ENVIRONMENTAL INVESTIGATION SERVICES

30 June 2011
Ref: E20345Klet2.1 (review)

Bluestone Capital Ventures No.1 Pty Ltd
Suite 3
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Attention: Mr Matt Crews

PROJECT REVIEW
CRONULLA SHARKS REDEVELOPMENT,
461 CAPTAIN COOK DRIVE, WOOLOOWARE

1. INTRODUCTION

Bluestone Capital Ventures No.1 Pty Ltd commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake a project review of the environmental investigations/assessments completed by EIS for the proposed Cronulla Sharks Redevelopment, 461 Captain Cook Drive, Woolooware. The site locality is shown on Figure 1.

The review was undertaken generally in accordance with EIS proposals (Ref: EP5250K and EP5250K2 of 11 November 2011 and 29 June 2011 respectively, and written acceptance by email of 30 May 2011 and 29 June respectively.

1.1. Proposed Development Details

The proposed mixed use redevelopment of the Cronulla Sutherland Leagues Club site including a new neighbourhood retail centre, residential development and upgrades to the sports facilities, including the Toyota Stadium, will create a long term sustainable and viable solution for the Club as well as create a new centre and destination location that meets the needs of the surrounding community. The Concept Plan prepared for the site is seeking to develop the site in three stages, being:

- Stage 1 – New Neighbourhood Retail Centre, Medical and Leisure facilities on the eastern car park site and redevelopment of the Leagues Club facilities ;
- Stage 2 - Residential Masterplanned Estate on the western car park and field area; and
- Stage 3 - Extension and improvement of the Sharks playing field facilities including grandstand extensions.

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EIS understand that the proposed re-development is likely to include capping the east and west sections of the site. It is considered likely that the buildings will be constructed on piles. All car parking will be above ground and there will be no significant excavation of the site.

1.2. Objectives

The primary objectives of the review were to summarise the information presented in the previous EIS investigation/assessment reports and to review the analysis data in light of the most current re-development proposal.

The review also aims to summarise the previous investigations in light of clause 13 of the Director General's Requirements (DGRs) for the development dated 25 March 2011:

" 13. Contamination/Acid Sulphate Soils

- *The EA is to demonstrate compliance that the site is suitable for the proposed use in accordance with SEPP55- Remediation of Land.*
- *The EA shall provide an Acid Sulphate Soils management Plan prepared in accordance with the manual produced by the Acid Sulphate Soil Management Advisory Committee.*
- *The EA shall demonstrate consistency with the NSW State Groundwater Policies."*

2. SITE INFORMATION

The site identification details are summarised below:

Site Owner:	Cronulla-Sutherland Leagues Club Ltd
Site Address:	461 Captain Cook Drive, Woolooware
Lot & Deposited Plan:	Lot 11 in DP526492 and Lot 20 in DP529644
Local Government Authority:	Sutherland Shire Council
Current Zoning:	Private Recreation
AHD:	Approximately 2.5m to 7.5m
Geographical Location (MGA):	N: 6232100 E: 328300 (approximately)
Site Locality Plan:	Refer to Figure 1
Site Layout Plan	Refer to Figure 2

The Cronulla Sutherland Leagues Club site is legally described as Lot 11 DP 526492 and Lot 20 DP 529644 and is known as 461 Captain Cook Drive, Woolooware. Three lots owned by Sutherland Shire Council (being Lot 21 DP 529644, Lot 1 DP 711486 and Lot 1 DP 501920) are also included within the proposed scheme.

The site is located on the northern side of Captain Cook Drive approximately 1.5 kilometres from Caringbah (to the south west) and 2 kilometres from Cronulla (to the south east). The site is bounded by the Solander playing fields to the west, Woolooware Bay to the north, and a service station and gymnasium to the east. The Woolooware Golf Club and the Captain Cook Oval are located to the south of the site across Captain Cook Drive.

The overall site is irregular in shape with an area of approximately 10 hectares, of which approximately 6ha is occupied by Toyota Stadium, Leagues Club building and the eastern carpark and 4ha is occupied by the western training fields and car park.

Toyota Stadium (also known as Endeavour Field and Shark Park) and the Cronulla Sutherland Leagues Club building occupy the central portion of the site, and represent a major community and entertainment hub within the region. The western playing fields within the site are private open space used as training fields for the Cronulla Sharks and for local games by the Cronulla Caringbah Junior Rugby League Football Club, whilst the remainder of the site is occupied by car parking.

The Taren Point Employment Area is located approximately 200 metres to the northwest of the site and occupies land located generally between the waterfront, Taren Point Road and the Captain Cook Bridge. Woolooware Railway Station is located 1 kilometre to the south west of the site, and Caringbah Town Centre is approximately 3 kilometres by road to the south west.

The site is located to the south of Woolooware Bay which forms part of the north boundary of the site investigation area. The regional topography falls gently towards the Bay to the north, apart from the golf course to the south of Captain Cook Drive that was generally at a lower level than the site. Sections of the site appear to have been filled above surrounding levels including the spectator areas. Regional drainage patterns are generally toward Woolooware Bay to the north via a stormwater channel located between the east and west sections of the site. Due to previous grading of the site some sections drain locally toward Captain Cook Drive toward the south rather than Woolooware Bay. An easement for transmission lines is located across the north section of the site.

For descriptive purposes the site can be divided into three principal sections (as shown on Figure 2):

- The western section that is occupied by open, grassed playing fields and an on-grade car park (which located to the south of the playing fields);
- The central section that is occupied by the Toyota Park stadium and club house (which is located to the east of the stadium); and
- The eastern section that is occupied by an on-grade car park.

