ENVIRONMENTAL ASSESSMENT (VOLUME 2)

Employment Lands (Huntingwood West)

for Landcom

LANDCOM
Creating Better Communities

November 2006

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29th November, 2006

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	Submission of Environmental Assessment (EA) Prepared under Part 3A of the *Environmental Planning and Assessment Act 1979*.
EA prepared by	
Name	Stephen Hills
Qualifications	BA (Hons.), Dip. TP, MRTPI, FPIA, CPP.
Address	The Planning Group (NSW) Pty Ltd PO Box 1612, North Sydney 2059.
Project to which Part 3A applies	
Proponent name	Landcom
Proponent address	Level 2, 330 Church Street, Parramatta, NSW
Land on which the development is to be carried out: address	Land Area subject of this application is described in **Figure 3, Volume 2** (Relevant Lots & DPs are included as an accompanying Table) • Land Area A (Huntingwood West – Government Land) • Land Area B (Huntingwood West – Private Land)
Proposed development	The land and proposed development known as Huntingwood West is the subject of this Concept Plan Application under Part 3A of the *EP&A Act 1979*. This land and proposed development is the subject of this EA. The application seeks consent for a proposed subdivision layout, types of employment uses, road intersections, essential infrastructure, and development design controls.
Environmental Assessment	An Environmental Assessment (EA) is attached.
Certificate	I certify that I have prepared the contents of this document and to the best of my knowledge: • It is in accordance with the requirements of Part 3A, • It contains all available information that is relevant to the environmental assessment of the development • It is true in all material particulars and does not, by its presentation or omission of information, materially mislead.
Signature / Name / Date	 Stephen Hills / 18 September 2006

1. INTRODUCTION

The land and proposed development known as Huntingwood West is the subject of this Concept Plan Application under Part 3A of the *Environmental Planning and Assessment Act 1979 (EP&A Act 1979).* This land and the proposed development is the subject of this Environmental Assessment (EA).

This document is **Volume 2,** of 3 volumes. **Volume 1** contains the Concept Plan application and **Volume 3** contains other reports prepared as part of the preparation and assessment of this application.

1.1 THE SITE

For ease of description in this document the areas within and adjoining the site of the concept plan application have been defined as Land Areas A, B and C[1]. These areas are defined in **Figure 2.**

The Huntingwood West land (Land Areas A and B) in the Blacktown Local Government Area (LGA) has an area of 61ha and is a strategically located area close to the intersection of the M7 and M4 Motorways. Approximately 46.13ha of the proposed subdivision is potentially developable area for employment uses.

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[1] ***Land Area A***

Land Area A describes the main land area that is the subject of this concept plan application. The land has an area of approximately 56.84ha and is owned by the Department of Planning. The land is earmarked for development as employment lands. It is bounded by Land Area C to the west, the Great Western Highway and Land Area B to the north, Brabham Drive to the east, and the M4 to the south. The land boundary is illustrated on **Figure 2.**

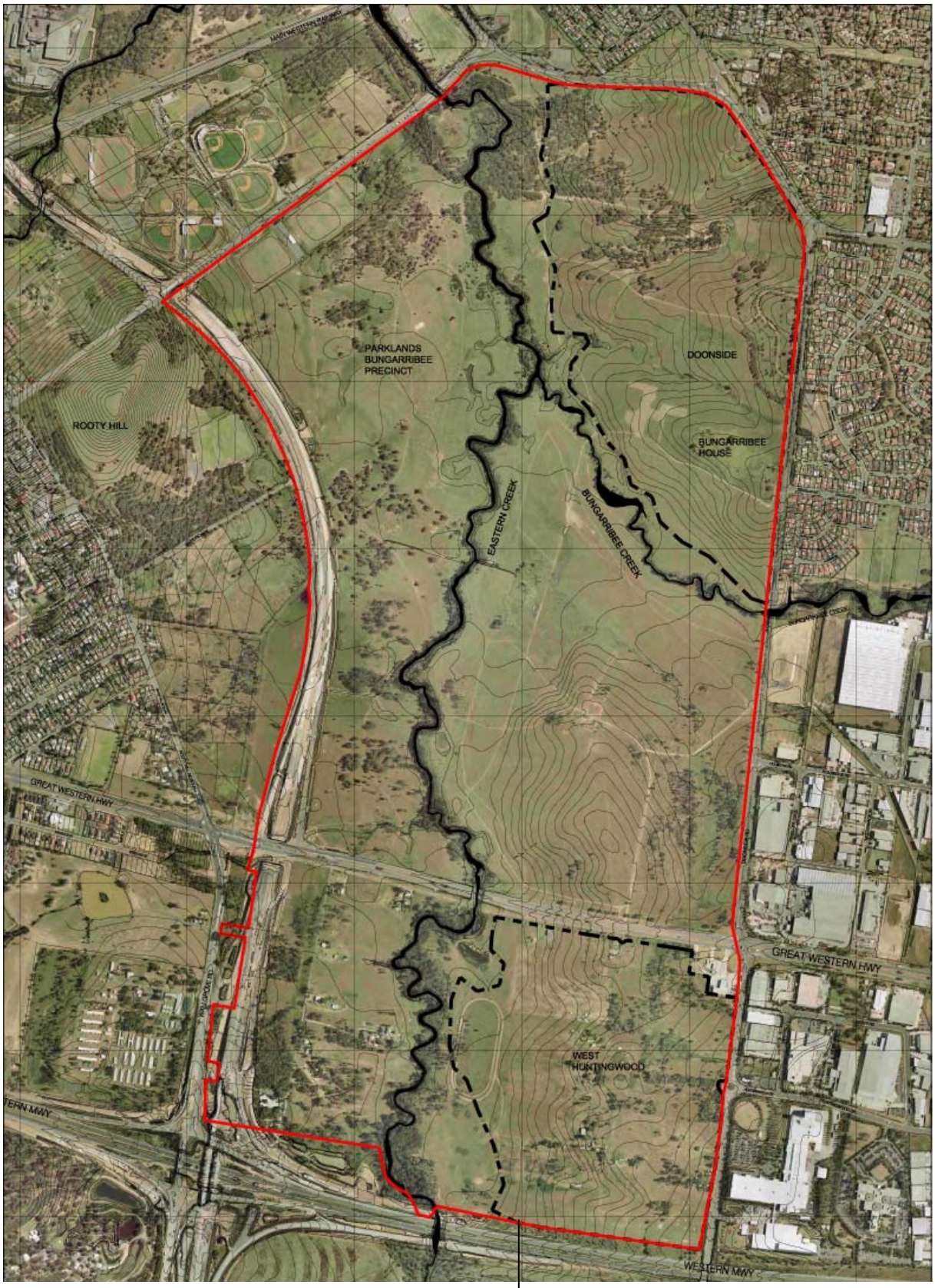
Land Area B

Land Area B describes the privately owned lots of land located at the intersection of Brabham Drive and the Great Western Highway in the north eastern corner of Huntingwood West. The land currently houses a petrol station and a Car Workshop. Whilst the land is not owned by the proponent, it is included in this concept plan application. The land has an area of 4.2ha and is illustrated on **Figure 2.**

Land Area C

Land Area C describes the Parkland adjoining and to the west of the subject site. This land is bounded by Eastern Creek on the west, The Great Western Highway to the north, land area A to the east and the M4 to the south. Whilst it is not subject of this concept plan, it will be included in a future concept plan application relating to Doonside and the Parklands.

Figure 1 Context plan



Bungarribee precinct shown within red line

Figure 2 Land Areas

Figure 3 Employment land precinct – subject of this submission

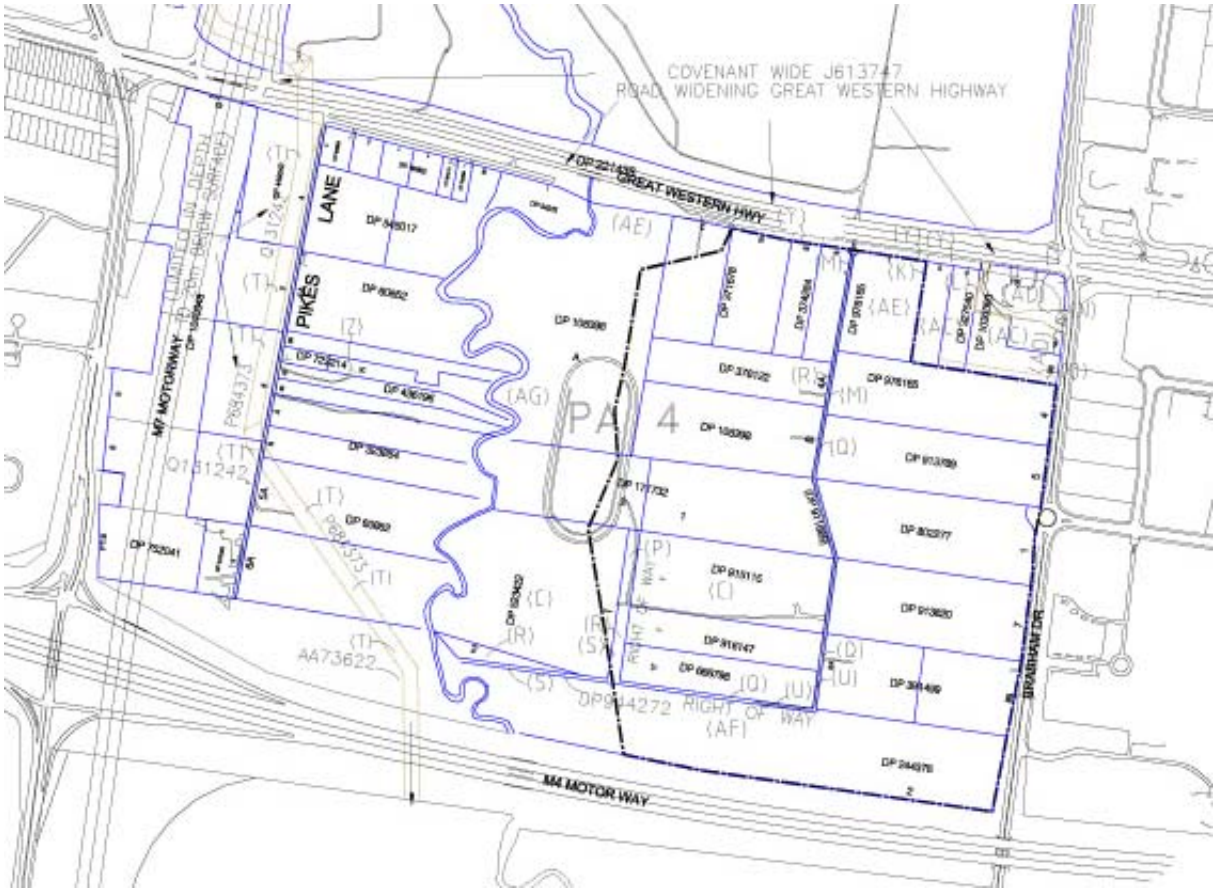


Figure 4 Photograph showing the Intersection of the M7 and M4 Motorways

Source: Sydney Morning Herald, July 2006

The Huntingwood West employment lands site is bounded by:

- The M4 to the south,
- Land Area C (Parklands) to the west,
- The Great Western Highway to the north, and
- Brabham Drive to the east.

The existing Huntingwood industrial estate lies to the east of the site, across Brabham Drive.

The land area subject of this application is described in **Figure 3.** Relevant Lots and existing Deposited Plan numbers (DPs) are included within the accompanying table to that figure. The total 61ha land area which forms part of this application is described as follows:

- Land Area A (Huntingwood West – Government Land – 56.8ha), and
- Land Area B (Huntingwood West – Private Land – 4.2ha)

The site slopes gently from Brabham Drive in the east down to Eastern Creek in the west. There is an overall fall of some 15m between Brabham Drive and the banks of Eastern Creek.

The site contains some areas of Cumberland Plain Woodland (Shale Plains Woodland) within its north-eastern corner. To the west of the site (within Land Area C), significant areas of riparian vegetation are located along Eastern Creek (Swamp Oak Floodplain).

Vegetation and habitat values of this woodland are high along Eastern Creek and moderate within the employment lands site.

Rudders Lane bisects the site within an easement in a north south direction (including a "dog leg" mid way along its length). Rudders Lane has local heritage significance, being part of the original subdivision of the land.

Major views to the site are available from the M4 and from the intersection of Great Western Highway and Doonside Road / Brabham Drive.

1.2 HISTORY AND CURRENT USE

1.2.1 History

A Heritage Impact Statement (HIS) has been prepared by Godden Mackay Logan (GML) for the Huntingwood West land (see **Appendix F**) and A Heritage Impact Statement (HIS) has been carried out by Jo McDonald Cultural Heritage Management Pty Ltd (see **Volume 3**).

While there is evidence of the original 1890's *"Rooty Hill District subdivision plan of Wallgrove Estate (Eastern Creek)"* within the current subdivision pattern, Richard Lamb and Associates, *'Visual and Landscape Assessment'* (see **Volume 3**) states that no significant landscape elements are identified at Huntingwood West and that there are *"no significant heritage items that would be potentially affected by appropriate development of these lands."* There are however elements in the landscape that have environmental and cultural heritage value.

A *'Management Vision and Concept Plan'* report was prepared by URS in March 2004, addressing the entire Western Sydney Parklands corridor. The report contains regional historical information about settlement of the area that includes Huntingwood West. The report states:

> *"The exploration of the Cumberland Plain was largely completed by 1813, at which time the Blue Mountains were crossed and the Plains were settled. The landscape character was defined by the Nepean River and Blue Mountains in the west, three northward draining creeks, a low hilly plain rising gradually to the south, and a fan of rugged sandstone hills striking out to the northwest and southwest from between Sydney and Parramatta. In effect, it was a large fertile bowl covered by open woodland, dissected by small creeks that were easily crossed.*
>
> *Post World War II saw a major expansion of population in the area boosted by migration mainly from Europe. Many settled in western Sydney, with market gardening being an economic mainstay. This migration wave is one of the dominant contributors to the visual landscape character of the Parklands corridor. Small holdings with a fibro-clad house and packing shed, associated glass houses and open farms are characteristic of western Sydney. This cultural landscape type is being rapidly replaced by urban development."*

Among the first settlers in the Eastern Creek area was William *'Lumpy'* Dean, a pardoned convict who arrived in Australia in 1788. In 1817 Dean received two grants of land from Governor Macquarie - one of 50 acres on the northern side of the Western Road bordered by the Eastern Creek to the east and (present day) Belmore Road to the west. The

second grant, of 100 acres, was located directly opposite on the southern side of the Western Road.

Further grants totalling 135 acres were made to Dean over the next ten years and by 1828 he owned 100 cattle and 8 horses. A variety of structures which resources have claimed association with Dean's grants include a school, post office, garrison, church, toll bar and dwellings. The first recorded building associated with William Dean was an inn, known as 'The Corporation Inn' (alternative name being *'The Bush Inn'*). This was located on the portion of land south of the Western Road close to the intersection of present day Wallgrove Road. For years Dean remained Eastern Creek's principal resident and it can be said that he was instrumental in the settlement and development of the village of Eastern Creek.

1.2.2 Current Landuse

Agriculture, particularly grazing, is the predominant land use throughout the Parklands, and has been at Huntingwood West. The Western Sydney Parklands incorporates a number of commercial recreation facilities including the Eastern Creek Motor Raceway immediately to the south of Huntingwood West, Sydney Dragway, Olympic Equestrian Centre and a Shooting Facility. Active sporting facilities are limited to the Olympic Softball facilities near Rooty Hill and associated playing fields. Passive recreation activities such as picnic facilities are generally limited to the Western Sydney Regional Park (Horsley Park), the eastern side of Prospect Reservoir and Nurrigingy Reserve.

Land Area A

Existing uses on the site are small rural lot holders with horse agistment. The existing lot pattern is rectilinear with the majority of lots having an average area of 2-3 ha. The western portion of this land is broken into smaller allotments containing residences, associated outbuildings, paddocks, remnant fence lines, market gardens and livestock.

Land Area B

This is the area of private land ownership within the north eastern corner of the site. This area includes the "Brenex land" and 2 other privately owned lots. Included within this land is the Shell Service Station and Beaurepairs outlet situated at the corner of Brabham Drive and the Great Western Highway.

2. DIRECTOR GENERALS REQUIREMENTS

This environmental assessment has been undertaken to respond to the general and specific requirements of the Director General (DG) of the Department of Planning. Final Director General's Requirements have been provided (see **Appendix A**). A summary of the general and key assessment requirements which have been considered in response to the DG's requirements are summarised in **Appendix A**.

The *"key assessment requirements"* of the DG have been assessed in this EA document as follows:

- Part A: Heads of Consideration (**Section 2.1**),
- Part B: Relevant Environmental Planning Instruments and Guidelines (**Section 3**),
- Part C: Key Issues (**Section 4**),
- Part D: Commitments (see **Volume 1**),
- General Environmental Risk Analysis (**Section 5**).

2.1 HEADS OF CONSIDERATION

The "Heads of Consideration" identified as Part A of the DG's Requirements relate to:

- Suitability of the site,
- Likely environmental, social and economic impacts,
- Justification for undertaking the project, and
- The public interest

These items are assessed below.

2.1.1 Suitability of the site

Location

The site is ideally located for the proposed land use and subdivision. The M4 and Great Western Highway are major roads which border the site and the M7 is in close proximity. Its location and good connections makes the site a strategic one for a number of employment sectors.

Physical conditions

The existing physical conditions of the site are also appropriate for its proposed employment use.

The site is relatively flat. Slope within and near the site is low, between 0 and 5 degrees and the topography and vegetation does not contribute greatly to bush fire hazard.

Development of the land would require very little earthwork or remodelling and existing water table levels and stormwater flows are retained and incorporated into the subdivision layout options proposed.

The majority of the site has been previously cleared of vegetation. There is approximately 5.6ha of existing Cumberland Plain Woodland vegetation. Most of this will be removed. A small amount will be conserved within the eco-median. The developer of the site will be required to pay a contribution to the Western Sydney Parklands Trust to facilitate revegetation of the Eastern Creek riparian corridor, as an offset for removing this vegetation. This requirement will be enforced through the sale contract.

Tenure and Zoning

The site is large and of a regular shape. The majority of the site is in a single ownership – ie, the Department of Planning. The small amount of privately owned land is consolidated at one corner and the Concept Plan designs allow for it to be integrated into the overall development if required. The fact that the entire site adjoins the established Huntingwood Industrial Estate and has high visibility from and connections to major roads also lends it well to general industrial and employment uses.

In December 2005, the NSW Government announced the creation of a new major employment hub near the intersection of the M4 and M7 motorways, where up to 36,000 jobs could be created. The NSW Government plans to make the entire Western Sydney Employment Hub area a ***State significant site in the Major Projects SEPP.*** The subject site has been designated within this employment hub, (see **Figure 5**).

Sydney Metropolitan Strategy

The proposed development of Huntingwood West as an employment area is in full compliance with the employment strategies of the Sydney Metropolitan Strategy. The following metropolitan strategies are of particular relevance:

A1 PROVIDE SUITABLE COMMERCIAL SITES AND EMPLOYMENT LANDS IN STRATEGIC AREAS

A1.5 Protect and Enhance employment lands of State Significance
A1.5.2 Protect and enhance employment lands in the M7 Motorway Corridor.
A1.6 Improve Planning and Delivery of employment Lands
A1.6.1 Government to develop integrated plans for employment lands and infrastructure.
A1.6.2 Government to establish mechanisms to ensure the timely delivery of infrastructure and services to employment lands.
A1.6.3 Streamline development control frameworks and development assessment processes.

Employment benefits

The development of the Huntingwood West employment area will assist in providing an appropriate mix of employment uses to encourage a diversity of job opportunities and support existing and new economic clusters within Western Sydney. The new estate is estimated to provide up to 800 jobs.

Revenue from the sale of the Department of Planning's land will assist in facilitating the development of the Western Sydney Parklands – the major recreational area for the residents of Western Sydney.

2.1.2 Likely environmental, social and economic impacts

Surrounding land uses and site linkages

Existing road corridors and other land uses which surround the Huntingwood West site include the following:

- Great Western Highway to the north.
- Huntingwood Industrial Estate to the east.
- M4 Western Motorway to the south.
- Eastern Creek and an area of the Western Sydney Parklands (Land Area C) to the west.

Proposed road corridors and other land uses which surround the Huntingwood West site include the following:

- Proposed intersection on the Great Western Highway to the north will provide improved access to the Western Sydney Parklands;
- Proposed Western Sydney Parklands to the north and west,
- Proposed link to existing Brabham Drive/Huntingwood Drive intersection to the east, and
- Pedestrian and cycle links and public transport connections.

Access and linkages

Two access points for the Huntingwood West site are proposed with this proposed subdivision, a four way intersection from the Great Western Highway and another on Brabham Drive aligning with Huntingwood Drive to the east.

Traffic modelling of the proposed concept shows it will not adversely impact on existing road networks and that new intersections will actually reduce delays for traffic using the existing Doonside Road/ Great Western Highway intersection.

Interface with Parklands

A Development Design Code (DDC) has been prepared for the concept plan and is provided in **Volume 1**. The document provides guidelines to *"ensure a positive visual and environmental relationship with the Western Sydney Parklands"*

Section 3.1 of the DDC describes how the interface will be realised with *"the establishment of a park edge road (limited to cars)"* and *"appropriate frontage uses/built form and location of open space"* in the employment area.

Design controls promoting these objectives include:

- Large lots fronting the Parkland;
- Where lots have a dual frontage (including a Parklands frontage), passenger vehicle and small vans only may access these lots from the park edge road and trucks must access from within the estate;
- A park edge road with narrow carriageways (suited to cars and small vans only) and a paved cross over entry treatment to encourage lower traffic speeds, and
- Provision of a parking lane on the built edge side of the park edge road only which incorporates street trees at periodic intervals to reinforce a seamless transition into the Parklands.

EDAW have prepared a landscape framework and landscape plans included within **Volume 1**. The proposed wetland zone provides a major transitional function between the employment lands and the Parklands. Pedestrian and recreational links are also provided from the employment lands to the Parklands to encourage use of the Parklands by future employees.

Interface with adjoining land

This proposal advocates the use of Huntingwood West site for general industrial use which is compatible with the existing Huntingwood Industrial Estate to the east. The Development Design Code ensures that built form will relate appropriately to the Huntingwood Estate and other adjoining land.

The Landscape and Visual Assessment report by RLA advised that the Huntingwood West site had few visual constraints and advised that *"maintaining some visual separation between the M7 and future development adjacent to Brabham Drive is important"*.

The proposed subdivision proposes street tree planting inside of the site boundaries with the Great Western Highway, Brabham Drive and the M4. The planting will afford visual and psychological separation of the employment lands from busy main roads. As the Industrial Park is self contained and may accommodate large bulky buildings, this screening seeks to reduce the impact of those buildings on views from surrounding roads.

Socio-economic impacts

The development of the Huntingwood West employment area will assist in providing an appropriate mix of employment uses. This mix will encourage a diversity of job opportunities and will support existing and new economic clusters within Western Sydney. Revenue from the sale of land owned by the Department of Planning will assist in facilitating the development of the Western Sydney Parklands as the major recreational area for the residents of Western Sydney.

2.1.3 Justification for undertaking the project

The subject site has previously been assessed to be "interface land" because it is land that adjoins the Western Sydney Parklands and is not required for Parkland purposes. The site has already been described as appropriate for employment use, being relatively flat and with few constraints to its development.

The subject site is designated within the Western Sydney Employment Hub area which the NSW Government plans to make as a State significant site in the Major Projects SEPP, (see **Figure 5**).

The Huntingwood West site has the potential to provide up to 800 long term jobs. The project is of State and regional significance as it will also contribute funds to the development of the Western Sydney Parklands, which are a major component of the Metropolitan Strategy. Funds will be returned to the future Parklands.

2.1.4 The public interest

The Concept Plan presents a well connected employment estate with the potential to provide up to 800 jobs. The estate has strong links to the existing road network and will provide an appropriate addition to it. The proposal protects and encourages public access to the adjacent Parklands and to regional links that will be realised with the creation of the entire Western Sydney Parklands corridor.

Development of extensive public resources such as the 5,500ha Western Sydney Parkland corridor cannot be achieved without the revenue generated from the development. Revenue that is not directed to the Parklands Trust will be returned to the Sydney Region Development Fund, which is administered and used by the Department of Planning to purchase strategic areas of open space.

Furthermore, the careful consideration given to the design and character of Huntingwood West employment area has been guided by best practice principles. Extensive consultation with government agencies, the local community and stakeholders has been undertaken as detailed in **Section 4.7**.

Landcom's focus on adding value to strategic projects, delivering quality urban developments and demonstrating best practice in social, environmental and economic sustainability are drivers which underpin this proposal.

3. RELEVANT ENVIRONMENTAL PLANNING INSTRUMENTS AND GUIDELINES

3.1 INTRODUCTION

As required by Part B of the DG's requirements, this section considers:

- Relevant EPIs and Guidelines,
- Relevant current EPIs applying to the site (including permissibility) and proposed planning provisions,
- Nature and extent of non-compliance with specified EPIs, and
- Alternatives to the proposal.

A summary of relevant clauses from EPIs and controls and a table outlining the Concept Plan's compliance with these is included in **Appendix B**.

The proposed "employment" use of the Huntingwood West site will be established when the NSW Government makes the entire Western Sydney Employment Hub area a State significant site in the Major Projects *SEPP* (see **Section 3.2.2).**

The Huntingwood West site is currently zoned 5a Special Uses – Corridor under the *Blacktown LEP 1988.* Because of the site's imminent rezoning, it was considered appropriate to consider the equivalent "industrial area provisions" within the *Blacktown LEP 1988* and *DCPs 1992 and 2006.*

The Huntingwood industrial area, adjoining to the east of the Huntingwood West site is zoned 4(d) within the *Blacktown LEP 1988.* This zone is considered similar to the proposed employment area of Huntingwood West, in terms of the standard of design, function and land usage proposed.

A small "edge area" of the proposed employment area traverses the boundary of that land to the west which is covered by the provisions of *Sydney Regional Environmental Plan No 31 (SREP 31).* The SREP 31 boundary is illustrated in **Figure 2,** with the suggested adjustment to the SREP 31 boundary illustrated in **Figure 7**. The suggested boundary adjustment will result in a similar area of land within the Parklands and create a more logical division between the parklands and the proposed employment land. The provisions of *SREP 31* are outlined in **Section 3.3.1**.

3.2 STATE PLANNING INSTRUMENTS

3.2.1 State Environmental Planning Policy (Major Projects) 2005

Formerly known as State Environmental Planning Policy (State Significant Development) 2005, *SEPP (Major Projects)* was gazetted on 1st August 2005. *SEPP (Major Projects)* defines certain developments that are major projects under *Part 3A of the Environmental*

Planning and Assessment Act 1979 and which are determined by the Minister for Planning. The SEPP also lists State Significant Sites. The policy repeals SEPP 34 and 38, as well as provisions in numerous other planning instruments, declarations and directions.

Clause 6 of the SEPP relates to the identification of Part 3A projects. Development that, "*in the opinion of the Minister"*, is development of a kind described in Schedule 1, 2, or 3. DoP advises that the entire Western Sydney Employment Hub area will be identified as a State significant site in Schedule 2 or 3 of the Major Projects SEPP. Huntingwood West is a nominated site within this employment hub.

The precinct is estimated to have the potential to provide 800 long term jobs. The project is of State and regional significance as it will contribute funds to the development of the Western Sydney Parklands, which are a major component of the Metropolitan Strategy.

As described below however, Huntingwood West is to be included as a state significant site within the proposed Western Sydney Employment Hub.

3.2.2 State Significant Site listing - Western Sydney Employment Hub

In December 2005, the NSW Government announced the creation of a new major employment hub near the intersection of the M4 and M7 motorways, where up to 36,000 jobs could be created. The NSW Government plans to make the entire Western Sydney Employment Hub area a ***State significant site in the Major Projects SEPP*** (see **Figure 5**).

The employment hub will incorporate the *State Environmental Planning Policy 59 (SEPP 59)* employment lands, including Eastern Creek, Huntingwood, the Raceway and Greystanes precincts. *SEPP 59* is a long-standing planning policy which promotes employment-generating activities.

This 2,450 hectare area is well positioned to become a major new job generating precinct, because of its strategic location near the M4 and M7. Employers will be able to have direct access to major facilities such as Kingsford-Smith Airport and Port Botany, along with the national highway network.

Sydney Metropolitan Plan

The State Government's long-term planning blueprint for the Sydney metropolitan area has been released. It caters for the creation of 500,000 extra jobs over the next 25 years, with nearly half of these in Western Sydney. The Western Sydney Employment Hub will help fulfil the vision of creating more jobs closer to the city's geographic heart. It will also help maintain Sydney's position as an economic powerhouse and a preferred location for Asian-Pacific regional headquarters.

The plan forecasts that up to 7,500 hectares more employment land would be required in Sydney to accommodate future demand. The Western Sydney Employment Hub will help provide some of this needed land supply. This area is already evolving as a key location for industrial and related development. It currently contains over 1,500 hectares of zoned employment lands.

Figure 5 Western Sydney Employment Hub

**source: NSW Department of Planning 2005, (Huntingwood West located within red circle).*

3.2.3 SEPP 11 – Traffic Generating Development

State Environmental Planning Policy No. 11 – Traffic Generating Development (SEPP 11) requires that certain types of development be referred to the Roads and Traffic Authority (RTA) for comment. Clause 7 of SEPP 11 refers to applications for development consent to carry out development specified in Schedule 1 or 2. Relevant extracts from Clause 7 and these schedules are included below.

***Clause 7*: Development applications to be referred to the Traffic Authority**
(4) Where a consent authority receives a development application (other than a development application to which subclause (3) relates) to carry out development specified in Schedule 2, being development on or of land that has direct vehicular or pedestrian access to:
(a) an arterial road, or
(b) a road connecting with an arterial road, if the access is within 90 metres (measured along the road alignment of the connecting road) of the alignment of the arterial road,

the consent authority shall, within 7 days of its receipt of the application, forward a copy of the application to the Traffic Authority.

Schedule 2
(f) the erection of a building for the purposes of industry where the gross floor area of the building is or exceeds 5,000 square metres, or the enlargement or extension of a building used for the purposes of industry where the gross floor area of that enlargement or extension is or exceeds 5,000 square metres,
(g) subdivision of land into 50 or more allotments,

The concept plan application relates to subdivision and will involve a new intersection with an arterial road (Great Western Highway). However Clause 7(4)(a) of SEPP 11 will not be triggered as the proposed subdivision includes 47 lots (less than 50 allotments) - (Schedule 2 (g). Notwithstanding, the RTA has been consulted as part of the consultation process undertaken (see **Appendix C**: Maunsell: *Transport and Accessibility Assessment*).

3.3 REGIONAL PLANNING INSTRUMENTS

3.3.1 Sydney Regional Environmental Plan No 31 – Regional Parklands

The development of the Western Sydney Parklands will be partly funded from development of nearby land, previously identified as Doonside (residential) and Huntingwood West (employment).

The Huntingwood West site is to the east and adjoining the Parklands. Whilst its development as "employment lands" will help to finance development of the Western Sydney Parklands, the site is not within the area covered by SREP 31, or subject to its provisions.

The current boundary of the SREP 31 land is illustrated in **Figure 7**. A proposed adjustment to the current common boundary between the SREP 31 land and the Huntingwood West land is also included within that drawing. The slight adjustment to this boundary will better accord with the proposed development of the employment land whilst complying with the aims of SREP 31.

The proposed wetland within the parkland has been designed to accord with the aims of SREP 31 especially in the maintenance and enhancement of natural systems and the care and management of cultural assets.

3.4 BLACKTOWN LOCAL ENVIRONMENTAL PLAN 1988

3.4.1 Introduction

The relevant local environmental planning instrument relating to the site and its local area is the *Blacktown LEP 1988.* The Huntingwood West site is currently zoned 5a Special Uses – Corridor under the *Blacktown LEP 1988* (see **Figure 6**). Planning control over the

Parklands however is currently exercised through *Sydney Regional Environmental Plan (SREP) 31* and its accompanying Development Control Plan No. 1, which was gazetted in 2001. The extent of the SREP 31 land in relation to the subject site is illustrated in **Figure 7**.

As the NSW Government plans to make the entire Western Sydney Employment Hub area a *State significant site in the Major Projects SEPP* and the Huntingwood West site is nominated within this hub, it is considered appropriate to consider the equivalent "industrial area provisions" within the *Blacktown LEP 1988.* There are currently 4 industrial zones within Blacktown:

- *Zone No. 4(a) (General Industrial Zone*
- *Zone No. 4(b) (Light Industrial Zone*
- *Zone No. 4(c) (Special Industrial Zone*
- *Zone No. 4(d) (Huntingwood Industrial Zone*

The Huntingwood industrial area, adjoining to the east of the West Huntingwood site is zoned 4(d) within the *Blacktown LEP 1988.* This zone is considered similar to the proposed employment area of West Huntingwood, in terms of the standard of design, function and land usage.

Relevant clauses of the LEP have also been considered in the preparation of the concept proposal and the HW DDC.

Figure 6 BCC LEP 1988 Zoning plan

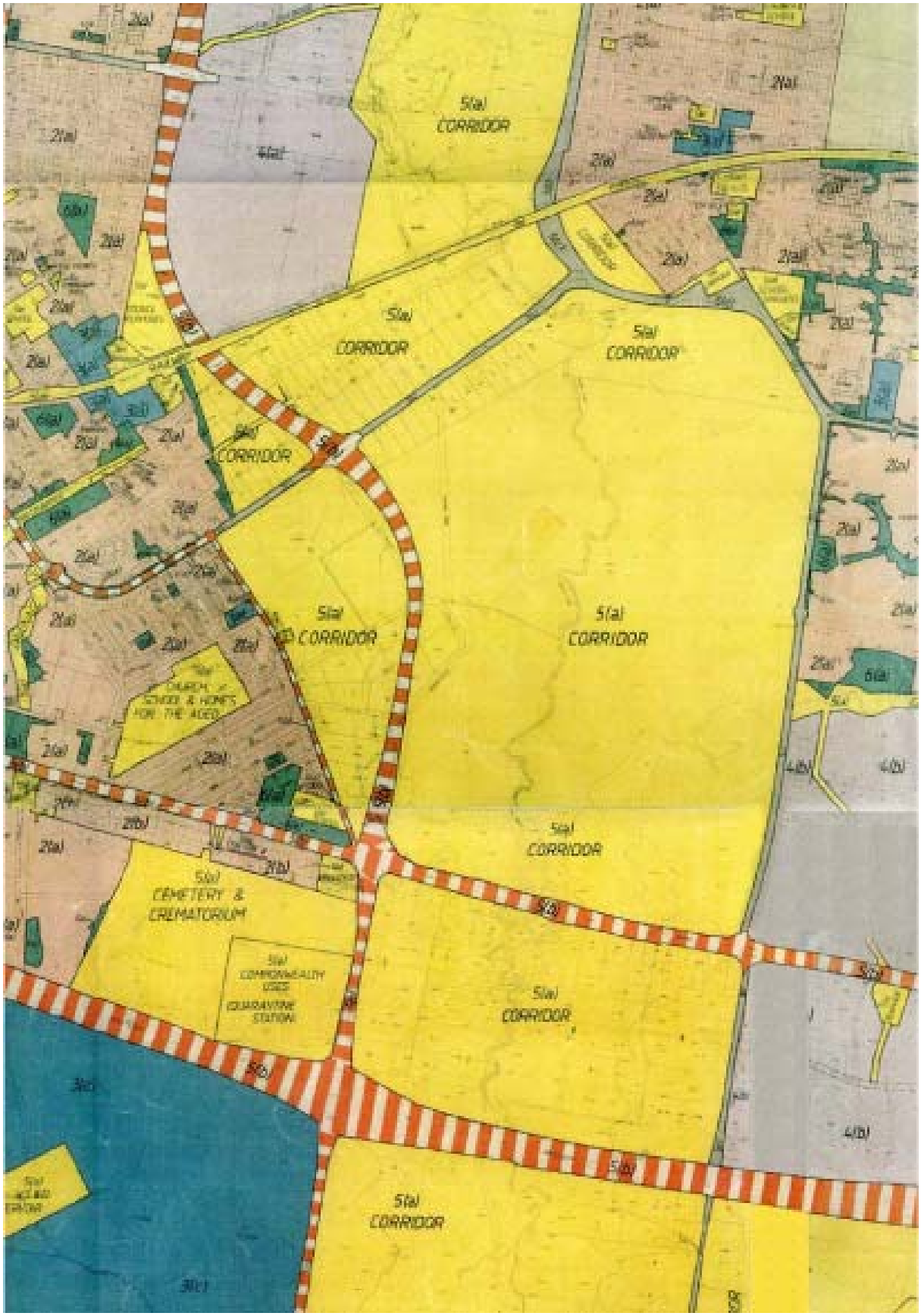
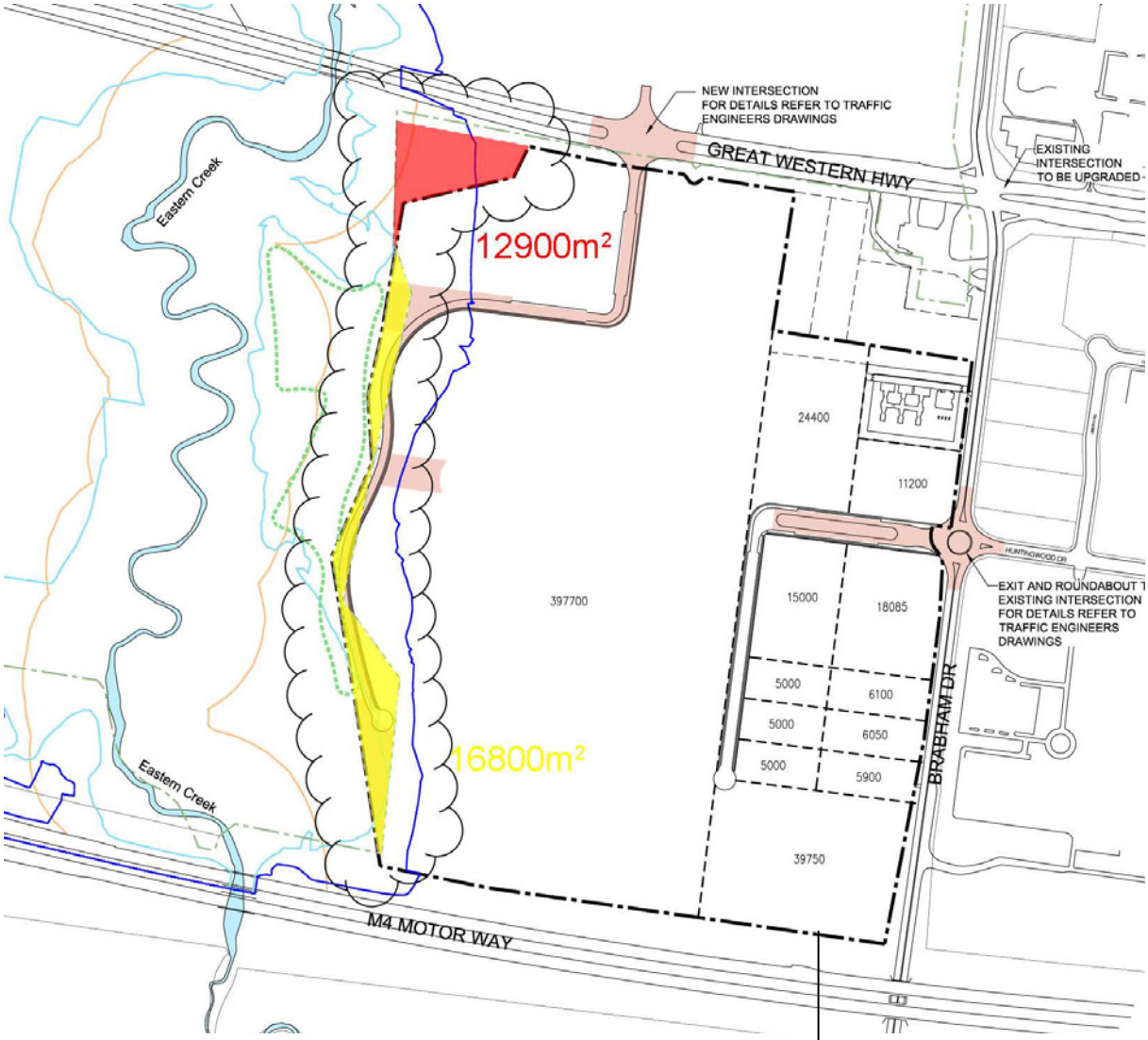


Figure 7 SREP Boundary



SREP boundary shown with dashed line

Clause 2: Objectives

The Clause 2 objectives of the Blacktown LEP 1988 state as follows (emphasis added):

> ***2 Aims, objectives etc***
> *(2) The objectives of this plan are:*
> *(a) to allow for a variety of rural based activities while maintaining the urban potential of relevant rural land,*
> *(b) to allow for a variety of residential lifestyles,*
> *(c) to allow for a variety of business uses while consolidating existing commercial centres,*
> ***(d) to enable a variety of uses in industrial areas while protecting the viability of existing retail centres,***
> ***(e) to prohibit offensive or hazardous industries,***
> *(f) to ensure space is provided for community services and facilities,*
> *(g) to ensure space is provided for recreational activities and facilities,*
> *(h) to ensure land is available to accommodate all required special land uses in the most effective manner, and*
> ***(i) to protect Blacktown's environmental heritage.***
>
> *(3) The strategy by which the aims referred to in subclause (1) and the objectives referred to in subclause (2) are to be achieved is the controlling of the development of land to which this plan applies by reference to land-use zones and the controlling of particular types of development in those zones by reference to controls specified as applying only to those types of development or to a development of a certain type being carried out in those zones.*

The proposed employment area within Huntingwood West has been designed to comply with the relevant objectives of the plan. The relevant BLEP objectives are:

- The overall aim to enable a variety of uses in industrial areas while protecting the viability of existing retail centres, (objective d),
- to prohibit offensive or hazardous industries (objective e) and
- the need to protect Blacktown's environmental heritage (objective i).

Relevant clauses of the LEP have also been considered in the preparation of the concept proposal. These clauses are discussed further in **Appendix B** and summarised in the Compliance Table which is included in that appendix.

The zoning provisions will ultimately end up in the Blacktown Comprehensive LEP which will be completed in the coming years. To ensure consistency with the LEP in the future, template zonings have been considered in relation to current permitted uses.

Because of the site's location adjoining the Eastern Creek motor racing precinct and in response to Blacktown Council's Vision for a Motor Related Employment Area, it is proposed that additional automobile-related uses (without repair style shops / panel beaters, spray painters and the like) will be specified and included as permissible uses within the site.

The three potential Industrial zoning references from the Draft LEP are:

1. Zone B7 Business Park

2. Zone IN1 General Industrial, and
3. Zone IN2 Light Industrial.

The other potential industrial Zone is the IN3 Heavy Industrial. This is not considered appropriate for the subject site as it relates to heavy, hazardous and offensive industry – none of which would be considered appropriate adjoining the Western Sydney Parklands.

To provide the greatest degree of flexibility in the provision of employment-generating uses, the IN1 General Industrial Use is proposed for the future zoning. The objectives and table of uses associated with the Zone IN1 General Industrial, state as follows:

(2) Zone IN1 General Industrial

Direction. The following must be included as either 'Permitted without consent' or 'Permitted with consent' for this zone:
Roads

1 Objectives of zone
• To provide a wide range of industrial and warehouse land uses.
• To encourage employment opportunities.
• To minimise any adverse effect of industry on other land uses.
2 Permitted without consent
3 Permitted with consent
Depots; Freight transport facilities; Light industries; Neighbourhood shops; Standard industries; Warehouse or distribution centres
4 Prohibited

The definitions of *"standard industry"* as well as *"light industry"* and *"warehouse or Distribution centres"* within the IN1 General Industrial Zone are included below.

standard industry *means an industry not being a heavy, light, offensive, hazardous or extractive industry or a mine.*

light industry *means an industry, not being a hazardous or offensive industry or involving use of a hazardous or offensive storage establishment, in which the processes carried on, the transportation involved or the machinery or materials used do not interfere with the amenity of the neighbourhood by reason of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil, or otherwise.*

warehouse or distribution centre *means a building or place used mainly or exclusively for storing or handling items (whether goods or materials) pending their sale, but from which no retail sales are made.*

Definitions from ***Standard Instrument (Local Environmental Plans) Order 2006***

Further details of the proposed development design controls for the development are provided within the HW DDC (see **Volume 1**).

3.5 BLACKTOWN DEVELOPMENT CONTROL PLANS 2006 AND 1992

Blacktown Development Control Plan 2006 (BDCP 2006) is the document which provides details of the various standards, policies and guidelines adopted by Council for

development in its Local Government Area. It also assists developers in designing proposed developments and preparing their applications to Council. BDCP 2006 supercedes the previous BDCP 1992.

The relevant sections within Parts A, E and H of BDCP 2006 relating to industrial development are outlined in **Appendix B.** Relevant clauses of the BDCP have been considered in the preparation of the concept proposal. These clauses are summarised in the Compliance Table which is included in that appendix.

Further details of the proposed development design controls for the development are provided within the draft WH DDC (see **Volume 1)**

3.6 CONSIDERATION OF ALTERNATIVES

As required in Part B of the DG's Requirements, an outline is provided below of the consideration of alternatives to the proposed subdivision.

The design development stage of this project provided an ideal opportunity for the transparent consideration of options and alternatives. Alternatives were however somewhat constrained by the limitation of access to the site. No vehicular access was considered possible from the M4 to the south and only limited access was considered possible from the west (Western Sydney Parklands). All short listed alternatives were based on vehicular access provided from the Great Western Highway (to the north) and from Brabham Drive (to the east).

The four main alternative designs considered are presented as diagrams below. A list of points explaining the key principles of each alternative is also provided. The four alternatives are described as follows:

- Alternative 1 – Cruciform road network
- Alternative 2 – Internal frontages
- Alternative 3 - Parklands incursion
- Alternative 4 - Park edge road

The preferred concept, which is the subject of this application, has developed from these alternatives. The proposed subdivision layout outlined in detail in **Volume 1** has been selected as the preferred option as it:

- Meets the location requirements of the RTA for the location of a new intersection on the Great Western Highway,
- Provides a flexible lot design,
- Incorporates the eco-median, and
- Provides the park edge road and pocket parks as an appropriate transition with the parklands.

Alternative 1

1. Retain Rudders Lane

2. Retain woodland within median and setbacks

3. Parklands terminate views

4. Special development fronting parklands

5. Vegetation buffers to major roads

6. Option to increase development footprint after earthworks and flood modelling

Alternative 1 *– Cruciform road network*

Alternative 2

1. Retain Rudders Lane

2. Pedestrianise part of Lane

3. Retain woodland within median and setbacks

4. Parklands terminate views

5. Special development fronting parklands

6. Vegetation buffers to major roads

7. Option to increase development footprint after earthworks and flood modelling

Alternative 2 *– Internal frontages*

Alternative 3

1. Ignore Rudders Lane

2. Retain woodland within public domain corridor and links to Parkland to north

3. Parklands terminate views

4. Special development fronting parklands

5. Vegetation buffers to M4

6. Most frontages to main roads

7. Option to increase development footprint after earthworks and flood modelling

Alternative 3 *- Parklands incursion*

Alternative 4

1. Retain Rudders Lane as public domain land

2. Retain woodland within public domain land

3. Parklands terminate views

4. Park Edge Road fronts parklands with new address

5. Vegetation buffers M4

6. Provide 3 large super lots and 3 smaller lots

Alternative 4 *- Park edge road*

4. KEY ISSUES

The key issues identified within Part C of the DG's requirements are as follows:

- Traffic
- Subdivision
- Natural Resources
- Heritage
- Contamination
- Drainage and Stormwater Management
- Utilities Infrastructure
- Community Consultation
- Planning Agreements and/or Developer Contributions

These issues are discussed below. The subdivision layout options considered during the development of the concept proposal are discussed within **Volume 1**.

4.1 TRAFFIC

A *'Transport Management and Accessibility Plan'* (TMAP) has been developed for the Huntingwood West site by Maunsell (see **Appendix C**). The TMAP considers the strategic and transport context of the site, estimates the traffic demand and assesses the impact of the demand on surrounding transport networks.

4.1.1 TMAP Objectives

There are no set performance measures that need to be achieved through the TMAP process. However, to date TMAPs have tended to include a mode shift target because, despite the limitations of this indicator, it is able to be monitored through the five yearly census data. In line with NSW Government policy, the objectives of the TMAP include:

- Providing an integrated transport network between modes and land uses;
- Providing a choice of travel mode by developing a comprehensively accessible transport network;
- Providing a safe and secure transport network;
- Providing a system that is efficient and equitable;
- Providing a system that is sustainable;
- Supporting the local economy; and
- Providing a healthy environment.

The TMAP objectives are compatible with Landcom's Sustainability Policy, which aims to:

- Deliver sustainable quality of life
- Conserve resources
- Protect biodiversity; and
- Minimise pollution.

The TMAP objectives are consistent with the wider planning context, for example, the Metropolitan Strategy, which does not set any travel targets but does support reduced car travel.

4.1.2 Impact Assessment

The impact assessment within the TMAP considered the future traffic and transport scenarios and the impact of the Huntingwood West development on the local network and assesses potential improvements that may ameliorate the impact, particularly in relation to local intersections.

The TMAP compared Base Scenarios and Design Scenarios (with development) to determine the particular impacts of the development on the surrounding traffic and transport networks. As the Western Sydney Employment Hub includes ten key employment sites which may create around 36,000 jobs these developments will have a significant impact on the road and public transport networks in the vicinity of the site. Developments in the vicinity of the Huntingwood West site have been included in the Base Scenario impact assessment.

4.1.3 Traffic volumes

Traffic generation for the site during the AM Peak has been estimated as 15 vehicle trips per developable hectare in line with RTA Guidelines. As a result, a demand of 840 vehicle trips is estimated for the site in the morning peak hour upon full development. 85% of trips are expected to be made to the site and 15% from the site. A target of a 10% reduction in these predicted employee car trips (as the driver) has been set for the site, which reduces the expected generated vehicle trips to 727 during the AM peak hour.

A two lane road (one lane in each direction) will be sufficient to accommodate the estimated traffic generation for industrial site uses in the peak hour. The internal road network will be constructed to accommodate turning movements.

4.1.4 Proposed intersection locations

The land subdivision plan has been guided by advice from the Department of Planning seeking two access points for the Huntingwood West site:

- a four way intersection with the Great Western Highway, and
- connection to the existing Brabham Drive roundabout.

Both intersections have been tested using aaSIDRA v2.1 modelling software and it is shown that they will operate at a Level of Service C or above - within capacity and without significant delay to drivers. (see **Appendix C).**

The proposed intersection on the Great Western Highway is located approximately 400 metres from the adjacent existing intersection at Doonside Road, and will not adversely affect the operation of that intersection.

The RTA has given in principle support, subject to detailed design and modelling.

4.1.5 Likely impact on surrounding road network

The main access to the site via the existing Brabham Drive/Huntingwood Drive roundabout provides direct connectivity to the existing Huntingwood industrial site. A secondary access via the Great Western Highway redistributes turning traffic from the Doonside Road/Great Western Highway intersection to the new intersection. This will benefit through traffic on the surrounding road network by reducing delay for traffic using the Doonside Road/ Great Western Highway intersection.

Overall the proposed intersection locations will link into the road network, providing integrated and efficient access through and around the site.

4.1.6 Pedestrians, cyclists and public transport

The site is relatively well served by both rail and buses. Rooty Hill and Doonside Stations are located to the north of the study area, providing access to the mainline rail system with fairly frequent services. The Blacktown to Arndell Park bus route serves the nearby industrial zone. This route runs adjacent to the site along Brabham Drive.

Huntingwood West is located close to the regional road network which will assist the freight task for any future industrial land uses. There is good access to the local and regional cycle network. New links have been identified close to the site connecting to local facilities, such as schools, retail, leisure and transport. Cycle lockers are provided at stations for cyclists transferring to rail. A cycle path is proposed by Blacktown CC to link the site with Doonside.

4.1.7 Summary

The Huntingwood West site provides challenges from the transport perspective since certain intersections are close to or at capacity. Against these challenges, the site is well located in terms of the strategic road network. A large population of car users provides a significant base of employees that can be worked with to promote alternatives to the car.

The recommendations of this study are reflected in the package of measures developed for the site together with the finding and implementation strategy. Implementation of these measures will go some way to achieving NSW Government sustainable planning guidance.

Key points of this package include:

- Workplace travel plans, to include measures such as car pools, marketing of public transport options, or discounts on cycle equipment.
- Infrastructure improvements to provide easy pedestrian and cyclist access to Doonside via a shared path and connections to existing shared paths such as the M7 cycleway.
- Public transport infrastructure with a minimum provision of a bus stop on Brabham Drive.
- Transport service improvements, including potential to divert a bus route past the site.
- Access to the site via an existing roundabout at Brabham Drive and a new intersection from the Great Western Highway.
- Intersection improvements at key locations.

As a comprehensive package of measures, this will meet the needs of employees and businesses at Huntingwood West, whilst encouraging a mode shift towards public transport.

Table 4.1: Summary of TMAP Package of Measures

Area	***Measure***	***Detail***
Travel Behaviour Change	Car pooling	• Establish car share/pooling scheme and encourage patronage with incentives for users.
	Increase walking	• Practical incentives to encourage walking. • Promote health benefits.
	Increase cycling levels	• Practical and financial incentives to encourage cycling. • Promote health benefits.
	Travel reduction	• Encourage video conferencing and travel planning to increase efficiencies • Provision of critical goods and services in close proximity to market/demand
Infrastructure	Travel Co-ordinator	• Appoint individual to role to champion 'green travel' and promote initiatives as a condition of development.
	Parking management	• Needs based parking permit system
	Marketing and promotion	• Web page • Increase awareness of benefits and incentives • Promotional events
Transport Services	Improved public transport services	• Improve frequency and hours of operation • Financial incentives such as season pass subsidies

Source: Maunsell 2006 table 8.2

4.2 NATURAL RESOURCES

A flora and fauna survey and assessment of the site has been undertaken by Eco Logical, Australia.

4.2.1 Flora and Fauna of the Site

No threatened flora or fauna species have been recorded in Huntingwood West.

Huntingwood West includes 5.6ha of Shale Plains Woodland which is classed as Moderate Ecological Constraint in the eastern part of the site. Shale Plains Woodland is part of the endangered ecological community Cumberland Plain Woodland listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). The remainder of the site is grassland (exotic dominated).

Vegetation on the site provides potential foraging habitat for mobile threatened fauna such as birds and microchiropteran bats but is not considered to play an important role in the long-term viability of threatened fauna that may utilise the site for foraging from time to time.

4.2.2 Evaluation of Impacts

The removal of existing vegetation on the site is required in order that the visions for the Huntingwood West Employment Lands, as described in Volume 1 of this submission, can be realised.

The proposed subdivision plan requires the removal of approximately 5.6ha of Shale Plains Woodland (Cumberland Plain Woodland), identified as a Moderate Ecological Constraint, from the eastern area of Huntingwood West. The woodland consists of four patches of woodland (between 0.2 and 0.5ha) on the east of the site and one larger patch (approximately 4ha).

The impacts ensuing from the removal of this woodland has been assessed by Ecological Australia Pty Ltd who have also prepared a comprehensive and rigorous vegetation Offset Strategy (detailed below) to ensure that best practice environmental management and ideologies are enshrined in the concept plan proposal.

4.2.3 Vegetation offset strategy for Huntingwood West

Most of the Huntingwood West site has been previously cleared of its original vegetation for grazing, rural and other farming uses that have occurred here since the 1890's. The site as it appears today, is heavily disturbed and possesses a predominantly rural character.

Nevertheless, the existing 5.6ha of Cumberland Plain Woodland vegetation which are proposed for removal provide habitat and character to the site. By preparing an Offset Strategy, the proponent has taken responsibility for the proposed removal of threatened Cumberland Plain Woodland and attempted to counterbalance it.

The *"Strategic Offset Directions"* document is included as part of this Concept Plan Application and is included in **Appendix D**. It proposes:

- A one to one vegetation offset ratio;

- Counterbalance (offset) the loss of 5.6ha of Shale Plains Woodland within the site by contributing to the ecological management and restoration of 5.6ha of Shale Plain Woodland 'in high Priority' areas within the Parklands in accordance with *the Western Sydney Regional Parklands Management Vision* (Department of Infrastructure, Planning and Natural Resources November 2004); and

- High priority areas mean those cleared or degraded areas between existing mapped patches of Shale Plains Woodland (as identified in the Parklands Concept Plan) that could be restored, in order to consolidate Shale Plains Woodland in the Parklands.

The objectives guiding the 'Strategic Offset Directions' strategy for vegetation offset for West Huntingwood link to and deliver the ecological objectives of *the Western Sydney Regional Parklands Management Vision Summary Report* (Department of Infrastructure, Planning and Natural Resources November 2004):

> "*The Western Sydney Regional Parklands form a unique component of the Sydney metropolitan open space system, linked to surrounding areas and providing a diverse range of recreation and cultural learning experiences integrated with the natural and cultural values of the land*."

4.3 HERITAGE

In accordance with the DG's Requirements and with the requirements of DEC and the NSW Heritage Office, a Heritage Impact Statement (HIS) was prepared by Godden Mackay Logan (GML) to address non-indigenous heritage, and an '*Aboriginal Archaeology Assessment'* has been carried out by Jo McDonald Cultural Heritage Management Pty Ltd to address Aboriginal heritage.

4.3.1 Non Indigenous Heritage Impact Assessment

The GML statement of August 2006 assesses the impacts of the proposed application on non-indigenous heritage (Rudders Lane and surrounds).

The HIS identifies the likely heritage impact of the proposed concept options and the Development Design Controls on the non-Aboriginal heritage resources of the Huntingwood West employment lands. The HIS was informed by the draft history and overview heritage and historical archaeological assessment on the site prepared by Conybeare Morrison (CM) in March 2006, as well as the RLA Report which was prepared to assess visual impacts in February 2006.

The Old Inn

The HIS found that the site may contain an archaeological site of significance known as 'The Old Inn'. The exact location of the Inn is unknown although it is understood to be sited next to the Great Western Highway adjacent to Eastern Creek. The HIS advised that more specific research is undertaken to closely locate the area and its likely remains.

It will be necessary for this specific research to be undertaken prior to any physical development taking place within the Employment Lands site.

Rudders Lane

Rudders Lane is an existing narrow carriageway running north south through the site and connecting to the Great Western Highway to the north.

The Godden Mackay Logan HIS and Conybeare Morrison Report advise that the lane has heritage significance as it was named after an early landowner in the area and its form relates to the original subdivision of the land from the 1890s. GML recommend that *"consideration be given to a road alignment that retains the Rudders Lane alignment for the purposes of interpreting this historic laneway".*

The submitted concept plan seeks to close the existing Rudders Lane and to create a new Rudders Lane located 80m to the west of its current alignment. The proponent acknowledges that the concept plan does not fully meet the recommendations of the HIS but provides the following justifications for the changes.

- Maintaining the Lane as an active circulation route is not viable if Huntingwood West is to operate as *"best practice designed"* employment lands, catering to industrial uses. The existing character and nature of the single carriage laneway with a kink in its alignment would not facilitate the efficient movement of vehicles through the site and significantly interferes with the desired subdivision pattern required for operation as industrial and employment uses.

- The laneway intersects with the Great Western Highway at a distance of only 350m west of the large and busy intersection of the Great Western Highway and Brabham Drive. The RTA has indicated they would not approve development of any intersection within 400m of such an important Highway intersection. They have indicated their preference for a fully designed intersection further to the west of the existing Rudders Lane junction. This RTA preferred intersection would provide access across the Highway, serving future parklands to the north and to the south. As such this concept proposal seeks to conform to this RTA advice.

- The proponent recognises the importance of heritage and local context as important factors in the creation of character and integrity of a site. Changing the alignment of Rudders Lane as proposed in this submission will bring operational and physical benefits and will greatly facilitate the development of the site for state significant Employment Lands. It is intended that a realigned Rudders Lane would contain interpretive features that would create a 'sense of place' and which would symbolically represent the site's rural and agricultural past.

- It is also considered that a realigned Rudder's Lane will continue to provide many of the same functions that the existing Lane provides.

  - The Lane would continue to provide physical access and circulation through the site as it has done since the 1890s. This concept proposal will maintain the function of the lane but appropriately design it to operate as a carriageway within an industrial area.

  - A realigned Rudder's Lane will continue to provide visual links through the centre of the site. As mentioned previously, interpretive treatment and detailed design will be used to reinforce the original scenic qualities of the original lane and the local area.

4.3.2 Non indigenous summary

The Huntingwood West site is not listed on the Blacktown LEP 1988 Schedule 2 as containing any significant heritage items, nor is it listed on the State Heritage Register. There are however elements in the landscape that have environmental and cultural heritage value. These values have been identified following consultation with the Department of Environment and Conservation (NSW), the Department of Planning and Blacktown City Council. These values have been responded to in the development of the concept plan, vegetation offset strategy and the landscape plan.

The *Visual and Landscape Assessment* by RLA prepared a number of guidelines specifically intended to inform the management of scenic resources at Huntingwood West. The following extract is taken from the RLA Assessment.

> *5.5 Scenic Resource Management Guidelines*
> *Huntingwood West has less visual and cultural constraints than Doonside but is more exposed to regional and local viewers.*
> *The following guidelines are provided to ensure appropriate development of this land parcel:*
> *a)Flood prone area to the immediate east of the creek corridor should be retained as a more rural character as it is at present. Existing creek line vegetation should be retained and augmented.*
> *……*
> *e) All vegetation remnants especially that within the eastern part of the Eastern Creek corridor are to be considered for retention and enhancement with enrichment planting and regeneration techniques*
> *f) Existing strands of vegetation should remain amongst future development areas. The vegetation should provide visual separation between buildings and structures as well as softening the appearance of larger industrial development*

These relevant suggested guidelines have been incorporated into the proposed concept plans. Existing creek line vegetation will be retained and augmented, all vegetation remnants especially those within the eastern part of the Eastern Creek corridor will be considered for retention and enhancement, and existing strands of vegetation wherever possible will be retained amongst future development areas (see Clause 3.3 of the DDC in **Volume 1**).

4.3.3 Indigenous heritage assessment

A Heritage Impact Statement (HIS) has been prepared by Jo McDonald Cultural Heritage Management Pty Ltd (JMCHM) to assess the impacts of the proposed development on Indigenous heritage.

Two surface archaeological sites (WSP/13 and WSP/15) and one area of Potential Archaeological Deposit (PAD WSP5) have been recorded within the Huntingwood West Parcel. The development as proposed in the Huntingwood West Concept Plan will directly impact on both of these sites and the identified PAD.

The concept plan being prepared for Precinct Two of the Western Sydney Parklands has identified areas which are to provide a conservation outcome for Indigenous heritage. These are not within the Huntingwood West Parcel.

The recommendations of JMCHM have been incorporated into the concept plan proposal. Using a 'whole of development' approach, sites and areas of PAD in the Parklands and the Doonside Parcel are considered to have more potential for containing intact archaeological deposit in higher value landscapes. Salvage excavation will be conducted in these areas to provide archaeological context for the Conservation Areas and mitigate against the destruction of land with archaeological potential in the Huntingwood West Parcel.

Further archaeological investigation is not required within the Huntingwood West Parcel.

It is proposed that the Bungarribee precinct of the Western Sydney Parklands will have an Indigenous heritage conservation strategy and outcome. This strategy, based on scientific and cultural values, will identify a conservation zone that encompasses a range of representative landscapes with the best conservation potential. It is anticipated that this conservation zone will be centred on the riparian zone of Eastern Creek north of the Great Western Highway. This represents the most meaningful management outcome and has the result that land which falls outside the conservation zone should be considered developable. The developable lands should be managed on the basis of the sensitivity mapping and the defined management principles. These principles are discussed further in Clause 2.4 of the DDC (see **Volume 1**).

4.4 CONTAMINATION

A *Report on Land Capability Assessment* was undertaken by Douglas Partners in January 2006. The report included an assessment of the West Huntingwood site. The objective of the study was to determine the suitability of the site for urban development, primarily with regard to site stability, soil erosion potential, soil salinity, soil contamination and minerals potential.

4.4.1 Existing Site

During recent site inspections the following potential contamination observations were recorded in relation to the Huntingwood West site:

- A number of soil stockpiles, building rubble and dumped material located at the south-eastern portion of the site,
- A service station located in the north-eastern portion of the site,
- Six (possibly asbestos) fibreboard structures across the site in various states of repair (some partially demolished),
- Farm machinery and several empty 1000 L plastic tanks were located on a concrete pavement in front of a farm shed,
- The whole area is used for horse grazing and training. A training track which may have used imported fill lies just beyond the site boundary, and
- Septic tanks were in use across the site.

4.4.2 Phase 1 Contamination Assessment

As part of the land capability assessment a *Phase 1 Contamination Assessment of the Huntingwood West Employment site* was undertaken in accordance with *SEPP 55* and various NSW DEC guidelines including the *Guidelines for the NSW Site Auditor Scheme*. This assessment included a detailed review of the site history and developed a list of potential contaminants of concern based on the site history. Individual lots were classified as either high medium or low risk sites.

4.4.3 Soil Contamination Potential - Huntingwood West

Soil contamination risk across the site was assessed to be generally low. However, a range of further investigations in Huntingwood West was recommended to assess the actual degree of contamination present on site.

It was not anticipated that soil contamination will present a constraint to development and any areas of contamination identified, once remediated, will be suitable for the proposed land use. The Phase 1 Assessment recommended that further works and sampling be undertaken during a second phase of assessment.

4.4.4 Phase 2 Assessment

An EPA accredited site auditor was appointed to review the Phase 1 Assessment and to provide a Site Audit Statement at the conclusion of Phase 2. The results of this showed that no Health Based Investigation levels were exceeded for any of the contaminants of concern, indicating that the site is suitable for the proposed reuse with respective organic and inorganic contaminants.

However, localised areas of asbestos contamination were identified during the assessment. These areas will require the formulation of a Remediation Action Plan (RAP) addressing the remediation methodology and requirements.

On the basis of the work undertaken during the Phase 1 and Phase 2 Assessments, it is considered possible to make the site suitable for the proposed industrial reuse following remediation and validation of the areas of asbestos contamination. In addition to the RAP for identified asbestos contamination, it was recommended that an asbestos management plan be created and incorporated into the future management of the site. These recommendations will be incorporated into the future site management to address the possibility of finding hidden or undetected asbestos during site earthworks. A Separate DA will be lodged to manage the demolition of structures on the site.

