

area could include an Antarctic / Southern Ocean Cruise Ship Terminal, Docking facilities and loading facilities for Antarctic Survey Vessels, Antarctic / Southern Ocean research facilities, and an extreme sports centre. A preliminary 50 year masterplan for this area has been included in the Appendix.

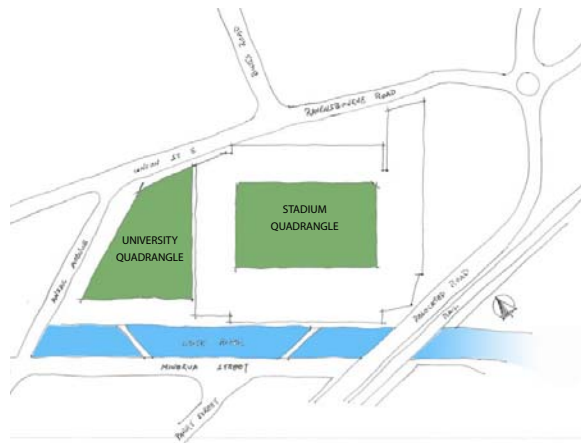


Figure 2-5.

## 2.2 Land

### 2.2.1 Ownership

Summary of the legal titles and ownership of each of the properties that make up the site are as shown in civil drawing titled "Site Plan – Legal Boundaries & Ownership" no. C-001 Rev A. (See Appendix)

### 2.2.2 Utilities Infrastructure

#### Proposed Bulk Earthworks

The building platform has been set at RL=103.70m and the calculated earthworks fill volume to be 41,386 cum and cut volume to be 220 cum. The 100 year extreme seal level for Otago harbour as well as a climate change impact of 0.5m by 2100 makes the design figure of RL=102.4m. The building platform is comfortable above this.

#### Existing Utilities Infrastructure

The current site is being used for industrial purposes. These industries have water supply, sanitary sewer, storm water, power and telecommunication services except gas supply.

#### Existing Water Supply Services

There are existing water supply pipes within the footprint of the proposed development as shown in civil drawing C-005. (See Appendix)

We have also attached in the appendix, a copy of the NZ Fire Services hydrants and mains capacity data sheet ref. 3/11 dated 17 Jan 2000.

#### Proposed Water Supply

The proposals are to:

- Relocate the existing water supply pipes outside the footprint of the proposed development
- Build at least 5 new fire hydrants.
- 100mm dia. water connection for cold water & water sprinkler supply.
- Re-instate water supply connection to the relocated sanitary pump station.
- Check fire hydrant flows and compare results before detailed design.

The new hydrants are to provide fire hydrant flows of 100 litres/s within a radial distance of 135m. The NZ fire services hydrants and mains capacity data sheet ref 3/11 shows adequate fire-flows. The fire flows are in excess of 100 litres/s for hydrants along Awatea St, Anzac Avenue and Union Street East.

Cold water supply for the stadium and fire sprinkler can be provided by using a 100mm dia. water connection with water meter, double testable back-flow preventer valve and control valves on the 150mm ring main along Union Street East.

Cold water supply to sanitary sewer pump station to be re-instated with meter and backflow preventers and valves.

During detailed design stage, a flow test is recommended to be carried out on fire hydrants to confirm the data sheets.

#### Existing Stormwater

There is an existing 2.3m x 5.2m stormwater double box culvert within the footprint of the proposed development as shown in civil drawing C-003. (See Appendix)

This box culvert is known as Opoho Creek double box culvert and drains into the Leith River.

#### Proposed Stormwater

The proposals are to:

- Build the stadium over the existing Opoho Creek double box culvert.
- Establish minimum ground floor level of RL=103.7m.
- Drain the development using Opoho double box culvert and or the existing site connection draining to the Leith Stream.

Due to proximity of the sea, flat terrain and inversion of the box culvert being only 344mm above the sea level, relocation of this existing box culvert is not feasible. Further discussion with DCC also confirms that it is better to design the stadium over this existing double box culvert than relocating the box culvert.

Also included in the appendix a feasibility study flood hazard report by David Hamilton & Associates Ltd. The report recommended a minimum design floor level of RL=103.7m with at least 600mm freeboard of an annual exceedance probability of 1% storm flow from all the various sources.

