



EIS 1435 Vol 1

AA068053

Lucas Heights 1 and Waste Management Centre : development
application report

NSW DEPT PRIMARY INDUSTRIES



AA068053



VOLUME 1 development application report

Lucas Heights 1 and Waste Management Centre



DECEMBER 1998



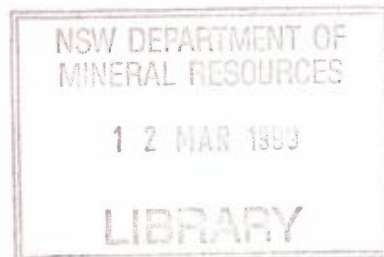
EIS 1435 'A' V1



HASSELL

LUCAS HEIGHTS 1 AND WASTE MANAGEMENT CENTRE DEVELOPMENT APPLICATION REPORT

Volume 1



Report prepared for :

Waste Service NSW and
Sutherland Shire Council

by

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DECEMBER 1998

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HASSELL

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EXECUTIVE SUMMARY

This Development Application describes developments proposed at two landfill sites at Lucas Heights. The developments are the result of an agreement between Waste Service NSW and Sutherland Shire Council which addresses these two sites and the Lucas Heights Conservation Area. Details of developments proposed in the Lucas Heights Conservation Area are included in a separate Environmental Management Plan Report.

The Lucas Heights 1 and Waste Management Centre sites addressed in this Development Application are proposed for recreation and sporting uses. Allocation of recreation and sporting uses has been based primarily on the recreation needs of the community in accordance with a vision to provide quality recreation and sporting facilities for this and future generations of the population of the Shire. It is anticipated that future recreation needs may change and the designs for the sites are sufficiently flexible to allow them to cater for future needs should they arise. The physical resource of the sites is designed simply as a setting for various recreation uses.

The report is divided into two sections, Part A and Part B, addressing the two sites, Lucas Heights 1 and the Waste Management Centre, respectively. Each Part includes a description of the existing site, the proposed development and implementation strategies.

Key aspects of the proposals are summarised below.

- The project allows for increased clean and dry waste landfilling at Lucas Heights 1 (total approximately 4 million tonnes) and increased clean filling and putrescible waste landfill capacity at the Waste Management Centre (total approximately 12.5 million tonnes).
- Development of the two sites provides a total area of 236 hectares of land to recreation and sporting facilities for public use.
- Recreation land available for public use will be released on a staged basis between 2001 and 2025.
- The recreation facilities most urgently required by the community will be released as the first stages of the development at Lucas Heights 1.
- The proposed parklands will be high quality developments which will provide a valuable long term local and regional resource.
- The rehabilitation proposed for the landfills will be capable of supporting a substantial and mature tree canopy and vegetation cover.
- Planting species proposed for the developments are essentially native, indigenous vegetation species which are commonly found in the surrounding areas.
- Stormwater runoff from the Lucas Heights 1 site will be collected, stored and re-used for irrigation to minimise reliance on potable water supply.
- Stormwater runoff from the Waste Management Centre will be collected and stored in ponds which will be a major landscape feature of the development.
- A variety of recreation settings ranging from intensive active recreation to quiet parkland settings are proposed in the parklands.

EXECUTIVE SUMMARY

- A network of trails for jogging, walking, hiking and horse riding, as well as to provide access to facilities, will be constructed.
- The existing riverine habitats along Lucas Height 1 Creek and Mill Creek will be rehabilitated.
- New entries and car parking will be provided to each site. A total of 440 car spaces is proposed at Lucas Heights 1. Minor car parking only is proposed at the Waste Management Centre at this stage.
- A Green Waste Processing and Composting and Bulk Waste Processing Facility and Recycling and Resource Recovery area are proposed on the Waste Management Centre adjacent to the parklands.

1. INTRODUCTION

1.1 Preamble

This Development Application relates to three areas at Lucas Heights:

- Lucas Heights 1 (LH1);
- the Waste Management Centre (WMC); and
- the Lucas Heights Conservation Area (LHCA).

The extent of these sites is shown in *Figure 1*. Details for the development proposed for the LHCA are included in the LHCA Draft Environmental Management Plan (EMP).

HASSELL was commissioned in 1997 to prepare development application documentation for the proposed rehabilitation and end uses for the two landfill sites, Lucas Heights 1 and the Waste Management Centre. The development for the two sites is one project involving staged landfill of both sites and staged rehabilitation for sporting and recreational uses. The landfill and associated rehabilitation of one site cannot proceed without the other.

The project has developed from a mediation agreement between Council and Waste Service NSW which involves financial arrangements between them. These arrangements link the two areas economically. Essentially, it is revenue generated by a rehabilitation enhancement fee linked to the intake of landfill material into each site that provides the basis for funding the development of sporting and recreational uses.

The agreement between Sutherland Shire Council and Waste Service NSW allowed for the following development at three sites:

- to create an acceptable landform profile for the development of an active sporting recreation complex by additional landfilling with clean and dry waste fill at LH1;
- to provide additional landfill capacity and extended landfill life at the WMC;
- to develop long term recycling and greenwaste processing facilities at the WMC;
- to create a Conservation Area north of the existing operating landfill site at the WMC;
- to create high quality parkland development at the WMC site for future public use, completed incrementally to follow the landfilling stages; and
- to provide a staged programme of landfilling, rehabilitation and release for rehabilitation and sporting facilities at both of the landfill sites.

1. INTRODUCTION

EXISTING CONDITIONS

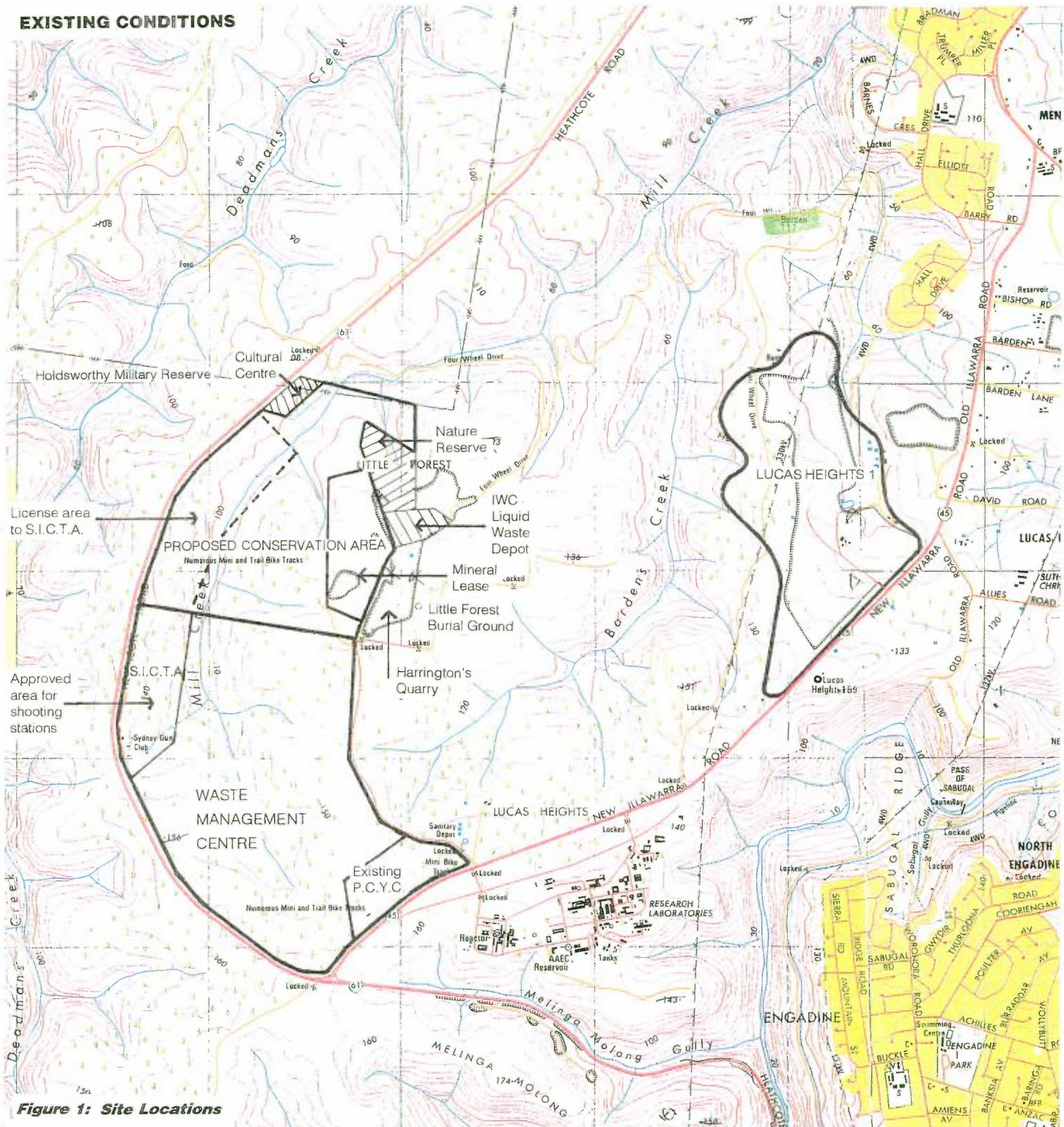


Figure 1: Site Locations

Figure 1: Site Locations

1. INTRODUCTION

1.2 Location

The LH1 and WMC sites are located adjacent to New Illawarra Road and Heathcote Road in Lucas Heights as shown in *Figure 1*. The sites drain to the north via Mill Creek, Bardens Creek or Lucas Heights 1 Creek as shown in Figure 1. The sites are bounded by the Holsworthy Field Firing Range to the west, generally undeveloped land to the north, Heathcote National Park to the south and residential areas including Heathcote, Engadine, Yarrawarra, Lucas Heights, Bangor, Bardens Ridge and Menai generally to the south and east.

Harrington's Landfill and the Industrial Waste Centre (IWC) are located off Little Forest Road to the north of the WMC. A night soil area and the Little Forest Burial Ground are also located in this area.

1.3 Environmental Impact Statement (EIS)

An EIS for the landfill sites has been prepared by National Environmental Consulting Services Pty Ltd (NECS) and a team of specialist consultants. The EIS has been prepared concurrently with this development application. The EIS addresses the impacts of both interim and long term proposals for the sites.

1.4 Structure of this Report

This report, comprising two volumes, documents the development proposals for the LH1 and WMC sites. **Volume 1** is divided into two sections, Part A and Part B. The two sections address the two sites separately and are followed by appendices with supporting information.

Volume 2 contains the full set of DA drawings reduced to a convenient A3 size divided into Parts A and B addressing the two sites separately as in Volume 1.

A

Lucas Heights 1 and Waste Management Centre
Development Application Report

PART A: LUCAS HEIGHTS 1

LUCAS HEIGHTS 1

2. SITE DESCRIPTION**2.1 The Existing Site**

The Lucas Heights 1 site.

Lucas Heights 1 is a former landfill comprising two major filling zones; those operated by the Sutherland Shire Council between 1965 and 1976, and those completed by the Metropolitan Waste Disposal Authority, now known as Waste Service NSW, between July 1976 and 1987.

An area further to the west of the landfill was cleared and utilised by Waste Service NSW to provide cover material for the landfill operation. This area is known as the borrow area. A plan of the site is shown in *Figure 2*.

The site is an irregularly shaped, undulating, modified ridgeline between two creeks and approximately 110 ha in area. The southern portion of the site is grassed, however, the northern and western portions are largely devoid of grass and have only a sparse cover of trees and shrubs.

Parts of the site are visible from the two flanking ridges, as well as from across the valley to the north. Portions of the site can also be glimpsed from the nearby New Illawarra Road.

Waste Service currently maintains a permissive occupancy (No. 1985/81) over most of the site (including the Borrow Area) with the Department of Land and Water Conservation. A new licence for the whole site is in the process of being issued to Waste Service. The Waste Service's responsibility is rehabilitation of the site to the requirements of the Department of Land and Water Conservation and the Environmental Protection Act and includes the continuing operation of the leachate and gas collection and disposal systems.

Waste Service has contracted Energy Developments Ltd (EDL) to collect landfill gas over the majority of the site. Gas is currently collected, and used on site to generate electricity which is supplied to the local electricity grid. The contract with EDL will extend to approximately 2025 or until commercial extraction is no longer viable. Flaring will then take place until gas generation is exhausted.

Two temporary playing fields are under construction in the north-western corner of the site. These will be opened for public use in 1999.

The site was the subject of a land claim by the Gandangara Local Aboriginal Land Council. This and other land claims in the locality are still under consideration.

2.2 Zoning

The site is Crown Land and is zoned 6(d) Future Recreation under the Sutherland Shire Local Environmental Plan, 1993 (Amendment No. 50).

The filled area of the site has not yet been designated as 'Unhealthy Building Land' by the Environment Protection Authority, however it is envisaged that this will ultimately be the case.

A

LUCAS HEIGHTS 1

2. SITE DESCRIPTION

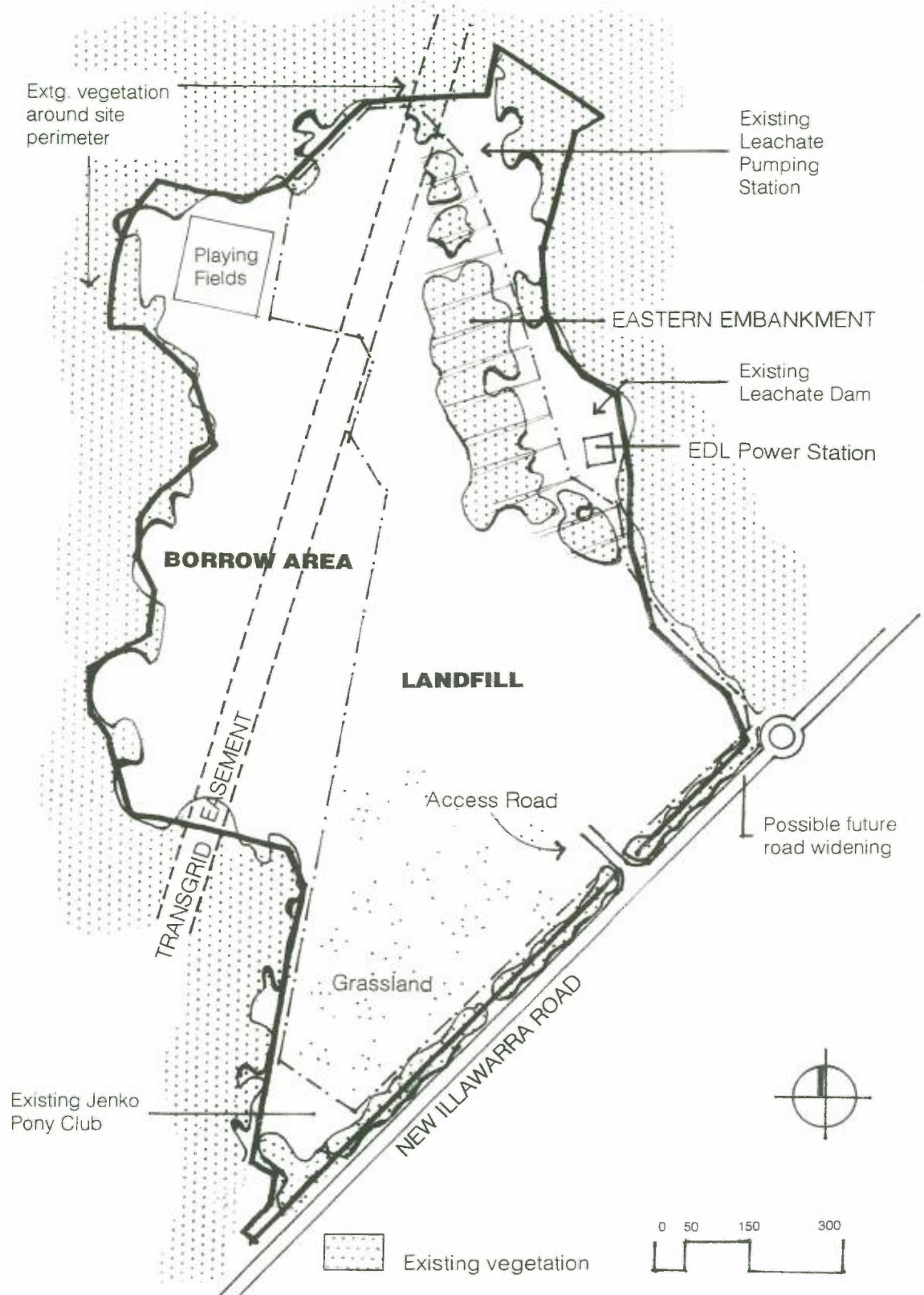


Figure 2: Lucas Heights 1 - Site Plan

2. SITE DESCRIPTION

2.3 Geology and Microclimate

The geology of the site is typical of the coastal plateau of the Sydney Basin being sandstone interbedded with layers of shale. The area comprises a landscape of undulating crests and ridges on plateau surfaces separated by steep sided valleys. Soils on adjacent, undisturbed sites are usually moderately deep (0.5 - 1.5 metres) lateritic podsols of a bleached and stony, sandy-clay loam structure which are readily transportable and subject to rapid erosion.

The site's microclimate is hot, dry and exposed, which leads to rapid evapotranspiration of the area's 1016mm average annual rainfall.

2.4 Landform, Drainage and Fill Patterns

The present landform of the site is comprised of several distinct landform zones - the irregular incline in the southern sector, the large, flat depression adjacent to New Illawarra Road, the extensive ridgelines and embankments formed by filling that run the length of the site, and the large, sloping 'borrow' areas to the north and west.

The site has good surface drainage particularly the south-east and western sectors, where runoff falls quickly to the creek, known as the Lucas Heights 1 creek, adjacent to the landfill site. The exceptions are the extensive flat depression near the entrance to New Illawarra Road where drainage is poor. Portions of the borrow areas drain generally to Bardens Creek (west).

Filling has occurred in three principal zones. The older Council filling zone to the south of the existing access road, the much larger Waste Service filling operation that formed the bulk of the site north and west of the access road, and the southern section of the site filled by Sydney Water using clean fill.

The Council filling was of an indeterminate nature. There are no accurate records of fill type or compaction levels. Site investigations (17 October 1995) have confirmed that filling comprised both putrescible and non putrescible waste to depths of up to six metres. The Waste Service filling regime involved controlled compaction of fill in layers, and comprises essentially putrescible waste.



There is little or no soil over the borrow area.

2.5 Soil Condition and Vegetation

The landfill is covered by a layer of crushed sandstone above the layers of putrescible waste.

Soil conditions across the site are variable. The depth of cover is understood to vary between 100mm to in excess of 1000mm. Much of this cover material was won from the extensive 'borrow' areas to the north and west. This soil is an acidic, sandy clay, highly compacted and low in nutrients and organic matter.

2. SITE DESCRIPTION

Large areas of the site are sparsely vegetated.

There is little or no topsoil over the borrow area. This area comprises a surface of ripped sandstone exposed to weathering.

Cover material over the southern fill area varies from 300mm to 1500mm depth (approximately).

The existing vegetation on the southern area of the site predominantly comprises exotic kikuyu grassland with peripheral screening by indigenous woodland. The balance of the site is sparsely vegetated with trees and shrubs and there are extensive unvegetated rocky areas over the 'borrow area'.

The site is surrounded to the north, west and south by generally undisturbed, indigenous low open woodland. The woodland ranges in height from 12-16 metres with a foliage cover of around 30-70%. With the exception of the area proposed for dam construction, it is intended that the development proposal for the site will have minimal impact on these existing indigenous stands of vegetation.

2.6 Access and Circulation

The existing access road.

Access to the site is from the main entrance at the northern end of the site off New Illawarra Road and continues west along a rough asphalt pavement into the centre of the site. There is also a minor access point at the southern most tip of the site from New Illawarra Road adjacent to the existing Jenko Pony Club area. An existing service road connects the existing leachate ponds and power station to the main entry. This is known as the EDL access road.

The steep gradients on the extensive filled batters over approximately 30% of the site place constraints on cross-site movement and circulation.

Future links to the site are possible to the north and east depending on the type of development that occurs adjacent to the site in these areas. At this stage it is anticipated that these links would be pedestrian only.

2.7 Services and Utilities

A 330 KVA TransGrid high voltage power transmission line runs from north to south through the site.