2.1. Regional Geology and Hydrogeology

The 1:100,000 geological map of Wollongong-Port Hacking (Map 9029-9129, 1:100,000 Department of Mineral Resources –1985) indicates the site to be underlain by manmade fill which typically consists of dredged estuarine sand and mud, coal washing, industrial and household waste. The fill is typically underlain by Quaternary aged deposits of organic rich, mostly "muddy" marine sand with Hawkesbury Sandstone at greater depths.

Department of Natural Resources (DNR) records were researched for the previous investigations and indicated that two registered groundwater bores lie within 1km of the site. The details are summarised below:

Ref No	Approx. distance from site(m)	Approx. direction from site	Depth(m)	Registered Purpose
GW011287	800m	East	15.30m	Recreational (irrigation)
GW011287	850	East	19.00m	Industrial

The stratigraphy of the site is expected to consist of relatively high permeability alluvial sandy soil overlying deep bedrock. Based on these conditions, groundwater may be considered to be a significant resource in the area, although use of the resource in the immediate area of the site may be reduced by the moderate salinity levels associated with tidal salt water intrusion from Woolooware Bay.

2.2. Acid Sulfate Soil Risk Map

The acid sulfate soil (ASS) risk maps indicate areas of high risk, low risk and no known occurrence of acid sulfate soils. The ASS Risk Map for Wollongong - Port Hacking (Acid Sulfate Soil Risk Map- 9129 N4 edition 2, December 1997, 1:25000, Department of Land and Soil Conservation) indicates that the site is located at the boundary of two areas as summarised below:

- The majority of the site lies within an area classified as "disturbed terrain" which is indicated to extend to depths of approximately 1m to 4m. Disturbed terrain may include filled areas, often associated with reclamation of low lying swamps for urban development, mined or dredged areas, or areas of heavy ground disturbance associated with the construction of dams and levees. Soil investigation is commonly necessary to assess acid sulfate soil conditions in these areas; and
- The area immediately to the north of the site (ie the mangrove area beyond the filled areas) is classified as being of "high probability" of ASS occurrence at or near the ground surface. This classification is typically associated with estuarine swamps, intertidal flats and supratidal flats. There is considered to be a significant

environmental risk associated with this classification if ASS materials are disturbed by activities such as shallow drainage, excavation or clearing.

3. SOIL CONTAMINANT THRESHOLD CONCENTRATIONS

The soil analytical data from previous investigations at this site have been compared to a number of guidelines that were dependent on the proposed development details at the time. The soil investigation levels adopted for this review are derived from the NSW DEC (now Office of Environment and Heritage - OEH) document *Guidelines for the NSW Site Auditor Scheme, 2nd Edition* (2006[1]) and the National Environmental Protection Council document *National Environmental Protection (Assessment of Site Contamination) Measure* (1999[2]). The contaminant thresholds listed below are levels at which further investigation and evaluation is required to assess whether the site is considered suitable for the proposed urban land use.

To accommodate the range of human and ecological exposure settings, a number of generic settings are used on which the Health based Investigation Levels (HILs) can be based. Four categories of HILs are adopted for urban site assessments. Contaminant levels for a standard residential site with gardens and accessible soil (Column A in Table A-1) are based on protection of a young child resident at the site. The remaining categories (Columns D to F) present alternative exposure settings where there is reduced access to soil or reduced exposure time. These categories include residential land use with limited soil access, recreational and public open space and commercial/industrial use. Where the proposed land use will include more than one land use category (eg. mixed residential/commercial development) the exposure setting of the most "sensitive" land use is adopted for the site.

Threshold concentrations for petroleum hydrocarbon contaminants including total TPH and BTEX compounds have previously been established in the *NSW EPA (now OEH) Contaminated Sites: Guidelines for Assessing Service Station Sites* (1994[3]) publication and this document is referenced in the Site Auditor Guidelines 2006. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have also been introduced in NEPM 1999.

Soil samples for the investigations have been analysed for total recoverable hydrocarbons (TRH) rather than TPH. TRH analysis is undertaken without a preliminary silica gel clean-up of the sample. Consequently the TRH result may include other compounds such as phthalates, humic acids, fatty acids and sterols (if present).

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[1] *Guidelines for the NSW Site Auditor Scheme, 2nd ed.,* NSW DEC, 2006 (Site Auditor Guidelines 2006)

[2] *National Environmental Protection (Assessment of Site Contamination) Measure,* National Environment Protection Council (NEPC), 1999 (NEPM 1999)

[3] *Guidelines for Assessing Service Station Sites,* NSW EPA, 1994 (Service Station Guidelines 1994)

3.1. Asbestos in Soil

NEPM 1999 does not provide numeric guidelines for the assessment of asbestos in soil. NSW DECCW (OEH) advice (2006) has indicated that consultants should use their 'professional judgement' regarding determination of appropriate investigation and remediation levels for asbestos in soils; however the NSW OEH have not published numerical guidelines for the assessment of asbestos in subsurface soils.

The WorkCover publication *Working with Asbestos Guide* (2008[4]) states that, where buried asbestos is encountered, "A competent occupational hygienist should assess the site to determine:

- If asbestos material is bonded or friable
- The extent of asbestos contamination
- Safe work procedures for the remediation of the site"

"*Any asbestos cement products that have been subjected to weathering, or damaged by hail, fire or water blasting are considered to be friable asbestos and an asbestos removal contractor with a WorkCover license for friable asbestos removal is required for its removal*". Under the *NSW Occupational Health and Safety (OHS) Regulations 2001*[5] and WorkCover requirements all necessary disturbance works associated with friable asbestos containing materials must be conducted by a licensed AS-1 Asbestos Removal Contractor.

