingly, the LIM states that due to the nature of these past activities, the property has been identified as a potential contaminated site. The LIM also notes that there are records of hazardous contaminants on site, and therefore further enquiries should be made to confirm site contamination.

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There is no record of any dangerous goods licences held for this site. The only resource consent recorded for this property for an addition to a wool store building.



## 5. Discussion and Conclusions

The site is situated on reclaimed land. The exact dates of the reclamation have not been ascertained during this investigation, but it is known that the majority of the reclamation was complete by 1909. The Institute of Geological and Nuclear Sciences map of the Dunedin area indicates that the fill used for the reclamation included mine tailings and industrial and domestic wastes which were sourced from mining operations, reclaimed embankments and landfills (Ref 2).

An area north of the site, named 'Lake Logan' remained unclaimed until 1921, after which anecdotal evidence suggests it was reclaimed using harbour dredgings.

Parts of the overall site of the proposed stadium development have a long history of occupation by a variety of businesses. Many past land uses have been confirmed from the LIM reports provided by the DCC. These are summarised in Table 2 in Section 4. Among these landuses, those that have the greatest potential to contribute contamination to the ground are hide processing and tanning, timber processing and storage, the installation of UST's, container loading and unloading and any sites where vehicles have been serviced or refuelled.

The ORC also provided information about past land uses that may have contributed contamination to the ground, and therefore appear on the ORC's "Database of Selected Landuses". These landuses are summarised in Table 1 in Section 4.1. Some of the landuses indicated by the ORC have been confirmed by the LIM reports. Tanning and associated trades have been confirmed at 77 Parry St and 8 Awatea St.

Many of the past landuses listed by the ORC have not been confirmed by the LIM reports. No record was found in the LIM reports of sites carrying out either asbestos production and disposal or chemical manufacture and formation. The existence of a service station on Union St, within the site boundaries, could also not be confirmed.

Other potential sources of contamination may also exist on these sites that could not be confirmed by a review of the LIM reports. These include the presence of power sources such as transformers, or asbestos building materials. Transformers contain oil which may spill or leak during transport or use. The oils used in older transformers, which may be present on some sites with a long occupation history, contained Polychlorinated Biphenyls (PCB's) which are highly toxic to humans and the environment. Asbestos was commonly used in building materials such as roofing panels and as a fire retardant until the mid 1980's. A site visit will be required to confirm that these contaminant sources are not present on site.

Overall, the past and present uses of the site indicate that there is a high potential for the underlying ground in many areas to contain contamination. In its present state, it does not appear to be causing



any hazard and this will probably be the case once the stadium has been built above the potentially contaminated soils. However if the site is to be redeveloped several aspects need to be considered to protect the interests of the site developers and the workers on the site, these include:

- Are there any potential long term liabilities associated with the contamination under the site in respect of the material migrating off the site to impact on the other surrounding land users;
- What are the health, safety and environmental controls which need to be put in place during construction to ensure that any potential hazards are controlled adequately; and,
- What are the long term management requirements for the site due to the potential presence of contamination within the soils.

Therefore, further site investigation work is required to confirm the presence, nature and concentration of contamination which could potentially be present on the site so the above questions can be answered. This further work can be integrated with future work streams such as geotechnical investigations and specimen design to streamline the process and reduce costs.

Visits should be carried out to all sites within the proposed development area to confirm the current land uses, site practices and their potential to contribute contamination to the ground. Evidence of any current contamination problems should be determined via visual inspections of the areas and through further discussions with the local councils. The history of the sites should be confirmed through reviewing documents and books on the history of Dunedin, for example from the Hocken Library or the Dunedin office of Archives NZ.

This additional work will provide more information so any intrusive work can be targeted to look for the right contaminants in the right places, thus providing a more cost effective investigation approach. In general the intrusive work should consist of taking sub-surface soil and groundwater samples.

Analysis of these samples will provide information about the types and concentrations of contaminants that are present on site, and if any contamination is migrating on or off site. The results of this analysis can then be used to determine the level of risk they pose, their mobility and the measures which can be put in place to mitigate them. These measures include health, safety and environment controls, sediment and erosion control, disposal of sediment run-off, disposal of water from dewatering processes and so on.

Earth removed during construction of foundations / piles may contain hazardous materials and have to be disposed of to a licensed landfill. Intrusive investigation results can also be used to determine the volumes and severity of the hazards so costs for disposal of this material to a suitable location can be accurately calculated.



## 6. Recommendations

Based on the above, it is recommended that the following further work is undertaken:

- Conduct further research to ascertain the nature of the fill material used to reclaim the harbour and to attempt to confirm the presence on site in the past of industry listed by ORC but not confirmed in the DCC LIM reports;
- Visit all sites to assess the historical and current location of contaminative processes so any intrusive work can be targeted and site contacts can be made;
- Visit the surrounding area and conduct further research to determine if it is being impacted by site activities, or if surrounding activities have the potential to impact the site;
- Carry out intrusive work, undertaken in conjunction with any geotechnical investigations to reduce costs, to determine groundwater flow, the presence of any contamination and the concentrations of contaminants present. The results of these investigations will provide information to:
  - Enable suitable health and safety measures to be put in place during site development;
  - Enable suitable environmental protection measures to be put in place during site development such as sediment and erosion control, disposal of contaminated excavated materials, disposal of dewatering water and so on;
  - If necessary, enable suitable controls to be put in place to avoid contamination of surrounding sites or to eliminate cross contamination from surrounding sites;
  - To formulate appropriate measures to be adopted to prevent the exposure of site users after development to any contamination present.
- Include the results of this report, further research and the results of the intrusive investigation in the following documents which may be required as part of the consenting process:
  - Assessment of Environmental Effects (AEE);
  - Environmental Management Plan (EMP); and,
  - Environmental Monitoring Guidelines (EMG).