Permissible uses beneath the TransGrid power lines are limited. Buildings or structures higher than 2.5m are not acceptable. Planting heights are limited to 4.0m. Access roads and car parking are acceptable within the easement provided vehicles do not exceed a height of 4.3m (including all extensions).

Other known existing services include:

- low voltage power lines to the leachate pumping station and a gas flaring facility;
- a new underground gas pipeline connection to the WMC site;
- disused power poles in the north of the site (to be removed); and

2. SITE DESCRIPTION

- a sewer main connection from the leachate pumping station and across the existing creek.

2.8 Adjoining Land Uses

Adjoining land uses include the adjacent concrete batching plant and sand/soil depot to the south and residential development generally to the north and east.

The site is also close to the new Lucas Heights Community School. Further development of residential areas will possibly continue in the Menai area, north and east of the site. However, the final land uses in this area have not yet been determined.

The site could eventually be adjoined by residential development, and development of the site in accordance with this development application may therefore form a significant part of the open space provision of the rapidly growing district. This, however, is unlikely to occur in the short term.

2.9 New Illawarra Road

New Illawarra Road, a major link between Menai and Heathcote, defines the south eastern boundary of the site. Future changes to the alignment of New Illawarra Road are proposed by the RTA (Refer *Figure 2*).

This work will affect the boundary of the site northwards from the existing entry point resulting in a slightly reduced site area. Commencement of the work is not anticipated within 10 years. Development proposals for the site allow for this future boundary adjustment.

3. THE PROPOSED DEVELOPMENT

The master plan for Lucas Heights 1 comprises seven distinct landscapes.

3.1 Landscape Master Plan

Proposed development at Lucas Heights 1 will provide extensive active recreation facilities. The site will be a regional recreation centre for the future generations of Lucas Heights, Sutherland and Menai.

The master plan for Lucas Heights 1 comprises seven distinct landscapes as shown in *Figure 3* and outlined below. The general arrangement and area of sporting facilities to be provided is shown in *Figure 4*.

3.1.1 The Spine

The Spine comprises an intensively developed linear park along the primary access road known as Recreation Drive. Three distinct landscape characters emerge along this spine in response to the varying topographic conditions. These include Recreation Drive, The Chevron and the Belvedere as described below.

Recreation Drive

As the spine traverses along the valley side from the main entry a serpentine avenue of Lemon Scented Gum creates a grand promenade into the site and frames alternating vistas into the adjoining parklands, golf course and equestrian centre. The driveway climbs from the entry off New Illawarra Road to the ridgeline under the power easement.

The Chevron

As the road ascends to the ridge top and enters the main body of the site and sports precinct a bold chevron of alternating dense trapezoidal bands of coloured shrubs and native grass planting beds define parks, wetlands, car parks and playgrounds, and entrance forecourts to adjacent buildings.

The leading edges of the chevrons are defined by a range of 'garden' wall elements including hedges, fences, stone pitched batters, these edges leading to the entries of the major sporting and recreation facilities and also articulating the overall surface stormwater collection and water management.

Road side swales and densely planted depressions of native grasses and sedges collect runoff, capture litter, attenuate water quality and slow runoff to promote infiltration.

The Belvedere

Towards the head of the spine the main pedestrian and vehicular corridor terminates in an elevated Belvedere Park that affords views out over the Mill Creek Valley and also provides passive recreation opportunities through picnic facilities, gardens and playgrounds.

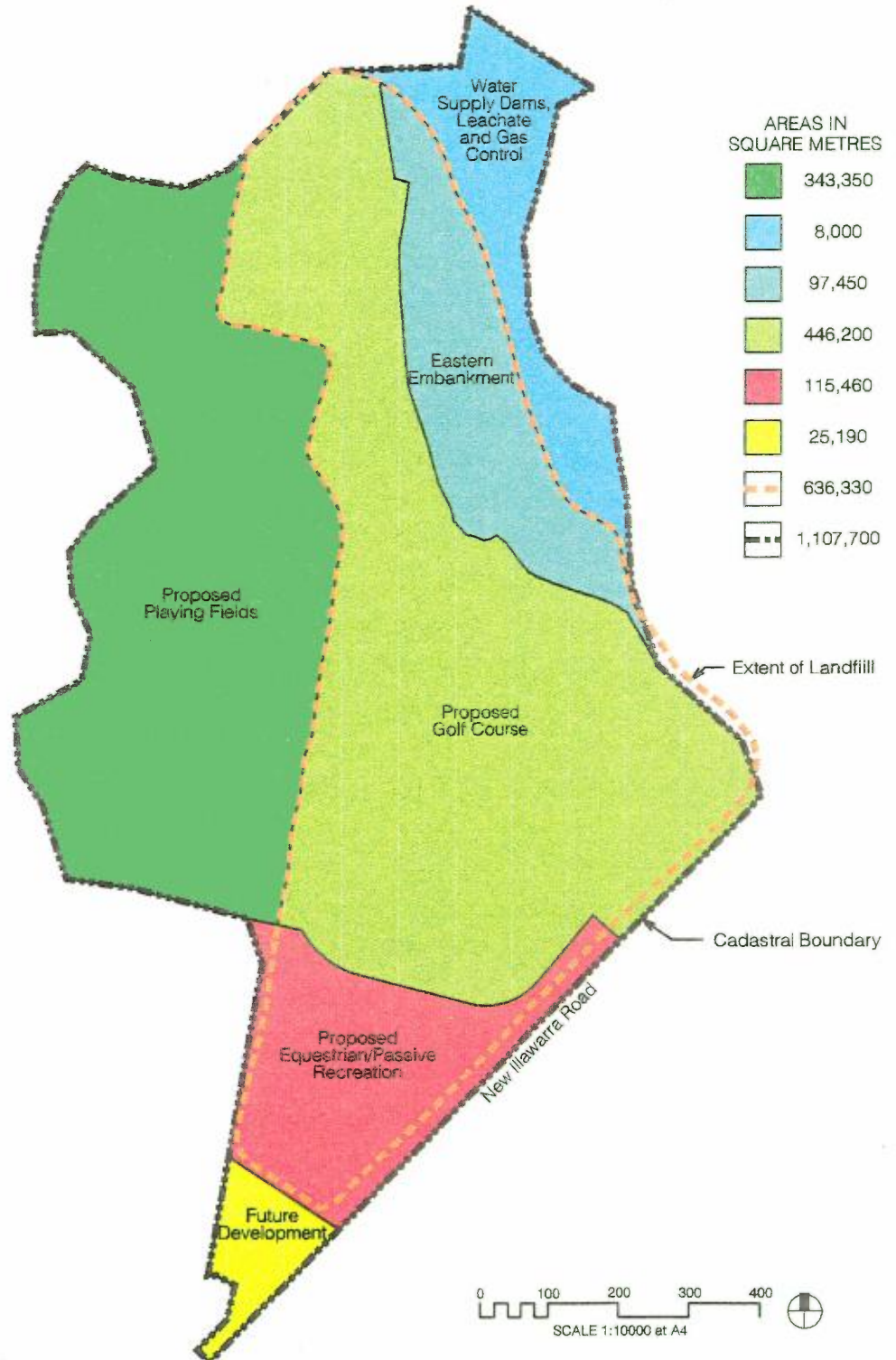
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LUCAS HEIGHTS 1

3. THE PROPOSED DEVELOPMENT



Figure 3: Landscape Master Plan Illustrative.

3. THE PROPOSED DEVELOPMENT**Figure 4: Arrangement and Area of Sporting Uses.**

3. THE PROPOSED DEVELOPMENT

The Belvedere Park will be a significant local attraction offering a high level of amenity, and connections to the regional pedestrian/cyclist trail that encircles the site.

3.1.2 The Hub

The Hub is the heart of the recreation complex containing the multi-use sports club, golf course pro-shop and amenities buildings as well as the primary east west promenade across the ridge top linking the golf course, car parking areas and playing fields.

3.1.3 The Golf Course

An 18 hole golf course is to be developed to the east of The Spine and ridge. The course, designed to municipal golf course standards, will be of grassy woodland character with rough areas between fairways established with grasses and open canopied woodland trees including Sydney Red Gum (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*) and Bloodwood (*Eucalyptus gummifera*).

3.1.4 Playing Fields

The multi-purpose playing fields will be established on the redeveloped borrow area on the ridge top west of The Spine. The fields will provide top quality playing surfaces in a woodland setting surrounded by passive use parkland.

3.1.5 Lucas Heights 1 Creek

LH1 creek, which runs along the boundary with New Illawarra Road, will be rehabilitated in association with the development of the dams at the northern end of the site, which are an integral part of the site water management strategy. Work adjacent to New Illawarra Road will be minimal however, as relocation of the creek line is anticipated when New Illawarra Road is realigned by the RTA. This work is anticipated within the next 10 years.

Weed removal, bank stabilisation, planting of aquatic and terrestrial species indigenous to the area and construction of a pedestrian and cyclist trail alongside parts of the creek will provide a community resource and important habitat for local fauna.



The Lucas Heights 1 Creek can be developed as a major landscape feature of the park.

3.1.6 Equestrian Park

On the high ground south of Recreation Drive an equestrian park will be established to provide a low intensity facility for the district.

3. THE PROPOSED DEVELOPMENT**3.1.7 Woronora Woodland**

All of the above facilities are embraced by a large scale revegetation programme that will re-establish the original woodland species surrounding the site.

A recreation trail will weave through this woodland for joggers, walkers and possibly horse riders as well providing picnic and rest areas.

3.2 Description of Primary Elements

The Master Plan Illustrative is shown in *Figure 3*. The primary components, as identified by Council's recreation needs study, include:

- a two level multi-purpose sports club building and a pro-shop;
- practice greens;
- four netball courts;
- ten playing fields;
- an eighteen hole golf course and driving range;
- three amenities blocks;
- a maintenance depot;
- two bowling greens;
- eight tennis courts;
- open space for unstructured recreation;
- picnic areas;
- equestrian park comprising a shed for storage and self-composting toilets;
- a recreation trail for hiking, jogging and possible horse riding;
- car parking for 440 cars plus possible future overflow car parking areas;
- a children's playground; and
- four new water storage dams for irrigation and water maintenance of the site.

All of the above facilities are shown on the DA master plans drawings 2511c/DA 01 to 06 inclusive (**refer Volume 2**). Each of the facilities will be addressed in further detail in the following sections. The final allocation of facilities may be amended to respond to future community needs.



An eighteen hole golf course is one of the primary components of the Lucas Heights 1 master plan.

3. THE PROPOSED DEVELOPMENT**3.3 Buildings** (refer Dwgs 2511c/D29-33 inclusive)*Environmentally Responsive Design*

The Lucas Heights DA provides Sutherland Council with a clear opportunity to demonstrate how buildings and landscapes can be designed and constructed in an environmentally responsible manner without compromising architectural quality and user amenity. The educational value of such a development is also clear as it is a high profile and easily accessible site with a diverse range of buildings and landscapes. There is potential for a variety of methods of environmentally responsive building methods to be utilised and demonstrated. The project could form the basis of a community education program in environmentally responsive building techniques raising social awareness. In this context the proposed buildings adopt the key environmental design principles of correct northern orientation, solar access, high thermal mass, passive internal temperature and humidity control, water conservation, and use of low embodied energy.

The proposed building designs have been audited to determine energy conservation (refer **Appendix A** for an example of an Energy Conservation Report which may be generated by the proposed building design).

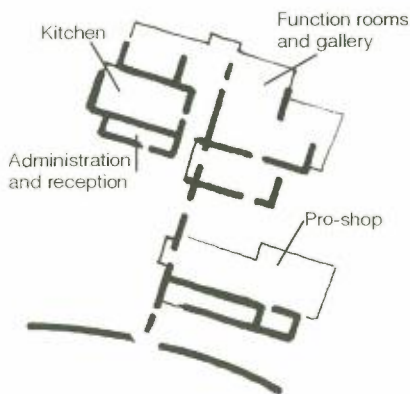
3.3.1 Sports Club*Programme*

The architectural programme comprises four discrete components; function rooms and gallery, kitchen core, administration/reception and pro-shop. These components are arranged as linear, glazed pavilions beneath a floating roof, and defined by a cruciform layout of masonry walls that define internal spaces, direct movement and provide the architectural and environmental structure.

Siting

The sports club and pro-shop are sited on natural ground between the edge of the landfill and the TransGrid easement. The buildings are centrally located on the site with the 18 hole golf course to the east, tennis courts and playing fields to the west, golf driving range to the south and two bowling greens to the north. In this way the sports club forms the centrepiece and hub for the overall proposal.

The structural expression of east-west walls that anchor the internal spaces permeates to the forecourt of the building and spine, articulating the Chevron linear park that dominates the ridgetop at LH1. The design objective is also reinforced through the landscape design using dense groves of trees to reinforce the building layout, connection across the site, and termination in smaller structures like the kiosk / amenities structures adjacent to the tennis courts and the golfers pavilion on the high point of the golf course between the 'in' and 'out' tees and greens.



*Sports Club and Pro-shop –
Programme.*

3. THE PROPOSED DEVELOPMENT*Orientation & Solar Access*

The public areas and long axis of the buildings are oriented north to provide solar access and passive control of the internal environment. Eave overhangs and sun louvres are designed so that sun is excluded in the summer months while admitted in the winter months. East and west glazing is shaded when the sun is low using external adjustable blinds, venetians or shutters.

Daylighting & Glare Control

Correct proportions and placement of glazing allow daylight, rather than electric lighting, to be used during daylight hours to reduce energy consumption. Glare control is provided through tinting of glass or use of special diffusing glass depending on the requirements of the internal spaces.

Thermal Mass

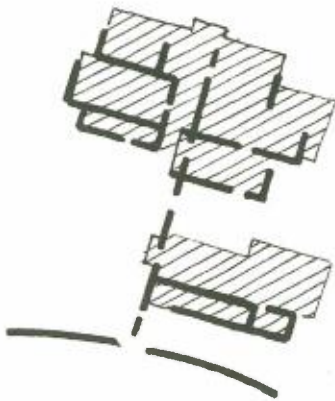
Exposed building mass in the form of concrete floors, ceramic tiles and masonry walls may be utilised as the principal way of stabilising the internal temperature of the buildings.

Sound Attenuation

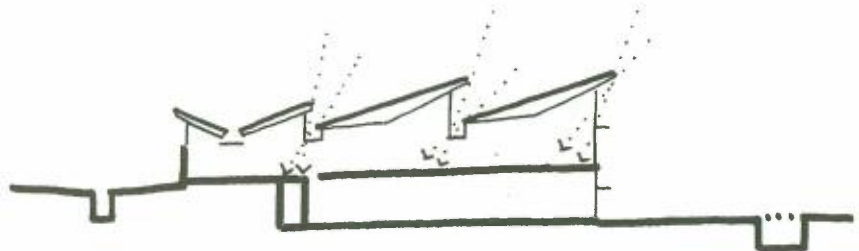
Due to thermal mass requirements the area of hard surface will be maximised. Sound attenuation in busy internal spaces may be addressed in the design using acoustic ceilings, wall panelling and timber flooring with high acoustic rating.

Ventilation

The building facades are designed to optimise natural ventilation. High capacity inlets and outlets are provided at floor level and at the highest ceiling level. Day to day operation of these inlets and outlets will depend on external factors such as the velocity of prevailing winds. In still conditions rising hot air escapes through high ventilation louvres pulling cooler air in through the lower inlets. In high wind conditions the direction of the prevailing wind will either pull air from low to high or push it from high to low. Some mechanical ventilation is required in kitchens, toilets and other wet areas.



Thermal mass – masonry walls and floors.



Daylighting – Daylighting strategy reduces energy consumption.

3. THE PROPOSED DEVELOPMENT*Temperature Control*

For extreme summer and winter situations and peak event demands (eg. wedding receptions) single reverse cycle air conditioning package units located throughout the buildings will be used as a supplement to passive controls.

Humidity Control

Humidity will be controlled using the humidity absorbing attributes of materials such as cement reinforced earth bricks. Locally operated floor and ceiling mounted air conditioning units will supplement this strategy in extreme conditions.

Low Embodied Energy Materials

Masonry walls may be used to provide the principal thermal mass to stabilise internal humidity.

Exposed concrete coffered ceilings and concrete floor slabs will add to this mass.

Ceramic tiles will provide a hard wearing, easily maintained surface in wet areas and enhance the effectiveness of thermal mass.

High density timber veneers glued directly to the concrete floor slab in public areas will be provided where tiling is not required.

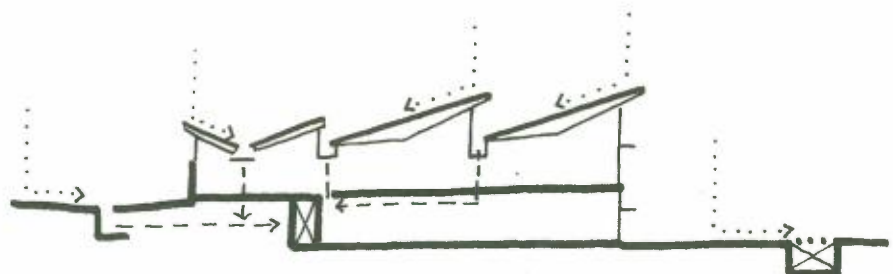
The final selection of materials, for the buildings will be determined to Council's approval.

Other Materials

Other materials utilised in the buildings are likely to include structural steel column and roof members, window frames, acoustic ceiling lining, plasterboard and timber veneers for joinery.

Water Strategy

An integrated water management strategy will be implemented for irrigation and other applications. The storage tank in the sports club is proposed to be incorporated into the building to further increase the thermal mass. The detailed design may include strategies for recycling of grey water from buildings.



Water strategy – harvested stormwater reused as grey water.

3. THE PROPOSED DEVELOPMENT*Summer Cooling Strategy*

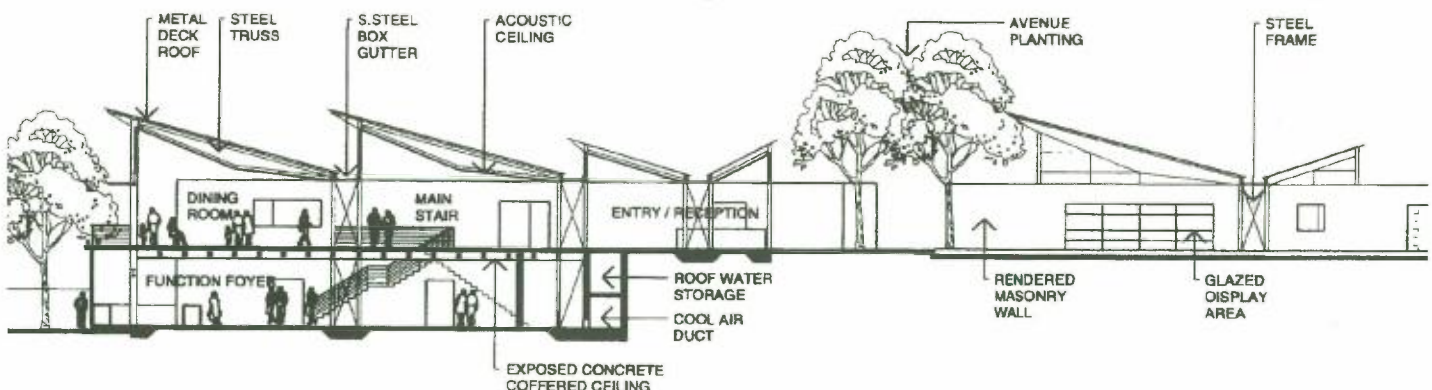
In extreme summer heat conditions it is proposed that the building will use minimal ventilation, relying on thermal mass for temperature stability. The building is to be left overnight with maximum ventilation to cool the mass for the following day. If the internal temperatures rise above a predetermined comfort range supplementary air conditioning units will be used.

Winter Heating Strategy

In extreme winter conditions a maximum amount of sun is to be admitted to the internal space through full floor to ceiling and celestory glazing thus directly heating the building mass. Overnight the building is to be closed to retain as much heat as possible for the next day. This may be achieved using heavy curtains and reducing ventilation to a minimum. Again supplementary temperature control below the predetermined comfort range is handled by locally operated reverse cycle air conditioning units.