4.5 DRAINAGE AND STORMWATER MANAGEMENT

A wide range of studies have been undertaken in the assessment of the impacts of the proposed development on ground and surface water.

4.5.1 Hydrogeology

Douglas Partners has prepared a Land Capability Assessment for this project which included a detailed description of the hydrology of this site.

Saline Groundwater

The general hydrogeological framework relevant to Western Sydney, including the subject site, is the shale terrain which is known for saline groundwater and where the salt accumulates by evapo-transpiration. In areas of urban development, this can lead to

damage to building foundations, lower course brickwork, road surfaces and underground services, where these impact on the saline zone or where the salts are mobilised by changing groundwater levels.

Urban development needs to be carried out with a view to maintaining the natural water balance so that long term rises do not occur in the saline groundwater level.

The Department of Planning infers a *"high salinity potential"* in the lower slopes and drainage areas of Eastern Creek, on their map entitled *"Salinity Potential in Western Sydney 2002"*. These DoP inferences are based on soil types, surface levels and general groundwater considerations but are not in general ground-truthed, hence it is not generally known if actual soil salinities are consistent with the potential salinities of DoP.

Whilst a detailed groundwater study was not undertaken as part of the current scope, recent groundwater investigations undertaken by DoP in the Blacktown area and previous studies of areas underlain by the Wianamatta Group and Quaternary river alluvium provide good evidence of groundwater conditions.

Salinity Risk areas have been identified and illustrated within Figure 10 of the Draft Huntingwood West DDC (see **Volume 1**). Clause 4.5.4 of the DDC relates to Salinity and seeks to manage and mitigate the impact of, and on, salinity. Amongst other controls, each future development application is to be accompanied by a salinity report prepared by a suitably qualified consultant.

4.5.2 Potential Impacts on Water Quality

Ecological Engineering has detailed the potential sources of stormwater pollution for the industrial area as well as treatments and management to mitigate any potential impacts arising from development.

Pollution Sources

Stormwater pollution can result from industrial activity (e.g. chemical handling or a spill) or from processes/activities that occur as a result of typical high-density development. The pollutant pathways are varied and each has differing risk profiles that are related to work practices and the design of individual industrial allotment and building.

In industrial precincts with a high proportion of impervious surfaces, typical pollutants found in the stormwater runoff include litter, coarse, medium and fine sized suspended solids, nutrients, heavy metals, hydrocarbons, oil and grease. Industrial precincts also accommodate greater percentage of commercial traffic and an increased proportion of impervious areas.

Industrial activity is a common contributor to stormwater pollution. A wide range of activities occur within industrial precincts, dependent on the business nature. Industrial activities vary greatly and likewise so do the substances handled by industry. The industrial zoning for Huntingwood West would see land use which may include office

areas within a business park, a wide range of industry as well as warehouse or distribution centres.

Zoning for heavy industrial based activities is not proposed for this site. Activities associated with light industry however could include the delivery, handling, manufacturing, transport and storage of substances that have the potential to harm the aquatic ecosystem. For example chemical handling in manufacturing sites, oil and greases contamination from the automotive servicing sector.

Stormwater treatment elements, together with appropriate building design guidelines are included with this proposal to reduce the impact of these pollutants, with best practice stormwater management required for the site.

4.5.3 On Site Detention of Stormwater/Drainage to Wetlands

EDAW describes the wetland located in the Parklands west of the Huntingwood West development as the preferred stormwater storage method. The form and size of the wetland has been designed to provide recreational opportunities as well to ensure the facility operates as part of the site's stormwater system and also brings a natural aesthetic to the development.

As a larger element, the wetland is capable of supporting a range of vegetation types, mitigating between the Parkland and large scale buildings of the employment lands. This will greatly assist in establishing the concept and character of *'buildings in the park'.*

The Concept Plan application proposes the drainage of overland flow water into onsite detention basins and Parklands wetland. Ecological Engineering has investigated the requirements and design objectives of on-site detention storages. These have been determined to ensure that:

(i) The rapid conveyance of frequent storm events will not impact on the geomorphic form of the low flow channel of Eastern Creek, and

(ii) The peak flood level and extent corresponding to the 100 year ARI event at both upstream and downstream of the site have not been detrimentally affected.

4.5.4 Stormwater Management

The stormwater management strategy for the Huntingwood West Industrial Precinct is directed at achieving the following outcomes:

1. Treat stormwater emanating from the site and catchments upstream of the site to current best practice water quality objectives
2. Provide flood attenuation of storm events corresponding to the 1.5 year Average Recurrence Interval to pre-development levels to protect the geomorphic structure of Eastern Creek adjoining the site

3. Provide flood attenuation of flood events corresponding to the 100 year Average Recurrence Interval to pre-development levels

Stormwater management measures identified to provide the above engineering functions are also required to provide a suitable interface between the parklands and the industrial precinct. The desired landscape vision for the precinct includes a large wetland area with open water and wetland vegetation.

Bioretention Areas of 0.6ha

Stormwater quality treatment will be met through bio-retention systems on site at the streetscale and in the precinct parks. The required total bio-retention area would be approximately 0.6 ha. There is sufficient area within the industrial precinct for water quality treatment such that it is feasible to meet best practice objectives using bio-retention systems as:

- Eco-Median
- Parks (drainage reserves, two in total)
- Bio-swales, street trees and rain gardens (optional)

A stormwater treatment wetland of 2.5ha

A stormwater treatment wetland is also suitable for delivering the stated stormwater quality objective. The required total wetland area to meet best practice stormwater quality objectives is approximately 2.5ha and is located within Area C to the west of the WH employment area (see **Figure 8).**

Proposed Strategy

Based on site assessment of opportunities and constraints, particularly the opportunity presented by the landscape vision for the precinct, the proposed stormwater management strategy is to integrate stormwater treatment functions into the Parkland's wetland. Some elements of the stormwater quality treatment train such as the capture of gross pollutants and sediment have been incorporated into the parks (drainage reserves) adjoining the wetland. This strategy is supplemented by a bioretention swale system along the main entry road to treat stormwater from the external catchment east of the development site.

This strategy is proposed as it will:

(i) Overcome the higher risk of damage to on-site measures (such as streetscale bioretention systems) in an industrial precinct (compared with residential precincts);

(ii) Be the most cost effective way to meet flood detention storage requirements (see further discussion below).

(iii) Provide an adequate area to possibly treat stormwater from the additional up stream catchment that drains through the site.

(iv) Be better integrated to the overall landscape design

The strategy also includes street-tree bioretention cells within the streetscape which will further increase the capacity to achieve stretch targets for stormwater quality treatment.

Flood Detention

Blacktown City Council's stormwater policy specifically states:

> *"The frequency of bank-full flows should not increase as a result of development. Generally, no increase in the 2 year and 100 year ARI peak flows".*

This policy is generally consistent with Landcom's WSUD objectives which stipulate that peak flow corresponding to the 1.5 year ARI event should be reduced to the pre-development level to protect the existing geomorphic form (and thus habitats) of the receiving waterway.

Hydrologic computations have identified the total flood detention storage requirement for the site as approximately 54,000m³ of flood storage of which 34,000m³ are required to return the pre- development 1.5 year ARI peak stormwater discharge... This requirement includes provision for flood retardation of stormwater discharge from the external catchments to the east of the site.

The provision of the required flood storage is through a combination of parks (drainage reserves) and the constructed wetlands. Flood storage provided at the drainage reserves will be first engaged and it is anticipated that this storage would be sufficient to attenuate events up to the 2 year ARI event to pre-development levels.

For larger events, flood storage provided in the constructed wetland will be engaged, with careful design incorporated to protect the structural integrity of the various elements with the wetland. The Wetland Concept Plan illustrates the typical sections of a precinct park retarding basin (see **Figure 8**).

Figure 8 Wetland concept

4.5.5 Water Sensitive Urban Design

The proposed Huntingwood West Concept Plan features best practice Water Sensitive Urban Design (WSUD). Details of this WSUD are included in the *WSUD Strategy* prepared by EcoLogical Engineering Pty Ltd, August 2006 (see Appendix I). These details are also incorporated into the DDC document for the site included within **Volume 1**.

4.6 UTILITIES INFRASTRUCTURE

A review of the civil infrastructure has been undertaken and prepared by YSCO Geomatics. The review investigated the existing provision and future provision levels required for water, sewerage, electricity, natural gas and telecommunications at Huntingwood West.

The overarching design principles of the indicative options for the subdivision layout provide sufficient scope to allow for efficient servicing of the employment zone. Conflict between the desirable environmental outcomes and the need to provide services, to the satisfaction of the relevant servicing authorities, are minimised and will be managed at the services design and installation level.

Servicing to and within the site is likely to be provided under the following fundamental guidelines, without compromising the development design philosophy.

Water

Potable water to service the site can be supplied from the Prospect Hill elevated system with minor main amplification works expected to be completed within 6months of lodgement of a Section 73 application to Sydney Water.

Reticulation of water supply within the employment zone will be within Sydney Water's street allocation.

Sewer

The employment land is not currently serviced with sewer utilities. Internal servicing will be via gravity mains in a westerly direction towards Eastern Creek and then in a northerly direction under the Great Western Highway. An extension of the existing carrier mains adjoining Eastern Creek (north of the Highway) will provide a link to the Sydney Water mains system (to the Bungarribee carrier) which runs along Bungarribee Creek.

Internal sewer reticulation works will generally be contained within the proposed subdivision parcels.

Electrical

Adequate servicing of the Huntingwood West Employment Land requires the construction of a new Substation. Integral Energy, together with Landcom, has selected an appropriate site for the substation, in the North Eastern corner of the zone.

The selected site allows efficient connection with the existing electrical grid and is removed from the more environmentally sensitive areas of the Western Sydney Parklands. The preferred development option allows for efficient connection to the proposed substation, by underground reticulation, within Integral Energy's street allocation.

132 kV electrical feeders are to be constructed to supply the Zone Substation. These feeders will occupy allocations currently utilised by Integral Energy for lower voltage lines and, accordingly, will not have significant additional impact. Undergrounding of the existing overhead works is being investigated.

Gas

Agility do not, as a matter of policy, reticulate services within employment zones, at the initial development phase. The nature of Employment Zones is such that demand can be highly variable and upfront supply cannot be adequately gauged. Gas is available in the vicinity and may be reticulated within the development zone, on an individual customer basis. The preferred development option provides sufficient connectivity for Agility to provide a service to customers on demand. Agility's street allocations should allow for preservation of future servicing routes.

Telecommunications infrastructure

Telstra facilities are available in all roads surrounding the Huntingwood West Employment Land and standard services will be extended within the road network. The services will be reticulated underground within the nominated street allocation and will not have an adverse environmental impact. Above ground Telecommunication equipment is generally small scale and can be readily sited in the public domain, without significant visual impact.

Telstra offers higher level telecommunications services (involving optical fibres) which may appeal to the end user and developer. This higher level system requires a critical mass of end users and comes at an additional financial cost.

4.7 COMMUNITY CONSULTATION

Community Consultation

Landcom has undertaken extensive community and stakeholder consultation during the preparation of the Concept Plan (October 2005 to September 2006) in accordance with the Draft Director General requirements.

The Western Sydney Parklands Ideas Competition

This project was publicly announced by the State Government in December 2004, followed by the commencement of an Ideas Competition (IC). The Concept Plan has incorporated feedback from an IC held between October and December 2005.

The Competition Brief sought to encourage ideas from both the general Community and professionals to assist Landcom in developing a plan for Bungarribee seeking design excellence. A total of 81 entries were received, including three international submissions.

The ideas competition provided a unique opportunity for delivering World's Best Practice to the development by allowing stakeholders to participate in the planning process, and as such it:

- Explored broad planning and design opportunities for the site taking into account its context, physical features and the surrounding land uses;
- Advocated for the integration of land uses and activities (interface) between the Parklands and the Huntingwood West employment zone (the subject of this Concept Plan);
- Promoted environmental, social and economic sustainability. In seeking these ideas Landcom has had dialogue with:
  - Local Government - Blacktown City Council,
  - Government agencies such as NSW Department of Planning, and Department of Education,
  - Professional associations ie. Australian Institute of Landscape Architects (AILA), and The Royal Australian Institute of Architects (RAIA),
  - Local residents and general public.
  - Government Agencies

Relevant authorities and government agencies have also been consulted as part of the Concept Plan process between January and September 2006. A Project Working Group (PWG) was established to discuss aspects of the project with Blacktown City Council.

A summary of the stakeholders that have been consulted is included in **Appendix G**.

4.8 DEVELOPER CONTRIBUTIONS

The Concept Plan has reviewed Blacktown Council's requirements and proposes to develop roads, stormwater management and water quality systems as well as street tree planting in accordance with Council's standards. The details have been outlined in the Design Development Code included within Volume One of the Concept Plan.

A development contribution towards the upgrading of the local and regional road network is proposed with the Roads and Traffic Authority. These negotiations are currently underway and are underpinned by the TMAP prepared by Maunsell.

This Concept Plan is not seeking to enter into a Voluntary Planning Agreement.

4.9 OTHER ISSUES

4.9.1 Built Form

Development Design Controls for Huntingwood West have been prepared by Architectus; they are an important part of this submission (see **Volume 1**). The controls have been developed to ensure that a quality urban outcome, as described in the principles below, is realised in the built form.

Urban Design principles:

- To ensure that the built form establishes a strong relationship to open space and to the Parklands areas.
- To ensure that development contributes to cohesive streetscapes and desirable pedestrian environments.
- To ensure a safe environment by promoting crime prevention through good urban design.
- To encourage pedestrian use of streets to enhance pedestrian safety and security.
- To promote energy efficient building orientation and envelopes.
- To avoid monotonous building forms and design and to avoid street views of long building elevations not screened by landscaping.
- To encourage the provision of a range of distinctive building forms that promotes the identity of each tenancy.
- To encourage a high quality built form by encouraging activity on elevations fronting streets, ensuring buildings address streets and emphasising vertical forms with landscape, buildings and street lighting.

4.9.2 Landscape

EDAW has prepared a landscape plan that is intrinsically connected with the land subdivision option proposed (see **Volume 1**). The landscape character and structure of the concept plan has been influenced by its location adjacent to the Western Sydney Parklands.

The landscape design requires the planting of Cumberland Plain plant communities in streetscapes, building setbacks and the public domain, extending the reconstructed Parkland ecologies of Eastern Creek and the Parklands into an urban, employment area.

The landscape design in turn relates strongly to the proposed WSUD strategy, where the Huntingwood West landscape will interact with the adjacent Parkland landscape at the wetland. The wetlands form part of the storm water management strategy and they will also provide an aesthetic feature in the landscape. It is envisaged that the wetland will be an attractive place offering passive recreation opportunities.

A distinct landscape treatment is proposed for the park edge road (see Landscape Plans, **Volume 1**). This defines the edge between privately and publicly managed lands and also demarcates urban (Huntingwood West) from natural (Eastern Creek) areas.

4.9.3 Visual Impact

Richard Lamb and Associates (RLA) prepared a Landscape and Visual Assessment in February 2006 for the Huntingwood West site. The assessment explored the site's visual character, scenic resources, landscape and visual constraints. In summary the management guidelines recommended and adopted for the Huntingwood West land include:

- Preservation and augmentation of existing native vegetation, notably within the Eastern Creek corridor.
- Maintaining some views to core parklands west of Eastern Creek for motorists.
- Enhancing the intersections where Brabham Drive meets The Great Western Highway and the M4 as nodes with supplementary vegetation and appropriate built forms.
- Developing the eastern side of the site (Land Area A and B)[2] for employment opportunities, the western part and the Eastern Creek corridor (Land Area C) being retained in their existing character.

The indicative land subdivision option proposed for the Huntingwood West employment lands fit comfortably with these recommendations.

Vegetation will be consolidated and rehabilitated in Land Area C along Eastern Creek and dedicated as Parkland to protect the natural and scenic qualities. The assessment by RLA considered that the visual links to places outside the Huntingwood West parcel were not of high importance.

It is proposed that views into and out of Land Areas A and B, be screened with buffer planting along the M4 and Brabham Drive to provide acoustic as well as psychological separation between traffic and the employment lands. Views into the parkland side of the site will be afforded from the M7, as it is elevated and offers sweeping views across the landscape.

4.9.4 Bushfire

Eco Logical Australia prepared a 'Bushfire Advice' report for the Bungarribee Precinct in February 2006 which advised that the principles of *'Planning for Bushfire Protection'* (Rural Fire Service, 2001) should be applied at the site. Rural Fire Service provisions

[2] Lands Areas A, B and C as defined in **Figure 2.**

relate to establishing adequate Asset Protection Zones (APZs) between buildings and bushland, perimeter trails, access, water and adequate construction.

The location and size of APZs are based upon the capacity of the site to support different vegetation communities (fuel groups) and hypothetical conservation/development boundaries. The Eco Logical Australia advised that as Huntingwood West would support Industrial land uses and operate as employment land an APZ of 20m was required between buildings and large woodland communities in the Parklands.

The Huntingwood West concept plan proposes a distinct separation of the Parkland and employment lands, the edge is clearly delineated by the Park Edge Road. The wetland, located on the west of the road (within the Parkland) and adjacent verge and roadway (See Landscape Plans, **Volume 1**) contribute to the 20m APZ.

4.9.5 Geotechnical

Douglas Partners undertook a *'Land Capability Assessment'* of the Bungarribee Precinct. This report included details on geotechnical issues

Stability and erosion and sedimentation do not constrain the site or impact adversely on development potential of the indicative subdivision layout plans. It was recommended that an erosion and sedimentation control plan be developed for the site before construction is approved.

Salinity hazard was detected and mapped onsite, various means of combating the salinity hazard were provided in the report including strategies for building in saline environments. These have informed the design of the subdivision layout options; land use decisions and landscape design.

In its current state, portions of the site are waterlogged and possess silt and sediment accumulation to several metres depth. Footing design of the proposed structures will need to accommodate these factors. It is assessed that these detailed design issues are best addressed at “built-form” DA stage and through detailed design controls.

5. GENERAL ENVIRONMENTAL RISK ANALYSIS

In addition to the assessment of the issues included above, an environmental risk analysis has been undertaken below. This summary aims to identify potential environmental impacts associated with the project, as well as proposed mitigation measures. Also included are any potentially residual environmental impacts after the application of proposed mitigation measures and/or any further studies and assessments that may be required to assess these factors.

Table 5.1 Risk Assessment

Description	The risk is...	Stakeholder	Likelihood of occurrence	Rating	Mitigation	Residual Likelihood of occurrence	Residual rating	Responsibility
PHYSICAL POLLUTION								
Air Impacts No individual air quality assessment has been undertaken	Proposed subdivision works and associated operation activities (Employment Land) may contribute to air pollution	Developer, Council, end user	low	C	Further studies will be undertaken at the individual DA Stage as required in accordance with Council and other authority requirements. Standard conditions of consent – Erosion and sediment control plans etc.	low	C	Developer, end user
Water impacts 'Drainage Flood and Water Quality' Jan 2006, URS	Refer Section 4.5. Water treatment of stormwater runoff from the proposed subdivision land is required to prevent pollution and flooding.	Developer, Council, end user	low	B	Detailed design of wetland to be undertaken at a later stage. Concept approval sought in this submission.	low	C	Developer, end user
Soil impacts	Proposed subdivision works and associated operation activities (Employment Land) may contribute to soil contamination.	Developer, Council, end user	low	B-C	Further studies will be undertaken at the individual DA Stage as required in accordance with Council and other authority requirements. Standard conditions of consent – Erosion and sediment control plans etc.	low	C	Developer

Description	The risk is...	Stakeholder	Likelihood of occurrence	Rating	Mitigation	Residual Likelihood of occurrence	Residual rating	Responsibility
Noise and vibration impacts	Proposed subdivision works and future associated operation activities (Employment Land) may contribute to noise pollution.	Developer, Council, end user	low	C	The site is well removed from "sensitive" land uses (including residential areas). Further studies will be undertaken at the individual DA Stage as required in accordance with Council and other authority requirements.	low	C	Developer construct-ion company
BIOLOGICAL								
Fauna	Removal of existing habitat will adversely impact biodiversity levels and health.	Developer Council, end user, flora and fauna communities	mod	B - C	A 'Draft Strategic Offset Directions' has been prepared and adopted into the Concept plan design. (see Appendix E) A detailed biodiversity offset strategy will be developed in conjunction with future Parklands Concept Plan (See *'Draft Strategic Offset Directions'* Conclusion).	low	C	Developer, end user
Flora						low	C	Developer, end user
Biodiversity						low	C	Developer, end user
Threatened species. Populations, communities, habitat						low	C	Developer, end user
RESOURCE USE								
Community Resources		Developer, Council, end user	low	C	A 'Civil Infrastructure Report' has been prepared by URS and has been incorporated into the Concept Plan proposal.			
Natural resources	Bushfire could effect the developed site (from the	Developer, RBFS, Council,	low	C	Bushfire management advice and APZ's have been incorporated into	low	C	Developer

Description	The risk is...	Stakeholder	Likelihood of occurrence	Rating	Mitigation	Residual Likelihood of occurrence	Residual rating	Responsibility
	north and west)	end user			the Concept plan proposal.			end user
Transportation	Proposed intersection to HW Employment Land will adversely effect LOS of existing intersections despite TMAP advice.	Developer, Council, end user, RTA	low	C	TMAP has been prepared with recommendations (See Appendix D)			
COMMUNITY								
Social impacts	Positive impact The creation of new jobs in a strategically important region.	Council, State Government, End user, Employment sector	high	B	Requires continued State Government commitment.	-		Developer
Economic impacts	Positive impact The creation of up to 800 new jobs in a strategically important location.	Council, State Government, End user, Employment sector	high	B	Requires continued State Government commitment.	-		Developer
Heritage, aesthetic, cultural impacts	HIS has been prepared for both the indigenous and non-indigenous heritage. Any risks related to damaging artefacts or significant archaeological sites has been avoided. Landscape integration of CPW will create distinct, appropriate and	Developer, Council, end user,	mod	B – C	Further work is required to attempt to determine the extent and quality of the Old Inn site, (See Section 4.3). Management of landscape required.	Low	C	Developer, end user

Description	The risk is...	Stakeholder	Likelihood of occurrence	Rating	Mitigation	Residual Likelihood of occurrence	Residual rating	Responsibility
	attractive Employment estate.							
Land use impacts	Positive impact: Contribution to Motor Sport vision of BCC and creation of world class green Employment Estate.	Developer, Council, end user, surrounding stakeholders	high					Developer, Council
Transportation impacts	The development of the site will result in an increase in traffic on local roads and existing intersections.	Developer, Council, end user, surrounding stakeholders	mod	B - C	A TMAP has been prepared by Maunsell and its recommendations on intersection design, scale, additional roads etc has been incorporated into the Concept Plan proposal.	low	C	Developer, end user, RTA, Council

6. CONCLUSION

The 61 ha land area and proposed development known as Huntingwood West is the subject of this Concept Plan Application and Environmental Assessment (EA) under Part 3A of the *Environmental Planning and Assessment Act 1979 (EP&A Act 1979).*

Huntingwood West is to be included as a state significant site within the proposed *Western Sydney Employment Hub*. The Huntingwood West project is considered to be a Major Project within the *NSW Major Projects State Environmental Planning Policy (Major Projects SEPP)*. The project is of State and regional significance as it will contribute funds to the development of the Western Sydney Parklands, which are a major component of the Metropolitan Strategy. Funds will be returned to the Parklands Trust which will be established in 2007 to manage the Parklands.

This employment lands application seeks consent for a land subdivision layout, types of employment uses, intersections and essential infrastructure and development design controls. The proposed subdivision is a result of a comprehensive urban planning exercise that seeks to maximise the site's opportunities and capitalise on it's proximity to Sydney's major transport network (i.e. the M7 and M4 motorways) and the adjacent regional Parklands.

The vision for Huntingwood West is that it "becomes a state of the art green employment estate with a strong connection to the Western Sydney Parklands, incorporating best practice urban design and environmentally sustainable initiatives.

This environmental assessment has been prepared in full compliance with the requirements of the Director General of the Department of Planning. It is assessed that the concept proposal will deliver a high quality employment estate that will result in:

- Positive impacts both socially and economically with respect to job creation for both Blacktown and the Western Sydney Region;
- A new model working environment for employees;
- New buildings seeking excellence in architectural design;
- Traffic managed through road improvement works and excellent connectivity to Sydney's regional road network;
- A best practice Water Sensitive Urban Design scheme including a new wetland for the adjoining Parklands; and
- Revegetation in the adjoining Parklands with Cumberland Plain Woodland landscape elements to aid biodiversity.

The Planning Group (NSW) Pty Ltd supports this application and recommends its approval.

6. BIBLIOGRAPHY

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'*Bushfire Advice'*, Feb 2006 - Eco Logical Australia Pty Ltd

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'Communication and Consultation Strategy', May 2006 - APP

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'Management Vision and Concept Plan Options', March 2004 - URS, Turf Design, Ian Perkins, Linda Corkery, Haglund Associates & Banksia Heritage

'Preliminary Noise Assessment for Rezoning', Jan 2006 - Heggies Australia

'Site Audit Report - Doonside', HLA Envirosciences

'Social Sustainability Assessment for Doonside', May 2006 - Elton Consulting

'Sustainability Report', 2005 - Landcom

'*Transport and Accessibility Assessment',* Feb 2006 – Maunsell

'Visual and Landscape Assessment', Feb 2006 - Richard Lamb and Associates

APPENDIX A
DIRECTOR GENERAL'S REQUIREMENTS

APPENDIX A
Director General's Requirements

NSW GOVERNMENT
Department of Planning

Contact: Felicity Greenway
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Our ref: 9042140

18 September 2006

Mr Jeremy Spinks
Senior Development Manager
Landcom
PO Box 237
PARRAMATTA NSW 2124

Dear Mr Spinks

Subject: Major Project – Huntingwood West - as part of the Western Sydney Employment Hub potential State significant site

Further to our letter dated 16 December 2005 regarding the above mentioned proposal being considered a potential State significant site (as part of the Western Sydney Employment Hub), we have further advice regarding your request that the Huntingwood West proposal be considered a Major Project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies.

I am pleased to inform you that on 15 September 2006 the Minister formed the opinion that the Huntingwood West proposal is a Major Project to which Part 3A of the Act applies. In addition, the Minister authorised submission of a concept plan for the site. The Director-General's environmental assessment requirements are attached. The requirements have primarily been developed in light of preliminary consultation with key stakeholders and a review of the preliminary environmental assessment.

The environmental assessment requirements were developed from information provided with your application. Section 75F(3) of the Act permits subsequent modification of the Director-General's requirements and may be invoked to address hitherto unidentified environmental impacts. If these powers are used, you will be formally notified of changes to the Director-General's requirements. The Department acknowledges that some issues contained within this documentation may be more appropriately addressed as part of subsequent project or development applications. Nonetheless, it would be prudent to address all the requirements either within the Concept Plan's environmental assessment and/or the Concept Plan's statement of commitments. To that end, all issues and requirements relevant to the Concept Plan should be addressed at this stage.

Once you have lodged the environmental assessment, the Department (in consultation with other agencies) will undertake a "test of adequacy" of the submitted documentation. Following that review, the environmental assessment (together with the Director-General's environmental assessment requirements) will be publicly exhibited for a minimum period of 30 days. You should keep the contact officer for this project up to date with the preparation of the environmental assessment and, where relevant, any emerging issues. The officer, David Gibson, is available during business hours on (02) 9228 6589 or via return email to david.gibson@planning.nsw.gov.au.

Yours sincerely

Sam Haddad
Director-General

Office of Sustainable Development Assessment and Approvals – Strategic Assessment
23-33 Bridge Street SYDNEY NSW 2000 GPO Box 39 SYDNEY NSW 2001
Phone 02 9228 6111 Fax 02 9228 6150 Website planning.nsw.gov.au

CONCEPT PLAN – HUNTINGWOOD WEST, SYDNEY
(MP 06_0203)
ENVIRONMENTAL ASSESSMENT REQUIREMENTS UNDER PART 3A OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Project Description	Subdivision of the site for future employment uses and associated road works.
Capital Investment Value	N/A
Site	Huntingwood West is a 56ha parcel bounded by Eastern Creek, the Great Western Highway, Doonside Rd and the M4 Motorway.
Proponent	Landcom
Date of Issue	18 September 2006
Date of Expiration	18 September 2008 (2 years from date of issue)
Special Provision	On 15 September 2006, the Minister for Planning declared by order in the gazette, pursuant to Section 75B(1) of the Environmental Planning and Assessment Act 1979 that the project is a Major Project under Part 3A of the *Environmental Planning and Assessment Act 1979*.
General Requirements	The Environmental Assessment must include: **State Significant Site listing** • The State or regional planning significance of the site; • Proposed land uses and suitability of the site for the proposed land uses taking into consideration environmental, social and economic factors, the principles of ecologically sustainable development and any applicable State or regional planning strategy; and • The implications of any proposed land use for local and regional land use, infrastructure, service delivery and natural resource planning. The above will be used by the Director-General to make recommendations to the Minister with regard to appropriate zoning and development controls for the site, and whether any subsequent development on the site should be declared to be a project subject to the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979*, local development or exempt and complying development. **Concept Plan** • An executive summary; • A description of the overall concept, its likely components and any staging of the development including: o description of the site, including cadastre and title details; o design, subdivision layout; and o project objectives and need (if relevant); • An assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below; and • A statement on the validity of the environmental assessment, the qualifications of person(s) preparing the assessment and that the information contained in the environmental assessment is neither false nor misleading.
Key Assessment Requirements	**Part A – Heads of Consideration** • Suitability of the site; • Likely environmental, social and economic impacts; • Justification for undertaking the project; and • The public interest. **Part B – Relevant EPIs and Guidelines to be addressed** • Relevant current EPIs applying to the site (including permissibility) and proposed planning provisions; • Nature and extent of non-compliance with specified EPIs; and • Consideration of alternatives to the proposal. **Part C – Key Issues to be addressed** • Requirements of the Department and other agencies are as follows:

Traffic

- Details to be provided of the traffic volumes likely to be generated and an assessment of the predicted impacts of this traffic on the safety and capacity of the surrounding road network.
- Justification of proposed intersection locations and design details (to meet RTA/Council requirements).

Subdivision

- Demonstrate that the subdivision layout is appropriate by achieving high degrees of access for all forms of transport (including walking) and detail the subdivision layout, lot size and mix, the location of open space and road network.
- Provide a detailed contour plan to identify the finished contour levels of the site, with details provided on the earthworks required to achieve the finished contours.

Natural Resources

- Potential impact of proposed land use (i.e. rezoning and subdivision to allow employment development) on surrounding waterways in terms of water quality and aquatic ecosystems.
- Impact on existing native flora and fauna, including identified threatened species.

Heritage

- A heritage impact statement should be prepared in accordance with the requirements of DEC and the NSW Heritage Office. The statement should assess the impacts of the application on indigenous and non-indigenous heritage (Rudders Lane and surrounds).

Contamination

- Contamination and geotechnical issues associated with the proposal should be identified and addressed in accordance with SEPP55 and other relevant legislation and guidance.

Drainage and Stormwater Management

- The environmental assessment should address drainage and stormwater management issues at a high level, including: on site detention of stormwater; water sensitive urban design (WSUD); and drainage infrastructure.

Utilities Infrastructure

- The environmental assessment should include details of how the development proposal will be satisfactorily serviced for utility services such as the supply of water, sewerage, stormwater, gas, electricity and telephone services and comply with the requirements of any public in regard to the connection to, relocation and/or adjustment of the services affected by the development.

Community Consultation

- The environmental assessment should document all consultation undertaken to date (i.e. Council, adjoining land owners, government agencies) and discuss the proposed strategy for undertaking consultation. This should include any contingencies for addressing any issues arising from the consultation and an effective communications strategy.

Planning Agreements and/or Developer Contributions

- The environmental assessment should address and provide the likely scope of a planning agreement (should one be proposed) and/or developer contributions between the proponent, Council and other agencies for matters such as community, regional and local infrastructure, public transport provision, social infrastructure and facilities etc either on site or the LGA.

Part D – Statement of Commitments

- Proposed mitigation and management of residual impacts; and
- A draft Statement of Commitments detailing measures for environmental management and mitigation measures and monitoring for the project.

Test of adequacy

If the Director-General considers that the Environmental Assessment does not adequately address the environmental assessment requirements, the Director-General may require the proponent to submit a revised environmental assessment to address the matters notified to the proponent. The Director-General may modify these requirements by further notice to the proponent.

General Environmental Risk Analysis (in relation to all components of the concept)

Notwithstanding the above key assessment requirements, the Environmental Assessment must include an environmental risk analysis to identify potential

	environmental impacts associated with the project, proposed mitigation measures and potentially residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impacts must be included in the Assessment.
Consultation Requirements	During the preparation of the EA, you should undertake an appropriate and justified level of consultation with relevant parties during the preparation of the Environmental Assessment. If consultation has already been undertaken or will be undertaken during exhibition, this needs to be documented. Relevant agencies include: • Agencies (a) Blacktown Council (b) Department of Planning (Sydney East Region office) (c) Roads and Traffic Authority (d) Ministry of Transport (e) NSW Heritage Office (f) Department of Environment and Conservation (g) Department of Natural Resources (h) Utilities and Emergency Services, including: NSW Police Service; NSW Fire Brigades; Sydney Water; Energy Australia; and Telstra Corporation Limited (i) The Local Aboriginal Land Council • Public • Any relevant community meetings already established and timetabled; and • Any additional meetings proposed by the local member or other relevant group. • Peer Review Requirements • List any components of the Environmental Assessment to be independently peer reviewed prior to submission. • If the Director-General considers that significant changes are proposed to the nature of the project, the Director-General may require the proponent to make the preferred project available to the public.
Exhibition requirements	Until such time as the Director-General accepts the Director-General's Environmental Assessment Requirements, the proponent is required to set up a website such that the Environmental Assessment report and all other material identified as being required for submission is available from this website.
Deemed refusal period	60 days (see Clause 8E of the Environmental Planning & Assessment Regulation)
Panels constituted under s75G	No Panels are required at this stage.
Application Fee Information	Fees are applicable to the application. The fee is based on estimated cost of works as per the *Environmental Planning and Assessment Regulation 2000*. Please consult with the Department about the Concept Plan fee.
Landowners Information	The consent of the landowner is to be provided in accordance with s8F of the *Environmental Planning and Assessment Regulation 2000*.
Documents to be submitted	• Ten (10) copies of the environmental assessment report; • Five (5) copies of the environmental assessment report and plans on CD-ROM (PDF format); and • Plans, models & drawings/montages.

APPENDIX B
RELEVANT LEP CLAUSES AND GUIDELINES AND TABLE OF CONCEPT PLAN COMPLIANCE WITH EPIs

APPENDIX B

Relevant LEP Clauses and Guidelines and Table of Concept Plan Compliance with EPIs

RELEVANT SECTIONS OF BLACKTOWN LOCAL ENVIRONMENTAL PLAN 1988 AND DEVELOPMENT CONTROL PLANS

(i) BLACKTOWN LOCAL ENVIRONMENTAL PLAN 1988

Introduction

The relevant local environmental planning instrument is the *Blacktown LEP 1988.*

The Doonside and Huntingwood West sites are currently zoned 5a Special Uses – Corridor under the *Blacktown LEP 1988 (BLEP 1988)*. Planning control over the Parklands however is currently exercised through *Sydney Regional Environmental Plan (SREP) 31* and it's accompanying Development Control Plan No. 1, which was gazetted in 2001.

As the NSW Government plans to make the entire Western Sydney Employment Hub area a *State significant site in the Major Projects SEPP* and the Huntingwood West site is nominated within this hub, it is considered appropriate to consider the equivalent "industrial area provisions" within the *BLEP 1988.* There are currently 4 industrial zones within Blacktown:

- *Zone No. 4(a) (General Industrial Zone*
- *Zone No. 4(b) (Light Industrial Zone*
- *Zone No. 4(c) (Special Industrial Zone*
- *Zone No. 4(d) (Huntingwood Industrial Zone*

The Huntingwood industrial area, adjoining to the east of the Huntingwood West site is now zoned 4(d) within the *BLEP 1988.* This zone is considered the closest zone to the proposed employment area of Huntingwood West, in terms of the standard of design, function and land usage. A short discussion is included below on the relevant BLEP clauses relating to the 4(d) zone and the subject development.

Relevant clauses of the LEP have also been considered in the preparation of the proposal. These clauses are discussed below and summarised in the Compliance Table.

Clause 2: Objectives

The Clause 2 objectives of the BLEP 1988 state as follows (emphasis added):

> ***2 Aims, objectives etc***
> *(2) The objectives of this plan are:*
> *(a) to allow for a variety of rural based activities while maintaining the urban potential of relevant rural land,*
> *(b) to allow for a variety of residential lifestyles,*
> *(c) to allow for a variety of business uses while consolidating existing commercial centres,*
> ***(d) to enable a variety of uses in industrial areas while protecting the viability of existing retail centres,***
> ***(e) to prohibit offensive or hazardous industries,***

(f) to ensure space is provided for community services and facilities,
(g) to ensure space is provided for recreational activities and facilities,
(h) to ensure land is available to accommodate all required special land uses in the most effective manner, and
(i) to protect Blacktown's environmental heritage.

(3) The strategy by which the aims referred to in subclause (1) and the objectives referred to in subclause (2) are to be achieved is the controlling of the development of land to which this plan applies by reference to land-use zones and the controlling of particular types of development in those zones by reference to controls specified as applying only to those types of development or to a development of a certain type being carried out in those zones.

The proposed employment area within Huntingwood West has been designed to comply with the relevant objectives of the plan. Further details are provided within the draft DDC (see **Volume 1**). The relevant LEP objectives are:

- The overall aim to enable a variety of uses in industrial areas while protecting the viability of existing retail centres, (objective d),
- to prohibit offensive or hazardous industries (objective e) and
- the need to protect Blacktown's environmental heritage (objective e).

Zone objectives

The Clause 9 aims and objectives of the BLEP 1988 which specifically relate the zone 4(d) Huntingwood Industrial Zone state as follows:

9 Zone objectives and development control table
ZONE No. 4 (d) (HUNTINGWOOD INDUSTRIAL ZONE)

1. Objectives of zone
The objectives are -
(a) to recognise the special character and function of Huntingwood Industrial Estate and provide for a new industrial zone applicable exclusively to the Huntingwood Industrial Estate;
(b) to ensure that new light industrial development in Huntingwood Industrial Estate is of a high standard and incorporates best practice environmental management techniques;
(c) to provide an area for modern forms of light industrial, warehousing, manufacturing, research and like development outside areas zoned for residential, business, general industrial, light industrial or special industrial purposes, to facilitate the provision of increased employment opportunities in the City of Blacktown;
(d) to discourage industrial development which is likely to detract from the amenity of the zone by reason of its appearance, noise, emissions and the like;
(e) to prohibit hazardous and offensive industries and industries where substantial measures are necessary to mitigate the chances or impacts of environmental damage;
(f) to enable development for the purposes of retailing only where it is associated with, and ancillary to, manufacturing carried out on the same land or where it serves the daily convenience needs of the local workforce;
(g) to enable development for the purpose of commercial offices only where it is associated with, and ancillary to, light industrial, warehousing or like use of the same land, or where it serves the daily convenience needs of the local workforce, or where location of the commercial offices in a business zone is not practical by virtue of the nature and scale of the use;
(h) to enable development for the purposes of community facilities such as child care facilities either in association with or independent of other permitted development to serve the needs of the workforce in the locality;

(i) to ensure new development enhances the amenity of Huntingwood Industrial Estate by including high quality landscaping , adequate building setbacks, high quality external finishes and the like; and
(j) to ensure new development in Huntingwood Industrial Estate is of a scale and character compatible with existing development in Huntingwood Industrial Estate.

2. Development that does not require consent
Nil.
3. Development which requires consent
Any purpose other than a purpose included in Item 2 or 4 of the matter relating to this zone.
4. Prohibited
Amusement centres; boarding houses; brothels; bulky goods retail establishments; caravan parks; commercial premises (other than those ancillary to and used in conjunction with a purpose permissible in this zone or which serve the daily convenience needs of the workforce in the industrial area or which are not suited to location in a business zone by virtue of the nature and scale of the use); dual occupancy or dwelling-houses (other than those ancillary to and used in conjunction with a purpose permissible in this zone); exhibition homes; exhibition villages; gasholders; generating works; group homes; hardware stores; hazardous industries; hazardous storage establishments; home activities; hospitals; housing for aged or disabled persons; industries (other than light industries); institutions;

The proposed Huntingwood West Employment Area has been designed to allow for new light industrial development of a high standard which incorporates best practice environmental management techniques (objective b) as well as providing an area for modern forms of light industrial, warehousing, manufacturing, research and like development (objective c).

Clause10: Subdivision Generally

Clause 10 of the BLEP 1988 relates to subdivision generally and states as follows:

10 Subdivision generally
(1) A person shall not subdivide land to which this plan applies without the consent of the council.
(2) Land shall not be subdivided unless the boundaries of allotments so created correspond generally with the boundaries, if any, between zones as shown on the map.
(3) Notwithstanding the provisions of subclause (2), the council may consent to a plan of subdivision whereby the boundaries of allotments so created will not correspond with the boundaries between different zones as shown on the map but which, in the opinion of the council, depart from those boundaries only to a minor extent.
(4) Where, upon a registration of a plan of subdivision referred to in subclause (3), the boundary between land is determined in a different position from the boundary between different zones indicated on the map, land shall be deemed to be within the appropriate zone as determined by the council.
(5) The council shall not grant consent to the subdivision of any part of the land to which this plan applies unless the plan of subdivision makes provision for any proposed road on that part of the land shown by parallel broken lines on the map to be opened generally in the locations shown on the map.

The proposed subdivision area is expected to be within the rezoned area identified within the Western Sydney Employment Hub. The boundaries of the proposed employment land will correspond with the boundaries of the proposed zoning.

Clause 14 and 16A: Protection of Heritage Items

Clause 14 of the BLEP 1988 relates to the protection of heritage items and relics and states as follows:

14 Protection of heritage items and relics
(1) When is consent required?
The following development may only be carried out with development consent:
(a) demolishing or moving a heritage item,
(b) altering a heritage item or relic by making structural or non-structural changes to its exterior, such as to its detail, fabric, finish or appearance,
(c) altering a heritage item by making structural changes to its interior,
(d) moving any relic, or excavating land and discovering, exposing or moving a relic,
(e) erecting a building on, or subdividing, land on which a heritage item is located.

(2) What exceptions are there?
Development consent is not required under this clause if:
(a) in the opinion of the consent authority:
(i) the proposed development is of a minor nature or consists of maintenance of the heritage item or relic, and
(ii) the proposed development would not adversely affect the significance of the heritage item, and
(b) the proponent has notified the consent authority in writing of the proposed development and the consent authority has advised the applicant in writing before any work is carried out that it is satisfied that the proposed development will comply with this subclause and that development consent is not required by this plan.
……...
(4) What must be included in assessing a development application?
Before granting a consent required by this clause, the consent authority must assess the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item.

(5) What extra documentation is needed?
The assessment must include consideration of a heritage impact statement that addresses at least the following issues (but is not to be limited to assessment of those issues, if the heritage significance concerned involves other issues). The consent authority may also decline to grant such a consent until it has considered a conservation management plan, if it considers the development proposed should be assessed with regard to such a plan.

(6) The minimum number of issues that must be addressed by the heritage impact statement for development that would affect a heritage item are:
(a) the heritage significance of the item as part of the environmental heritage of the City of Blacktown, and
(b) the impact that the proposed development will have on the heritage significance of the item and its setting, including any landscape or horticultural features, and
(c) the measures proposed to conserve the heritage significance of the item and its setting, and
(d) whether any archaeological site would be adversely affected by the proposed development, and
(e) the extent to which the carrying out of the proposed development would affect the form of any historic subdivision.

Clause 16A: Development in the vicinity of heritage items
(1) Before granting consent to development in the vicinity of a heritage item, the consent authority must assess the impact of the proposed development on the heritage significance of the item.
(2) This clause extends to development:
(a) that may have an impact on the setting of a heritage item, for example, by affecting a significant view to or from the item or by overshadowing, or
(b) that may undermine or otherwise cause physical damage to a heritage item, or
(c) that will otherwise have any adverse impact on the heritage significance of a heritage

item.
(3) The consent authority may refuse to grant any such consent unless it has considered a heritage impact statement that will help it assess the impact of the proposed development on the heritage significance, visual curtilage and setting of the heritage item.
(4) The heritage impact statement should include details of the size, shape and scale of, setbacks for, and the materials to be used in, any proposed buildings or works and details of any modification that would reduce the impact of the proposed development on the heritage significance of the heritage item.

The Huntingwood West site is not listed on the Blacktown LEP 1988 Schedule 2 as containing any significant heritage items, nor is it listed on the State Heritage Register. There are however elements in the landscape that have environmental and cultural heritage value. These values have been identified following consultation with the Department of Environment and Conservation (NSW), the Department of Planning and Blacktown City Council. These values have been responded to in the development of the concept plan; vegetation offset strategy and the landscape plan.

In accordance with the DG's Requirements and with the requirements of DEC and the NSW Heritage Office, a Heritage Impact Statement (HIS) was prepared by Godden Mackay Logan (GML) in August 2006 for the Huntingwood West land. A Heritage Impact Statement (HIS) has also been carried out by Jo McDonald Cultural Heritage Management Pty Ltd of the Huntingwood West land.

The findings of the two HISs have been considered in the development of the proposed concept plan.

Clause 19: Drainage

Clause 19 and 20 of the Blacktown LEP 1988 relate to drainage land affected by the 1% annual exceedance probability flood. These clauses state as follows:

19 Drainage
(1) Notwithstanding any other provision of this plan, a person shall not carry out development on land to which this plan applies unless the land is filled to a level satisfactory to the council.
(2) Where, in relation to the carrying out of development on land to which this plan applies, the council makes any requirements with respect to the drainage of land or the drainage of other land, a person shall not carry out that development except in accordance with those requirements.

20 Development of land affected by the 1% annual exceedance probability flood
(1) In this clause:
"floodway" means the channel of a river or stream and those portions of land, affected by the 1% annual exceedance probability flood, adjoining the channel and which constitute the main flow path of floodwaters. Floodwaters are areas which, even if only partially blocked, would cause significant redistribution of the flood flow, which may in turn adversely affect other areas. They are often, but not necessarily, the areas of deeper flow or the areas where higher velocities occur.
"1% annual exceedance probability flood" means a flood which has a 1 in 100 chance of occurring in any one given year.

(2) Despite any other provision of this plan, the council may refuse consent to the carrying out of any development on land affected by the 1% annual exceedance probability flood where, in its opinion, the development may:

(a) adversely affect the efficiency, or unduly restrict the capacity, of the floodway or where the safety of the development would be affected in time of flood,
(b) affect the flood peak at any point upstream or downstream of the development,
(c) affect, to a substantial degree, the flow of floodwater on adjoining lands,
(d) cause avoidable erosion, siltation or unnecessary destruction of riverbank vegetation in the area,
(e) affect the water table on any adjoining land,
(f) adversely affect riverbank stability, or
(g) create a hazard to life or property in time of flood.

The concept plan proposal addresses the above issues (see *Drainage and Stormwater Management*).

Clause 24: Services

Clause 24 of the BLEP 1988 relates to the provision of services. Clauses of relevance to the subject application state as follows:

24 Services
……
(3) A person shall not carry out development on any land to which this plan applies unless arrangements satisfactory to the Water Board have been made with the Board for the provision of water services to the land.
(4) A person shall not carry out development on any land to which this plan applies unless arrangements satisfactory to:
(a) in the case of land within Zone No 1 (a) or 1 (b), the council, or
(b) in the case of all other land, the Water Board, have been made for the provision of sewerage services to that land.

The concept plan proposal addresses the above issues (see *Utilities Infrastructure).*

Clause 25: Tree Preservation

Clause 25 of the Blacktown LEP 1988 relates to tree preservation and states as follows:

25 Tree preservation
(1) A person shall not ringbark, cut down, lop, top, remove, injure or wilfully destroy any tree, or cause any tree to be ringbarked, cut down, topped, lopped, removed, injured or wilfully destroyed; except with the consent of the council.
……..

The concept plan proposal will result in the removal of some existing trees and this is detailed in the proposal for which consent is sought, (see *Natural Resources*).

Clause 34: Bulky Goods Retail

Clause 34 of the Blacktown LEP 1988 relates to bulky goods retail and states as follows:

Bulky goods retail establishments
34. The Council may consent to development for the purposes of a bulky goods retail establishment within Zones Nos. 3(b) and 4(c) only if:
(a) the proposed development will not have an adverse impact on the viability of business centres; and

(b) the gross floor area of the part of the premises used for the sale, storage or display of a type of good listed in the first column of the table to this clause is not less than the minimum floor area shown in relation to that type of good in the second column of the table.	
Permitted Retail Uses	***Minimum Floor Area (m²)***
Furniture	*500*
Electrical goods	*500*
Outdoor products	*500*
Office supplies	*500*
Automotive parts/accessories	*500*
Kit homes	*500*
Floor coverings	*250*
Lighting	*250*
Antiques/secondhand goods	*250*
Kitchen/bathroom showrooms	*150*
Tiles (floors, ceiling or walls)	*150*

Generally bulky goods use is not contemplated for this employment area although Blacktown Council has expressed a desire for Automotive parts/accessories as part of a potential *"Automobile related area".*

(ii) DRAFT LEP TEMPLATE / (FUTURE) BLACKTOWN COMPREHENSIVE LEP

The zoning provisions will ultimately end up in the Blacktown Comprehensive LEP which will be completed in the coming years. To ensure consistency with the LEP in the future, template zonings have been considered in relation to current permitted uses.

Because of the site's location adjoining the Eastern Creek motor racing precinct and in response to Blacktown Council's request for "automobile uses" within the area, it is proposed that additional automobile-related uses (without repair style shops / panel beaters, spray painters and the like) will be specified and included as permissible uses within the site.

The three potential Industrial zoning references from the Draft LEP are:

1. Zone B7 Business Park
2. Zone IN1 General Industrial, and
3. Zone IN2 Light Industrial.

The other potential industrial Zone is the IN3 Heavy Industrial. This is not considered appropriate for the subject site as it relates to heavy, hazardous and offensive industry – none of which would be considered appropriate adjoining the Western Sydney Parklands.

To provide the greatest degree of flexibility in the provision of employment-generating uses, the IN1 General Industrial Use is proposed for the future zoning. The objectives and table of uses associated with the Zone IN1 General Industrial, state as follows:

(2) Zone IN1 General Industrial

Direction. The following must be included as either 'Permitted without consent' or 'Permitted with consent' for this zone:
Roads

1 Objectives of zone
• To provide a wide range of industrial and warehouse land uses.
• To encourage employment opportunities.
• To minimise any adverse effect of industry on other land uses.
2 Permitted without consent
3 Permitted with consent
Depots; Freight transport facilities; Light industries; Neighbourhood shops; Standard industries; Warehouse or distribution centres
4 Prohibited

The definitions of *"standard industry"* as well as *"light industry"* and *"warehouse or Distribution centres"* within the IN1 General Industrial Zone are included below.

standard industry *means an industry not being a heavy, light, offensive, hazardous or extractive industry or a mine.*

light industry *means an industry, not being a hazardous or offensive industry or involving use of a hazardous or offensive storage establishment, in which the processes carried on, the transportation involved or the machinery or materials used do not interfere with the amenity of the neighbourhood by reason of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil, or otherwise.*

warehouse or distribution centre *means a building or place used mainly or exclusively for storing or handling items (whether goods or materials) pending their sale, but from which no retail sales are made.*

Definitions from ***Standard Instrument (Local Environmental Plans) Order 2006***

(iii) BLACKTOWN DCP 1992 (NOW PARTLY SUPERCEDED BY DCP 2006)

At the time of writing, most of BDCP 1992 has been superseded by BDCP 2006. The relevant sections within Parts A, E and H of BDCP 2006 are summarised in the Compliance Table below. However, *Part H* of the Blacktown DCP 2006 which relates specifically to Huntingwood Industrial Zone was not publicly available at the time of writing. Part H of the Blacktown DCP 1992 is currently still applicable.

Compliance Table: Relevant EPIs and Guidelines (Blacktown LEP and DCP)

Relevant EPIs, Guidelines	***Compliance or nature and extent of non-compliance***	***Comment***
(i) Blacktown Local Environmental Plan 1988		
Clause 2: (LEP)Objectives	√ *complies* *(d) to enable a variety of uses in industrial areas while protecting the viability of existing retail centres.*	Complies also with (e) which prohibits offensive/hazardous industries and (i) which seeks to protect environmental heritage.
Clause 9: Objectives and development control table – ZONE No. 4 (d) (HUNTINGWOOD	√ *complies* The proposed Huntingwood West Employment Area has been designed to allow for new light industrial development of a high standard which	See Draft DDC Section 4 Subdivision design and built form controls See Draft DDC Section 4.6 Built form controls

INDUSTRIAL ZONE)	incorporates best practice environmental management techniques (objective b). The Concept Proposal will also prove an area for modern forms of light industrial, warehousing, manufacturing, research and like development (objective c).	
Clause 10, - Subdivision	√ *complies* The proposed subdivision area is expected to be within the rezoned area identified within the Western Sydney Employment Hub.	
Clause 14 and 16A – Protection of Heritage Items	√ complies See Godden Mackay Logan (GML) Report and Jo McDonald Cultural Heritage Management Pty Ltd Report.	See Draft DDC Section 4.5.1 Heritage
Clause 19 and 20 - drainage & land affected by the 1% annual accedence probability flood.	√ *complies* land will be filled to a level satisfactory to Council. Comprehensive flood assessment and modelling undertaken.	
Clause 24 - the provision of services	√ *complies* Arrangements will be made to the satisfaction of Sydney Water re provision of sewerage services	
Clause 25 - tree preservation	√ *complies* Removal of trees subject to consent of Council. Comprehensive landscaping plan forms part of the concept plan together with "offsets" within the adjoining Parklands	See Draft DDC Section 3.3 Conservation of natural values
Clause 34 - bulky goods retail	√ *complies* Generally bulky goods use is not contemplated for this employment area although Blacktown Council has expressed a desire for Automotive parts/accessories as part of a potential "Automobile related area".	Permissible in 4(c) zone. "Automobile related area" is suggested as an additional permitted land use (to be appropriately defined).
(ii) Draft LEP Template / (Future) Blacktown Comprehensive LEP		
The zoning provisions of the proposed development will ultimately end up in the Blacktown Comprehensive LEP which will be completed in the coming years. To ensure consistency with the LEP in the future, template zonings have been considered in relation to current permitted uses. (Suggested motor showroom type uses without repair style shops being permissible.)		To provide the greatest degree of flexibility in the provision of employment-generating uses, the ***IN1 General Industrial Use*** is proposed for the future zoning of the subject site.
(iii) Blacktown DCP 1992 (now superceded in part by Blacktown DCP 2006) (Relevant topics where applicable have been included in the *Draft DCP for Huntingwood West* which is included as **Appendix A** of this EA.)		
Part A: Blacktown DCP – *Relevant sections*	***Compliance or nature and extent of non-compliance***	Comment and reference to relevant section of *Draft DDC for Huntingwood West*
Part A is applicable to all DAs and provides overall guidance on the operation of Blacktown LEP 1988 and Blacktown DCP 2006, the submission of DAs and the general requirements of Council.		
3. Environmental Protection		
3.2 Areas requiring fill	√ *complies* The fill limits and areas shown on the DCP map are indicative only. Final fill areas will be determined by detailed designs, survey information, development proposed and adjoining constraints. Appropriate details provided.	See Section 4.5.4 Soils Management (Land filling controls)
3.3 Soil Conservation	√ *complies* Development proposal will incorporate soil conservation measures to minimise soil erosion	See Section 4.5.4 Soils management

	and siltation during construction and following completion of development.	
3.4 Tree Preservation	√ *complies* Existing trees will be preserved wherever possible. The siting and layout of the development at this initial concept stage has considered the location of trees.	See Section 3.3 Conservation of natural values See Section 4.1.3 Asset protection zones See Section 4.3 Open space and public domain See Section 3.3 Tree retention
3.5 Cultural Heritage	√ *complies* Schedule 2 of Blacktown LEP 1988 does not include anything within the site as certain buildings or works which are defined as "items of the environmental heritage" Areas of high archaeological significance are located along the Eastern Creek Corridor to the west of the subject site.	See Section 4.5.1 and 4.5.2 Heritage
4. Roads		
4.2: Road Hierarchy and Road Widths	The proposal is generally in accord with Council's road hierarchy.	See Section 3.4.1 Road hierarchy See Section 4.2 Access and movement
5. Car Parking	√ *complies* (see Cl 4.8 in DCP part E below)	
7. Special Considerations		
7.4 Drainage	√ *complies* On-site stormwater detention will be provided as the proposed development site is within the Upper Parramatta River catchment. The on-site detention system will be designed in accordance with the standards identified by the Upper Parramatta River Catchment Trust in its publication *"Catchment On-site Stormwater Detention (OSD) Policy*".	See Section 3.5 Landscape and drainage network
7.5 Crime Prevention Through Environmental Design	√ *complies* The Subdivision has been designed in such a manner that allows for natural surveillance from private areas into public and recreational spaces. Natural surveillance is promoted.	
8. Development on Flood Prone Land	√ *complies* It is noted that floor levels other than habitable floor levels shall be determined by Council on the basis of each individual case and that for industrial and commercial buildings the floor level will be at least 300mm above the designated flood level.	See Section 4.5.3 Water cycle management (Land filling controls)
9. Contributions	√ *complies* It is noted that Council has identified that development within certain areas of the City of Blacktown will, or is likely to, require the provision of or increase the demand for public amenities and public services such as trunk drainage, roads, open space, community facilities and car parking.	
Part E: Blacktown DCP – Development in the Industrial Zones- *Relevant sections*	***Compliance or nature and extent of non-compliance***	Comment and reference to relevant section of *Draft DDC for Huntingwood West* of this EA.)
2.1: Retailing in the 4(a), 4(b), and 4(c) zones	√ *complies* The proposal is in accord with the 3 categories of retailing allowable by Council and the specific requirements adopted by Council in relation to such proposals.	See Section 4.6.4 Daily convenience shops
2.2: Commercial	√ *complies*	

Premises in the 4(a), 4(b), and 4(c) zones	The proposal is in accord with the specific requirements adopted by Council in relation to such proposals.	
3.1: Allotment Sizes and Dimensions	√ *complies with Huntingwood "sizes" and (all other areas)* minimum width = 50m (35m) minimum area = 4000m² (1,500m²)	See Section 4 Subdivision design and built form controls Section 4.1.2: a) Lots are to have a minimum land area of 4,000m² b) Lots are to have a minimum width at the building line of 50m.
4.1: Drainage	√ *complies* Efficient disposal of stormwater described. As the site has a slope which falls away from the fronting street (Brabham Drive), information is provided which establishes the agreement of all relevant downstream property owners (i.e. The Parklands / DoP).	See Section 3.5 Landscape and drainage network See Section 4.1.4 Drainage corridors See Section 4.5.2 Water cycle management (Land filling controls)
4.2: Setbacks	√ *generally complies or exceeds min setback* (a) 20m of the street alignment of a road zoned 5(b) (Gt Western Highway / M4); (b) 10m of the street alignment of a road zoned 5(c) or an industrial collector road, (Huntingwood Drive). (NOTE: a 9m setback is proposed from the collector road within the DDC – page 26) (c) 7.5m of the street alignment of any other road.	See Section 4.1.1 Subdivision layout - f) 40m wide vegetation buffer is to be provided to the M4 g) 25m landscaped setback is to be provided to the Great Western Highway and Brabham Drive. See Section 4.6.3 Setback controls a) Buildings are to setback by: - 25m from Great Western Highway and Brabham Drive - 9m from the collector road and park edge road alignments, and - 7.5m from the alignment of other roads.
4.3: Landscaping	√ *complies* Landscaping proposals should generally be in accordance with the following requirements: (a) every effort to preserve existing trees, (b) all setback / car parking areas to be landscaped and maintained, (c) all landscaped areas are to be separated from vehicular areas (d) earth mounding is encouraged (e) trees to have a minimum height of 1m at the time of planting; (f) landscaping to harmonise with buildings & (g) native species should be used.	See Section 3.5 Landscape and drainage network See Section 4.3 Open space and public domain See Section 3.3 Conservation of Natural Values See Section 3.5 Landscaping
4.5 Building Design and Construction	√ *complies* To complement landscaping and ensure a high standard of visual and environmental quality, it is noted that Council encourages high aesthetic standards for building designs.	See Section 4 Subdivision design and built form controls
4.6: Open Storage Areas	√ *complies* Open storage areas are to be effectively screened and sealed in a dust-free manner. Such areas are to be located preferably behind buildings. No storage should occur above the height of proposed screening.	See Section 4.6.11 External industrial activities – to mitigate the environmental and visual impact of external processing and storage of materials.
4.7: Vehicular Access and Circulation	√ *complies* Vehicular access and circulation for Council's approval and to specifically relate to vehicular movement, layout and turning circles. All internal two-way roadways are to have a minimum width of 7m. Developments are to comply with the requirements of the RTA in relation to the number, location and design of vehicular entry and exit points and/or	See Section 4.2 Access and movement

	certain road construction works.	
4.8: Car Parking	√ *complies* The car parking standards relevant to development within the 4(a), 4(b) and 4(c) industrial zones are provided in BCC DCP Table 4.1	See Section 4.6.5 Parking • Factory 1 space/75sqm GFA • Warehouse/bulk storage 1 space/200sqm GFA • Commercial/office component 1 space/40sqm GFA
5.1: Services	√ *complies* Water/Sewerage – Sydney Water Electricity – Integral Energy Telephones – Telstra Gas - Relevant supplier	See Section 4.4 Site services
5.2: Pollution Control	√ *complies* Air, Water, Noise Pollution - DEC	See Section 4.5.3 Water cycle management See Section 4.5.4 Soils management See Section 4.5.5 Salinity
Part H: Blacktown DCP – *(Huntingwood Industrial Estate)*	***Compliance or nature and extent of non-compliance***	Comment and reference to relevant section of *Draft DDC for Huntingwood West* .
The 4(d) Huntingwood Industrial zone is intended for high standard light industrial developments and large scale office activities which, due to their size and nature are not suited to the city's commercial zones. Part H (Huntingwood Industrial Estate) of Blacktown Development Control Plan (DCP) 1992 relates specifically to land within this zone.		

APPENDIX C
HUNTINGWOOD WEST TRANSPORT MANAGEMENT AND ACCESSIBILITY PLAN

APPENDIX C

Huntingwood West Transport Management and Accessibility Plan



Huntingwood West
Transport Management and Accessibility Plan

Bungarribee Precinct, Western Sydney Parklands

Landcom

15 September 2006

MAUNSELL | AECOM

Transport Management and Accessibility Plan

Prepared for

Landcom

Prepared by

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			Name/Position	Signature
A	13/07/2006	Draft Report	Sigrid Sanderson Manager, Planning & Advisory	Original signed
B	18/07/2006	Draft Report	Sigrid Sanderson Associate Director, Planning & Advisory	Original signed
C	29/08/2006	Final Report	Sigrid Sanderson Associate Director, Planning & Advisory	Original signed
D	15/09/2006	Final Report – minor edits	Sigrid Sanderson Associate Director, Planning & Advisory	15/9/06

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Executive Summary

Maunsell has been commissioned by Landcom to prepare a Transport Management and Accessibility Plan (TMAP) for the Huntingwood West site. The Huntingwood West site falls within the Bungarribee Precinct Project for the Western Sydney Parklands development.

This report forms the second phase of the masterplanning process and follows earlier work undertaken by Maunsell to establish the existing position of the site and current traffic conditions in the area.

The site identified for development is currently mostly vacant land located between the Great Western Highway and the M4 motorway. There are a small number of dwellings on the site, inhabited by short lease tenants.

It is intended that this TMAP will form one of the supporting documents for a Masterplan being prepared by Architectus on behalf of Landcom. The TMAP will:

- Define the transport impacts stemming from development of the site; and
- Develop a package of measures that will assist in meeting the performance measures.

The recommendations of this study are reflected in the package of measures developed for the site which include:

- Provision of a vehicular site access at Brabham Drive/ Huntingwood Drive;
- Provision of a vehicular site access from the Great Western Highway to the west of Rudders Lane (including closure of Rudders Lane);
- Diversion of existing and/ or future bus services to call at the site;
- Provision of connections to the existing and proposed cycle network; and
- Workplace travel plans to promote sustainable travel.

1.0 Introduction

1.1 Study Purpose

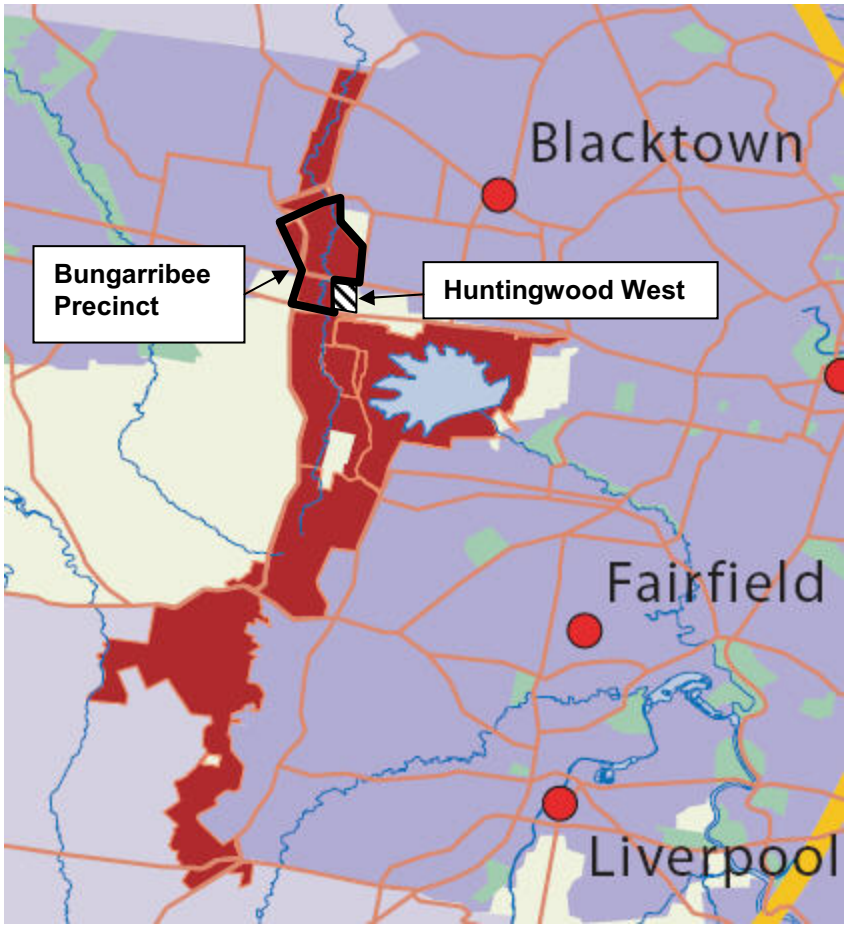
Maunsell has been commissioned by Landcom to prepare a Transport Management and Accessibility Plan (TMAP) for the Huntingwood West site adjacent to the Bungarribee Precinct within the Western Sydney Parklands.