#### Existing Sanitary Sewer

There are existing sanitary sewer pipes and pump station within the footprint of the proposed development as shown in civil drawing C-004. (See Appendix)

Drawings of the existing pump station are included in the Appendix.

#### Proposed Sanitary Sewer

The proposals are to:

- Relocate the existing pipes and pump station away from the proposed development.
- Connect 21 litres/s peak flow from the 30,000 capacity stadium to a satellite manhole to the new sanitary sewer pump station.

Further discussion with DCC confirms that the existing pump station can be resized and relocated outside the proposed development footprint. The pumpstation can be downsized to accommodate the proposed development and existing catchment flows. The existing foul sewage pumpstation with storage well was constructed in 1946 when the contributing catchment had many high water use industries such as wool scouring and tanning. These industries are no longer located within the catchment. As such the pumpstation can be down sized.

There needs to be a detailed catchment analysis and flow testing to identify the design of the new relocated pumpstation.

#### Existing Telecom & Power Services

There are existing telecom & power services located within the proposed building footprint.

These services are as shown in civil drawing C-006 & C-007 and attached in the appendices the utilities service sheet furnished by network utilities operators.

#### Proposed Telecom and Power Services

The proposal is to relocate the services away from the proposed building footprint and lay the new network along road shoulder of Union Street East.

This will work and the decision will be confirmed by the network utilities provider.

#### Existing Gas Services

There is no live gas service on site.

#### Appendices

NZ Fire Service hydrants & main capacity data sheet 3/11  
 Flooding & Stormwater Issues by David Hamilton & Associates  
 Drawings for Existing Foul Sewage Pump Station  
 Civil Drawings  
 C-000 - Coversheet  
 C-001 - Existing Site Boundaries & land Ownership Plan  
 C-002 - Proposed Site Plan  
 C-003 – Existing & Proposed Stormwater Plan  
 C-004 – Existing & Proposed Sewer Plan  
 C-005 – Existing & Proposed Water Plan  
 C-006 – Existing & Proposed Power Plan  
 C-007 – Existing & Proposed Telecom Plan  
 C-008 – Proposed Bulk Earthworks – Existing Contours  
 C-009 – Proposed Bulk Earthworks – Finished Contours  
 C-010 – Proposed Bulk earthworks – Cut/Fill Depth Contours

### 2.2.3 Ground Conditions

#### Geotechnical

The following preliminary geotechnical information has been obtained for this site.

#### Historical plans

A late 1800's historical plan indicates the site to be originally part of the harbour basin and about 500m downstream of the mouth of the original Leith River. Another early 1900 historical plan indicates a modified coastline, showing the extent of the reclamation at that time. Further reclamation has taken place since then to achieve present day coastline. It is relevant that the Leith River originally crossed the site but was subsequently modified after that period.

#### Dunedin Teachers College

This site abuts the North-West corner of the site but on the other side of the current Leith River alignment. Borelog records were obtained for this site located along Albany Street towards the Leith River (Awatea Street) end. These indicate presence of 'large boulders to 12 inches' at various depths (from depths of 2 feet to 30 feet (1m to 9m)). Water levels were recorded at 4 feet depth (1.2m). The basalt boulders are of significant interest as they are a potential obstruction to deep foundations but alternatively may provide a good bearing formation.

#### Liquigas Terminal

This development is located at the reclaimed area at the end of Fryatt St, due South of the site, adjacent to the marina, but on the West embankment of the Leith River. Available information suggests this area to be part of the further reclamation that took place since the original 1900's reclamation.

Available borelogs do not reveal boulders found in the Teachers College site. The borelogs indicate layers of gravels, sands (fine to coarse), silts and clay, up to borehole depths of 30m. Fine sands are of significant interest as they are susceptible to liquefaction. Gravels are located beyond 25m depth (approximately). These could be good bearing stratum.

#### Fonterra Building

This building is located centrally on the Awatea Street site. Although no geotechnical records have been obtained the following hearsay historic information has been provided via the engineer for that building:

- Ground is soft for average depth of 8m but up to 14m on this site
- Layer below soft ground is 'boulders' providing 1MPa bearing for piles
- Soft ground has lots of rubbish in it hence the need for bored piles.
- Similar conditions were experienced at part of the Teachers College campus closest to Anzac Avenue and also for the Reid Farmers store in Parry Street.