3.2. Site Assessment Criteria (SAC) for Soil Contaminants

The 'residential with minimal opportunities for soil access' (Column D) exposure setting has been adopted for this review and the appropriate soil criteria are listed in the following table:

[4] *Working with Asbestos Guide,* NSW WorkCover, 2008 (WorkCover Working with Asbestos Guide 2008)
[5] *Occupational Health and Safety Regulation,* NSW Government, 2001 (NSW OH&S Regulation 2001)

Contaminant	SAC - HILs Column D (mg/kg)
Heavy Metals	
Arsenic (total)	400
Cadmium	80
Chromium (III)	48%
Copper	4000
Lead	1200
Mercury (inorganic)	60
Nickel	2400
Zinc	28000
Petroleum Hydrocarbons	
TPH (C_6-C_9)	65 [a]
TPH (C_{10}-C_{36})	1000 [a]
Benzene	1 [a]
Toluene	1.4 [a]
Ethylbenzene	3.1 [a]
Total Xylenes	14 [a]
PAHs	
Total PAHs	80
Benzo(a)pyrene	4
Pesticides (OCPs & OPPs)	
Aldrin + Dieldrin	40
Chlordane	200
DDT + DDD + DDE	800
Heptachlor	40
Total OPPs	0.1[b]
Others	
PCBs (Total)	40
Asbestos	NDLR [c]

Note:

[a] Service Station Guidelines 1994

[b] Due to the absence of locally endorsed guideline criteria, the laboratory practical quantitation limit (PQL) has been adopted.

[c] Not Detected at Limit of Reporting (NDLR)

3.3. Groundwater Contaminant Trigger Values

Groundwater resources in NSW are managed and regulated by environmental and planning legislation which include the POEO Act 1997, *Environmental and Planning Assessment Act* (1979[6])/E&PAA 1979 and the *Water Management Act* (2000[7]).

In 2000, Australian and New Zealand Environment Conservation Council (ANZECC) released the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000[8]) which superseded the previous guideline documents.

The ANZECC 2000 guidelines include a complete framework for the development of appropriate guidelines for aquifer assessment. The above guidelines provide water quality parameters at the point of use including aquatic ecosystems (fresh and marine waters), drinking water, industrial and agricultural/irrigation uses.

The National Health and Medical Research Council (NHMRC) released the *Australian Drinking Water Guidelines* (2004[9]). These guidelines are predominantly used to assess drinking water quality and have been referenced in some cases.

The appropriate settings for current and potential uses of groundwater should be identified in establishing applicable groundwater trigger values:

- raw drinking water source;
- agricultural use – stock watering;
- agricultural and domestic use – irrigation;
- protection of aquatic ecosystems – freshwater; and
- protection of aquatic ecosystems – marine.

The presence of elevated contaminant concentrations in groundwater triggers further investigation of aquifer conditions to assess the source(s) of contamination and the lateral and vertical extent of the contamination.

Guidance on the remediation and management of contaminated groundwater is presented in the document *NSW DECCW (OEH) Guidelines for the Assessment and Management of Groundwater Contamination (2007[10])*.

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[6] *Environmental Planning and Assessment Act,* NSW Government, 1979 (EP&AA 1979)

[7] *Water Management Act*, NSW Government, 2000 (Water Act 2000)

[8] *Australian and New Zealand Guidelines for Fresh and Marine Water Quality,* ANZECC, 2000 (ANZECC 2000)

[9] *Australian Drinking Water Guidelines*, National Health and Medical Research Council, 2004 (NHMRC 2004)

[10] *Guidelines for the Assessment and Management of Groundwater Contamination,* NSW DECCW, 2007 (Groundwater Contamination Guidelines 2007)

3.4. Petroleum Hydrocarbons in Groundwater

In the absence of locally endorsed guidelines for petroleum hydrocarbon compounds in water, the 'intervention value' concentration for mineral oil specified in the *Circular on Target Values and Intervention Values for Soil Remediation* (2000[11]) has been adopted for mid to heavy fraction (C_{10}-C_{36}) TPH.

It is noted that these guidelines have not been endorsed by NSW OEH and are used only as a preliminary screening tool.

3.5. Site Assessment Criteria (SAC) for Groundwater Contaminants

The marine groundwater trigger values have been adopted along with other guideline values for this investigation as outlined in the following table:

Contaminant	Units	Marine Water Criteria[1]
Metals		
Arsenic (total)[6]	µg/L	2.3[a]
Cadmium	µg/L	5.5
Chromium (III)	µg/L	10[a]
Copper	µg/L	1.3
Lead	µg/L	4.4
Mercury	µg/L	0.4
Nickel	µg/L	70
Zinc	µg/L	15
Petroleum Hydrocarbons		
TPH C_{10}-C_{36}	µg/L	600[b]
Benzene	µg/L	500[a]
Toluene	µg/L	180[a]
Ethylbenzene	µg/L	5[a]
o-Xylene	µg/L	350[a]
m + p Xylene	µg/L	75[a*]
OC Pesticides		
Aldrin	µg/L	0.0003
Dieldrin	µg/L	0.01
trans-Chlordane	µg/L	0.001
cis-Chlordane	µg/L	
trans-nonachlor	µg/L	
Oxychlordane	µg/L	

[11] *Circular on Target Values and Intervention Values for Soil Remediation,* Ministry of Housing, Spatial Planning and Environment, 2000 (Dutch Guidelines 2000)

Contaminant	Units	Marine Water Criteria[1]
DDT	μg/L	0.0004
DDE	μg/L	0.0005
Heptachlor epoxide	μg/L	0.0004
HCB	μg/L	0.005
beta HCH	μg/L	0.0007
gamma HCH	μg/L	
Mirex	μg/L	0.004
OP Pesticides		
Demeton-S-methyl	μg/L	4
Diazinon	μg/L	0.01
Dimethoate	μg/L	0.15
Chlorpyrifos	μg/L	0.009
malathion	μg/L	0.05
Azinphos Methyl	μg/L	0.01
Fenitrothion	μg/L	0.001
Parathion (ethyl)	μg/L	0.05
Parathion (methyl)	μg/L	
Herbicides		
MCPA	μg/L	1.4
2,4-D	μg/L	280
2,4,5-T	μg/L	36