This report has been prepared in accordance with guidelines for TMAPs to support a Part 3a application to the Department of Planning for rezoning of the site for commercial uses. This study builds on the Phase 1 analysis completed by Maunsell In January 2006, determining traffic issues that require consideration throughout the rezoning and master planning process and proposing appropriate mitigation measures for identified issues.

1.2 Background

Figure 1.1 illustrates the location of the Huntingwood West site in relation to the Bungarribee Precinct and the Western Sydney Parklands as a whole.

Figure 1.1: Location of the Site in Relation to Western Sydney Parklands



Source: DIPNR, 2004

Phase 1 of the study determined that the majority of the existing transport network performs at an acceptable level of service, with the exception of the Doonside Road / Great Western Highway

intersection. Over the next 15 years it is expected that the region surrounding the study area will experience significant growth, resulting in increased transport demands. This would have a considerable impact on the performance of the existing road network.

Key recommendations identified in Phase 1 of the study, include:

- Further investigations to be undertaken to identify mitigation measures for the intersections that are forecast to experience reduced levels of service in the future. Consultation should be undertaken with the NSW Government to confirm proposals for such intersection improvements;
- Access arrangements should be confirmed with the assistance of other team members to minimise conflicts with flora, fauna and / or heritage constraints;
- The Ministry of Transport should be consulted as the sites are planned;
- Opportunities to integrate the sites with adjacent cycle routes and pedestrian paths should be investigated and confirmed with relevant planning authorities;
- The constraints analysis will help to confirm the site yields, which will affect the traffic generation of the sites. Further traffic advice should also be provided into the site planning/master planning processes to ensure a high quality outcome; and
- Workplace travel planning principles should be considered for the Huntingwood West development.

Tasks undertaken in the preparation of this TMAP have addressed each of these recommendations.

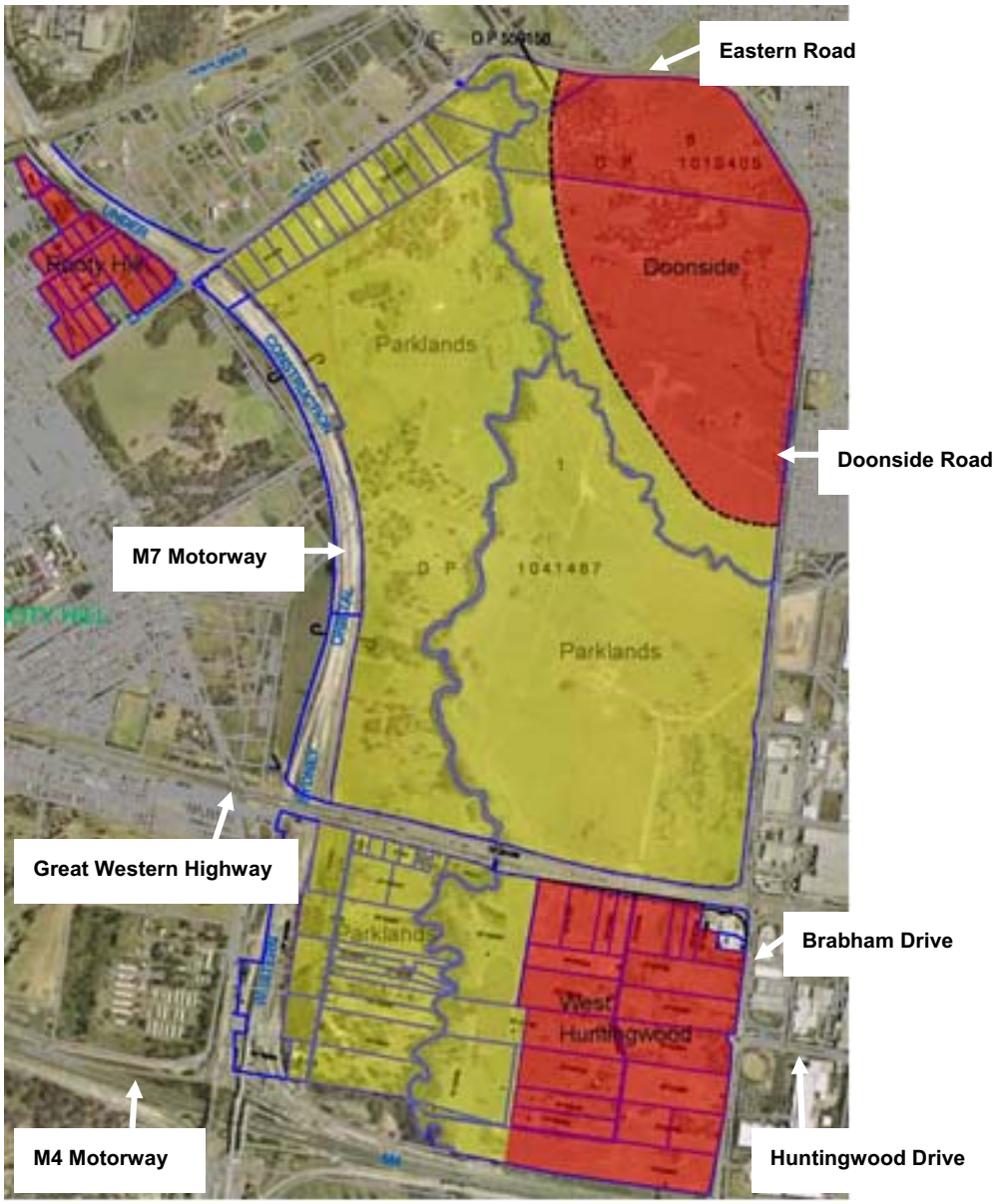
1.3 The Study Area

Figure 1.2 illustrates the position of the Bungarribee Precinct development sites relative to the surrounding transport network. The precinct is located in Blacktown LGA.

The Doonside residential site is to the north east of the precinct, bordered by Doonside Road and Eastern Road. Doonside rail station is the nearest heavy rail station and is approximately 1 kilometre walk distance from the centre of the site.

The Huntingwood West industrial site is to the south east of the site and is bordered by the Great Western Highway, the M4 Motorway and Brabham Drive. The site is in close proximity to the East Huntingwood industrial area which is located on the east side of Brabham Drive. The site is approximately 3.5 kilometres walk distance from Doonside rail station or approximately four kilometres from Rooty Hill rail station.

Figure 1.2: Location of the Site in Relation to the Local Transport Network



Source: Maunsell 2006

1.4 TMAP Process

This report forms the second stage of the TMAP process and is one of a series of supporting specialist studies being undertaken to support the development of a Development Control Plan.

The framework for TMAPs is defined as having six stages:

a) Project Context – outline the strategic context, set objectives and targets / performance criteria (**Sections 2 and 3**);

b) The Project – describe the site and proposed development (**Section 4**);

c) Initial Transport Assessment – outline technical assumptions and assess existing travel patterns (**Section 5**);

d) Transport Assessment of Proposal – estimate travel demand and mode split (**Section 6**), capacity/policy implications, testing of options (**Section 7**);

e) TMAP and Agreement – confirmation of the package of measures (**Section 8**), costing and apportionment (**Section 9**); and

f) Review of TMAP and Agreement – this stage follows at time of development application and at an appropriate future date (usually in the order of two years). This stage is beyond the scope of this study.

2.0 Strategic Context

2.1 Introduction

The strategic context of the study area is governed by three frameworks, being:

a) State and Regional planning policies;
b) Local planning policies; and
c) The local transport context.

This section provides an overview of the main aspects of each these frameworks and its relevance to the study area. A discussion of the objectives of the TMAP and targets / performance criteria is also provided.

2.2 State and Regional Context

Metropolitan Strategy

The Metropolitan Strategy for Sydney was released by the NSW Government in December 2005. *City of Cities — A Plan for Sydney's Future* is a broad framework for delivering strong and sustainable growth and to secure Sydney's place in the global economy.

The Plan is a strategic document that outlines a vision for Sydney over the next 25 years; the challenges we face, and the directions we will follow to address these challenges and to achieve the vision. It is the start of a process to bring the State Government, local government, stakeholders and the community together to discuss, review and then make decisions to guide the future of Sydney's economy, environment and communities

City of Cities — A Plan for Sydney's Future supports continuing economic growth while balancing social and environmental impacts. It is based on anticipated population, economic and demographic trends. The Plan has been developed with five aims that have been identified to achieve a more sustainable city. These are:

Enhance Liveability – by ensuring a diverse choice of housing for an ageing and changing population, close to services, while protecting the character of our suburbs and communities.

Strengthen Economic Competitiveness – strengthening Sydney's long–term economic prosperity by increasing the city's and region's competitiveness in globalised markets, and sharing the benefits across the city.

Ensure Fairness – providing fair access to jobs, services and lifestyle opportunities by aligning services close to where people live, and by providing access to high quality transport.

Protect The Environment – protecting Sydney's unique environmental setting and reducing the city's use of natural resources and production of waste.

Improve Governance – improving the quality of planning and decision making, and giving the community confidence in its institutions.

The Strategy includes priorities for planning and responsibilities of each level of Government, including investment priorities and a context for decision-making by Local Government and the private sector. The Strategy is not a single policy document, but rather a dynamic action strategy based on a series of key directions – including the announced Land Releases in North West and South West Sydney, Centres Renewal, Key Corridor Revitalisation Plans (Parramatta Road, Sydney Airport – CBD), Metropolitan Water Plan, Rail Clearways and Bus Reform.

Funding is integral to the planning of the new metropolitan strategy. The Government is committed to identifying innovative sources of funding to pay for the infrastructure required to support the growth of the region. The funding and apportionment of the package of measures identified through this TMAP process is discussed in more detail in **Section 9**.

The systematic release of land in the South West and North West growth centres aims to increase the quality of the growth areas by encouraging a mix of land uses and hence improving the accessibility of residents to amenities and employment. This in turn would contribute to achieving ecologically sustainable development (ESD) objectives.

The proposed planning for these release areas proposes to provide:

- Improved public transport, including frequent buses linking with the rail system. Proposals in the North West sector include the duplication of the Richmond railway line to Schofields, which will commence in the first five years of the release of the Metropolitan Strategy;
- A range of land uses to provide the right mix of houses, jobs, open and recreational space and green spaces;
- Easy access to major town centres with a full range of shops, recreational facilities and services along with smaller village centres and neighbourhood shops;
- Employment opportunities available locally and within the region, reducing the demand for transport services into the Sydney CBD and reducing travel times;
- Streets and suburbs, which are planned so that residents can walk to shops for their daily needs;
- A wide range of housing choices to provide for varying needs and incomes. Single residential dwellings on their own block of land will be provided as well as smaller, lower maintenance homes, units and terraces for older people and young singles or couples; and
- Conservation land in and around the development sites will help to protect the region's biodiversity and provide clean air for Western Sydney.

Rail Clearways Plan

The Rail Clearways Plan is a NSW Government initiative to improve the reliability of the CityRail network. The program of works to separate Sydney rail routes into five clearways will be completed by 2010 at an estimated cost of one billion dollars. By removing the congestion in the network that causes delays, CityRail will be able to operate more reliable and frequent services with reduced passenger crowding, with the capacity to increase services as demand grows into the future.

As mentioned within the Metropolitan Strategy summary, a specific project that may benefit passengers travelling on the Western Line and catching a train from Blacktown, Doonside or Rooty Hill is the Quakers Hill to Schofields duplication. The Western Line Richmond branch is a single track route and therefore suffers congestion. A double track will be constructed by 2010 to improve reliability and reducing passenger crowding.

Action for Bikes

Action for Bikes 2010 was released in September 1999 as an accompanying document to Action for Transport 2010. Action for Bikes seeks to increase levels of cycling in Sydney through a four step plan that includes improving the bike network, making it safer to cycle, improving personal and environmental health, and raising community awareness.

A key innovation of Action for Bikes is the development of rail trails, such as the Liverpool-Parramatta rail trail, by the RTA in co-operation with rail agencies.

Draft SEPP 66: Integrating Land Use and Transport

The release of a draft State Environmental Planning Policy (SEPP) on integrated land use and transport planning in 2001 is indicative of the Government's heightened focus on this issue. It is likely that increasing densities, providing public transport, walking and cycling infrastructure and developing travel demand management programs will be critical in the delivery of the Metropolitan Strategy.

The policy represents an integrated approach to urban management and transport planning and is particularly relevant to the future development of the Bungarribee Precinct. The package emphasises the importance of effectively integrating land use and transport planning in order to improve urban environments.

Review of Bus Services in New South Wales ('Unsworth' Review)

The stated objective of the Unsworth Review was "to examine, and make recommendations to improve, the provision of bus services in New South Wales."

The main outcomes of the Review were recommendations for changes to bus operations and licensing (bus reform), contract boundaries and a network of strategic corridors between Centres. The strategic routes will be 'fast, frequent, direct, convenient' links to regional centres. Bus priority measures are suggested to reach these goals but are subject to benefit / cost analysis.

Four routes were included to link Blacktown to other major centres as follows:

- 1 Penrith – Blacktown (northern route)
- 2 Penrith – Blacktown (southern route)
- 3 Blacktown – Castle Hill
- 4 Blacktown – Parramatta

Route 2 may pass the Huntingwood West site via Brabham Drive and Huntingwood Drive, although the final location of the strategic corridors will not be finalised until patronage modelling has been completed by the Ministry of Transport and consultation with Councils and the community has been undertaken. This is scheduled for 2007/8.

State Infrastructure Strategy

The State Infrastructure Strategy marks a new direction for the planning and delivery of infrastructure in the next 10 years for New South Wales's six broad regions — Sydney, the Central Coast, the Hunter, the Illawarra and the South East, the North Coast and Inland New South Wales.

In the 2006-07 financial year, the New South Wales Government will invest almost $10 billion in infrastructure, 32% of which will be transport related. Over the next four years it will increase the State's capital spend by 45 per cent over the previous four years. This record investment is about delivering infrastructure for New South Wales that sets it up to manage its projected population growth. The Strategy is explicitly designed to meet the growing demand for infrastructure, which will remain at very high levels over the next decade as the population grows.

The State Infrastructure Strategy also marks a new direction by linking the four year Budget cycle and the 25 year regional plans, including the Sydney Metropolitan Strategy. Furthermore, the integrated nature of this Strategy will allow the private sector, public sector agencies, local councils and the wider community to make decisions based on the NSW Government's priorities and timing for major infrastructure projects.

These infrastructure priorities illustrate the connections between infrastructure planning and long–term planning strategies, including:

- Sydney Metropolitan Strategy — City of Cities;
- A Plan for Sydney's Future;
- Metropolitan Water Plan 2006;
- North West and South West Growth Centres; and
- Draft Regional Strategies for the Far–North Coast, Lower Hunter and the South Coast.

2.3 Local Planning Context

Historical Development

The Western Sydney Parklands encompass the former Eastern Creek, Horsley Park and Hoxton Park open space / special uses corridors, identified in the Sydney Region Outline Plan (SROP) of 1968. The SROP predicted that the required amount of open space would triple by the end of the century, which led to a significant program to acquire 15,000 hectares of open space in Sydney.

In 1974 the boundaries of the Eastern Creek and Hoxton Park corridors were confirmed and controls on the lands in local planning schemes were introduced. The Department of Planning and its predecessors were given the responsibility to acquire the parklands, which would provide a physical break from surrounding development. The parklands were acquired for environmental protection and for major public utilities and special uses in Western Sydney.

By 1978 about 70 percent of the Western Sydney Parklands corridor was publicly owned. In 1989 the area around Eastern Creek was gazetted under State of Environmental Planning Policy (SEPP) No. 29 - Western Sydney Recreation Area, which led to the approval of Eastern Creek Raceway. A number of sporting facilities are located within the parklands, which were constructed for the 2000 Sydney Olympic Games, for the rowing, shooting, equestrian, baseball, softball and mountain biking events.

The Sydney Regional Environmental Plan (SREP) No. 31 was in produced in response to the sudden residential development encroaching on the boundaries of the parklands' corridor. SREP 31 considers issues associated with balancing and evaluating development within the parklands, providing the framework to balance the wide range of land use objectives.

SEPP 59 and the Major Projects SEPP

The Bungarribee Precinct of the Western Sydney Parklands is located adjacent to the Western Sydney Employment Hub. The hub was the subject of State Environmental Planning Policy 59 (SEPP 59) but is in the process of absorption to the Major Projects SEPP following an announcement by the Department of Planning in December 2005. The purpose of the Major Projects SEPP is to consolidate planning for growth in the areas adjacent to the M4 Motorway and M7 Motorway.

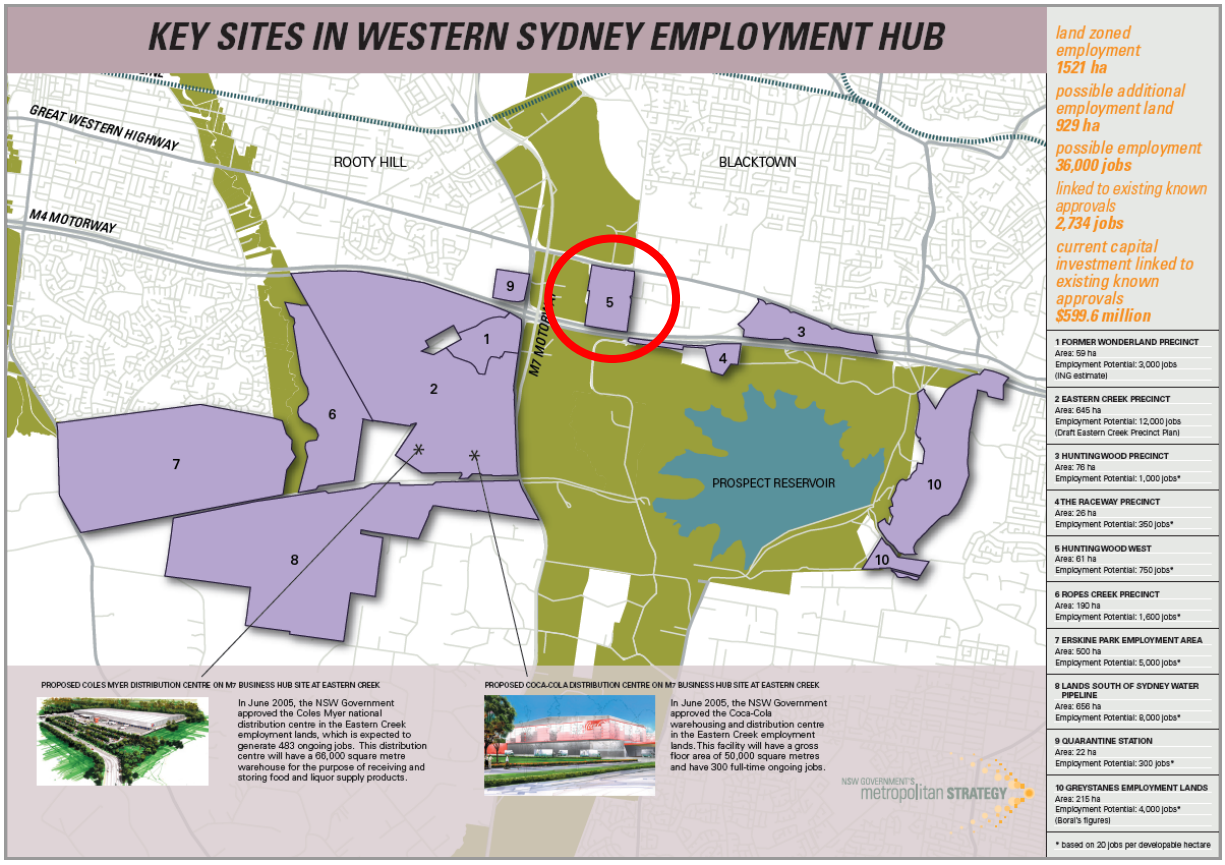
The Western Sydney Employment Hub will include 10 precincts of varying size as shown in **Figure 2.1**:

- 1: Former Wonderland Precinct (59ha, 3,000 jobs);
- 2: Eastern Creek Precinct (645ha, 12,000 jobs);
- 3: Huntingwood Precinct (76ha, 1,000 jobs);
- 4: The Raceway Precinct (26ha, 350 jobs);
- 5: Huntingwood West (61ha, 750 jobs);
- 6: Ropes Creek Precinct (190ha, 1,600 jobs);
- 7: Erskine Park Employment Area (500ha, 5,000 jobs);

- 8: Lands South of the Sydney Water Pipeline (656ha, 8,000 jobs);
- 9: Quarantine Station (22ha, 300 jobs); and
- 10: Greystanes Employment Lands (215ha, 4,000 jobs).

Precinct 5: Huntingwood West is the subject of this TMAP. Details of Precincts 3, 4 and 9 are included in this report at **Section 2.4** and **Section 7.2**.

Figure 2.1: Key Sites in Western Sydney Employment Hub



Source: NSW Department of Planning, 2005

State of the Environment

Blacktown Council has developed a State of Environment Plan, which is aimed to contribute Corporate Management Plans via a "Priority Action Table" summarising the major actions for Council.

Actions identified in the Priority Action Table that are relevant to this study include:

- Implementation of the *Eastern Creek Land Use and Employment Study*, which includes industry attraction and developing strategic partnerships with relocating industry;
- Inclusion of transport-related actions in Council's Blacktown Greenhouse Action Plan;
- Working with the Department of Planning to develop a regional plan for Western Sydney;
- Monitoring future development of the Blacktown LGA and align this development with the principles of Ecologically Sustainable Development (ESD);
- Working with the Western Sydney Regional Organisation of Councils (WSROC) to develop a Greater Western Sydney Regional Planning Framework;

- At Stage 1 of the development of an integrated transport plan, review component of Metropolitan Strategy that relates to public transport options such as cycle paths and pedestrian access with traditional transport modes;
- Continue to monitor the impact of construction of the Westlink M7 on the existing transport network and local communities; and
- Continue to monitor the impact of construction of the T-Way Network on the existing transport network and communities.

Local Land Release Areas

In December 2004, the State Government released an innovative plan, which outlines the future of land releases in the North West and South West of Sydney. For the North West Sector, the plan proposes 60,000 dwellings to be released over the next 25 to 30 years.

As a consequence of Bringelly and North West Sector release areas, the population surrounding the study area would increase by approximately 400,000 residents. The demographics of the projected population would comprise a large proportion of young people and children. Therefore there would be a growth in demand for recreational and sporting parklands facilities in the area.

2.4 Previous Planning

Eastern Creek Precinct Local Traffic Study – ARUP, July 2005

The Eastern Creek Precinct is identified in SEPP 59: Central Western Sydney Economic and Employment Area for the purpose of establishing new employment land to promote economic growth in the area. The precinct is split into the following stages of development.

- Lot 11: Approximately 58 hectares of land comprising the former Sydney Wonderland site.
- Stage 1: Approximately 28 hectares of land adjacent to Wallgrove Road and Wonderland Drive.
- Stage 2: Approximately 12 hectares of land located to the east of the Stage 1 and Lot 11 sites.
- Stage 3: Approximately 598 hectares of land bounded by the M4 Motorway to the north, Stages 1 and 2 to the east, the Sydney Water Supply Pipeline to the south (including Austral Bricks) and the subject site to the west.

Blacktown City Council commissioned consultants ARUP to undertake a traffic study for the Eastern Creek sites so that the impact of development of the entire precinct could be understood.

A traffic model was constructed to develop a road network that could manage the large volumes of traffic that will be generated by the site.

The Eastern Creek site is identified as Precincts 1 and 2 within **Figure 2.1**.

East Huntingwood Transport Management and Access Plan – SKM, October 2004

The Huntingwood Precinct is bordered by the Great Western Highway, the Western Motorway (M4), Brabham Drive and designated parklands to the east. This area is designated under SEPP 59.

A portion of the precinct (known as Huntingwood Estate) has already been developed as a light industrial area, with a significant proportion of distribution warehouses and some offices. The 76 hectare eastern portion of the precinct is still to be developed as an industrial area.

Consultants SKM developed a Traffic Management and Access Plan for the site and considered that it would likely generate 630 trips in the morning peak hour. The TMAP reports the results of a NETANAL

model which distributed traffic across the road network in the vicinity of the site. The model indicates that the majority of traffic from the site would be distributed to the regional road network via the M4 Motorway and to Blacktown City Centre via Reservoir Road, Flushcombe Road and the Prospect Highway. Minimal traffic is expected to travel in the vicinity of the Huntingwood West site.

The East Huntingwood site is identified as Precinct 3 within **Figure 2.1**.

Erskine Park Employment Area DCP and Section 94 Plan

Erskine Park Employment Area covers a gross area of 540 hectares and a developable area of 276 hectares. Erskine Park Employment Area is bounded by Erskine Park residential area and transmission lines to the north, Ropes Creek to the east, the Water Supply Pipeline to the south and Mamre Road to the west.

It is anticipated that an ultimate employment target of between 6,000 to 8,000 jobs will be met when the area is fully developed between 2016 and 2021. The Development Control Plan and Section 94 Contributions Plan for Erskine Park came into force on 3 January 2003. In 2003, Council approved the first development applications on the estate including subdivision, road access construction and the first industrial building.

Erskine Park Employment Area is zoned for employment generating development located with easy access to the M4 Motorway and M7 Motorway. Planning of the site has also made provision for an arterial link through the estate linking the estate to SEPP 59 lands and to the proposed Westlink M7. The strategy for the provision of the proposed link road is referred to as the 'Lenore Road Link'.

Other committed developments in the vicinity of the Huntingwood West site have not yet completed traffic and transport studies, such as the Investa development near the Raceway.

The Erskine Park site is identified as Precinct 8 within **Figure 2.1**.

3.0 The TMAP

3.1 TMAP Objectives

There are no set performance measures that need to be achieved through the TMAP process. However, to date TMAPs have tended to include a mode shift target because, despite the limitations of this indicator, it is able to be monitored through the five yearly census data. In line with NSW Government policy, the objectives of the TMAP include:

- Providing an integrated transport network between modes and land uses;
- Providing a choice of travel mode by developing a comprehensively accessible transport network;
- Providing a safe and secure transport network;
- Providing a system that is efficient and equitable;
- Providing a system that is sustainable;
- Supporting the local economy; and
- Providing a healthy environment.

The TMAP objectives are compatible with Landcom's Sustainability Policy, which aims to:

- Deliver sustainable quality of life
- Conserve resources
- Protect biodiversity; and
- Minimise pollution.

The TMAP objectives are consistent with the wider planning context, for example, the Metropolitan Strategy, which does not set any travel targets but does support reduced car travel.

Consideration of the following factors in peoples' travel choice is crucial to successfully reaching these objectives:

- The availability of alternative modes;
- The competitiveness of public transport against private car travel;
- Local accessibility to non-car modes;
- Quality of the pedestrian environment; and
- The availability of parking.

3.2 Targets / Performance Criteria

To monitor the success in reaching the TMAP objectives, suitable performance indicators and targets must be formulated. Suitable performance indicators may include service delivery, local accessibility and competitiveness of public transport. Targets for these indicators would assist in meeting the recommendations of Government policy, but that some form of mode shift target should also be established together with a recommendation of suitable intersection performance.

Service Delivery

In July 2004, the Ministry of Transport replaced the 1991 Minimum Service Level (MSL) requirements with Service Planning Guidelines. The July 2004 guidelines have been updated and were re-released in June 2006. They will be subject to further ongoing periodic reviews.

The Service Planning Guidelines reflect the NSW Government focus on delivering an integrated network of bus services that utilise strategic corridors. The guidelines are also intended to enable greater flexibility for operators to target resources at existing and potential demand, and allow the

provision of flexible 'demand responsive' routes and timetables for services in low demand area and at low demand times.

In terms of coverage, 90 percent of households should be within 400 metres of a bus route or rail station during commuter peaks and day times. During night-time periods 90 percent of households should be within 800 metres of a bus route or rail station. For the ten percent of households not serviced by regular route services or areas without sufficient patronage to sustain 60-minute frequencies, flexible alternatives may be considered. There are no guidelines for coverage for places of employment, however, it is reasonable to set the same target as for households.

Target: 90 per cent of businesses within 400 metres of a bus route

Local Accessibility

Local accessibility can defined as a permeable network. An appropriate target for local accessibility is to aim for 85 percent of residents to live within an actual 400-metre walk distance of a public transport stop, rather than a 400-metre 'crow-fly' distance. It is recognised that people are prepared to walk further than 400 metres to a public transport services, but that they tend to dislike walking as far as 400 metres from a public transport stop.

Target: 90 per cent of businesses within 400 metres of a bus route

Competitiveness of Public Transport

A review of the strategic modelling undertaken by Maunsell in support of the mode choice modelling in this study suggests that travel speeds for car journeys are likely to increase over the next ten years as congestion increases across the metropolitan area.

Target: Maintain bus journey times with priority measures

Mode Split Target

The existing mode split proportions of commercial areas surrounding the site are a fair indication of the likely travel characteristics if commercial land uses were developed with no additional transport infrastructure.

Although freight transport and trips by employees and visitors through the day are not represented, the journey to work mode split is a clear indicator from the Census that can be used to monitor progress towards a target of reducing car use.

Journeys to work will be a significant proportion of daily travel to the site and progress towards reducing demand on transport networks will benefit the movement of freight and other commercial needs.

Target: 10% mode shift from car (as driver).

Road Network Performance Targets

The capacity of an urban road network is controlled by the capacity of the intersections within that network. Average delay is commonly used to assess the actual performance of intersections, with Level of Service used as a simple index. A summary of the Level of Service index is shown in **Table 3.1**.

Table 3.1: Level of Service Criteria for Intersections

Level of Service	Average Delay / Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, RTA 1993

Level of Service D is accepted by the RTA as an absolute minimum design criteria. However, the RTA also use capacity constraint as a demand management technique. That is, additional capacity at intersections is not provided at certain intersections to dissuade drivers from that route.

Target: It is recommended that intersections in the range of influence around the precinct are ameliorated to the Level of Service prior to development, where the development decreases the Level of Service of D or below.

Freight Movements

A high proportion of heavy vehicles within general traffic volumes reduce capacity of the roads and intersections. Reducing the number of freight vehicles using the road network, reduces the freight vehicle kilometres and therefore fuel use and greenhouse emissions.

Target: Design site accesses and internal roads to accommodate B-doubles.

4.0 The Project

4.1 Overview

This section provides a brief description of the development proposal considered in this assessment.

Two sites have been identified as being suitable for development within the Bungarribee Precinct: Doonside, for residential uses and Huntingwood West, for commercial uses. The results of constraint studies have been consolidated by Architectus, the sites' masterplanners, resulting in the following approximate developable areas:

- Doonside - 55 hectares
- Huntingwood West - 56 hectares

This TMAP considers the commercial site at Huntingwood West. The Doonside residential site is considered as a committed development. The commercial site masterplan has been developed by Architectus as a concept plan without predetermining the actual commercial business types that may use the site. The development yield is not known and trip generation estimates in **Section 5** rely on the typical trip rates of 15 trips per developable hectare, suggested to be appropriate by Blacktown Council during consultation for this study.

The main access to the site is via the Brabham Drive roundabout. A secondary access is proposed from the Great Western Highway. **Figure 4.1** illustrates the concept plan 'Option 3 – Small Lots' devised by Architectus.

Figure 4.1: Huntingwood West Concept Plan

Source: Architectus 2006

At the detailed design stage, Austroads Turning Path Templates (2006) should be used to determine adequate swept paths for trucks that will serve the industrial site at Huntingwood West. A preliminary examination of the aerial photograph of Blacktown using the templates suggests that the existing Huntingwood estate has been designed to accommodate B-doubles and the Brabham Drive access roundabout will accommodate a B-double travelling between five and 15 kilometres per hour. The site is bordered by B-double permit routes.

5.0 Initial Transport Assessment

5.1 Introduction

This section provides a more thorough review of existing transport conditions in the study area. It considers the analysis undertaken by Maunsell in 2005 which has been updated to include post M7 opening conditions.

5.2 Walking

Pedestrian facilities within the study area are limited due to the rural nature of the area, however facilities are provided throughout the surrounding outer areas. The majority of roads bordering the Bungarribee Precinct have paved footpaths on at least one side of the roadway suitable for all users, including Eastern Road (shown in **Figure 5.1)**, Knox Road, Great Western Highway, Doonside Road, Rooty Hill Road and Bungarribee Road.

Figure 5.1: Existing pedestrian pathway in Doonside (Eastern Road looking west)

Source: Maunsell, 2005

In locations where a paved footpath has not been provided a clear and compacted grassed area is available for pedestrians to walk along in a reasonably safe manner as shown in **Figure 5.2.**

Figure 5.2: Non-paved pedestrian pathway (Brabham Drive)

Source: Maunsell, 2005

The signalised intersections surrounding the study area provide pedestrian crossing facilities on the majority of the junction legs enabling safe crossing of the roadway.

The three roundabouts located north of the Doonside (residential) release area at Eastern Road/Knox Road; Eastern Road/Doonside Road; and Doonside Road/Bungarribee Road have limited pedestrian crossing facilities, besides the median(s) provided at each of the junction legs. The limited provision of pedestrian crossing facilities in this area is of some concern in providing (and promoting) a safe walking environment between the proposed development areas and the existing surrounding facilities.

5.3 Cycling

As shown in **Figure 5.3** there are an increasing number of cycle facilities in the Blacktown area, with a recent 50/50 funding agreement with the RTA. Blacktown City Council commissioned a review of the 1994 bike plan for the City of Blacktown in 2002 to determine cyclists needs and priorities for action. The Department of Planning are involved with cycle route development in the area, with the planning of a recreational trail within the Western Sydney Parklands.

Cycle paths leading towards the study area include:

Regional Routes:

- M4 Motorway
- M7 Motorway

Existing Recreational Route

- Nurragingy Recreation Area

Long Term Recreational Routes

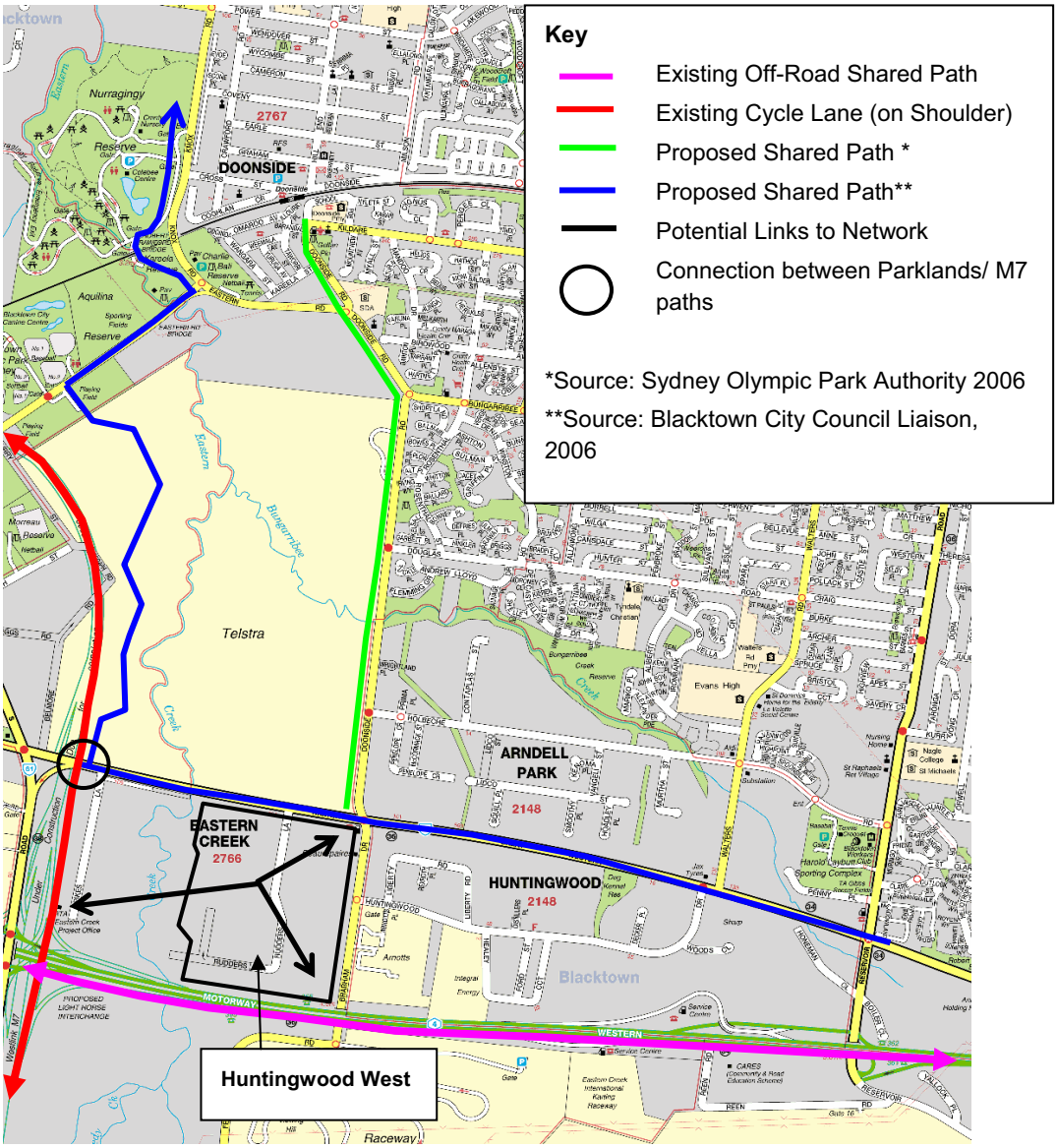
- Eastern Creek between Great Western Highway and Richmond Road. This route links to another cycle route which provides access to the Parklands north-east of Douglas/Doonside Road and Featherdale Wildlife Park.
- Western Sydney Parklands recreational trail

Other Proposed Routes

- Blacktown Council plans to implement a shared path running from Doonside rail station to the Huntingwood industrial areas.

The RTA has also developed a 10-year bicycle plan 'Action for Bikes – Bike Plan 2010, NSW[1]' to be completed in 2010. A proposed route that may provide a connection within the vicinity of the study area is the Penrith-CBD Rail Trail (proposed completion year 2010).

Figure 5.3: Cycleway Network



Source: Maunsell, 2006

[1] September 1999

Bike lockers are provided near the railway stations, similar to that shown in **Figure 5.4** at Doonside station. The number of lockers is limited, however their provision does promote and facilitate patrons who live within the area to cycle to the train station.

Figure 5.4: Bike lockers at Doonside Railway Station

Source: Maunsell, 2005

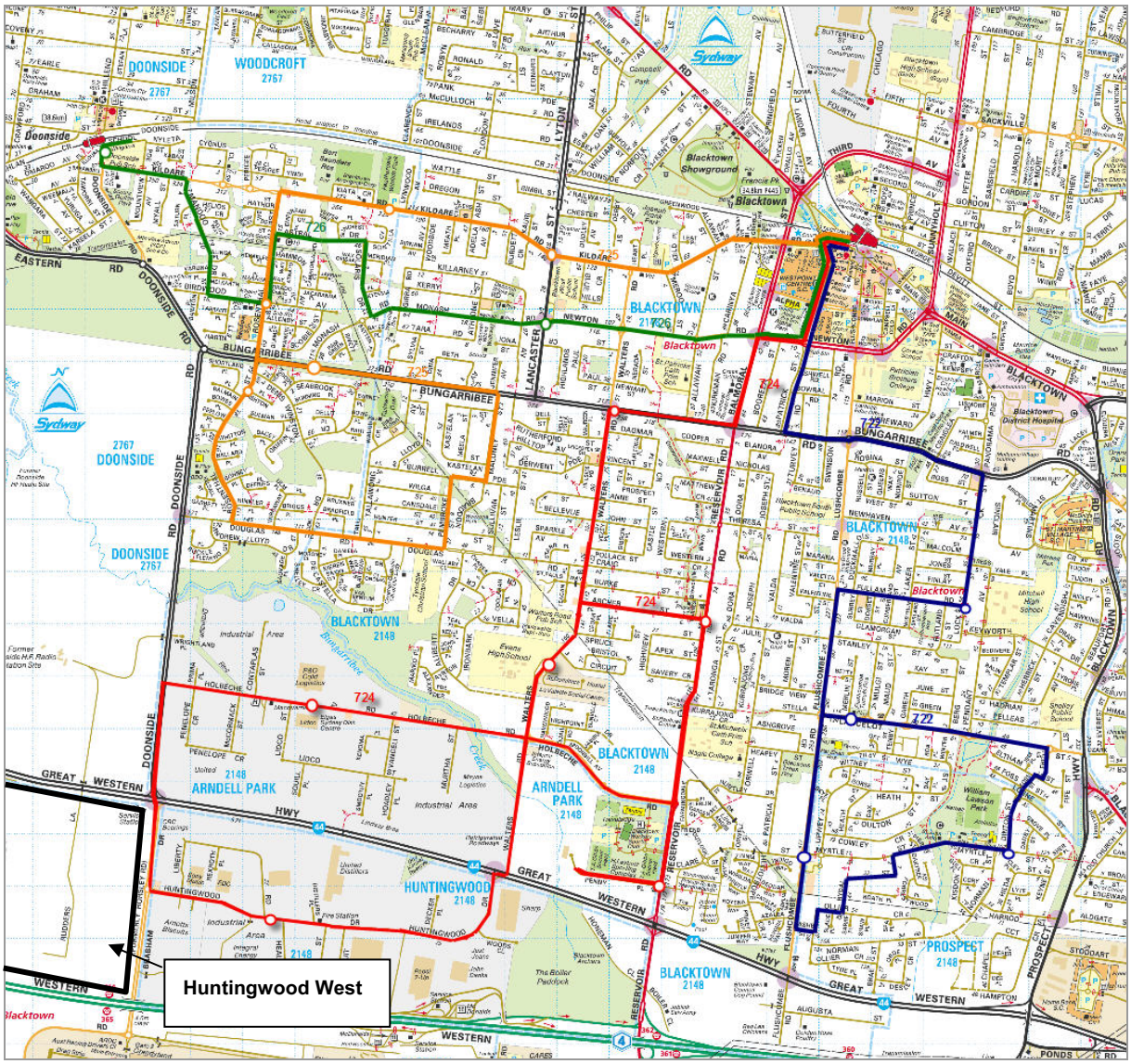
5.4 Bus Services

Bus services to the Bungarribee Precinct are currently limited to roads that either run along sections of the Parklands Boundary or the surrounding road network.

Buses form a very small proportion of travel within the surrounding study area at around 2% of total Journey to Work movements.[2] Services in the area are predominately provided by Busways. Several services are provided to the east of the study area within the Huntingwood and Blacktown suburbs as shown in **Figure 5.5** and to the west within the Rooty Hill suburb as shown in **Figure 5.6**.

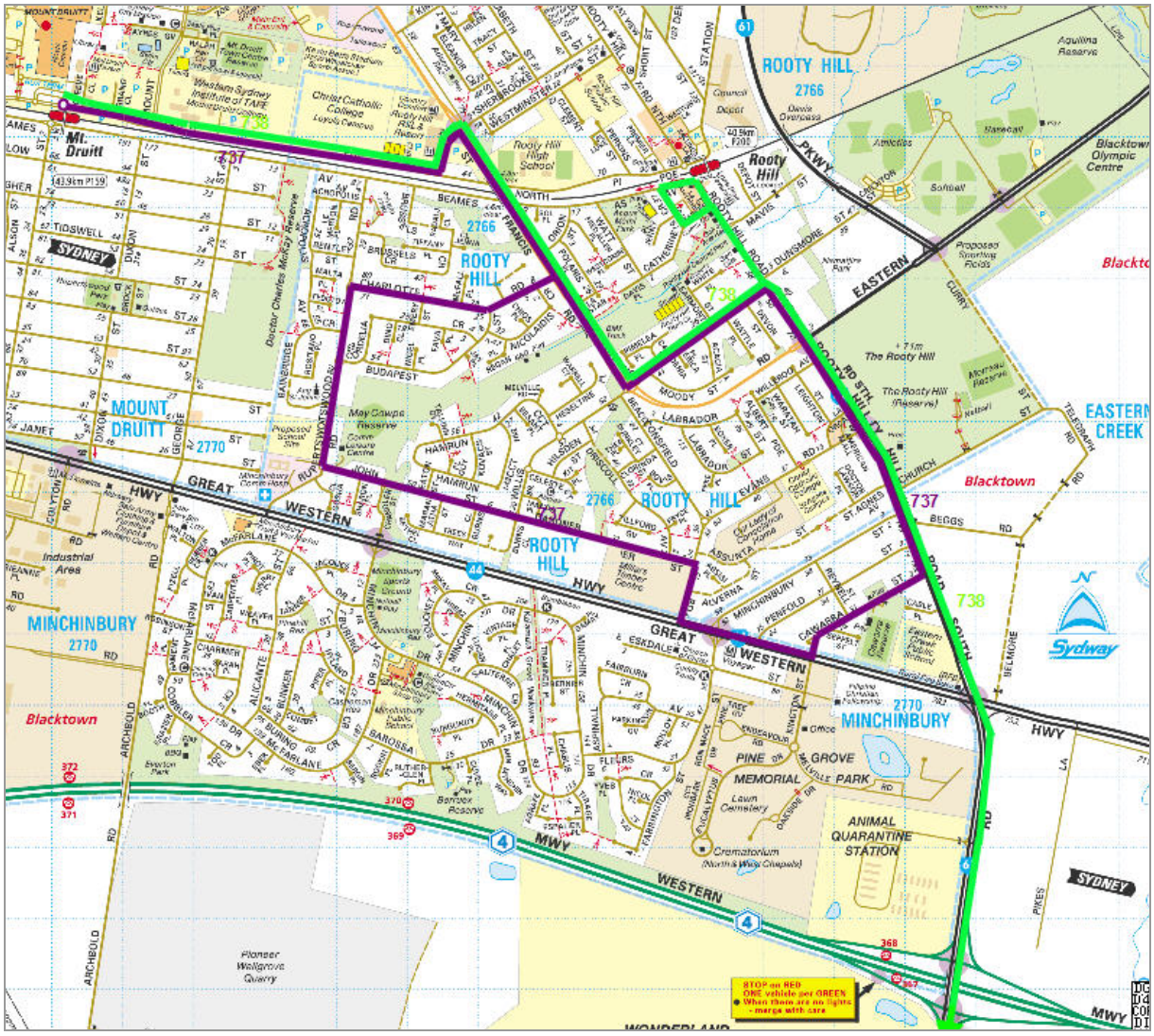
[2] 2001 Journey to Work Data, Blacktown South East and Blacktown South West SLA

Figure 5.5: Bus Routes east of the Study Area



Source: Maunsell, 2005 (from Busways, September 2005)

Figure 5.6: Bus Routes west of the study area



Source: Maunsell, 2005 (from Busways. September 2005)

Table 5.1 provides a summary of the bus services, including route and peak and off-peak frequency. Services terminating at stations are timed to meet respective train services. Weekend services are more limited. There are currently no bus priority measures along the road network surrounding the study area. Service 724, the closest route to the Huntingwood West site, is highlighted.

Table 5.1: Bus Routes Servicing Western Sydney Parklands

Number	Route	Weekday Peak Frequency	Weekday Off-Peak Frequency	Sat / Sun Pub. Hol. Frequency
722	Blacktown to Prospect	16	30	30
724	**Blacktown to Arndell Park**	**25 - 30**	**30**	**30**
725	Blacktown to Doonside (Douglas Road)	15	30	30
726	Blacktown to Doonside Station via Monash Road	30	60	60
737	Mt Druitt to Eastern Creek via Rooty Hill (loop)	30	30	60
738	Mt Druitt to Eastern Creek Industrial Park	Irregular Services		Nil

Source: Busways, April 2006

5.5 Rail Services

Rooty Hill and Doonside stations are located relatively close to the Huntingwood West site and although they may be beyond walking distance for some employees, they are well within typical cycle distances. Rooty Hill station is located approximately four kilometres north-west of the Huntingwood West site near the Rooty Hill Road/ Eastern Road intersection. Doonside station is located approximately 3.5 kilometres from the site near the Doonside Road/ Eastern Road intersection. Blacktown station is accessed via the 724 feeder bus service.

CityRail services to the study area are provided by the Western Line, which terminates at Emu Plains. A summary of currently timetabled CityRail services connecting Mount Druitt, Doonside and Blacktown stations to the city during the morning peak period is shown in **Table 5.2**, while the average frequency of rail service to each of these stations can be gauged from **Table 5.3**.

Table 5.2: AM Peak City-bound Rail Service Arrival Times (0700 to 0900 Hours)

→ Direction of Travel →			
Mount Druitt	**Doonside**	**Blacktown**	**Central**
7:01	7:07	7:12	7:53
7:13	-	7:21	7:56
7:27	-	7:35	8:11
7:12	7:18	7:23	8:14
7:31	7:37	7:43	8:23
7:44	-	7:52	8:26
7:53	-	8:01	8:41
7:42	7:48	7:53	8:44
8:02	8:08	8:13	8:56
8:14	-	8:22	9:00
8:11	8:17	8:23	9:14
8:33	8:39	8:44	9:26
8:42	8:48	8:53	9:44
9:16	9:22	9:28	10:13

Source: www.cityrail.info, April 2006

Table 5.3: Summary of AM Peak Period Rail Amenity

Station	Mount Druitt	Doonside	Blacktown	Central
Number of services 0700-0800	6.5	4	6.5	5.5
Average time between services	12 minutes	14 minutes	8 minutes	9 minutes

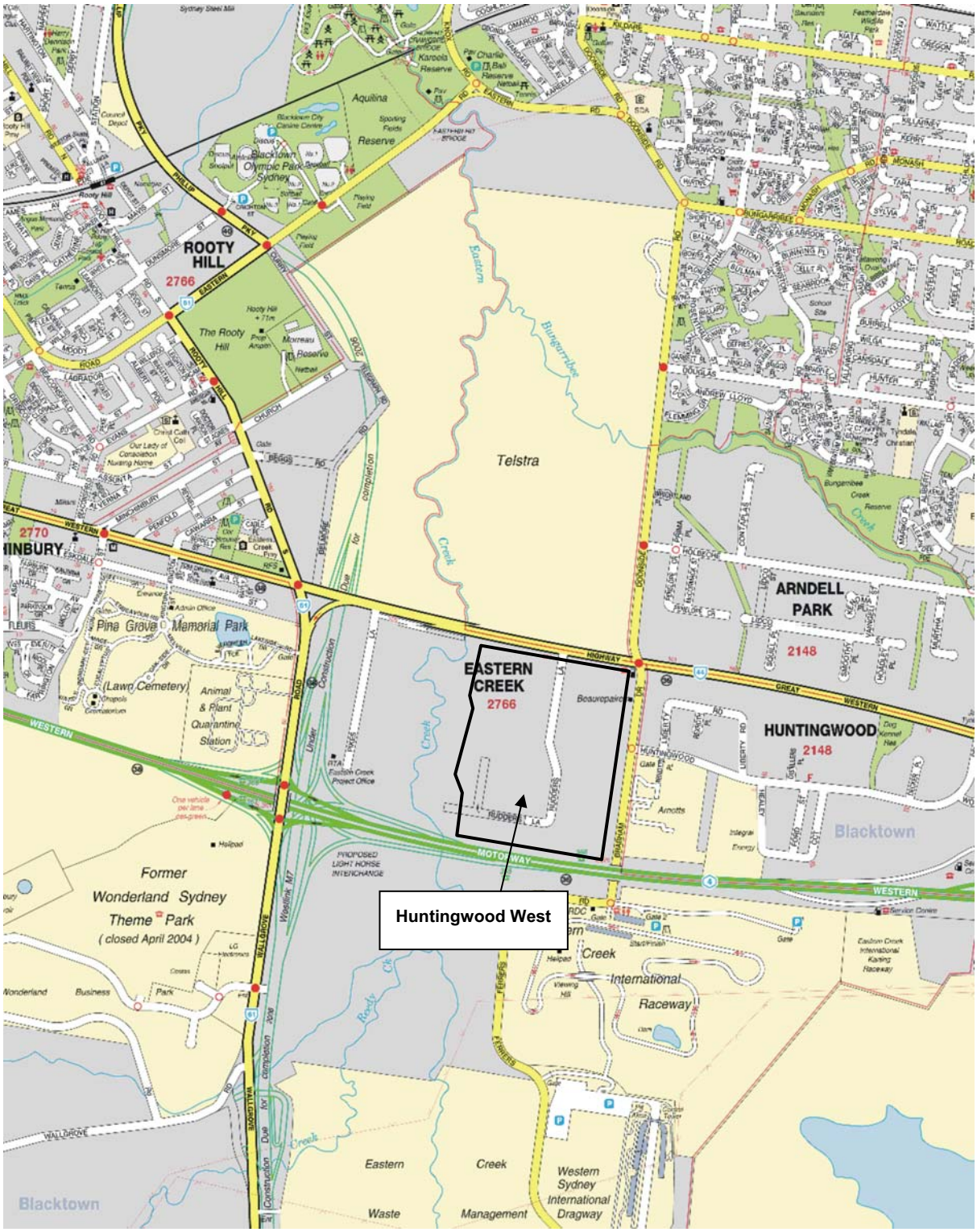
Source: www.cityrail.info, April 2006

5.6 Road System

5.6.1 Local Roads

The nearest public roads to the site include Doonside Road, Brabham Drive to the east, Eastern Road to the north-west, Rooty Hill Road South, Wallgrove Road to the south-west, M4 motorway to the south and Great Western Highway which runs through the site. The proximity to the freeway network is one of the key advantages of the site to service freight movements. The surrounding road network is shown in **Figure 5.7**.

Figure 5.7: Road Network



Source: Sydway

5.6.2 Motorways, Highways and Main Traffic Routes

The following classified roads are owned and maintained by the RTA.

M4 Motorway

The M4 Motorway connects Strathfield and Penrith, and is a key east-west link between suburbs in the east, including the Sydney CBD and suburbs in the west, including Penrith. The M4 is a classified State Road, with traffic volumes exceeding 70,000 Annual Average Daily Traffic (AADT). The speed limits along the route range from 90 to 100 kilometres per hour.

The M4 forms the southern boundary of the study area. The interchange at Wallgrove Road provides sufficient access to the Western Sydney Parklands.

M7 Motorway

The M7 Motorway provides a link between the M2 Motorway in the north and the M5 Motorway in the south, completing Sydney's orbital road network. The M7 runs parallel with Wallgrove Road, forming western boundary of Western Sydney Parklands.

The M7 intersects with the M4 and the Great Western Highway, providing access from the northern and southern suburbs.

Great Western Highway

The Great Western Highway is the key east-west link between the Sydney CBD and the western suburbs. A number of regional and local roads are accessed by the Great Western Highway including Rooty Hill Road South, Doonside Road to the north, Wallgrove Road and Brabham Drive to the south. The Great Western Highway is a classified State Road, with traffic volumes exceeding 30,000 AADT. The speed limits along the route range from 60 to 80 kilometres per hour.

Wallgrove Road

Wallgrove Road connects Rooty Hill in the north to Cecil Park in the south. Wallgrove Road is a classified State Road, consisting of four lanes and a speed limit of 80 kilometres per hour. Traffic volumes along the route range from 20,000 AADT north of the Great Western Highway and 40,000 AADT north of the M4 Motorway.

Between the M4 and the Great Western Highway, Wallgrove Road runs adjacent to the western edge of the Western Sydney Parklands. Its intersection with the Great Western Highway consists of an at-grade signalised intersection. The M4 / Wallgrove Road intersection is grade-separated.

Rooty Hill Road

Rooty Hill Road connects Rooty Hill in the south to Oakhurst in the north. Rooty Hill Road is a classified State Road, consisting of four lanes and a speed limit of 70 kilometres per hour. Traffic volumes on Rooty Hill Road are around 20,000 AADT.

Between Eastern Road and the Great Western Highway, Rooty Hill Road runs parallel to the western edge of the Western Sydney Parklands. Its intersections with the Great Western Highway and Eastern Road intersections are both at-grade, signalised intersections.

5.6.3 Regional Roads

The following classified roads are owned and maintained by Blacktown Council, with funding assistance from the RTA.

Eastern Road

Eastern Road runs between Rooty Hill Road and Bungarribee Road. Eastern Road is a classified Regional Road, consisting of four lanes and a speed limit of 70 kilometres per hour. Traffic volumes range between 24,500 AADT north of Rooty Hill Road and 19,600 AADT south of Knox Road.

Eastern Road lies north of the Western Sydney Parklands and the Doonside residential release area. Eastern Road's intersections with Knox Road and Doonside Road consist of two-lane roundabouts, and its intersection with Rooty Hill Road is an at-grade, signalised intersection.

Doonside Road

Doonside Road runs between Bungarribee Road and the Great Western Highway, east of the Western Sydney Parklands and Doonside residential release area. Doonside Road is a classified Regional Road, consisting of four lanes and a speed limit ranging between 60 and 70 kilometres per hour. Traffic volumes on Doonside Road are approximately 24,000 AADT.

Doonside's intersection with the Great Western Highway is an at-grade, signalised intersection. The intersection with Bungarribee Road consists of a two-lane roundabout.

Brabham Drive

Brabham Drive runs between the Great Western Highway and the M4. Brabham Drive lies east of Huntingwood West employment release area. The route is a classified Regional Road consisting of four lanes, with a speed limit of 70 kilometres per hour. Traffic volumes along Brabham Drive are around 18,000 AADT. The intersection with the Great Western Highway is an at-grade, signalised intersection.

5.6.4 Existing Intersection Performance

The intersection analyses undertaken in Phase 1 of the study involved traffic volume counts prior to the opening of the M7 Motorway. An analysis of the existing intersections surrounding the study area was carried out to incorporate traffic volumes associated with the recent opening of the M7 Motorway.

Following is a summary of intersection controls at the key intersections surrounding the study area.

Signalised Intersections

- Great Western Highway and Doonside Road (Node 1);
- Great Western Highway and Rooty Hill Road South (Node 2);
- Rooty Hill Road South and Eastern Road (Node 3); and
- Doonside Road and Douglas Road (Node 6).

Roundabouts

- Eastern Road and Knox Road (Node 4);
- Doonside Road and Bungarribee Road (Node 5);
- Brabham Drive and Huntingwood Drive (Node 8); and
- Knox Road and Power Street (Node 9).

Tables 5.4 and **5.5** summarise the results from the aforementioned intersection analyses using aaSIDRA 2.1 for the AM and PM peak hours respectively. The intersections highlighted yellow in the tables indicate the intersections that have inadequate levels of service, that is lower than level of service C.

Table 5.4: 2006 Weekday Morning Peak Period Intersection Performances

Intersection	Degree of Saturation	Average Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road	1.0	61.0	E
2: Great Western Highway / Rooty Hill Road	0.7	27.3	B
3: Rooty Hill Road South / Eastern Road	0.7	30.3	C
4: Eastern Road / Knox Road	0.7	9.7	A
5: Doonside Road / Bungarribee Road	0.7	12.7	B
6: Doonside Road / Douglas Road	0.7	14.1	B
8: Brabham Drive / Huntingwood Drive	0.5	8.2	A
9: Knox Road / Power Street	>1.2	145.5	F

Source: Maunsell, 2006

The roundabout at Knox Road/ Power Street is already failing during the morning peak due to unbalanced flows on entry arms. This could be the result of changes in traffic patterns following the opening of the M7 Motorway and associated interchanges. The subsequent review of traffic associated with the proposed development has found that it contributes less than two per cent of traffic to the total at the Knox Road/ Power Street intersection. Therefore, as the impact of this development would be negligible it has been excluded from further assessment.

The Great Western Highway / Doonside Road intersection is also reporting a level of service that is operating near capacity. The M7 Motorway opened to traffic in December 2007 and may still be in a 'ramp up' period, so traffic patterns may be subject to further change.

Table 5.5: 2006 Weekday Evening Peak Period Intersection Performances

Intersection	Degree of Saturation	Average Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road	0.8	41.0	C
2: Great Western Highway / Rooty Hill Road	0.8	31.8	C
3: Rooty Hill Road South / Eastern Road	0.7	31.4	C
4: Eastern Road / Knox Road	0.7	9.7	A
5: Doonside Road / Bungarribee Road	0.6	10.1	B
6: Doonside Road / Douglas Road	0.6	12.5	B
8: Brabham Drive / Huntingwood Drive	0.6	9.5	A
9: Knox Road / Power Street	0.9	21.2	C

Source: Maunsell, 2006

No significant problems are experienced with the intersections during the evening peak period.

Table 5.6 illustrates a spreadsheet analysis of the link flow capacities by direction on the road network in the vicinity of the site in the existing situation and following the addition of developments already committed to the area. The committed developments will be completed over a number of years, but for this analysis they are added to the estimated 2016 flows to assess the residual capacity on the links. The table indicates that capacity remains on all links within the network with the exception of the Great Western Highway, which would already appear to be operating above capacity in 2006.

The committed developments included within the table are:

- Eastern Creek
- Esrkine Park
- Investa/ Raceway
- East Huntingwood

- Doonside Residential Development

Further details and assumptions relating to the traffic generated by these sites are included in **Section 7**.

Table 5.6: Local Road Network Link Flows: AM Peak Period

Link	2006		2016*		2016 plus Committed Developments **	
	Veh	V/C	Veh	V/C	Veh	V/C
Doonside Road (N of Douglas Road) Northbound	570	0.30	630	0.33	650	0.34
Doonside Road (N of Douglas Road) Southbound	1,120	0.59	1,240	0.65	1,470	0.77
Eastern Road (West of Knox Road) Eastbound	960	0.50	1,060	0.56	1,130	0.59
Eastern Road (West of Knox Road) Westbound	580	0.31	640	0.34	970	0.51
Rooty Hill Road South (N of GWH) Northbound	520	0.29	580	0.32	690	0.38
Rooty Hill Road South (N of GWH) Southbound	840	0.46	920	0.51	1,660	0.92
Great Western Highway (E of Brabham Drive) Eastbound	2,070	1.09	2,280	1.20	2,420	1.27
Great Western Highway (E of Brabham Drive) Westbound	670	0.35	750	0.39	1,100	0.58
Brabham Drive (N of Site Access) Northbound	410	0.21	450	0.24	450	0.24
Brabham Drive (N of Site Access) Southbound	1,130	0.59	1,250	0.66	1,290	0.68

Veh = vehicles

V/C = Volume to Capacity Ratio

Notes: Capacities based on Austroads Part 2: Roadway Capacity

* Estimated based on historical growth rates

** Please refer to Section 7.

5.7 Summary

The key strengths of the existing transport networks in the vicinity of the site include:

- The proximity of the motorway network which removes trips from local roads including Doonside Road.
- The opening of the M7 motorway has resulted in a decrease in traffic flow on certain links within the local network.
- The site is adjacent to an extensive cycle way network, both existing and proposed.

This review of existing transport conditions has noted a number of weaknesses in the local area, including:

- The opening of the M7 motorway has resulted in an increase in traffic flow on certain links within the local network including Rooty Hill Road South and Eastern Road.
- Certain intersections are close to or at capacity, including the roundabout at Knox Road and Power Street.
- The rail station is not within walking distance; journeys by train must also include a bus trip.

- The site is within walking distance of only a small part of the Blacktown residential area.

These strengths and weaknesses will provide ample opportunity for leverage towards a package of measures through this TMAP process.

6.0 Travel Demand

6.1 Introduction

Trip generation depends on many variables. This section provides a summary of the forecasting approach used to determine the number of trips travelling by each mode of transport. This review has considered both the morning and evening peak periods.

6.2 Existing Travel Behaviour

A review of the Census 2001 Journey to Work data for Blacktown South East SLA indicates that:

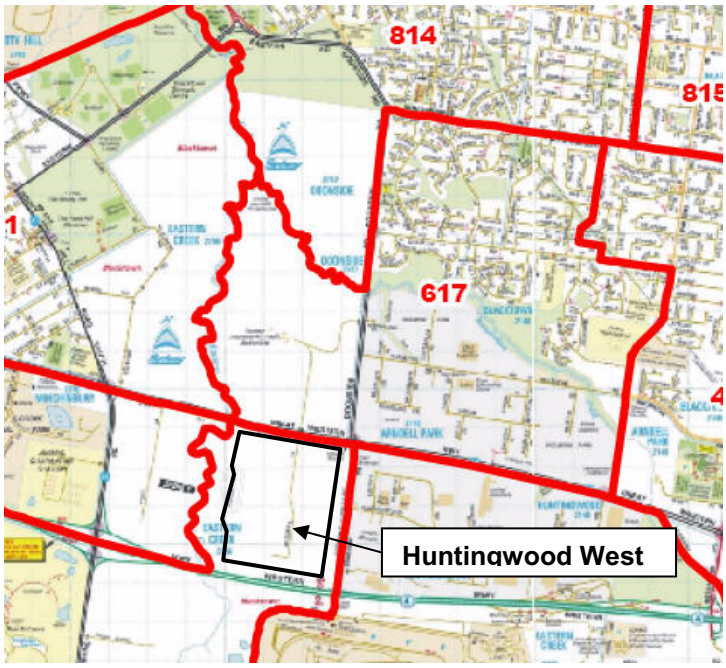
- 72 per cent of trips to the SLA are made by car
- 18 per cent of trips to the SLA are made by train
- 2 per cent of trips to the SLA are made by bus
- 8 per cent of trips to the SLA are made by other modes (e.g. walking and cycling)

At a more detailed level, a review of the Census 2001 Journey to Work data for travel zone 617 adjacent to the site including the Arndell Park industrial estate indicates that:

- 90 per cent of trips to the zone are made by car
- 2 per cent of trips to the zone are made by train
- 1 per cent of trips to the zone are made by bus
- 7 per cent of trips to the zone are made by other modes (e.g. walking and cycling)

An analysis of the trip distribution from the 2001 journey to work database was undertaken based on Travel Zone 617 (tz617), for commercial uses (using trips into tz617). This zone, located immediately to the north east of the site, is a developed area with similar employment land uses to that proposed for the Huntingwood West site. It is therefore considered likely to display similar trip making characteristics to the development site.