Mild Conditions Strategy

Where external conditions are mild and within the acceptable comfort range, which should comprise 70% of the normal daylight time, it is proposed that the building will be opened up with no need for air conditioning.



Sports Club Architectural Section Through Entry.

3. THE PROPOSED DEVELOPMENT*Intense Use Strategy*

During periods of intense use where heat loads from people and smoking levels are increased the supplementary air conditioning units are used.

In addition to the fundamental considerations described above the sports club has specific characteristics as described in the following section.

Detailed Brief

The Lucas Heights Sports Club is a 1500sqm building (not including 300sqm of maintenance and cart / buggy store below) including:

- a main lounge, viewing balcony and gaming area;
- dining room and kitchen;
- meeting rooms;
- administration offices and reception;
- gallery;
- members amenities;
- function area, foyer and bars;
- delivery dock, garbage room, liquid store and cellar, and
- public amenities and various stores.

It is designed to allow expansion to 3000sqm in the future.

Circulation

Arrival to the site will generally be by car or bus to parking areas adjacent to the club on the west side. The walk from the car park is via a tree lined promenade leading to the forecourt and courtyard. Patrons and employees may also be dropped off directly outside the entry via a loop road. Licensing laws for the club require that all patrons be signed in at the reception desk at the main entry point. However, electronic locks and entry cards allow members to enter via the locker rooms if they wish.

A 'blade wall' runs perpendicular to the forecourts and courtyard axis forming the cruciform circulation layout around which the building is structured. Internally, the main circulation runs parallel with this blade wall and doubles as a gallery for display of club trophies and memorabilia. Patrons with physical disabilities or infirmity may utilise a passenger lift to access lower levels and are provided with specially designed amenities throughout the buildings.

Aspect and Planning

Floor levels provide public areas which are elevated to take advantage of views across the golf course, surrounding bushland valleys and the city skyline to the north west. The main open public spaces are therefore on the northern side of the building with the service and administrative areas to the south and west.

3. THE PROPOSED DEVELOPMENT*The 'Blade Wall'*

In addition to providing connection between the sports club, pro-shop and golf driving range, the blade wall (described above) contains facilities such as services, stairs, ventilation routes, display joinery and storage.

Materials

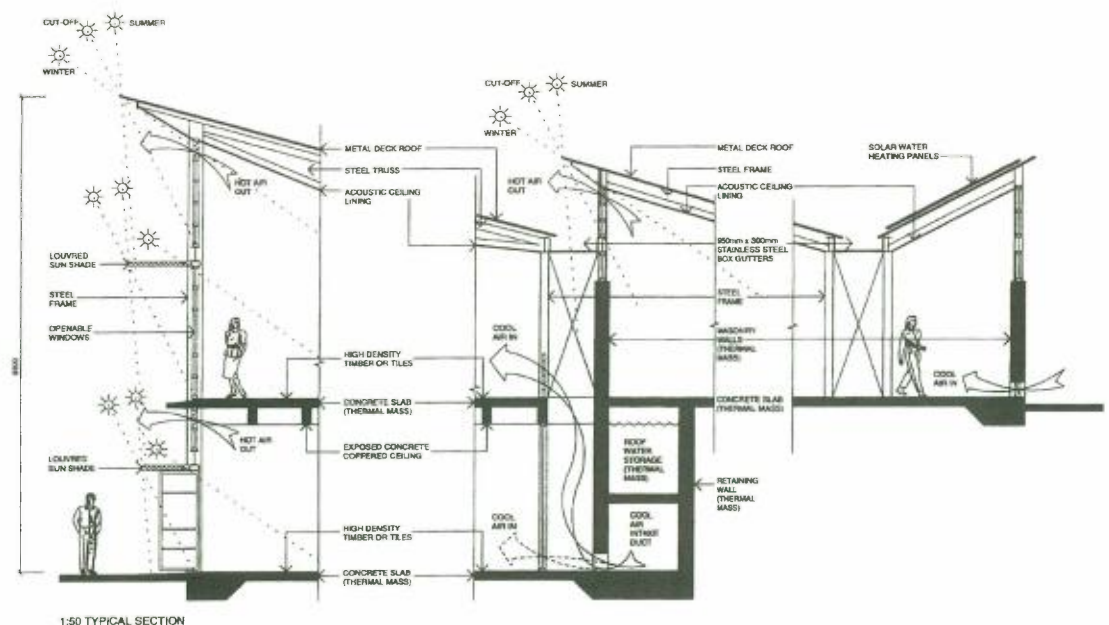
Walls are generally proposed to be masonry walls, or other suitable material to Council's satisfaction, that will provide thermal mass benefits. Floors are of reinforced concrete construction finished with ceramic tiles or high density timber glued directly to the slab. Ceilings to public areas are acoustic lined. Windows are aluminium framed with operable glass ventilation louvres.

Construction Strategy

The primary structure is a steel frame supporting concrete floor slabs and steel framed metal deck roof with masonry or other suitable material used as an infill to the frame. This means that structural steel work can be fabricated and erected first, allowing most of the works to be completed under the roof.

Cool Air and Water Duct

This duct runs along the entire length of the building and is located at the lower level against the retaining wall. The duct is split horizontally so the upper portion is used for water storage while the lower portion is used for cool air intake.



Sports Club Building – Environmental Principles.

3. THE PROPOSED DEVELOPMENT

3.3.2 Pro-Shop

In addition to the fundamental considerations described earlier the pro-shop has the following specific characteristics.

Brief

It is intended that the pro-shop will service the golf driving range, golf course and tennis courts as well as providing equipment maintenance, repair services and public amenities. It provides space for sales of associated sporting goods as well as a cafe for patrons with a covered external deck area adjacent to the courtyard.

Circulation, Aspect & Planning

The pro-shop is accessed along the promenade from the car park past the sports club reception, through a threshold in the wall to an entrance located opposite the sports club members entry. A large glazed goods display area provides visual connection from the car park to the pro-shop. From the pro-shop one can continue through to the golf driving range over a bridge and drainage channel.

The pro-shop is located to facilitate surveillance of associated sporting activities. The cafe overlooks the golf course providing players with a comfortable place to wait for tee off or for other group members to arrive. The promenade from the courtyard terminates in a small players pavilion on the highest point of the course.

Materials and Construction Strategy

The materials and construction strategy used are similar to the sports club.

3.3.3 Amenities Blocks

As well as conforming to the environmental principles outlined previously the amenities blocks have the following specific characteristics.

Brief

Each the three amenities blocks (190 sqm each) proposed for Lucas Heights 1 provides amenities for patrons and players using the playing fields. Each includes toilets (incl. disabled), change rooms with showers, a covered viewing verandah and kiosk.

3. THE PROPOSED DEVELOPMENT*Circulation, Aspect and Planning*

Each amenities block is planned as a pavilion with its long side oriented north and the covered viewing verandah addressing the playing field with which it is associated. Rooms are generally accessed directly from outside.

Proposed materials are similar to those for the sports club.

Materials and Construction

Proposed materials are similar to those for the Sports Club.

3.3.4 Maintenance Depot

The maintenance shed and storage area possess the same environmental principles outlined previously and have the following specific characteristics.

Brief

The 400sqm maintenance building provides working and storage facilities for maintenance of the entire site including the golf course, playing fields, landscaped areas etc. Included within the generally open area are lunch room, office, change rooms, small goods store, fuel store, tool store, workshop and staff amenities. A 500sqm service yard is provided at the rear of the building for stockpiling of materials, wash bay, refuelling area and for the standing and manoeuvring of vehicles.

Circulation, Aspect & Planning

The maintenance depot area is a pavilion with its long side oriented north with roller shutters along the south side as access from the concrete area adjacent. Offices and work spaces within the maintenance building provide for passive surveillance over the car park and public amenities buildings.

Materials

Maintenance shed and storage area utilise the same materials as the sports club and pro-shop buildings.

3.4 Recreation Drive

Recreation Drive is proposed to service all facilities on the site. The main entry point is at the existing location on New Illawarra Road. Future adjustments to this location may be necessary depending on the nature of proposed RTA road work (*refer 3.1.5*). The future preferred entry point is 155m south of the existing entry point as indicated on the master plan. This new location may be incorporated at the time of the proposed RTA work.

The entrance driveway follows the alignment of the southern boundary of the golf course and under the TransGrid easement to the east of the playing fields.

3. THE PROPOSED DEVELOPMENT

TransGrid ground level clearance requirements (minimum 10m) are achieved in all areas.

A separate Development Application for a temporary road along the alignment of the entrance driveway and for the temporary use of land for the first two playing fields (Fields 1 and 2) has already been lodged by Sutherland Shire Council. The application was approved in November 1997. The carriageway is 9m wide providing for one traffic lane in each direction and parallel parking on one side only (south and west). A road reservation of 15m is proposed allowing 3.0m verges both sides, an underground service corridor, and a concrete footpath for pedestrians on one or two sides as shown on the DA master plans.

The roadway provides access to all playing fields, terminating with 'Belvedere Park' at playing fields 1 and 2 in the far north-west corner of the site.

Construction will be flexible pavement with asphaltic concrete wearing course over both landfill and natural ground areas. Car parks will be finished with concrete kerb and gutter. The driveway will be finished with either concrete kerb and gutter or flush concrete edge with surface drainage directed into surface drainage swales.

Formal avenue tree planting of Lemon Scented Gums is proposed along the length of the driveway on both sides except where it travels under the TransGrid easement. The arrangement of trees allows views into the golf course and the adjacent passive recreation/equestrian area.

Planting under the TransGrid easement is restricted to 4.0 metres in height to meet statutory requirements. Planting of tall shrubs and small trees in a 'chevron' pattern is proposed in formal bands in this area as an alternative. The bands of planting will control views to the adjacent playing fields, driving range and sports club areas.

A possible future connection to the entrance driveway could be made from New Illawarra Road in the southern corner of the site as shown on the master plans (*refer Dwg 2511c/DA06*). This could also provide additional (future) car parking opportunities.

3.5 Golf Course and Driving Range (*refer Dwg 2511c/DA01-05 inclusive*)

A Par 71, 18 hole golf course is proposed on the landfill portion of the site. The golf course covers an area of 54.2 hectares (including the area of the eastern embankment above the proposed dams).

LUCAS HEIGHTS 1

3. THE PROPOSED DEVELOPMENT

ACR 71 Holes	MEMBER	
	Metres	PAR
1	265	4
2	395	4
3	190	3
4	390	4
5	325	4
6	360	4
7	350	4
8	180	3
9	510	5
OUT	2965	35

Lucas Heights Golf Course -
proposed holes 1-9.*The Front Nine (Holes 1 - 9)*

The front nine holes play to the north and east of the sports club building and pro-shop. The Par 35 front nine holes is summarised in the adjacent table. The 1st tee and ninth green are located near the sports club building and pro shop.



ACR 71 Holes	MEMBER	
	Metres	PAR
10	475	5
11	160	3
12	325	4
13	370	4
14	340	4
15	410	4
16	490	5
17	185	3
18	400	4
IN	3155	36

Lucas Heights Golf Course proposed
holes 10-18.*The Second Nine (Holes 10-18)*

The second nine holes play to the east and south of the sports club and pro-shop. The Par 36 second nine holes is summarised in the adjacent table.

The 10th tee and 18th green are located near the sports club and pro-shop. Access between greens and tees is provided by concrete or hammermilled bark chip paths.

The Weighbridge Dam (refer Dwg. 2511c/DA 15)

The Weighbridge Dam is a proposed off-line storage dam located adjacent to the 12th, 13th and 14th holes. The dam is positioned primarily on natural ground in the location of the former landfill weighbridge station.

The dam has a capacity of around 20 megalitres (ML) and a small surface catchment area incorporating a portion of the golf course. Water levels in the dam will be sustained by pumping from the proposed lower dams on Lucas Heights 1 Creek during wet periods. If required for irrigation of either the golf course or playing fields during dry periods water will be transferred from the Weighbridge Dam to the lower dams by gravity feed.

3. THE PROPOSED DEVELOPMENT

Dams provide landscape amenity and a golf course hazard.

Excess water from the Weighbridge Dam can escape over a spillway at the eastern end and flow by overland flow to Lucas Heights 1 Creek below the 11th green to the lower water storage dams. Spillway stabilisation structures and dam lining details are to be finalised to Waste Service engineers details.

The Weighbridge Dam provides landscape amenity and a golf course hazard. Its edge conditions vary to provide landscape interest and a variety of habitats including gentle wetland margins with aquatic planting at 1:10 grade, gently sloping grassed edges accessible to the public and steeper sided edges with dense tree and screen shrub planting.

Fire Trail

A fire trail access road of cement stabilised crushed sandstone construction, has been provided over the golf course to provide alternative emergency access/egress to the main driveway. The trail connects from the sports club car park and the northern section of the driveway, across the 5th and 6th fairways, to the existing EDL access road and back to the main entry off New Illawarra Road

Driving Range

A 250m x 110m driving range is proposed to the south of the Lucas Heights Sports Club. The driving range faces south and provides for approximately 30 players at any given time.

A future extension of the driving range may include construction of a tiered structure to allow accommodation for up to 60 players.

The driving range is adjacent to, and serviced by, the pro-shop.



Greens and tees will be established with high quality grasses.

Surface Finishes

Surface finishes for the golf course playing areas are as follows:

- roughs - dryland and native grasses maintained by slashing and woodland tree planting;
- fairways - couch or kikuyu grass established by sprigging;
- tees - couch grass established by seeding and oversown as required; and
- greens and green surrounds - hybrid Creeping Bent Grass established by seeding and maintained to a very high standard.

Vegetation

Detailed indigenous tree and shrub species lists are appended (refer **Appendix B**).

3. THE PROPOSED DEVELOPMENT*The Eastern Embankment*

An existing embankment occurs to the north-east of the golf course above the proposed storage dams 1,2 and 3 (refer *Figure 3*). The embankment is a result of past landfilling activities and is graded at around 1:4. Previous rehabilitation of the embankment has resulted in establishment of some shrub and tree vegetation. Supplementary planting is proposed to improve some of the poorer established areas.

3.6 Bowling Greens (refer Dwg. 2511c/DA18)

Two bowling greens are proposed. These are located immediately north of the sports club with car parking adjacent and under the TransGrid powerline. Function rooms which can be used by the bowling club are located on the lower floor of the sports club at the level of the greens.

The bowling greens and gardens beyond are connected to the sports club by a vine covered arbor.

Access around the greens is provided by concrete pavements. Simple shade structures are envisaged to the north and south end of both greens. These structures extend the full width of the greens.

3.7 Tennis Courts (refer Dwg. 2511c/DA02)

Eight tennis courts are proposed as part of the DA. The courts are located south-west of the sports club building, which are linked by the central east-west promenade of The Hub. The promenade crosses Bardens Drive and is a major feature of the most intensively developed and central zone of the site.

The courts are serviced by an amenities block and kiosk located immediately to the north. Pavilions and seating areas are also proposed for each court. The courts will have a synthetic grass finish.



Eight tennis courts are proposed as part of the DA.

3.8 Netball Courts (refer Dwg. 2511c/DA02)

The DA provides for four netball courts with provision for future expansion to include another five courts to the west of fields 7 and 8.

The courts provided as part of the DA are located to the south of the tennis courts and are serviced by amenities blocks located near the tennis courts and adjacent to fields 9 and 10. The courts will have a hardcourt, flexi-pave finish.

3. THE PROPOSED DEVELOPMENT

Ten playing fields will be provided.

3.9 Playing Fields (refer Dwg. 2511c/DA01, 02 and 04)*General*

Ten playing fields are proposed as part of this DA. Specific sporting uses are not allocated to the playing fields at this stage. However, the following sports may be provided for:

- all football codes;
- hockey;
- cricket; and
- baseball.

Detail relating to playing field preparation, layout, subsoil drainage, surface finishes and irrigation is contained in **Appendix C**.

3.10 Unstructured Open Space and Picnic Areas

Large areas of unstructured open space areas are provided around the proposed formal facilities on the site. These comprise grassland and woodland or screen shrub planting which will be established by temporary irrigation.

Picnic facilities over the site include table settings and electric barbecues. Woodland planting areas are designed to create shade, shelter and screening for the picnic areas.

A children's playground is proposed to be located adjacent to the sports club and tennis courts.

3.11 Equestrian Facilities (refer Dwg. 2511c/DA06)

A section of the southern portion of the site is proposed for low intensity equestrian use. Part of this area is currently used by the Jenko Pony Club. Minimal facilities are proposed in the DA to replace existing structures and facilities. These include a new shed/storage facility and two self composting toilets. This area may ultimately service a number of equestrian groups.

Existing access to the southern portion of the site is from New Illawarra Road to the south of the main entry. Future connection to Recreation Drive may occur from this point. It may be necessary to provide improved access and sightlines on New Illawarra Road than currently exist. This may be included as part of the proposed RTA improvements to New Illawarra Road.

Vegetation in this area will consist of couch or kikuyu grassland and informal groups of native woodland trees and shrub planting. Indigenous woodland vegetation communities along New Illawarra Road and to the west of this area will be retained and protected.

3. THE PROPOSED DEVELOPMENT

Jogging and cycle trails can be provided and linked to regional routes

The southernmost tip of the site may be available for future development to provide additional sporting facilities required in the Shire. This will be subject to future recreation needs and to the discretion of Sutherland Shire Council.

3.12 Recreation Trail

A 2.5m width recreation trail providing for possible equestrian use as well as hiking or jogging is proposed around the site perimeter. The trail is approximately 4.5km in length and will be constructed from cement stabilised crushed sandstone and edged with hardwood timber. Where the trail travels through indigenous woodland areas minimal disturbance is proposed to protect existing vegetation.

3.13 Car Parking

Three major car parking areas are proposed adjacent to the following facilities:

- sports club, driving range and bowling greens (200 spaces);
- fields 1 and 2 (100 spaces); and
- fields 7-10 inclusive (140 spaces).

A total of 440 car spaces are provided in the three car parks. All car parks will be of asphaltic concrete with kerb and gutter and drained by sub-surface drainage.

Future overflow car parking areas are also indicated on the drawings. Permanent car park spaces could be provided in these areas.



Three new storage dams will harvest and store water for irrigation purposes.

3.14 Storage Dams (refer Dwg. 2511c/DA14)

Three storage dams are proposed to the north-east of the site at its lowest level. The dams are referred to as Dams 1, 2 and 3 and are located on Lucas Heights 1 Creek draining ultimately to the Georges River. The purpose of the dams is to store surface runoff water and non-putrescible leachate for irrigation of playing fields and the golf course.

The capacity of the dams is 23.65ML and they cover an area of 7890sqm. They are located remotely to the active playing facilities proposed for the site and are not intended as a landscape or public feature of the park. Access to the dams will be restricted.

The dams will be serviced by the existing EDL access road. Existing woodland vegetation will be retained wherever possible and supplemented by native tree and shrub screen planting and aquatic/wetland species to the dam margins. The EDL access road will be upgraded with a 2 coat flush seal surface

3. THE PROPOSED DEVELOPMENT

Spillways are located at the northern end of each dam with the major spillway located to the northern end of Dam 2 allowing overflow into LH1 creek bypassing Dam 3. Final details of dam spillways, scour protection structures, linings etc. are to be provided by Waste Service engineers. The DA plans show schematic plans and sections only.

4. IMPLEMENTATION STRATEGIES

Bulk filling at LH1 will provide new soil profiles suitable to support mature tree vegetation.

4.1 Bulk Filling (refer Dwgs. 2511c/DA07 - 12 inclusive)

Filling is proposed at Lucas Heights 1 to achieve a new landform for construction of finishing works for the park. Design and construction of the landfill and provision of all filling material, will be by Waste Service to achieve the landform profiles shown on the DA grading plans.

The proposal allows for 1.3 million tonnes of dry waste material to be disposed. This equates to approximately 2.88 million cub.m (total 4,052,200 tonnes) of additional material to be placed and spread on the existing site. An isopach diagram showing proposed depths of filling above existing ground level is shown in *Figure 5*. This work will improve surface water runoff in areas where runoff is currently inadequate and assist in reducing infiltration to minimise leachate production from the putrescible landfill below. Proposed grades on the landfill area range between minimum 1:40 (2.5%) and maximum 1:3 (33%).

Bulk filling is also required on the borrow area to create level playing field platforms. New embankments below the playing field platforms do not exceed 1:4 grade. Two retaining walls are required located below playing fields 3 and 4 and in the golf course area under the TransGrid easement. Gabion/rock retaining wall structures are proposed to final engineering designs by Waste Service engineers.