Notes:

[1] 95% Trigger Values for Marine Water (ANZECC 2000)

[2] Australian Drinking Water Guidelines (NHMRC 2004)

[6] The Arsenic (III) trigger value has been adopted

[a] Low or Moderate Reliability Trigger Values have been quoted (ANZECC 2000)

[b] In the absence of locally endorsed guidelines, the Dutch investigation levels have been quoted

[d] The aesthetic guideline concentration has been quoted

[e] In the absence of locally endorsed guidelines, the laboratory PQL has been adopted

[a*] Low or Moderate Reliability Trigger Values (ANZECC 2000) for m-Xylenes have been quoted. We note that m-Xylene guideline value is 75μg/L and the p-Xylene guideline value is 200μg/L. However, these two isomers cannot currently be distinguished analytically

nsl – No set limit

4. PREVIOUS REPORTS

EIS have previously prepared the following environmental assessment/investigation reports for various sections of wider Leagues Club site. A number of investigations have been undertaken over the years for a variety of different proposed developments:

1. "*Report to St George Partnership Banking Ltd, Environmental Site Screening (of Site C) at Cronulla Leagues Club, Captain Cook Drive, Woolooware*", Ref: E10715SC/a, dated 1 November 1994;
   This investigation involved drilling six boreholes in the west section of the site (in the open playing fields). The boreholes encountered fill material ranging from 2m to 3m deep. Eight soil samples were analysed for heavy metals, all of the results were less than the SAC adopted for the purpose of this review. Four soil composite samples were analysed for organics and potentially elevated concentrations of benzo(a)pyrene were detected in one of the samples. However these composite results are not considered to be reliable. Five groundwater samples were analysed. However, as with the composites these results are not considered to be particularly reliable.

2. "*Report to St George Partnership Banking Ltd, Environmental Site Screening (of Site B) at Cronulla Leagues Club, Captain Cook Drive, Woolooware*", Ref: E10715SB/b, dated 1 November 1994;
   This investigation involved drilling three boreholes in the east section of the site (in the car park). The boreholes encountered fill material 3m to 4m deep. Six soil samples were analysed for heavy metals, all of the results were less than the SAC adopted for the purpose of this review. One soil composite sample was analysed for organics and potentially elevated concentrations of benzo(a)pyrene were detected in the sample. However these composite results are not considered to be reliable. One groundwater sample was analysed. However, as with the composite these results are not considered to be particularly reliable.

3. "*Report to All Star Real Estate on Further Contamination Investigation (Site C) for Cronulla Sutherland Leagues Club at Captain Cook Drive, Woolooware*" Ref: E10715S/a, dated 15 February 1995;
   This investigation involved the drilling of 34 boreholes in a regular grid across the west section of the site. Most of the boreholes were terminated in the fill at a depth of 1m. Thirty soil samples were analysed for heavy metals. Two samples contained lead concentrations greater than 1,200mg/kg (ie the SAC adopted for the purpose of this review). The maximum lead result was 2,295mg/kg. Four groundwater samples were analysed. However, these results are not considered to be particularly reliable. During

drilling the methane gas concentration in the boreholes was measured. The methane gas concentrations ranged from 0% to 5%.

4. "*Report to Cronulla Sharks Rugby Leagues Club on Environmental Site Screening for Shark Park Redevelopment at Cronulla Leagues Club, Captain Cook Drive, Woolooware*", Ref: E15009FRPT/2, dated 29 November 2000;
   This investigation included a desk top site history assessment together with an additional ten boreholes drilled across the site. The limited site history indicated that:
   - The site was mangrove swamp in the 1950s and was gradually backfilled in the 1960s and 1970s;
   - By 1978 the basic current layout of the site was complete;
   - Council records indicated that Council had purchased the land in the 1950s with the intention of filling the low lying areas with non-putrescible waste;
   - The Leagues Club and Stadium area of the site were sold by tender to the Cronulla Sutherland Leagues Club in 1968 with an agreement that the council would fill the remainder of the site and transfer the ownership to the Leagues Club;
   - Development of the stadium and other club facilities was undertaken in a number of stages with approval for the main Club building obtained in 1973. Approval for spectator seating, change rooms and amenities facilities was obtained in 1979 and extensions to the club and spectator facilities were undertaken in 1981; and
   - A fill mound approximately 6m above the field level was constructed in the north section of the stadium on 1981. Records indicate that approval for this development was not sought from the council. This mound extended beyond the Leagues Club land into Woolooware Bay. Council subsequently ordered that stabilisation works be undertaken.

   Of the ten boreholes, four were drilled in the western playing fields, four were drilled in the eastern car park and two were drilled in the area to the north of the stadium. The boreholes in the western playing fields encountered up to 3.2m of fill, the boreholes in the eastern car park encountered 3.4 to 4.5m of fill and the boreholes drilled to the north of the stadium encountered greater than 6m of fill (these two boreholes were drilled in the spectators hill). A total of 19 soils samples were analysed for heavy metals and all of the results were less than the SAC adopted for the purpose of this review.

   Nineteen soil samples were analysed for a range of heavy metals. All of the results were less than the SAC adopted for the purpose of this review. Eight composite samples were analysed for organic compounds. Although no significant elevations of organics were recorded in the composite samples the results are not considered to be reliable.

Three of the deeper natural soil samples (estuarine clayey silt/silty clay) were screened for potential ASS conditions using the POCAS analytical technique. The samples were all considered to be potential ASS (PASS).