Figure 6.1: Surrounding TPDC Travel Zones



This information highlights the high dependence on car travel to work in the study area and it is a challenge to this TMAP to offer practical alternatives to the car to inspire mode shift.

Reasons for the high car dependence could be the result of lack of alternatives, for example, if an employee works industrial shifts and starts or finishes work at unsociable hours when little transport is available or security is an issue. However, Section 5 investigated the public transport provision and found it to offer regular services at daytime start and shift ends. Therefore, the dependence on the car could be due to reasons such a perception of low provision or interchange issues. It is likely that from the majority of destinations, an employee would be required to make at least a two leg public transport trip to reach the site.

In summary, the high proportion of car users provides a large base of employees that can be worked with to promote alternatives to the car.

6.3 Travel Demand

Following discussions with Blacktown Council in May 2005, an AM peak hour trip rate of 15 vehicle trips per developable hectare has been adopted. Thus, for a development of 56 developable hectares, 840 peak hour trips would be generated.

This trip rate is expected to be high since the industrial estate is likely to operate with shift work patterns or early start times so that employees may not need to travel in the usual morning and evening peak hours. However, since the uses of the site are not confirmed, the trip rate is adopted as a worst case scenario.

The 2001 Census Journey to Work data mode splits have been applied to the data to obtain trips by other modes as well as the car, as shown in **Table 6.1**. After a mode shift from car to sustainable modes of ten per cent, the number of employees travelling by car decreases and the number travelling by other modes, including as a car passenger, increases.

Table 6.1: AM Peak Huntingwood West Trip Generation: All Modes

Mode	Without Mode Shift		With Mode Shift	
	Mode Share	Employee Trips	Mode Share	Employee Trips
Car driver	83%	840	73%	739
Car passenger	7%	71	14%	162
Train	2%	20	2%	20
Bus	1%	10	1%	10
Cycle	3%*	30	4%*	50
Walk	4%*	40	4%*	50
Total	100%	1012	100%	1012

Source: Maunsell 2006

* Assumed split of ‘other modes’

On the basis of rate of 15 vehicles trips per developable hectare and the mode shares exhibited by employees at a neighbouring site, total employees at the site are estimated at 1,102. Landcom expects 800 employees to be accommodated on the site, so this assessment tests a worse case.

In the AM peak it is assumed that there will be some counterflow to the large numbers of employees entering the site as visitors or service vehicles leave the site, so a split of 85 per cent / 15 per cent has been applied to the generated traffic.

6.4 Mode Choice

The determinates used to assess mode choice within a mode choice model are travel time, travel cost and amenity (comfort, reliability and security). As an example: rail provides a more competitive choice to destinations such as the city where parking congestion makes car trips unattractive.

Maunsell has constructed mode choice models for previous TMAPs, using 2001 Journey to Work data to develop a generalised cost mode choice logit model that replicates observed journey to work mode splits (generally to within 5-10%) to major destinations in the Sydney metropolitan area from south east Blacktown. In all cases, the effect of increasing congestion on the road network has the effect of causing a minor mode shift of a few per cent since car journey times increase over train trips.

The mode choice model can be used to test measures within a TMAP that will decrease the generalised cost of public transport in comparison to car trips. Measures would include increasing bus or train frequency, or reducing walk time to the route. Policy measures or improvements to the quality of walking or cycling trips cannot be tested in the model.

To determine the likely mode choice shift as a result of other measures within a TMAP, it is possible to examine the success rates of previous projects. Projects to bring travel behaviour change using individualised marketing in Western Australia have resulted in differing success rates, ranging from four per cent reduction in car trips to 14 per cent. However, when the details of the study areas are compared, an outer suburb with poor public transport links, records a four percent reduction in car trips. The high mode shift results are recorded in inner city areas with good public transport provision.

Travel plans for workplaces have been adopted for a number of years in the United Kingdom. Research into the success of workplace travel plans and the reasons for success have been research by the UK Department for Transport. An examination of 21 workplaces that adopted travel plans showed a range of car use decreases from five per cent to 66 per cent. These figures are equivalent to a percentage point mode shift of between three per cent and 52 per cent.

To achieve a mode shift of between five and ten percent, it would be necessary to implement a range of measures, including those that improve the perception of public transport and that cannot be measured in a simple mode choice model. A comprehensive package of measures has been identified in **Section 8** to ensure the targets specified in this TMAP are met.

6.5 Trip Distribution

Trip distributions reflect the range of external origins of employees of a development site. Trip distribution patterns are influenced by wealth, employment patterns, the accessibility of regional employment zones and the cost and amenity of surrounding transport networks. Distribution patterns change relative to these variables over time.

The trip distribution undertaken by residents in tz617 for commercial uses is summarised in **Table 6.2.** These proportions have been used as a proxy to distribute trips to the local road networks for the commercial development.

Table 6.2: 2001 Journey to Work Destinations for Commercial Uses

Location	Total	Proportion
Penrith	480	17%
Blacktown – South East	425	15%
Blacktown – South West	314	11%
Blacktown – North	228	8%

Location	Total	Proportion
Baulkham Hills	167	6%
Fairfield	149	5%
Holroyd	133	5%
Parramatta	129	4.5%
Liverpool	117	4%
Hawkesbury	103	3.5%
Blue Mountains	93	3%
Campbelltown	72	2.5%
Bankstown	55	2%
Hornsby	37	1%
Ryde	30	1%
Ku-ring-gai	30	1%
Auburn	29	1%
Camden	27	1%
Wollondilly	28	1%
Other	220	7.5%

Source: Journey to Work data, 2001

In order to apply the distribution to the network, it is necessary to make assumptions about the route that the employees would take through the study area. This is conducted using gravity model principles, where the driver would take the shortest route. Where route length is similar, trips have been divided between the routes.

The Journey to Work trip origins for the purposes of this study can be translated into the road on which the trip enters the study road network. These are based on the assumptions of route choice given in the previous paragraph and are summarised in **Table 6.3**.

Table 6.3: Journey to Work Origins at Extent of Study Road Network

Trip Origin	Percentage of Trips	Number of Vehicle Trips
M4 East	12.0%	89
M4 West	20.0%	148
M7 North	6.0%	44
M7 South	19.0%	140
Great Western Highway East	5%	37
Great Western Highway West	5%	37
Francis Road	5%	37
Knox Road	6%	44
Power Road East	3%	22
Power Road West	3%	22
Bungarribee Rd	11%	81
Douglas Rd	5%	37
Total	**100%**	**739**

Source: Journey to Work data, 2001

7.0 Impact Assessment

7.1 Introduction

This Section discusses the future traffic and transport scenarios, considers the impact of the Huntingwood West development on the local network and assesses potential improvements that may ameliorate the impact, particularly in relation to local intersections.

The main purpose of this section is to compare the 2016 Base Scenarios to the 2016 Design Scenarios (with development) to determine the particular impacts of the development on the surrounding traffic and transport networks.

The Western Sydney Employment Hub includes ten key employment sites which may create around 36,000 jobs. These developments will have a significant impact on the road and public transport networks in the vicinity of the site and therefore those developments in the vicinity of the Huntingwood West site are included in the Base Scenario impact assessment.

7.2 Local Developments

The following paragraphs summarise the details of the committed local developments in the vicinity of the Huntingwood West site. This information has been used to estimate a number of generated trips and the distribution of these trips through the study network. These trips, when added to the background traffic, form Base Scenario 1 for the impact assessment.

Eastern Creek Precinct

The Eastern Creek Precinct is expected to develop some 700 hectares, generating 8,700 vehicle trips in the AM peak hour and 10,000 vehicle trips in the PM peak hour. Traffic modelling undertaken as part of the Eastern Creek Precinct Local Traffic Study[3] assumed that development would be complete by 2016.

Examination of the model output and report reveals that the impact of the generated traffic is expected to be distributed beyond the limits of the recommended network improvements. The model network included the Rooty Hill South Road/ Wallgrove Road/ Great Western Highway intersection that also falls within the Huntingwood West study network. **Table 7.1** reproduces data regarding the performance of this intersection from the Eastern Creek Precinct Local Traffic Study.

Table 7.1: Hill South Road/ Wallgrove Road/ Great Western Highway Intersection Performance

	AM Peak		PM Peak	
Performance Measure	**2002**	**2016***	**2002**	**2016***
Level of Service	E	F	E	F
Average Delay	60 seconds	230 seconds	56 seconds	189 seconds

Source: Eastern Creek Precinct Local Traffic Study (Arup, 2005)

*including development and recommended network improvements

The performance of the Rooty Hill South Road/ Wallgrove Road/ Great Western Highway intersection is expected to deteriorate dramatically by 2016. However, improvements to ameliorate it have not yet been investigated.

[3] ARUP, July 2005

Erskine Park Employment Area

The Erskine Park Employment Area has 276 hectares of developable land. Using the traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 4,140 vehicle trips. It is assumed that the development will be complete by 2016.

It has been assumed that the majority of the generated traffic will travel via the motorway network in a similar fashion to the Eastern Creek Precinct traffic. A minor proportion of traffic will impact the Huntingwood West study network as it travels via Wallgrove Road.

East Huntingwood Precinct

This precinct consists of 76 hectares of development. Using the traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 1,140 vehicle trips.

An examination of the Census 2001 Journey to Work data for the existing Huntingwood site would suggest that only a minor proportion of trips to the site will originate from the west and travel in the vicinity of the Huntingwood West site.

Investa Raceway Site

This site consists of 26 hectares of development. Using the traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 350 vehicle trips.

The majority of the developable land on the site is to the east, suggesting that the majority of generated traffic will enter the road network via Reservoir Road rather than Brabham Drive. However, a minor proportion of the traffic is expected to be distributed along Brabham Drive and therefore past the access to the Huntingwood West site. An examination of the Census 2001 Journey to Work data for the existing Huntingwood site, which is suitable for application to the Raceway site, would suggest that only a minor proportion of trips to the site will originate from the west and travel in the vicinity of the Huntingwood West site.

Bungarribee Precinct Land Uses, Western Sydney Parklands

Concept planning of the Bungarribee Precinct of the Western Sydney Parklands is progressing, to the stage that certain land uses for the site are being discussed. It is likely that a leisure or educational facility may be developed.

The impact on the AM peak hour flows on the surrounding network of these types of facility will be minor. Leisure uses are not likely to experience peak demand at this time and educational visitors are likely to arrive by coaches after the AM Peak. Staff may arrive during the morning peak, but these volumes are not expected to be significant when distributed through the network.

Doonside Residential Development, Western Sydney Parklands

Planning is being undertaken for Doonside residential site adjacent to the Bungarribee Precinct of the Western Sydney Parklands. The site developable area is 55 hectares which has been assumed to equate to accommodate approximately 750 dwellings, of which around 90 per cent could be detached homes and the remainder attached homes, being either terraces or apartments.

Trip rates for these types of dwellings have been extracted from the Guide to Traffic Generating Developments (RTA, 2002) and applied to the lot numbers as shown in **Table 7.2**.

Table 7.2: Doonside Residential Development Trip Rates

Dwelling Type	Yield (Number of lots)	Trip Rate	Generated Trips (Peak Hour)
Apartment	34	0.50	19
Terrace	35	0.65	24
Detached	675	0.85	574
Total	**750**	**-**	**617**

It was assumed that 15 per cent of trips would be travelling to the site and 85 percent to the site in the morning peak hour. The trips were distributed to destinations based on the Census 2001 Journey to Work data. The trips were applied to the appropriate route through the surrounding road network using gravity model principles. Current masterplanning for the site includes site accesses that connect via existing intersections at Doonside Road/ Eastern Road, Doonside Road/ Bungarribee Road and Doonside Road/ Douglas Road.

7.3 Traffic Impacts and Opportunities

7.3.1 Traffic Assessment

A review of the 2006 traffic count data has established that the peak loading on the road network in the vicinity of the Huntingwood West site occurs during the AM peak between 7.30am and 8.30am. Therefore, this traffic assessment focuses on the AM Peak and considers the impact of employees trips to work.

Peak levels of traffic demand have been estimated using a strategic spreadsheet model. Four scenarios have been developed within the model:

- Base Scenario 1 – existing traffic counts factored to likely 2016 flows (at a rate of one percent per year) plus estimates of all committed development trips as described previously;
- Base Scenario 2 – existing traffic counts factored to likely 2016 flows (at a rate of one percent per year) plus committed development traffic relating to the proposed Doonside residential development only;
- Design Scenario 1 – Base Scenario 1 plus Huntingwood West development trips; and
- Design Scenario 2 – Base Scenario 2 plus Huntingwood West development trips.

Since the capacity of a network is limited by the delays caused by intersections in the network, this traffic assessment considers improvements to intersections only and does not consider mid-block improvements.

At the current time there are no published plans to improve the intersections in the surrounding area to accommodate the impacts of the Western Sydney Employment Hub. Therefore, the impact assessment applies the 2016 flows from each of the four Scenarios to the existing 2006 layout.

A number of assumptions have been made both in the total trips generated by these developments and the distribution of the trips through the network. In addition, this analysis does not take into account re-routing by vehicles to alternative less congested routes. The spreadsheet model indicates that traffic arriving at the site from the M4 and M7 motorways will be significant, creating a heavy right turn movement at the Great Western Highway / Doonside Road intersection. As a consequence,

Intersection 1 reports a poor level of performance in each of the Scenarios and therefore measures to alleviate this delay are proposed in later sections.

Intersection assessments were conducted using aaSIDRA v2.1. **Tables 7.3** to **7.6** summarise the results of the analysis for each Scenario in turn.

Table 7.3: 2016 Base Scenario 1 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,487	1.1	>150	F
2: Great Western Highway / Rooty Hill Road	7,220	1.1	116.0	F
3: Rooty Hill Road South / Eastern Road	3,585	1.0	90.8	F
4: Eastern Road / Knox Road	4,499	0.9	11.1	B
5: Doonside Road / Bungarribee Road	3,634	>1.2	81.3	F
6: Doonside Road / Douglas Road	2,679	0.9	32.6	C
8: Brabham Road / Huntingwood Drive	2,346	0.5	8.7	A

Source: Maunsell, 2006

With reference to the existing performance shown in **Table 5.4, Table 7.3** illustrates that the impact of other committed developments, and natural traffic growth, in the vicinity of the Huntingwood West site, would significantly reduce the Level of Service at several local intersections, causing many to fail. Level of Service F is recorded at five of the eight intersections, with the worst performing being Doonside Road/ Bungarribee Road.

Intersection 'failures' are generally recorded due to the poor performance of individual approaches or single movements at the intersection. This can be due to a number of factors, including lack of capacity, minimal green time at traffic signals and / or high traffic demand from an opposing movement, therefore limiting exit opportunities. Experience has shown that often a right turn with high traffic demand is the key movement that will determine the failure of an intersection.

A number of the intersections fail significantly in the Scenario shown in **Table 7.3**. Analysis of the results identifies the following movements that perform worst at each of these intersections:

1. Through movements on Great Western Highway from both directions and through and right turns from Doonside Road.
2. Through movement from Great Western Highway (west) and right turn from Wallgrove Road.
3. All movements from Rooty Hill Road (north), left turn from Eastern Road and right turns from Rooty Hill Road (south) and Francis Road.
5. Both movements from Bungarribee Road.

Following this initial analysis, the performance of each intersection was tested where only base 2016 flows (i.e. factored from 2006) and Doonside residential flows are added. The results of this Scenario, presented in **Table 7.4**, show that intersection 1 is likely to fail regardless of further committed development.

Table 7.4: 2016 Base Scenario 2 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,026	1.0	81.1	F
2: Great Western Highway / Rooty Hill Road	5,499	0.9	37.9	D
3: Rooty Hill Road South / Eastern Road	2,924	0.9	36.7	D
4: Eastern Road / Knox Road	4,102	0.8	10.6	A
5: Doonside Road / Bungarribee Road	3,261	1.0	30.3	C
6: Doonside Road / Douglas Road	2,535	0.8	28.9	C
8: Brabham Road / Huntingwood Drive	2,309	0.5	8.7	A

Source: Maunsell, 2006

A review of intersection 1 in this Scenario shows that failure is due to the poor performance of the same individual movements listed above.

2016 Design Scenario 1 applies the Huntingwood West development trips to the potential flows from all other developments. This level of flow defines a worst case scenario for future traffic demand and consequently a number of intersections are again likely to fail. The results from this Scenario are given in **Table 7.5.**

Table 7.5: 2016 Design Scenario 1 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	6,371	>1.2	>150	F
2: Great Western Highway / Rooty Hill Road	7,741	1.1	120.4	F
3: Rooty Hill Road South / Eastern Road	3,610	1.1	105.9	F
4: Eastern Road / Knox Road	4,478	0.9	11.1	B
5: Doonside Road / Bungarribee Road	3,934	1.0	32.2	C
6: Doonside Road / Douglas Road	2,885	0.9	29.4	C
8: Brabham Road / Huntingwood Drive	4,752	0.9	17.6	B

Source: Maunsell, 2006

The same four intersections as reported for Base Scenario 1 fail in this Scenario. These failures can again be attributed to the individual turning movements that were detailed previously, albeit in this Scenario they are reporting a reduced level of performance.

In order to establish a better understanding of the likely impacts of the Huntingwood West development on its own, expected flows generated from this site were applied to the 2016 base data and the committed development at Doonside only. Consequently lower traffic flows were applied to the intersection models and as expected improved levels of service were recorded at the intersections. These results are presented in **Table 7.6**.

Table 7.6: 2016 Design Scenario 2 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,763	1.1	>150	F
2: Great Western Highway / Rooty Hill Road	5,889	0.9	51.5	D
3: Rooty Hill Road South / Eastern Road	2,961	0.9	37.3	D
4: Eastern Road / Knox Road	4,190	0.9	10.6	B
5: Doonside Road / Bungarribee Road	3,700	0.9	18.3	B
6: Doonside Road / Douglas Road	2,742	0.8	26.7	C
8: Brabham Road / Huntingwood Drive	3,015	0.9	17.2	B

Source: Maunsell, 2006

Comparison between **Tables 7.4 and 7.6** illustrates that the Huntingwood West development will have an impact on most of the local intersections, although this is marginal in most cases. Intersections where the impact is greatest are highlighted in yellow.

Further to the comments above, failure of intersection 1 was to be expected. Intersection 2 is reported as being at capacity and so improvements should be investigated. The individual turning movements that are contributing to these poor levels of performance are the same as those detailed previously.

Improvements to the two worst performing intersections from Design Scenario 2 are considered in the **Section 7.3.2**.

7.3.2 Intersection Improvements

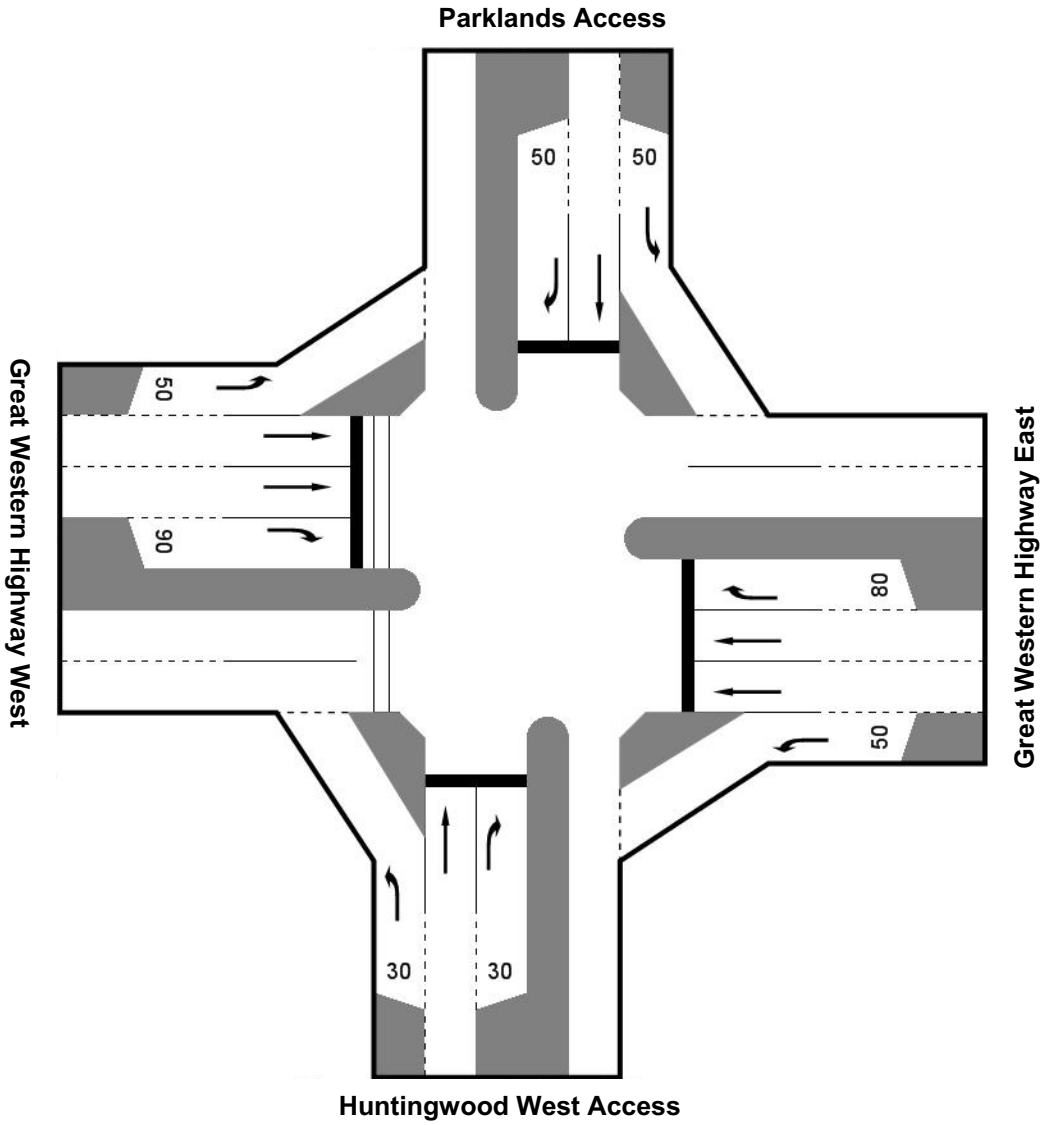
Improvements to the four worst performing intersections were undertaken as follows:

- 1. Great Western Highway / Doonside Road: Alter line marking to separate through and right turn movements from Doonside Road and Brabham Drive and provide a new access from Great Western Highway to relieve right turn movement
- 2. Great Western Highway / Rooty Hill Road South: Improve signal phasing

In order to ameliorate the heavy right turn movement at the Great Western Highway / Doonside Road intersection, a concept design for a site access from the Great Western Highway has been developed. This access would replace the existing Rudders Lane left in-left out access with a full signalised intersection to the west. An intersection in this location has the potential to also serve the Parklands. This access has been agreed in principle with the RTA at a meeting in August 2006.

The concept design for the intersection is illustrated by **Figure 7.1**. The intersection would be located at a distance of 400 metres or more from the nearest signalised intersection in both directions and so would not be expected to directly impact operations. The intersection would be designed to accommodate B-doubles and service vehicles as well as commuting employees.

Figure 7.1: Great Western Highway/ Access Intersection Layout



Source: Maunsell, 2006

Table 7.7 illustrates the effect of the improvements on intersection performance. The Level of Service is shown to improve significantly for Intersection 1 when compared to the 2016 Base Scenario 2 results as shown in **Table 7.4**. Intersection 2 perform satisfactorily following amelioration. The new access intersection from the Great Western Highway performs satisfactorily under a diamond signal phasing arrangement and a maximum cycle time of 140 seconds.

Table 7.7: 2016 Design Scenario 2 Weekday Morning Peak Period Intersection Performances, including intersection improvements

Intersection	Degree of Saturation	Average Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road	1.0	79.6	E
2: Great Western Highway / Rooty Hill Road	0.9	40.2	D
X: Great Western Highway/ Rudders Lane	0.9	29.8	C

Source: Maunsell, 2006

The improved designs take in to account the primary movements that are occurring at the intersections and apply the signals phasings accordingly. Intersection 1 continues to report poor performance on a number of individual movements but these are on the movements with lowest levels of flows, from Great Western Highway (east) and the right turn from Brabham Drive. Intersection 2 reports a good level of service for every individual movement.

An assessment of intersection performance under Design Scenario 2 was undertaken with and without the Great Western Highway access and is reported in **Table 7.8**. The table shows that by providing the additional intersection, average vehicle delay is reduced at the Great Western Highway/ Doonside Road intersection by 7 seconds.

Table 7.8: 2016 Design Scenario 2 Weekday Morning Peak Period Intersection Performances: Comparison of with and without Great Western Highway access

Intersection	Degree of Saturation	Average Intersection Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road (without Great Western Highway / Access Road intersection)	1.1	86.1	F
1a: Great Western Highway / Doonside Road (with Great Western Highway / Access Road intersection)	1.0	79.6	E

Source: Maunsell, 2006

7.4 Pedestrians Impacts and Opportunities

The site will generate walking demands both within the site and to and from the site. This would include trips to:

- Food retailers serving the industrial employees;
- The parklands for lunchtime recreation;
- Bus stops; and/or
- Home.

The Huntingwood West site is between three and four kilometres of the residential areas to the north around Douglas Road and Bungarribee Road so there is some potential for employees to walk to work. These opportunities will be improved by provision of direct and secure walking routes.

7.5 Cycling Impacts and Opportunities

Cycling mode splits are expected to remain low for journey to work trips to the Huntingwood West site. However, improvements to cycle facilities and networks around the site offer opportunities to increase the mode share. The site is within cycle commuting distance for a number of communities within Blacktown.

It is likely that between one and four per cent of trips will be made by bicycle. At the upper end, this would create 40 cycle trips to the site during the AM peak hour.

Planned improvements to the cycle network will accommodate these cyclists, and any mode shift to cycling, but it should be ensured that the connection is provided from the cycle network to the site.

Sufficient secure cycle parking, lockers and change facilities on the employment site should be provided to cater for cyclists.

7.6 Bus Impacts and Opportunities

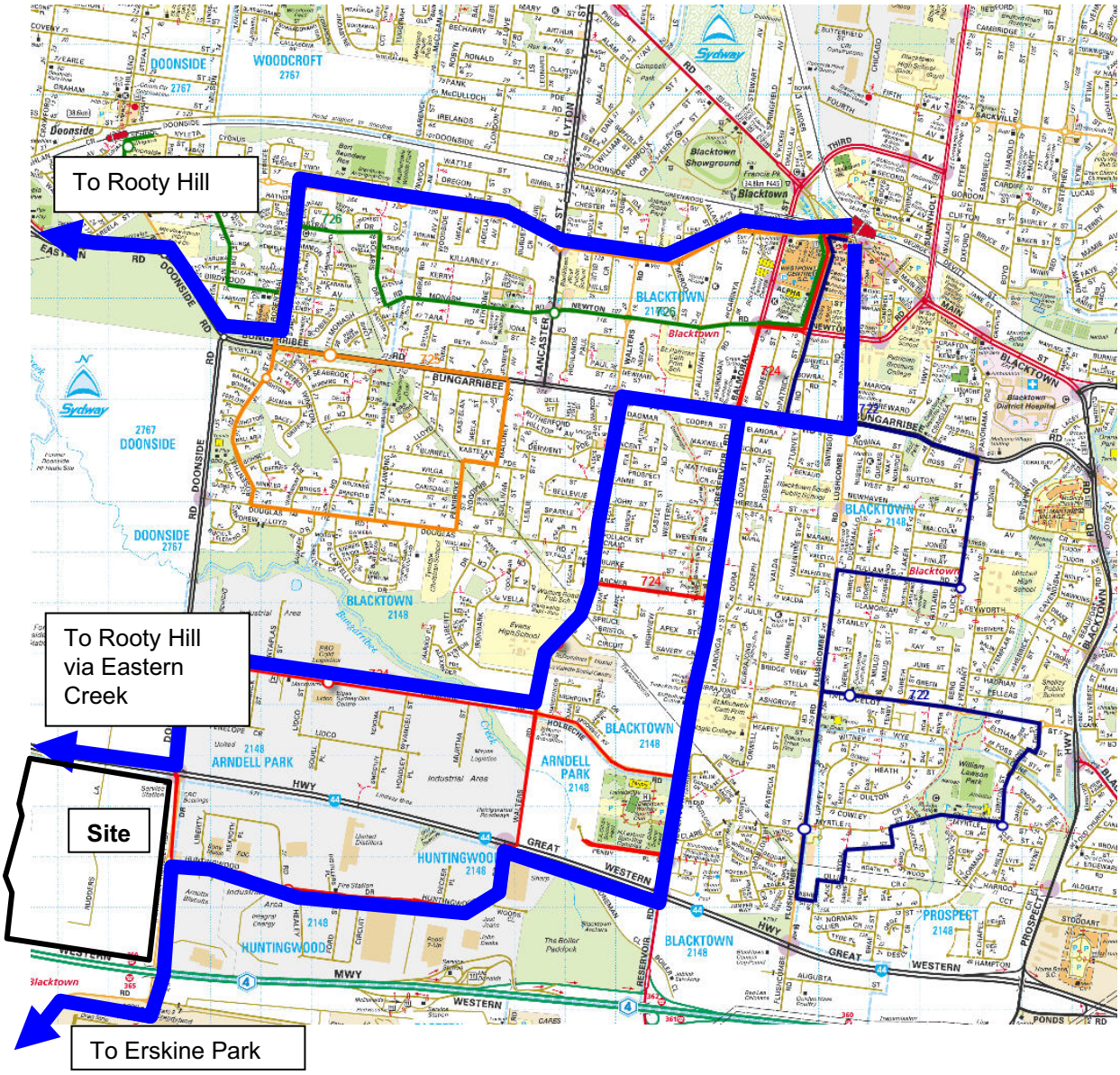
Consultation with the Ministry of Transport has revealed that new bus routes to meet growing demand in the Western Sydney Employment Hub area are in the planning stages. These have not been evolved to the stage of consultation with operators and the community but they can be used as an indication of future provision.

Upon full development, the Huntingwood West site is expected to generate 30 bus trips during the morning peak hour. This level of patronage is not sufficient to support a new bus service for the site.

However, the opportunity exists to divert an existing route to serve the site. Route 724 currently serves the existing Huntingwood industrial estate and could potentially be diverted to travel through the site. Public transport measures are explored in further detail in **Section 8**.

Potential also exists for employers to provide shuttle transport for employees to neighbourhood centres or their home address. This is particularly relevant to this site as employees working shifts could start or finish work at unsociable hours. Public transport use at these times will be limited due to lack of or the perception of a lack of public transport or security issues.

Figure 7.2: Huntingwood West Potential Bus Provision



Source: MOT, 2006

7.7 Rail Impacts

Upon full development, the Huntingwood West site is expected to generate 20 rail trips during the morning peak hour. These would be accommodated across the four peak hour train services that call at Doonside station or the eight peak hour services that call at Blacktown station.

These rail trips include a walk and/or bus trip to the station. For the purposes of this assessment, it is assumed that the rail users will catch a bus to Blacktown station. These trips are included within the walking and bus impacts in earlier paragraphs.

7.8 Conclusion

The findings of the impact assessment indicate that a package of measures will be required to mitigate the traffic impacts of the Huntingwood West development. These are:

- Great Western Highway / Doonside Road: alter line marking to separate through and right turn movements from Doonside Road and Brabham Drive and provide a new access from Great Western Highway to relieve right turn movement
- Great Western Highway / Rooty Hill Road South: Improve signal phasing

A range of measures will be required will also be supplement these infrastructure improvements in order to meet the sustainability objectives of this TMAP. The comprehensive package of measures is detailed in **Section 8**.

8.0 Package of Measures

8.1 Introduction

This section discusses the package of measures recommended for implementation in the vicinity of the site. The driving force behind the package will be the implementation of work place travel plans on the Huntingwood West site to encourage mode shift. This mode shift will be enabled by supporting initiatives, addressing:

- Infrastructure needs – including measures to improve walking, cycling and public transport opportunities, while maintaining private vehicle access; and
- Service needs – providing sufficient services to promote a higher public transport mode split.

Planning principles that would guide the provision of high quality infrastructure are also included. At this stage of the TMAP, the approach is independent and holistic so that the most appropriate package of measures is developed.

8.2 Travel Behaviour Change

The key aim of a Workplace Travel Plan for a development site is to discourage use of the private car and or greater use of more sustainable modes such as walking, cycling and public transport. Car sharing is encouraged where it is unlikely that sustainable modes will be attractive. It will enable all employees and visitors to have a greater choice and flexibility in how they travel to the site each day and how they travel during the day.

If the site is developed by one occupant, then a single travel plan would be developed. If there is multi-occupancy of the site, individual employers can develop in-house measures (in particular marketing, and travel reduction) and facilities such as cycle parking and showers.

Prior to occupation of the Huntingwood West site, a travel plan framework should be developed. This would apply to the entire site regardless of the number of occupants and outline the following:

- A review of existing on-site facilities and access to information on travel to the site (that will be provided);
- A review of the existing transport services available in the local areas covering bus, and rail modes as well as a review of the local pedestrian and cycle networks;
- Draft Travel Survey with timescale for when this will be conducted;
- Timescale for development of recommended initiatives; and
- Draft details of future monitoring and review.

Within three months of the first occupation of site, a travel survey should be conducted. The results of the travel survey will be analysed and used to determine if measures are required to cater for existing demand and also encourage modal shift away from the private car. The measures will be dependent on the needs of the employees, that is, their journey to work.

Table 8.1 illustrates some of the measures that could be incorporated into a Travel Plan to encourage mode shift that would be appropriate for the Huntingwood West site.

Table 8.1 Suggested Workplace Travel Plan Measures

Travel co-ordinator	This will be a key appointment. Each new site within the Western Sydney Employment Hub will need to promote mode shift to fulfil conditions of development. It may be that the RTA employs a Travel co-ordinator to oversee Travel Plans at each of these sites. Alternatively the role can be shared by the facilities management, HR, finance, marketing departments of each site occupant.
Parking management	Designated Parking or Needs based parking permit system: Reallocation of car park or permit system to prioritise use e.g. for mobility impaired, car sharers, business need, those with no access to alternate modes.
Public transport improvements	Improvements to frequency or hours of operation.
	Offer subsidies to public transport season ticket holders in the first year of implementation of the Travel Plan
	Offer equivalent benefits to public transport users as to car leasers.
Car pooling	Establish car share / car pool schemes
	Guaranteed Ride Home – if the designated driver goes home sick, the employee who shared the trip is given a cabcharge voucher to get home.
	Car share priority spaces
Improved cycle facilities	Introduce an interest free loan for the purchase of a train or bus ticket, bicycle/equipment, waterproof clothing
	Bicycle User Group
	Bicycle repair facilities
	Shower, changing facilities, Bicycle storage
	Discounts at Retailers
Walking	Discounts at Outdoor Clothing Retailers
Travel reduction	Work pool cars – for business travel
	Video conferencing facilities
	Provision of on site food retailers, banking, post box, internet facility for those who do not work with a desktop computer.
Marketing	Introduce prize draw/lottery scheme to encourage travel by means other than single occupancy vehicle
	Develop a well designed web page on the intranet
	Develop a well designed Travel Plan booklet for staff and visitors
	Provide Travel Plan Noticeboards at strategic locations such as main building entrances and canteens
	Promotional events – car free day, bike to work day
	Ongoing travel plan marketing

Source: Maunsell 2006

Within six months of occupation the full travel plan must be developed and include;

- Results of the Staff Travel Survey;
- Recommended travel plan measures including how they will be adopted;
- Agreed procedure and timescales for implementation; and
- Details of future TP monitoring and review.

Full implementation will then proceed.

It is expected that the key to travel behaviour change, and therefore a decrease in vehicle trips, for the Huntingwood West site would be to initiate a car sharing scheme. In addition, the excellent cycle path network in the vicinity of the site should be promoted.

8.3 Infrastructure

This section discusses the infrastructure that is required to underpin the service and policy initiatives. The infrastructure package has been tailored to improve sustainable transport, while maintaining satisfactory levels of private car performance.

Walking and Cycling Infrastructure

Internal roads within Huntingwood West will connect to the existing street network so that footpaths are connected without creating diversions. This will provide a direct route for employees to facilities such as take away food retailers or bus stops. It also provides a direct route for employees of the existing industrial areas to the Parklands during breaks.

Roundabouts are not recommended within the development site. The site access will connect to the existing roundabout at the Huntingwood West, however there will be no school children or elderly persons attempting to cross at this location and no safety problems for pedestrians are envisaged. Pedestrians will be able to cross without significant diversion from desire lines.

Connections to pedestrian and cycle paths, such as those adjacent to the M7 and M4 and the proposed Parklands cycle path, will be provided where appropriate. There is the opportunity for the developer to provide a contribution to the construction of a shared path proposed by Blacktown Council which would connect Huntingwood to Doonside station. This could enable construction of the path prior to the site opening.

Rail Infrastructure

The Clearways programme is a project that will upgrades the Sydney rail network that will benefit rail users from increases in reliability and capacity. A specific project that may benefit passengers travelling on the Western Line and catching a train from Blacktown, Doonside or Rooty Hill is the Quakers Hill to Schofields duplication. The Western Line Richmond branch is a single track route and therefore suffers congestion. A double track will be constructed by 2010 to improve reliability and reducing passenger crowding.

An improvement to rail infrastructure in the local area is in progress at Blacktown Station. The customer lift facilities are being improved at the station and bus interchange to improve reliability, increasing the attractiveness of a trip by rail for passengers with restricted mobility or families with pushchairs. Works are programmed for completion by the end of June 2006.

Bus Infrastructure

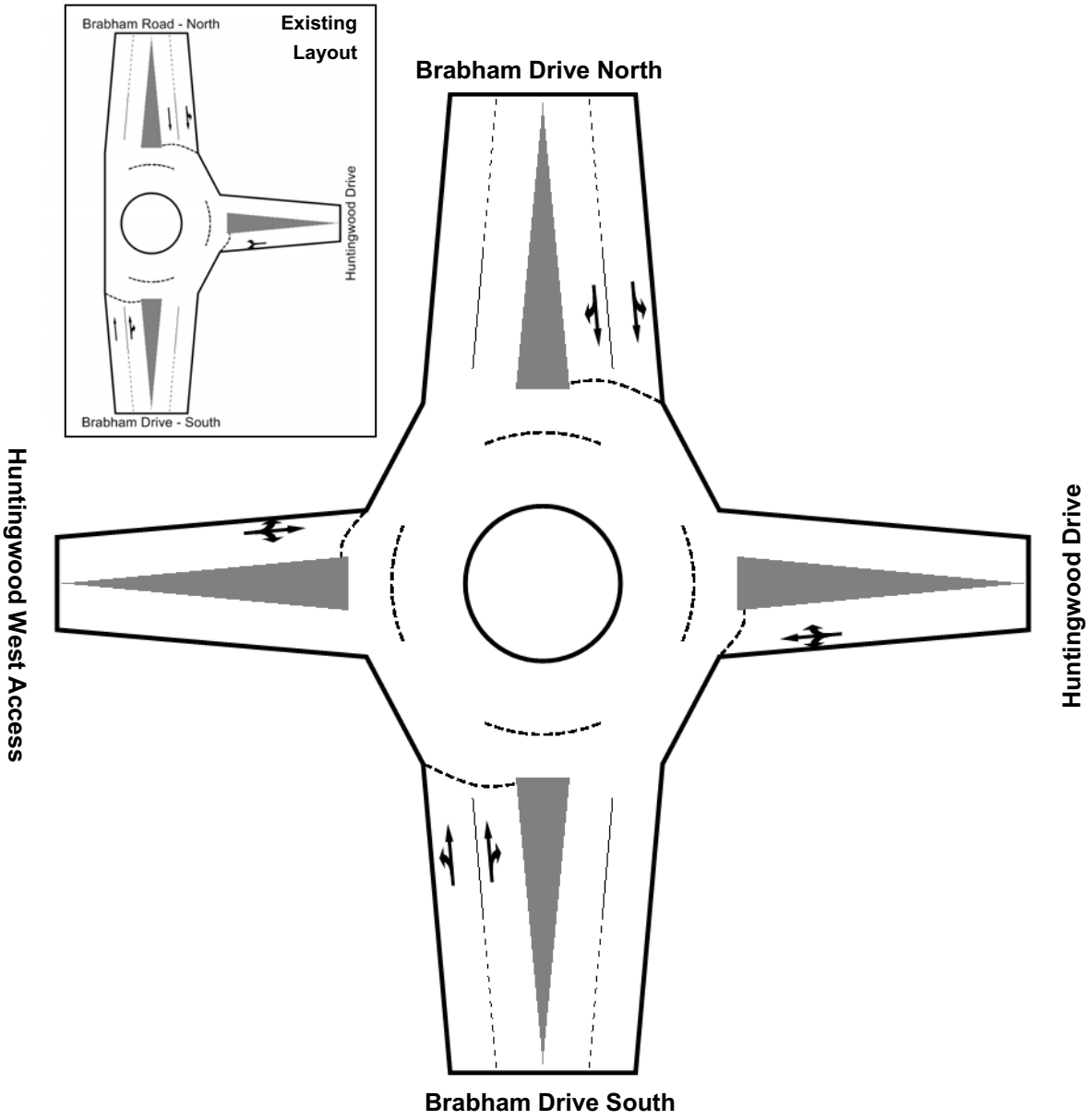
To accommodate employees travelling by bus, in the short term it is proposed that a bus stop for Service 724 from Blacktown to Huntingwood West is introduced on Brabham Drive. This will provide a bus route within 400 metres of approximately half of the site employees. The bus shelter should provide a shelter in case of bad weather.

Road Network Infrastructure

Major upgrade works will be required to accommodate traffic volumes generated by the Western Sydney Employment Hub. However, the measures within this TMAP address only the traffic volumes generated by the Huntingwood West site so as not to attempt to redesign the Western Sydney road network, which is not within the scope of this TMAP.

The main site access will be provided via a connection to the existing roundabout at Brabham Drive/ Huntingwood Drive. The suggested intersection arrangement is illustrated by **Figure 8.1**. A preliminary assessment of swept paths suggests that this intersection could accommodate B-double trucks.

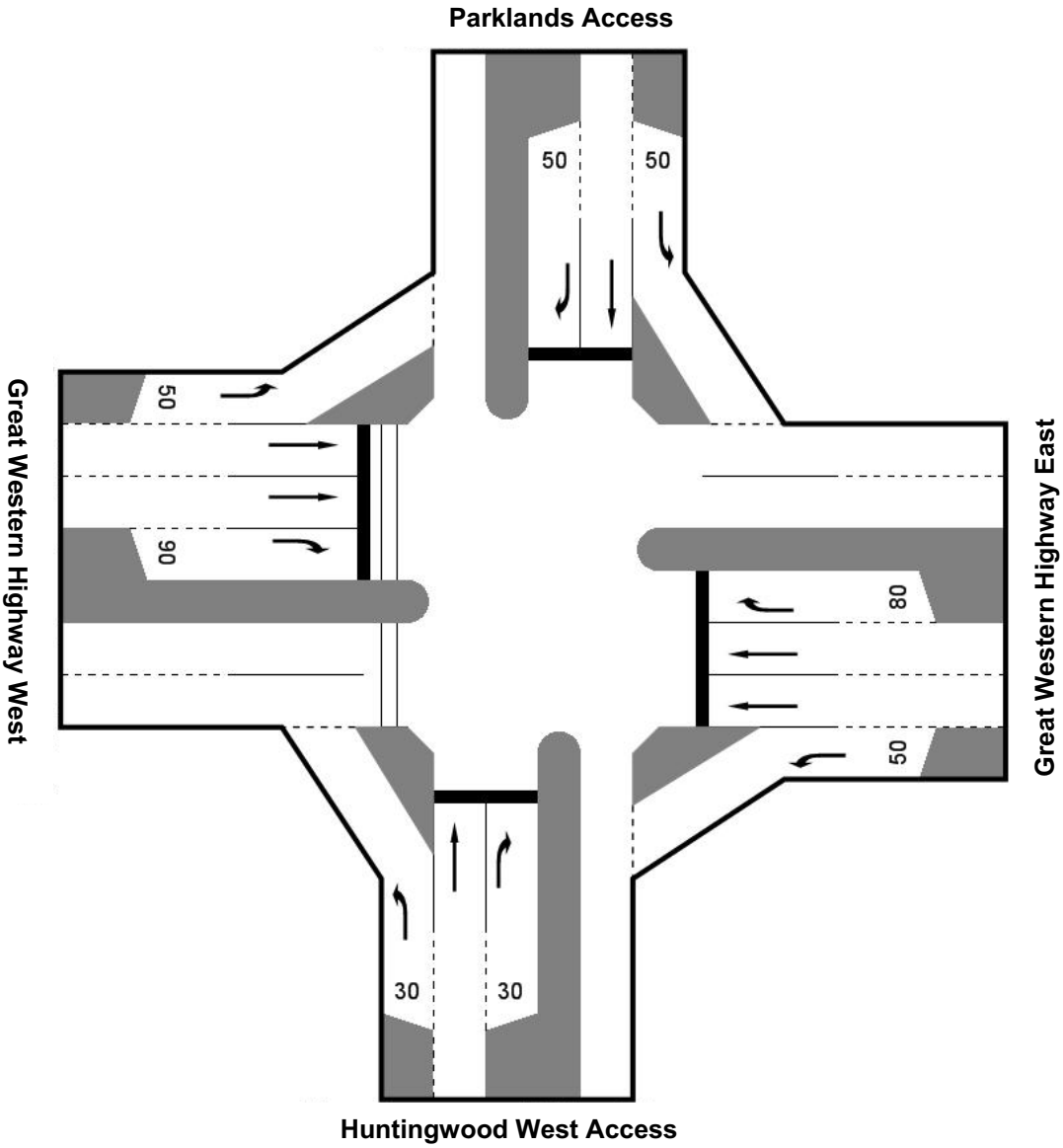
Figure 8.1: Proposed Brabham Drive Access Road Layout



Source: Maunsell 2006

A secondary access is proposed via the Great Western Highway. The suggested intersection arrangement is illustrated by **Figure 8.2**.

Figure 8.2: Proposed Great Western Highway Access Layout



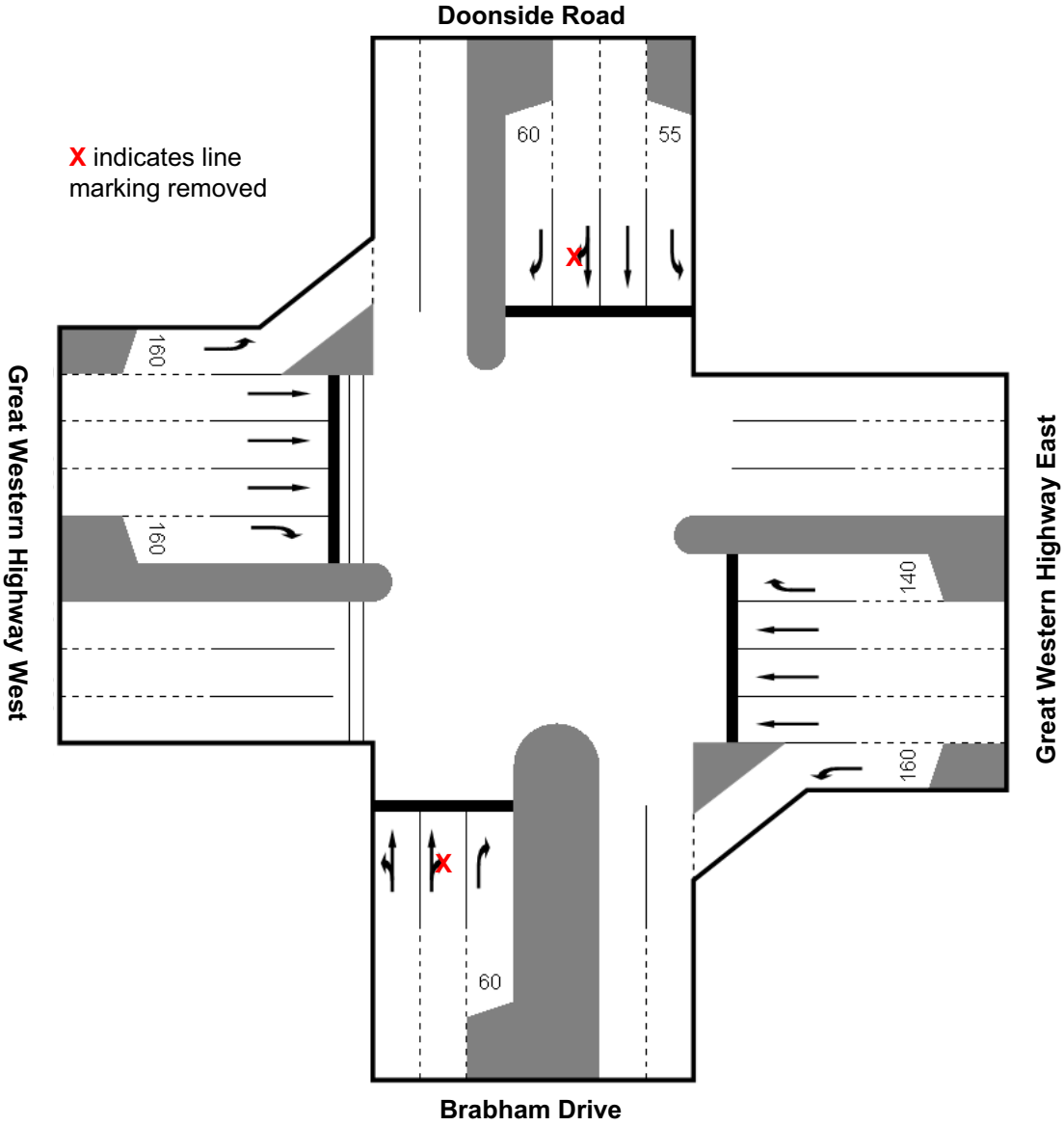
Source: Maunsell

Other intersection improvements have been tested, including signalisation of roundabouts, alterations to phasing arrangements and line markings. The improvements tested are summarised as follows:

- Great Western Highway / Doonside Road: Alter line marking to separate through and right turn movements from Doonside Road and Brabham Drive.
- Great Western Highway / Rooty Hill Road South: Improve signal phasing.

Figure 8.3 illustrate the proposed line marking for the Great Western Highway / Doonside Road intersection.

Figure 8.3: Great Western Highway/ Doonside Road: With proposed changes to line markings



Source: Maunsell 2006

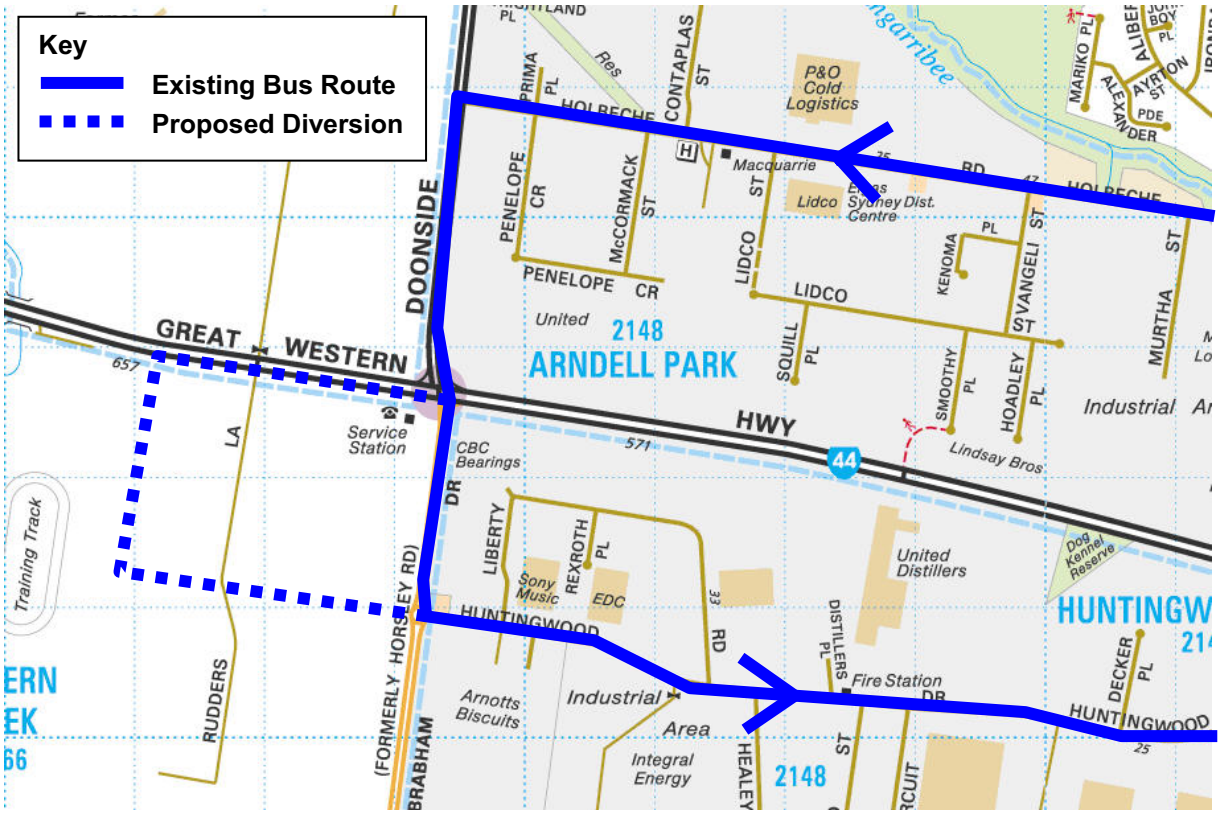
8.4 Service Responses

Bus Services

The study area falls within Contract Area 1, scheduled for review by the Ministry of Transport under NSW Bus Reform in 2007/2008. Therefore, improvements to bus services to serve the site are considered to be medium term measures.

The opportunity exists to divert the existing service 724 for less than two kilometres through the Huntingwood West site via the Great Western Highway access and the Brabham Drive roundabout. The potential disbenefit of this route is that the bus would encounter a right turn movement at the Great Western Highway intersection. (see **Figure 8.4**). This loop arrangement would also function with the existing left in left out arrangement at Rudders Lane or at another location on the Great Western Highway.

Figure 8.4: Bus Service Measures



Source: Maunsell 2006

Negotiations between the operator and the Ministry of Transport will take place to determine the best way to serve the Huntingwood site as a whole, given that it is expanding over a large area to both the east and west.

New services drafted by the MoT but not yet negotiated with operators or put to community consultation are shown in **Figure 7.2**. It may be appropriate to redirect the service along the Great Western Highway via the Huntingwood West site.

Rail Services

There are no scheduled changes to rail services that may benefit the site and encourage mode shift.

8.5 Planning Principles

In order to create high quality pedestrian and cycling environments there are a number of general principles that should be considered and applied when planning and designing facilities. These include:

- ***Permeability*** – pedestrians and cyclists should be able to move conveniently through the study area by ensuring that all key origins and destinations are well connected. Large sites, developments and buildings should not present unacceptable barriers to movement.
- ***Priority*** – high priority should be given to pedestrian and cycle movements on key routes, through measures such as short wait times at signalised crossing points.
- ***Continuous*** – pedestrian and cycle routes should be continuous, with connected foot/cycle paths, crossing facilities and entry points.

- ***High quality*** – pedestrian and cycle facilities should at least meet design standards. Footpaths should include provision for people with disabilities. Designs should at least meet the standards expressed in Austroads Guide to Traffic Engineering, Part 13: Pedestrians and Part 14: Bicycles.
- ***Integration*** – walking and cycling should be integrated with other modes (particularly bus and train services) through the provision of obvious, safe and convenient pedestrian/cycle access paths to interchange areas, as well as secure cycle storage facilities.
- ***Legibility*** – the local environment should be easy for pedestrians and cyclists to 'read' so that they can easily find their way – street names should be clearly visible and clear signage should be provided including key destinations and distances.
- ***Capacity*** – pedestrian and cycle paths should be designed to provide ample space for both travelling and waiting pedestrians and cyclists.
- ***Pleasant*** – streetscapes should be designed to high urban design standards that provide interesting pedestrian and cycle routes, free of litter and fear of crime. Appropriate lighting should be provided on all routes. Greater levels of pedestrian and cyclist activity will assist in these regards.

The following principles relate well to the design of pedestrian facilities and should be incorporated into the design of the plan:

- ***Comfortable*** – pedestrian paths should be comfortable to walk on. Walking surfaces should be free of obstructions and provide a smooth surface (with no broken paving).
- ***Crossing facilities*** – appropriate at-grade pedestrian crossing facilities should be provided on desire lines. Consideration should be given to reducing the road width at these locations. Grade separated crossing facilities should be avoided where possible.
- ***Facilities*** – appropriate facilities should be provided within the footpath area, including regular seating, rubbish bins and maps. Design of facilities should be coordinated with the overall urban design theme and care should be taken when placing facilities to ensure that footpaths are not obstructed.
- ***Access to car parks*** – pedestrian access between car parks and local attractions should be considered to ensure that safe, convenient and obvious routes are provided, including pedestrian routes within car parks.

The following principles relate well to the design of cyclist facilities and should be incorporated into the design of the plan:

- ***Segregated facilities*** – cyclists should generally be provided with segregated on-road facilities, with clear cycle lanes, advance stop lines and other priority treatments. Particular care needs to be taken if cycle lanes and on-street parking are to be integrated.
- ***Storage Facilities*** – appropriate storage facilities should be provided at work. Storage facilities should provide for both long and short term storage of cycles and related equipment. Design should be such that storage is not only secure and provides weather protection, but also conveys a sense of high priority for the treatment of cycles and cyclists.
- ***Intersection Treatments*** – appropriate facilities should be provided for cyclists at intersections and at locations where cyclists have to move between on and off-street paths and vice versa to ensure safe and convenient access. These locations are typically the most difficult and confusing areas of the network for both cyclists and other road users.

The following principles relate well to the design of shared pedestrian / cyclist facilities and should be incorporated into the design of the plan:

- ***Separate*** - in general, facilities should be provided separately for pedestrians and cyclists, taking into account the different needs of these two groups.
- ***Consultation*** - where opportunities for shared off-road routes are identified (such as the Doonside Road facility), paths should be carefully planned with wide consultation at an early stage to ensure suitability of the route and the proposed facilities. Once implemented, use of the route should be monitored and changes made if problems arise.

8.6 Package of Measures

This chapter has described in some detail a proposed package of measures for implementation in and around the Western Parklands site. The package has been designed as an integrated package, requiring implementation of all measures if the objective of increasing public transport use, walking and cycling is to be achieved.

The analysis undertaken to supplement this TMAP in **Section 6.4** suggests that a mode shift of 5 per cent could be achieved through the implementation of this integrated package of measures. **Table 8.2** provides a summary of the recommended measures developed as part of this TMAP.

Table 8.2: Summary of Package of Measures

Area	Measure	Detail
Travel Behaviour Change	Workplace Travel Plans	Site framework: Provide a framework for employers to produce travel plans to encourage mode shift
		Individual Workplace Travel Plans
Infrastructure	Road Network	Site Access Brabham Drive
		Site Access Great Western Highway
		Improve peak hour phasing at intersections
		Alter line marking at Doonside Road/ Great Western Highway
	Bus	Introduce bus stop to Brabham Drive
	Pedestrian/ Cycle	Connections to existing pedestrian and cycle facilities
		Doonside Road shared path
Transport Services	Bus	Divert existing or future bus service to pass by or through the site

Source: Maunsell, 2006

9.0 TMAP Agreement

This section identifies the funding mechanisms available to the proponent and consent authority, including probable costs, available funding options and apportionment of funding and delivery responsibility.

9.1 Introduction

Costs have been provided for each of the infrastructure package measures by the cost estimating consultants YSCO Geomatics, with the exception of the bus stop on Brabham Drive. YSCO Geomatics have estimated costs on the basis of road network upgrade measures suggested by Maunsell.

For the new bus stop, travel behaviour and service measures, Maunsell has formed an opinion of probable cost.[4]. The probable cost is indicative at this preliminary stage and may have a confidence level of between +/-30 per cent and +/-50 per cent.

Upon agreement of the package and an associated scope of works for each measure, a more thorough scrutiny of likely costs can be undertaken if appropriate within the context of the planning process.

9.2 Cost Summary

The costs provided by YSCO Geomatics and details of the probable cost calculations are included at **Appendix A**. It is noted that the cost for the Great Western Highway access intersection is estimated at the lowest possible cost to construct.

Table 9.1 includes costs for measures that are internal to the site or provide direct access to the site and are expected to be funded by the proponent. **Table 9.2** includes costs external to the site on the surrounding road and transport networks. These costs are expected to be funded in part by the proponent via a levy.

[4] Opinion of probable costs are made on the basis of best judgment as an experienced and qualified engineering consultant, familiar with the construction industry As Maunsell is not a qualified Quantity Surveyor, nor does it employ quantity surveyors, Maunsell cannot and will not guarantee that any tenders or actual costs will not vary from this opinion of probable cost.

Table 9.1: Summary of Cost Options: Internal to Site and Access

Area	Measure	Probable Cost
Travel Behaviour Change	Site framework: Provide a framework for employers to produce travel plans to encourage mode shift	$15,000
Infrastructure	Site Access Brabham Drive	*$250,000
	Site Access Great Western Highway	*$2,354,050
	Connections to existing pedestrian and cycle facilities	$245,700
Total		**2,864,750**

Source: Maunsell, 2006, except *YSCO Geomatics, 2006

Table 9.2: Summary of Cost Options: External to Site

Area	Measure	Probable Cost
Travel Behaviour Change	Travel Plan Co-ordinator (10 years salary)	$546,000
Infrastructure	Improve peak hour phasing at intersections	Negligible
	Alter line marking at Doonside Road/ Great Western Highway	Negligible
	Introduce bus stop to Brabham Drive	$10,000
	Doonside Road shared path	$889,200
Transport Services	Divert existing or future bus service to pass by or through the site (over 5 years)	$74,200
Total		**$1,519,400**

Source: Maunsell, 2006, except *YSCO Geomatics, 2006

The total cost for external measures could be in the region of $1.5 million. On the basis of a developable area of 56 hectares, this is equivalent to $27,100 per hectare.

9.3 Timing

The likely timing for each of the elements of the package are shown in **Table 9.3.** The timing has been developed with consideration of the following factors:

- Businesses are likely to begin to occupy the site in 2008/9.
- Certain measures need to be in place prior to occupation in an effort to encourage preferred travel habits.
- All required funding may not be available during one year and must be programmed.
- The study area falls within Contract Area 1, scheduled for review by the Ministry of Transport under NSW Bus Reform in 2007/2008.

Table 9.3: Suggested Timing

Area	Measure	Timing
Travel Behaviour Change	Workplace Travel Plan Framework	With first DA submitted
	Workplace Travel Plans	Commence three months after occupation by business
Infrastructure	Access intersections	Prior to first occupation
	Other intersection improvements	Prior to full occupation
	Pedestrian/ Cycle Connections	Prior to first occupation
	Doonside Road shared path	Prior to first occupation
	Bus Stop Brabham Drive	Prior to first occupation
Transport Services	Bus Service	Following review of Bus Contract Area One

Source: Maunsell, 2006

10.0 Conclusions

10.1 Introduction

The Huntingwood West site provides challenges from the transport perspective since Certain intersections are close to or at capacity, especially the roundabout at Knox Road and Power Street.

Against these challenges, the site is well located in terms of the strategic road network. A large population of car users provides a significant base of employees that can be worked with to promote alternatives to the car.

Building on the work completed in Stage 1 of this TMAP and an assessment of existing traffic conditions in the local area, the implications of the development traffic on the local transport networks has been reviewed to enable a package of measures to be identified that will go some way to achieving NSW Government sustainable planning guidance.

10.2 Key Recommendations

The recommendations of this study are reflected in the package of measures developed for the site discussed in **Section 8**, together with the finding and implementation strategy discussed in **Section 9**.

Key points of this package include:

- Workplace travel plans, to include measures such as car pools, marketing of public transport options, or discounts on cycle equipment.
- Infrastructure improvements to provide easy pedestrian and cyclist access to Doonside via a shared path and connections to existing shared paths such as the M7 cycleway.
- Public transport infrastructure with a minimum provision of a bus stop on Brabham Drive.
- Transport service improvements, including potential to divert a bus route past the site.
- Access to the site via an existing roundabout at Brabham Drive and a new intersection from the Great Western Highway.
- Intersection improvements at key locations.

As a comprehensive package of measures, this will meet the needs of employees and businesses at Huntingwood West, while achieving a mode shift towards public transport.

Appendix A Cost Estimates

Cost Estimates

Opinion of Probable Cost

Measure	Detail	Length (m)	Unit Cost	Unit	Probable Cost	Cost plus Contingency	Total
Shared path	Huntingwood to Doonside Station	3800	$60	per m^2	$684,000	$889,200	$889,200
Connections	Site to M4	300	$60	per m^2	$54,000	$70,200	$245,700
	Site to M7	750	$60	per m^2	$135,000	$175,500	

Travel Plan Framework: $15,000, based on transport consultant fee for 2-3 weeks work

Travel Plan Co-ordinator: $54,600 per year, a total of $546,000 over 10 years.
This is based on the upper end of a Grade 13 salary at Blacktown Council (town planner level), which is reasonable.

Bus Operating Costs: Based on 1.6 kilometres increased service length under the following assumptions:

- 10 round trips per day
- Average running speed 22 km/h
- Variable Operating Cost per km $0.62
- Overhead Cost per km $0.39
- Driver Wages per km $0.92
- Annual Capital Cost per peak bus (over 15 year period) $23,788

YSCO Geomatics Cost Estimates

Brabham Drive Roundabout. Services relocation, re sheeting, splitter island construction, marking etc would conceivably cost about $250,000.

An estimated bill of quantities and costs follows for the Great Western Highway access intersection. he Two water mains and overhead power lines may need to be adjusted during construction, and YSCO has included an allowance for this items in section 7 'Miscellaneous Works'.