Material to be used for filling is based on the agreement between Sutherland Shire Council and Waste Service (as amended) and is anticipated to comprise a combination of materials including dry waste, crushed sandstone and topsoil. Non-putrescible waste (dry waste) will be used for filling over the old landfill and virgin excavated natural material (VENM) will be used under the playing field platforms. The final agreed volumes and tonnage of each bulk filling material is tabulated (refer **Appendix D**).

4.2 Soil Preparation

High quality topsoil and subsoil materials for planting, grassing, golf course, and playing field preparation will be manufactured on the site or at the Waste Management Centre or imported to the site if necessary.

These growing media will be manufactured mainly from crushed sandstone and compost material provided by Waste Service to agreed specifications as outlined in **Appendix E**.

Six soil mixes are proposed for the development and are divided into topsoil, subsoil and bulk filling layers. The arrangement and types of these are shown diagrammatically in *Figures 6 and 7*.

A

LUCAS HEIGHTS 1

4. IMPLEMENTATION STRATEGIES



Figure 5: Depths of Filling.

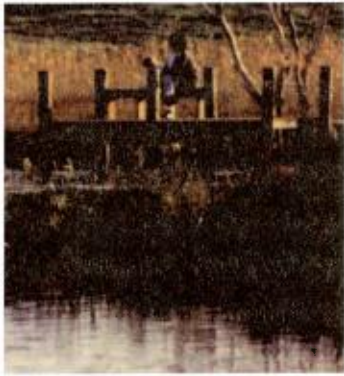
4. IMPLEMENTATION STRATEGIES

All of the above materials are specified in further detail in **Appendix E**.

A bulk filling material has already been supplied and spread on the site to achieve the required platform under playing fields 1 and 2.

Schematic diagrams (*Figures 6 and 7*) show the relative locations of the above fill types at Lucas Heights 1.

Proposed distribution and depths of special topsoil and subsoil materials are shown in *Figure 8*.



Water will be harvested and stored on site for re-use.

4.3 Water Management Strategy

Management of water for irrigation of playing field and golf course areas will be a significant ongoing requirement at LH1. With current forecasts for rapidly increasing costs for town water this requirement represents a major area of recurrent expenditure.

There are three feasible water source alternatives for irrigation at LH1 other than town water supply. These sources include:

- re-use of putrescible leachate;
- re-use of non putrescible leachate; and
- on-site storage and re-use of surface stormwater runoff.

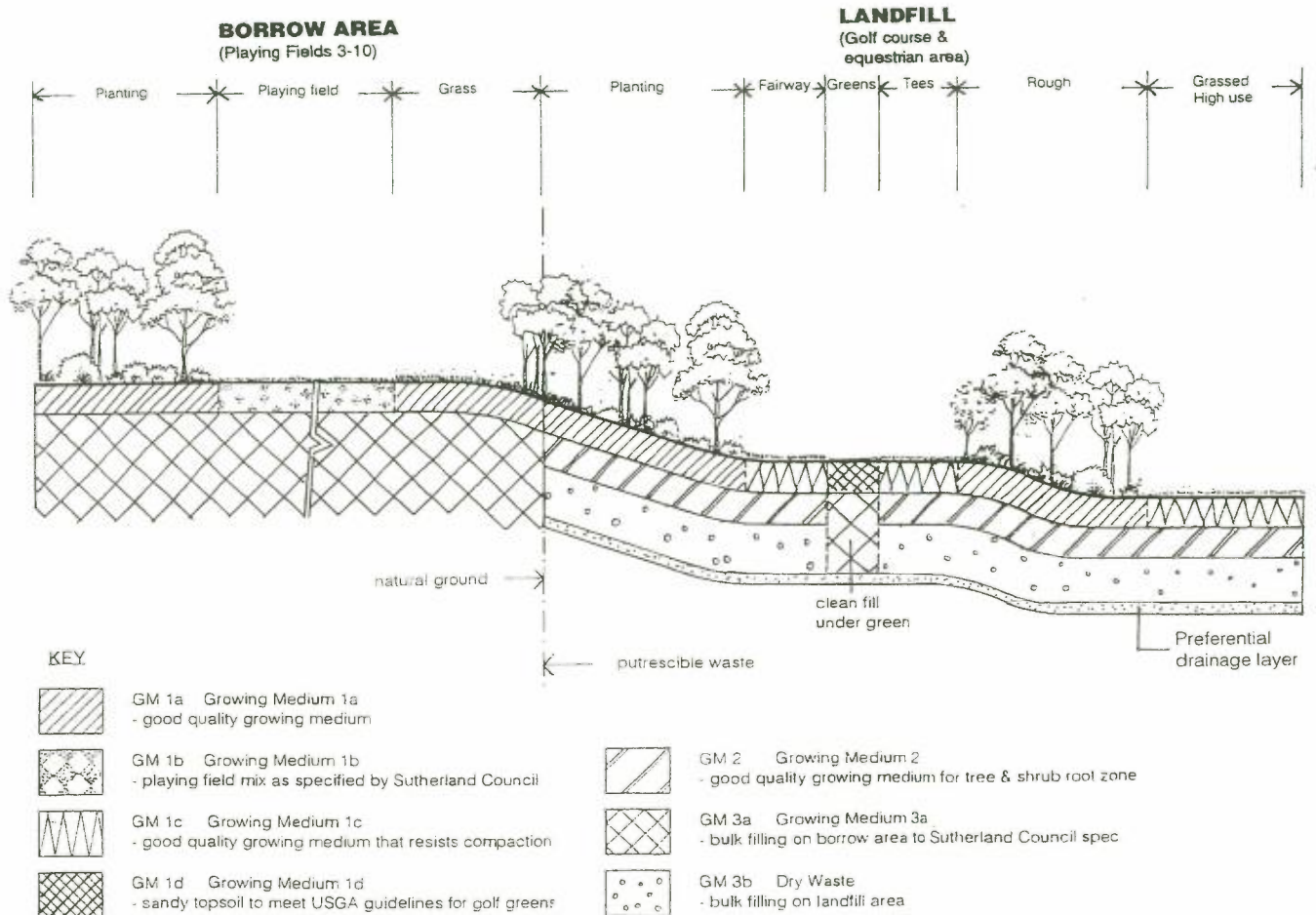
A significant amount of leachate is currently produced on the site and disposed to sewer. Waste Service and Sutherland Shire Council have undertaken specific investigations into the re-use of the various sources of water for irrigation and the problem of ongoing disposal of putrescible leachate on the site. This work is presented on Technical Report No. 2 (Sutton, Dodds and Knight, September 1998). The report proposes two options for both disposal of leachate and irrigation as summarised below.

Leachate Disposal

There are two options for the disposal of putrescible leachate at Lucas Heights 1. The leachate can be treated to remove ammonia and then disposed of to sewer. Currently the landfill produces leachate with ammonia concentrations in the range of 600-800mg/L. Landfill leachate falls under the Category IV Trade Waste Discharges to sewers for which Sydney Water has set out a limit of 50 ppm for ammonia.

The alternative is to utilise the leachate for irrigation at the Lucas Heights 1 site. This option is the subject of current investigations involving the irrigation of trial areas on the site. If the trials are successful and non adverse environmental impacts are identified, it is proposed to adopt this option of leachate re-use.

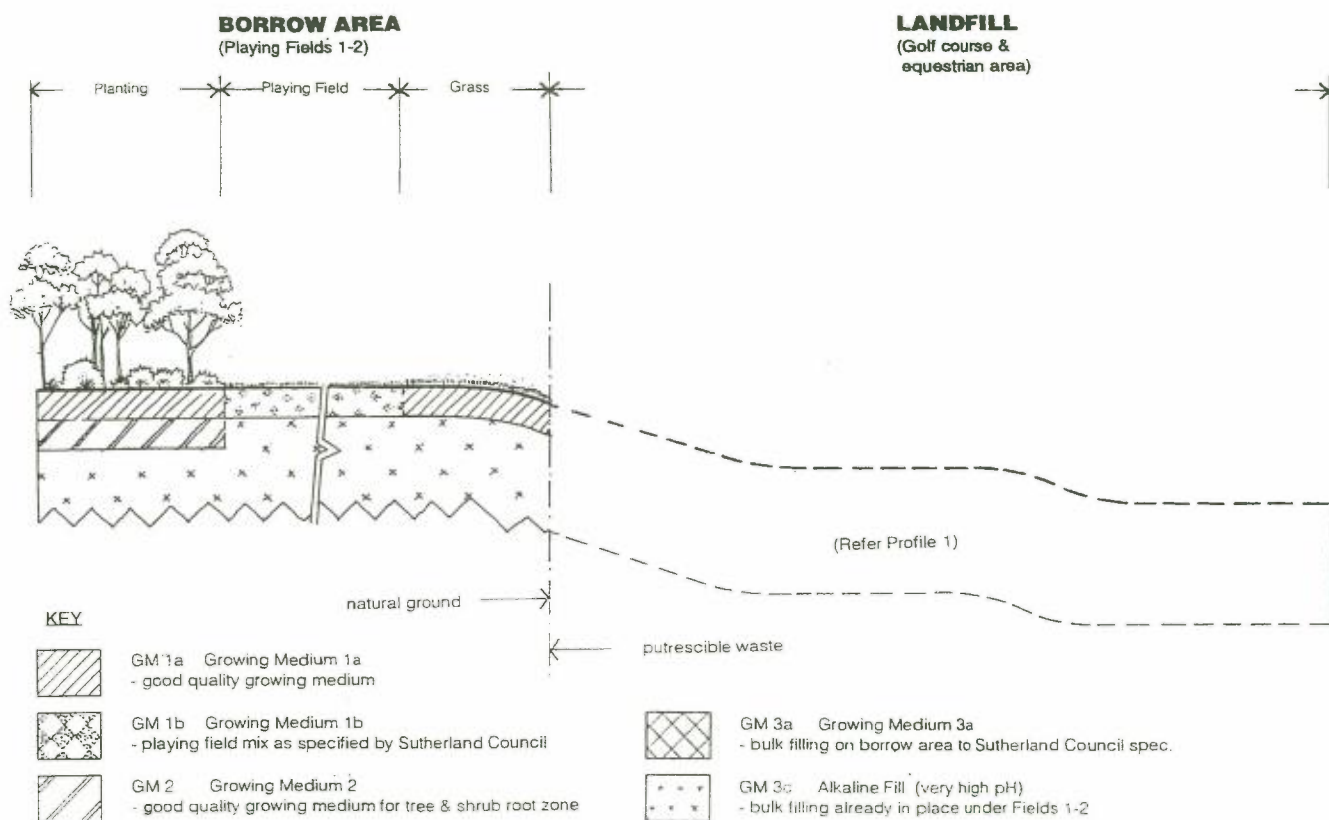
4. IMPLEMENTATION STRATEGIES



Indicative SOIL PROFILE 1

Figure 6: General Arrangement of Fill Materials at Lucas Heights 1.

4. IMPLEMENTATION STRATEGIES



Indicative SOIL PROFILE 2

Figure 7: General Arrangement of Fill Materials under Playing Fields 1 and 2, Lucas Heights 1.

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LUCAS HEIGHTS 1

4. IMPLEMENTATION STRATEGIES

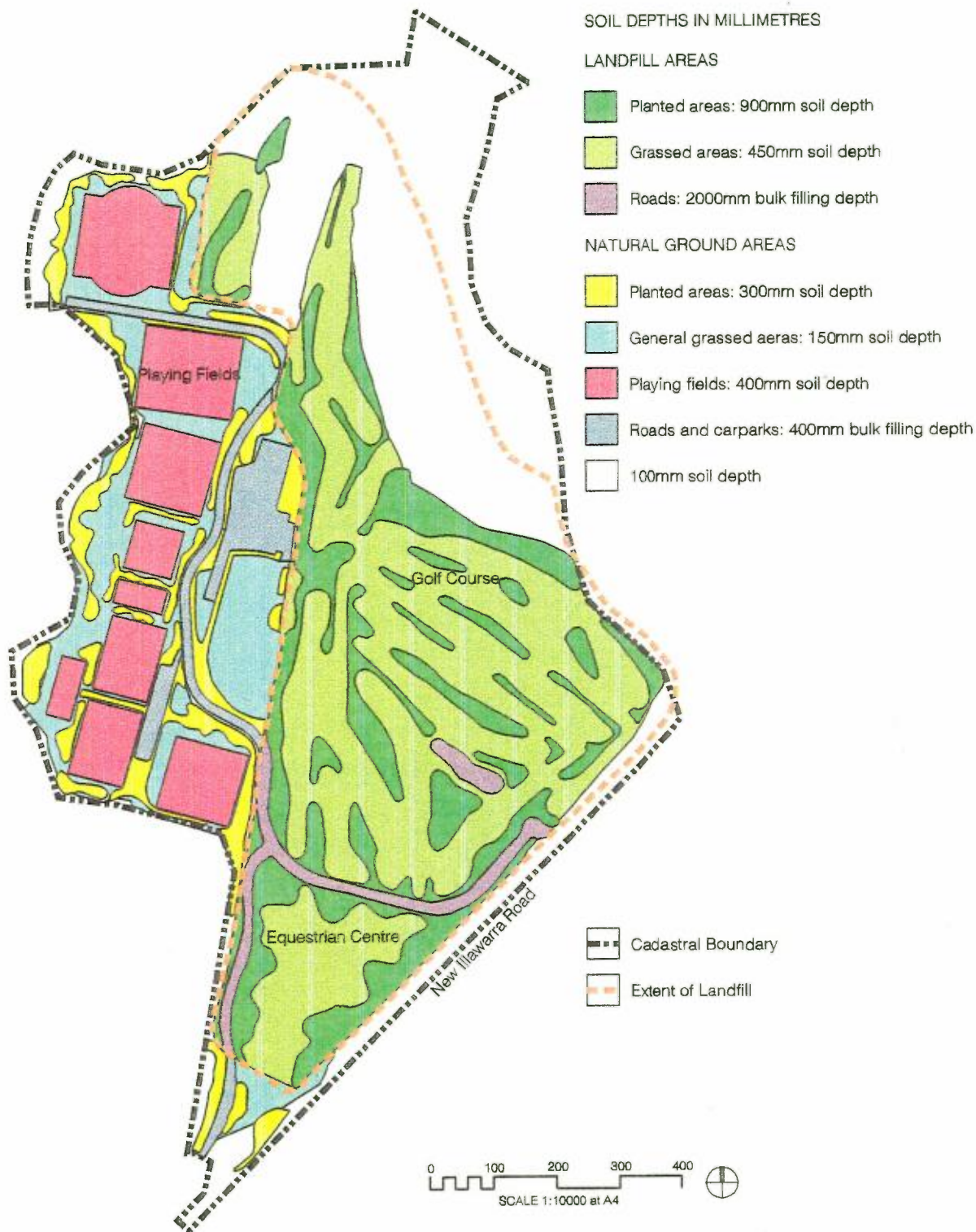


Figure 8: Topsoil and Subsoil Depths Allowed for Planting and Finishing Works.

4. IMPLEMENTATION STRATEGIES

Details are provided in Technical Report No. 2 (Sutton, Dodds and Knight, September 1998).

At this time, however, insufficient information is available to enable adoption of this option and it is proposed to construct and operate a leachate treatment plant on site and to discharge the treated leachate to sewer.

Irrigation (refer Dwgs. 2511c/DA34-37 inclusive)

Two alternative irrigation systems are proposed for the LH1 site at this stage. Irrigation is necessarily linked to the water management and leachate disposal strategies described above. Essentially, the alternative irrigation systems are as follows.

- *Alternative 1*

Irrigation strategy alternative 1 allows for automatic pop-up sprinkler irrigation to all tees, greens, playing fields, fairways and landscaping around buildings. Temporary irrigation only is proposed to roughs and all other recreation areas. Irrigation water will comprise surface water runoff and sub-surface non-putrescible leachate from the dry waste fill layers harvested and collected in the four new dams. The mixed water (dam water) will be pumped to and distributed from a 100,000 litre nominal capacity irrigation tank located to the north of the bowling greens as shown on the master plans (*Dwg. 2511c/DA34*).

- *Alternative 2*

Irrigation strategy alternative 2 allows for automatic pop-up sprinkler irrigation for all tees, greens, playing fields and landscaping around buildings. A sub-surface irrigation system is also proposed for the permanent irrigation of fairways, roughs and other recreation areas. Irrigation water will comprise both dam water (comprising surface water run-off and non-putrescible leachate collected in the four new dams) and putrescible leachate collected from the bottom of the putrescible landfill and stored in the existing leachate dam. The sub-surface irrigation system will deliver putrescible leachate to the fairways, roughs and other recreation areas. This system will be flushed with dam water as necessary to maintain healthy plant growth in all these areas. The surface sprinkler irrigation system will deliver only dam water to tees, greens, playing fields and landscaping around buildings. Dam water and leachate water will be pumped separately to separate balance tanks (100,000 litre nominal capacity each) located to the north of the bowling greens for distribution (*refer Dwg 2511c/DA36*)

Irrigation strategy Alternative 1 will be implemented in the early stages of the development. The preferred long term option at this stage is Alternative 1. The adoption of irrigation with leachate at the LH1 site is subject to current investigation involving the irrigation of trial areas on the site.

4. IMPLEMENTATION STRATEGIES*Stormwater Water Collection and Re-use*

The six key elements of the stormwater collection and reuse strategy are:

- collection and diversion of stormwater runoff from building roofs, pavements and playing field, parkland and golf course areas;
- filtering of gross pollutants through open grassed and planted swales and wetland planting;
- storage of all collected water;
- interconnection of storage reservoirs to facilitate flexibility and minimise pumping costs;
- reuse of harvested water; and
- intensive monitoring of soil moisture levels to ensure optimum plant establishment and minimal water wastage.

4.4 Engineering Services

Engineering documentation to support this DA has been provided by Waste Service. The following description outlines the engineering infrastructure provisions for the site.

Sewer

A sewer gravity main is proposed to service the sports club, the three amenities blocks and the maintenance shed. The gravity main will connect into the existing sewer gravity main located north of the pumping station at the northern end of the site.

Power Supply

Power will be provided from the existing Energy Australia overhead line located along New Illawarra Road. The proposed supply includes:

- an 11kV underground feeder to be laid from the existing supply on New Illawarra Road to a proposed substation located near the sports club building. (The underground feeder is to follow the alignment of Recreation Drive);
- a single pad mounted transformer substation located near the sports club building;
- a main distribution board/switchboard to be located within the sports club. All further distribution of 415V power supply will be from the main distribution board to other distribution boards located throughout the site;
- an emergency and essential services standby generator (size to be determined) is proposed as the existing Energy Australia power supply is not part of a ring main at this stage; and



Solar lighting is proposed to Recreation Drive.

4. IMPLEMENTATION STRATEGIES

- an additional 45KVA generator for the temporary playing fields is being installed prior to the permanent power supply being commissioned.

Electrical and Lighting

Lighting requirements for the sporting facilities are anticipated as follows:

- training standard floodlighting to all playing fields;
- upgraded competition standard floodlighting to one 'premier' field.
- floodlighting to the driving range;
- night lighting to the tennis and netball courts;
- solar powered street lighting to Recreation Drive and car parks; and
- power for general servicing requirements to the sports club, pro-shop amenities buildings, irrigation pumphouse etc.

Power is also required for:

- permanent automatic irrigation to all playing fields; and
- permanent automatic irrigation to the golf course.

Water Supply

The water supply will be provided from the existing Sydney Water main located adjacent to the existing reservoir in New Illawarra Road to the south of the site. The water supply is to service the sports club, three amenities blocks, and the maintenance depot. The supply shall also service the proposed irrigation tanks to supplement irrigation should site harvested water be insufficient during long dry spells.

Stormwater Drainage

Surface water runoff from the site is proposed to be collected via sub-surface drainage structures and grassed swales. The runoff will ultimately be collected in the proposed dams. The playing fields generally have stormwater drainage pits and pipes on their perimeter. Subsoil drainage is proposed beneath the surface of the playing fields and is connected into the perimeter stormwater collection system.

Sub-surface drainage will generally be used for car parks and the main access road located over the borrow area.

Over the existing landfill area, grassed and planted swales will be generally used for drainage collection. (refer Dwg. 2511c/DA07-12 inclusive).