Significant concentrations of methane gas were encountered in four of the boreholes (up to a maximum concentration of 42% v/v).

5. "*Report to Cronulla Sutherland Leagues Club on Further Environmental Site Assessment for Proposed Cronulla Leagues Club Rezoning at Captain Cook Drive, Woolooware*", Ref: E17119FK-rpt, dated October 2002;
   This investigation included ten boreholes across the eastern car park for a proposed basement and two boreholes on the west side of the western playing fields for a proposed power easement. The fill depths in the eastern car park ranged from approximately 2.0m in the south west corner of the car park to approximately 4.5m along the north boundary. The depth of fill encountered in the two boreholes drilled on the west boundary of the western playing fields ranged from approximately 1m to 2m.

   Twenty four soil samples were analysed for heavy metals, polycyclic aromatic hydrocarbons and organochlorine pesticides. One sample contained an elevated concentration of lead (2,400mg/kg) above the SAC adopted for the purpose of this review. The remaining results were all less than the SAC adopted for the purpose of this review. Twelve samples were analysed for petroleum hydrocarbons. The results were all less than the SAC adopted for the purpose of this review.

   Twenty two of the underlying natural samples were analysed for potential acid sulfate soil. The results indicated that the underlying natural soil were considered to be potential acid sulfate soils.

   Groundwater in the boreholes was measured up to 26 hours after completion of drilling at depths that ranged from 2.4m to 3.2m below the existing ground levels.

   Methane gas was encountered in the boreholes at concentrations that ranged from 0% to 19% v/v.

6. "*Report to Cronulla-Sutherland District Rugby League Football Club on Environmental Site Assessment for Proposed Upgrade Works at Toyota Park, 461 Captain Cook Drive, Woolooware*", Ref: E20345FJ-RPT, dated August 2006.
This investigation was confined to the the south section of the western playing fields and the accessible open areas adjacent to the north, south and west of the stadium. The depth of fill in the south section of the western playing fields ranged from 1.6m to 4.3m. The depth of fill in the accessible areas adjacent to the west and south of the stadium ranged from 1.1m to 4.2m. The depth of fill in the area to the north of the stadium ranged from 1.4m to 8.6m (it should be noted that these boreholes were drilled in the hill located to the north of the stadium). Monitoring wells were installed in eight of the boreholes. Groundwater levels were found to range from 0.41m AHD to 1.2m AHD (this correlates to approximately 1m to 2m below existing site levels). This investigation was designed to address the requirements *SEPP55-Remediation of Land, Managing Land Contamination: Planning Guidelines*[12]. The investigation was also the subject of a contaminated site audit review by Mr Rod Harwood of Environmental Strategies. However, the audit was never completed due to the cancelation of the proposed development.

   A summary of the detailed soil laboratory analysis is provided below:
   - Seventy soil samples were analysed for heavy metals and polycyclic aromatic hydrocarbons. One sample contained an elevated concentration of lead (1,400mg/kg) above the SAC adopted for the purpose of this review. The remaining results were all less than the SAC adopted for the purpose of this review;
   - Sixty one samples were analysed for organochlorine pesticides. The results were all less than the SAC adopted for the purpose of this review;
   - Thirteen samples were analysed for organophosphate pesticides and phenoxy acid herbicides. The results were all less than the practical quantitation limit of the analytical technique;
   - Seventy samples were analysed for petroleum hydrocarbons. The results were all less than SAC adopted for the purpose of this review;
   - Fifty eight fill samples were screened for asbestos. Asbestos was detected in eighteen of the samples;
   - Thirteen fill samples and thirty four natural samples were screened for ASS characteristics using the sPOCAS method. The fill and natural soil samples were considered to be PASS.

[12] State Environmental Planning Policy No. 55 – Remediation of Land, NSW Government, 1998 (SEPP55)

A summary of the groundwater chemistry results encountered in the eight monitoring wells is provided below:

- Groundwater pH was generally neutral and ranged from pH6.7 to 7.4;
- Electrical conductivity ranged from 2,200µS/cm to 34,000µS/cm;
- The groundwater samples did not contain organochlorine, organophosphate or herbicide concentrations above the adopted SAC.
- Elevated arsenic concentrations were encountered in seven of the eight monitoring wells. These results were considered to be associated with regional groundwater conditions rather than a site specific source;
- One groundwater sample contained an elevated mercury concentration of 3.7*µ*g/L compared to the site assessment criteria of 0.4*µ*g/L. However this result may have been an anomaly as it was not confirmed by the analysis of a duplicate sample;
- The concentrations of ammonia in the groundwater samples ranged from 2.1mg/L to 34mg/L and were all above the SAC of 0.91mg/L.
- The concentrations of volatile organic compounds (VOCs) and petroleum hydrocarbons were less than the practical quantitation limits and less than the adopted SAC;
- Two groundwater samples were analysed for herbicides, organophosphate pesticides and organochlorine pesticides. The results were all less than the SAC.

Methane gas readings were obtained from the eight monitoring wells. Methane gas reading in six of the eight wells exceeded 1.25% v/v, with a maximum concentration of 29% v/v.

The following letters have also been prepared for the project:

1. "*Assessment of Existing Stockpiled Material for Re-use, Toyota Park, 461 Captain Cook Drive, Woolooware"* Dated 22 August 2007, Ref: E20345FJ2 Let;
2. *"Acid Sulfate Soil Management Plan, Proposed Upgrade of Sports Stadium Facilities, 461 Captain Cook Drive, Woolooware"* Dated 29 August 2007;
3. *"Review of Methane Measures for Proposed Southern Grandstand Works, Toyota Park, 461 Captain Cook Drive, Woolooware"* Dated 30 August 2007, Ref: E20345FJ Let-M; and
4. *"Review of Methane Measures for Proposed Southern Grandstand Works, Toyota Park, 461 Captain Cook Drive, Woolooware"* Dated 30 August 2007, Ref: E20345FJ Let-M2.