HUNTINGWOOD WEST
CROSS ROAD ACCESS TO PARKLAND
ESTIMATED BILL OF QUANTITIES AND COSTS

NO.	DESCRIPTION OF WORK	QTY	UNIT	RATE $	AMOUNT $
1	GENERAL				
1.1	Site establishment, including noticeboards, Superintendents site office, site facilities, setting out of the works, dust control, Public Liability & Insurance of the Works, construction and maintenance of side access tracks, and preparation of a site specific Environmental Management Plan,		Item		$150,000.00
1.2	Provision for traffic management and night works,		Item		$250,000.00
2	CLEARING				
2.1	Clearing of all improvements, trees and scrub from the works area, including grubbing out of stumps, mulching and stockpiling on site,		Item		$30,000.00
3	TOPSOIL				
3.1	Strip topsoil to a depth of 250mm from areas of works areas, and remove from site,	5,000	sq.m	$5.00	$25,000.00
3.2	Replace, spread and compact topsoil, from stock pile, on formed footways, berms and batters of roads to 100mm compacted thickness,	3,000	sq.m	$2.00	$6,000.00
4	BULK EARTHWORKS				
4.1	Excavation by cut to fill in roads, in all classes of material,	3,000	cu.m	$20.00	$60,000.00
PAGE SUBTOTAL					**$521,000.00**

HUNTINGWOOD WEST
CROSS ROAD ACCESS TO PARKLAND
ESTIMATED BILL OF QUANTITIES AND COSTS

NO.	DESCRIPTION OF WORK	QTY	UNIT	RATE $	AMOUNT $
5	DRAINAGE				
5.1	Excavate drainage trenches in all classes of material, including dewatering and disposal of surplus,	1,000	cu.m	$45.00	$45,000.00
5.2	Supply all materials, bed in clean graded sand, lay, joint and backfill RRJRC stormwater pipes,				
	450mm dia "class 2"	250	m	$100.00	$25,000.00
5.3	Supply, place and compact additional approved granular backfill material in drainage trenches under pavements, to subgrade level,	100	cu.m	$50.00	$5,000.00
5.4	Excavate for, supply all materials and construct standard drainage structures including transitions, jointing, step irons etc:				
	a) Standard mild steel grated gully pit with 1.8m kerb inlet,	8	each	$2,500.00	$20,000.00
	b) Headwall to DN375 outlet, including earth formed and turfed inlet/outlet channel,	4	each	$1,500.00	$6,000.00
PAGE SUBTOTAL					**$101,000.00**

HUNTINGWOOD WEST
CROSS ROAD ACCESS TO PARKLAND
ESTIMATED BILL OF QUANTITIES AND COSTS

NO.	DESCRIPTION OF WORK	QTY	UNIT	RATE $	AMOUNT $
6	ROADS AND FOOTPATHS				
6.1	Excavate by cut to fill for road pavements in material other than rock, cart surplus to stockpile indicated on the Soil and Water Management Plan,				
	Cut	4,500	cu.m	$12.00	$54,000.00
6.2	Prepare, trim and consolidate to profile:				
	a) Pavement subgrade	4,500	sq.m	$3.00	$13,500.00
	b) Footpaths, berms and batters	2,500	sq.m	$3.00	$7,500.00
6.3	Supply, place and compact road and driveway pavement in layers, subject to subgrade testing, consisting of:				
	c) 150mm compacted thickness DGB 20, base course,	4,500	sq.m	$15.00	$67,500.00
	d) 600mm compacted thickness DGS 40, sub-base course,	4,400	sq.m	$50.00	$220,000.00
6.5	Surfacing of road pavements with 50mm 7% modified SBS bitumen, including reprofiling,	9,000	sq.m	$32.00	$288,000.00
6.6	Surfacing of road pavement with one coat hot bitumen flush seal incorporating pre-coated aggregate,	4,400	sq.m	$7.00	$30,800.00
6.7	Supply all materials and construct standard concrete elements,				
	a) 150 Kerb & Gutter,	500	m	$40.00	$20,000.00
	b) Mountable kerb to splitter islands,	1,000	m	$25.00	$25,000.00
6.8	Supply all materials and construct 150mm thick concrete infills, with F82 mesh to median islands, splitter islands,	1,000	sq.m	$100.00	$100,000.00
PAGE SUBTOTAL					**$826,300.00**

HUNTINGWOOD WEST
CROSS ROAD ACCESS TO PARKLAND
ESTIMATED BILL OF QUANTITIES AND COSTS

NO.	DESCRIPTION OF WORK	QTY	UNIT	RATE $	AMOUNT $
7	MISCELLANEOUS WORKS				
7.1	Make smooth joins with all existing works,	4	Item	$5,000.00	$20,000.00
7.2	Sawcut bitumen, remove existing pavement and dispose of materials off site.	800	sq.m	$50.00	$40,000.00
7.3	Excavate for supply all materials and lower Sydney Water Mains.	1	Item	$50,000.00	$50,000.00
7.4	Supply all materials and adjust Integral Energy OH power.	2	Item	$20,000.00	$40,000.00
7.5	Supply and install Traffic Signals complete and line marking	1	Item	$330,000.00	$330,000.00
7.6	Supply and install timber post and wire boundary fencing,	500	m	$25.00	$12,500.00
7.7	a) Excavate in all classes of material, supply, bed, lay, joint and backfill subsoil drains, in filter sock,	1,000	m	$30.00	$30,000.00
	b) Supply all materials and constructstandard inspection eyes to subsoil drainage lines,	15	each	$100.00	$1,500.00
7.8	Excavate trenches in material other than rock, supply, lay, joint and backfill with sand, UPVC Class 6 Electricity conduits to local Authority standards:				
	6 X 125mm conduits per trench	150	m	$140.00	$21,000.00
PAGE SUBTOTAL					**$545,000.00**

HUNTINGWOOD WEST
CROSS ROAD ACCESS TO PARKLAND
ESTIMATED BILL OF QUANTITIES AND COSTS

NO.	DESCRIPTION OF WORK	QTY	UNIT	RATE $	AMOUNT $
8	SEDIMENT AND EROSION CONTROL				
8.1	Surface stabilisation of areas by turfing:				
	a) Supply and place couch turf, apply light top dressing, maintain, water and mow,	2,500	sq.m	$6.00	$15,000.00
8.2	Supply all materials, erect and maintain silt fencing and remove from site at completion of works,	600	m	$15.00	$9,000.00
8.3	Supply all materials, erect and maintain orange low density polypropylene barrier fencing and remove from site at completion of works,	600	m	$12.00	$7,200.00
8.4	Form and maintain turfed earth diversion banks, minimum 0.3 high,	200	m	$10.00	$2,000.00
8.5	Form turfed level spreader at ends of diversion banks,	100	sq.m	$15.00	$1,500.00
8.6	Supply all materials, erect and maintain straw bale silt barriers and remove from site at completion of works,	300	m	$20.00	$6,000.00
8.7	Construct and maintain site exit washdown area and remove from site at completion of works,	1	each	$10,000.00	$10,000.00
8.8	Construct a bund of impervious material around the area for storage of liquid hydrocarbons or chemicals with minimum 110 percent of materials storage capacity,	1	Item	$2,000.00	$2,000.00
8.9	Provide waste disposal container for collection of all industrial type waste, including provision for regular disposal of accumulated waste,	1	Item	$1,000.00	$1,000.00
PAGE SUBTOTAL					**$53,700.00**
TOTAL ESTIMATED COSTS					**$2,047,000.00**
15 PERCENT CONTINGENCY					$307,050.00
RECOMMENDED BUDGET					$2,354,050.00

APPENDIX D
DRAFT STRATEGIC OFFSET DIRECTIONS

APPENDIX D
Draft Strategic Offset Directions

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ASSESSMENT | PLANNING | MANAGEMENT

STRATEGIC OFFSET DIRECTIONS HUNTINGWOOD WEST EMPLOYMENT LANDS

Report prepared for:
Landcom

September 2006

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Contents

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Executive Summary

The Regional Western Sydney Parklands (Parklands) occupy a strategic position linking the North-West and South-West Development Sectors of Sydney. It includes the Bungaribbee Development Precinct, which in turn consists of Huntingwood West and Doonside interface lands and the Parklands Precinct (Figure 1). Development is proposed for Huntingwood West, which adjoins the Parklands Precinct.

The Huntingwood West site is 56 ha in area, most of which is exotic grassland. Approximately 5.6 ha of Shale Plains Woodland of Moderate Ecological Constraint occur on the site. Shale Plains Woodland is part of Cumberland Plain Woodland which is an Endangered Ecological Community listed under the NSW Threatened Species Conservation Act 1995. Proposed development necessitates the loss of this woodland.

To counterbalance (offset) the loss of 5.6ha of Shale Plains Woodland within the site the developer will contribute to the ecological management within the adjoining Parklands Precinct in accordance with the Western Sydney Regional Parklands Management Vision (Department of Infrastructure, Planning and Natural Resources November 2004). This vision includes establishment of an Ecological Network that maintains core habitat areas linked by habitat corridors. This network would be achieved by protection, management and restoration of vegetation and habitats along Eastern Creek. Conservation measures within the Parklands Precinct would be managed by the Parklands Trust.

This contribution by the developer will take the form of a monetary sum that will go towards the protection, restoration and management of 5.6 ha of Shale Plains Woodland in high priority areas within the Parklands Precinct.

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1. Introduction

1.1 Bungarribee Development Project

The Regional Western Sydney Parklands occupy a strategic position linking the North-West and South-West Development Sectors of Sydney. The Parklands cover 5,500ha of land and stretches 27km from Quakers Hill in the north to Leppington in the south. The Parklands corridor contains existing recreation facilities such as the Olympic Equestrian, Shooting and Baseball centres, Prospect Reservoir and the Eastern Creek raceway.

The Bungarribee Development Project contains (Figure 1):

- Precinct 2: Bungarribee - one of the nine precincts that make up the 5,500ha Western Sydney Parklands. This precinct of the Parklands comprises approximately 300ha or land in Blacktown LGA. The Precinct is described in greater detail in *The Western Parklands Management Vision* (Department of Infrastructure, Planning and Natural Resources 2004).

- Interface lands:
    - Huntingwood West: a 56ha (approx) site, adjoining the Parklands at West Huntingwood, to be developed for employment purposes.
    - Doonside: a 55ha (approx) site, adjoining the Parklands at Doonside, to be developed for residential purposes.

The land is owned by the Department of Planning (DoP). A Parklands Trust will be created in 2007. The Trust will take control of the Parklands. Development of the Interface Lands will raise funds to be returned to the Parklands Trust.

1.2 Parklands Management Vision

The biodiversity offset objectives for Huntingwood West have been designed to link to, and deliver, the strategic ecological objectives of the Western Sydney Regional Parklands Management Vision as set out in the Western Sydney Parklands Management Vision Summary Report (Department of Infrastructure, Planning and Natural Resources November 2004).

The Western Sydney Regional Parklands Management Vision is:

- "*The Western Sydney Regional Parklands form a unique component of the Sydney metropolitan open space system, linked to surrounding areas and providing a diverse range of recreation and cultural learning experiences integrated with the natural and cultural values of the land.*"

A key element of the Management Vision is the establishment of an Ecological Network that maintains core habitat areas linked by habitat corridors.

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1.3 Aim of this Report

The aim of this report is to describe the offsets strategy for the removal of vegetation from Huntingwood West and how it fits in with the overall ecological management objectives of the Parklands Precinct.

This report includes:

- a brief description of the proposal for Huntingwood West;
- an outline of offsetting principles;
- an outline of the framework within which offsets for Huntingwood West will be achieved;
- identification of responsibilities and tasks, and
- Identification of timeframes for implementing offset actions;

This report sits in the appendices of the Part 3A Environmental Assessment for the Huntingwood West Employment Lands.

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2. Biodiversity Offsetting Background

2.1 What is Biodiversity Offsetting?

A biodiversity offset is one or more actions that are put in place to counterbalance (offset) the impacts of development on biodiversity (Department of Environment and Conservation 2006). Such offsets have potential to deliver the maintenance of both local environmental values as well as an overall improvement in environmental values across a region.

There are different types of offsets, including:

- an on-site offset, where biodiversity values on another part of the same site are secured and improved;
- an off-site offset, where the developer secures and improves biodiversity values on another piece of land, and
- an off-site offset through a third party, where a developer purchases credits from or pays a third party to provide an offset either in advance, or at the time, of the development. The third party then must secure and maintain the offsets on behalf of the developer.

Where a range of options exist, the developer may consider which type of offset is most appropriate. This depends on offset availability. Offsets ideally should be undertaken before development to provide certainty that they will be effective while ensuring that there is no net loss of biodiversity (Department of Environment and Conservation 2006). The offset should also address biodiversity priorities in the area.

2.2 Biodiversity Offsetting Principles

The following principles have been developed from various sources including NSW Government (2002), Eco Logical Australia Pty Ltd (2003) and NSW Department of Natural Resources (2005) and experience in developing offsets for project through New South Wales.

Principles underpinning habitat offsetting include:

- impacts must be avoided first by using prevention and mitigation measures. offsets are then used to address remaining impacts;
- offsets cannot be used as a substitute for assessment requirements;
- offset schemes must not encourage landholders to deliberately degrade or mismanage offset areas in order to increase their value from the offset;
- offsets should complement other government conservation programs;
- offsets must be underpinned by sound ecological principles;
- offsets should aim to deliver a net improvement in biodiversity over time;
- offsets must redress the impact of the development for the time period that the impact occurs;
- offsets should be agreed upon prior to the impact occurring;
- the impacts and benefits of the offset must be reliably estimated;

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- offsets must be targeted – i.e. they must offset impacts on a basis of like-for-like or better conservation outcome;
- offsets must be located in the same region;
- offsets must go beyond existing requirements of other programs and not be already funded by another scheme, and
- offsets and their actions must be enforceable.

2.3 Biodiversity Offsetting Actions

The kinds of actions that could be taken to offset impacts on biodiversity need to be determined at a local level and need to contribute to the overall environmental objectives of an area. Actions which are commonly associated with biodiversity offsetting include:

- **Protection of habitat** – overall aim is to contribute to the number of hectares in the most secure tenure for conservation.
- **Enhancing habitat viability** – in addition to increasing the conservation security of habitat, it is important to increase the viability of habitat that has become degraded. Ensuring the health and integrity of the habitat secured for conservation is a vital part of ensuring that protecting land is a successful mechanism for protecting and enhancing biodiversity.
- **Creating habitat** – to increase the area of important ecological communities creating new habitat in areas that are adjacent to existing habitat or in areas where there is a sound ecological reason to do so (e.g. corridor network or stream buffers). Any habitat creation works would have to be planned, appropriate, enforced and managed over time.

The primary objective of an offset action should be to create, enhance, or maintain ecologically viable habitat for locally endemic species, in the same or adjacent area/s.

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3. Huntingwood West Offset

3.1 Impact on Biodiversity

The Huntingwood West site is 56 ha in area, most of which is exotic grassland of negligible ecological constraint (Figure 1). Approximately 5.6 ha of Shale Plains Woodland of Moderate Ecological Constraint occur on the site (Eco Logical Pty Ltd 2005). This community is Shale Plains Woodland, which is part of Cumberland Plain Woodland, which in turn is an Endangered Ecological Community listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act). No streams are present on the site.

The woodland consists of five patches of woodland comprising one large patch of approximately 4 ha and four scattered smaller patches of between 0.2 and 0.5 ha in the eastern part of the site. The condition of the woodland habitat ranges from areas of scattered trees in paddocks to areas of natural canopy with recovery potential ranging from low to high.

The impact of the development on biodiversity in Huntingwood West will include the removal of 5.6 ha of Shale Plains Woodland of Moderate Ecological Constraint. NO threatened species were recorded on Huntingwood West (Eco Logical Australia 2003).

3.2 Potential Biodiversity Offsetting Actions

Potential offsetting actions to counterbalance the loss of 5.6 ha of Shale Plains Woodland from Huntingwood West could include:

- broad conservation measures in the Parklands Precinct aimed at maintaining broad scale ecological viability, and
- targeted offsetting measures in the Parklands Precinct aimed at counterbalancing the loss of the particular values of 5.6 Shale Plains Woodland from Huntingwood West.

3.3 Recommendations

3.3.1 Monetary Contribution

Proposed targeted offsetting measures include protection, enhancement and creation of 5.6 ha of high priority areas of Shale Plains Woodland within the Parklands Precinct.

The developer would commit to providing a monetary contribution of a sufficient value to protect, create and manage 5.6 ha of Shale Plains Woodland in high priority areas within the Parklands Precinct. This would allow an offset on a like for like basis and in accordance with the offset principles in Section 2.

This monetary contribution would facilitate the consolidation of Shale Plains Woodland in high priority areas, thus contributing to the Ecological Network along Eastern Creek according to the objectives of the Management Vision for the Parklands Precinct.

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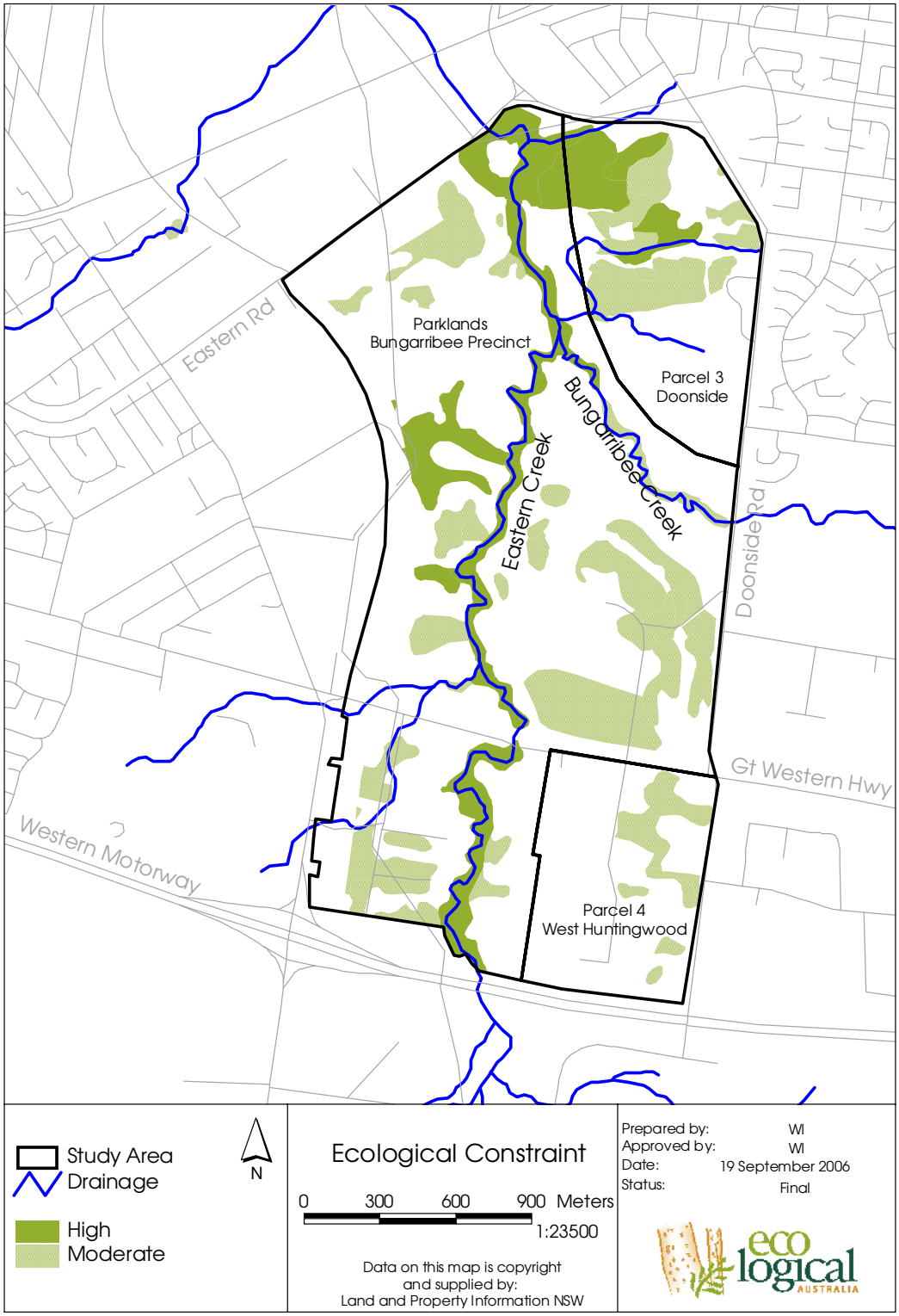

Figure 1 Ecological Constraint

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3.3.2 Potential Offset Locations

There are a number of patches of Shale Plains Woodland within the Parklands Precinct that are fragmented, have high edge to area ratios and are of varying degrees of connectivity, conditions and resilience. These areas should be used for the creation, protection and management of 5.6 ha of Shale Plains Woodland. This would contribute to the establishment of an Ecological Network and in enhancing the ecological viability of the parklands. These areas would be clarified during further investigated during development of the Parklands Concept Plan.

3.3.3 Responsibilities and Timeframes

The future Parklands Trust will have overall responsibility for delivering the conservation management outcomes for the Parklands Precinct.

Deliverance of conservation outcomes will also include involvement of other stakeholders with interests in the Parklands Precinct including Department of Environment and Conservation (DEC), Department of Natural Resources (DNR), Greening Australia (GA) and potentially other federal or state government agencies, community groups and landholders.

The developer of Huntingwood West would be responsible for providing the money that will protect, restore and manage 5.6 ha of Shale Plains Woodland in the Parklands. The developer will also be responsible for negotiating the funding scheme and reporting with the future Parklands Trust and with DEC.

3.3.4 Monitoring and Accountability

The Parklands Trust will have responsibility for the management of the Parklands Precinct and therefore of creation, protection and management of woodland to offset the loss from Huntingwood West. Accountability and reporting will be agreed between the Parklands Trust and DEC.

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4. Conclusion

This document provides recommendations for offsetting the loss of 5.6 ha of Shale Plains Woodland from Huntingwood West Employment Lands. This would be achieved though both the delivery of broad conservation objectives as well as a monetary contribution that could be used to protect, enhance and restore Shale Plains Woodland in the Parklands Precinct. These recommendations are in accordance with the Management Vision for the Western Sydney Parklands.

The targeted offset action of a monetary contribution from the developer needs to be sufficient to protect, restore and manage at least 5.6 ha of Shale Plains Woodland within the Parklands Precinct. Offsetting measures would be underpinned by current accepted offsetting and ecological principles.

Offsets will be funded through an agreement negotiated between the developer, Parklands Trust and DEC. The Parklands Trust will have responsibility for the conservation and management of the Parklands Precinct. Mechanisms of accountability and reporting will also be negotiated through an agreement between the developer, DEC and the Parklands Trust.

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5. References

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APPENDIX E
WATER SENSITIVE URBAN DESIGN STRATEGY

APPENDIX E

Water Sensitive Urban Design Strategy

ECOLOGICAL ENGINEERING

Western Sydney Parklands – Bungarribee Precinct

Huntingwood West WSUD Strategy

Employment Lands

November 2006

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Table of Contents

Executive Summary

This report presents the Water Sensitive Urban Design (WSUD) strategy for the 56ha Huntingwood West site, addressing water conservation, pollution control and flow management. This strategy has been developed in collaboration with EDAW and Architectus, the Landscape Architects and Urban Designers for the project, to ensure that the WSUD elements proposed for the site have been designed to be integrated into the open space and built form.

The site is gently undulating to Eastern Creek with two ephemeral depressions draining the site. The site also drains a 20ha industrial development upstream, while the north-east corner of the site drains north across the Great Western Highway.

The industrial precinct will generate stormwater pollution as a result of high percentages of impervious surfaces and traffic volumes, and industrial practices that result in a wide range of pollutants types and concentrations entering the stormwater drainage system. Stormwater washoff from hard paved areas convey typical pollutants including litter, coarse, medium and fine sized suspended solids, nutrients, heavy metals, hydrocarbons, oil and grease. WSUD elements will be used to reduce pollutants carried from the Huntingwood West industrial precinct.

The WSUD strategy has been guided by a series of water management principles for the site derived from the provisions of state and local government planning policies, as well as responding to the site opportunities and constraints. The WSUD Strategy is centred on achieving the following outcomes:

- Potable mains water needs to be reduced through demand management including the installation of water efficient fixtures and using alternative sources of water based on matching water quality to uses on a "fit-for-purpose" basis.
- Stormwater runoff from the development as well as the 20ha catchment to the east of the development which flows through the site, is to current best practice water quality standards.
- Post-development storm discharges to equal pre-development storm discharges for the one and a half year ARI event, so as to minimise the impact of frequent events on the natural waterways and to minimise bed and bank erosion.
- Post-development storm discharges up to the 100 year ARI event need to be contained so as to minimise the impact of flood events on Eastern Creek. These targets can be met in conjunction with the downstream wetland adjacent to the site.

With end users (industry type) and likely water demands currently not known, it is not possible to develop and evaluate potable water conservation strategies. However, guiding principles for potable water conservation based on demand management and provision of alternative non-potable water sources apply.

While the stormwater quality targets could be met through either a series of bioretention systems or a constructed stormwater wetland, only a wetland system allows the site to meet each of the three stormwater related targets outlined above. A bioretention system requires other complementary measures to meet the flood attenuation targets. The proposed wetland improves water quality and also provides flood detention storage. The wetland consists of three zones - precinct parks with inlet ponds, a macrophyte zone, and ephemeral zones.

Hydrologic modelling indicates the total flood detention volume required is approximately 54,000 m^3, of which 34,000 m^3 is required to return the pre-developed 1.5 year ARI peak stormwater discharge. The footprint of the 3.5 ha wetland and associated 0.6 ha of precinct ponds have been configured to provide the required flood detention storage. Flood storage provided at the precinct ponds (wetland inlet zones) and ephemeral zones will be engaged first and this storage should be sufficient to attenuate the majority of events up to the 1.5 year ARI event to pre-development levels. For larger events, flood storage provided above the wetland macrophyte zones will be engaged. The wetland is the preferred stormwater strategy due to it:

- provides the highest flexibility in the final layout of the industrial precinct and thus accommodate other design considerations/requirements by the purchaser.
- overcomes the higher risk of damage to on-site measures (such as street-scale bioretention systems) in an industrial precinct (compared with residential precincts).
- is the most cost effective way to meet flood detention storage requirements.
- provides the potential to treat stormwater from the additional upstream catchment that drains through the site.
- is better integrated to the overall landscape design and provide a suitable interface between the parklands and the industrial precinct.

Incorporating the pre-developed 1.5 year ARI peak stormwater discharge storage into onsite detention (OSD) will reduce the requirement for centralised flood storage provision and thus the size of the wetland system. To contain the 1.5 year ARI peak discharge through OSD at each lot, the storage provision required is 750 m^3/ha impervious area.

The elements of the proposed WSUD Strategy include;

- Gross Pollutant Traps (GPTs) located within the site for initial pollutant reduction,
- A constructed wetland within the parklands as an interface with the Huntingwood West employment lands. The wetland improves water quality and provides flood detention storage. The macrophyte zone is a shallow body of water, heavily vegetated with water plants. The ephemeral zones are planted with species capable of withstanding short term inundation and long term drying.
- Attenuation of storm and flood events is integrated into the storage areas associated with the precinct ponds (within the site), and the macrophyte zone and ephemeral zones of the wetland (within the parklands). This provides geomorphic protection to the waterways downstream, by limiting discharge to pre-development flows for frequent storm events with high erosion potential.
- Bioretention system within the central median of the main entry road to treat stormwater discharged from the upstream catchment
- The option to include street-tree bioretention cells within the streetscape will further increase the capacity of the strategy to achieve stretch targets for stormwater quality treatment.
- Development of building design guidelines to ensure that pollution sourced from work areas does not enter into stormwater drains.
- Guiding principles for potable water conservation initiatives within the precinct

1 Introduction

Ecological Engineering has been engaged by Landcom to develop Water Sensitive Urban Design (WSUD) strategies for the key parcels of the Western Sydney Parklands – Bungarribee Precinct. These areas include the Doonside and Rooty Hill residential sites and the Huntingwood West employment zone.

The WSUD strategy developed for the 56 ha Huntingwood West site is presented in this report. This strategy has been developed in collaboration with EDAW and Architectus, the Landscape Architects and Urban Designers for the development. The WSUD elements proposed for the site have been designed to be integrated into the open space and built form, adding aesthetically and functionally to the design.

This strategy has been further informed by discussions with the Department of Planning, Landcom, Blacktown City Council, the project managers, and other consultants as required. The WSUD strategy is designed to integrate the site specific opportunities with the WSUD principles and objectives to deliver best practice water cycle management.

This report presents a WSUD Strategy for the Huntingwood West site with the aim of ensuring that water cycle management options are optimized for the site. The key sections of this report include:

- water management principles and objectives identified for the parklands through the *Sydney Regional Environmental Plan (SREP) 31 – Regional Parklands* and *Development Control Plan (DCP 1) – Interim Regional Parklands Management*, as well as Landcom's WSUD targets, and the provisions of Blacktown City Council's policies.
- Stormwater quality characteristics in relation to industrial precincts and the opportunity to use building guidelines for pollutant source control at the lot level.
- Water quality treatment measures that are recommended for the site, specifically outlining the function and typical configuration of bioretention central medians, constructed wetlands and street trees
- The details of the WSUD strategy developed for the site, explaining the combination of elements that will deliver the objectives outlined and opportunities identified through the creation of this strategy.
- Preliminary costing of elements proposed for Huntingwood West.
- Flood modelling and the integration of the required flood detention with the site layout and other WSUD elements.
- Potable water conservation measures including demand management and use alternative water sources to meet non potable demands – fit for purpose use of water.

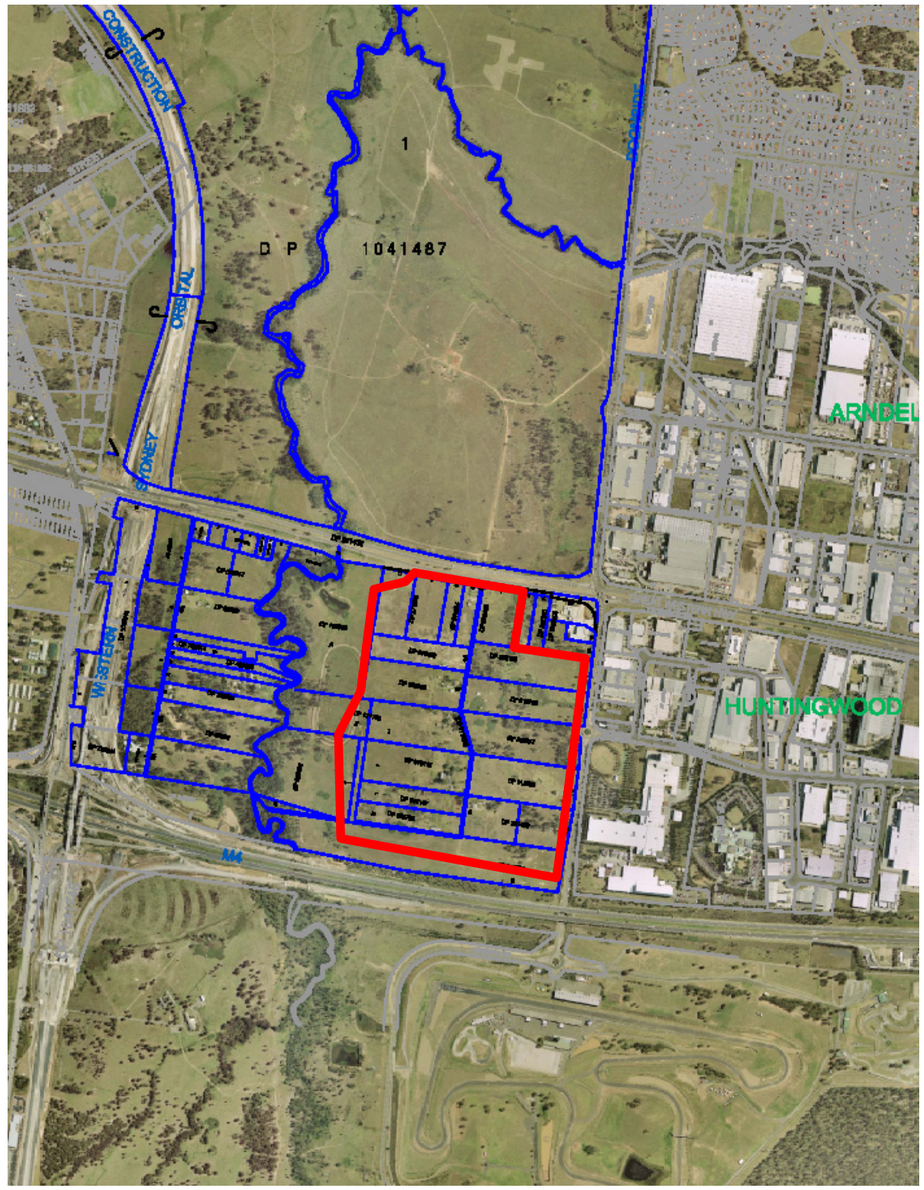


Figure 1.1: Aerial photo showing the Huntingwood West site, at the southern end of the Bungarribee Precinct. The Great Western Highway on the northern boundary, M4 and Eastern Creek International Raceway on the southern side. Whelans ref C607-001A.dwg, 19/9/2005

2 Water Management Principles and Objectives

Water management principles for the site are derived from the provisions of state and local government planning policies, as well as responding to the site opportunities and constraints. The following outlines the principles and objectives that have been established for the development.

2.1 Bungarribee Precinct Water Management Targets

The Western Sydney Parklands Management Vision establishes a range of ecologically sustainable development objectives for the Parklands (DIPNR 2004), including:

- Protect and restore biodiversity values across the Parklands including within core habitat and core habitat needs
- Manage and restore remnant vegetation within riparian zones and along drainage lines
- Ensure that landuse and development within the parklands maintains and enhances water quality runoff
- Implement WSUD principles in existing and future development of facilities within the parklands, such as recycling of water from adjacent treatment plants.

The *Sydney Regional Environmental Plan (SREP) 31 – Regional Parklands*, aims to "…promote recreation, biodiversity and heritage conservation and landscape protection for the Western Sydney Regional Parklands". It is supported by the *Development Control Plan No.1 – Interim Regional Parklands Management*. This DCP identifies key natural resource principles including:

- Protect and enhance the natural systems of the parkland, locating all development in areas that are already cleared.
- Conserve and enhance remnant bushland to ensure protection of biodiversity, threatened species, populations and ecological communities and areas of environmental importance.
- Conserve and enhance watercourses and riparian areas.
- Establish a biodiversity and pedestrian and cyclist movement corridors linking recreation areas and areas of environmental importance.
- Improve long-term Regional Parklands management and establish appropriate management systems (revegetate creek-lines to create good ecological status, control erosion, filter nutrient run-off and re-establish biodiversity links, protect habitat and remnant vegetation)

2.2 Landcom Water Management Targets

Landcom's WSUD Policy includes objectives for water conservation, pollution control and mitigation of the effect of increased flow as a result of catchment urbanisation. The implementation of the WSUD policy aims to achieve the protection of aquatic ecosystems and water resources. The policy has been developed to provide Landcom development staff, its consultants and private sector partners with an overview of WSUD guiding principles and practices together with selection guidelines of suitable and appropriate WSUD practices. The specific WSUD targets within the policy are listed in Table 2.1.

Table 2.1 – Landcom's WSUD Targets

Objective	Performance Measure and Target
1. WSUD Strategy	(a) 100% of projects to have project-specific WSUD strategies.
2. Water Conservation	(a) Combination of water efficiency and reuse options, 40% reduction on base case.
3. Pollution Control	(a) 45% reduction in the mean annual load of Total Nitrogen (TN).
	(b) 45% reduction in the mean annual load of Total Phosphorus (TP).
	(c) 80% reduction in the mean annual load of Total Suspended Solids (TSS).
4. Flow Management	(a) Post-development storm discharges = pre-development storm discharges for one and a half years ARI event. The purpose of this is to minimise the impact of frequent events on the natural waterways and to minimise bed and bank erosion.

To complement the WSUD targets, Landcom's mandatory WSUD requirements are:

- All Landcom projects must have a project specific WSUD strategy developed appropriate to the size, scale and complexity of the project. The WSUD strategies must meet Landcom WSUD targets (related to objective 1).
- Priority must be given to the use of non-potable water sources for public domain irrigation within all Landcom projects (related to objective 2).
- Where reticulated recycled water is available from the local water utility, it must be used for appropriately matched uses such as toilet flushing, garden watering etc. (related to objective 2).

2.3 Blacktown Council DCP Water Management Targets

Blacktown City Councils (2000a and 2000b) Policies "Stormwater Quality Control" and "Stormwater Quality Control Policy Background Information and Guidelines for Application" are aimed at implementing the council's objectives for new development as listed in the Stormwater Management Plans for the area. The Policy applies to commercial areas, residential developments, and industrial developments greater than 1000m^2.

The policy sets both quantitative and qualitative objectives, and establishes a priority hierarchy for prioritising pollutants (hydrocarbons, litter, coarse sediments, fine sediments, and nutrients) based on the different types of development (industrial, commercial, residential etc). The policy establishes treatable flow volumes, requires modelling for larger catchments, and promotes a treatment train approach where critical pollutants are targeted for removal with a combination of appropriate treatment measures. For sites greater then 5 ha, other then residential developments, the policy requires the development of Stormwater Management Plan to be submitted as part of the development application.

Appropriate targets for the site include:

- Gross pollutants: 90% total annual load
- Coarse sediment: 80% total annual load
- Fine sediment: 50% total annual load
- Nutrients: 45% total annual load
- Hydrocarbons, oil & grease: 90% total annual load, total hydrocarbons < 10 mg/L

In addition to the pollution retention criteria listed above, there are qualitative operational objectives for new developments that have been adapted from the WSUD-Technical Guidelines for Western Sydney, 2004 and include:

- Limiting the direct connection between impervious areas and the stormwater drainage system and using vegetated flow paths where possible
- Maximising reuse of stormwater for non potable demands
- Infiltrating stormwater 'at source' where soil types allow
- Protecting natural wetlands, watercourses and riparian corridors and protecting drainage channels with base flow, defined bed or banks, or native riparian vegetation.
- Maintaining natural flow paths, discharge points and runoff volumes. The frequency of the bank-full flows should not increase as a result of development. Generally, no increase in the 2 year and 100 year ARI peak flows.
- Compatible multiple use of stormwater facilities
- No adverse impacts from stormwater discharging to urban bushland areas.

2.4 DCP Controls for Huntingwood West

Based on the objectives identified in the above planning controls the following DCP provisions are recommended to be adopted for the Huntingwood West development.

2.4.1 Objectives

- Stormwater runoff from the development as well as the 20ha catchment to the east of the development which flows through the site, is to meet the following pollution reduction targets which can be met in conjunction with the proposed downstream wetland adjacent to the site.
    a. total suspended solids – 80% reduction in the average annual load from that typically generated from an urban catchment
    b. total phosphorous (TP) and total nitrogen (TN) – 45% reduction in the average annual load from that typically generated from an urban catchment.
    c. litter and gross pollutants will be removed from stormwater leaving the site.
    d. Hydrocarbons, oil & grease: 90% total annual load, total hydrocarbon discharge < 10 mg/L
- Post-development storm discharges to equal pre-development storm discharges for the one and a half year ARI event, so as to minimise the impact of frequent events on the natural waterways and to minimise bed and bank erosion.
- Post-development storm discharges up to the 100 year ARI event need to be contained so as to minimise the impact of flood events on Eastern Creek. These targets can be met in conjunction with the downstream wetland adjacent to the site.
- Potable mains water needs to be reduced through demand management including the installation of water efficient fixtures and using alternative sources of water based on matching water quality to uses on a "fit-for-purpose" basis.
- Investigate the potential of using alternative water sources including wastewater and stormwater to meet non potable demands on the site.
- Where reticulated recycled water is available from the local water utility, it must be used for appropriately matched uses such as toilet flushing, garden watering etc.
- Avoid adverse impacts due to soil salinity.

2.4.2 Source controls

a. Stormwater quality controls to meet the development objectives can include gross pollutant traps, bioretention systems, rain gardens and wetlands. These systems can be located as discrete individual elements, as larger regional elements, or a combination therein. Modelling at the detailed design stage should determine appropriate size and location in conjunction with the downstream wetland. All WSUD elements should minimise any potential impact on sodic soils.

b. Pollution sourced from work areas is to be prevented from entering the stormwater system and thereby the downstream environment by roofing work areas, directing wash-down to storage (which is subsequently pumped out as industrial waste) or sewer and controlling activities undertaken in areas connected to stormwater drains.

2.4.3 Downstream controls

a. The precinct ponds (within the site), and the wetland (within the parklands) will provide sufficient flood storage so that the one and a half year ARI event equals the pre-development one and a half year ARI event. For the wetland storage is provided in both the ephemeral wetland zones and the extended detention of the macrophyte zone

b. A wetland adjacent to the development can be used to assist the development attaining stormwater quality objectives and retardation of the flows up to the 100 year ARI event. If this wetland is not constructed, the objectives need to be met within the development.

2.4.4 Minor and major drainage controls

The drainage system is to consist of the following components:

a. Minor drainage system – Pipe and street system able to convey runoff safely through the development up to the 20 year ARI storm.

b. Major drainage system – Overland flow paths must be designed to convey the 100 year ARI flows.

c. Combined detention / wetlands to provide necessary quantity/quality controls whilst being able to cope with 100 year ARI flows.

2.4.5 Potable water controls

a. A water balance should be undertaken to ascertain water consumption and stormwater harvesting potential within the development.

b. Where feasible, the development should use collected rainwater for toilet flushing.

c. Priority shall be given to the use of non-potable water sources for public domain irrigation

d. Developments that consume high volumes of water in their operation shall incorporate recycling initiatives in the plant's operation to reduce the demand on water.

e. The following water saving devices are to be installed through the development:

- 6/3 litre dual flush toilets, waterless urinals, at least AAA water efficiency ratings for all staff amenity appliances and aerators fitted to hot and cold water taps over basins and sinks in staff amenity areas.

The WSUD strategy for Huntingwood West is guided by the objectives outlined above.

3 Stormwater Management Strategy for Huntingwood West

Improving stormwater quality prior to discharge into Eastern Creek is an essential stormwater management objective. Stormwater pollution in industrial precincts is associated with typically high percentages of impervious surfaces and traffic volumes, and industrial practices that result in a wide range of pollutants types and concentrations entering the stormwater drainage system. Stormwater washoff from hard paved areas convey typical pollutants including litter, coarse, medium and fine sized suspended solids, nutrients, heavy metals, hydrocarbons, oil and grease. WSUD elements can be used to reduce pollutants carried from the Huntingwood West industrial precinct.

Stormwater treatment elements include gross pollutant traps, bioretention systems, swales and wetlands. These systems can be located as discrete individual elements, as larger regional elements, or a combination therein. These stormwater management features can be readily incorporated into the landscape and streetscape design of the industrial precinct and the adjoining parkland. The optimal configuration of WSUD elements is typically a combination of these alternatives, with the detail of a strategy for a particular site determined in collaboration with the landscape and urban design teams.

Stormwater modelling was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), to determine the approximate size of the treatment elements. The model used eleven years (1967 – 1977) of 6 minute rainfall data from the Liverpool Bureau of Meteorology station which has a mean annual rainfall of 857 mm/yr and mean annual potential evapo-transpiration of 1496mm/yr. This station has rainfall comparable with the daily data available from the Prospect Dam Bureau of Meteorology station which has a mean annual rainfall of 866 mm/yr (120 year record from 1887).

3.1 Preferred Stormwater Management Strategy

The preferred stormwater management strategy for the Huntingwood West Industrial Precinct is centred on achieving the following outcomes:

- Stormwater runoff from the development as well as the 20 ha catchment to the east of the development which flows through the site, is to attain current best practice water quality standards.

- Post-development storm discharges to equal pre-development storm discharges for the one and a half year ARI event, so as to minimise the impact of frequent events on the natural waterways and to minimise bed and bank erosion.

- Post-development storm discharges up to the 100 year ARI event need to be contained so as to minimise the impact of flood events on Eastern Creek.

While the stormwater quality targets could be met through either a series of bioretention systems or a constructed stormwater wetland, only a wetland system allows the site to meet each of the three outcomes outlined above. A bioretention system requires other complementary measures to meet the flood attenuation targets. For example, incorporating the pre-developed 1.5 year ARI peak stormwater discharge storage into onsite detention (OSD) will require 750 m^3/ha impervious area at each lot. Further details are given in Section 5.

The preferred WSUD strategy involves the construction of a downstream wetland adjacent to the site. The adoption of this strategy is due to the following reasons:

- provides the highest flexibility in the final layout of the industrial precinct and thus accommodate other design considerations/requirements by the purchaser;
- overcomes the higher risk of damage to on-site measures (such as street-scale bioretention systems) in an industrial precinct (compared with residential precincts);
- is the most cost effective way to meet flood detention storage requirements (see further discussion below).
- provides the potential to treat stormwater from the additional up stream catchment that drains through the site.
- is better integrated to the overall landscape design and provides a suitable interface between the parklands and the industrial precinct.

The elements of the preferred WSUD strategy are shown in Figure 3.1 and include;

- Gross Pollutant Traps (GPTs) for initial pollutant reduction (located underground, adjacent to precinct pond)
- a constructed wetland as an interface between the parklands and the Huntingwood West employment lands. The wetland improves water quality and provides flood detention storage. The wetland consists of three zones – precinct parks with inlet ponds, a macrophyte zone, and ephemeral zones. The macrophyte and ephemeral zones are located within the parkland.
- bioretention system within the central median to treat stormwater discharged from the upstream catchment
- the option to include street-tree bioretention cells within the streetscape will further increase the capacity of the strategy to achieve stretch targets for stormwater quality treatment.

Flood storage provided at the precinct ponds (wetland inlet zones) and ephemeral zones will be engaged first and this storage is sufficient to attenuate the majority of events up to the 1.5 year ARI event to pre-development levels. For larger events, flood storage provided above the wetland macrophyte zones will be engaged. Careful design is required to protect the structural integrity of the various wetland elements.

Hydrologic modelling indicates the total flood detention volume required is approximately 54,000 m^3, of which 34,000 m^3 is required to return the pre-developed 1.5 year ARI peak stormwater discharge. The proposed footprint of the wetland has been configured to provide the required flood detention storage, with the component required for events up to the 2 year ARI being provided at the precinct ponds/inlet zones and the ephemeral zones of the wetland.

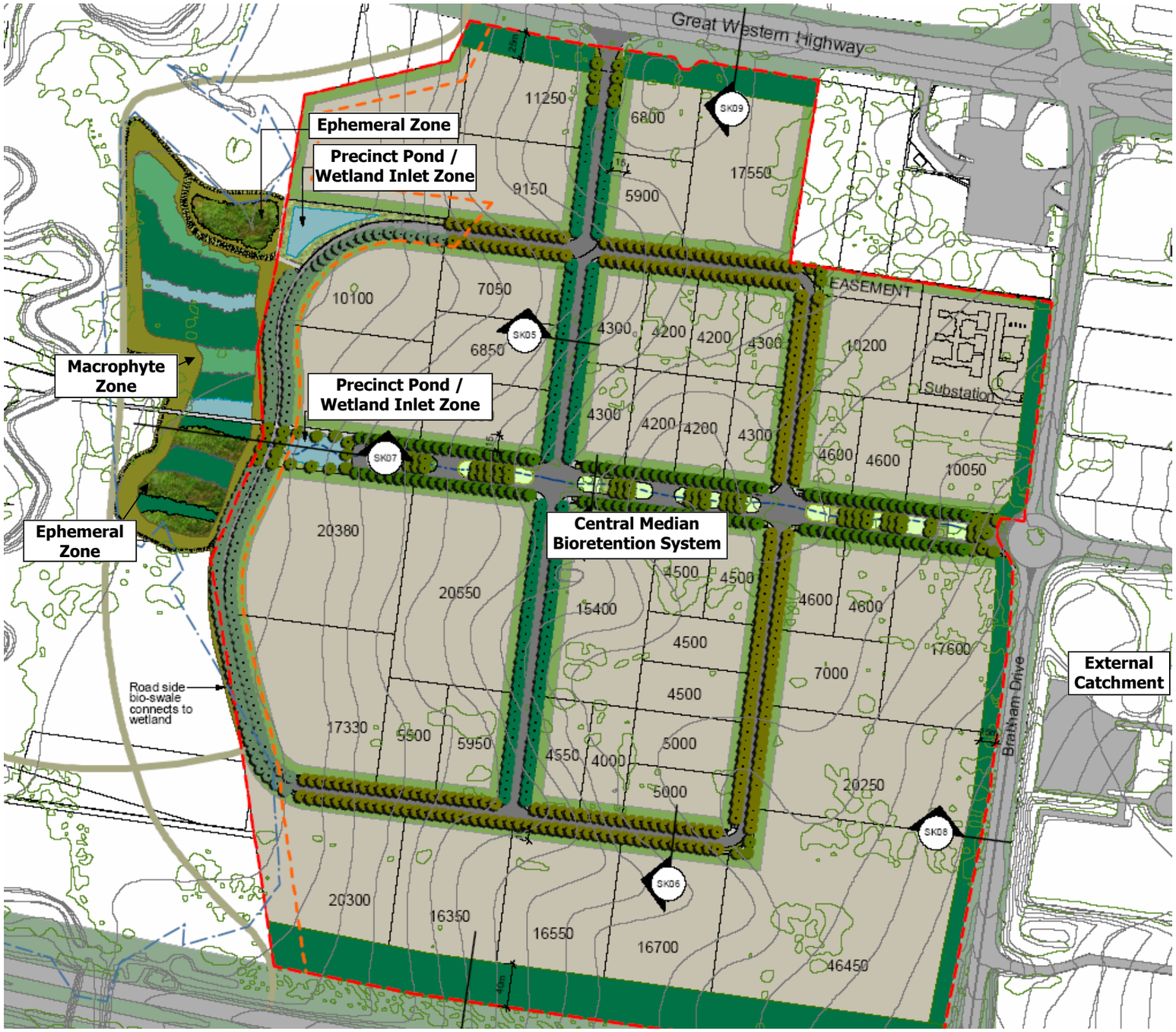


Figure 3.1 – WSUD elements for Huntingwood West, overall site layout

- the wetland (marcophyte and ephemeral zones) as an interface between the parklands and the Huntingwood West Employment lands,
- the central median which will be used to treat stormwater from the upstream industrial catchment and
- the precinct ponds which incorporate inlet zones for the wetland and detention for geomorphic protection
- streetscape bioretention cells in the form of street trees, raingardens and roadside swales can be integrated with the proposed landscaping

3.2 Constructed Wetlands

The preferred stormwater management strategy for the 56 ha Huntingwood West industrial precinct is a treatment train consisting of gross pollutant traps (GPTs) and a constructed wetland. The GPTs would be effective in reducing the suspended solids load by 70% and phosphorus by approximately 35%. Downstream of the GPTs the wetland has been sized to meet best practice water quality targets as well as flood attenuation requirements. The precinct ponds/ inlet zones are located within the site. The ephemeral and macrophyte planting is predominantly located in the parklands. The wetland comprises three zones;

1. precinct ponds / inlet zone (0.6 ha) – where heavier sediments (> 0.125 mm) are removed from the water column prior to the stormwater entering the wetland macrophyte zone.

2. macrophyte (marsh) zone (1.5 ha) – to provide a low velocity environment where the smaller suspended particles settle out of suspension or adhere to the vegetation. Soluble pollutants such as nutrients may be adsorbed onto the surfaces of suspended solids and entrained within the wetland sediments, or biologically absorbed by the epiphytic biofilms present upon the macrophytes or by the macrophytes themselves.

3. ephemeral zone (2.0 ha) – primarily used for flood detention but will also contribute to the treatment of stormwater quality

The configuration of a wetland can vary. However the preferred ratio of length to width is between 1:4 and 1:10. Where wetland cells have irregular shapes it is suggested that the flow direction and conditions in the wetlands are regulated by berms placed in the wetland.

The configuration of the precinct ponds/inlet zones has been designed to balance flood detention requirements, sustainable wetland function and developable area. These are located within the industrial precinct and are connected to both the macrophyte and ephemeral zones of the larger wetland system located adjacent to the precinct boundary. Stormwater from the site and the external catchment east of the site will discharge into Gross Pollutant Traps (GPTs) and thence into the two precinct ponds operating as inlet zones of the wetland. Stormwater inflow to this inlet zones is preferentially directed into the macrophyte zone for water quality treatment for normal storm events, and into the ephemeral zone when the macrophyte zone reaches its extended detention depth. This mode of operation prioritises water quality treatment before excess flow is diverted for further flood detention to limit flows to predevelopment levels for up to the two year ARI storm. This operation is considered essential in protect the water quality and waterway geomorphic form of Eastern Creek. For the 100 year ARI, the wetland will be submerged, and the entire footprint used for flood storage to attenuation flood events up to the 100 year ARI event.

The macrophyte (marsh) zone is designed with a permanent pool with an average depth of 0.3m, with provision for extended detention of 0.5 m (the water quality detention depth) and a notional detention period of 72 hours. Figure 3.2 illustrates the macrophyte zone of the wetland and the adjacent precinct pond/inlet zones and ephemeral zones at the northern and southern sections of the proposed wetland.

Stormwater diverted into the macrophyte zone will pass through a sequence of densely vegetated areas of varying depth before being discharged to Eastern Creek. The macrophyte zone of the wetland will allow for up to 0.5 m additional ponding above the normal water level following rainfall and drain via a riser over 72 hours.

Stormwater will spill into the ephemeral zones via bypass weirs when the depth of inundation in the macrophyte zone is at its design water quality treatment detention depth. The ephemeral zones will drain via pipes to Eastern Creek at such a rate as to preserve the predevelopment 1.5 year ARI discharge from the site and catchment.

The peak inundation level in the inlet zone and ephemeral zone for the 1.5 year ARI event is estimated to be the same as the top of the extended detention level in the macrophyte zone. Storm events larger than the 1.5 year ARI event and up to the 100 year event will fully engage the wetland as a single detention storage unit. For the 100 year event, the maximum depth of inundation above the permanent pool level of the wetland is estimated to be one metre. The wetland storage will drain via a number of pits that will maintain the peak 100 year ARI 36 hour discharge from the existing catchment. The duration of inundation at these levels will be short (hours) with the pits rapidly draining the wetland storage to minimise inundation beyond the water quality detention depth.

Images of wetlands in both urban environments and more natural parkland areas are shown in Figure 3.5. Details of the water quality modelling are provided in Appendix 2.

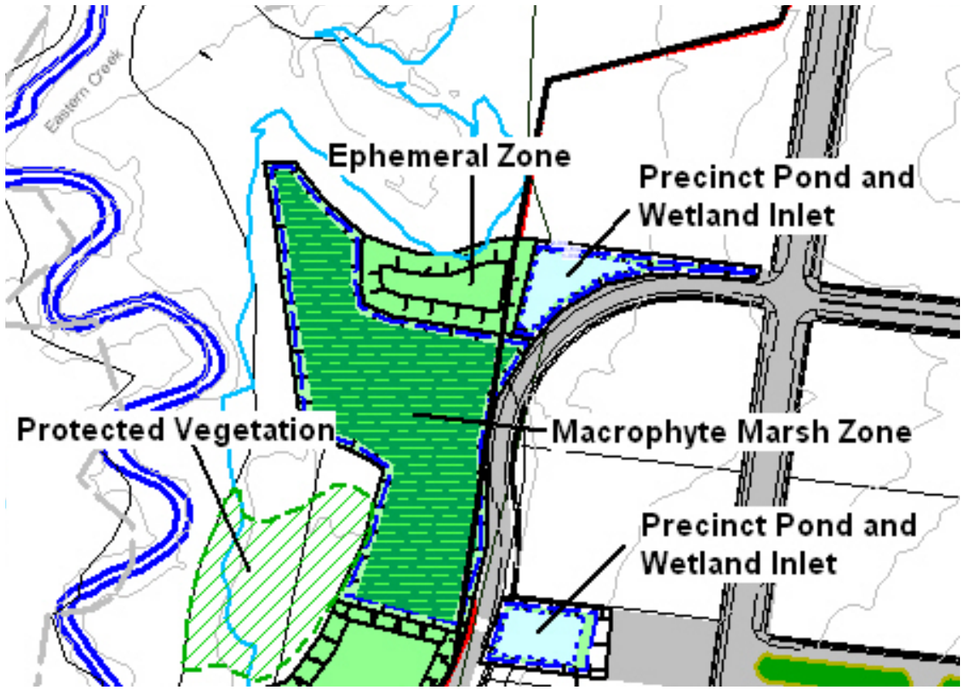


Figure 3.2: Wetland and precinct areas. Operational details are discussed in section 4.

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) developed by the Cooperative Research Centre for Catchment Hydrology was used to assess the expected performance of the proposed wetland system. Details of the modelling setup are presented in Appendix 2.

The plot below (Figure 3.3) represents the results with the load of pollutants generated with no treatments installed, the loads generated with the proposed wetland constructed and the target pollutant loads for the catchment. The plot shows that the wetland meets the best practice objectives for stormwater pollutant removal. The results are as follows:

- Total suspended solids loads reduced by 88%;
- Total Phosphorus loads reduced by 65%; and
- Total Nitrogen loads reduced by 45%.

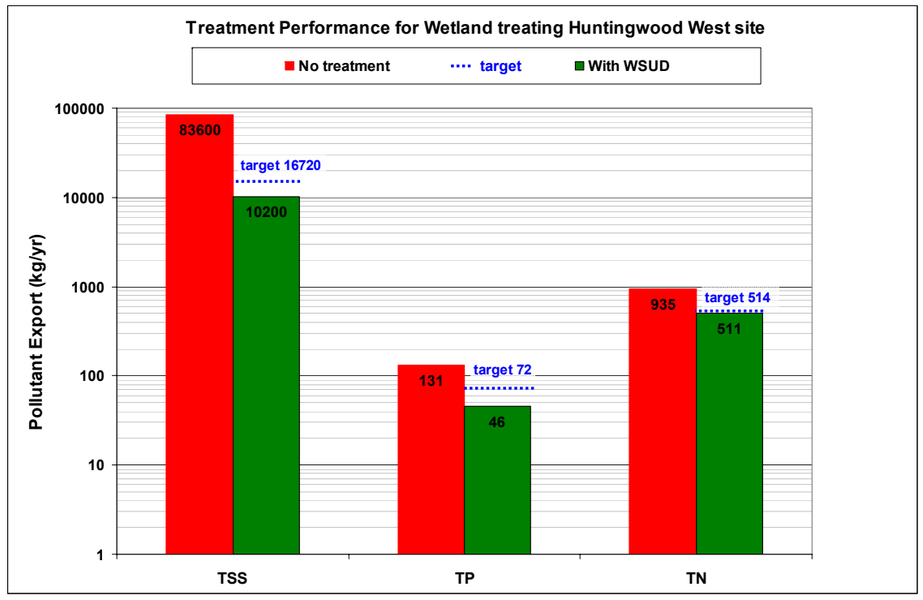


Figure 3.3 Treatment Performance – Wetland

3.2.1 Wetland Vegetation for Huntingwood West

The full details of the plant species to be planted in the various wetland zones are provided in Appendix 1, Table A2. Figures 3.4 and 3.6 gives an overview of suitable plants for each of the wetland zones. The selection of plant species is based upon Shale-Plains Woodland and Alluvial Woodland ecological communities as present within the Bungarribee Precinct.

The inlet zone will be planted with a range of ephemeral marsh and low profile terrestrial plant species to provide protection from erosion.

The macrophyte zone is a shallow body of water that will be heavily vegetated with emergent and submerged macrophytes (water plants). The macrophytes will be planted in a series of bands corresponding to the depth profiles of the shallow marsh, marsh, deep marsh and submerged marsh zones (Figure 3.6). This will ensure that uniform flow conditions across the wetland are achieved. The macrophyte species have been purpose selected for the stormwater treatment wetland, with consideration given to the hydrologic conditions expected within the wetland.

The ephemeral zones will be planted as a lateral Melaleuca wetland with a range of plant species that are capable of withstanding short term inundation and long term drying. The species selected for this zone are typically found growing in riparian zones within Alluvial Woodland ecological communities.

Figure 3.4: Examples of planting species and wetland areas.

Figure 3.5a: Wetland at Woolworths Industrial estate Wyong (Industrial / Forest edge)
NB photo is shortly after planting

Figure 3.5c: Wetland at Coomera Waters Brisbane (Parkland edge)

Figure 3.5b: Wetland at Melbourne Docklands (Urban edge)

Figure 3.5d: Wetland at Waitangi Park NZ (Urban edge)

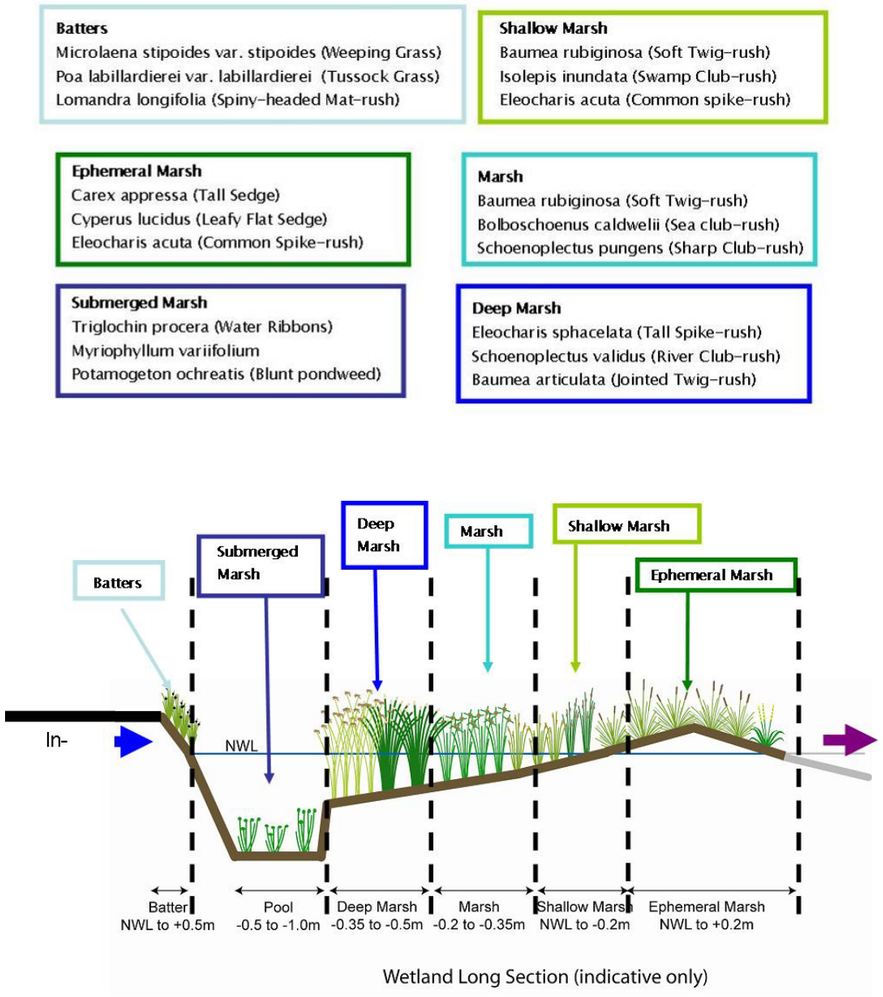


Figure 3.6: Indicative species planting for macrophyte zone of the wetland.

3.2.2 Costing of wetland and precinct parks

Cost estimates for the wetland are based on similar projects and from the MUSIC User Manual (Taylor 2005). The estimated costs for the wetland, GPTs and precinct ponds are shown in Table 3.6. More detailed costing can be done in association with detailed design of the wetland.

The costing below is itemised for:

- 1.5 ha macrophyte wetland area, treating stormwater water runoff from the site
- 2.0 ha ephemeral wetland area, essential for detention of small storm events to provide geomorphic protection as well as flood storage for extreme events
- 0.6 ha in total of the two precinct ponds which act as inlet ponds for the wetland and integrate with the ephemeral wetland detention storages
- gross pollutant traps for additional stormwater quality and litter control.

Table 3.1 – Costing of stormwater quality wetland and flood detention storage elements

Wetland Area: 1.5 ha	**Estimated Cost**	**Cost range (Low – High Estimate)**
Total Acquisition Cost [1]	$825,000	$600,000 – $1,500,000
Annual Maintenance Costs [2]	$17,000	$6,000 – $50,000
Annualised Life Cycle Cost [3]	$23,000	
Ephemeral Wetland Area: 2.0 ha		
Total Acquisition Cost	$880,000	$600,000 – $1,850,000
Annual Maintenance Costs	$30,000	$8,000 – $70,000
Annualised Life Cycle Cost	$30,000	
Precinct Ponds/inlet zones [4]: 0.6 ha		
Total Acquisition Cost	$750,000	$500,000 – $1,000,000
Annual Maintenance Costs	$15,000	$10,000 – $25,000
Annualised Life Cycle Cost	$25,000	
Gross Pollutant Traps [5]		
Total Acquisition Cost	$120,000	$30,000 – $150,000
Annual Maintenance Costs	$15,000	$5,000 – $30,000
Annualised Life Cycle Cost	$8,000	
TOTAL		
Total Acquisition Cost	$2.6 million	
Annual Maintenance Costs	$77,000	
Annualised Life Cycle Cost	$86,000	

Note[1]: The total acquisition cost includes preliminary feasibility studies, design costs, construction and overhead costs. GST is not included.

Note[2]: Annual maintenance costs are typically 2% of design and construction costs for first few years, then 1%. Corrective maintenance every 10 years: ~5% of construction cost. Vegetation establishment in the first two years ~ $10,000/ha/yr. Ongoing maintenance of the plants is estimated at $4,000/ha/yr

Note[3]: 50 yr analysis, real discount rate of 5.5% and annual inflation rate of 2%.

Note[4]: The precinct ponds/parks are designed to provide flood detention for up to the two year ARI for geomorphic protection. The cost is particularly depended on the cost of engineering structures for inlet and outlet flow control, landscape design and vegetation selection that will be confirmed through detailed design. The maintenance and renewal costs are particularly difficult to estimate, given the range of values reported for various sites.

Note[5]: GPTs are required for sediment control the catchment. Replacement required after approximately 25 yrs.

The cost components within the development and within the parkland are tabulated below. The cost of the bioretention central median is also located within the Huntingwood West site and is detailed in section 3.3, Table 3.3.