To ensure that all potential contamination concerns are covered during the consenting process, the findings of this report and the plans for any intrusive investigation should be discussed with DCC and ORC contaminated land staff. This will ensure that the intrusive investigations meet the requirements of the councils, preventing consent processing delays. Intrusive work should also be undertaken in conjunction with any geotechnical investigation to reduce the cost of site work.



## 7. Limitations

This report (“Report”) has been prepared by [ *Sinclair Knight Merz Pty Limited* ] (“SKM”) for the sole use of Arrow International Ltd (“the Client”) and in accordance with the scope of services detailed in the agreement dated December 2006 (“the Agreement”).

Undertaking an assessment or study of the on-site conditions may reduce the potential for exposure to the presence of contaminated or inadequate bearing ground and/or groundwater. All reports and conclusions that deal with sub-surface conditions are based on interpretation and judgement and as a result have uncertainty attached to them. You should be aware that this report contains interpretations and conclusions which are uncertain, due to the nature of the investigations. No study can completely eliminate risk, and even a rigorous assessment and/or sampling programme may not detect all problem areas within a site. The following information sets out the limitations of the Report.

This Report should only be presented in full and should not be used to support any objective other than those detailed within the Agreement. In particular, the Report does not contain sufficient information to enable it to be used for any use other than the project specific requirements for which the Report was carried out, which are detailed in our Agreement. SKM accepts no liability to the Client for any loss and/or damage incurred as a result of changes to the usage, size, design, layout, location or any other material change to the intended purpose contemplated under this Agreement.

It is imperative to note that the Report only considers the site conditions current at the time of investigation, and to be aware that conditions may have changed due to natural forces and/or operations on or near the site. Any decisions based on the findings of the Report must take into account any subsequent changes in site conditions and/or developments in legislative and regulatory requirements. SKM accepts no liability to the Client for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the Report.

The Report is based on an interpretation of factual information available and the professional opinion and judgement of SKM. Unless stated to the contrary, SKM has not verified the accuracy or completeness of any information received from the Client or a third party during the performance of the services under the Agreement, and SKM accepts no liability to the Client for any loss and/or damage incurred as a result of any inaccurate or incomplete information.

The Report is based on assumptions that the site conditions as revealed through selective sampling are indicative of conditions throughout the site. The findings are the result of standard assessment techniques used in accordance with normal practices and standards, and (to the best of our



knowledge) they represent a reasonable interpretation of the current conditions on the site. However, these interpretations and assumptions cannot be substantiated until specifically tested and the Report should be regarded as preliminary advice only.

Any reliance on this report by a third party shall be entirely at such party's own risk. SKM provides no warranty or guarantee to any third party, express or implied, as to the information and/or professional advice indicated in the Report, and accepts no liability for or in respect of any use or reliance upon the Report by a third party.

This report makes no comment on the presence of hazardous materials, unless specifically requested.



## 8. References

1. Ministry for the Environment, 2003. Contaminated Land Management Guidelines No. 1, Reporting on Contaminated Sites in New Zealand.
2. Institute of Geological and Nuclear Sciences, 1992. Geology of the Dunedin Urban Area.



## **Appendix A**

# **Addresses, Legal Descriptions and Sizes of Sites in the Development Area**

**Table A1: Addresses , legal descriptions and sizes of sites within the development area**

<b>Site Address</b>	<b>Legal Description</b>	<b>Site Size</b>
1 Awatea St	Lot 2 DP 18243	0.0538 ha
2 Awatea St	Lot 1 DP 21260	0.2627 ha
5 Awatea St	Lot 1 DP 18243	0.1550 ha
8 Awatea St – includes 12 Awatea St 12 Ravensbourne Rd 157 Union St	Lot 1 DP 303016	0.5174 ha
9 Awatea St	Lot 1 DP22510 Lot 2 DP 11150 Lot 2 DP 22510 Lot 62 DP 6277 Lot 63 DP 8016 Lot 64 DP 6277 Lot 65 DP 8016 Lot 66 DP 6277 Lot 67 DP 8016 Lot 68 DP 6277 Lot 69 DP 8016 Lot 70 DP 6277 Lot 71 DP 8016 Lot 72 DP 6277 Lot 73 DP 8016 Lot 74 DP 6277 Lot 75 DP 8016 Lot 76 DP 6277 Lot 77 DP 8016 Lot 79 DP 8016 Lot 81 DP 8016 Lot 97 DP 6277 Sec 78 Blk 76 Tn of Dunedin Sec 80 Blk 76 Tn of Dunedin Sec 82 Blk 76 Tn of Dunedin	1.6594 ha
58 Parry St – includes 58A Parry St 58B Parry St 54 Parry St 60 Parry St	Lot 3 DP10880 Lot 1 DP 10880 Lot 2 DP 10880 Sec 99/100 Blk 76 Tn of Dunedin Sec 101 Blk 76 Tn of Dunedin	0.2401 ha
64 Parry St – includes Parry St Magnet St	Lot 1 DP 5045 Lots 7 &8 DP 7957 Sec 98 Blk 76 Tn of Dunedin	1.1258 ha
77 Parry St	Lots 1 & 2 DP 15878	1.6957 ha