5. SUMMARY OF PREVIOUS INVESTIGATIONS

The site consists of three principal sections: the western playing fields (an open grassed area); the centrally located stadium and associated club house; and the eastern car park (an on-grade

asphalt paved car park). The north section of the site is bounded by mangrove swamp and Wooloware Bay. Aerial photographs indicated that the site was initially mangrove swamp that was backfilled sometime in the 1950s to1960s. The basic layout of the site buildings had been completed by 1978.

Since 1994 EIS have undertaken a number of investigations in various sections of the site for a variety of proposed developments.

A number of the results in the earlier reports (pre 2001) are not considered to be reliable enough for inclusion in data sets for future reports. The reasons for this are:

- The organics analysis was undertaken on composite samples (ie samples from three or four adjacent boreholes were combined together into one sample to provide a broad screening). Although common at the time this process can result in artefacts;
- QA/QC procedures in the field and in the laboratory in the older reports do not comply with the very stringent procedures that are currently implemented;
- The current procedures for groundwater well installation and subsequent sampling are considered to result in samples that are more representative of actual groundwater conditions; and
- Due to the above issues old data sets would not be acceptable to a site auditor undertaking a review of older reports.

However, old data sets can be discussed in general terms and may be useful if they backup the conclusions of more robust data sets.

Based on the results of investigations a number of general conclusions can be drawn:

- The site sits on approximately 1m to 4.5 m of fill and is underlain by natural estuarine soil including silty sand, clayey sand and sandy clay. Bedrock was encountered at depths ranging from 12m to 26m. Groundwater was generally encountered at 1 to 2m below the current site levels;
- The investigations have not encountered any significant widespread chemical soil contamination. Some isolated elevations of lead have been encountered. During the 2006 investigation, 30% of the soil samples were found to contain traces of asbestos;
- The investigations have not encountered any significant widespread groundwater contamination. Elevated concentrations of arsenic encountered during one of the investigations were considered to be a regional issue rather than a site specific one;
- Both the fill and natural soils are considered to be PASS; and
- The site is generating methane gas as a result of organic material buried during the landfilling process.

6. FUTURE INVESTIGATIONS

In order to provide a report that meets the requirements of a Stage 2 Detailed Investigation as specified in *SEPP55* there are a number of issues and data gaps that need to be resolved. These include the following:

- The appointment of an OEH licensed independent contaminated site auditor to undertake a review of former and future investigations. EIS understand that Chris Jewell of CM Jewell and Associates has been engaged to provide this function;
- Representative soil sampling over the entire development area so that the final sampling density meets that specified in the *NSW EPA Sampling Design Guidelines (1995[13]);*
- Analysis of soil samples for contaminants and Acid Sulfate Soils;
- Methane monitoring across the site;
- Installation of additional groundwater monitoring wells and groundwater sampling for a more accurate understanding of groundwater conditions
- Updating of the Acid Sulfate Soil Management Plan presented in the 2006 report to take account of new data and the proposed new development; and
- Implementation of adequate QA/QC procedures so that a reliable, robust data set can be generated;

7. SUITABILITY OF THE SITE FOR THE PROPOSED RE-DEVELOPMENT

EIS understand that the proposed development now includes a high density residential development in the western section of the site and a commercial/retail development in the eastern section of the site. All parking for the development will be above ground and there will be no significant excavation of the area.

EIS are of the opinion that the site could be made suitable for the proposed re-development provided that:

- The site is capped and the development is constructed on piles (ie there is no significant excavation and no access to the underlying soil). EIS are of the opinion excavation/disturbance of the site should be kept to a minimum in order avoid potential mobilisation of any contaminants present in the landfill and subsequent adverse impacts on the mangrove zone located to the north
- Suitable measures are taken to protect the buildings from the ingress of methane gas and that the OEH/site auditor agree with these measures:
- A Remedial Action Plan (RAP) is prepared that addresses all remedial work necessary to make the site suitable for the proposed development including capping requirements;

[13] Contaminated Sites Sampling Design Guidelines, NSW EPA, 1995 (EPA Sampling Design Guidelines 1995)

- An additional investigation is undertaken to address potential data gaps in the old reports and increase the sampling density to the minimum recommendation of the Sampling Design Guidelines 1995)
- The additional investigation addresses the current requirements for QA/QC analysis;
- No groundwater is extracted for use on the development;
- There are suitable management plans prepared to address any contingencies that may arise during development (eg an acid sulfate soil management plan and asbestos management plan);
- An Environmental Management Plan (EMP) is prepared for the development and that this plan is notated to the land title via the Section 149 certificate or a covenant on the land title under Section 88B of the Conveyancing Act 1919 (it should be noted that this may have an impact on the future property value).

8. LIMITATIONS

The conclusions presented in this letter are based on site conditions which existed at the time of the previous site assessment s/investigations and the objectives of the review as referenced previously in this letter. They are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, and visual observations of the site and vicinity, together with the interpretation of available information and documents reviewed as described in this report.

The preparation of this letter has been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined previously in this report.

Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated.

Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes.

EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1970 constructed buildings or fill material at the site.

EIS have not and will not make any determination regarding finances associated with the site.

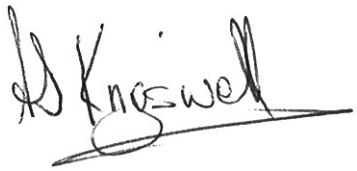
During development works, soil, fill and any unsuspected materials that are encountered should be monitored by qualified environmental and geotechnical engineers to confirm

assumptions made on the basis of the limited investigation data, and possible changes in site level and other conditions since the investigation.

This letter has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report.

Should you require any further information regarding the above, please do not hesitate to contact us.