4. IMPLEMENTATION STRATEGIES**4.5 Landfill Gas Collection and Use**

Energy Developments Limited (EDL) currently collects landfill gas produced on the site by gas wells located over the landfill area. Proposed filling and development of the site will necessitate considerable modifications to the existing gas collection system. The final design and construction of the new system will be undertaken by EDL and Waste Service. Preliminary designs have already been provided by EDL. Proposed new locations for gas well stations are shown on the DA master plans (*refer Dwgs. 2511C/DA01 to DA06*) including minor amendments required to accommodate the new design.



The existing power station at the Lucas Heights 1 site.

4.6 Staging Strategy (*refer Dwg. 2511C/DA13*)

Site rehabilitation and finishing works at LH1 are generally proposed in five stages relating to the filling program envisaged for the site. Filling and final site rehabilitation will commence in the north-west corner and move progressively southwards. The anticipated programme and earliest availability of facilities in each stage is as follows:

Stage One (approximately 2000 – 2001)

- playing fields 1-2;
- playing fields 3-6;
- proposed entrance driveway including roundabout, median and entry off New Illawarra Road and footpaths;
- pro-shop and golf driving range;
- practice putting greens (x2);
- maintenance depot;
- amenities building/kiosk (adjacent to fields 1-2);
- car park for 100 cars (adjacent to fields 1-2);
- car park for 50 cars (adjacent to the golf driving range);
- cricket practice nets (x6);
- picnic areas;
- gabion/rock retaining walls;
- dams 1,2 and 3, including pipe connections to future Weighbridge Dam, irrigation pumps and tanks;
- native tree planting and soft landscaping, including feature avenue trees; and
- future car park for additional 40 cars (fields 1-2).



4. IMPLEMENTATION STRATEGIES*Stage Two (approximately 2003)*

- golf course (holes 1-9);
- 'gabion' retaining wall to edge of Transgrid easement;
- native tree planting and soft landscaping to golf course; and
- upgrade/resurface existing EDL access road.

Stage Three (approximately 2004)

- fields 7-10;
- tennis courts (x8);
- netball courts (x4);
- car park for 140 cars;
- children's playground and seating/viewing area;
- picnic area;
- amenities building/kiosk (fields 9-10); and
- native tree planting and general soft landscaping.

Stage Four (approximately 2005)

- 1500sqm. sports club building;
- bowling greens (x2);
- car park for additional 150 cars; and
- native tree planting and general soft landscaping.

Stage Five (approximately 2009)

- golf course (holes 10-18);
- Weighbridge Dam;
- equestrian centre buildings;
- recreation trail (eg. horse riding, mountain bikes, joggers, bushwalking etc.);
- unstructured open space/future picnic area;
- native tree planting and soft landscaping to golf course and open space generally;
- future secondary access road, entry and roundabout; and
- future recreation area (not included in this DA).

LUCAS HEIGHTS 1

4. IMPLEMENTATION STRATEGIES**4.7 Opinion of Probable Cost**

The capital costs to complete the finishing works for the Lucas Heights 1 development are summarised in Table 1 below. These include the costs of finishing works only. The costs of landfill, bulk earthworks and topsoiling to final design levels are to be borne by Waste Service, NSW. The preferred option (Option A) allows for sub-surface drainage and irrigation using raw water. Option B costs allow an extra over amount to cover the cost of installation of a leachate irrigation system.

ITEM	*DA COST PLAN (Option A)	**OPTIONAL COSTS (Option B)
STAGE		
General	\$416,000.00	\$816,000.00
Stage 1A	\$5,452,000.00	\$5,736,000.00
Stage 1B	\$4,508,000.00	\$4,508,000.00
Stage 2	\$4,351,000.00	\$5,120,000.00
Stage 3	\$3,789,000.00	\$3,789,000.00
Stage 4	\$4,929,000.00	\$5,419,000.00
Stage 5A	\$3,390,000.00	\$3,906,000.00
Stage 5B	\$1,335,000.00	\$1,569,000.00
TOTAL	\$28,170,000.00	\$30,863,000.00
ELEMENT		
Preliminaries	\$1,116,945.50	\$1,222,495.50
Demolition	(excluded)	(excluded)
Site Preparation	\$4,244,919.00	\$4,244,919.00
Roads, Footpaths and Paved Areas	\$2,466,894.00	\$2,466,894.00
Boundary Walls, Fences and Gates	\$240,800.00	\$240,800.00
Landscaping and Improvements	\$5,692,545.23	\$5,692,545.23
Buildings/Structures	\$3,612,872.00	\$3,612,872.00
External Stormwater Drainage	\$487,797.00	\$487,797.70
External Sewer Drainage	\$15,225.00	\$15,225.00
External Water Supply and Irrigation	\$3,347,067.70	\$5,458,334.90
External Electric Light and Power	\$970,486.00	\$970,486.00
Contract Maintenance	(excluded)	(excluded)
Special Provisions	\$5,974,718.10	\$6,451,373.10
TOTAL	\$28,170,269.53	30,863,742.43

* Includes sub-surface drainage and associated special equipment.

** Includes sub-surface drainage and leachate irrigation.

Table 1: Lucas Heights 1 Option of Probable Cost - Finishing Works

PART B: WASTE MANAGEMENT CENTRE

5. SITE DESCRIPTION*The Waste Management Centre.***5.1 The Existing Site**

The DA comprises land owned by Waste Service NSW, which includes the Sydney International Clay Target Shooting Association (SICTA) lease area, and land leased from the Australian Nuclear Science and Technology Organisation (ANSTO), comprising a total area of 205ha. Within the DA site the Waste Management Centre site includes 61ha owned by Waste Service and 115.5ha (including the Police Citizens Youth Club (PCYC) area) owned by ANSTO. The Lucas Heights Conservation Area (LHCA) is located immediately to the north of the WMC.

Landfill operations commenced in 1987 and more than 75% of the site has been disturbed for waste disposal, cover material extraction, site facilities and roadworks. An area of approximately 30 hectares has already been partially rehabilitated with a cover crop, mulch and native tree planting. This area will be subject to further landfill in the proposed development.

In accordance with the mediation agreement proposed landfilling operations are to be completed by approximately 2025 or earlier if the agreed tonnage to landfill is reached (8,225,000 tonnes).

5.2 Zoning

In November 1997 Sutherland Shire Council revised the Sutherland Shire Local Environmental Plan 1993, to reflect the proposed land use within the study area. Amendment No. 50 to the Local Environmental Plan introduced additional zoning categories:

- 5(f) Special Uses - Waste Recycling,
- 6(d) Future Recreation,

as well as retaining existing land uses under the category:

- 7(b) Environmental Protection – Bushland.

The new 5(f) zoning allows for the proposed green waste processing and composting facility and bulk waste processing area and the proposed recycling and resource recovery facilities, including an enclosed biowaste facility (refer *Figure 10*).

New development proposals described in this report relate to land zoned 5(f) and 6(d) in the WMC. New development proposed in the LHCA is addressed in the Draft LHCA Environmental Management Plan.

WASTE MANAGEMENT CENTRE

5. SITE DESCRIPTION

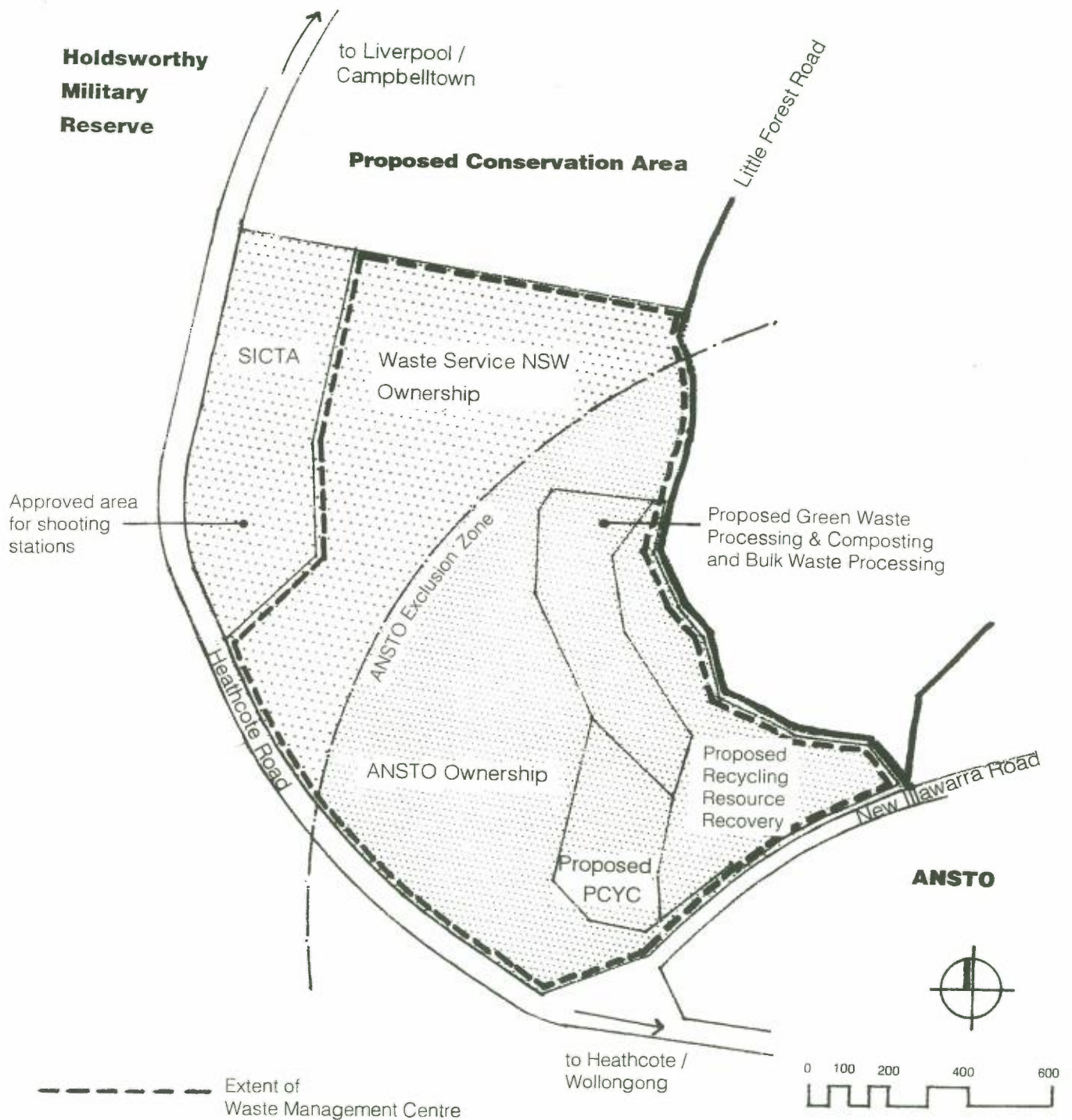


Figure 9: The Waste Management Centre: Site Plan.

5. SITE DESCRIPTION

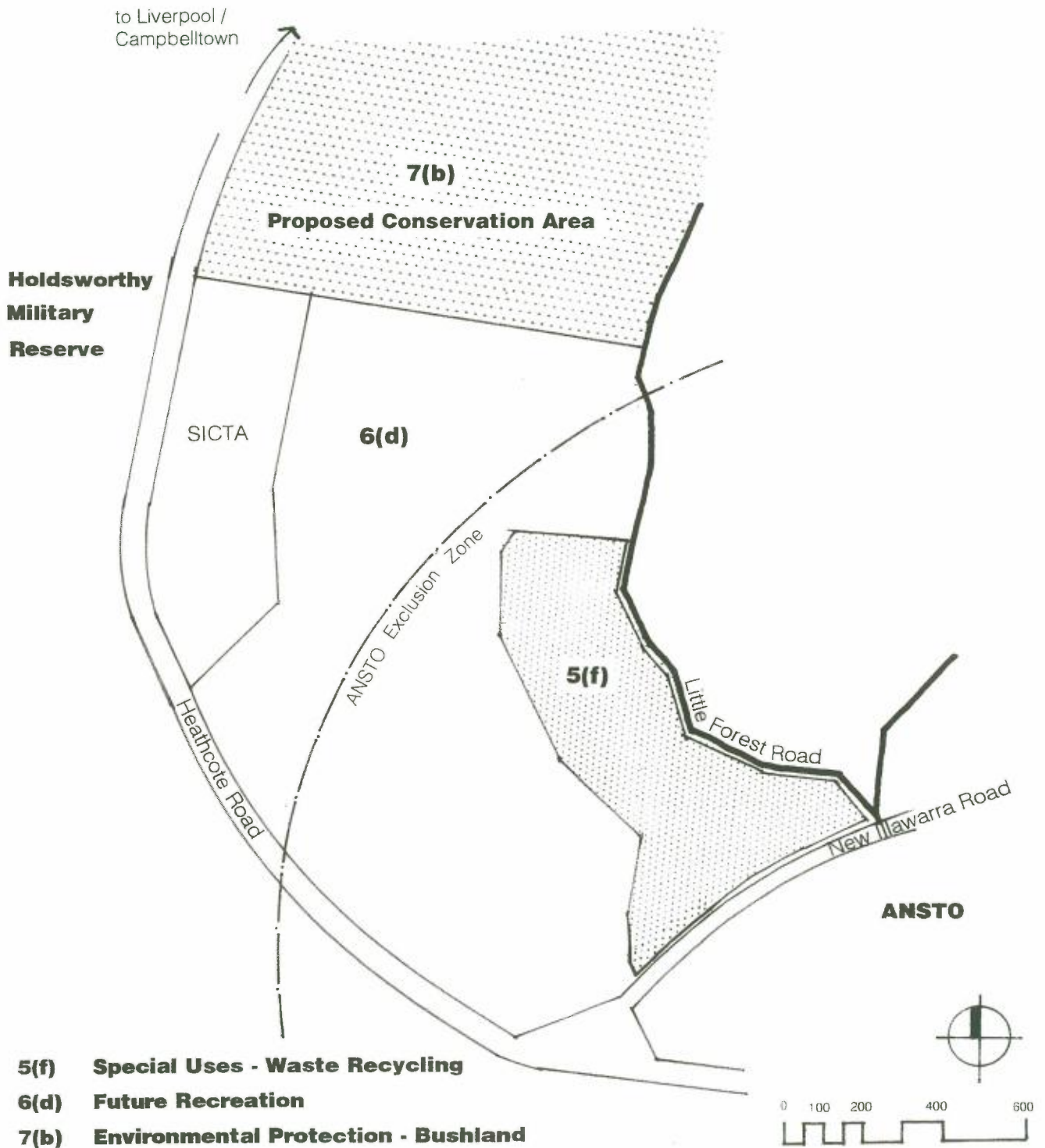


Figure 10: Zoning.

5. SITE DESCRIPTION**5.3 Landform and Drainage Patterns**

The site of the WMC was originally a steep sided valley, typical of the area, draining into Mill Creek and ultimately to the Georges River.

Waste Service NSW currently has approval (1985) to fill the valley with putrescible and non putrescible waste to achieve an agreed new profile. Work to achieve this began in 1987. Waste Service estimated remaining capacity of the landfill under the existing approval to be approximately 9.12 million tonnes at June 1996.

The current (1985) approval allows for filling to a maximum height of 162m (AHD).

The southern portion of the site has already been filled to this height and Waste Service is progressively filling the remainder of the site northwards.

5.4 Access

Access to the site is currently off New Illawarra Road via Little Forest Road through the Waste Management Centre weighbridge station. Separate access points also exist to the existing Police Citizens Youth Club (PCYC) facility (off Little Forest Road) and the Sydney International Clay Target Association (SICTA) off Heathcote Road. There is no existing direct access to the site from New Illawarra Road.

5.5 Power Station

Development of a 12 MW power station was recently completed in the south-east portion of the site in accordance with approval from Sutherland Shire Council within the 5(f) zoning. The power station is intended to utilise landfill gas to supply electricity to the electricity grid. The power station will collect gas from existing and proposed gas wells constructed and operated by Energy Developments Limited as for LH1. It is located adjoining the proposed recycling and resourcing recovery area and the proposed green waste processing and composting and bulk waste processing.

5.6 The Police Citizens Youth Club (PCYC)

The PCYC uses an 11 hectare area of land on the corner of New Illawarra Road and Little Forest Road. This use will remain on the site but in a new location. The new site will be operated by the PCYC under licence from Waste Service subject to formalisation of leasing of the land from ANSTO to Waste Service. The new facility will be designed and constructed by Waste Service NSW as part of the first stage of the development. Detailed development of the facility is

5. SITE DESCRIPTION

not part of this application, however, approval for the final use of the allocated area is sought. The cost of redeveloping the facility is not included in the opinion of probable cost.

5.7 Adjoining Land Uses *(Figure 1)*

Land surrounding the WMC is generally undeveloped, still covered with extensive native woodland vegetation. To the north east of the WMC is a quarry which is currently being rehabilitated, a former quarry which was filled with solid waste (Harrington's Quarry), a liquid waste depot on Commonwealth land, a burial facility for low level radio active waste and the former Sutherland Shire Council night soil depot. The LHCA is now to be retained as managed bushland. An Aboriginal cultural and tourist centre is proposed in the north western corner of the land with access permitted to cultural sites.

Areas to the west and south of the site are occupied by the Holsworthy Military Reserve and Heathcote National Park.

Immediately east of the site, on the other side of New Illawarra Road, is the Australian Nuclear Scientific Technology Organisation (ANSTO).

SICTA occupies Waste Service land in the north-west of the site under license. Waste Service NSW has agreed to undertake tree planting along the eastern facing bank within the area in conjunction to Stage 1. No other work is proposed.

A review of police regulations for shooting has indicated there is a need for safety fencing and signage around all shooting areas.

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT

Kite flying and many other recreation pursuits will be catered for in the parkland development proposed at the WMC.

6.1 General

Proposals for the ultimate development of WMC include:

- a 126 ha parkland for public use;
- the relocation and redevelopment of the existing 11ha PCYC facility;
- the provision of a 14.0ha green waste processing and composting facility to be operated by Waste Service NSW; and
- the provision of a 25.5ha recycling and resource recovery facility to be operated by Waste Service NSW (including the existing administration area).

The 28.5ha existing clay target shooting area (S.I.C.T.A) remains but no further development is proposed in this application other than additional bushland planting.

The general arrangement and area of facilities to be provided is shown in *Figure 11*.

6.2 Master Plan (refer *Figure 12*)*General*

The WMC will be rehabilitated to provide a new broadscale parkland similar to Sydney's Centennial and Bicentennial Parklands. It will be a regional destination for future generations of the children of The Shire and beyond.