Table 3.2 – Costing of stormwater quality wetland and flood detention storage elements

	Estimated Costs within Parkland	Estimated Costs within Huntingwood West Development
Wetland Area: 1.5 ha Ephemeral Wetland Area: 2.0 ha	$825,000 $880,000	
Precinct Ponds/Parks : 0.6 ha 3 x Gross Pollutant Traps		$750,000 $120,000
Total Acquisition Cost	**$1,705,000**	**$870,000**
Total Annual Maintenance Costs	$47,000	$30,000
Annualised Life Cycle Cost	$53,000	$33,000

3.3 Bioretention Systems

Bioretention systems can be designed as street trees, rain gardens or linear bioretention systems to integrate with the landscape design. A schematic cross section of a bioretention system is illustrated in Figure 3.7, in which stormwater is designed to pond to a depth of between 0.2 m and 0.5 m, then filter through the soil media to a sandy transition layer and then a gravel drainage layer where it is collected in perforated pipes and can be directed to a storage tank or discharged to the stormwater system and downstream environment.

Bioretention systems provide water quality treatment by filtering stormwater through vegetated soil media. Ponding above the bioretention system enables a larger proportion of the stormwater volume to be treated. The bioretention area is defined as the area of the base of the bioretention system and does not include the batter slopes which are required to provide the extended detention depth. A central median bioretention system, from Landcom's Victoria Park development, is illustrated in Figure 3.8b.

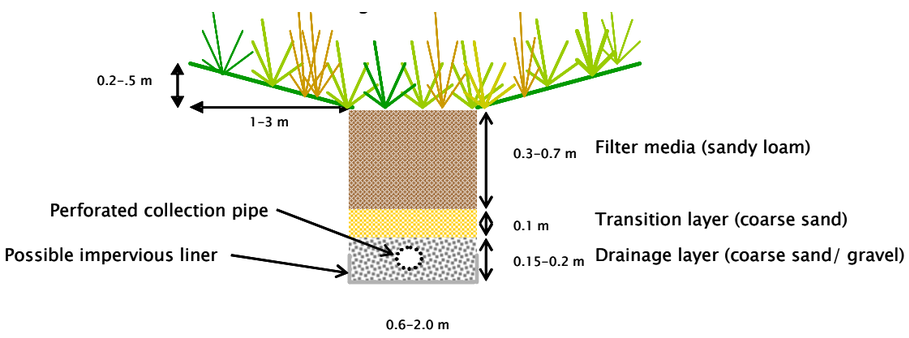


Figure 3.7 – Cross section of a bioretention system

For Huntingwood West, a central median bioretention system is proposed to treat stormwater from the upstream external 20 ha industrial area. Figure 3.8a shows the integration of the bioretention median with the landscape design for the major entrance road to the Huntingwood West site. The bioretention elements are alternated with landscaping vegetation for visual effect. A cross section of the proposed central median is shown in Figure 3.9.

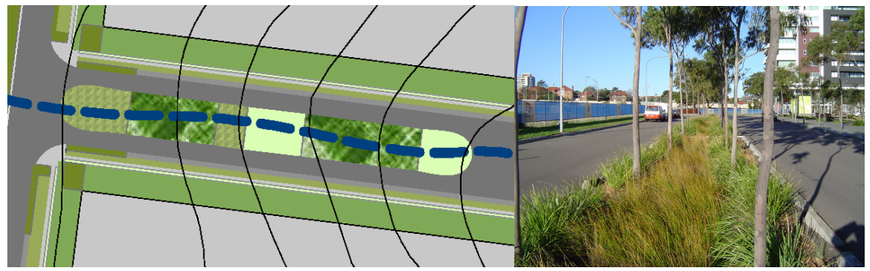


Figure 3.8a Bioretention elements and alternate vegetation / turf for the central median providing water quality treatment of the upstream external catchment.

Figure 3.8b Central median bioretention system, Victoria Park, Sydney

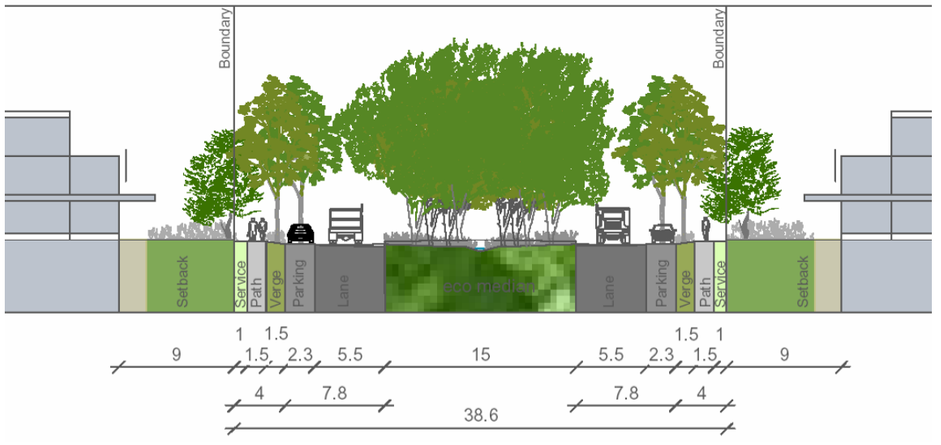


Figure 3.9 – Cross section of the entrance road with central median bioretention system

Modelling shows that a bioretention system area of 2,000 m², with a detention depth of 0.3 m, will deliver the required water quality treatment. The soil filter depth is 0.6 m, and the soil filter has a mean particle size 0.5 mm (sandy loam filter media), and a saturated hydraulic conductivity 100 mm/hr. If the depth of extended detention is reduced, the required bioretention footprint will increase.

MUSIC was used to assess the performance of the bioretention central median in treating stormwater from the external catchment. Modelling details are presented in Aopendix 2. The plot below (Figure 3.10) represents the load of pollutants generated with no treatments installed, the loads generated with the proposed bioretention median constructed and the target pollutant loads for the catchment. The plot shows that the best practice objectives for stormwater pollutant removal are met, with the following pollutant reductions.

- Total suspended solids loads reduced by 86%;
- Total Phosphorus loads reduced by 72%; and
- Total Nitrogen loads reduced by 45%.

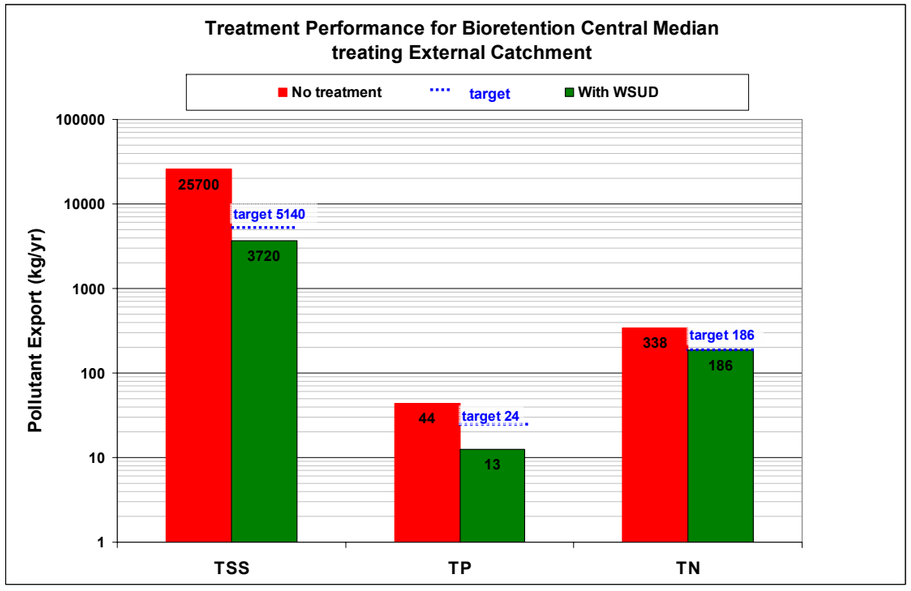


Figure 3.10 Treatment Performance – Bioretention Central Median

The bioretention elements that are to be contained within the central median have a combined area of 2000m². The planted area covers approximately 7000 m² (including the bioretention area) as the length of the central median is approximately 450 m and proposed width 15 m. The total length including road intersections is 600 m. The costing is particularly dependent on the landscape selection and vegetation costs.

Cost estimates for the proposed bioretention system are provided in Table 3.3 for the system based on a bioretention area of 2000 m² using a combination of the cost/size relationships available through the life cycle costing module of MUSIC and a preliminary assessment of specific structures that may be required. A more refined cost estimate will be developed as part of the detailed design of the project and should be informed by the proposed road layout, the location of the stormwater drainage network, connections between bioretention cells and the designed road cross fall.

Table 3.3– Life Cycle Costing of bioretention/landscaped central median

Bioretention Area: 2,000m²	**Estimated Cost**
Total Acquisition Cost [1]	$260,000
Annual Maintenance Costs [2]	$9,000
Annualised Life Cycle Cost [3]	$8,500
Other vegetation: 5,000m²	
Total Acquisition Cost	$170,000
Annual Maintenance Costs	$5,000
Annualised Life Cycle Cost	$5,000
TOTAL	
Total Acquisition Cost	$430,000
Annual Maintenance Costs	$14,000
Annualised Life Cycle Cost	$13,000

Note[1]: The total acquisition cost includes preliminary feasibility studies, design costs, construction and overhead costs. GST is not included. The estimated range of acquisition cost for a bioretention system of this size is between $60,000 and $350,000 as per life cycle costing element of MUSIC, collating available costing information from Australia in 2003-04.

Note[2]: Annual maintenance costs for particular systems are highly dependent on available budget and management practices. The cost of replanting approximately 50% of the system every 5 years: $25,000 for landscaped vegetation, $10,000 for bioretention vegetation.

Note[3]: 50 yr analysis, real discount rate of 5.5% and annual inflation rate of 2%.

3.3.1 Bioretention Vegetation for Huntingwood West

Ecological communities present within the Bungarribee Precinct include Shale-Plains Woodland and Alluvial Woodland. The plant species selected for the bioretention system are primarily based upon the Alluvial Woodland (Sydney Coastal River Flat Forest). The vegetation prevents erosion and maintains the porosity of the system by continuously breaking up the filter media through plant growth. The root systems also provide sites for biofilms (fungi and bacteria) that absorb and transform pollutants.

A list of indicative plant species that are suitable for planting in the bioretention system is provided in Table 3.4. Several of the shrub species recommended for planting along the wetland batters would also be suitable for the bioretention system (See Appendix 1, Table 2 for the recommended wetland planting).

Table 3.4 - Recommended plant species for bioretention systems at Huntingwood West.

Austrostipa verticillata	Slender bamboo grass
Carex appressa	Tall sedge
Dianella longifolia	
Dianella revoluta	Blue flax-lily
Lomandra longifolia	Spiny-headed matt rush
Lomandra multiflora	Many-flowered matt-rush
Poa labillardierei	Tussock grass
Themeda australis	Kangaroo grass

3.3.2 Street tree bioretention systems

Where street trees are desired within the road reserves of the industrial precinct, stormwater quality treatment functionality can be incorporated into the landscape design. Bioretention street trees are commonly used to treat road runoff with stormwater diverted from the gutter to a street tree pit that is either flush with or lower than the road (Figure 3.11).

The integration of street trees in industrial precincts can be difficult to plan and design for as the layout of lot entrances can change prior to the building construction with driveways and suitable locations for trees conflicting. The spacing between street trees and the size of the filter area provided for each tree is bioretention street trees is related to the road area or impervious area directed to the tree.

The WSUD strategy proposed to meet best practice stormwater quality objectives for the Huntingwood West site does not rely upon the construction of street trees. Where these systems are constructed, the stormwater quality will be improved further, bringing additional benefits to the downstream environment.

Street trees at Docklands in Melbourne

Construction of a planter tree in Sydney (Kings Cross)

Figure 3.11: Street tree pits in built up urban areas in Melbourne and Sydney (Ecological Engineering).

3.3.3 Road side bioretention systems / swale

Where road side bioretention systems or swales are desired, stormwater quality treatment functionality can be incorporated into the landscape design. Speccifically, the opportunity exists for a 'bio-swale' or other road side treatment adjacent to the park edge road. Through the detailed design process further opportunities may be identified to integrate treatment requirements with the proposed landscape design. The location and connections for a swale are also dependent on the configuration of stormwater infrastructure and requirements for particular edge treatments.

The WSUD strategy proposed to meet best practice stormwater quality objectives for the Huntingwood West site does not rely upon the construction of road side bioretention systems or swales. The integration of such measures, in line with the landscape vision, should be considered through detailed design to compliment or supplement the treatment achieved through the proposed stormwater wetland.

4 Stormwater Quantity Management at Huntingwood West

With increased impervious areas associated with the proposed development, the volume and rate of stormwater runoff will increase. Provision of stormwater drainage infrastructure will include an underground stormwater pipe system to cater for frequent storms and overland flow paths for conveyance of large events up to, and including, the 100 year Average Recurrence Interval (ARI) event. Attenuation of increased flows is required to protect the geomorphic form of the low flow channel of Eastern Creek, and prevent worsened downstream flooding.

Based on Landcom and Council requirements for stormwater flow management, storages must be sized and configured to:

- Return peak discharge from the developed catchment in a 1.5 year event back to predevelopment peak flow from the catchment in accordance with Landcom's WSUD objectives.
- Ensure no increase in the frequency of bank full flows in Eastern Creek, generally the 2 year and 100 year ARI peak flows from the site in accordance with Blacktown City Council's stormwater policy.
- Ensure no adverse interaction between the 100 year ARI hydrograph from the site and the Eastern Creek flood hydrograph.

To meet these conditions, stormwater can be managed within a regional facility, or in combination with on site detention (OSD) within each of the allotments.

The regional facility will comprise precinct ponds, ephemeral zones and macrophyte zones to restore predevelopment 1.5 year flows, as demonstrated by design 1 and 2 year ARI events flows. Additional flood detention within the proposed wetland will provide storage to ensure no adverse interaction between the 100 year ARI hydrograph from the site and the Eastern Creek flood hydrograph. At present the wetland footprint has been selected to maintain the existing peak 100 year ARI discharge in Eastern Creek and thus provide an upper estimate of the required storage. This requirement can be further refined during the design phase of the project.

Alternatively, OSD could provide the required storage up to the 1 and 2 year event, with exceeding flows up to the 100 year event being managed through the regional wetland.

4.1 Existing Catchment and Proposed Development

The proposed development will replace approximately 56 ha of rural lands with an industrial employment precinct. The landuse on the site is presently agricultural and drains to Eastern Creek. The natural predevelopment flow paths of the catchment have been altered by an underground drainage network and intersecting roads.

Approximately 20 ha of industrial lands external to the site, drain through the site via minor drainage networks. Some part of the external catchment is controlled by a retarding basin. Some overland flow from the upstream catchment will also enter the site via the entrance road into the site off Brabham Drive. At present, other areas of the catchment now drain away from the site along Brabham Drive. The entrance road appears to be the most logical pathway for overland flow from the external catchments east of the site and Council has suggested that modification of the vertical alignment of Brahham Drive may enable overland flow from a larger proportion of the external catchment to be directed towards this road. In the design of the entrance road, it will be necessary to ensure adequate provision is made to convey the 20 ha external catchment to the east of the site.

The proposed development will feature pipe networks, overland flow paths along roads, flood detention storages and stormwater quality treatment facilities. The major entrance to the site (off Brabham Drive) runs west along a minor ridge. This entrance road will feature a bioretention swale and will convey runoff from the upstream catchment during frequent storms events.

Detention storage will be required prior to discharge to Eastern Creek as discussed in section 4.4. Subject to detailed assessment, it is desirable that the capacity of detention storage provided include provision for the external catchment.

Preliminary hydrologic modelling has been undertaken to size the stormwater detention structures and is discussed in the following section.

4.2 Hydrologic Model Set Up

Hydrologic modelling was undertaken to size stormwater detention structures using the flood estimation software RORB. RORB is a runoff and routing program developed at Monash University, Australia to calculate flood hydrographs from design rainfall patterns, loss and run-off processes, catchment storage and channel network routing, and has been developed in line with Australian Rainfall and Runoff for applications across Australia. The model can also be used to investigate storage and discharge configurations to design retarding basins.

RORB models were developed for the following development conditions:

- the pre developed catchment, which assumes the entire catchment is in a relatively natural condition with drainage paths following the natural surface contours,
- the existing catchment with the subject site in a rural condition and industrial development in the catchment east of Brabham Drive; and
- the developed catchment incorporating the proposed Huntingwood West development.

4.2.1 Catchment Delineation and RORB Model Structure

Discretisation of the catchment into sub-catchments and slope calculations were performed using Council's 2 metre interval contour set. The model structure was determined referring to feature survey of the site, the existing and proposed road network and Council's underground pipe network.

The structure of the three models differs, reflecting the changes to site topography and drainage under the three development conditions, as outlined in Appendix 2. The pre developed and existing catchment RORB model layout is presented in Figure 4.1 and the developed RORB model layout is presented in Figure 4.2.

Areas of the predevelopment catchment that now drain away from the site were identified.

Under the existing development condition, the industrial catchment to the west of the proposed development drains onto the site via culverts and a low point in Brabham Drive. It is anticipated that flows within the culverts will be drained through the site, but overland flows will be directed north along Brabham Drive and then east via a reserve adjacent to the Great Western Highway.

Flows draining to Eastern Creek, were routed north to the Great Western Highway, which was selected as the coincident location to compare flows rates from the catchment under the different development conditions.

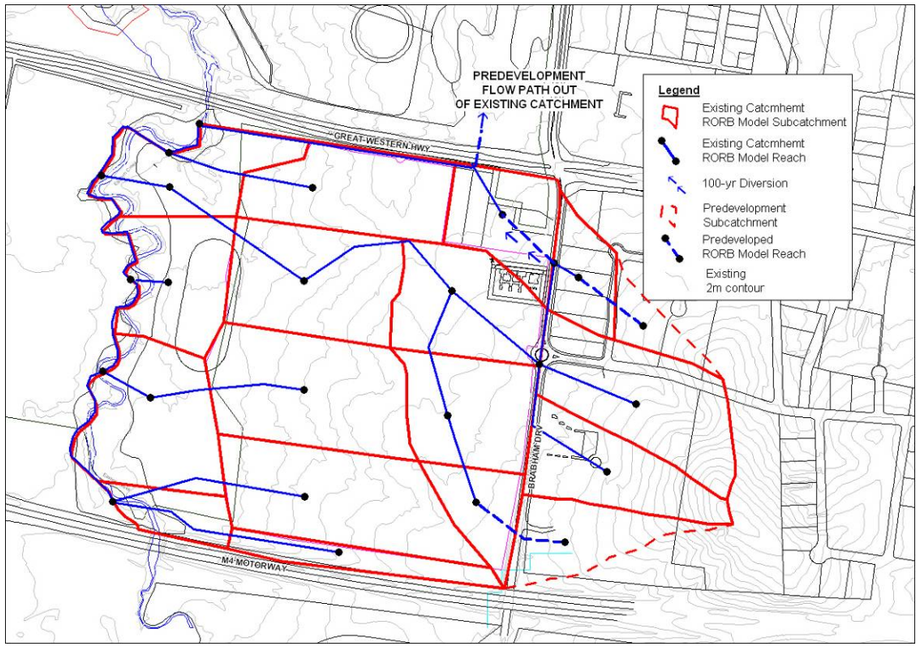


Figure 4.1: Pre development and existing catchment RORB model structures

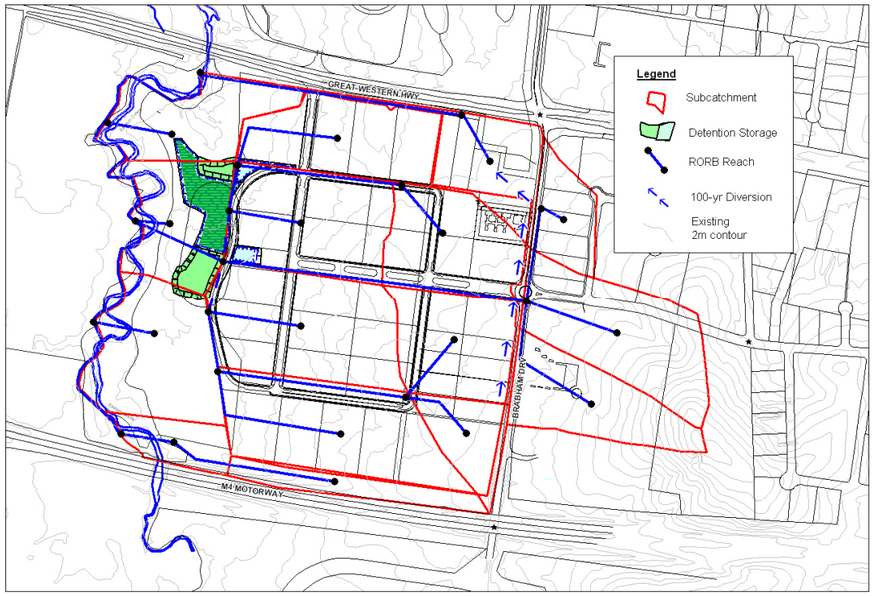


Figure 4.2: Developed catchment RORB model structure

4.2.2 Catchment and RORB Parameter Selection

Rainfall intensity, frequency and duration parameters applicable for the site were obtained from Blacktown City Council. Fraction impervious values of 0.8 and 0.02 were adopted for industrial land use and rural / pre development areas respectively. Values were selected with reference to site inspections and aerial photography.

RORB reach type parameters were selected to represent routing as either overland sheet flow, concentrated flow in natural/rural depressions and, flow along underground pipes and street gutters.

An initial loss of 20 mm and volumetric runoff coefficients of 0.6, 0.21 and 0.2 were selected for the 100, 2 and 1 year ARI events respectively.

A default value of 0.8 was adopted for RORB parameter “m”. A “kc” parameter of 3.3 was adopted and verified by comparing the undiverted results of the developed model to the flow rate derived by applying the Rational Method, calculated using the methodology described in Australian Rainfall and Runoff Volume 1. For the pre development and existing catchment modelling, a kc value of 3.0 was adopted to ensure the ratio of average flow path length to “kc” was preserved.

The results of hydrologic modelling are presented in Section 4.3.

4.3 Hydrologic Modelling Results

Flood simulations were undertaken for a range of storm duration. A summary of peak flows for different ARIs under different development conditions is presented in Table 4.1.

Table 4.1 –Peak Stormwater Discharges to Eastern Creek

ARI	Modeled Discharge to Eastern Creek at the Great Western Hwy (m^3/s)
Pre Developed Catchment	
1 –year	0.5
2 –year	0.7
Existing Catchment	
2 year	0.9
100 year	6.0 (9 hour) 4.9 (36 hour)*
Developed Catchment Without Attenuation	
1 year	2.0
2 year	2.7
100 year	7.5 (9 hour) and 5.8 (36 hour)

*** Critical for 100 year downstream flooding in Eastern Creek**

Due to the distributed flow paths across the site, routing of flows was performed in Eastern Creek to ensure flows were compared at a coincidental point at the Great Western Highway. Routing flows within Eastern Creek has an extenuative effect on peak flows and hence Table 4.1 reports a more pronounced increased discharge from the developed catchment that is in fact the case.

4.4 Onsite Detention and Flood Detention Storage Design

Provision of flood detention can be provided by a stand-alone regional wetland facility within adjacent parklands or through a combination of OSD and a regional wetland facility with a reduced associated park land-take.

A stand alone flood detention storage were designed to restore peak flows from the developed catchment back to predevelopment flows for the 1.5 ARI event, with additional flood detention storage provided to maintain the existing peak 100 year discharge from the catchment.

Consideration was also given to the arrival of the 100 year flood hydrograph in Eastern Creek to ensure that interaction of flood hydrographs does not worsen downstream flooding.

4.4.1 Regional Wetland Storage Facility

A system of interacting wetland inlet zones, ephemeral zones, wetland extended detention storage and wetland flood storage have been designed that balance flood detention requirements, sustainable wetland function and developable area. The results of modelling the wetland facility in RORB indicate that approximately 25,000 and 34,000 m^3 of storage will be required to return the peak pre development 1 and 2 year ARI flows respectively. The peak 100 year volume within the wetland storage required is 54,000 m^3

The operation of the wetland system is described in Section 3.2.

4.4.2 Combined OSD and Regional Wetland Storage Facility

With OSD provided throughout the development the wetland storage could be designed to operate in only rare events, and the footprint could be reduced.

OSD could be provided at a rate of 560 and 750 m^3/hectare of impervious development (within the site and excluding roads) to return the peak predevelopment 1 and 2 year ARI flows respectively from the entire catchment.

4.5 Results of Modelling Wetland Storages in RORB

A summary of peak flow rates from RORB modelling is presented in Table 4.3.

Table 4.3 –Flood Detention Storage Details

ARI	Modeled Discharge to Eastern Creek (m^3/s)
Target Discharges	
1 year (pre developed catchment)	0.5
2 year (pre developed catchment)	0.7
100 year (existing catchment)	6.2 (9 hour); 4.9 (36 hour)*
Developed Catchment with Precinct Park Storage and Wetland Flood Detention Storage	
1 year	0.5
2 year	0.6
100 year	4.4 (9 hour); 5.1 (36 hour); 5.3 (48 hour)

*** Critical for 100 year downstream flooding in Eastern Creek**

Table 4.3 shows that the proposed stormwater detention and wetland system will maintain frequent peak discharges at pre development levels. A comparison of hydrographs is presented in Figure 4.3.

To prevent adverse impacts to downstream flooding, it is critical to ensure the run off hydrograph from the site and catchment does not interact with the peak 100-yr 36 hour flood hydrograph from the entire Eastern Creek catchment. Modelling shows that the wetland system will attenuate the developed 100 year ARI peak flows to the effect of no net increase in peak flow in the Eastern Creek flood hydrograph. This is illustrated by the reductions in peak 100 year ARI 9 hour and 36 hour duration storm events shown in Table 4.3 and Figure 4.4.

It is evident from Table 4.3 and Figure 4.4 that the estimated peak discharge for a 48 hour 100 year ARI storm is 5.3 m^3/s. This is higher than the 4.9 m^3/s peak discharge corresponding to the critical storm duration of 36 hours under existing conditions. This higher flow under post-development conditions is not expected to increase the 1% AEP flood levels in Eastern Creek and thus will comply with Council's requirement that to ensure no adverse interaction between the 100 year ARI hydrograph from the site and the Eastern Creek flood hydrograph. A 48 hour storm duration would

have resulted in a lower peak discharge in Eastern Creek (compared to that from the critical 36 hour storm). Thus the increased flow from the site during a 48 hour storm would have coincided with a lower peak discharge in Eastern Creek resulting in an overall lower combined peak discharge in Eastern Creek compared to the discharge for a 36 hour event.

Figure 4.5 shows the attenuation effect and timing effect of the wetland storage system and therefore this will satisfy the criteria that the frequency of bank full flows is not increased and downstream flooding is not exacerbated.

Further optimisation of the basin system and confirmation of timing can be addressed at the detailed design stage.

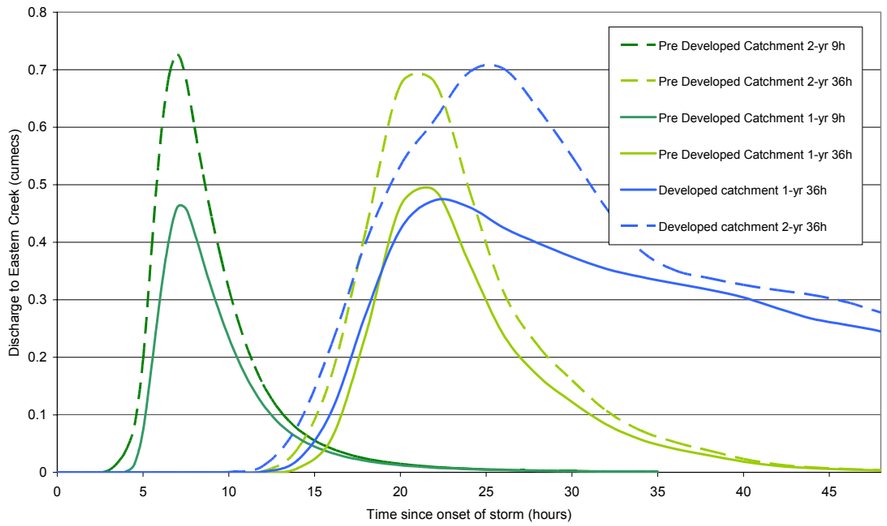


Figure 4.3: 1 and 2 year ARI discharge hydrographs to Eastern Creek for existing catchment and developed catchment with proposed stormwater detention in place.

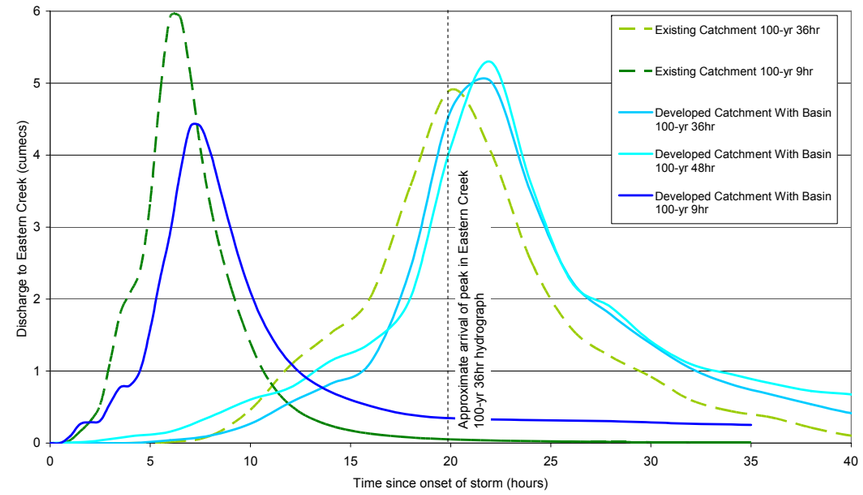


Figure 4.4: 100 year ARI discharge hydrographs to Eastern Creek for existing catchment and developed catchment with proposed stormwater detention in place.

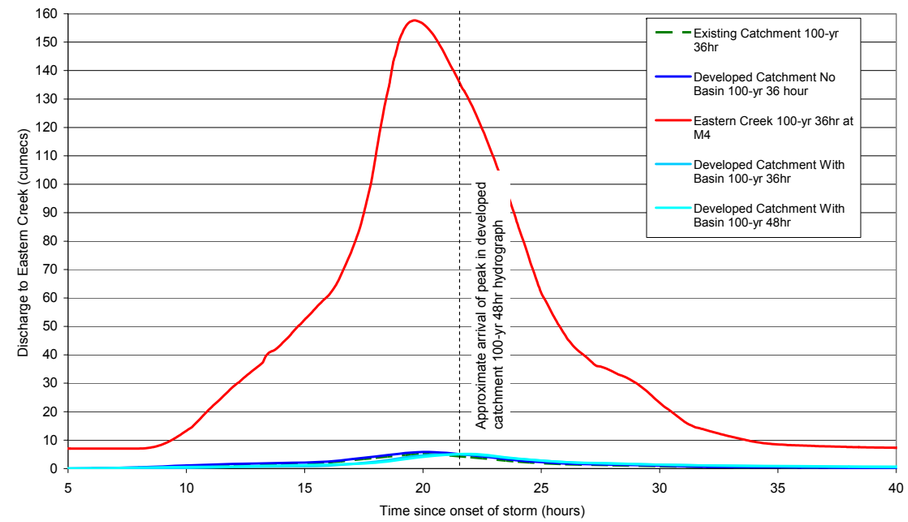


Figure 4.5: Timing of peak hydrograph from the site and the Eastern Creek

4.6 Summary

Hydrologic modelling of the pre developed, existing and developed catchment has been undertaken using RORB to assess the impact of the proposed development on the hydrology of the catchment and determine the requirement for stormwater detention. Modelling shows that the proposed development will increase the magnitude of peak discharges to Eastern Creek and stormwater detention is required. Stormwater storages can be provided by regional wetland or in combination with OSD.

Stormwater detention facilitates have been sized to meet the following criteria:

- to restore the 1.5 year ARI discharge from the developed catchment;
- to ensure the discharge from the developed catchment does not increase the frequency of 100 year ARI discharge in Eastern Creek; and
- to ensure the discharge from the developed catchment does not exacerbated downstream flooding.

A stand alone regional wetland facility with total storage of 54,000 m^3 can be designed to meet the above requirements.

Alternatively 34,000 m^3 of OSD can be provided throughout the development at a rate of between 560 m^3 and 750 m^3/hectare of impervious development to meet 1.5 year ARI detention requirements. In this case a wetland storage can be designated to attenuate flows larger than the 2 year ARI event and up to the 100 year event. Adopting OSD throughout the development will significantly reduce the volume and footprint of the wetland facility.

Optimisation of wetland performance and configuration can be carried out at detailed design.

5 Potable Water Conservation and Dual Reticulation

As the end users and likely potable and non potable water demands are not known at present, it is not possible to develop potable water conservation strategies and assess the feasibility of stormwater harvesting or wastewater reuse. It is recommended that the following water balance calculations are done once information is available:

- Assessment of non potable demands (toilet flushing, irrigation, wash down water, cooling tower, laundry and other possible non potable demands associated with business types)
- Calculation of the reliability of supply to meet non potable demands with suitable tank storage sizes connected to the large roof areas of the industrial precinct
- Calculation of the reliability of supply to meet non potable demands with a regional storage (located perhaps within the precinct parks), harvesting from all impervious surfaces and plumbed through a common reticulated network to service the industrial precinct
- Consideration of the likelihood of a non potable water supply being made available from the Quaker's Hill STP (7 km from the site), possibly in conjunction with a water reuse pipeline to service non potable demands within the parklands.

5.1 Demand Management

Demand management through the use of water efficient fixtures and appliances is a critical and effective way to reduce potable water use. The most cost effective strategy to reduce potable water consumption is to ensure the widespread adoption of demand management measures including water efficient toilets, fixtures and fitting as well as hoses for wash down areas and irrigation infrastructure for landscaped areas. Building guidelines can address appropriate metering, monitoring and management practices to ensure conservation of potable water.

5.2 Alternative Water Sources

Alternative water sources include wastewater, stormwater and groundwater which can be used to meet non potable demands. "Fit for purpose use" is where alternative water sources are used for demands which do not require potable water, including toilet flushing and air conditioning systems reliant on evaporative cooling. Building design guidelines can be used to ensure that non-potable water is appropriately connected to meet appropriate demands.

Stormwater runoff should be managed as a resource with consideration given to harvesting either from large roof surfaces for reuse within buildings or at a precinct scale with runoff pumped from the proposed detention basins to storage areas and plumbed to meet significant non potable demands through the development.

The Quakers Hill Sewage Treatment Plant is located 7km from the site. The reticulation for the development should be designed to integrate with a possible reuse pipeline. Where dual reticulation is provided, initially harvested stormwater (supplemented with mains water) can be used as the alternative water source. Plumbing design should be configured to adapt to future opportunities, specifically centralised provision of non potable water. Non potable water may also be used to meet irrigation demands of the adjacent parklands – active recreation areas.

The substitution of potable water with alternative water sources where available would result in a significant reduction in potable water consumption. Consideration should be given to providing dual reticulation for the development, even where a non potable water source may not be immediately available. The plumbing design should be resilient to future opportunities, with connection points suitably located to integrate with a centrally reticulated non potable water source.

5.3 Microclimate Control

Where a non potable water supply is available, strategic location of areas of vegetation with a high demand for non potable water may assist in bringing microclimate benefits to the Huntingwood West industrial site. This opportunity contrasts with demand management measures applicable also to alternative water sources, but warrants further consideration as the detail design for the site progresses.

5.4 Water Supply and Sewerage

As identified in the Civil Infrastructure Masterplan Report (YSCO Geomatics), potable water will be supplied through the Brabham Drive main from the Prospect Hill elevated system with minor main amplifications at an estimated cost of $200,000. Sewage from the site would be transported to the Quaker's Hill Sewage Treatment plant, with works totalling approximately $800,000 for extension of the sewer main and a horizontal bore beneath the Great Western Highway, linking to the north western part of the site.

6 Building Design Guidelines for Huntingwood West

Stormwater pollution in industrial precincts has two risk profiles, one associated with its typically high percentage of impervious surfaces and traffic volumes, and the other related to industrial practices that result in pollution entering the stormwater drainage system. It is the latter that differentiate stormwater pollution characteristics in industrial precincts from that of a typical high density urban environment. Inappropriate drainage of works areas and inappropriate work practices are largely responsible for a wider range of pollutants types and concentrations experienced in industrial precincts and are the main causes of stormwater pollution during dry-weather conditions. Difficulties will arise in the long term if stormwater treatment devices are tailored to known pollutants from a particular business activity as businesses will change premises and devices tailored to the needs of one business are unlikely to suit subsequent businesses.

Building design guidelines can be developed to ensure that pollution sourced from work areas does not enter into stormwater drains and thence to the downstream environment. This is the most effective method in implementing WSUD in industrial precincts in a sustainable manner and can be achieved by:

- roofing work areas,
- directing wash-down to storage (which is subsequently pumped out as industrial waste) or directing wash-down to sewer and
- controlling activities undertaken in areas connected to stormwater drains.

It is important to isolate the work areas with a higher pollutant risk profile to ensure that standard WSUD treatment measures designed to treat stormwater from typical urban environments are not compromised with the wider range of pollutants types and concentrations experienced in industrial precincts. Conventional WSUD practices for the management of stormwater runoff from impervious surfaces other than work areas can be implemented along the same basis as other urban environments.

Programs to promote good environmental practice in businesses in industrial precincts are seen as an essential part in helping sites meet water quality objectives. Programs may specifically promote good environmental practices in the operation of individual businesses, with structural measures physically separating work areas from stormwater runoff into the drainage system. Other programs aim to raise awareness and responsibility for appropriate environmental protection behaviour of individuals working in industrial precincts.

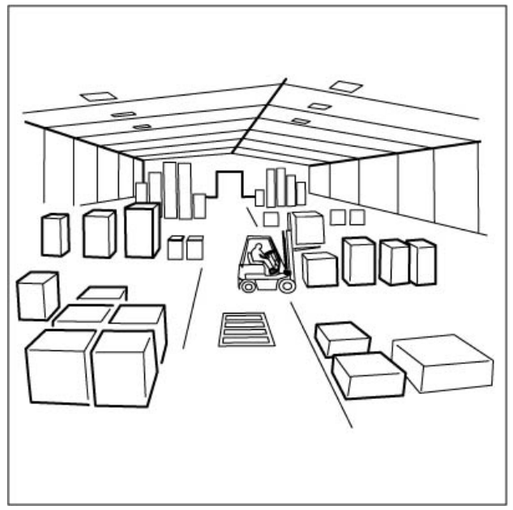


Figure 6.1: Pollution source control, with roofed work areas and interception of pollutant that would otherwise be discharged to the stormwater network from work areas.

Further details regarding appropriate controls for industrial sites can be found in 'Water sensitive urban design for industrial sites and precincts', available under the *Papers and Publications* page on the Ecological Engineering website; www.ecoeng.com.au

7 Conclusions

The proposed WSUD Strategy for the Huntingwood West employment zone addresses pollution control and flow management.

With end users (industry type) and likely water demands currently not known, it is not possible to develop and evaluate potable water conservation strategies. However, guiding principles for potable water conservation based on demand management and provision of alternative non-potable water sources apply. Water demand management measures include water efficient toilets, fixtures and fittings as well as efficient hoses for wash down areas and irrigation infrastructure for landscaped areas. Building guidelines can address appropriate metering, monitoring and management practices to ensure conservation of potable water.

Consideration should be given to installing infrastructure that would provide the industrial precincts resilience to future opportunities. Providing dual reticulation for the development, even where a non potable water source may not be immediately available is one such initiative. The plumbing design of buildings should be adaptive to future alternative sources of non-potable water with connection points suitably located to integrate with a centrally reticulated non potable water source.

Source control is important for industrial precincts. Building design guidelines can be developed to ensure that pollution sourced from work areas does not enter into stormwater drains. The key structural measures include roofing work areas, directing wash-down to storage (which is subsequently pumped out as industrial waste) or to sewer and controlling activities undertaken in areas connected to stormwater drains. Additionally programs can be introduced to encourage good environmental practices for both businesses and individuals.

The stormwater management strategy for the Huntingwood West Industrial Precinct is centred on achieving the following outcomes:-

- Stormwater runoff from the development as well as the 20 ha catchment to the east of the development which flows through the site, is to attain current best practice water quality standards.

- Post-development storm discharges to equal pre-development storm discharges for the one and a half year ARI event, so as to minimise the impact of frequent events on the natural waterways and to minimise bed and bank erosion.

- Post-development storm discharges up to the 100 year ARI event need to be contained so as to minimise the impact of flood events on Eastern Creek.

Pollution control would be achieved with WSUD elements for the management of stormwater runoff from impervious surfaces other than work areas. The strategy proposed uses a wetland to treat stormwater runoff from the site to best practice and bioretention elements within the central median of the main entry road to improve the water quality of stormwater passing through the site from the upstream catchment. Attenuation of storm and flood events is integrated into the storage areas associated with the precinct parks, the macrophyte zone and lateral Melaleuca ephemeral zone. This provides geomorphic protection to the waterways downstream, by limiting discharge to pre-development flows for frequent storm events with high erosion potential.

Best practice pollution control and flow management targets are met for both the Huntingwood West site and stormwater draining from the upstream catchment. The bioretention central median and the wetland have been integrated with the urban design and provide the required functionality.

The stormwater management measures identified to meet the desired outcomes in terms of water quality and flood attenuation also provide a suitable interface between the parklands and the industrial precinct. The desired landscape vision for the parklands precinct includes a large wetland area with open water and wetland vegetation.

The elements of the preferred WSUD strategy include;

- building guidelines for pollutant source control at the lot level; specifically addressing the need to roof work areas, direct wash-down water to storage (for subsequent pumped out or discharge to sewer) and control of other activities undertaken in areas connected to stormwater drains.
- Gross Pollutant Traps (GPTs) for initial pollutant reduction
- a constructed wetland as an interface between the parklands and the Huntingwood West Employment lands. The wetland improves water quality and limits stormwater discharge to pre-development flows for frequent storm events. The wetland consists of three zones – precinct parks with inlet ponds, a macrophyte zone, and the ephemeral zone.
- flood detention storage for extreme event integrated within the bunded wetland footprint.
- the option to include street-tree bioretention cells within the streetscape will further increase the capacity of the strategy to achieve stretch targets for stormwater quality treatment.
- Potable water conservation measures including demand management and use alternative water sources to meet non potable demands – fit for purpose use of water.

The WSUD Strategy presented for the Huntingwood West site will ensure that water cycle management opportunities are optimised for the site and that the environmental objectives are met, delivering best practice water cycle management.

Appendix 1 – Wetland and bioretention vegetation

The Huntingwood West site lies within the Blacktown LGA of the Cumberland Plains. Ecological communities present within the immediate vicinity of the site include Shale-Plains Woodland and Alluvial Woodland, and are listed as endangered ecological communities under the Threatened Species Conservation Act 1995.

The plant species selected for the bioretention system and the stormwater treatment wetland are primarily based upon the Sydney Coastal River Flat Forest – Alluvial Woodland ecological communities.

A list of the plant species that are suitable for planting in the bioretention system is provided in Table 1. Several of the shrub species recommended for planting along the wetland batters would also be suitable for the bioretention system (Table 2).

The details of the plant species to be planted in the various wetland zones are provided in Table 2. The selection of plant species has been guided by the Shale-Plains Woodland and Alluvial Woodland ecological communities present within the Blacktown LGA of the Cumberland Plains.

The macrophyte species have been purpose selected for the stormwater treatment wetland, with consideration given to the hydrologic conditions expected within the wetland. The planting location and species mixes are designed to ensure that optimal stormwater treatment performance is achieved based on the specifications of the wetland. In particular, macrophyte species have been chosen that suit the frequency of inundation, depth of permanent pools and the depth of extended detention.

The lateral Melaleuca wetlands will provide temporary flood storage and also contribute to the treatment of stormwater quality. This wetland zone will be planted with a range of plant species that are capable of withstanding short term inundation. The species selected for this zone are typically found growing in riparian zones within Alluvial Woodland ecological communities.

Table A1 Recommended plant species for the central median bioretention system.

Austrostipa verticillata	Slender bamboo grass
Carex appressa	Tall sedge
Dianella longifolia	
Dianella revoluta	Blue flax-lily
Lomandra longifolia	Spiny-headed matt rush
Lomandra multiflora	Many-flowered matt-rush
Poa labillardierei	Tussock grass
Themeda australis	Kangaroo grass

Table A2 – Recommended plant species for the Huntingwood West stormwater treatment wetland

Wetland zone Littoral/ephemeral marsh (NWL to +0.2m)	Alisma plantago-aquatica Carex appressa Carex gaudichadiana Carex polyantha Cyperus lucidus Cyperus sphaeroideus Eleocharis acuta Juncus subsecundus Juncus usitatus Lythrum salicaria Microlaena stipoides Persicaria decipiens Persicaria prostrata	Water plantain Tall sedge Tufted sedge Leafy flat sedge Common spike-rush Finger rush Purple loosestrife Weeping grass Slender knotweed
Shallow marsh (NWL to – 0.2m)	Baumea rubiginosa Isolepis inundata Eleocharis acuta	Soft twig-rush Swamp club-rush Common spike-rush
Marsh (-0.2m to -0.35m)	Baumea rubiginosa Bolboshoenus caldwellii Schoenoplectus mucronatus Schoenoplectus pungens	Soft twig-rush Sea club rush Sharp club-rush
Deep marsh (-0.35m to -0.5m)	Baumea articulata Eleocharis sphacelata Schoenoplectus validus	Jointed twig-rush River club rush
Submerged marsh (-0.5m to 1m)	Myriophyllum variifolium Potamogeton ochreatis Potamotgeton tricarinatus Triglochin procera	 Blunt pondweed Floating pondweed
Ephemeral Zone Lateral Melaleuca wetland	Bursaria spinosa Casuarina glauca Hymenanthera dentata Imperata cylindrica Melaleuca linariifolia Microlaena stipoides Poa labillardierei	Sweet bursaria Swamp oak Blady grass Flax leaved paperbark Weeping grass Tussock grass
Batters	Austrostipa ramosissima Austrostipa verticillata Bursaria spinosa Cassinia arcuata Daviesia ulicifolia Dianella longifolia Dillwynia sieberi Einadia hastata Gahnia filifolia Imperata cylindrica Lomandra filiformis Lomandra longifolia Microlaena stipoides Poa labillardierei Themeda australia	Stout bamboo grass Slender bamboo grass Sweet bursaria Chinese scrub Gorse bitter pea Berry saltbush Blady grass Wattle matt-rush Spiny-headed matt rush Weeping grass Tussock grass Kangaroo grass

Appendix 2 – Modelling Details

This appendix presents more detail of the water quality and flood modelling undertaken in the development of the Huntingwood West WSUD Strategy.

1 Water Quality

Stormwater modelling was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), to determine the approximate size of the treatment elements. The model used eleven years (1967 – 1977) of 6 minute rainfall data from the Liverpool Bureau of Meteorology station which has a mean annual rainfall of 857 mm and mean annual potential evapo-transpiration of 1496 mm. This station has rainfall comparable with the daily data available from the Prospect Dam Bureau of Meteorology station which has a mean annual rainfall of 866 mm (120 year record from 1887).

As shown in Figure A2.1, the model schematically represents source nodes (catchment areas) and treatment nodes (eg wetlands, bioretention systems and gross pollutant traps).

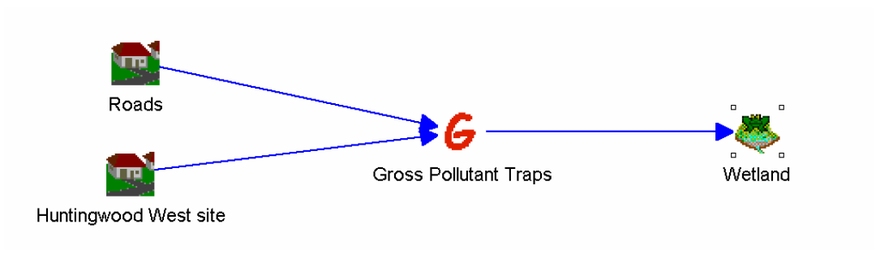


Figure A2.1 Schematic of MUSIC Water Quality Modelling – Wetland

The pollutant profiles used for the catchment areas are based on stormflow concentrations of pollutants reported for industrial landuse sites. (Chapter 3, Australian Runoff Quality). The table below reports the storm flow concentrations for Total Suspended Solids, Total Phosphorus and Total Nitrogen. The base flow concentrations are not used for the modelled impervious runoff.

Table A2.1 –Pollutant Profiles Used

Industrial Pollutant Profile	TSS	TP	TN
Storm flow mean (mg/L)	160	0.3	2.5
Storm flow mean (log mg/L)	2.2	-0.52	0.4
Std Dev	0.32	0.25	0.19
Road Pollutant Profile	**TSS**	**TP**	**TN**
Storm flow mean (mg/L)	240	0.26	2.09
Storm flow mean (log mg/L)	2.38	-0.585	0.32
Std Dev	0.45	0.5	0.29

The modelled road area uses the pollutant profile parameters for road runoff. The road layout for the Huntingwood West site will be dependent on the configuration of the lots within the employment zone. The road area modelled was 8 ha. The remaining part of the 56 ha site uses the industrial pollutant profile for runoff from the impervious area (estimated at 80%).

The modelled wetland size is 1.6 ha which includes part of the embankment area (average of the footprint at the top of the extended detention and footprint for the permanent pool). The wetland permanent pool has an average depth of 0.3 m, extended detention of 0.5 m and a notional detention period of 72 hours. The inlet zone modelled corresponds to the volume in the precinct ponds (assuming average 1.5 m depth).

Using MUSIC the performance of the proposed WSUD elements was assessed. The plot below (Figure A2.2) represents the results with the load of pollutants generated with no treatments installed, the loads generated with the proposed wetland constructed and the target pollutant loads for the catchment. The plot shows that the wetland meets the best practice objectives for stormwater pollutant removal. The results are as follows:

- Total suspended solids loads reduced by 89%;
- Total Phosphorus loads reduced by 68%; and
- Total Nitrogen loads reduced by 48%.

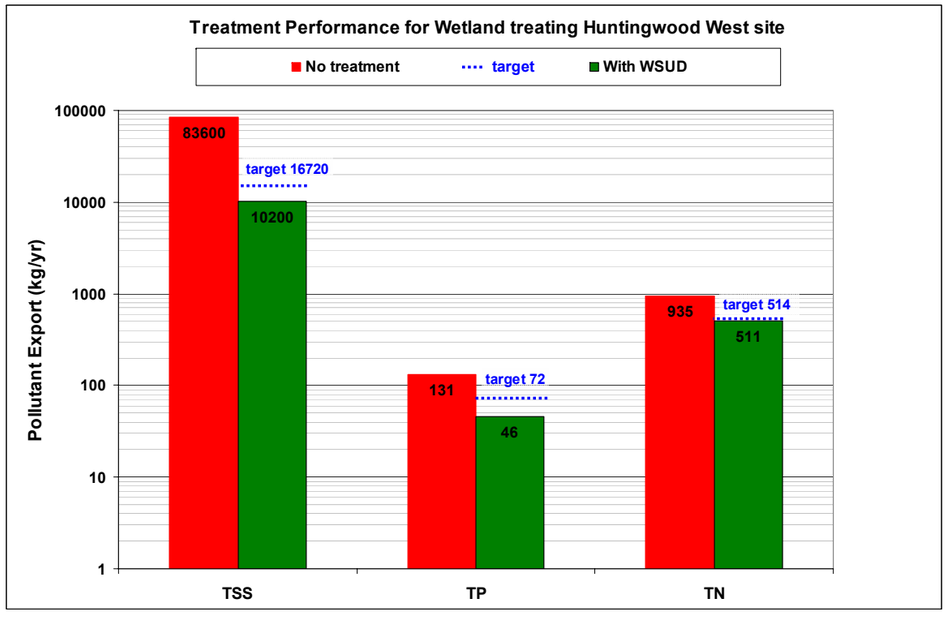


Figure A2.2 Treatment Performance – Wetland

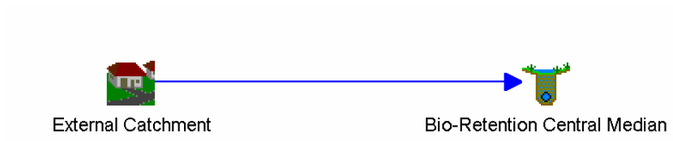
The wetland area is found to be adequate to provide treatment to meet best practice water quality targets for the range of layout options presented though the masterplanning. The configuration of the wetland and precinct ponds will be refined during the detailed design

phase. This would include re-modelling the expected treatment performance to ensure that the water quality targets are met.

Similarly the proposed central median bioretention system treating the external catchment was modelled as represented below. The external catchment (20ha) was assumed to be 80% impervious from analysis of aerial photos. The key parameters for the bioretention system include:

- surface area 2000m²
- filter area 1750m²
- extended detention depth 0.3m
- filter depth 0.6m
- filter median particle size 0.5mm
- saturated hydraulic conductivity 100mm/hr

Figure A2.3 Schematic of MUSIC Water Quality Modelling – Bioretention Central Median



As the following plot shows, the bioretention system meets the best practice objectives for stormwater pollutant removal. The results are as follows:

- Total suspended solids loads reduced by 86%;
- Total Phosphorus loads reduced by 72%; and
- Total Nitrogen loads reduced by 45%.

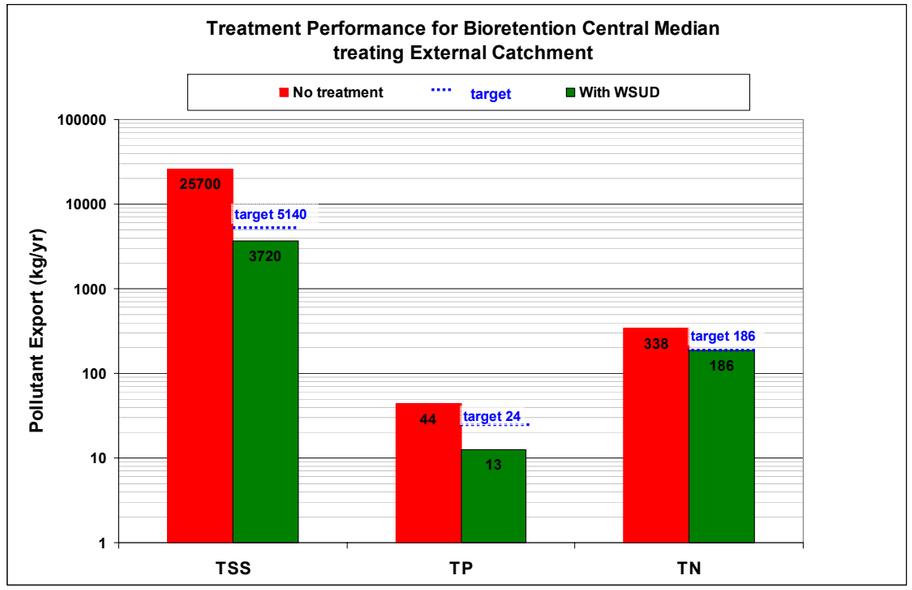


Figure A2.4 Treatment Performance – Bioretention Central Median

Other water quality treatment elements are proposed as optional, additional features including street trees and a roadside swale. These elements are sometimes difficult to incorporate in industrial precincts with required road widths and access points to lots. In the detailed planning, these elements will be modelled to complement the wetland and bioretention central median in meeting the water quality targets for the site and the external catchment.

2 Flood Hydrology

2.1 IFD Parameters

The following IFD parameters were adopted.

	2y1h	2y12h	2y72h	50y1h	50y12h	50y72h	Skew	F2	F50
Blacktown (Zone 1)	30.60	6.58	1.97	59.00	12.90	4.33	0.00	4.29	15.85

2.2 Impervious Fraction

Fraction imperviousness values were selected from standard values after inspection of the site and reference to aerial photography. The following were adopted

Land Use	Impervious Fraction
Pre-developed catchment	0.02
Existing industrial	0.80
Existing rural	0.02
Proposed industrial	0.80
Parkland	0.02

2.3 Hydrologic Models

The RORB Runoff Routing model was used to undertake flood estimation at the site for a range of scenarios. Hydrologic modelling of the site and upstream catchment was undertaken using 3 models to determine hydrology for the following:

- Pre-developed catchment model – to determine the peak 1 and 2 year ARI flows
- Existing catchment model – to determine the peak 100 year ARI flow
- Developed catchment model – to determine the peak 1, 2 and 100 year ARI flows and determine detention basin size and configuration to meet discharge targets.

2.3.1 Pre-developed Catchment Model

The pre-developed catchment model structure is presented in Figure A2.5 with Reaches labelled with Routing Order, Reach Type and RORB type respectively. These labels can be used to assist interpreting the RORB catchment file

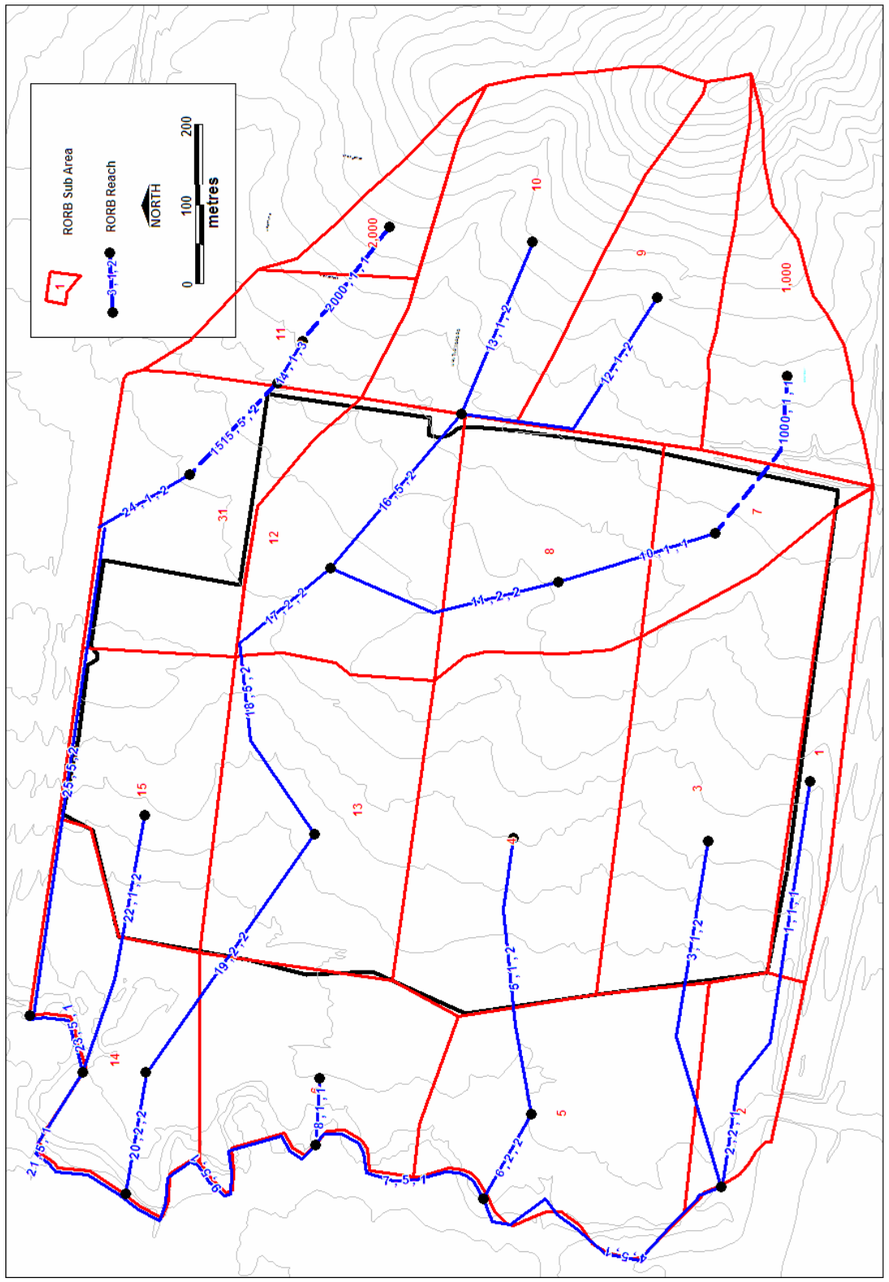


Figure A2.5 Schematic of Pre-developed Catchment hydrologic model

WstHunt_Predev.cat

```
2 yr Predeveloped Catchment West Huntingwood
C Catchment area = 1.1km2
C Average flow path length = 250m
C Catchment break up from
C IL = 20mm
C C100 = 0.60
C C2   = 0.21
C C1   = 0.20
C Kc   = 3.3
0
1, 1, 0.382949, -99, Reach 1 3.1,
2, 1, 0.121406, -99, Reach 2 0.8,
3,
1, 2, 0.427747, 2.4, -99, Reach 3
4,
5, 1, 0.364394, -99, Reach 4 0.3,
3,
C 1, 2, 0.336431, 2.4, -99, Reach 5
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4,
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3,
1, 1, 0.0700026, -99, Reach 8 0.8,
4,
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2, 2, 0.285988, 1.6, -99, Reach 11
3,
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3,
1, 2, 0.195793, 2.6, -99, Reach 13
4,
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4
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5, 2, 0.25247, 2.5, -99, Reach 18
2, 2, 0.357161, 2.4, -99, Reach 19
2, 2, 0.148494, 0.8, -99, Reach 20
7,
CentreFlow
4,
5, 1, 0.229029, -99, Reach 21 0.3,
3,
1, 2, 0.323206, 2.8, -99, Reach 22
4,
5, 1, 0.114003, -99, Reach 23 0.3,
7,
HWY withOUT Service Station
3,
1, 1, 0.182, -99, Reach 2000
2, 2, 0.059813, 3, -99, Reach 14
5, 2, 0.192592, 2, -99, Reach 1515 Overland
2, 2, 0.104907, 2.5, -99, Reach 24
5, 2, 0.598031, 2.4, -99, Reach 25
4,
7,
HWY WITH Service Station
0,
0.0308, 0.0267, 0.1082, 0.1103, 0.08947, 0.0667, 0.06067, 0.03351, 0.0703,
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```

2.3.2 Existing Catchment Model

The existing catchment model structure is presented in Figure 2.6 with Reaches labelled with Routing Order, Reach Type and RORB type respectively. These labels can be .used to assist interpreting the RORB catchment file.

This model was used only to determine 100-year flows from the development and catchment. A diversion has been incorporated into Reach 15 in the model to represent flow splitting on Brabham Drive. Overland flow will tend to head north towards the Great Western Highway. It is assumed that overland flows do not cross the highway and are directed west to Eastern Creek. Piped flows will head south and into the site opposite Huntingwood Drive.

Storage external to the catchment has been included into the playing fields at the south eastern corner of Brabham and Huntingwood Drive. Contour data indicates the area of the storage and a maximum depth of 0.5 was used. An outlet pipe diameter of 450mm was adopted from council's drainage network. The storage volume of the basin at 0.5m was estimated as 3900 m^3.

WstHunt_Exg.cat

```
100-yr Existing West Huntingwood
C Catchment area = 1.0km2
C Average flow path length = 250m
C Catchment break up from
C IL = 20mm
C C100 = 0.60
C C2   = 0.21
C C1   = 0.20
C Kc   = 3.3
0
1, 1, 0.382949, -99, Reach 1 3.1,
2, 1, 0.121406, -99, Reach 2 0.8,
3,
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C 3,
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C 5, 3, 0.220108, 0.5, -99, Reach 15
C 4,
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7,
HWY WITH Service Station
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0.06829, 0.1017, 0.07504, 0.09290, 0.06400, 0.08058, 0.03351, 0.05358, -99
1, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.8, 0.8, 0.02, 0.02,
0.02, 0.02, 0.8, 0.5, -99
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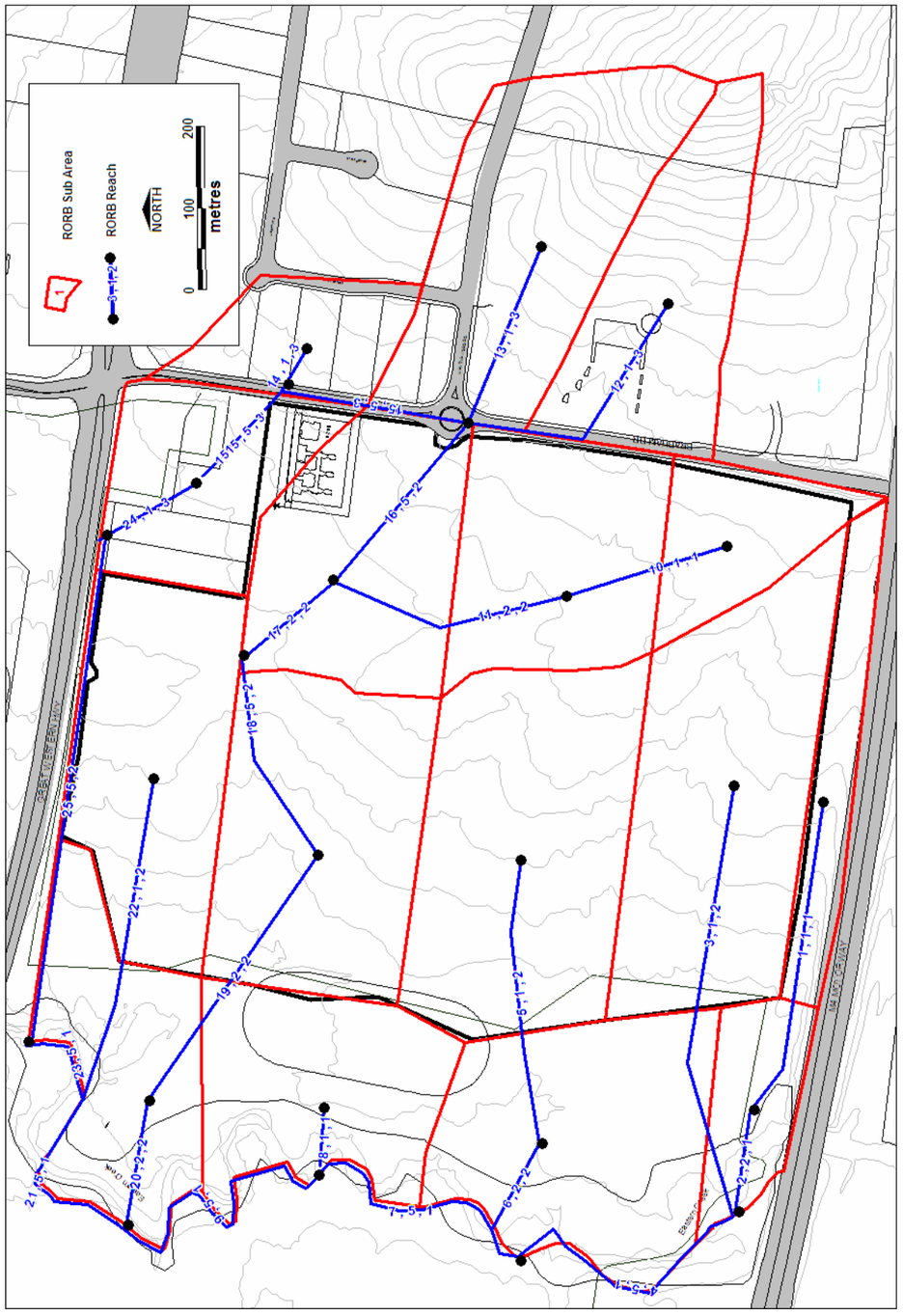

Figure A2.6 Schematic of Existing Catchment hydrologic model

2.3.3 Developed Site and Catchment Model

The developed site and catchment model structure is presented in Figure 2.7 with Reaches labelled with Routing Order, Reach Type and RORB type respectively.