Yours faithfully
ENVIRONMENTAL INVESTIGATION SERVICES



Adrian Kingswell
Senior Associate

Attachments:

Table A-1:	Environmental and Health-based Soil Investigation Levels
Figure 1:	Site Locality Plan
Figure 2:	Site Layout Plan

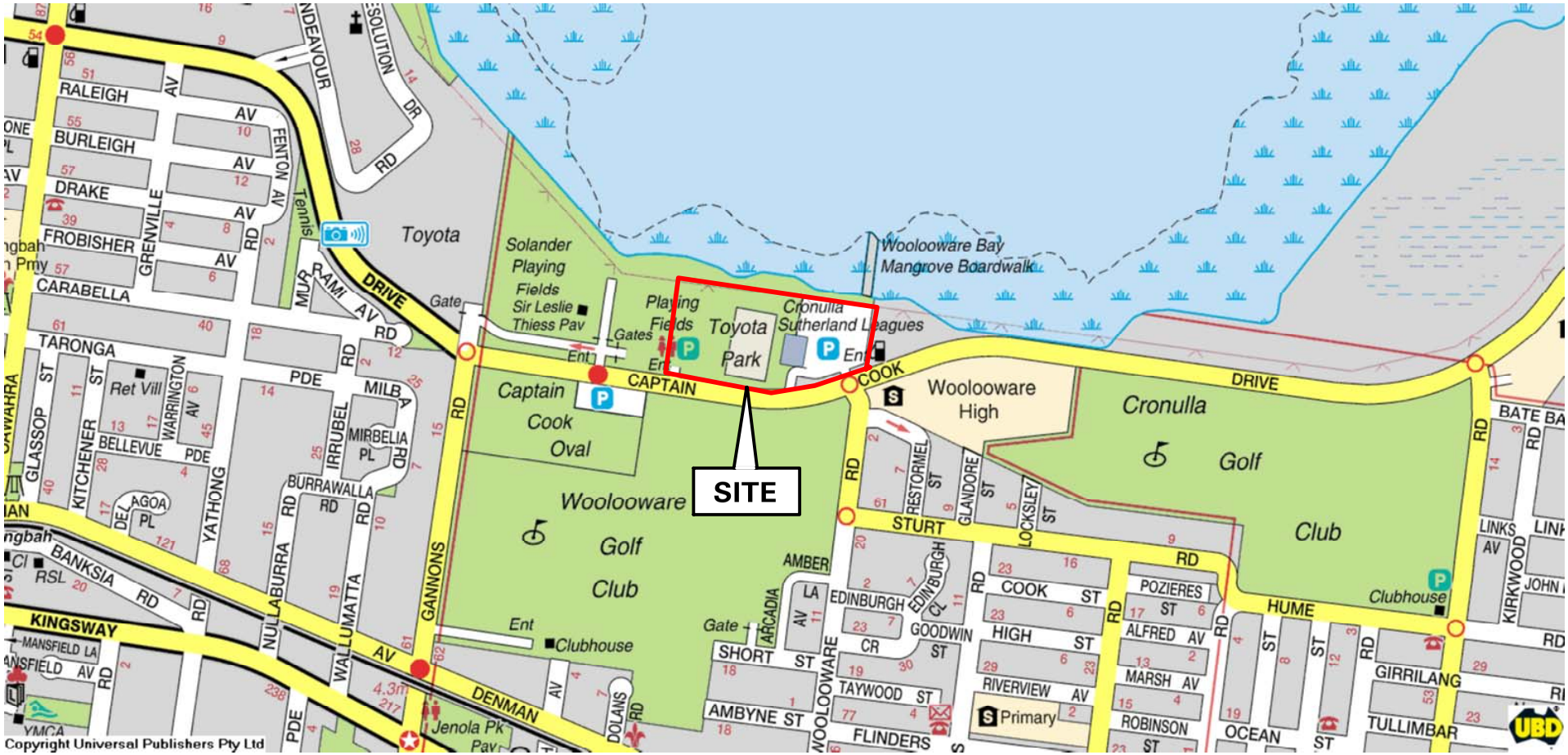
TABLE A-1
ENVIRONMENTAL AND HEALTH-BASED SOIL INVESTIGATION LEVELS (mg/kg)

Substances	Health Investigation Levels (HILs)[1]				Provisional Phyto-toxicity Investigation Levels (PPILs)[1]	NSW EPA Guidelines for Assessing Service Station Sites[2]	Back-ground Ranges[1]
	A	D	E	F			
	'Standard' residential with garden/ accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry); includes children's day-care centres, kindergartens, preschools and primary schools	Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats	Parks, recreational open space and playing fields: includes secondary schools	Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites			
METALS/METALLOIDS							
Arsenic (total)	100	400	200	500	20		1-50
Barium					300		100-3000
Beryllium	20	80	40	100			
Cadmium	20	80	40	100	3		1
Chromium(III)	12%	48%	24%	60%	400		
Chromium(VI)	100	400	200	500	1		
Chromium (total)							5-1000
Cobalt	100	400	200	500			1-40
Copper	1000	4000	2000	5000	100		2-100
Lead	300	1200	600	1500	600		2-200
Manganese	1500	6000	3000	7500	500		850
Methyl mercury	10	40	20	50			
Mercury (inorganic)	15	60	30	75	1		0.03
Nickel	600	2400	600	3000	60		5-500
Vanadium					50		20-500
Zinc	7000	28000	14000	35000	200		10-300
ORGANICS							
Aldrin + Dieldrin	10	40	20	50			
Chlordane	50	200	100	250			
DDT + DDD + DDE	200	800	400	1000			
Heptachlor	10	40	20	50			
Polycyclic aromatic hydrocarbons (PAHs)	20	80	40	100			
Benzo(a)pyrene	1	4	2	5			
Phenol	8500	34000	17000	42500			
PCBs (total)	10	40	20	50			
Petroleum Hydrocarbon Components (constituents):							
>C16 - C35 Aromatics	90	360	180	450			
>C16 - C35 Aliphatics	5600	22400	11200	28000			
>C35 Aliphatics	56000	224000	112000	280000			
C6-C9						65	
C10-C40						1000	
Benzene						1	
Toluene						1.4	
Ethyl Benzene						3.1	
Total Xylenes						14	
OTHER							
Boron	3000	12000	6000	15000			
Cyanides (complexed)	500	2000	1000	2500			
Cyanides (free)	250	1000	500	1250			
Phosphorus					2000		
Sulfur					600		
Sulfate					2000		