#### Foundation Options

There is a marked difference in ground conditions between the Teachers College and Liquigas sites. In particular, boulders are present in the former site and absent in the latter.

However, considering the historical plans, the Awatea street site is probably closer to

Teachers College as it was part of the same reclamation stage and appears to match the description provided for the Fonterra building.

Two issues to consider during design are potential liquefaction and the possibility of piling through or onto basalt boulders. Pile depth, at this stage, is variable possibly as deep as 30m.

Potential liquefaction could be resolved in the sense that the piles can be designed to accommodate the additional loading. As the site is near the coastline, liquefaction (if present) could result in lateral spreading of the ground. This can be resolved via ground treatment but the cost is likely to be prohibitive but depends on the (horizontal and vertical) extent of ground treatment.

Driven piles (such as H piles) are not considered appropriate given the presence of boulders. In any case, their capacity is probably not adequate given the relatively large structural loading.

Bored piles of 1.2m diameter or greater are more likely to overcome the issue of boulders and this has been confirmed with a major piling contractor. Permanent casings may be required and this increases piling cost.

To summarise,

Piling is likely to be technically feasible and indicative installation costs are provided.

The cost of ground treatment to overcome lateral spreading may be cost prohibitive.

The historical plans indicate that the Leith River crossed the site in the early 1900s. Variation in ground conditions are likely and can affect piling costs, even if detailed ground investigation is undertaken.

#### Contamination Issues

A Preliminary Environmental Site Assessment (PESA) was conducted to collate historical and current environmental data regarding activities which could have impacted on the proposed stadium site. The PESA involved a review of the readily available information relating to the site from a soil and groundwater contamination perspective. The PESA was carried out in line with Ministry for the Environment Contaminated Land Management Guidelines No. 1, 'Reporting on Contaminated Sites in New Zealand'.

The procedure for the PESA was to review current and historical aerial photographs, maps, Land Information Memorandum's (LIM's), regional council files and easily accessible information on the internet for all sites within the proposed development area. The following is a summary of the PESA. The full report can be found attached in the Appendix.

The area of the proposed site is situated on reclaimed land. Reclamation was undertaken between 1872 and 1909. Parts of the overall site of the proposed stadium development have a long history of occupation by a variety of businesses. Table 1 summarises the past and present land use information and potential contamination risk from the industries on sites within the proposed stadium development site.

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 Underground Storage Tank (UST) on site	Moderate due to UST on site. Risk will be high if wooll scouring or tanning have been carried out on site
77 Parry St	1943 – Sawmill, timber processing and storage 1980 – Wooll scouring and tanning processes	Container unloading and goods distribution	High – from timber, tanning and container unloading processes

The ORC also noted that asbestos production and disposal may have been carried out on several sites, however this could not be confirmed by reviewing LIM reports. A more detailed description of information reviewed and past and present site uses can be found in the full PESA, attached as Appendix to this report.

From the current and past uses of the site outlined in Table 1, there is a high potential for the underlying ground in some areas to contain contamination, which may include but not be limited to:

- Asbestos from reported production and disposal operations;
- Cu, Cr, As, PCPs and dioxins from timber storage and treatment;
- Hydrocarbon products including petrol, diesel, hydraulic & lubricating oils from UST's, service station and vehicle use / storage;
- Chromium, acid, methylene chloride, ammonium, solvents and caustic substances from tannery operations; and,
- Elements including Zn, Cu, B, Fe, Mn, Ca, Mg, S, N, K and P from fertiliser storage. In its present state, the soil and any contamination it contains does not appear to be causing any hazard as it is covered by industrial units. This will also likely 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 on site and that excavated contaminated soils are disposed of appropriately?
  - 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. This work should be split into stages:

- Site visit to assess the current location of contaminative processes so any intrusive work can be targeted and to assess the possibility that the surrounding are is being impacted by site uses. Site contacts and access for intrusive work can also be established at this time;
- Intrusive work, undertaken in conjunction with any geotechnical investigations to reduce costs, to determine groundwater flow, presence of contamination and its concentrations.
- Preparation of documents for inclusion in the consenting process (Assessment of Environmental Effects, Environmental Management Plan, Environmental Monitoring Plan).