This model was used to determine 1, 2 and 100-year flows from the development and catchment, and for sizing detention structure volume. A diversion has been incorporated into Reach 15 in the model to represent flow splitting on Brabham Drive. Overland flow will tend to head north towards the Great Western Highway. It is assumed that overland flows do not cross the highway and are directed west to Eastern Creek. Piped flows will head south and into the site opposite Huntingwood Drive. Storage has also been included into the playing fields at the south eastern corner of Brabham and Huntingwood Drive.

WstHunt_Dev.cat

```
100 yr Developed West Huntingwood _ Final Model
C Catchment area = 1.0km2
C Average flow path length = 250m
C Catchment break up from
C C100 = 0.60
C C2   = 0.20
C Kc   = 2.22
0
1, 3, 0.600, 3, -99, Reach 1
3,
1, 3, 0.357, 2.4, -99, Reach 2
4, Add 2 and 1
3,
1, 3, 0.239, 2.4, -99, Reach 4
5, 3, 0.137, 0.5, -99, Reach 3
4,
3,
1, 3, 0.162, 2, -99, Reach 10
5, 3, 0.496, 2.4, -99, Reach 11
4,
5, 3, 0.122, 0.5, -99, Reach 5
7,
Southern catchment in
3,
1, 3, 0.324, 3, -99, Reach 6
3,
1, 3, 0.196, 2.6, -99, Reach 7
C 7,
C Cricket Oval Inflow
16
Cricket Oval
2, 0, 1,
0.5, 20.0, 1.5, 1.0, 0.0, 1,
30, 1.0, 0.0, 1, 0.450, -99
1, 4,
0, 0, 0.1, 780, 1, 7850, 2, 16000, -99
4,
9, 1, 0, 0, 1111
Piped external flow
0, 5.0, 1, 1, -99
7,
Piped flow = 5 m3/s
3,
4,
7,
External 2 yr catchment
5, 3, 0.244, 1.8, -99, Reach 9
5, 3, 0.496, 2.4, -99, Reach 11
4,
7
South and Centre Basin Inflow
3,
1, 3, 0.21, 2.7, -99, Reach 12
3,
1, 3, 0.144, 2, -99, Reach 13
5, 3, 0.390, 2.5, -99, Reach 14
3,
1, 3, 0.305, 2.8, -99, Reach 15
4,
4,
7,
North catchment
4,
7,
Wetland and Storage
16
Wetland 2.6 ha
2, -3300, 1,
2.0, 10.0, 1.75, 1.0, 0.0, 2,
20, 1.0, 0.0, 1, 0.375, 20, 1.0, 1.5, 6, 0.525, -99
1, 9,
0, 0, 0.1, 800, 0.9, 9670, 1.0, 13780, 1.4, 18840, 1.5, 27930, 1.6, 31300, 2.0, 46300,
2.5, 66000, -99
5, 3, 0.182, 0.8, -99, Route to Creek Reach 23
3,
1, 1, 0.383, -99, Reach 18 slope 3.1
2, 1, 0.121, -99, Reach 19 slope 0.8,
5, 1, 0.314, -99, Reach 20 slope 0.3,
3,
1, 1, 0.111, -99, Reach 21
4,
5, 1, 0.353, -99, Reach 22
4,
3,
1, 1, 0.07, -99, Reach 24
4,
5, 1, 0.384, -99, Reach 25
3,
1, 1, 0.148, -99, Reach 26
4,
5, 1, 0.343, -99, Reach 27
7,
HWY withOUT Service Station
3,
C Return diverted flow
9, 2, 0, 1, 1111, -99
7,
Return overland flow
5, 3, 0.22, 2.0, -99, 2-yr Reach 88
C
C 5, 3, 0.193, 2.0, -99, 100-yr Reach 88
3,
1, 3, 0.06, 3.0, -99, Reach 8
4, Move catchment
2, 3, 0.105, 2.5, -99, Reach 28
5, 2, 0.598, 2.4, -99, Reach 29
7,
Service Station
4,
7,
HWY WITH Service Station
0,
0.034, 0.108, 0.110, 0.070, 0.068, 0.098, 0.093, 0.075, 0.0805, 0.031, 0.027, 0.089,
0.067, 0.064, 0.034, 0.054, -99,
1, 0.8, 0.8, 0.8, 0.8, 0.8, 0.7, 0.8, 0.8, 0.8, 0.8, 0.02, 0.02, 0.02, 0.02, 0.8, 0.8,
-99
```

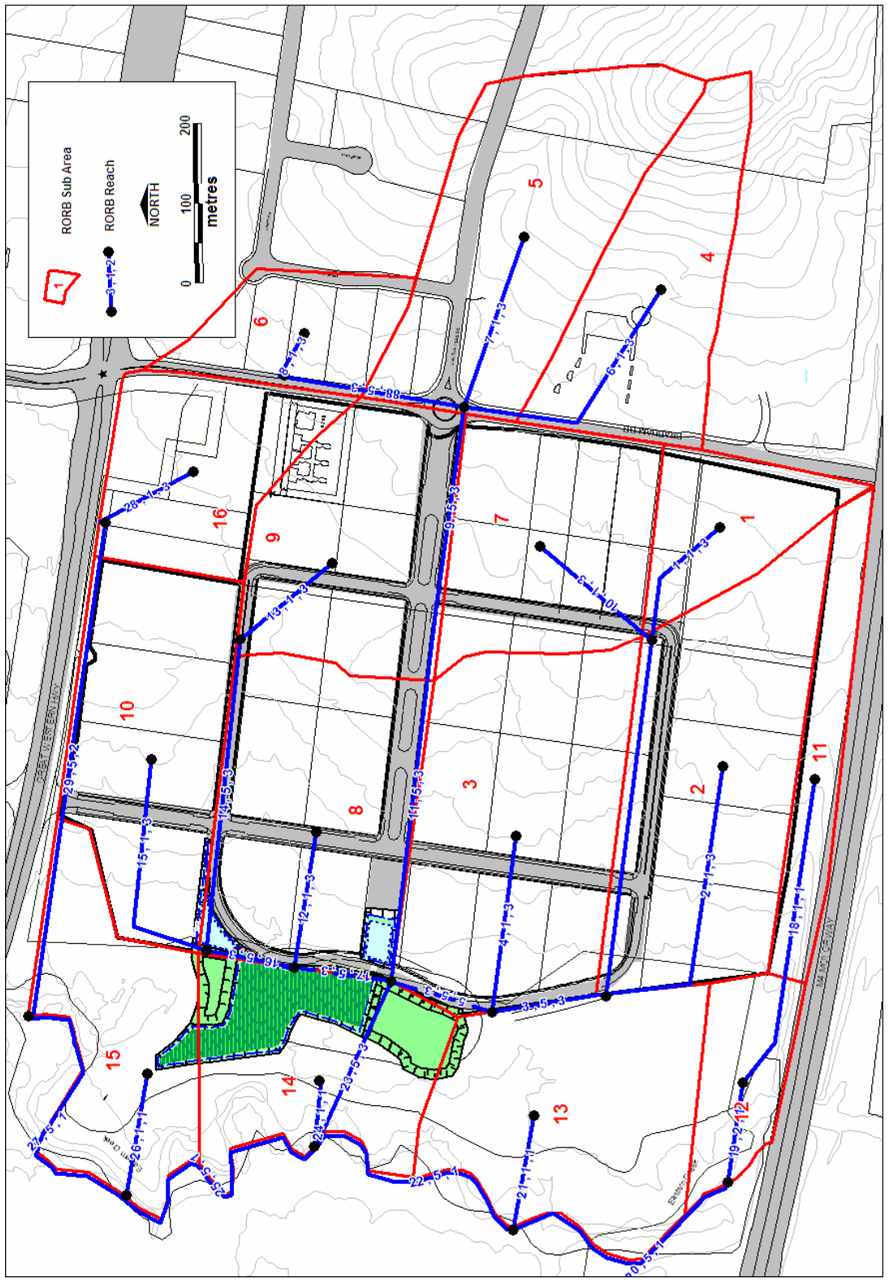

Figure A2.7 Schematic of Developed Site and Catchment hydrologic model

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Blacktown City Council (2000b). Stormwater Quality Control Policy Background Information and Guidelines for Application, Blacktown City Council.

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YSCO Geomatics (Aug, 2006), Civil Infrastructure Masterplan Report for the Release of the Bungarribee Employment Lands (Huntingwood West).

APPENDIX F
HERITAGE IMPACT STATEMENT

APPENDIX F

Heritage Impact Statement

Western Sydney Parklands—Huntingwood West Employment Lands
Heritage Impact Statement—September 2006

1.0 Introduction

1.1 Background

Godden Mackay Logan has been engaged by Architectus (acting for Landcom) to prepare a Heritage Impact Statement (HIS) in relation to a Concept Plan for the development of the Huntingwood West Employment Lands. The Concept Plan includes indicative options for subdivision, land use, the location of essential services and infrastructure and development design controls.

The Huntingwood West Employment Lands consist of 56 hectares of relatively undeveloped rural/residential land a few kilometres west of Prospect Reservoir, in Blacktown Local Government Area, western Sydney. The lands are bounded on the north by the Great Western Highway, Brabham Drive to the east, the M4 Motorway to the south and a section of the Western Sydney Parklands (Bungarribee Precinct) to the west. Its development will assist the improvement and public release of the Western Sydney Parklands, other areas of which also extend to the north and south of the site (see Figure 1).

1.2 Methodology

This HIS assesses the likely heritage impact of the proposed Concept Plan options and the Huntingwood West Development Design Controls (DDC) (August 2006) insofar as non-Aboriginal heritage resources of the Huntingwood West Employment Lands are concerned. It considers buildings and structures, the historic subdivision pattern, landscape features and the potential archaeological resource. The basis for impact assessment contained in this HIS is a draft history and overview heritage and historical archaeological assessment of the site prepared by Conybeare Morrison and Partners March 2006 (Conybeare Morrison Report), the Visual and Landscape Assessment prepared February 2006 by Richard Lamb (Lamb Report), and site inspections by David Logan, Lisa Newell and Chris Colville of Godden Mackay Logan on 10 May and 15 August 2006. No additional research or heritage significance assessment was undertaken for the purposes of the HIS.

The archaeological component of the HIS is limited to identifying whether there is any likelihood that 'relics', as defined by the *Heritage Act 1977* (NSW), could be located in the concept plan area. It also identifies what further detailed archaeological assessment would be required as detailed planning proceeds and specific development proposals are developed and documented.

The HIS has been prepared in response to the August 2006 written requirements of the Heritage Office, Department of Planning for the submission of the proposed Concept Plan. The methodology used is based on the guidelines contained in the *NSW Heritage Manual* (Department of Urban Affairs and Planning and the Heritage Council of NSW, 1996) and the principles contained in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999*. The part of the report that considers archaeology follows the initial sections of *Archaeological Assessments* guidelines of the *NSW Heritage Manual* (Department of Urban Affairs and Planning and the Heritage Council of NSW, 1996) but does not constitute a full archaeological impact assessment as this cannot be determined within a 'concept plan' of this nature.

Consultation with the Heritage Office, Department of Planning was undertaken at a meeting on 21 August 2006. Their written requirements for the HIS have not yet been received.

This HIS has been prepared by Lisa Newell, Senior Associate, and Chris Colville, Senior Consultant, Godden Mackay Logan. Input and review has been provided by David Logan, Director, of Godden Mackay Logan.

2.0 Proposed Concept Plan and Huntingwood West DDC

The Concept Plan and Huntingwood West Development Design Controls (DDC) assessed in this HIS are illustrated and documented in the following:

- Huntingwood West Subdivision—Large Lot option drawing no. 2201 Rev G prepared August 2006 by Architectus;
- Huntingwood West Subdivision—Medium Lot option drawing no. 2202 Rev G prepared August 2006 by Architectus;
- Huntingwood West Subdivision—Small Lot option drawing no. 2203 Rev G prepared August 2006 by Architectus;
- Huntingwood West Subdivision—Super Lot option drawing no. 2204 Rev D prepared August 2006 by Architectus; and
- Huntingwood West Employment Lands: Development Design Controls prepared August 2006 by Architectus.

The Concept Plan is described in detail in the Environmental Assessment (Final Draft)—Bungarribee Employment Lands (Huntingwood West) report, prepared in August 2006 by The Planning Group. In summary, it proposes to:

- develop Huntingwood West as employment land;
- create an employment area within a landscape setting that integrates with the adjoining Western Sydney Parkland's natural and conservation values; and
- integrate new development with the existing industrial area at Huntingwood and encourage visual and access links.

The Huntingwood West DDC is appended to the Environmental Assessment report prepared by The Planning Group.

3.0 Statutory Context (Heritage)

3.1 Australian Heritage Council Act 2003 and Environment Protection and Biodiversity Conservation Act 1999

The site is not included in the database of the Register of the National Estate (RNE), maintained by the Australian Heritage Council under the *Australian Heritage Council Act 2003* (Clwth), nor is it included on either the Commonwealth or National Heritage Lists, established under the *Environment Protection and Biodiversity Conservation Act 2000* (Clwth) (EPBC Act).

3.2 Environmental Planning & Assessment Act 1979 (EP&A Act)

State Environmental Planning Policy (State Significant Development) 2005

Part 3A of the Environmental Planning and Assessment Act (1979)

The proposed development falls within the definition of a 'state significant development'—Group 4—under *State Environmental Planning Policy (State Significant Development) 2005,* and the Minister for Planning has approved that the 'concept plan' for the Huntingwood West Employment Lands can be submitted to him under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for a determination.

While Sections 75R and 75U of Part 3A of the EP&A Act suspend the operation of most planning instruments and other Acts (including the Heritage Act), insofar as many Part 3A developments are concerned, the suspension does not apply to 'Concept Plan'. This is because the definition of an 'approved project' (75A) specifically excludes a 'concept plan', and only 'approved' projects trigger the suspension of other planning instruments and other Acts (75R, 75U).

It is likely that subsequent Development Applications for specific developments in the Huntingwood West Employment Lands will be determined under local planning instruments.

Blacktown Local Environmental Plan 1988

The site (in whole or part) is not included on Schedule 2—Heritage Items of *Blacktown Local Environmental Plan 1988* (BLEP 1988). Consequently, none of the heritage provisions of that plan apply to the consideration of the 'concept plan' for the subject site, except those that apply to the consideration of heritage items in the vicinity of a Heritage Item.

Clause 16A: Development in the Vicinity of Heritage Items

Clause 16A requires the preparation of a Heritage Impact Statement as part of the DA documentation, to inform the consent authority (in this instance, the Minister) of any adverse impacts (of the proposed development) on a heritage item in the vicinity of the development. This includes impacts on the setting and heritage significance of the heritage item, or any direct physical impacts. The only heritage item in the vicinity of the subject land is the Bungarribee Homestead Complex—Archaeological Site, Doonside Road, Doonside, which is approximately 1.5km north of site. Thus it is not 'in the vicinity' for the purpose of heritage consideration.

Schedule 2 also notes milestones along the Great Western Highway at Prospect, Huntingwood, Minchinbury and Mount Druitt (the stones are not mapped or specifically located). Site inspection did not reveal any milestones along the Great Western Highway in the vicinity of the Huntingwood West Employment Lands.

3.3 Heritage Act 1977 (NSW)

The State Heritage Register (SHR)

The site in whole or part is not listed on the State Heritage Register (SHR), established under the *Heritage Act 1977* (NSW).

Archaeological Relics

Under Section 139 of the Heritage Act, archaeological 'relics' are protected from being 'exposed, moved, damaged or destroyed' by the disturbance or excavation of land unless an Excavation Permit has been obtained. A 'relic' is defined by the Heritage Act as:

Any deposit, object or material evidence:

(a) which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and

(b) which is 50 or more years old.

This HIS contains a brief overview of the historical archaeological potential of the site and identifies whether there is any likelihood that 'relics', as defined by the Heritage Act, could be located in the concept plan area. It also identifies what further, more detailed archaeological assessment would be required as detailed planning proceeds and specific development proposals are developed.

Section 170 Register

Section 170 of the Heritage Act requires New South Wales Government authorities to keep a register of their assets with heritage significance. Section 170A of the Heritage Act requires that a government instrumentality give the Heritage Office, Department of Planning at least '14 days notice of its intention to remove an item from its Section 170 Register, or demolish the item'.

Section 170 only applies to the assets and actions of State Government instrumentalities. Legal advice should be sought in the event that current survey and title searches find that that the Station and Yard Group Section 170 Register listing boundary extend into the subject (private) land.

The site in whole or part is not included on the Section 170 Register of any State Authority.

4.0 Outline History of the Site

The Huntingwood West Employment Lands were part of a larger area at Prospect secured by Governor King in 1803 as grazing common. By 1812, Governor Macquarie began releasing the land to emancipists and free settlers for cultivation and by 1820, the Prospect Common (and other reserve land in the area) had been divided into multiple lots and allocated to various grantees.

The released land east of Eastern Creek, bounded to the north by the Great Western Highway (the subject land), was granted to a number of individuals. In 1817 William Dean (who also owned land west of Eastern Creek, both north and south of the Western Highway) obtained a 100 acre lot just east of the creek. Dean's land east of the creek included the site of the 'Red Lion Inn', the location of which is noted in the 1890 subdivision plan of Wallgrove Estate on a Mrs Lintern's property (the Lintern's having bought Dean's land east of the creek in 1878). Dean also had an inn on the western side of the creek (outside the subject land) known as the 'Corporation Inn' or 'Bush Inn'.

Other grantees of land east of the creek obtained lots ranging from 30 to 50 acres. Given there were stipulations to cultivate and occupy the granted land, it is likely that most lots were improved to some degree throughout the nineteenth century. However, the 1890 subdivision plans do not record improvements east of the creek other than Dean's 'Red Lion Inn' (noted as the plan as 'Old Inn'). It may be

that most improvements were located west of Eastern Creek (outside the Huntingwood West Employment Lands area) or that the early improvements were short lived and/or peripheral in nature, and so did not survive until the 1890s, or that they were demolished or cleared for sale purposes.

The 1890s subdivision plan clearly shows the alignment of a north–south road, Rudders Lane, through the proposed subdivision. This is generally the alignment of Rudders Lane today.

Following subdivision and sale in the 1890s, most of the land east of the creek was used for rural/residential small lot grazing and market gardening. Various improvements (houses, sheds, gardens, dams, fences etc) were constructed on the land throughout the twentieth century, the majority of the surviving built and landscape elements dating to the mid-century. The Shell service station and the Beaurepairs workshop at the corner of the Highway and Brabham Drive reflect late twentieth century subdivision and changing use.

A copy of the Historic Overview prepared by Conybeare Morrison is included as Appendix A.

5.0 The Site and its Existing Heritage Resources

The Concept Plan shows a reduced boundary to Huntingwood West that excludes four lots located to the northeast portion of the land parcel (corner of Brabham Drive and Great Western Highway). However, these lots would be subject to the Huntingwood West DDC, prepared August 2006 by Architectus. A landscape buffer is also proposed between the western boundary of the proposed Huntingwood West Employment Lands and Eastern Creek.

The Lamb Report notes that the character of the Huntingwood West Employment Lands area can be described as rural residential, with a number of small land holdings and some small pockets of open grassland.

5.1 Built and Landscape Heritage

The following is a summary of the Assessment of Significance and Management Recommendations sections of the Conybeare Morrison Report.

Significance Assessment

The area of Huntingwood has historic associations with early land grants and continuity of land use for horse breeding and market gardens from the early nineteenth century to the present based on its historic, aesthetic and technical/research values.

Rudders Lane, a narrow single carriage lane set between pasturelands, has scenic qualities that are becoming rare in the local area. Vistas across pasturelands to the vegetation associated with Eastern Creek enhance the scenic qualities and provide views of rural activities which have remained the same for almost two hundred years.

Management Recommendations

Surrounded by pastureland, Rudders Lane has a picturesque setting that should be retained and conserved. Rudders Lane is named after one of the early land-owners in Huntingwood and has moderate local heritage significance. This lane marks the early subdivision of the area and provided an access route for small allotments.

Visual connections with Eastern Creek across pastureland and through strands of indigenous trees should be maintained.

Copies of the Significance Assessments and Management Recommendations prepared by Conybeare Morrison are included as Appendix A.

The following is a summary of the Assessment of Parcel 4: West Huntingwood (the Huntingwood West Employment Lands) section of the Lamb Report.

Landscape and Visual Constraints

Land Parcel 4 (Huntingwood West Employment Lands) *has high visual exposure from viewing locations along the Great Western Highway and M4 Motorway.*

The dense vegetation along the creekline is the most significant remnant vegetation in this parcel of land. There is also a pocket of relatively dense vegetation located in the northeastern corner of the parcel. Other vegetation is relatively scattered and sparse within the open rural residential land and open grasslands.

This area has a high visual fit for potential future light and medium industrial development as a result of the existing development on the eastern side of Brabham Drive. The greatest potential for such development is located on the eastern side of the site adjacent to Brabham Drive.

The retention of existing groups of vegetation and the introduction of buffers and some informal screen plantings along the three primary frontages would increase the potential suitability of development within the eastern part of the site.

Overall, it would be acceptable for there to be significant change in the visual character of the area as a result of future development. It would be preferable if there was retention of the open character of the flood prone land adjacent to the creek.

Scenic Resource Management Guidelines

The flood prone area to the immediate east of the creek corridor should be retained as a more rural character as it is at present. The existing vegetation within the creek alignment should be retained and augmented as appropriate.

The land within the eastern part of the site, including that in the immediate vicinity of Rudders Lane and existing rural residential properties, could be developed for light industrial purposes of high quality building and landscape design.

All vegetation remnants, especially those within the eastern part of the site and within the Eastern Creek corridor, are to be considered for retention and enhancement with enrichment planting and regeneration techniques.

Existing stands of vegetation located should remain amongst future development areas of the parcel. This vegetation would provide visual separation between buildings and structures as well as softening the appearance of larger industrial development.

A copy of the Visual and Landscape Constraints and Scenic Resource Management Guidelines prepared by Lamb is attached as Appendix B.

5.2 Historical Archaeology

The following is a summary of the Archaeological Report and Significance Assessment sections of the draft Conybeare Morrison Report for Huntingwood West (for archaeology). It includes comment and clarification (*in italics*) by Lisa Newell of Godden Mackay Logan based on more recent documentary review and site inspection.

The conclusion is by Godden Mackay Logan.

Archaeological Survey

- The area was surveyed by vehicle along the Highway and Rudders Lane from where properties and outbuildings were inspected.
- The original subdivision (*meaning the Wallgrove Estate 1890s subdivision, not original grants*) is still evident, although there has been some further subdivision.
- The 1890s map shows an unenclosed area/paddock, belonging to Mrs Lintern, to the northwest of the central road *(Rudders Lane),* three-quarters of which is in the survey (*the Huntingwood West Employment Lands*) area.
- The site of the 'Old Inn' *(Dean's Red Lion Inn)* is in the *(north)* western corner of Mrs Linton's Lot.
- A series of original post and rail fences exist along some of the sub-divisions *(old post and wire, not post and rail, fences were noted but it is not clear whether they are all original—viz, related to the 1890s subdivision).*
- The location of the Old Inn was searched along the Highway, in the front yards of two houses adjacent to *(east of)* Eastern Creek.
- A shallow depression marked by differential grass growth was just visible near the front fence of the house closest to the creek, and just in the boundary of the study area (*inspection of all the Highway frontages of the site by GML did not reveal any discernable 'depression' that could indicate remains of a previous structure—this may be explained by recent grading of the area*).
- A cobbled pathway leads from the fence entrance to the front of the house closest to the creek. This could be an original *(relating to the Red Lion Inn)* feature, perhaps a path leading to the carriage or horse barn *(no cobbled pathway was noted by GML in any of the frontages to the Highway. The location of the Old Inn needs to be explored further and substantiated through detailed research and survey).*
- The 1930–1950 fibro cottage may be constructed on an earlier building footprint *(this suggestion was based on the location of the cobbled path, which is now not evident. Further detailed research and survey and perhaps excavation is needed to clarify the potential location of the Old Inn and its grounds/outbuildings).*

A copy of the Archaeological Survey Report prepared by Conybeare Morrison is included as Appendix C.

Significance Assessment

- The Huntingwood land parcel *(the Huntingwood West Employment Lands*) may contain an archaeological site of scientific significance—the Old Inn site next to the Great Western Highway adjacent to (*just east of*) Eastern Creek.
- A test excavation should be carried out on the site of the fibro house (then/now) on the site

Management Recommendations

- A test excavation should be carried out on the site of the Old Inn before it is disturbed (*it is unclear where the Old Inn site is most likely to be—further research and survey and then perhaps excavation would be required to more closely locate the area of its likely remains*).
- An Excavation Permit under the Heritage Act should be sought to undertake the testing.

Copies of the Significance Assessments and Management Recommendations prepared by Conybeare Morrison are included as Appendix A.

Godden Mackay Logan Conclusions

- The history, use and occupation of the Huntingwood West Employment Lands from first land grants to the present indicate that 'relics', as defined by the Heritage Act, could survive throughout the land in various forms.
- The 'relics' could be in the form of structural remains relating to former pastoral landscapes, wells, dams, buildings, private roads and carriageways and/or occupation and waste (rubbish heaps) deposits. Most surviving relics (archaeological resources) would be provenanced to the late nineteenth and twentieth century use and development of the site. This indicates that they would unlikely to be of major significance (except for the Old Inn) and unlikely to require in-situ retention.
- The potential location of 'relics', and their possible integrity, research value or heritage significance, has not been identified or assessed in detail, except for the likely location of the Old Inn at the northwest corner of the site.
- The conjectured location of the Old Inn under the current fibro house closest to the creek is not substantiated through detailed research or survey and needs to be explored further. However, it is likely that remains of the Old Inn, should they survive, would be very close to that house, probably just to its north and west.
- Given the cumulative episodes of Highway upgrade and widening, and the difficulty with scale and accuracy in the 1890s Wallgrove Estate subdivision plan, it may be that the remains of the Old Inn may lay just inside, or just outside the subject land, or straddle it, or may be within the current road reserve.
- Until more specific research, survey and test excavation is undertaken to identify the location and survival of the remains of the Old Inn, a precautionary approach should apply to confirming the boundary of the Employment Lands and Parklands and developing any specific works-related proposal that may affect the northwest corner (as now mapped) of the Huntingwood West Employment Lands.
- Should more specific research, survey and test excavation conclude that substantially intact remains of the Old Inn survive (whether within or outside the Huntingwood West Employment Lands), the remains

are likely to be of State heritage significance because of their research potential, rarity and historical associations.

- It is Heritage Council of NSW policy to retain in situ archaeological remains of State significance, or where they cannot be retained, to undertake their research investigation and excavation prior to those works which may disturb or destroy them.

6.0 Identification and Assessment of Impacts

6.1 Built and Landscape Heritage

The subject site does not contain any built or landscape heritage items identified in BLEP 1988. While the Bungarribee Homestead Complex—Archaeological Site, Doonside Road, Doonside, lies approximately 1.5km north of the site, the proposed Concept Plan options would not have any heritage impact on that archaeological resource.

A number of single-storey residential dwellings survive throughout the subject site which have no identified heritage value (see Figures 2 and 3).

The Concept Plan, included as Appendix C of this report, indicates the options for proposed subdivision, land use, road network and circulation, infrastructure and landscaping for the site. These works have the potential to affect a number of landscape elements identified in the Lamb Report discussed above.

The Concept Plan does not include, or seek approval for, specific works or construction but rather outlines options for subdivision, land use, road and circulation network, infrastructure and landscaping. However, while details about construction and (such as clearing, levelling and building) are not included in the Concept Plan, the type of development they envisage has the potential, when constructed, to affect landscape and visual values.

Landscape and Visual Constraints

The Lamb Report identifies a number of visual and landscape elements (summarised above) which the proposed Concept Plan options have the potential to impact on. These elements are considered below in accordance with the proposed Concept Plan options.

- The Huntingwood West Employment Lands have high visual exposure from viewing locations along the Great Western Highway, M4 Motorway and Brabham Drive. The significant views identified by Lamb have been incorporated into the Concept Plan options by way of road alignments and the proposed subdivision patterns (including site boundary setbacks). Options 2 and 3 include an access road from Brabham Drive (junction of Huntingwood Drive) which would ensure that a framed view across the site to Eastern Creek is retained. In addition, the setbacks proposed from the Great Western Highway and the M4 motorway would limit obstruction of these views towards the creekline. The Brabham Drive access road and proposed super and large lot options would potentially impact on this significant view but this would depend on future development of this lot and what form/layout it takes. However, it is noted that an eco median is proposed between Brabham Drive and Eastern Creek which would allow future interpretation of this significant view.
- The dense vegetation along the Eastern Creekline is identified as significant remnant vegetation in this parcel of land. The Concept Plan options are consistent as they recognise its importance as a

landscape buffer between the western boundary of the proposed Huntingwood West Employment Lands and the creekline. This would ensure that this area of remnant vegetation is protected (see Figure 4).

- The provisions of the Huntingwood West DDC allow for retention of significant trees, in particular along road reservations and drainage lines. The four Concept Plan options proposed involve removal of a pocket of relatively dense vegetation located in the northeast corner of the subject site (see Figure 5). The Lamb Report identifies this group of trees as significant. However, Lamb's findings have been further refined in the Huntingwood West DDC following the outcomes of a tree survey. This identifies individual trees of significance. The road alignment, from Brabham Drive in particular, would potentially impact on a small group of these significant trees (within the pocket of trees identified above) shown in Figure 12 (included as Appendix D) of the Huntingwood West DDC. However, the eco median proposed in all four options would lessen any potential impact.
- All four options proposed as part of the Concept Plan propose the introduction of buffers and setbacks along the three primary frontages (Brabham Drive, Great Western Highway and the M4 Motorway). This increases the potential suitability of industrial development within the eastern part of the site in accordance with Lamb's recommendations and subject to adequate screening of these frontages.
- The proposed road alignment (including eco median) and subdivision shown in small and medium lot options would ensure that scenic qualities of the site (identified in the Conybeare Morrison Report) including vistas across the site towards the vegetation associated with Eastern Creek would be retained to ensure future interpretation of these visual qualities (see Figures 6 and 7).

Historic Subdivision Pattern

The Conybeare Morrison Report assesses the significance of Huntingwood West which is summarised above.

The four Concept Plan options propose removal of Rudders Lane, a narrow single carriage lane set between pasturelands. The Conybeare Morrison Report recognises the significance of Rudders Lane as a remnant of early subdivision (Wallgrove Estate 1890). The proposed road realignment shown in the options would remove the potential for interpretation of the original laneway and historic subdivision pattern. There may be potential to retain the laneway alignment as part of a new road pattern and it is recommended that this be explored.

6.2 Historical Archaeology

Discussion

The above summary of the overview archaeological survey and assessment of the site indicates that 'relics', as defined by the Heritage Act, could potentially occur at various locations throughout the site. Most relics (archaeological resources) would be provenanced to the late nineteenth and twentieth century use and development of the site, although the remains of the early nineteenth century Old Inn may have survived within or just outside the northwest corner of the site. The location, integrity and heritage significance of the potential archaeological resource is not yet identified.

The Concept Plan options outline plans for subdivision, land use, road and circulation network, infrastructure and landscaping. However, while details about construction and land disturbance (such as

cut and fill, clearing, levelling and building) are not included in the Concept Plan options, the type of development they envisage has the potential, when constructed, to affect archaeological resources ('relics') that may survive.

It is the later stage construction and disturbance potential to affect 'relics' that is identified and assessed below.

The Options

The proposed subdivision patterns, landscape options and land uses in all four Options provide for a future development intensity and footprint that could disturb archaeological resources, should they be located on the subject land. None of the three indicates a development form that would, by the nature of its construction, form or intensity, have more or less potential to impact on the archaeological resources.

All the options outline a redevelopment that has potential to disturb surviving 'relics' on the land, although their location, integrity and heritage significance is not yet identified. However, given the history of the use of the land, it is unlikely that 'relics' of State heritage significance would occur (except for those which may relate to the Old Inn), and it is unlikely that intact remains with sufficient integrity to provide research opportunities, or remains with high local heritage significance, would survive. Consequently, while 'relics' would potentially be affected, they are unlikely to be of sufficient significance for the Concept Plan be adjusted or modified in any major way to allow for their in situ conservation or interpretation, except for the remains of the Old Inn which could be sufficiently significant to require that the Employment Lands/Parklands boundary to change so the Inn remains can be conserved in the Parklands.

Details of the potential archaeological impact, and whether further archaeological investigation or excavation would be required, would be a matter to resolve when more intensive survey, assessment and test excavation (in the case of the Old Inn) is undertaken, if required, prior to, and part of, detailed development planning.

The 'Old Inn'

The likely location of any remains that may survive of Deane's 'Red Lion Inn', also known as the 'Old Inn' on the 1890s subdivision plans for the Wallgrove Estate remains unsure. The conjectured location of the Old Inn under the current fibro house closest to the creek is not substantiated; however, it is likely that remains of the Old Inn, should they survive, would be very close to that house, probably just to its north and west.

Given the cumulative episodes of Highway upgrade and widening, and the difficulty with scale and accuracy in the 1890s Wallgrove Estate subdivision plan, it may be that the remains of the Old Inn may lay just inside, or just outside the subject land, or straddle it, or may be within the current road reserve. A closer location and confirmation cannot be determined without further investigation and archaeological test excavation.

The Concept Plan options provide different scenarios for this potentially archaeologically sensitive area. All include a road off the Highway just east of the current fibro house and land uses, services, roads and improvements (within the subject land and to the Highway road reserve) that have potential, during construction, to disturb or destroy, in whole or part, remains of the inn that may survive. However, the degree of impact, if any at all, cannot be accurately determined at this point. More specific research, survey and test excavation is required prior to, or part of, detailed planning in this area to identify whether substantially intact remains of the Old Inn survive (whether within or outside the Huntingwood West

Employment Lands), and to identify whether the remains, should they be found, are of State heritage significance.

Once this has been undertaken, a closer assessment of the potential impacts of future development in this archaeologically sensitive area can be determined and management regimes/options for the remains of the Old Inn identified. This may include adjusting the boundary of the Employment Lands/Parklands to ensure the remains of the Old Inn are located in the Parklands, or, if that is not possible, some minor adjustments to the Concept Plan, such as a service diversion or subdivision boundary adjustment to allow for the in situ retention of the remains should that be required, or their excavation.

It is unlikely, however, that even if intact remains of the inn survive and they are of State significance, they would require major boundary changes of the Employment Lands/Parklands or re-design or change to any great degree of the Concept Plans.

7.0 Conclusions and Recommendations

7.1 Built and Landscape Heritage

The subject site does not contain any built or landscape heritage items identified in any statutory or non-statutory planning instruments. However, the site does have cultural significance identified in the Conybeare and Morrison and Lamb reports.

The Concept Plan options would ensure that significant views and scenic qualities identified in the Lamb Report are retained by way of road alignments and the proposed subdivision patterns with minimal impact on the cultural landscape. However, the road alignment, from Brabham Drive in particular, would potentially impact on a small group of significant trees located within the northwest pocket of vegetation identified as significant in the Lamb Report and in the Huntingwood West DDC. It is acknowledged that the eco median proposed in each option would lessen any potential impact. However, it is recommended that those trees identified as significant be retained in accordance with Figure 12 of the Huntingwood West DDC.

The landscape buffer proposed as part of the Concept Plan options between the western boundary of the Huntingwood West Employment Lands and Eastern Creek reduces the potential impact that any subsequent subdivision and development of the study area on the culturally significant vegetation identified.

The loss of Rudders Lane would have an impact on the potential interpretation of the historic subdivision pattern of the site. Accordingly the following is recommended:

Consideration should be given to a road alignment that retains the Rudders Lane alignment for the purposes of interpreting this historic laneway as part of the original subdivision of the area.

7.2 Historical Archaeology

Conclusions

All the Concept Plan options have potential to disturb surviving ‘relics’ on the land, although the location, integrity and heritage significance of the ‘relics’ is not yet identified. It is unlikely that ‘relics’ of State heritage significance would occur, other than those that may relate to the Old Inn, if found. ‘Relics’ that may survive are unlikely to be of sufficient significance to require that the Concept Plan be adjusted or modified

to allow for their in situ conservation or interpretation, with the possible exception of those relating to the Old Inn, should they be found.

The Concept Plan options provide different scenarios for this potentially archaeologically sensitive area. All have potential, during construction, to disturb or destroy, in whole or part, remains of the Old inn that may survive. However, the degree of impact, if any at all, cannot be accurately determined at this point and further assessment and archaeological test excavation should be undertaken as part of detailed development planning for the site and as part of the finalisation of the boundary between the Employment Lands and Parkland (so that remains of the Old Inn can be located in Parklands where possible). This may also result in a management options for the remains that require minor adjustment to the Concept Plan such as the re-location of service locations or specific lot boundaries. However, it is not anticipated that substantial change to the Concept Plan would be required.

Details of the potential archaeological impact of the development proposed in the Concept Plan, and whether further archaeological investigation or excavation would be required, would be a matter to resolve when more intensive survey and assessment is undertaken prior to, and part of, detailed development planning. Accordingly, it is recommended that as part of the finalisation of the boundary between the Employment Lands and Parkland and detailed planning for the subject land (particularly the area around the northwest corner of the site where the Old Inn is likely to be), more detailed archaeological research and assessment should be undertaken to determine whether 'relics', as defined by the Heritage Act, are likely to be on the land, and to identify their heritage significance and appropriate management. The site of the Old Inn would require test excavation as soon as practical so that the Employment Lands and Parkland boundary can be confirmed.

The more detailed assessment should include;

- Historical research of the subject land, including maps, plans and aerial photographs to identify previous structures and landscape elements. Overlay of historical material on current site plans.
- A site survey and recording to determine whether the specific land had physical indications of potential to contain 'relics' of a specific nature.
- A significance assessment of any potential 'relics' and archaeological resources identified.
- Developing management recommendations. These could include recommendations to undertake test excavations, seeking an excavation permit under the Heritage Act, seeking an 'exception' to the requirement for an excavation permit Under the Heritage Act, or monitoring during works etc.
- In the case of any remains of the Old Inn, test excavation should be undertaken as soon as possible and before finalisation of the boundary between the Employment Lands and Parkland so that the remains can be conserved in the Parklands is possible. Should the remains be found, or should they be very likely to be found intact and of high heritage and research value, management recommendations may include modifying or adjusting road alignments/boundaries to incorporate their in-situ retention or research excavation prior to the removal and disturbance of the 'relics'.

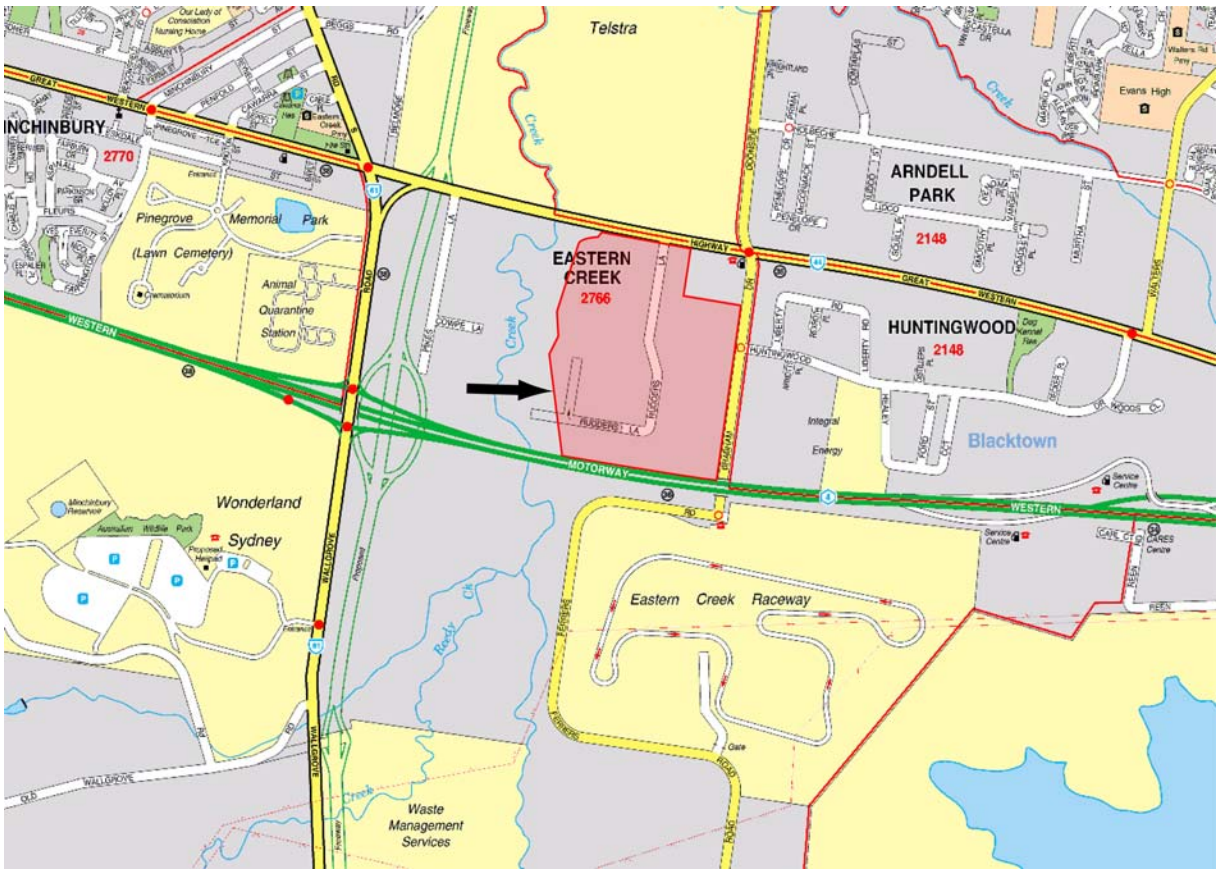


Figure 1 Site locality plan. The approximate location of the subject site is indicated.

Figure 2
Photograph taken from the Great Western Highway looking south across the study area. The weatherboard cottage shown is located to the west of Rudders Lane.

Figure 3
Photograph taken the Great Western Highway looking southeast across the study area. The dwelling shown is located to the immediate west of Rudders Lane.

Figure 4
Photograph taken from the Great Western Highway looking southwest across the study area. The trees in the far distance indicate the location of Eastern Creek.

Figure 5
Photograph taken from Rudders Lane looking northeast across the study area. Note the mature trees occupy the northeast pocket of Huntingwood West Employment Lands.

Figure 6
Photograph taken from Rudders Lane looking north towards the Great Western Highway.

Figure 7
Photograph taken from Rudders Lane looking west across the study area. Note the pastoral landscape characteristic of Huntingwood West. The trees visible in the far distance indicate the Eastern Creekline.

8.0 Appendices

Appendix A

Extract from draft history and overview heritage and historical archaeological assessment of the site prepared March 2006 by Conybeare Morrison and Partners

Appendix B

Extracts from Visual and Landscape Assessment prepared February 2006 by Richard Lamb

Appendix C

Concept Plan Options prepared August 2006 by Architectus

Appendix D

Extract from the Huntingwood West Development Design Controls prepared August 2006 by Architectus

Appendix A

Extract from draft history and overview heritage and historical archaeological assessment of the site prepared March 2006 by Conybeare Morrison and Partners

2.5 Huntingwood (Land Parcel 4)

2.5.1 Land Tenure - Early Land Grants

In August of 1803, Governor King, in addition to securing lands for the grazing of government stock, also implemented a strategy of land granting. He deemed it:

> *"essential for the present and future prosperity of this Colony and the inhabitants thereof that every facility should be afforded to all description of settlers and cultivators being free men and holding land by Grant under the Crown or by lease for or more than seven years to rear and maintain cattle and other stock by allotting in the several districts portions of land for the use of the settlers and cultivators".*[88]

As a result three large portions of land were provided for the use of settlers and cultivators whose allotments were inadequate for their increasingly acquired stock. These 'Commons' were located at Prospect Hill, Baulkham Hills and the Richmond Hill districts. Initial grants were for a period of fourteen years, following which the lands reverted back to the Crown.

When the leases expired, Governor Macquarie with the Surveyor General decided to release vast areas of the Commons together with the substantial sections of the government reservations. This was undertaken in order to cope with the ever-increasing demands of the free and emancipated settlers. Between the years 1818 and 1820, all the area of land from Prospect to South Creek along the southern side of the Western Road (Great Western Highway) and down to Chandos Road was allocated for private cultivation purposes. Some of the large allocations were to William Dean, John Brabyn, Frederick

84 Austral Archaeology Pty Ltd, 2000; p. 37
85 Austral Archaeology Pty Ltd, 2000; p. 25
86 Austral Archaeology Pty Ltd, 2000; p. 25
87 Bloxham F, 2002; *A History of Prospect*, Blacktown & District Historical Society, p.78
88 Bloxham F, 2002; p. 14

Dixon, John Thomas Campbell, James Erskine, William Cox Jnr (son of the engineer who established the Great Western Highway through the lower Blue Mountains), Samuel Terry and George Druitt.[89]

Figure 2.13 *Portion of Parish of Prospect Map (showing original land grants of Huntingwood site) (Source: Department of Lands/ PMapMN04-Image ID:14072601)*

For the multiple blocks granted in the West Huntingwood area (east of Eastern Creek) their size was determined by the grantees' status. In addition, the land grants were conditional that the person to whom the land was granted was to reside within the land and cultivate and improve at least a portion of the grant. In total, under Governor Macquarie's instruction, forty six grants totalling 5,625 acres were allocated within an area bounded on the north by the Western Road between present day Old Horsely Road and Ropes Creek on the west and Ferrers Road to the east.[90]

Based on subdivision plans, parish maps and the Certificates of Title held by the Department of Lands, of relevance to this report were the following grantees which cover the area of West Huntingwood within the study site: William Clark (50 acres), Mary Marshall (30 acres), William Blackman (60 acres) and Stephen Richardson (30 acres) who received their grants on 17 August 1819 and a further 24 acres being granted to Richard Aspinall and Warham Jebbet Browne on 19 October 1831. The map shown in Figure 2.13, which dates prior to 1890, locates these grants. On 6 January 1890 Mr John Shand purchased all of the above land grants together and appears to have immediately begun selling the area off again under the title of the 'Wallgrove Estate' and on 1 February 1892, Mr Shand was joined in ownership of most of the relevant allotments by James Anderson and Andrew Barclay Shand (excluding those granted to Mary Marshall and William Dean).

The large parcel of land abutting Eastern Creek and bordered to the north by the Western Road was the eastern half of William Dean's original 100 acre land grant dated 24 January 1817 and purchased by the Lintern family on 27 June 1878. This property maintained separate ownership from those lots purchased by John Shand.

89 Nicolaidis G, 2000; p. 15
90 Nicolaidis G, 2000; p. 16

2.5.2 William 'Lumpy' Dean

Among the first settlers in the Eastern Creek area was William Dean. Dean arrived in Australia as a convict on the 'Hillsborough' on 23 December 1798, having stolen a £20 bank note from his master's pocketbook. He received a conditional pardon in 1818. In 1806 he married fellow convict Elizabeth Hollingsworth.[91] He affectionately became known later in life as 'Lumpy' Dean due to his generous proportions and even had a special chair built to accommodate his size.

On 24 January 1817, Dean received two grants of land from Governor Macquarie. One grant of 50 acres was located on the northern side of the Western Road bordered by the Eastern Creek to the east and (present day) Belmore Road to the west. The other grant of 100 acres was located directly opposite on the southern side of the Western Road and conditional on the following:

> *The intent and meaning of this grant is that the proprietor shall maintain and keep up a House of entertainment for Travellers otherwise the grant to revert to the Crown. Conditioned- not to sell or alienate the same for the space of five years and cultivate twenty acres within the same said period.*[92]

Further grants were made to Dean. A grant of 50 acres was made in 1819 on the provision that 16 acres of the granted land be placed under cultivation[93]. A further grant of 70 acres was made in 1828. By this time he was in possession of 100 cattle and 8 horses.[94]

William Dean built a number of structures and operations on his grants within the Eastern Creek region. A variety of structures which resources have claimed association with the Dean's grants include a school, post office, garrison, church, toll bar and dwellings. The first recorded building associated with William Dean was an inn, known as 'The Corporation Inn' (alternative name being 'The Bush Inn'). This was located on the portion of land south of the Western Road[95] on the western side of Eastern Creek close to the intersection of present day Wallgrove Road. For years Dean remained Eastern Creek's principal resident and it can be said that he was instrumental in the settlement and development of the village of Eastern Creek.

A description of the route of the Great Western Road referenced within the NSW Directory dated 1832 states:

> *23¾: On the left, public house called the Corporation, kept by Mr. Lumpy Dean;*
> *24: On the right, Rooty Hill, where 8,000 acres having been granted to the Church; most of it is cleared land, having been formerly a Government grazing establishment.*[96]

This is substantiated by W M Freames writing in 1918 describing the village of Eastern Creek and the history of William Dean's involvement in the region as follows:

> *Eastern Creek is a small road side village that takes its name from the creek that crosses the Western-road at this place. It once boasted three public houses; Wm. Pike's which still remains, though long since closed, was in full swing more than 50 years ago. But "Lumpy" Dean's Corporation Inn was "the old original." We find it mentioned in Tegg's Itineraries as early as*

91 Austral Archaeology Pty Ltd, 2000; *Archaeological and Heritage Assessment of the Telstra OTC Site, Great Western Highway, Doonside*, p.29
92 Lovely M & Nicolaidis G, undated; p. 2
93 Austral Archaeology Pty Ltd, 2000; *ob cit*, p. 29
94 Lovely M& Nicolaidis G, undated; *Eastern Creek- The Early Days*, Blacktown City Council Local History Collection, p. 7
95 Eastern Creek Public School, 1967; *Centenary 1866-1966, Eastern Creek School*, p. 17
96 NSW Directory, 1832; cited in Blacktown City Council Library vertical files

1832.....He has long since gone to his rest, and the Corporation Inn has gone also.[97]

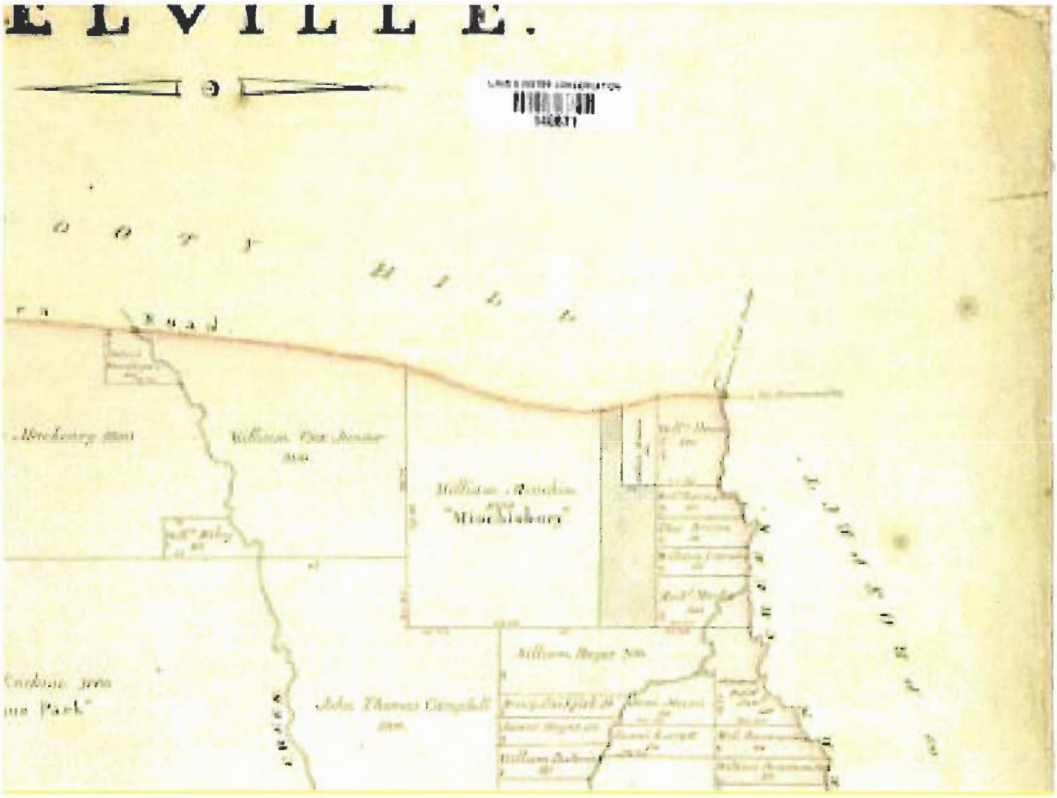


Figure 2.14 *Parish of Melville Map (undated) showing location of William Dean's initial 100-acre land grant (Source: Department of Lands/ PMapMN04 Image ID: 14067101)*

The second inn referred to in the above is assumed to have been located on the second grant of 50 acres located on the northern side of the Western Road. This inn was possibly known as the "The Old House at Home" Inn. It served as a type of boarding house when it was owned and run by William Dean's son-in-law, Thomas Pike. The suggestion has been made that it was this building that held the first school in the village of Eastern Creek.[98] A third inn is also supposed to have been located on the southern portion of Dean's land, known as 'The Red Lion'. Resources suggest that 'The Red Lion' Inn was located on the eastern side of the Eastern Creek, approximately 200 metres away from 'The Corporation' Inn and was granted license and was operated by William Dean's son, Thomas[99]. The suggested location of 'The Red Lion' Inn places any possible archaeological remains within the boundaries of the West Huntingwood study site.

A government notice in the *Sydney Gazette* in 1818 announced that as the Western Road from Parramatta to Emu Ford on the Nepean River had been completed and two Toll Bars were to be erected: one next to Parramatta on the summit of the hill adjoining the new parsonage house and the other at Dean's Farm Eastern Creek.[100] Although the official location of his toll house has not been established, suggestions have been made that the toll house (or toll bar) was built on the portion of Dean's land located on the northern side of the Western Road and later converted into a lockup (known locally as the 'Garrison').[101] Dean is said to have claimed it from the government in 1840 and renamed the premises

97 Freame W, 1918; *Old Prospect*; cited in Parramatta & District Historical Society Journal and Proceedings, Vol 1; p. 59
98 Eastern Creek Public School, 1967; p. 8
99 Nicolaidis G, 2000; p. 87
100 Nicolaidis G, 2000; p. 30
101 Nicolaidis G, 2000; p. 30

'Hollingsworth'.[102] The Learmonth family (direct descendants of the Deans) later occupied 'Hollingsworth House'. It was acquired and demolished by the Department of Main Roads in 1960 for widening of the Great Western Highway.[103] All that remains is a beehive well adjacent to the Great Western Highway (located within the Western Sydney Parklands study area).

Subdivision plans from the late 1800s indicate that the Dean land grant to the north of the Western Road, held a blacksmith's forge and the Eastern Creek post office. The subdivision plans from the late 1890s also show the location of a single inn to the east of the Eastern Creek and south of the Western Road (possibly 'The Red Lion' Inn), once part of Dean's initial 100-acre grant and at that time owned by Mrs Lintern and located within the Huntingwood study site (refer to Figure 2.16).

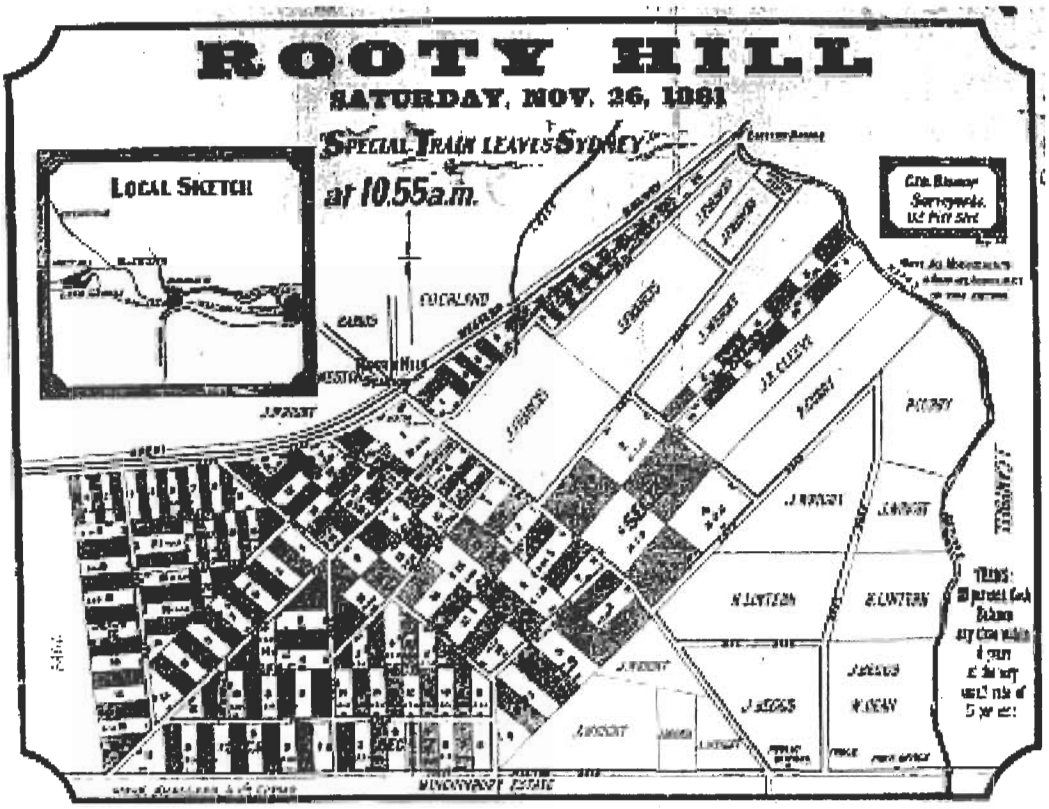


Figure 2.14 *Rooty Hill Subdivision Plan 1881 (Source: Mitchell Library/SP: R13/64)*

William Dean died in 1847. In his will he left his dwelling together with sixty acres to his daughters, Ann and Martha, as tenants in common. These 60 acres were part of the Dean allotment located on the southern side of the Western Road and located on the western side of Eastern Creek. In 1870 Thomas Pike (Ann Dean's husband) subdivided the sixty acres into allotments of approximately 9 acres each, serviced by Pikes Lane.[104]

Following the initial subdivisions of the southern portions of Dean's original land grants, Pike leased a number of lots to market gardens. Pike moved to Penrith in 1869 to run the Wheelwright Arms Hotel. To purchase the premises Pike asked a Mr John Shand to lend him £150, which he did in return for 123 acres of the Eastern Creek lands. It was not until Pike returned to the area in 1873, that the 123 acres were returned to the Dean family ownership.[105]

102 Nicolaidis G, 2000; p. 30
103 Sharpe A, 2000; *Pictorial History of Blacktown District*, Kingsclear Books, Alexandria, p.33
104 Nicolaidis G, 2000; p. 36
105 Nicolaidis G, 2000; p. 87

The eastern portion of William Dean's initial 100 acre land grant located to the south of the Great Western Highway comprises the north-western corner of West Huntingwood study site. This land comprising a total of 52 acres and one rood was purchased by Henry Lintern, mason of the City of Sydney on the 27 June 1878.[106] This land grant subsequently changed ownership to George Gale, carpenter in 25 May 1887 through to George Gale (jnr) and Robert Hume, gentlemen (joint tenants) on 5 March 1897. Eugene Frederick Rudder, gentleman purchased the whole of the site on 17 April 1907 (presumably Rudders Lane is named after him) and subsequently transferred the holdings to William Hopper Cochram, grazier 21 July 1911. In 17 February 1926 the lot again was transferred to Arthur William Cockram and Robert Lindley Elliot; who sold it on to Alfred Browne on 27 August 1930.

2.5.3 Stephen Richardson, W Blackman, William Clark, R Aspinall and Warham Jebbet Brown Grants

The remainder of the West Huntingwood site is comprised of the land grants of William Clark (50 acres), William Blackman (60 acres) and Stephen Richardson (30 acres) who received their grants on 17 August 1819 and a further 24 acres being granted to Richard Aspinall and Warham Jebbet Browne on 19 October 1831.

Based on research through the Department of Lands (see Appendix A - Land Titles), ownership of the original allotments passed through the hands of a series of market gardeners, farmers, a dairyist and poultry farmers. The allotments originally granted to Richardson, Aspinall and Browne were subdivided early on by John Anderson, John Shand and Andrew Barclay Shand in the late 1890s. The majority of the subdivided allotments remain today at their original 1890s area and alignment. The exception to this is allotments on the corner of Brabham Drive (previously Horsley Road) and Great Western Highway which are currently under the ownership of the Shell Company of Australia Ltd and hold the Shell service station and Beaurepairs mechanical workshop.

2.5.4 The Naming of Huntingwood

The naming of the suburb of Huntingwood came about as the region was used for hunting expeditions which were conducted by the Hunt Club who met regularly at Bungarribee. In association with this activity, an inn was established to the east of the subject site, known as the 'Fox under the Hill', serving as a halfway house for the participants of the hunt.[107] The present day 'Fox Hills' Golf Club now stands on the site.

2.5.5 Roads in West Huntingwood

When the initial land grants were made, action had to be taken to access them to a road, and with the scattering of the inhabitants in the county, the establishment of a main road system was a primary concern of the early governors. The colony's' first cleared road was the 16 miles between Sydney and Parramatta. In Governor Phillip's days this was referred to as 'the Path'. However, the land grants to individuals in the Eastern Creek locality were required to be provided with and connected to a road or recorded easement. This was achieved through the initiative of those original grantees who collectively agreed to a line of roads to serve their land holdings and submitted their proposals to the Deputy Surveyor. Two road easements were established to serve those early grants, being the present day Wallgrove Road and Brabham Drive (previously known as Horsley Road).[108]

106 Certificate of Title Vol 354 Fol 111; source Department of Lands
107 Bloxham F, 2002; *A History of Prospect*, Blacktown & District Historical Society, p. 72
108 Nicolaidis G, 2000, p. 23

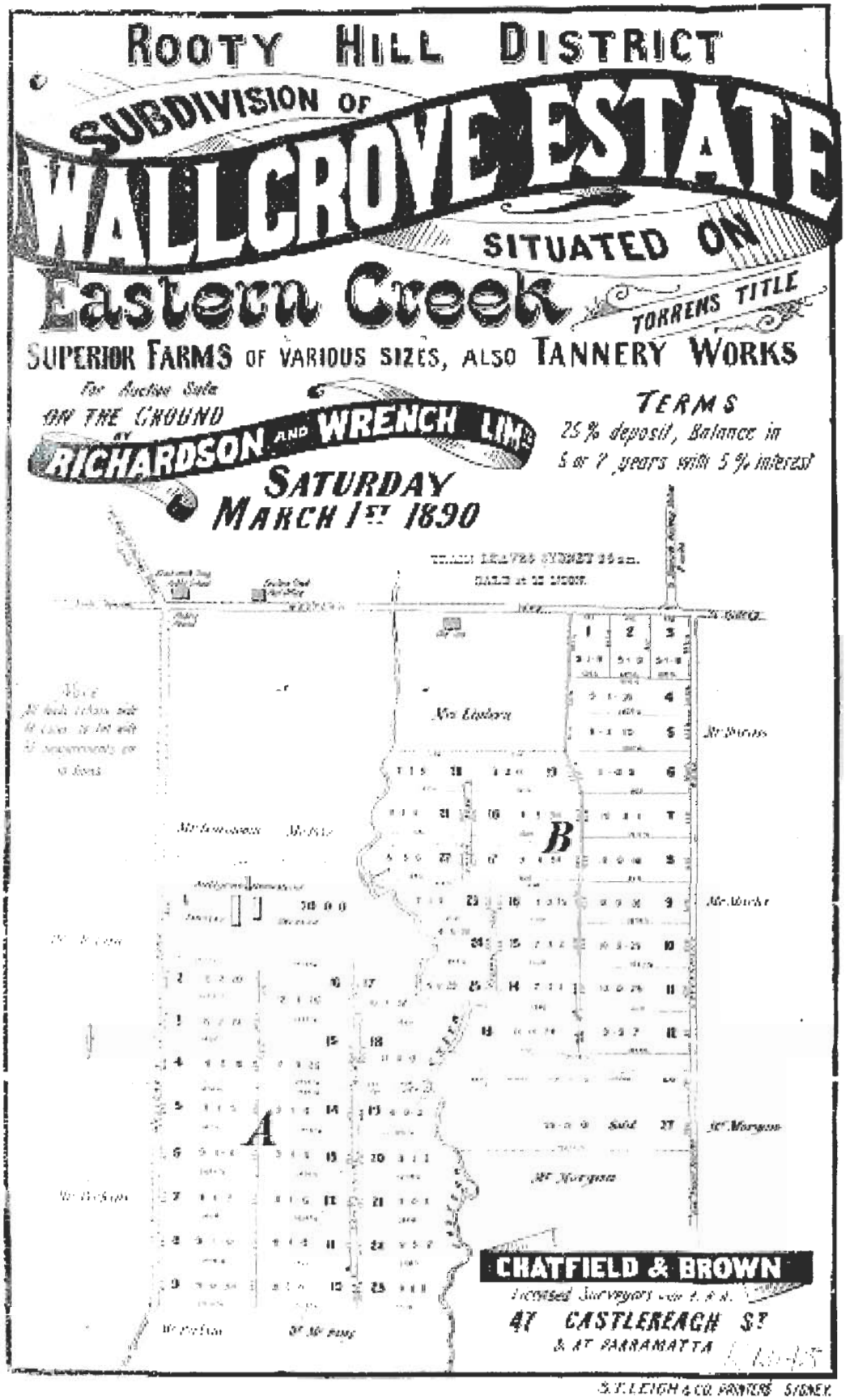


Figure 2.16 *Subdivision of the Wallgrove Estate 1890 (Source: Mitchell Library/SP:R13.1/45)*

2.6 Historic Themes

The heritage values of individual heritage elements and precincts may derive significance as a result of what they contribute to their context and environment. Consideration of heritage values in this context involves an appreciation of the underlying historical influences that have shaped and continue to shape the area. Historical themes have been developed to allow categorisation of the major forces or processes that have historically contributed to the development of a heritage context or environment and provided a framework within which the heritage significance of an item can be demonstrated. Historical themes are considered as National, State and local level.