6. THE PROPOSED DEVELOPMENT

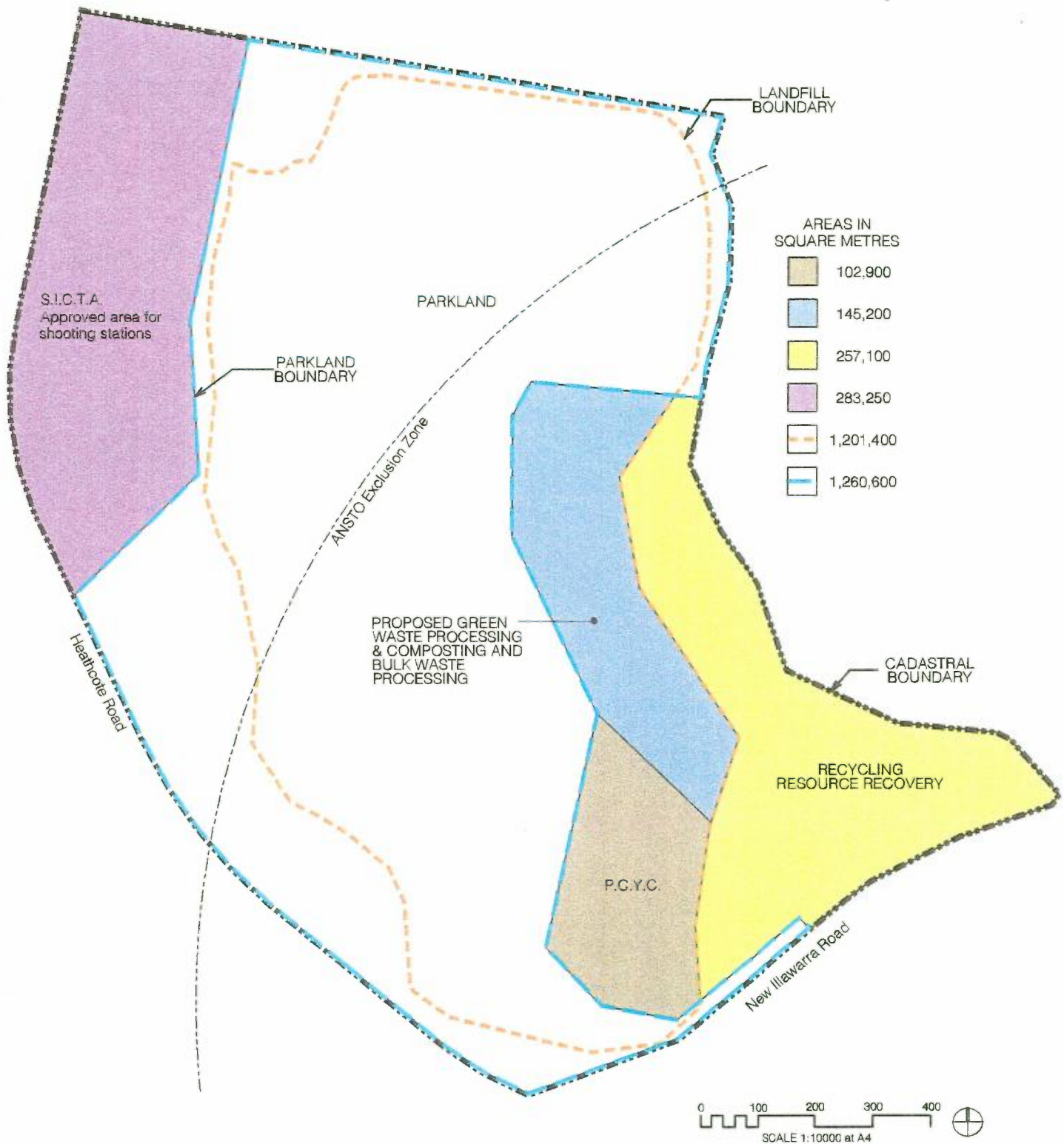


Figure 11: General Arrangements and Area of Facilities.

6. THE PROPOSED DEVELOPMENT



Figure 12: Landscape Master Plan Illustration.

6. THE PROPOSED DEVELOPMENT*The Ridge*

A new ridgeline will be created by the landfill. The ridgeline is consistent with the surrounding landform and will blend with adjacent vegetated hilltops and ridgelines. It is intended that the addition of natural woodland tree vegetation on elevated areas of the site will vastly improve long and middle distance views into the site.

Landscape Character

The character of the parkland is intended to be low key, even rural. Large grassed 'meadow' or 'wold' areas are joined by a system of link roads and paths. These routes direct park uses to the major features of the site including Mill Creek, Mill Pond, Duck Pond and 'The Peak'. Soft surface finishes, bird life and 'paddock' style bridges reinforce the rural character as does the variety of edge treatments and finishes to the ponds and creekline.

Circulation

The main vehicular tracks circulate between the three new entry points at Heathcote Road, New Illawarra Road and Little Forest Road (north). This system is criss-crossed by numerous smaller trail links for pedestrians.

Vegetation

Tree and shrub vegetation species are selected from a range of species indigenous to the area. Detailed recommended vegetation space are appended (refer **Appendix F**). It is hoped that revegetation of the site will encourage rehabilitation by native animal and bird life common in the area.

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT**6.3 The Ridge and Peak**

The WMC site will be reshaped during a staged landfill programme to create a new broad ridgeline peaking at maximum 172 metres AHD (10m higher than the existing high point) with lateral valleys that drain towards Mill Creek. The high point is close to the central north - south axis of the site, slightly towards the eastern side. Relative levels range from the 172 metre high point to maximum 90 metres at the north western corner on the newly configured Mill Creek alignment.

The site high point and a north-south ridgeline afford prominent views to the Sydney city skyline, and along the North Shore. This ridge and high point will serve as a major design element, offering opportunities for lookouts and observation platforms. The highpoint, referred to as 'The Peak', would lend itself to future development of a kiosk or other structure which could take advantage of the prominent views; as well as views down the drainage lines into the various developments within the site.

Such an architectural element, which would be of modular lightweight construction, could also serve as an interpretive device, providing an opportunity to display the history of the area, development and operation of the landfill, and other recycling operations which have occurred or continue to occur within the area. Reference could also be made to the culture (natural, Aboriginal and European) of the area.

6.4 Chain of Ponds*Mill Creek*

A chain of ponds is proposed on the west side of the parkland. The original Mill Creek watercourse was moved westwards prior to commencement of current landfill operations to allow more space for filling. Its present course provides a chain of small sedimentation ponds. At the conclusion of landfill operations the existing chain of ponds will no longer be required for sedimentation purposes.

These existing ponds however, will be used as a basis for development of a 'chain of ponds' along the present Mill Creek alignment. The remnant sedimentation dams will be re-shaped to suit available runoff recharge capacity, and to meet functional and aesthetic needs, with water levels controlled by adjustable spillways.



Water and drainage will become major landscape features of the new parkland

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT*Mill Pond and Duck Pond*

Mill Pond and Duck Ponds are two major ponds proposed for the parkland. Mill Pond will be reshaped from an existing dam required for sedimentation purposes during the early stages of landfilling. Duck Pond will be newly constructed to provide a landscape water feature. Further engineering study is required to verify the sustainability of the Mill Pond.

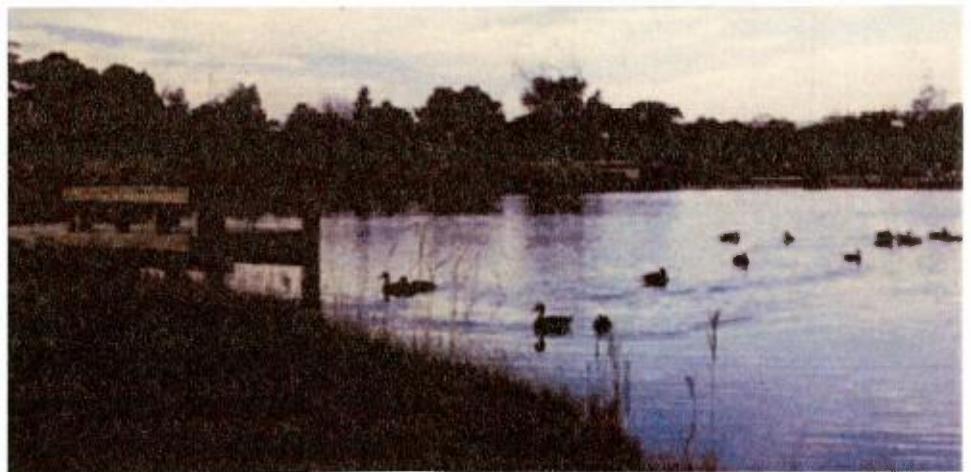
A variety of edge treatments are proposed to maximise landscape amenity and provide areas of public accessibility to the waters edge. Planted margins comprise aquatic macrophytes on a 1:10 slope to meet safety requirements. It is not envisaged that improvement of water quality by natural stripping of nutrients via macrophyte planting will be a major requirement. Gently sloping grassed edges will allow public access to the waters edge at both water bodies.

Simple rural style culverts are proposed across the dam to provide pedestrian and vehicular access. These will be a visual feature of the pond environments.

Weir and spillway structures will be constructed to control water levels. Detailed engineering detailing of all dam structures will be provided by Waste Service NSW.

Both ponds contain a central island as a landscape feature and to serve as fauna protection areas, especially for waterfowl.

Opportunity for future development on the edges of the Mill Pond may include the location of a small pavilion, café or kiosk possibly taking on the theme of a Mill. Two self composting toilets will be located adjacent to the Mill Pond.



New ponds will become major features of the new park.

6. THE PROPOSED DEVELOPMENT

The parkland will provide for primarily passive recreation uses.

Recreation Opportunities

The parkland will provide primarily for passive recreation uses. The final structure of the parkland will not fully emerge until completion of the final stage around the year 2027. It has been difficult to predict the exact uses the parkland will finally offer as completion of each stage is some time in the future. As a result, grading and landscaping of all site areas has been developed to provide maximum flexibility to accommodate the possible needs of future generations. Large, gently undulating and sloping spaces edged with trees and pathways will be able to cater for a range of different activities.

Final uses of each space can be determined some time in the future through community consultation, recreation needs studies, and through consultation with ANSTO. At this stage it is envisaged facilities in the first completed portion of the parkland will comprise the relocated Police Citizens Youth Club area, and include dog training and model aeroplane flying areas.

ANSTO has indicated the following special requirements for recreation uses proposed on land in ANSTO ownership:

- unless ANSTO agrees to ongoing recreational uses and retention of infrastructure, recreational uses will cease and recreational infrastructure be removed by 1 July 2025;

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT

- after completion of each landfill staged area and during rehabilitation of that area, a review of the proposed recreational uses for that area be undertaken with ANSTO's participation;
- proposed specific recreational uses will require ANSTO's prior approval and must meet ANSTO and NSW Emergency Service Organisations safety criteria and directions; and
- ANSTO has no financial or other responsibility for maintenance of recreational areas.

Rehabilitation

Rehabilitation of the WMC will create a parkland area of large grassed spaces fringed with native open woodland tree vegetation. Native shrub understorey vegetation will be provided on steeper slopes within the site. A major component of the proposal is to re-establish a vegetation character on the completed landfill which resembles the surrounding natural landscape and blends with indigenous woodland communities.

6.5 Access and Circulation

Three vehicular entry points are ultimately proposed into the parkland. These include:

- New Illawarra Road;
- Heathcote Road; and
- Little Forest Road (northern end).

The major park entries would be from New Illawarra Road and Heathcote Road. Little Forest Road is primarily envisaged as a service access point. The Heathcote Road entry is proposed as part of the final vision for the site. It will be used for emergency access/egress only during the early stages of the parkland development.

Two distinct circulation systems are proposed in the development. These are:

- provision for light-duty vehicular movement (and occasional service vehicles); and
- provision for pedestrian, bicycle and other non-motorised movement.

Road and footpath pavements are 6m and 2.5m width respectively. Cement stabilised crushed sandstone with 2 coat seal finish is proposed.



Trails will be provided throughout the park.

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT*South Entry View.**Vehicular Traffic*

A light-duty vehicular road system would be constructed to link between the three proposed park entrances. A series of loop roads and parking areas has been designed to allow movement completely within the park environs.

The major vehicular links are known as the Mill Run linking New Illawarra and Heathcote Roads through the site, Woodlands Drive connecting Heathcote Road to the north of the site, and the service road (to be built by Waste Service) connecting the leachate dam and Little Forest Road.

Secondary road connections include Meadow Lane, The Cutting and The Ridgeway providing vehicular connections to the highest point of the site and along the eastern boundary of the parkland.

Vehicular parking would be provided in specific parking areas at selected destination points as shown on the master plans, however parking would also be encouraged in lay-bys and on road shoulders in other areas.

Pedestrian / Cycle Paths

2.5m wide cement stabilised crushed sandstone pedestrian/cycle paths/trails are proposed throughout the development linking various parkland facilities. These are shown on the master plans (*refer Dwgs 2511c/DA 41 and 42*).

6.6 Green Waste Processing & Composting and Bulk Waste Processing Facility (GW&BWPF)

A platform of approximately 4.4 hectares has been established for windrow or static pile processing and storage of green waste within the 14.5ha area allocation for the GW&BWPF. This is illustrated on the master plan.

A sedimentation dam of approximately 4 ML capacity is proposed for use in the green waste processing area. The dam will collect runoff from the composting platform and the adjacent embankment. Following treatment, the water would be recycled and re-used in the composting operations.

Under the mediation agreement a maximum of 55,000 tonnes of recyclable material per year will be diverted from landfill to the GW&BWPF and the RRRF. Up to 50,000 tonnes may be processed at the GW&BWPF.

Options for compost processing include windrowing and static piles. These will be located on the composting platform. A further area of approximately 1.6 hectares to the north of the composting platform is proposed for stockpiling of materials.

Access to the GW&BWPF is via the existing Waste Service administration area and weighbridge station located off Little Forest Road.

WASTE MANAGEMENT CENTRE

6. THE PROPOSED DEVELOPMENT**6.7 Leachate Lagoon**

The existing leachate lagoon located in the north-west corner of the site is to remain approximately in its present location and possibly to be expanded. This facility would be fenced from public access. A service road will be maintained for access to this area from Little Forest Road by Waste Service.

This portion of the site comprises steeply sloping land under an open tree canopy. It is intended to provide for further tree regeneration and planting to allow development of the area as a woodland. This will create a screened and secluded woodland environment around the leachate lagoon.

6.8 Recycling & Resource Recovery Facility (RRRF)

The portion of the site previously used by the P.C.Y.C. will be developed for various recycling and resource management facilities. During the mediation process was agreed that activities will not include incineration or re-manufacturing operations.

One Biowaste Facility is proposed as part of the Recycling and Resource Recovery Facilities at the Waste Management Centre. The Biowaste Facility would produce high quality compost from, in the main, food waste that is currently placed in the landfill. The process would occur in enclosed buildings and structures except for final compost curing and stockpiling. The design of the proposed Biowaste Facility presented in the DA and EIS includes both aerobic and anaerobic processes. Waste Service NSW is currently evaluating tenders for construction and operation of the facility. The final design may not include all aspects of the two processes described in the EIS. The facility will be required to operate in accordance with EPA licence requirements. Commencement will be deferred subject to the conditions of consent for the proposed development.

All structures proposed within the RRRF site are to be low key structures, no more than two storeys in height. The only exceptions will be tank structures, part of the anaerobic facility, which may reach 17m in height. The power station, located within the recycling area, is excluded from the DA.

All of the built facilities in the RRRF area are proposed to be constructed within a landscaped 'parkland' setting. In addition to the existing stands of woodland vegetation along New Illawarra and Little Forest Roads, substantial planting of new nature woodland tree and understorey screen planting is proposed to both the boundaries and internal areas of the site. Avenue trees will define internal roads and group tree plantings will enclose composting facilities, operational areas and internal parkland areas.

6. THE PROPOSED DEVELOPMENT**6.9 Improvements to Existing Site Facilities**

During the period of landfilling at Lucas Heights WMC, Waste Service proposes to improve the existing site facilities. This work will include the construction of a Visitor's centre and improvements to the small vehicle transfer station, recycling and office/amenities area.

The proposed location of the Visitors' Centre will be in the vicinity of the existing administration buildings. This building will incorporate eco-design principles and will become a display/exhibit in itself. The Visitors' Centre will be used as an educational and promotional Facility to increase public awareness into waste management.

Improvements to the small vehicle transfer station, recycling and office/administration areas will be carried out with the intention of making those facilities more functional and efficient for their respective users. The modifications to the small vehicle transfer station and recycling areas will allow a higher level of customer service and a greater level of control and supervision by Waste Service. It is intended to upgrade the office/amenities area in order to improve the accommodation requirements of Waste Service and Contracting Partner employees.

Separate building approval for these improvements will be sought by Waste Service at a later stage when details have been finalised.



7. IMPLEMENTATION STRATEGIES

7.1 Landfill and Site Formation *(refer Dwgs 2511C DA44 and 45)*

Additional putrescible and non-putrescible landfilling at WMC is proposed as per the 1996 mediation agreement. Design and construction of the landfill and provision of all filling material will be provided by Waste Service to achieve the landform profile shown on the DA grading plans.

The DA proposal allows the addition of 8.225 million tonnes of additional putrescible and non-putrescible waste at the WMC site, 6.025 million tonnes will be placed above the existing approved landfill profile and 2.2 million tonnes will be placed in an extension of the existing area of excavation at the northern end of the site (Stage 5). The final agreed volumes and tonnages of each bulk filling material are tabulated in **Appendix G**. The above equates to the placement of approximately 7.4 million cubic metres of material above the existing profile currently approved by Sutherland Shire Council for the site. An isopach diagram showing proposed depths of additional filling over the site is shown in *Figure 13*. Proposed grades for the WMC range between minimum 1:40 (2.5%) and 1:5 (20%).

Bulk filling will generally comprise putrescible and non-putrescible waste layers. The final landform will be covered by a minimum 600mm depth cover material comprising compacted clean fill derived from crushed sandstone. Deeper soil profiles will be provided beneath proposed planting areas. Detailed engineering proposals are to be provided detailing the landfill profiles.

7.2 Soil Preparation

High quality topsoil and subsoil materials are proposed for planted and grassed areas at the WMC in accordance with the mediation agreement. As for LH1, these will be manufactured mainly from crushed sandstone and compost materials by Waste Service NSW to the outline specification included in **Appendix E**. Soil mixes proposed for the WMC are shown on the drawings.

Growing medium to support plant growth on the site is allowed in the volume calculations for filling. Depths calculated for special fill materials are shown in *Figure 13*.

7.3 Surface Water Management

During landfill operations, sedimentation dams have been constructed and operate as initial treatment for surface runoff from the landfill areas. Additional dams are to be constructed and the recommendations presented in the Lyall & Macoun report dated September 1997 have been adopted.

The 'clean' surface runoff from the site will be channelled separately from landfill runoff and continue to provide flow downstream in Mill Creek.

7. IMPLEMENTATION STRATEGIES

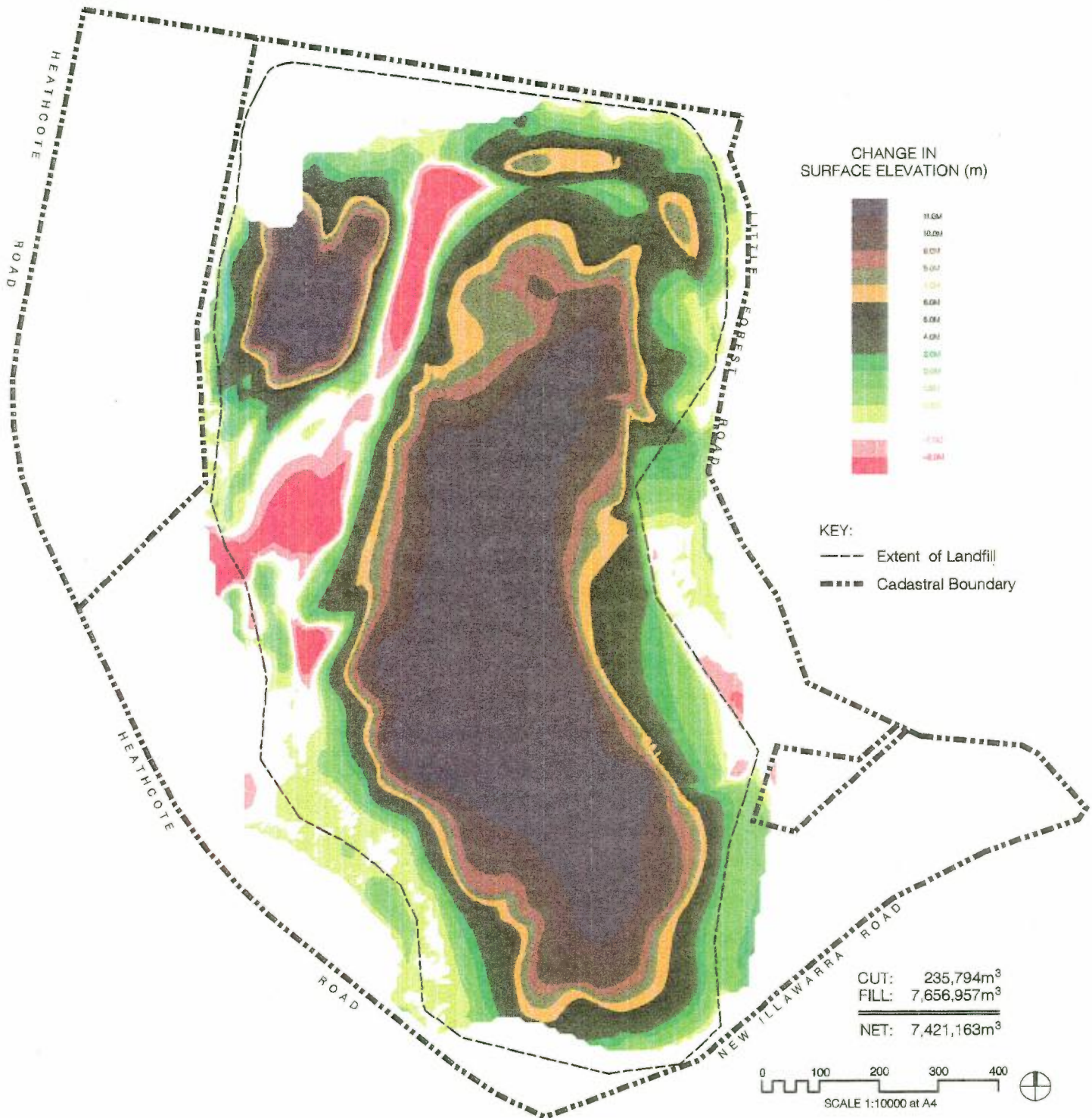


Figure 13: Depths of Filling.