NOTE: Reference should be made to the following guidelines for further details (as referenced in the above table):

1 National Environment Protection (Assessment of Site Contamination) Measure - 1999, National Environment Protection Council. Human exposure settings based on land use have been established for HILs and details are outlined in Taylor and Langley 1998.

2 NSW DECCW (formerly EPA) Guidelines for Assessing Service Station Sites - 1994.

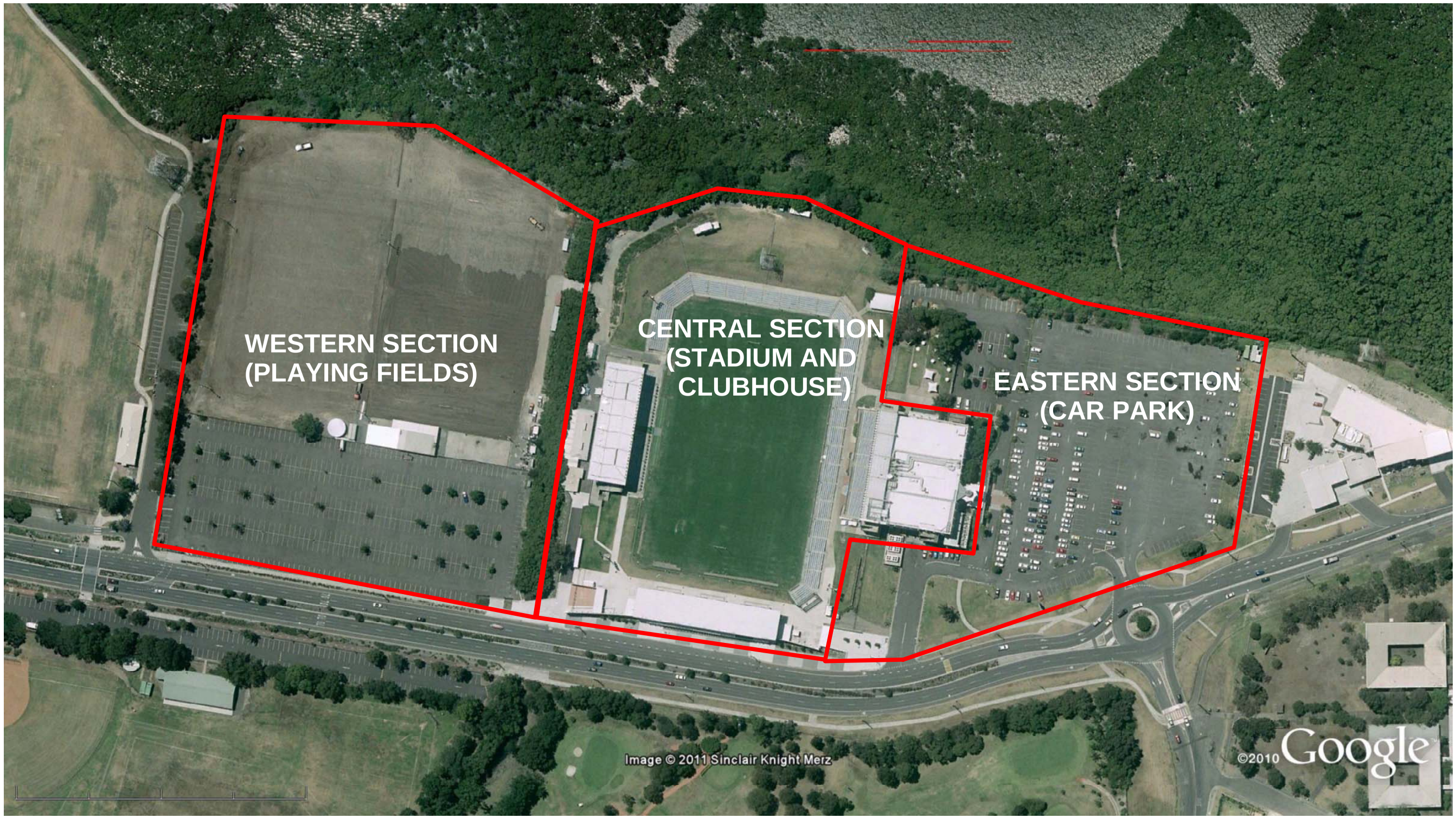


NOTES:
Figure 1 has been recreated from UBD on disc (version 5.0). Figure is not to scale.

UBD Map ref: 334 K5

Reference should be made to the report text for a full understanding of this plan.

ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E20345K	Title: SITE LOCATION PLAN
	Figure: 1	Address: CRONULLA LEAGUES CLUB, CAPTAIN COOK DRIVE. WOOLOOWARE, NSW



NOTES:
Figure 2 has been recreated from Google EarthPro

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m): 0 20 40 60 80 100	ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E20345K	Title: SITE LAYOUT
		Figure: 2	Address: CRONULLA LEAGUES CLUB, CAPTAIN COOK DRIVE. WOOLOOWARE, NSW