

LOCAL STRUCTURE PLAN HERITAGE PARK ESTATE

LOTS 31. 971 & 979 BALDIVIS ROAD,
BALDIVIS

JULY 2008

prepared for: **Rockingham Park Pty Ltd**

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in association with: **ENV Australia**
RPS Bowman Bishaw Gorham
Sinclair Knight Merz

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1.0 INTRODUCTION

This report has been prepared on behalf of Rockingham Park Pty Ltd, the owner of lots 31, 971, & 979 Baldivis Road, Baldivis (the subject land).

Contributions to this report have also been made by the following specialist consultants:

- | | |
|--------------------------------|---|
| • ENV Australia | Botanical Advice |
| • RPS Bowman Bishaw Gorham | Environment including Drainage Management |
| • Sinclair Knight Merz Pty Ltd | Engineering Services and Development Issues |

1.1 Purpose

A Comprehensive Development Plan (now Local Structure Plan - LSP) was approved in 2006 across the subject land holdings. The western portion of the site was designated for urban development while the eastern portion was to remain Rural, consistent with its zoning under both the Metropolitan Region Scheme (MRS) and the City's Town Planning No. 2 (TPS2).

The MRS is currently subject to an amendment that will rezone the Rural portions of the subject land to Urban, thus necessitating an updated approach to local structure planning. Approval to a new design proposing urban development over the entire LSP area is now sought.

Lodgement of a revised LSP at this time will allow necessary post-rezoning planning processes to occur in a timely and efficient manner, with minimal delays encountered once the appropriate zonings are in place over the land.

2.0 THE SITE

2.1 Title Particulars

Lots 31, 971, & 979 are located within the City of Rockingham, approximately 9 kilometres east of the Rockingham City Centre (refer **Figure 1**).

The legal description of the properties is as follows:

Table 1: Legal Description

Description	Volume/Folio	Plan or Diagram	Area
Lot 31	2520/598	Plan 32048	12.9429 ha
Lot 971	2084/903	Plan 202758	10.4464 ha
Lot 979	2109/18	Plan 202758	11.9726 ha
TOTAL			35.3619 ha

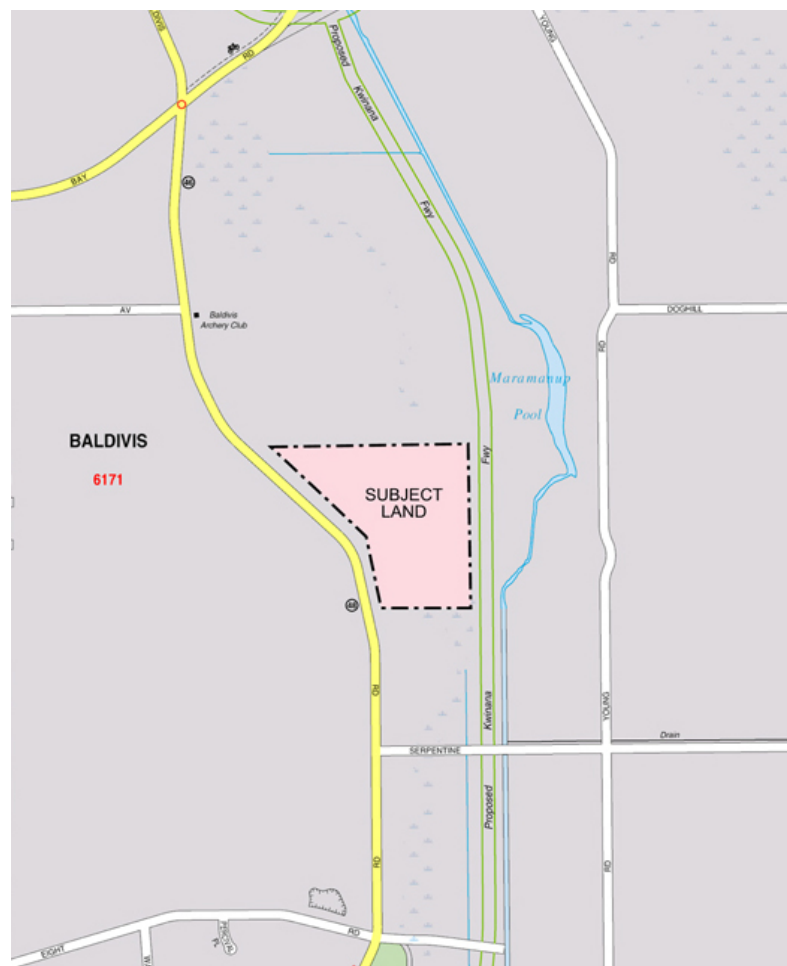


Figure 1 – Location Plan

2.2 Statutory Planning Framework

2.2.1 Metropolitan Region Scheme

As illustrated in **Figure 2** below, the majority of the site is zoned Urban, which facilitates the subdivision and development of the land for residential purposes.