7. IMPLEMENTATION STRATEGIES

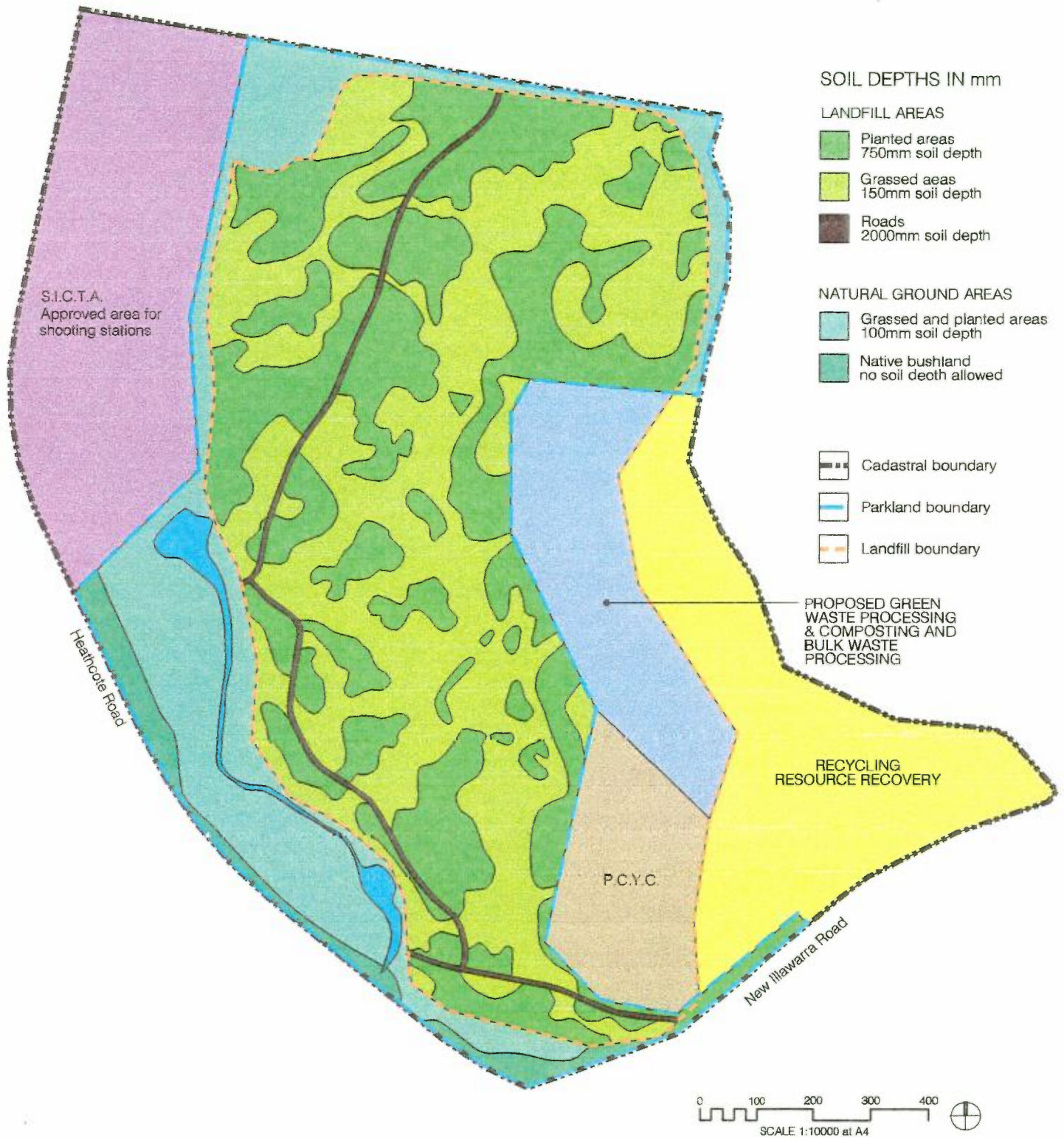


Figure 14: Topsoil and Subsoil Depths Allowed for Planting and Finishing works.

7. IMPLEMENTATION STRATEGIES

All the landfill surface water management structures (dams, channels, bund walls, etc) become redundant, following the finalisation of landfilling at the WMC. Some of the structures, however, will be modified and rehabilitated for use in the finishing works on the site.

The key elements of the stormwater collection and reuse strategy are:

- collection and diversion of stormwater runoff from pavements and parkland area;
- filtering of gross pollutants through open grassed and planted swales and wetland planting;
- storage of all harvested water; and
- interconnection of storage reservoirs to facilitate flexibility and minimise pumping costs.

7.4 Engineering Services

As for LH1, engineering services are provided by Waste Service NSW. At this stage no services are envisaged for the site other than electrical requirements to provide minimal lighting.

7.5 Methane Gas Collection and Use

Energy Developments Limited is currently establishing a landfill gas collection network over the landfill area. Well stations will be located at approximately 30 metres intervals over the parkland as shown on the master plans. Wherever possible they will be located amongst planted areas for screening.

Collections of gas at the WMC and conversion to power at the new power station will continue as long as conversion is economically viable. Beyond this time gas will be disposed by flaring and the plant dismantled.



Methane gas collection well.

WASTE MANAGEMENT CENTRE

7. IMPLEMENTATION STRATEGIES**7.6 Staging Strategy**

The availability of the various portions of the site for end use development corresponds to completion of the multi-staged landfill operations. It is anticipated that the rehabilitated stages of the site would be available for the proposed end uses as follows (*refer Dwg 2511C/DA45*).

Stage	Commencement of land fill	Availability for recreational development
1	1999	2005
2	2002	2007
3	2004	2012
4	2005	2018
5	2005	2026

7.7 Opinion of Probable Cost

The capital costs to complete the finishing works for the Waste Management Centre parkland development are summarised in Table 2 below.

These include the costs of finishing works only for the parkland. The costs of landfilling, bulk earthworks and topsoiling to final design levels are to be borne by Waste Service, NSW.

In all cases the costs below relate to development of the parkland only. They do not include any works proposed to the proposed GW & BWPF, RRRF and Waste Service Administration Area. Costs relating to the final development of the PCYC are also excluded.

ITEM	DA COST PLAN
Preliminaries	\$564,000.00
Earthworks and Drainage	\$844,107.60
Soil Reconstruction	\$2,717,384.00
Water supply and Irrigation	\$1,143,122.00
Pavements and Structures	\$2,241,020.00
Grassing	\$725,537.95
Revegetation	\$2,109,938.64
Temporary fencing	\$37,500.00
Boundary walls, fencing and gates	\$44,500.00
Light and power	\$40,000.00
Miscellaneous allowances	\$1,360,000.00
Additional costs	\$3,107,000.00
TOTAL	\$14,934,110.00

Table 2: Waste Management Centre Parkland Opinion of Probable Cost – Finishing Works

8. ACKNOWLEDGEMENT

A team of consultants and other parties collaborated in the preparation of this development application.

Interim Steering Committee

Chairman and Mediator	John T Woodward
Waste Service NSW	John Lawson Mark Lane Robert Callegari
Sutherland Shire Council	Derril Greenway Scott Lee Keith Lund Peter Warne
HASSELL Pty Ltd	Ross de la Motte Don Sigsby Deborah Eastment Steven Wilson Phillip Darmanin
Quantity Survey and Cost Planning	Page Kirkland Partnership
Irrigation and Water Management	Fluid Flow Pty Ltd
Soil Amelioration	Sydney Environmental and Soil Laboratory
Golf Course Design	Golf and Recreation Planners
Building Energy Audit	Ove Arup and Partners

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1. Woodward, John T. *A Proposal for Future Use of Lands at Lucas Heights*, November 1996. Office of Environmental Mediation and Inquiry.
2. Local Environmental Plan, Amendment No. 50.
3. Lyall & Macoun, *Lucas Heights Waste Management Centre - Surface Water Management Strategy* (Draft). September 1997.
4. Sutton, Dodds and Knight. *Water Management Plan for Lucas Heights 1* Technical Report 2, September 1998.

APPENDICES

APPENDIX A

Energy Conservation Report (example)

Lucas Heights DA Lucas Heights Sports Club

Energy Conservation Report

Prepared for
Hassell Pty Ltd

by
Ove Arup & Partners

24 March 1998

REPORT ISSUE AUTHORISATION

PROJECT: Lucas Heights DA - Sports Club

Project No: 10574

Rev	Date	Purpose of Issue/Nature of Revision	Prepared by	Issue Authorised by
φ 1	18.3.98 27.3.98	Draft First Revision	MWC MWC  27.3.98	PAS PAS  27/3/98

This report takes into account the particular instructions and requirements of our Client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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INTRODUCTION

This report is a limited evaluation of the energy efficiency of the Lucas Heights Multi-purpose Sports Club. The building design is reviewed in relation to energy consumption and methods of energy conservation in order to assist the project architects and engineers in the design and selection of the most energy efficient and cost-effective building.

PROJECT DESCRIPTION

The proposed Development comprises the following major components:

- Function areas
- Dining room
- Lounge
- Gaming area
- Café/kiosk
- Pro-shop
- Offices

LOCATION

The proposed development is located in Lucas Heights. This area is characterised as a mild temperate climate with an average diurnal range of 8°C. Heating for comfort is required in the winter months and cooling is required in the warm, humid summers. A brief overview of the local climate is given in the following table:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3pm Mean temperature (°C)	24.1	24.3	23.1	20.9	17.8	15.2	14.8	16.0	18.0	19.6	21.4	23.6
Relative humidity at 3pm (%)	59	61	60	57	56	59	51	48	49	54	54	55
Daily max. temperature (°C) 86 Percentile	30.7	30.0	28.5	25.7	22.0	18.3	18.0	20.2	23.7	26.7	29.0	31.7
Daily min. temperature (°C) 14 Percentile	14.9	15.2	13.8	10.3	7.3	5.6	4.3	5.0	6.4	8.9	10.5	13.1
Av. Daily solar irradiation (kWh/m ²)	6.5	5.8	5.1	4.1	3.1	2.4	2.9	3.6	4.4	5.3	6.4	6.9

Source : Climatic Averages of Australia, Bureau of Meteorology
Lat. 34° 3' S, Long. 150° 59' E
Elevation 140m

4. PASSIVE DESIGN ELEMENTS

4.1 Orientation

The building generally faces north/south with limited glazing in the west facing facade. The absence of any significant west facade glazing will reduce the cooling energy load arising from low angle sun coincident with high outside air temperatures.

4.2 Thermal Mass

Due to the proposed use of exposed earth bricks and reinforced concrete slabs, the building can be classed as being of high thermal mass. For this reason the construction will:

- Reduce the swings in temperature within the building by reducing and delaying the diurnal temperature change.
- Delay the solar heat gain to the building through the external facades.

These effects will reduce the cooling energy required by the building.

Further benefits can also be gained by night time cooling. Keeping the ventilation louvres open at night and using the lower external temperatures to purge the building of heat and cool the structure, the capacity for the building to moderate the daytime heat gains will be enhanced.

4.3 Thermal Insulation

The proposed heavy weight construction and a high standard of thermal insulation will reduce both winter heat loss and summer heat gain.

Additional careful architectural detailing to minimise unwanted infiltration will also have a significant effect on the energy efficiency of the building. For example, this includes providing good sealing for windows, doors and cladding elements.

4.4 External Shading

External shades are designed to cut out high angle summer sun whilst allowing low angle winter sun to penetrate into the building. Solar loads are absorbed and re-radiated outside of the building without becoming a load on the space.

External shades will therefore reduce summer heat gains whilst allowing the winter heat gain and day lighting.

The external shading currently proposed is in the form of either roof overhangs or shades made from a number of inclined blades.

4.5 Natural Ventilation

The building will be provided with natural ventilation openings with an aggregate opening or openable size not less than 5% of the floor area as defined in the BCA Section F4.6. During the mid-seasons this will provide comfortable internal conditions without the use of mechanical ventilation systems.

The performance of the natural ventilation will be further enhanced by the use of a central ventilation tunnel. Outside air will be drawn into the building via the thermally high mass tunnel due to buoyancy forces. The exhaust air will be through the north facing high level clerestory windows.

Occupant control of the openings will enhance comfort as a result of:

- having the ability to directly influence their environment;
- the facility to reduce air movement on cooler windy days;
- reducing noise levels due to external sources;
- close the building in extreme weather conditions to stabilize internal conditions.

Night cooling of the tunnel will also enhance the comfort of the building by cooling the incoming supply air. The tunnel will be of large cross-sectional area allowing for louvres and vermin control to avoid restricting the air flow. Air flow can be enhanced by arranging the inlets to benefit from wind assisted cross ventilation.

4.6 Daylighting

The room glazing will be supplemented by high level clestory windows at intervals across the roof. Being clear glazed, these will allow maximum penetration of daylight into the space during the winter months. To limit the solar gain during the summer months, the windows will be fully shaded though some benefit will be gained from light reflected off the external shading and roof sheeting.

5. MECHANICAL SERVICES

Due to the inclusion of the passive design measures the building will be able to operate with natural ventilation only during the mid-season months. No fan or chilled water pump power will be required during this period. This means that the cooling for peak summer days effectively becomes a 'peak lopping' system that is offsetting the peak gains only. Additionally, the capacity of the system can be reduced as the external gains will be lower.

During the winter season heating will be required. However, again due to the inherent building characteristics the heating system will be of a smaller capacity. Occupants will be able to open the high level vents a small amount to introduce fresh air without the need of a fan assisted system.

5.1 Air-conditioning Systems

The airconditioning system can vary from sophisticated ducted systems to single split reverse cycle units. The most suitable solution has yet to be explored.

5.2 Control System

Control systems can also vary from a direct digital control (DDC) system to control all mechanical services, to local controls for packaged plant. For local systems, switching will be provided in rooms to allow the system to be turned off when it is not occupied.

6. LIGHTING SYSTEM

When it is not possible to provide daylight, the following measures are proposed to reduce the energy consumption of the lighting system:

6.1 Time Clock and Photo Electric Cell Controls for Exterior Lighting

Time switch controls enable the lighting to be automatically turned on and off to suit the client's requirements. This method is more reliable than relying on staff to control the lights. This facility coupled with the photo-electric characteristic of ensuring the lights only run when daylighting levels fall below a pre-determined set point or during the night, results in a far more energy efficient lighting system.

6.2 High Efficiency Luminaires

High efficiency light fittings will be specified to achieve the required lighting level with minimum energy consumption.

6.3 Task Lighting

Where suitable a lower level of illuminance will be provided by general lighting and supplemented by task lighting of individual work stations. This is more economical in running costs than providing a high general lighting level to all areas.

6.4 Movement sensor

The use of movement sensors will be considered in the rooms which are not constantly used. However, these can be distracting in rooms where movement is low during occupied periods, as the lights switch off while the room is still occupied.

6.5 Switching

A simple but effective energy saving strategy is to provide adequate switching. The switching arrangement will also be designed to complement the use of daylight by allowing rows of luminaires parallel to the windows to be switched off individually.

7. HYDRAULICS SERVICES

The hydraulic services for the project will comprise:

- Waste water disposal
- Domestic cold water services
- Domestic hot water services
- Water storage of roof rain water

Domestic hot water services for the kitchen and the surrounding areas will be generated centrally via heat exchangers using solar water heating and high efficiency gas fired boilers when external solar gains are insufficient to meet the load.

Other means of reducing the energy demand and conserving water resource are as follows:

- flow management control systems to reduce water consumption at fixtures and fittings;
- the use of infrared sensors for urinal flushing and dual flush cisterns;
- the use of flow restrictors in taps.

8. ENERGY ANALYSIS

The energy analysis results must be considered as preliminary. No thermal modelling of the spaces, or computer simulation of the air conditioning plant, over a design year has been carried out. The results are based on typical cooling and heating loads and estimates of runs hours.

The results should be used for general comparison between a solely air-conditioned building and one with natural ventilation supplemented with air conditioning.

The following assumptions of plant operating regimes have been made:

Passive Design	> 26°C outside - cooling
	18°C to 26°C outside - natural ventilation
	< 18°C outside - heating

Conventional Design > 20°C outside - cooling
 < 18°C outside - heating

Occupancy 12 hours/day (4,380 hours per year)

Preliminary indications of the impact of the passive and energy efficient design measures proposed are given in the table below:-

	Conventional Design	Passive Design
Peak Cooling load	275 kW	175 kW
Peak Heating load	126 kW	126 kW
Cooling hours of use	1900 hrs/year	258 hrs/year
Heating hours of use	1779 hrs/year	1779 hrs/year
Annual plant energy costs	\$14,500	\$5,500
Annual lighting energy costs	\$3,200	\$2,400

9. SUMMARY

The summary above demonstrates that by including passive design measures, peak loads and annual energy costs can be reduced. Additional savings in the order of \$10,000 can also be made as a result of the reduced capacity of the cooling plant.

This report and its energy conservation measures should be reviewed and amended throughout the design process to ensure the project team selects systems and materials that meet and better the expected performance of buildings of this type.