2.6.1 National Themes

The nine national themes address broad issues of the development of Australia as a nation, with the classifications related to Australia's natural evolution, peopling the nation, developing a range of economies, settling the economies, settling the country, work, education, government, cultural development and the phases of life in Australia.

2.6.2 State Themes

The 38 State themes, sub-classified under the National themes address the following:

- (Australia's Natural Evolution) the natural environment;
- (Peopling the Nation) Aboriginal, convict and ethnic origins, and migration;
- (Developing Local, Regional and National Economies) agriculture, commerce, communication, the cultural landscape, events, exploration, fishing, forestry, health, industry, mining, pastoralism, science, technology and transport;
- (Settling the Country) Urbanisation, land tenure, utilities and accommodation; (work) labour;
- (Education) education;
- (Government) defence, government and administration, law and order and welfare;
- (Cultural Development) domestic life, creative endeavour, leisure, religion, social institutions and sport; and
- (The Phase of Life in Australia) birth and death, persons.

Relevant Historical Themes

National	State	Local Application
(2) Developing Local, Regional and National Economies	Agricultural	Throughout the past 200 years much of the subject sites have been continuously associated with agricultural pursuits. Rooty Hill Government Depot site was associated with one of the initial government farms supplying the growing colony with food and livestock, Bungarribee holds evidence of early pastoral land holdings and the West Huntingwood site exhibits a continuation of use in the form of market gardens and farming in general.
	Pastoralism	Early estates of pastoralists at Bungarribee Estate and Rooty Hill Hill Depot site
	Cultural landscape	Remnant of cultural plantings and significant landmark trees in the cultural landscapes at Bungarribee Homestead and Government Depot sites
	Communication	The Bungarribee Estate was used as a Telecommunications centre for a period of almost 50 years. This phase of occupation resulted in numerous changes to the site including a phase of building construction and cultural landscaping on the site.
(3) Building settlements, towns and cities	Land Tenure	Evidence of land tenure through roads, allotments and fencelines
	Towns, suburbs and villages	The subject sites are associated with the development of the suburbs of Rooty Hill and Eastern Creek (Hebersham).
	Accommodation	The former residence of the Government Depot site was associated with the provision of accommodation for travellers journeying between Parramatta and the route across the Blue Mountains to the grazing areas of the western plains. The former Bungarribee Homestead was a landmark building in the area and home to the well-known settler, John Campbell.

4.4 Land Parcel 4 - West Huntingwood

4.4.1 Archaeological Survey of West Huntingwood

The area was surveyed by driving down the Highway and Rudders Lane and inspecting all of the properties and outbuildings in the many small farms.

When comparing the current land parcel information and the original 1890s 'Rooty Hill District subdivision plan of Wallgrove Estate (Eastern Creek) it is possible to see that the original subdivision is still evident on the ground, with some further subdivided. The subdivision is bounded to the north by Western Road, to the east by Government Road, to the south by lot 15, the northwest by open land and to the southwest by lots 20, 23 and Union Road. A narrow single-track road (Rudders Lane) runs northwest up the centre of the subdivision plan and turns west before the last division.

The 1890s map shows an unenclosed area/ paddock to the north west of the central road, of which three quarters is in the survey area. This is noted as belonging to Mrs Lintern and has a building marked 'Old Inn' in the western corner. The area to the northeast has been subdivided into five lots, one - three running north - south and four and five running east – west. The southeast has been subdivided into four lots (six to nine) all running east-west. The southwest has been subdivided into four lots (sixteen to nineteen) all running east west. A series of original post and rail fences exist along some of the subdivisions.

The Old Inn Site

The location of the Inn was searched for along the Great Western Highway in the front yards and paddocks of the two houses adjacent to Eastern Creek. A shallow depression marked by differential growth of grass was just visible near the front fence of the house closest to Eastern Creek, and just in the boundary of the study area.

A cobbled pathway leads from the fence entrance to the front door of the house. This could be an original feature, perhaps leading to the carriage or horse barn. The 1930s-50s fibro house may be constructed on earlier building footings.

4.4.2 Management Recommendations

Medium Term

Before the area of the Inn location is changed for the Department of Planning's proposed new uses of the area, a test excavation should be carried out to determine whether the area does enclose the remains of the Old Inn and its cobbled driveway and outbuildings. An Excavation Permit under Section 139(4) should be applied for from the NSW Heritage Office.

5.6 Assessment of Heritage Significance – Land Parcel 4 - Huntingwood

5.6.1 Criterion (a) – Historical Significance

Land Parcel 4 Huntingwood has historic associations with the early land grants in the local area. Horse breeding was associated with the local area and remnants of this historic activity are retained on this site. It has associations with continuity of land use as market gardens from the early nineteenth century.

5.6.2 Criterion (b) – Historical Significance – Persons

The site has associations with William "Lumpy" Dean, one of the first settlers in the Eastern Creek area, publican the local personality. He is associated with the construction of a school, post office, garrison, church, toll bar and several dwellings.

5.6.3 Criterion (c) - Aesthetic Significance

Rudders Lane, a narrow single carriage lane set between pasturelands, has scenic qualities that are becoming rare in the local area. Vistas across pasturelands to the vegetation associated with Eastern Creek enhance the scenic qualities and provide views of rural activities which have remained the same for almost two hundred years.

5.6.4 Criterion (d) – Social Significance

Based on the exclusion and inclusion guidelines the Huntingwood Land Parcel is not significant for this criterion.

5.6.5. Criterion (e) – Scientific Significance

Based on the exclusion and inclusion guidelines the Huntingwood Land Parcel is not significant for this criterion.

The Huntingwood Land Parcel may contain an archaeological site of scientific significance. The Old Inn site next to the Great Western Highway near Eastern Creek is a potential archaeological site. Archaeological testing should take place when the area is being developed for parkland and the current house and fences demolished. The potential site is significant in that it dates from the early 19th century and in 1900 was known as 'old'. The fibro house on that block may have been built on old footings of a barn or coachhouse as a cobbled path was observed leading to it from the road.

5.6.6 Criterion (f) – Rarity

Based on the exclusion and inclusion guidelines the Huntingwood Land Parcel is not significant for this criterion.

5.6.7 Criterion (g) – Representative

Based on the exclusion and inclusion guidelines the Huntingwood Land Parcel is not significant for this criterion.

LAND PARCEL 4 - HUNTINGWOOD		
Item	**Significance Grading**	**Significance Level**
Pastureland between Rudder Lane and Brabham Drive	Moderate	Local
Rudders Lane	High	Local
Rudders Lane Vista North to Bungarribee Estate	High	Local
Rudders Lane Vista South to pastureland and M4	Moderate/ Little	Local
Rudders Lane Vista East to pastureland and Brabham Drive	Moderate	Local
Rudders Lane Vista West to pastureland and Eastern Creek	High	Local
Alignment of Brabham Drive (formerly Horsley Road)	Moderate	Local

5.9.3 Land Parcel 4: Huntingwood Area

The area of Huntingwood (known in the study as Land Parcel 4) has local significance based on its historic, aesthetic and technical/research values.

The area has historic associations with early land grants and continuity of land use for horse breeding and market gardens from the early nineteenth century to the present. Rudders Lane, set between pasturelands, has scenic qualities associated with vistas across pasturelands to Eastern Creek and views of rural activities which have remained for almost two hundred years and are becoming rare in the local area.

The site has associations with William "Lumpy" Dean, one of the first settlers in the Eastern Creek area, local personality and publican. Dean's "Old Inn" site located on the Great Western Highway, east of Eastern Creek is a potential archaeological site that dates from the early 19th century.

8.10 Land Parcel 4 – Huntingwood

Policy 23 Moving of People and Goods – Roads

Surrounded by pastureland, Rudders Lane has a picturesque setting that should be retained and conserved. Rudders Lane is named after one of the early land-owners in Huntingwood and has moderate local historic significance. This lane marks the early subdivisions of the area and provided an access route for small allotments. Rudders Lane is the principal address for allotments that extend to Eastern Creek.

The entry to Rudders Lane should not be marred by development. Consideration could be given to landscaping and plant regeneration on the eastern corner of Rudders Lane and the Great Western Highway.

Policy 24 Pastoralism, Small Land Holdings, Market Gardens and Horse Stabling

Land west of Rudders Lane down to Eastern Creek is used as Market Gardens and Horse Stabling. These traditional rural activities are remnants of the former economy that proliferated. This activity should continue from Rudder Lane to Eastern Creek. Existing fence lines should be retained in the area and domesticated livestock retained to interpret the use of the site.

Policy 25 Cultural Landscape – Views and Vistas

Views down to Eastern Creek across pastureland are significant for their picturesque quality and should be retained where possible. These include vistas from Rudder Lane north to the Bungarribee Estate and west to Eastern Creek.

Existing significant vistas from Brabham Drive through to Eastern Creek should be maintained through any future development. This includes retention of the vista between DP802277 and DP913820 through to Eastern Creek (see Richard Lamb Study).

Policy 26 New Development

There is an opportunity for small land holdings between Brabham Drive and Rudder Lane to be developed as an industrial park, similar to development on the northern side of Brabham Drive. Consideration should be given to screening development from Rudder Lane by providing a vegetated buffer zone of approximately 10-20 metres setback from the lane. This buffer zone would maintain a country lane quality.

The scale and form of any development onto the lesser scale of Rudders Lane should be maintained. Consideration should be given to wall height, roof form and front setback. The possible height of the development should be a maximum of four-storeys facing onto Brabham Drive (or similar in proportion of development to the east of Brabham Drive) with a decrease in height towards Rudder Lane - to not exceed two-storeys. Figure 6.4 describes this development opportunity.

Appendix B

Extracts from Visual and Landscape Assessment prepared February 2006 by Richard Lamb

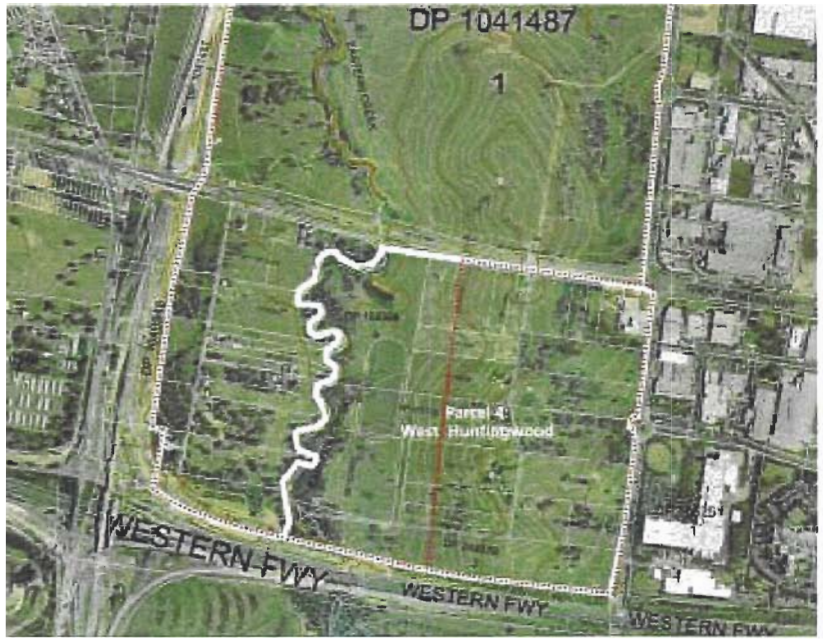
5.0 Assessment of Parcel 4: West Huntingwood

5.1 Visual context and character of the landscape of Parcel 4: West Huntingwood

This Parcel of land is located in the southeast of the parklands Precinct 2 and is bounded by the Great Western Highway in the north, Brabham Drive in the east and M4 in the south. The western boundary of the Parcel follows the alignment of the Eastern Creek. To the east of the Parcel are located the industrial/commercial areas of the suburbs of Huntingwood and to the south is the Eastern Creek Raceway.

The overall character of the Parcel can be described as of a rural residential and rural small holdings character with large land holdings and a few number of small pockets of open grasslands. A Petrol Service Station is located at a small section in the northeast at the corner of the Great Western Highway and Brabham Drive. Views to the western part of the parklands Precinct 2 are screened due to the presence of vegetation along Eastern Creek alignment. There are views to the eastern part of the parklands across the Great Western Highway.

The primary character areas of the Parcel 4 are shown in Figure 17 of this Report.



Site Boundary

Figure 16: Parcel 3 West Huntingwood Study Area

Base Plan adapted from Wheelers Plan showing
Terrestrial Contours and orthorectified aerial photography,
dated January 2005

Not to Scale

Character Area A: Service Station Site
Area located at the intersection of the Great Western Highway and Brabham Road. Area is mostly cleared and dominated by the service station and associated commercial and retail premises. Views to this area have vegetation within the study area as the background.

Character Area B: Agricultural Flood Plain Land
Cleared former agricultural land with some remnant and regrowth vegetation. Relatively flat, with little topographic variation. Visually separated from other areas of similar character to the west by riparian vegetation. Contains some evidence of past agricultural use such as fence lines as well as the horse training track.

Character Area C: Mixed Woodland Area
Area characterised by native woodland and some wetland vegetation that is of visual significance and provides some screening and visual diversity to the site interior when experienced from Brabham Road and existing development to the east.

Character Area D: Grassy Ridge & Side Slopes
Cleared former agricultural land. Gently undulating and open in character. Mostly vegetation has been cleared from these areas, and that which remains is scattered native, and/or regeneration plantings.

Character Area E: Rural Small Holdings
Mostly cleared area containing small rural residential holdings, and their associated outbuildings, fences etc. Some scattered vegetation, including both cultural plantings and remnant trees.

Character Area Identification

Character Area Boundary

Parcel 4: West Huntingwood Area

Site Boundary

Figure 17: Parcel 4 Visual Character Areas

Base Plan adapted from Whelan Plan Showing
Terrestrial contours and orthorectified aerial photography
Dated January 2013

Not to Scale

5.2 Visual exposure of Parcel 4: West Huntingwood

This Parcel has a high visual exposure from viewing locations along the Great Western Highway and M4. There are views from the southern section of Brabham Drive to the interiors of the Parcel. Views to the interior of the Parcel are screened due to the presence of relatively dense vegetation in the northeastern section of the Parcel when seen from the northern section of Brabham Drive. There are focal views of the Parcel from Huntingwood Drive and from its intersection with Brabham Drive.

There would be views from the southern part of the Parklands Precinct 2 across the Great Western Highway.

Figure 18 of this report identifies the primary external viewing locations from which there are significant views to the interior of the Parcel 4 lands. The photographic figures taken from these viewing locations are shown at the end of the report on Page 33.

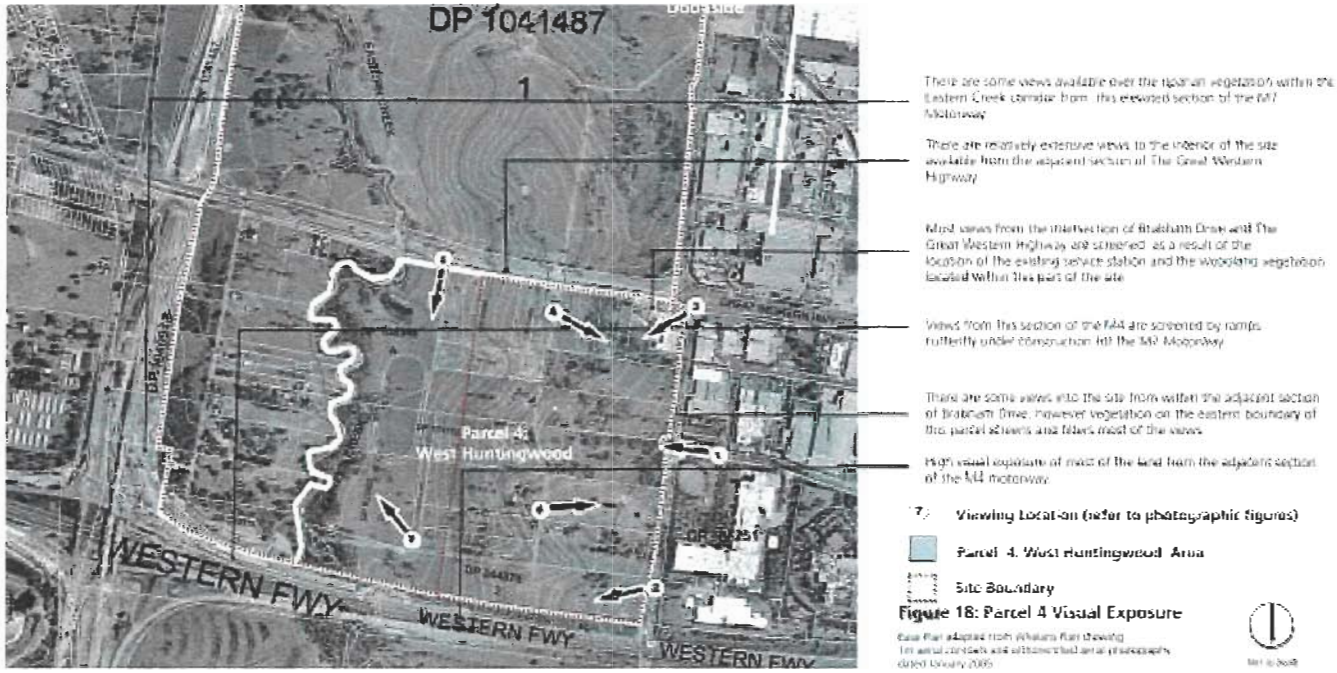


Figure 18: Parcel 4 Visual Exposure

Base Plan adapted from Aerial Plan showing 1m aerial contours and cadastral data (photographs dated January 2005

5.3 Scenic Resources of Parcel 4: West Huntingwood

5.3.1 Hills and prominent slopes

This Parcel of land is relatively flat, although it does slope gently downwards from east to west towards the creek. The slope is not visible from most locations within the Parcel and from outside generally.

5.3.2 Lower slopes and floodplains

The lower slopes of this land are located within the western part of the Parcel and in the immediate vicinity of the creek alignment. There is a horse training track located in the central western section of the Parcel near the creekline.

5.3.3 Creeks and Drainage Lines

Eastern Creek alignment forms the western boundary of the Parcel and visually separates it from the western part of the parklands Precinct 2. This area of land is characterised by relatively dense vegetation along the creek alignment as is the case in the Parklands precinct 2.

5.3.4 Significant remnant vegetation

The dense vegetation along the creekline is the most significant remnant vegetation in this Parcel of land. There is also a pocket of relatively dense vegetation located in the northeastern corner of the Parcel. Other vegetation is relatively scattered and sparse within the more open rural residential land and open grasslands.

5.3.5 Cultural landscape elements

There is no significant cultural landscape element identified within this Parcel of land.

Figure 20 of this Report shows the Scenic Resources and Management Guidelines for Parcel 4

5.4 Landscape and visual constraints of Parcel 4: West Huntingwood

5.4.1 Visual Exposure

This area has a high visual exposure to two main roads being the M4 Motorway and the Great Western Highway, as well as to Brabham Drive which is also heavily trafficked. There are more distant views to this area from the fly overs of the M7 and M4 intersection with Wallgrove Road. This Parcel of land is relatively isolated from the other Parcels and most of the core Parklands area as a result of the high usage roads on three of its boundaries.

5.4.2 Visual Fit

This area has a high visual fit for potential future light and medium industrial development as a result of the existing development on the eastern side of Brabham Drive. The greatest potential for such development is located on the eastern side of the site adjacent to Brabham Drive.

The retention of existing groups of vegetation and the introduction of buffers and some informal screen plantings along the three primary road frontages would increase the potential suitability of development within the eastern part of the site.

5.4.3 Visual Diversity

This area is assessed as possessing a lower level of visual diversity and that these levels could be retained, albeit of a different character, or even increased by future development and associated landscaping.

5.4.4 Character of the Area

Overall it would be acceptable for there to be significant change in the visual character of the area as a result of future development. It would be preferable if there was retention of the open character of the flood prone land adjacent to the creek.

5.4.4 Proximity to the M7

A section of the M7 is under construction and is located within Precinct 2 of the core Parklands area on the western side of Eastern Creek. This area is not part of the Parcel 4 lands. The overpasses associated with the intersection of the M7 with Wallgrove Road and the M4 provide some

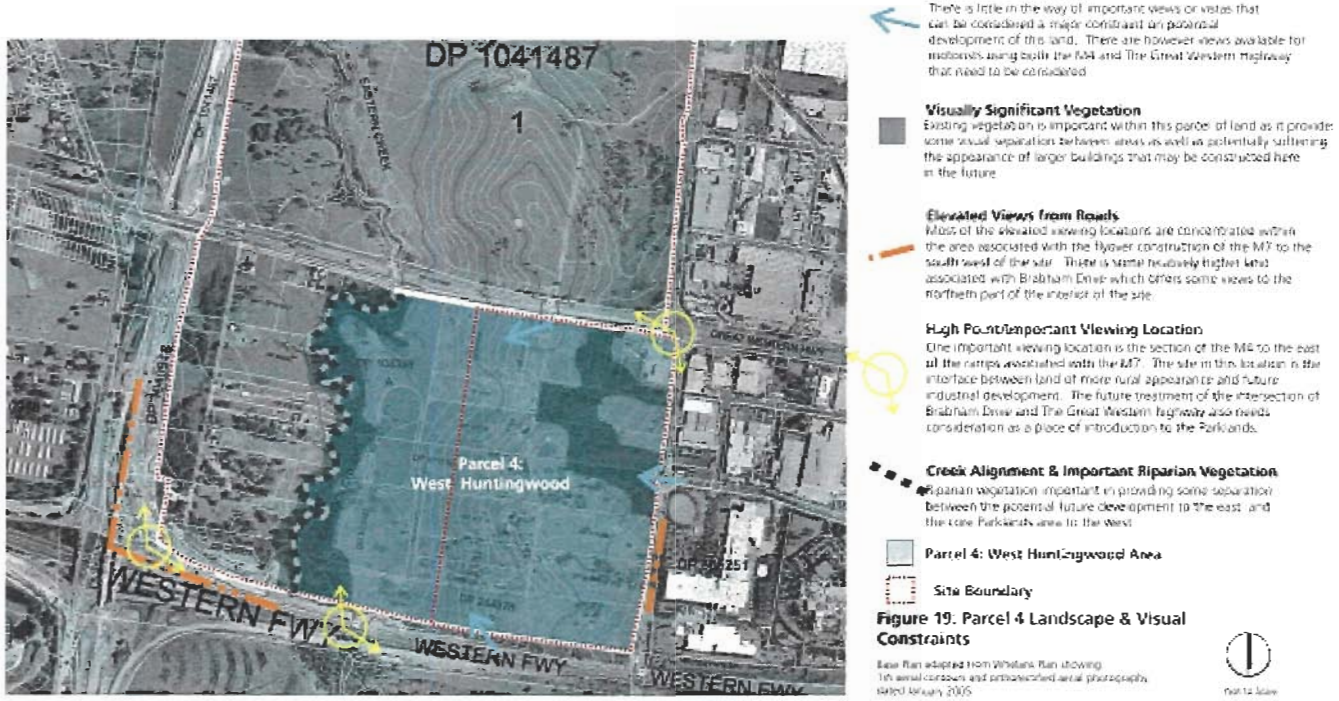


Figure 19: Parcel 4 Landscape & Visual Constraints

Base Plan adapted from Whitlams Plan showing 1m aerial contours and orthorectified aerial photographs dated January 2005

elevated viewing positions with close visual exposure to the Parklands and Parcel 4, with new on-ramps to the M4 eastbound running along the boundary of the parcel for some distance. The visibility of the Parcel is otherwise similar to the existing visibility from the M4.

The adjacent development east of Brabham Drive and Doonside Road is a prominent part of this experience and it is considered that subject to buffer and landscaped areas being maintained, there would be no significant constraints on development.

5.4.6 Settings of Heritage Items

There are no significant heritage items that would be potentially affected by appropriate development of these lands.

Figure 19 of this Report shows the Landscape and Visual Constraints of the Parcel 4.

5.5 Scenic Resource Management Guidelines of Parcel 4: West Huntingwood

Parcel 4 has less visual and cultural constraints than Parcel 3 (the Doonside Parcel), but is more exposed to regional and local viewers. This Parcel of land, while not intrinsically of high scenic quality in itself does provide for an expansive view experience to viewers on the M4 Motorway and the Great Western Highway. However there is potential for future development of some of the lands, primarily that on the eastern part of the site beyond the flood plain and toward to Brabham Drive.

The cultural significance of the viewing places on the Great Western Highway and M4 Motorway, and the number of viewers that can be expected to experience the views increase the importance of this land Parcel. The major importance of the land is as a buffer between urban elements and the open space experience of the Regional Parklands. The effectiveness of this buffer however has been diminished by the alignment of the M7 which passes on the west of the Eastern Creek corridor, and the increase of industrial development on the eastern side of Brabham Drive. As such it is considered that maintaining some visual separation between the M7 and future development adjacent to Brabham Drive is important and would provide some visual connections to the core Parklands areas as seen from surrounding roads, especially the M4 Motorway.

The following guidelines are provided to ensure appropriate development of this land Parcel.

a) The flood prone area to the immediate east of the creek corridor should be retained as a more rural character as it is at present. The existing

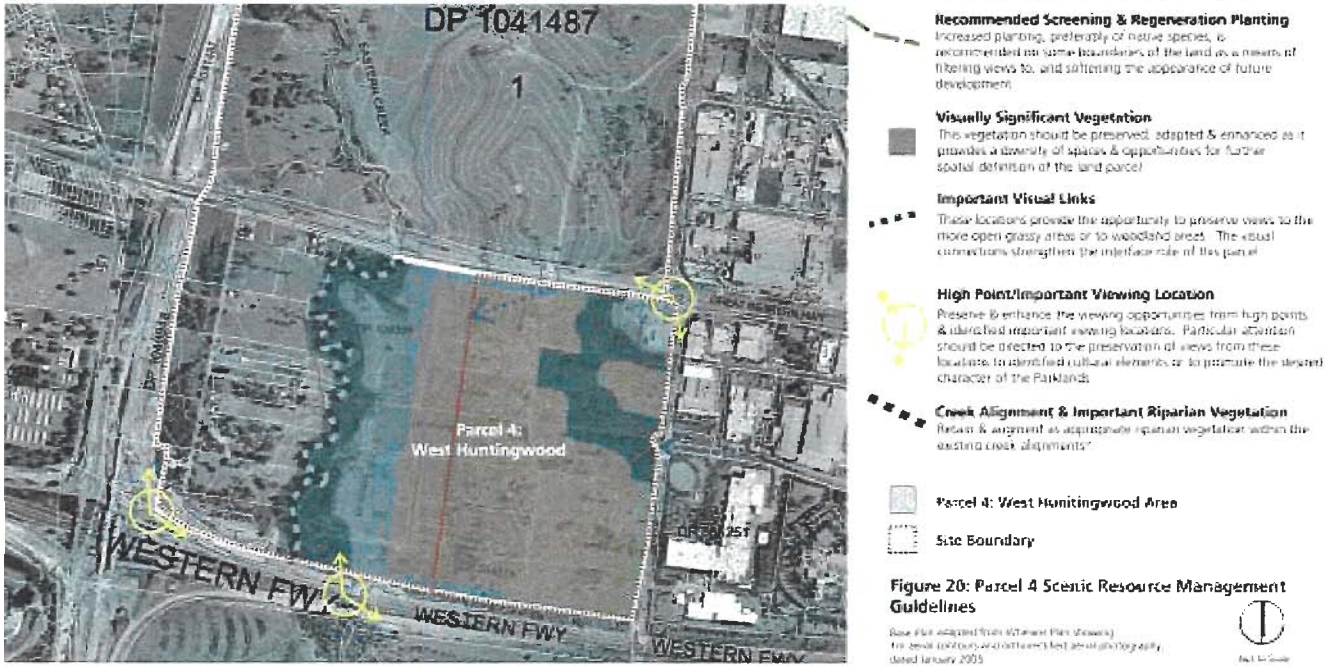


Figure 20: Parcel 4 Scenic Resource Management Guidelines

vegetation within the creek alignment should be retained and augmented as appropriate.

b) The land within the eastern part of the site, including that in the immediate vicinity of Rudders Lane and existing rural residential properties could be developed for light industrial purposes of high quality building and landscape design.

c) This area would then act as a transition area between the development fronting Brabham Drive and the core Parklands areas.

d) Buildings of a greater bulk and density, similar to that on the eastern side of Brabham Road could be located within the eastern part of the land.

e) All vegetation remnants, especially that within the eastern part of the site and within the Eastern Creek corridor, are to be considered for retention and enhancement with enrichment planting and regeneration techniques.

f) Existing stands of vegetation located should remain amongst future development areas of the Parcel. This vegetation would provide visual separation between buildings and structures as well as softening the appearance of larger industrial development.

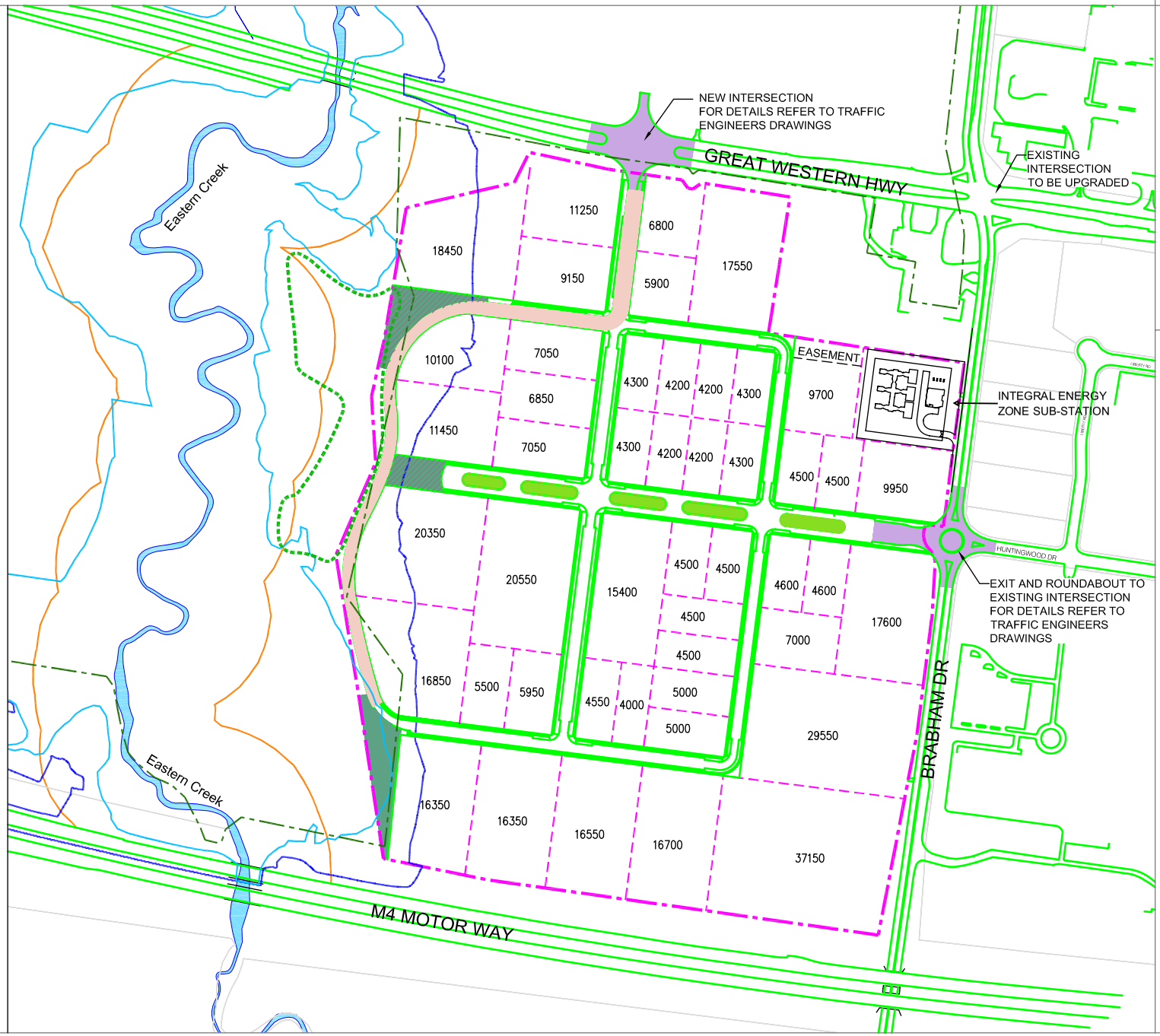
g) Potential impacts of future development on views from the M4 and from the Great Western Highway, should be mitigated by buffer plantings of indigenous plantings on the north western and south western boundaries of the site.

h) The heights of the proposed industrial structures should generally relate to the heights of the industrial development along the M4 and Brabham Drive.

Appendix C

Concept Plan Options prepared August 2006 by Architectus

	AREA (sqm)
TOTAL	568469
DEVELOPABLE AREA	462035
ROAD AREA	81366
SUBSTATION AREA	13200
OPEN SPACE	11868
	No.
LOT 0.4–1ha	31
LOT 1–2ha	12
LOT >2ha	4
	No.
STREET CAR PARK	660



LEGEND

- SITE BOUNDARIES
- LOT BOUNDARIES
- 100yr FLOOD LINE
- PMF LINE
- REP LINE
- BIODIVERSITY CORRIDOR
- WETLAND
- 4500 LOT AREA (m²)
- DETENTION BASIN

COMMON ELEMENTS OF 4 OPTIONS

- ECO MEDIAN
- POCKET PARKS
- PARK EDGE ROAD
- INTERSECTION

LANDCOM

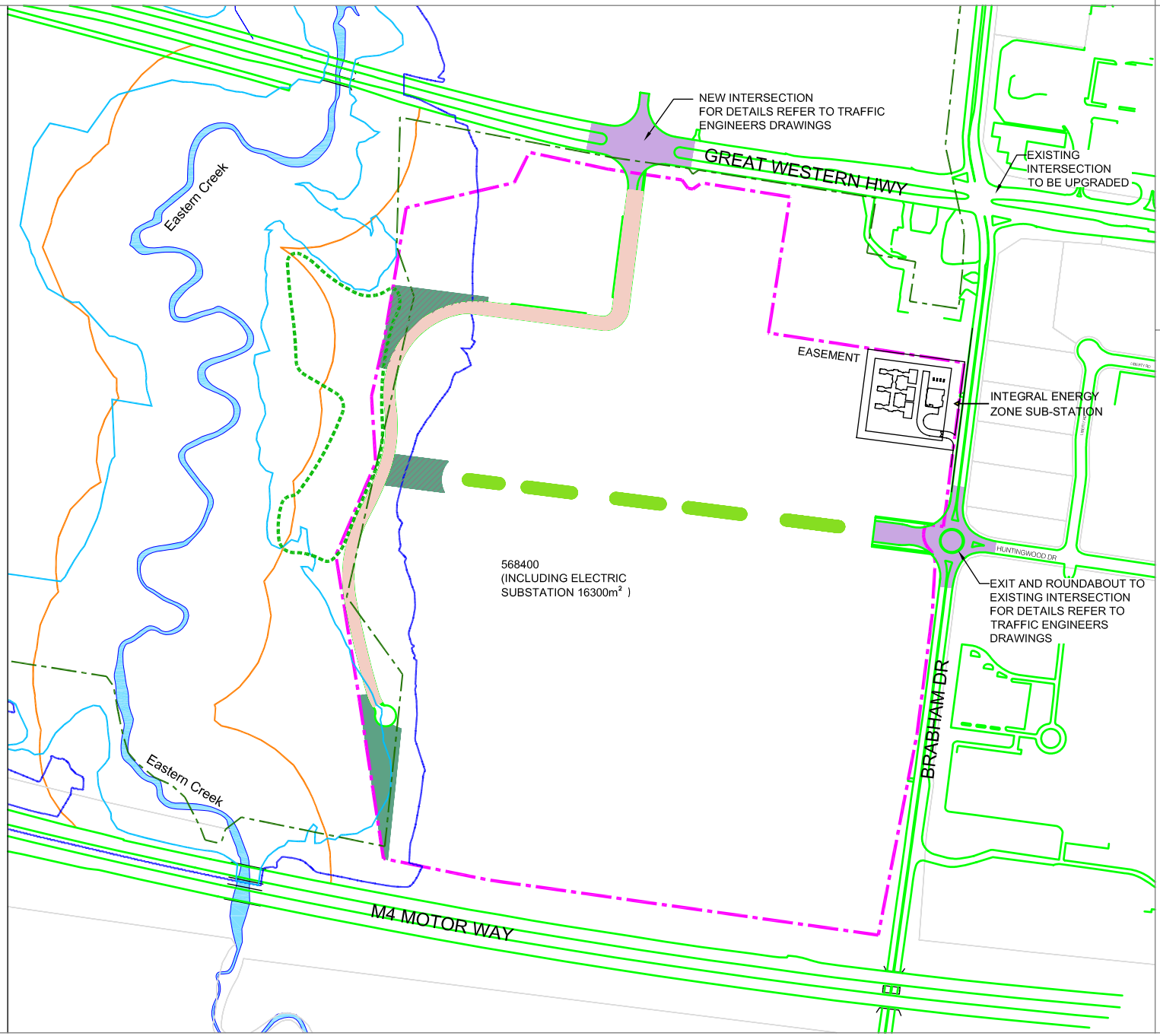
BUNGARRIBEE PRECINCT

M 25 50 125 250

DATE	14 September 2006	Prepared for DOP LANDCOM	HUNTINGWOOD WEST PROPOSED SUBDIVISION PLAN	Scale 1:5000 @ A3	Drawing No. 2203	Revision I

	AREA (sqm)
TOTAL	568469
DEVELOPABLE AREA	555269
ROAD AREA	30548 *
SUBSTATION AREA	13200
OPEN SPACE (STORMWATER INFILTRATION)	11868 *
	No.
STREET CAR PARK	220 *

Note:
* The open space is within the lot
* All roads are within the lot
* All street car park are within the lot



architectus

Architecture
Urban Design
Planning
Interior Architecture

LANDCOM

LEGEND

- SITE BOUNDARIES
- LOT BOUNDARIES
- 100yr FLOOD LINE
- PMF LINE
- REP LINE
- BIODIVERSITY CORRIDOR
- WETLAND
- 4500 LOT AREA (m²)
- DETENTION BASIN

COMMON ELEMENTS OF 4 OPTIONS

- ECO MEDIAN
- POCKET PARKS
- PARK EDGE ROAD
- INTERSECTION

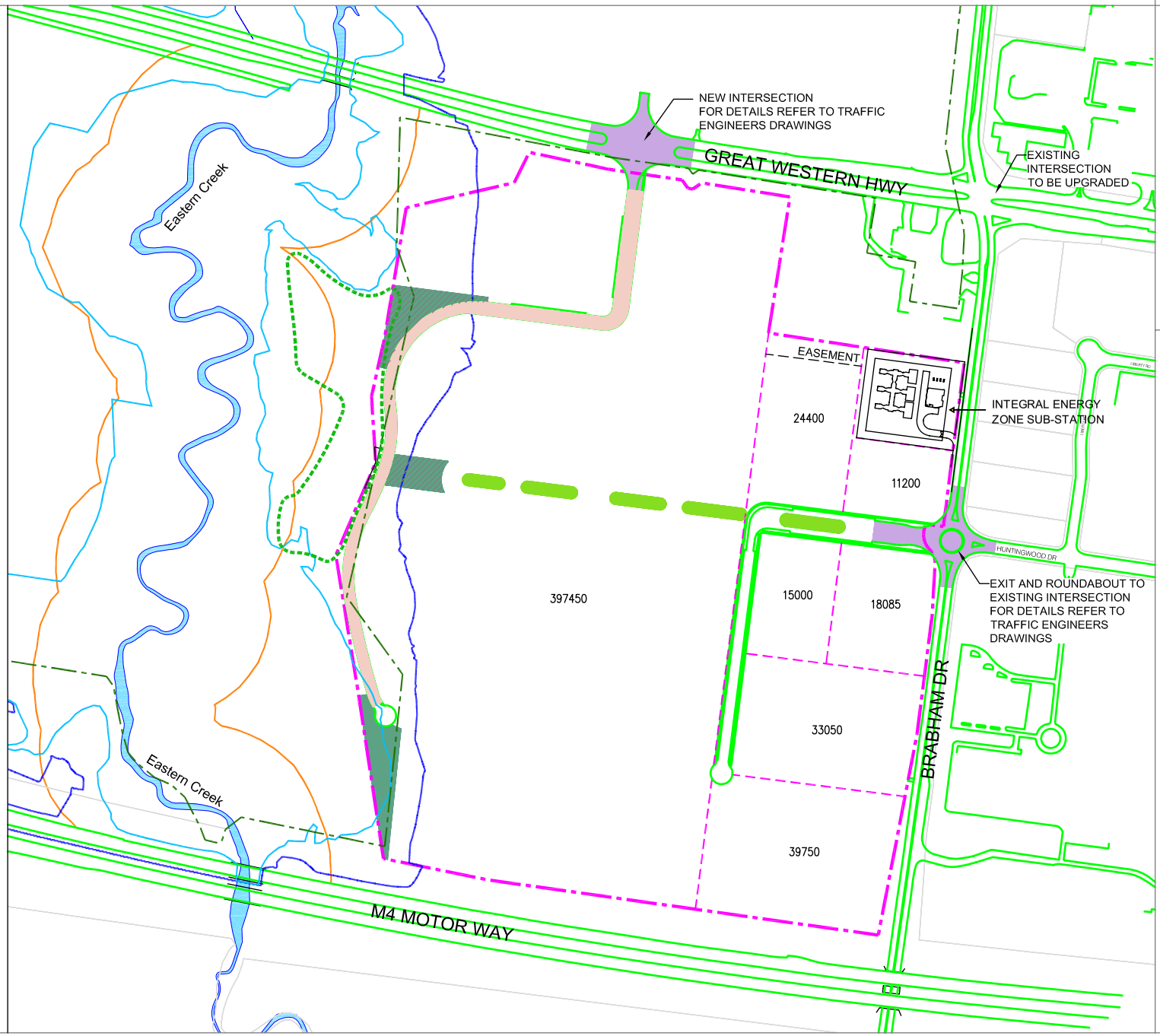
BUNGARRIBEE PRECINCT

M 25 50 125 250

DATE **14 September 2006** | Prepared for **DOP LANDCOM** | HUNTINGWOOD WEST - SUPER LOT OPTION | Scale 1:5000 @ A3 | Drawing No. 2204 | Revision F

	AREA (sqm)
TOTAL	568469
DEVELOPABLE AREA	539639
ROAD AREA	30548 *
SUBSTATION AREA	13200
OPEN SPACE (STORMWATER INFILTRATION)	11868 *
	No.
LOT 0.4–1ha	0
LOT 1–2ha	3
LOT >2ha	4
	No.
STREET CAR PARK	220 *

Note:
* The open space is within the 36ha lot
* 14380sqm of the total road area is within the 36ha lot
* 100 street car park are within the 36ha lot



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LEGEND
- SITE BOUNDARIES
- LOT BOUNDARIES
- 100yr FLOOD LINE
- PMF LINE
- REP LINE
- BIODIVERSITY CORRIDOR
- WETLAND
- 4500 LOT AREA (m²)
- DETENTION BASIN

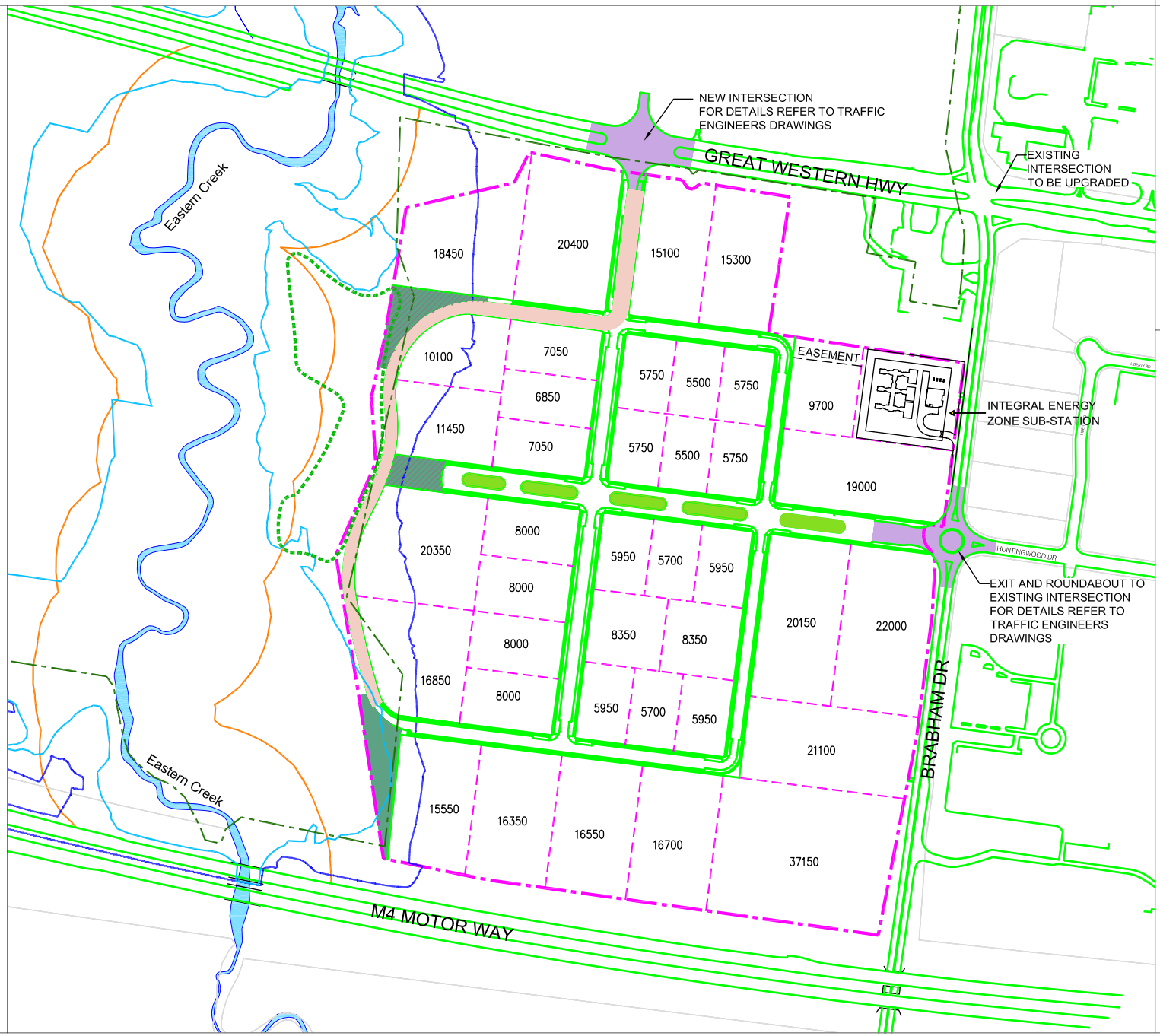
COMMON ELEMENTS OF 4 OPTIONS
- ECO MEDIAN
- POCKET PARKS
- PARK EDGE ROAD
- INTERSECTION

BUNGARRIBEE PRECINCT

M 25 50 125 250

DATE **14 September 2006** | Prepared for **DOP LANDCOM** | HUNTINGWOOD WEST - LARGE LOTS OPTION | Scale 1:5000 @ A3 | Drawing No. 2201 | Revision I

	AREA (sqm)
TOTAL	568469
DEVELOPABLE AREA	462035
ROAD AREA	81366
SUBSTATION AREA	13200
OPEN SPACE	11868
	No.
LOT 0.4–1ha	22
LOT 1–2ha	11
LOT >2ha	6
	No.
STREET CAR PARK	700



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LEGEND

- SITE BOUNDARIES
- LOT BOUNDARIES
- 100yr FLOOD LINE
- PMF LINE
- REP LINE
- BIODIVERSITY CORRIDOR
- WETLAND
- 4500 LOT AREA (m²)
- DETENTION BASIN

COMMON ELEMENTS OF 4 OPTIONS

- ECO MEDIAN
- POCKET PARKS
- PARK EDGE ROAD
- INTERSECTION

BUNGARRIBEE PRECINCT

M 25 50 125 250

DATE **14 September 2006** | Prepared for **DOP LANDCOM** | HUNTINGWOOD WEST - MEDIUM LOTS OPTION | Scale 1:5000 @ A3 | Drawing No. 2202 | Revision I

Appendix D

Extract from the Huntingwood West Development Design Controls prepared August 2006 by Architectus

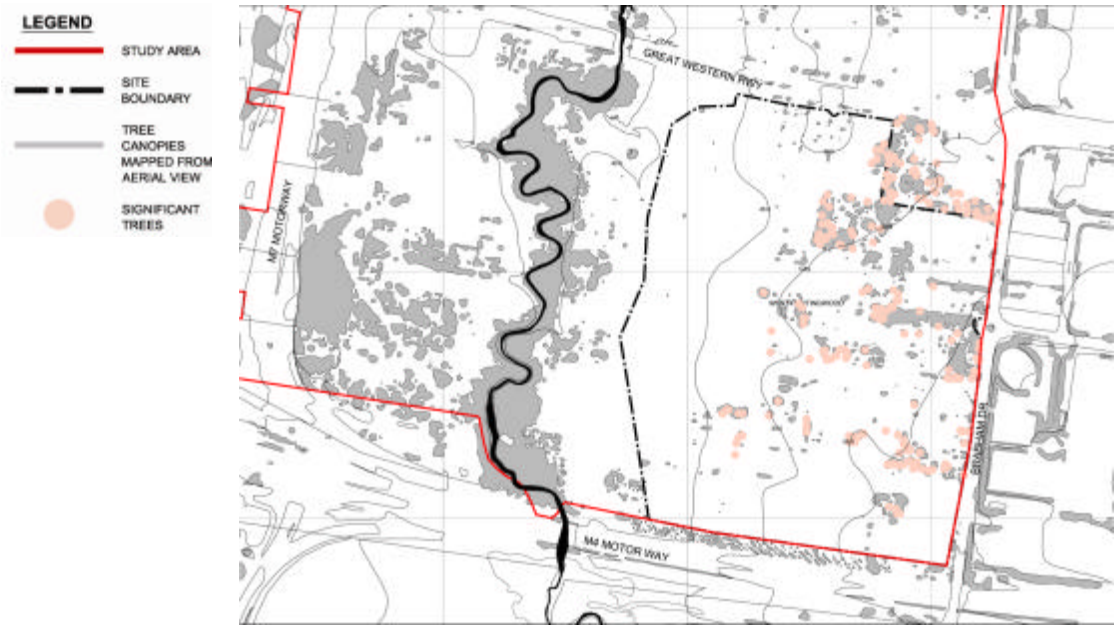

Figure 12: Tree survey of the site
Significant trees are shown in red.

3.3 Access and movement

3.3.1 Road hierarchy

The proposed road hierarchy for Huntingwood West is shown in Figure x. The road hierarchy comprises the following:

a) Provision of two principle public road vehicular access points to the site: one each at Great Western Highway and Brabham Drive.
b) Connection of the northern and eastern intersections by a collector street that will form the main transport route through the site.
c) A street hierarchy comprising:
   - A north-south collector road that connects to the Great Western Highway
   - An east-west collector road that connects to Brabham Drive and features a median that incorporates stormwater management – i.e. an eco-median road.
   - A park edge road that is for passenger vehicles and small vans only that forms the management edge to the Western Sydney Parklands
   - Local access roads that travel north-south of the eco-median collector road.
   - Local access roads that travel east-west and fall to the centre of their carriageways for surface drainage incorporating stormwater management.
d) Direct vehicular access to Great Western Highway and Brabham Drive for lots fronting them.

Road hierarchy diagram

3.3.2 Pedestrian and cycle network

The indicative pedestrian and cycle network for Huntingwood West is shown. Figure x. Pedestrian and cycle paths form a key component of the connectivity of Huntingwood West. The key features of the network are:

APPENDIX G
CONSULTATION RECORDS

APPENDIX G
Consultation Records

Business Stakeholders Consulted

Location	Organisation	No.	Address	Phone Number	Contact Name	Position	Comments
Huntingwood	Sharp Corporation of Australia P/L	1	Huntingwood Dr	9830 4783			
Huntingwood	Gilbert & Roach	8	Huntingwood Dr	8825 1000			
Huntingwood	Colan Products P/L	6	Woods Close	9672 7888	Genelle Coghlan	Director	Textiles Technology
Huntingwood	JeansWest Corporation		Huntingwood Dr	(03) 9860 8888			
Huntingwood	Danks John & Sons	15	Huntingwood Dr	9839 0777			Homehardware, Thrifty Hardware suppliers
Huntingwood	Sefar Filter Specialists	19-21	Huntingwood Dr	9672 1755	Jeff Smith	Finacial Manager	
Huntingwood	Bantex	20	Huntingwood Dr	1300 655 667			For Lease Sign on Front
Huntingwood	Bosch Securities	25	Huntingwood Dr	8282 6734	Tony Piper	Finacial Director - Pacific Region	Norwest Real Estate - on behalf of owners
Huntingwood	Freightliner Dealer	10	Decker Place	8822 4800			
Huntingwood	Linfox	1	Decker Place	9542 1111	Catherine Denman	PA to CEO	Linfox + Adecco
Huntingwood	Merc & Mitsubishi Service - NSW Gov.		Decker Place				
Huntingwood	Cadbury Schweppes	27	Huntingwood Dr		Greg Lynch	Operations Manager	PO BOX 1127 Blacktown 2148
Huntingwood	Rite Pak	29	Huntingwood Dr	9672 7887	John Battiato	Account Manager	
Huntingwood	DHL Distribution Centre		Huntingwood Dr	13 14 06			
Huntingwood	Coles Myer Logistics		Huntingwood Dr	9261 2266			Coles Myer Real Estate Properties
Huntingwood	Beiersdorf Distribution Center	36	Huntingwood Dr	0298880977			Head office North Ryde - Contact Number
Huntingwood	Sterling Group Services	10	Decker Place	9672 7499			

Huntingwood	Sauer Danfoss Daikin	15	Healey Cct	9853 0600			
Huntingwood	Strand bags	45	Huntingwood Dr	9479 7777			
Huntingwood	H.J Langdon	15-17	Healey Cct	9672 1677			
Huntingwood	A/K Power Solution	22	Healey Cct	9676 3500			
Huntingwood	Oberthur	4	Ford St	9672 5000			
Huntingwood	Rocket	40	Huntingwood Dr	8825-1900			
Huntingwood	Huntingwood Fire Station		Huntingwood Dr	9672 8250			
Huntingwood	Krispy Kreme	4	Healey Cct	1800557363			
Huntingwood	RMD metal Products	6	Healey Cct	9421 1600			
Huntingwood	Signum	3	Healey Cct	9676 3888			
Huntingwood	Fantech	8	Healey Cct	8811-0400			
Huntingwood	Fanuc	10	Healey Cct	8822-4600			
Huntingwood	Alfagomma	12	Healey Cct	9853 0950	Steve Clapham	National Sales Manager	
Huntingwood	Alfa Laval	14	Healey Cct	8822 2700			
Huntingwood	International Anmial Helath products	18	Healey Cct	9672 7944			
Huntingwood	Accidental First Aid People	16	Healey Cct	07 3236 3944			For Lease Sign
Huntingwood	Air International Transit	3	Distillers Place	9830 7100			
Huntingwood	Diageo (United Distillers)	4	Distillers Place	9830 6666			
Huntingwood	Seco Tools	44	Huntingwood Dr	1300 557 326			
Huntingwood	Linde Materilas Handling	5	Distillers Place	9831 9500			
Huntingwood	Weidmuller	43	Huntingwood Dr	9671 9999			
Huntingwood	Orix Truck & Trailer Retail	46	Huntingwood Dr	8814 9466			
Huntingwood	Wartsila	48	Huntingwood Dr	9672 8200			
Huntingwood	Jim Pearson Transport		Cnr Huntingwood Drv & Liberty Rd	9672 7222			
Huntingwood	Exel Logistics	52	Huntingwood Dr	9678 2220			
Huntingwood	General Import P/L	33	Liberty Rd	9678 9663			
Huntingwood	Gasparre Holdings	35	Liberty Rd	9678 9177			
Huntingwood	Nichiyu Forklifts	25	Liberty Rd	9672 7430			
Huntingwood	Stratco	15	Liberty Rd	8811 7211			

Huntingwood	CBC Bearings	11	Liberty Rd	9672 1500			
Huntingwood	Arnotts	25	Brabham Dr				
Huntingwood	Eastern Creek Tavern	64	Huntingwood Dr	9672 8550			
Huntingwood	Sony DADC	60	Huntingwood Dr	9839 0222			
Huntingwood	DB Rreef	27-29	Liberty Rd	1800 819 675			
Arndell Park	Prima Lumber	3	Holbeche Rd	9672 1311			
Arndell Park	Whites Wires	2	Holbeche Rd	9672 7200			
Arndell Park	Electrolux Home Products		Penelope Cr				
Arndell Park	Pryda (ITW Australia) - Roof Construction	7	Squill Pl	9853 0777			
Arndell Park	Pryda (ITW Australia) - Building Supplies	3	Penelope Cr	8811 6999			
Arndell Park	Lite'n'easy			13 15 12			
Arndell Park	Surteco	7-11	Penelope Cr	9421 0300			
Arndell Park	Budget Waste Recycling Depot		Penelope Cr				
Arndell Park	Beaumont Tiles (M & Z Tiling)	13	Penelope Cr	8884 4900			
Arndell Park	Arndell Park Truck, 4WD & Car Wash (plus Tyres)	1-17	Penelope Cr	8814 8050			
Arndell Park	Iveco Truck Sales	598	Great Western Hwy	8822 3456			
Arndell Park	Holland Hitch	4/13	McCormack St	9672 1950			
Arndell Park	Bluescope Steel Lysaght		Penelope Cr	1800 800 789			
Arndell Park	King's Office Supplies	3/16	McCormack St	9671 1570			
Arndell Park	Burndy Electrical Supplies	14	McCormack St	1300 287 639			
Arndell Park	Davis Distributing/ Kapnopoulos	11	McCormack St	9672 3002			
Arndell Park	Premier Lattice Wholesalers	10	McCormack St	9672 7255			
Arndell Park	Allied Civil	5	McCormack St	9679 8666			
Arndell Park	Ancon Development Group	5	McCormack St	9678 9456			
Arndell Park	Heartland Holden Service Centre	8	Holbeche Rd	9676 6155			
Arndell Park	Kanes Hire	1/10	Holbeche Rd	9418-6899			
Arndell Park	Just Scrap Metal	11	Holbeche Rd	9678 9678			

Arndell Park	Action Workforce	2/11	Holbeche Rd	9672 7777			
Arndell Park	South Pacific Salads	6	Holbeche Rd	9672 1995			
Arndell Park	Arrow Plastics		Holbeche Rd				
Arndell Park	Sumitomo Drive Technologies	9	Holbeche Rd	8811 6555			
Arndell Park	BagTrans	15	Holbeche Rd	9676 7166			
Arndell Park	Macquarie Corporation	1/14	Holbeche Rd	9672 1933			
Arndell Park	Café Lavita	1-12	Hollbeche Rd	8814 9782			
Arndell Park	Orda Roters & Drums	3	Contaplas St	9672 8211			
Arndell Park	Exedy Australia P/L	2-3	Contaplas St	9831 7771			
Arndell Park	Smorgan Steel		Penny Pl	02 9714 8000			
Arndell Park	Laspak Contaplas	8	Contaplas St	9672 0909			
Arndell Park	Nestle		Contaplas St	1800 025 361			
Arndell Park	Truck Service Centre - Gov?		Contaplas St				
Arndell Park	The Landmark Business Centre	17-14	Hollbeche Rd	9671 5555			
Arndell Park	Versacold	21	Hollbeche Rd	8811 7300			
Arndell Park	Lidco	20	Hollbeche Rd	9672 1466			
Arndell Park	Eastern Portable Buildings	25	Hollbeche Rd	8811 6300			
Arndell Park	Elgas Distribution Centre		Hollbeche Rd	131161			
Arndell Park	ProduceOne - Growers and Packers	27	Hollbeche Rd	9831 7600			
Arndell Park	Orixi Café	1-26	Hollbeche Rd	9671 2496			
Arndell Park	MC Auto Specialists	18-14	Hollbeche Rd	9672 1064			For Lease
Arndell Park	Mike's Automatic Services	1-28	Hollbeche Rd	9672 7717			
Arndell Park	Eastern Creek Mechnical Repairs	32	Hollbeche Rd	9672 1927			
Arndell Park	Austrlaian Boom & Scissor	39	Hollbeche Rd	9678 9666			
Arndell Park	Blacktown Prestige Moter Vehicle Repair	34	Hollbeche Rd	(02) 9672 1444			
Arndell Park	G/M Baden	43	Hollbeche Rd	9672 1551			
Arndell Park	Breaktime Café	36	Hollbeche Rd	(02) 9672 1770			
Arndell Park	Bearing Traders	36	Holbeche Rd	(02) 9622			

				9322			
Arndell Park	CSG Telcommunications	36	Holbeche Rd	9672 7774			
Arndell Park	Excellence in Learing Aids	36	Holbeche Rd	1300 720 156			
Arndell Park	Sicame Australia	36	Holbeche Rd	9621 3155			
Arndell Park	Group 12 Security	36	Holbeche Rd	9622 8311			
Arndell Park	Bartercard International	36	Holbeche Rd	88149100			
Arndell Park	Kells Training Centre	36	Holbeche Rd	9834 1391			
Arndell Park	Allstate Cranes	45	Hollbeche Rd	9622 3333			
Arndell Park	Eaton Fluid Power Centre	47	Hollbeche Rd	9671 0600			
Arndell Park	Austrlaian Sheet Traders	49	Hollbeche Rd	9672 3099			
Arndell Park	ACCO Australia	40	Hollbeche Rd	9852 8500			
Arndell Park	Aspen Commercial Furniture	53	Hollbeche Rd	9622 8844			
Arndell Park	All Reefer Spares	1-51	Hollbeche Rd	9622 7325			
Arndell Park	Moury	2-55	Hollbeche Rd	9676 8699			
Arndell Park	Bill Gibson Fencing Supplies	4-7	Hollbeche Rd	9672 1465			
Arndell Park	Exel - DB Rreef	52	Hollbeche Rd	9678 6111			
Arndell Park	Yamaha Independent Outboards	59	Holbeche Rd	9672 1922			
Arndell Park	JMAC - Diff & Gear	2-51	Holbeche Rd	9671 5800			
Arndell Park	York Refrigeration	6/36	Holbeche Rd	9679 8040			
Arndell Park	Consolidated CST	19	Lidco St	9672 8700			
Arndell Park	Allcastle Homes	10	Kenoma Pl	9672 7055			
Arndell Park	Hales & Lunn P/L	9	Kenoma Pl	9831 1966			
Arndell Park	Barline	14	Kenoma Pl	9672 1119			
Arndell Park	All Areas Fork Hire P/L	12	Kenoma Pl	96721288			
Arndell Park	Works Infrastructure	8	Kenoma Pl	9672 7199			
Arndell Park	Glowmeat wholesalers	1-8	Vangeli St	9672 1344			
Arndell Park	Nicom Interior	9	Vangeli St	9672 1990			
Arndell Park	Boral Alternative Fuel Services	10	Vangeli St	02 9672 3259			
Arndell Park	Signs & Graphs	4/8	Vangeli St	9678 9540			
Arndell Park	Daman Diesel	12	Vangeli St	8814 8588			
Arndell Park	Wire & Steel Industries	14	Holbeche Rd	9621 6577			
Arndell Park	Lindsay Bros. Transport		Hoadley Pl	9672 7000			

Arndell Park	Quantum Plant Maintenance	2-34	Lidco St	9676 8688			
Arndell Park	SJ Electrical NSW	25	Lidco St	9672 7922			
Arndell Park	Sydney Filter Service	1-24	Lidco St	9672 7008			
Arndell Park	Asphalt Laying Service	26	Lidco St	9672 4554			
Arndell Park	Western Truck Equipment	3	Smoothy Lane	9672 1973			
Arndell Park	K & K Glass	1-6	Smoothy Lane	9672 1899			
Arndell Park	Ark Corporation	8	Smoothy Pl	9678-9036			
Arndell Park	Abet	11-13	Smoothy Lane	9672 7300			
Arndell Park	Menora Foods	7	Smoothy Lane	9672 8088			
Arndell Park	G & O Industries	5	Smoothy Lane	9679 7144			
Arndell Park	Boss Glass & Aluminium		Smoothy Lane				
Arndell Park	Atherton	23	Lidco St	9679 8911			
Arndell Park	DSE Transport Supply	2-23	Lidco St	9678 9100			
Arndell Park	Consolidated Chemical Co.	19	Lidco St	9672 8700			
Arndell Park	D.D.C Diesel Services	22	Lidco St	9672 7991			
Arndell Park	Polycell	20	Lidco St	9672 1515			
Arndell Park	A & R Brayford P/L	21	Lidco St	9672 1553			
Arndell Park	Exel	18	Lidco St	9671 0500			
Arndell Park	Metso Minerals	16	Lidco St	8825 1600			
Arndell Park	Neverfail Springwater	16	Lidco St	13 3037			
Arndell Park	Hystandard	4	Squill Pl	9672 1026			
Arndell Park	Transpec	10	Squill Pl	8811 7000			
Arndell Park	Mini-pickers	5	Squill Pl	1300 137 776			
Arndell Park	Windsor Farm	7	Squill Pl	9622 8002			
Arndell Park	Wittur P/L	9	Squill Pl	9676 3711			
Arndell Park	Westview Frames & Trusses	8	Squill Pl	9676 4866			
Arndell Park	ZF Sales & Services	14	Lidco St	9679 5555			