The eastern-most portion of each lot is zoned Rural. Omnibus Amendment No. 1099/33 will rezone these portions Urban, thereby allowing this LSP proposal to proceed.

Land set aside for the future Kwinana Freeway extension forms the eastern boundary of the site and is reserved as Primary Regional Road.

A Parks & Recreation Reserve (known as the 'Tramway Reserve') abuts the western site boundary.

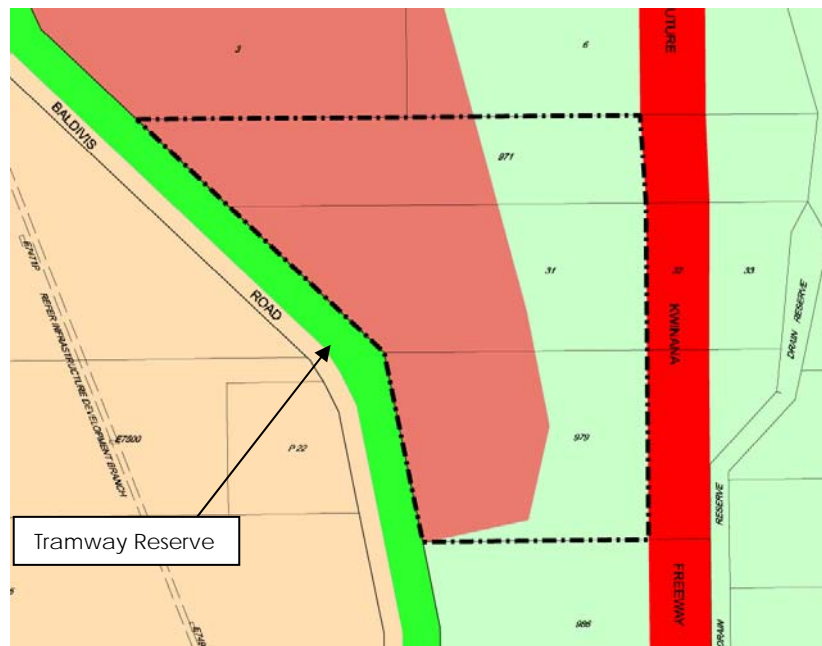


Figure 2 –Existing/Proposed Metropolitan Region Scheme Zoning

2.2.2 City of Rockingham Town Planning Scheme No. 2

The Scheme reflects the zonings currently included in the MRS. It is a statutory requirement for local town planning schemes to reflect the MRS. Therefore, upon the finalisation of Omnibus 1099/33, the Scheme will require updating (to zone the subject land entirely Urban).

Council resolved that such zoning will be implemented simultaneous with Omnibus Amendment No. 1099/33 at its March round of meetings.

It is a Scheme requirement for an endorsed LSP to be in place prior to subdivision and for such subdivision to accord with that endorsed LSP. Endorsement of this proposal by the City and the Commission (LSP) will satisfy this statutory obligation.

2.3 Strategic Planning Framework

2.3.1 Baldvis (South) District Structure Plan

The Baldvis (South) District Structure Plan (attached as **Appendix 1**) reflects the existing Metropolitan Region Scheme and designates the majority of Lots 31, 971 and 979 for 'Urban' purposes. The eastern third of the subject land is identified as Rural.

The rezoning processes outlined in section 2.2 of this report supersede the District Structure Plan with respect to the eastern portion of the land.

This LSP applies more detailed planning and urban design proposals to the overall urban framework identified by the District Structure Plan and MRS/ Scheme rezonings.

2.3.2 *Heritage Park Estate Comprehensive Development Plan, June 2006*

The existing CDP will soon be out of date given that it does not reflect the Urban zoning over the eastern portion of the subject land that will be imminently applied.