APPENDICES

APPENDIX B

Recommended Plant Material - Lucas Heights 1

Recommended Plant Material for Lucas Heights N^o. 1 :-

OPEN FOREST/WOODLAND with Understorey Plants :

Native tree species to 15.0m with dense shrub understorey 2-4m

Botanic Name	Common Name	Hgt. (m)
NATIVE TREES		
* <i>Angophora costata</i>	Smooth-barked Apple	12.0m
* <i>Eucalyptus gummifera</i>	Bloodwood	12.0m
<i>Eucalyptus pilularis</i>	Blackbutt	15.0m
<i>Eucalyptus piperita</i>	Sydney Peppermint	15.0m
<i>Syncarpia glomulifera</i>	Turpentine	15.0m
SHRUBS/SMALL TREES		
<i>Acacia linifolia</i>	Flax Wattle	2.0m
<i>Acacia suaveolens</i>	Sweet-scented Wattle	2.5m
* <i>Acacia terminalis</i>	Sunshine Wattle	2.0m
<i>Allocasuarina distyla</i>	She-oak	4.0m
* <i>Banksia marginata</i>	Silver Banksia	4.0m
* <i>Bursaria spinosa</i>	Blackthorn	4.0m
<i>Callistemon citrinus</i>	Red Bottlebrush	4.0m
<i>Callistemon linearis</i>	Narrow-leaf Bottlebrush	3.0m
<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	4.0m
* <i>Hakea salicifolia</i>	Willow-leaf Hakea	4.0m
* <i>Jacksonia scoparia</i>	Dogwood	2.5m
<i>Leptospermum parvifolium</i>	Small-leaf Tea Tree	2.0m
<i>Leptospermum squarrosum</i>	Pink Tea Tree	2.5m
<i>Persoonia levis</i>	Broad-leaf Geebung	4.0m

OPEN FOREST/WOODLAND :

Native tree species 10.0-12.0m high with grassland understorey

Botanic Name	Common Name	Hgt. (m)
* <i>Acacia melanoxylon</i>	Blackwood	10.0m
<i>Allocasuarina littoralis</i>	Black She-oak	10.0m
<i>Allocasuarina torulosa</i>	Forest Oak	12.0m
* <i>Angophora costata</i>	Smooth-barked Apple	12.0m
* <i>Eucalyptus gummifera</i>	Bloodwood	12.0m
<i>Eucalyptus haemastoma</i>	Scribbly Gum	10.0m
<i>Eucalyptus racemosa</i>	Snappy Gum	10.0m

FEATURE/AVENUE PLANTING :

Native trees to 15.0m high (to clubhouse, car park & roadway)

	Botanic Name	Common Name	Hgt. (m)
*	<i>Acmena smithii</i>	Lilly Pilly	8.0m
	<i>Brachychiton acerifolium</i>	Illawarra Flame Tree	15.0m
	<i>Ceratopetalum apetalum</i>	Coachwood	12.0m
	<i>Eucalyptus citriodora</i>	Lemon Scented Gum	10.0m
	<i>Flindersia australis</i>	Crows Ash	15.0m
	<i>Grevillea robusta</i>	Silky Oak	15.0m
	<i>Lophostemon confertus</i>	Brush Box	12.0m
	<i>Melia azedarach</i>	White Cedar	15.0m
	<i>Pittosporum rhombifolium</i>	Pittosporum	10.0m

SWAMPLAND/RIPARIAN PLANTING :

Native riparian trees and shrubs (to watercourses/edges of dams)

	Botanic Name	Common Name	Hgt. (m)
NATIVE TREES			
	<i>Callicoma serratifolia</i>	Black Wattle	6.0m
*	<i>Casuarina cunninghamiana</i>	River Oak	12.0m
	<i>Casuarina glauca</i>	Swamp Oak	15.0m
	<i>Melaleuca linariifolia</i>	Snow-in-Summer	8.0m
	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	10.0m
	<i>Melaleuca styphelioides</i>	Prickly-leaf Paperbark	10.0m
*	<i>Pittosporum undulatum</i>	Sweet Pittosporum	6.0m
	<i>Tristaniopsis laurina</i>	Water Gum	6.0m
SHRUBS/SMALL TREES			
	<i>Acacia elongata</i>	Swamp Wattle	4.0m
	<i>Backhousia myrtifolia</i>	Scrub Myrtle	4.0m
	<i>Leptospermum flavescens</i>	Yellow Tea Tree	4.0m
	<i>Melaleuca ericifolia</i>	Swamp Paperbark	4.0m
LOW SHRUBS/GROUNDCOVERS			
	<i>Lomandra filiformis</i>	Wattle Mat-rush	
	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	
	<i>Lomandra multiflora</i>	Many-flowered Mat-rush	
*	<i>Myoporum acuminatum</i>	Boobialla	
	<i>Pennisetum alopecuroides</i>	Swamp Foxtail	

TALL SCREEN PLANTING :

Native shrubs to 4.0m high (along Transgrid easement)

Botanic Name	Common Name	Hgt. (m)
<i>Acacia longifolia</i>	Sydney Golden Wattle	4.0m
<i>Allocasuarina distyla</i>	She-oak	4.0m
* <i>Banksia marginata</i>	Silver Banksia	4.0m
* <i>Bursaria spinosa</i>	Blackthorn	4.0m
<i>Callistemon citrinus</i>	Red Bottlebrush	4.0m
<i>Callistemon linearis</i>	Narrow-leaf Bottlebrush	3.0m
<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	4.0m
* <i>Hakea salicifolia</i>	Willow-leaf Hakea	4.0m
<i>Persoonia levis</i>	Broad-leaf Geebung	4.0m

HEATH PLANTING :

Native heath shrubs & groundcovers (to selected areas)

Botanic Name	Common Name	Hgt. (m)
SHRUBS		
<i>Acacia suaveolens</i>	Sweet-scented Wattle	2.5m
* <i>Acacia terminalis</i>	Sunshine Wattle	2.0m
<i>Allocasuarina paludosa</i>	Scrub She-oak	2.5m
<i>Grevillea sericea</i>	Pink Spider Flower	2.0m
* <i>Jacksonia scoparia</i>	Dogwood	2.5m
<i>Kunzea ambigua</i>	White Kunzea	2.0m
<i>Leptospermum parvifolium</i>	Small-leaf Tea Tree	2.0m
<i>Leptospermum squarrosum</i>	Pink Tea Tree	2.5m
LOW SHRUBS/GROUNDCOVERS		
<i>Baeckea ramosissima</i>	Rosy Heath Myrtle	
<i>Dampiera stricta</i>	Blue Dampiera	
<i>Dillwynia retorta</i>	Eggs-and-Bacon Plant	
<i>Epacris longifolia</i>	Fuchsia Heath	
<i>Leucopogon lanceolatus</i>	Whitebeard	
* <i>Myoporum acuminatum</i>	Boobialla	
<i>Persoonia laurina</i>	Laurel Geebung	
<i>Prostanthera saxicola</i>	Slender Mint-bush	
<i>Pultenaea elliptica</i>	Wreath Bush-pea	
<i>Pultenaea villosa</i>	Bronze Bush-pea	

DISPLAY PLANTING :

Native shrubs & grasses (to roundabouts & feature/entry areas)

Botanic Name	Common Name	Hgt. (m)
SHRUBS		
<i>Callistemon linearis</i>	Narrow-leaf Bottlebrush	3.0m
<i>Crinum pedunculatum</i>	Swamp Lily	2.0m
<i>Doryanthes excelsa</i>	Gynea Lily	2.0m
<i>Grevillea 'Robyn Gordon'</i>	Grevillea	2.0m
<i>Lambertia formosa</i>	Mountain Devil	2.0m
<i>Xanthorrhoea australis</i>	Grass Tree	2.0m
GROUNDCOVERS/GRASSES		
<i>Danthonia spp.</i>	Wallaby Grass	
<i>Dianella spp.</i>	Flax Lily	
<i>Grevillea 'Royal Mantle'</i>	Prostate Grevillea	
<i>Helichrysum spp.</i>	Everlasting Daisy	
<i>Hibbertia scandens</i>	Guinea Flower	
<i>Lomandra filiformis</i>	Wattle Mat-rush	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	
<i>Poa labillardiera</i>	Common Tussock Grass	
<i>Pennisetum alopecuroides</i>	Swamp Foxtail	
<i>Stipa mollis</i>	Spear Grass	
<i>Stipa pubescens</i>	Tall Spear Grass	
<i>Themeda triandra</i>	Kangaroo Grass	

AQUATIC/WETLAND PLANTING :

Macrophytes & aquatic plants (to shallow water areas of dams)

Botanic Name	Common Name
<i>Gahnia erythrocarpa</i>	Saw Sedge
<i>Juncus planifolius</i>	Broad Rush
<i>Shoenus apogon</i>	Common Bog Rush
<i>Shoenus melanstachys</i>	Black Bog Rush
<i>Xyris gracilis</i>	Slender Yellow-eye

* denotes plant species of reduced fire risk as recommended by Sutherland Shire Council

APPENDICES

APPENDIX C

Playing Field Preparation and Layout

APPENDICES

Playing Field Preparation

Sutherland Council and Waste Service NSW require a high quality surface for playing fields at LH1. Designs for the fields are currently based on the following criteria:

- centrally crowned playing field and surface grading at 1:70 to east and west and 1:200 to north and south;
- minimum depth 300mm high quality sandy topsoil over prepared subgrade;
- subgrade falls to match surface falls as a minimum;
- subsurface agricultural drainage at 10m centres and perimeter drainage to all fields; and
- automatic pop-up sprinkler irrigation.

Layout

Current allowances for playing field platforms to accommodate various field layouts are as follows:

- Field 1 and 2: playing field platform of 155m x 155m to accommodate 2 fields;
- Fields 3 and 4: playing field platform of 155m x 135m, to accommodate 2 fields;
- Fields 5 and 6: playing field platform of 125m x 125m to accommodate 2 junior fields;
- Field 7 and 8: 2 playing field platforms of 125m x 90m each; and
- Field 9 and 10: playing field platform of 120m x 120m to accommodate 2 fields.

Fields 1 and 2 are currently under construction as temporary fields which will be available for public use by winter 1999. This work is being undertaken by Waste Service and includes provision of car parking for 100 cars. There is opportunity for future expansion of the carpark to accommodate a further 50 cars.

Temporary amenities, lighting and general servicing will also be provided.

Subsoil Drainage

100mm diameter lateral, slotted subsoil drains (with stocking) will be provided under all playing field surfaces at 10.0m centres (approximately). Trenches

APPENDICES

will be backfilled with 10mm aggregate. Surface drainage to the west of the playing field platform will be collected in concrete V drains and piped around playing fields eastwards to the proposed Dams 1,2 and 3A. In this way runoff from the playing fields surface is prevented from entering the adjacent bushland and draining into Bardens Creek.

Playing Surfaces

Playing field platforms are to be turfed with kikuyu turf.

Irrigation

Automatic pop-up sprinkler irrigation is proposed for all playing field platforms.

APPENDICES

APPENDIX D

Agreed Filling Types and Volumes: Lucas Heights 1

APPENDICES

Agreed Filling Types and Volumes at Lucas Heights 1

	Golf Course and Equestrian Area (over landfill)		Playing Fields (Borrow Area)		Total	
Material	Volume (m ³)	Tonnage (t)	Volume (m ³)	Tonnage (t)	Volume (m ³)	Tonnage (t)
Dry Waste	1,690,000	1,300,000	--	--	1,690,000	1,300,000
Cover Material (20% by volume)	incl.	608,400	--	--	incl.	608,400
VENM*	--	--	760,000	1,368,000	760,000	1,368,000
Clean Fill **	324,400	583,920	106,600	191,880	431,000	775,800
TOTAL	2,014,400	2,492,320	866,600	1,559,880	2,881,000	4,052,200

Agreed Conversion Rates:

Effective Landfill Consumption Rate

Dry Waste: 1.3m³/t

Cover Material: 1.8t/m³

VENM: 1.8t/m³

Clean Fill: 1.8t/m³

* VENM - Virgin Excavated Natural Material used for bulk filling under playing fields to achieve platforms.

** Clean Fill - clean, filling material to suit special site uses such as topsoils, subsoils, drainage materials, sand layers etc.

APPENDICES

APPENDIX E

Soil Specifications

APPENDICES

Soil Specifications

*prepared by Sydney Environmental & Soil Laboratory
and HASSELL*

GM1a Growing Medium 1a - Planted Areas

- to meet chemical & physical requirements of natural soil or soil blends from AS 4419 - Soils for Landscaping and Garden Use, with the exception of :-
 - permeability: 2-30cm/hr (reduced to enhance run-off rather than percolation)
 - organic matter should be 3-15% by weight (rather than 20% by volume as specified in the standard)

GM1b Growing Medium 1b - Playing Fields

- as per Sutherland Shire Council's specification

GM1c Growing Medium 1c - Golf Course Fairways and Tees

- to meet chemical & physical requirements of soil blends from AS 4419 - Soils for Landscaping and Garden Use, with the exception of :-
 - organic matter should be 3-15% by weight (rather than 20% by volume as specified in the standard)
- silt and clay combined: 12-15% *
- after compaction (as described in Canberra Landscape Guidelines 1991) soil should have a bulk density of <1.6 and saturated hydraulic conductivity of >3cm/hr (tested to AS 4419 requirements) *
- at pH >5%, soil should pass the Emerson Dispersion test *

* refer Bruce Sutton's specification for fairways

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GM1d Growing Medium 1d - Golf Course Putting Greens

- to meet standards of USGA Guidelines

GM2 Growing Medium 2 - Sub grade

- pH: 5.5-7.5
- EC: <1mS/cm (moderate salinity)
- permeability: 2-20cm/hr (based on AS 4419)
- exchangeable Sodium: <5% of CEC
- no rocks or clods >20mm diameter

GM3a Growing Medium 3a - Fill

- pH: 5.5-8.0
- EC: <1mS/cm (moderate salinity)
- permeability: 2-15cm/hr (based on AS4419)
- exchangeable Sodium: <5% of CEC
- no rocks or clods >50mm diameter

APPENDICES

APPENDIX F

Recommended Plant Material: Waste Management Centre

Recommended Plant Material for Lucas Heights WMC :-

OPEN FOREST/WOODLAND with Heath Understorey :

Native tree to 15.0m with dense shrub understorey 2-4m high

Botanic Name	Common Name	Hgt. (m)
NATIVE TREES		
* <i>Angophora costata</i>	Smooth-barked Apple	12.0m
* <i>Eucalyptus gummifera</i>	Bloodwood	12.0m
<i>Eucalyptus pilularis</i>	Blackbutt	15.0m
<i>Eucalyptus piperita</i>	Sydney Peppermint	15.0m
<i>Syncarpia glomulifera</i>	Turpentine	15.0m
SHRUBS/SMALL TREES		
<i>Acacia linifolia</i>	Flax Wattle	2.0m
<i>Acacia suaveolens</i>	Sweet-scented Wattle	2.5m
* <i>Acacia terminalis</i>	Sunshine Wattle	2.0m
<i>Allocasuarina distyla</i>	She-oak	4.0m
* <i>Banksia marginata</i>	Silver Banksia	4.0m
* <i>Bursaria spinosa</i>	Blackthorn	4.0m
<i>Callistemon citrinus</i>	Red Bottlebrush	4.0m
<i>Callistemon linearis</i>	Narrow-leaf Bottlebrush	3.0m
<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	4.0m
* <i>Hakea salicifolia</i>	Willow-leaf Hakea	4.0m
* <i>Jacksonia scoparia</i>	Dogwood	2.5m
<i>Leptospermum parvifolium</i>	Small-leaf Tea Tree	2.0m
<i>Leptospermum squarrosum</i>	Pink Tea Tree	2.5m
<i>Persoonia levis</i>	Broad-leaf Geebung	4.0m

OPEN FOREST/WOODLAND :

Native tree species 10.0-12.0m high with grassland understorey

Botanic Name	Common Name	Hgt. (m)
* <i>Acacia melanoxylon</i>	Blackwood	10.0m
<i>Allocasuarina littoralis</i>	Black She-oak	10.0m
<i>Allocasuarina torulosa</i>	Forest Oak	12.0m
* <i>Angophora costata</i>	Smooth-barked Apple	12.0m
* <i>Eucalyptus gummifera</i>	Bloodwood	12.0m
<i>Eucalyptus haemastoma</i>	Scribbly Gum	10.0m
<i>Eucalyptus racemosa</i>	Snappy Gum	10.0m

FEATURE TREE PLANTING :

Native feature trees to 15.0m high

Botanic Name	Common Name	Hgt. (m)
* <i>Acmena smithii</i>	Lilly Pilly	8.0m
<i>Brachychiton acerifolium</i>	Illawarra Flame Tree	15.0m
<i>Ceratopetalum apetalum</i>	Coachwood	12.0m
<i>Flindersia australis</i>	Crows Ash	15.0m
<i>Grevillea robusta</i>	Silky Oak	15.0m
<i>Lophostemon confertus</i>	Brush Box	12.0m
<i>Melia azedarach</i>	White Cedar	15.0m
<i>Pittosporum rhombifolium</i>	Pittosporum	10.0m

RIPARIAN PLANTING :

Native riparian trees and shrubs (to watercourses/edges of dams)

Botanic Name	Common Name	Hgt. (m)
NATIVE TREES		
<i>Callicoma serratifolia</i>	Black Wattle	6.0m
* <i>Casuarina cunninghamiana</i>	River Oak	12.0m
<i>Casuarina glauca</i>	Swamp Oak	15.0m
<i>Melaleuca linariifolia</i>	Snow-in-Summer	8.0m
<i>Melaleuca quinquenervia</i>	Broad-leaf Paperbark	10.0m
<i>Melaleuca styphelioides</i>	Prickly-leaf Paperbark	10.0m
* <i>Pittosporum undulatum</i>	Sweet Pittosporum	6.0m
<i>Tristaniopsis laurina</i>	Water Gum	6.0m
SHRUBS/GROUNDCOVERS		
<i>Acacia elongata</i>	Swamp Wattle	4.0m
<i>Backhousia myrtifolia</i>	Scrub Myrtle	4.0m
<i>Leptospermum flavescens</i>	Yellow Tea Tree	4.0m
<i>Melaleuca ericifolia</i>	Swamp Paperbark	4.0m
<i>Lomandra filiformis</i>	Wattle Mat-rush	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	

PARK SHADE TREE PLANTING :

Landmark feature trees (to selected areas)

Botanic Name	Common Name	Hgt. (m)
<i>Ficus 'Hillii'</i>	Hill's Weeping Fig	15.0m
<i>Ficus macrophylla</i>	Moreton Bay Fig	20.0m
<i>Ficus rubiginosa</i>	Port Jackson Fig	15.0m

SCREEN PLANTING :

Native heath shrubs & groundcovers (to selected areas)

Botanic Name	Common Name
<i>Baeckea ramosissima</i>	Rosy Heath Myrtle
<i>Dampiera stricta</i>	Blue Dampiera
<i>Dillwynia retorta</i>	Eggs-and-Bacon Plant
<i>Epacris longifolia</i>	Fuchsia Heath
<i>Grevillea sericea</i>	Pink Spider Flower
<i>Kunzea ambigua</i>	White Kunzea
<i>Lambertia formosa</i>	Mountain Devil
<i>Leucopogon lanceolatus</i>	Whitebeard
* <i>Myoporum acuminatum</i>	Boobialla
<i>Persoonia laurina</i>	Laurel Geebung
<i>Prostanthera saxicola</i>	Slender Mint-bush
<i>Pultenaea elliptica</i>	Wreath Bush-pea
<i>Pultenaea villosa</i>	Bronze Bush-pea

DISPLAY PLANTING :

Native shrubs and grasses (to feature/entry areas)

Botanic Name	Common Name	Hgt. (m)
SHRUBS		
<i>Callistemon linearis</i>	Narrow-leaf Bottlebrush	3.0m
<i>Crinum pedunculatum</i>	Swamp Lily	2.0m
<i>Doryanthes excelsa</i>	Gynea Lily	2.0m
<i>Grevillea 'Robyn Gordon'</i>	Grevillea	2.0m
<i>Lambertia formosa</i>	Mountain Devil	2.0m
<i>Xanthorrhoea australis</i>	Grass Tree	2.0m
GROUNDCOVERS/GRASSES		
<i>Danthonia spp.</i>	Wallaby Grass	
<i>Dianella spp.</i>	Flax Lily	
<i>Grevillea 'Royal Mantle'</i>	Prostate Grevillea	
<i>Helichrysum spp.</i>	Everlasting Daisy	
<i>Hibbertia scandens</i>	Guinea Flower	
<i>Lomandra filiformis</i>	Wattle Mat-rush	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	
<i>Poa labillardiera</i>	Common Tussock Grass	
<i>Pennisetum alopecuroides</i>	Swamp Foxtail	
<i>Stipa mollis</i>	Spear Grass	
<i>Stipa pubescens</i>	Tall Spear Grass	
<i>Themeda spp.</i>	Kangaroo Grass	

AQUATIC/WETLAND PLANTING :

Macrophytes & aquatic plants (to shallow water areas of dams)

Botanic Name	Common Name
<i>Gahnia erythrocarpa</i>	Saw Sedge
<i>Juncus planifolius</i>	Broad Rush
<i>Shoenus apogon</i>	Common Bog Rush
<i>Shoenus melanstachys</i>	Black Bog Rush
<i>Xyris gracilis</i>	Slender Yellow-eye

* denotes plant species of reduced fire risk as recommended by Sutherland Shire Council

APPENDICES

APPENDIX G

Agreed Filling Types and Volumes: Waste Management Centre

APPENDICES

Agreed Filling Types and Volumes at the Waste Management Centre

Material	Landfill Area		Non-Landfill Area		Total	
Material	Volume (m ³)	Tonnage (t)	Volume (m ³)	Tonnage (t)	Volume (m ³)	Tonnage (t)
Putrescible Waste	6,907,000	6,087,000	--	--	6,907,000	6,087,000
Cover Material (Putrescible waste x 0.9)	incl.	5,478,000	--	--	--	5,478,000
VENM*	--	--	20,000	36,000	20,000	36,000
Clean Fill **	493,000	887,000	31,000	56,000	524,000	943,000
TOTAL	7,400,000	12,452,000	51,000	92,000	7,451,000	12,544,000

Agreed Conversion Rates:

Effective Landfill Consumption Rate

Putrescible Waste: 1.14m³/t

Cover Material: 1.8t/m³

VENM: 1.8t/m³

Clean Fill: 1.8t/m³

* VENM - Virgin Excavated Natural Material used for bulk filling to form ponds etc. outside the landfill area.

** Clean Fill - clean, filling material to suit special site uses such as topsoils, subsoils, drainage materials, sand layers etc.