The current CDP predominantly provides for single residential holdings at a density of R20, as well as four grouped-housing sites at a density of R40.

Stage 1 of the Estate (based on the approved subdivision plan) has commenced construction and it is Rockingham Park Pty Ltd's intention to release lots within this stage for sale as soon as practicable. Accordingly, the layout proposed over this portion of the land remains unchanged from the original (approved) CDP of June 2006. Notwithstanding, this portion of the subject land has been included in the proposed revised LSP for the purpose of completeness.

2.3.3 *Local Government and Western Australian Planning Commission Policies*

The LSP acknowledges the principles outlined in the policies of the WAPC with particular regard to Liveable Neighbourhoods. This is reflected in the legible/permeable street layout, maximised climate-sensitive lots and interface with open space areas. These elements are discussed in detail, within the relevant sections of this report.

The LSP also takes into account the strategic planning policies of the City of Rockingham, including its *Statement of Planning Policy No. 3.4 - Public Open Space Provision in Residential Areas* and *Statement of Planning Policy No. 3.11 - Landscaping Plans for New Subdivisions* as outlined further below.

2.4 Land Use Context

Lots 31, 971 and 979 Baldivis Road are currently utilised for agricultural purposes; Lot 971 is used for horse agistment, Lot 31 contains a small mandarin orchard, whilst Lot 979 is used primarily for grazing cattle.

Lots 3 and 6, which adjoin the site to the north, also appear to be utilised for general agricultural purposes. However, the land is appropriately zoned to enable residential development to occur in the future. We understand that no formal local structure plan is in place over the abutting land although it is likely to be developed for urban purposes in the near future, thereby linking the Rivergums estate to the north with Heritage Park. The latest design prepared by the planning consultants for the landowner of Lot 3 has been reflected in the LSP. It is understood that the Department of Education and Training is in the process of acquiring Lot 6 for the development of a school.

Land beyond Lots 3 and 6 are approved for urban development and a low to medium density residential subdivision, being the Rivergums, is currently under construction.

Properties to the west of the site (on the western side of Baldivis Road) are also identified for residential development. The majority of land in this area is subject to endorsed structure planning.

Lots 986 and 993 to the south of Heritage Park Estate are also owned by Rockingham Park Pty Ltd. The owners are currently pursuing the rezoning of these properties to Urban under the MRS and Development under the Scheme. The manner in which the proposed LSP interfaces with Lots 986 and 993 is outlined in section 5.2.1.1 of this report.

3.0 SITE CONDITIONS & ENVIRONMENTAL CONSIDERATIONS

3.1 Topography & Soil Types

The subject site is generally flat in nature. It falls from approximately 10 mAHD at the north-western corner of lot 971, to approximately 5 mAHD to the south-east of lot 979.

3.2 Geology

The geology of the Rockingham locality has been mapped at a regional scale by Gozzard (1983). The majority of the study area is mapped as Sand (S_0), or Bassendean Sand; described as very light grey at the surface, yellow at depth, fine to medium grained being of Aeolian origin.

The south east of the site is mapped as Clayey Silt (Mc_2) of the Guildford formation, being dark greyish brown with varying clay content.

These soils have been associated with the potential for acid sulphate soils (see section 4.3.4).

3.3 Wetlands & Water Courses

Hill *et al.* (1996) identify a Multiple Use management category palusplain, which corresponds to the flood plain of the Peel Main Drain that covers approximately 40% of lot 979 (**Figure 3**). The palusplain also extends into a small portion of Lot 31.

Wetlands within the Multiple Use category have few natural attributes and, consequently, are not considered a high priority for conservation. Examination of the site confirms that the wetland area consists predominantly of seasonally inundated paddocks, with a small area of vegetation on the northern boundary of lot 979.

Maramanup Pool is located approximately 400m to the east of the subject land at its closest point. When constructed, the Kwinana Freeway will create a barrier (approximately 100 metres wide) between the Pool and the subject land. Notwithstanding the physical separation of the subject land from Maramanup Pool, an updated Drainage and Nutrient Management Plan (DNMP) will be prepared at subdivision stage to ensure the appropriate treatment of run-off such that it does not negatively impact on the wider network of waterways and wetlands. A prior iteration of the Management Plan (relating to the endorsed CDP of June 2006) confirmed that the land could be developed in a manner that was appropriate and sensitive to nutrient management.

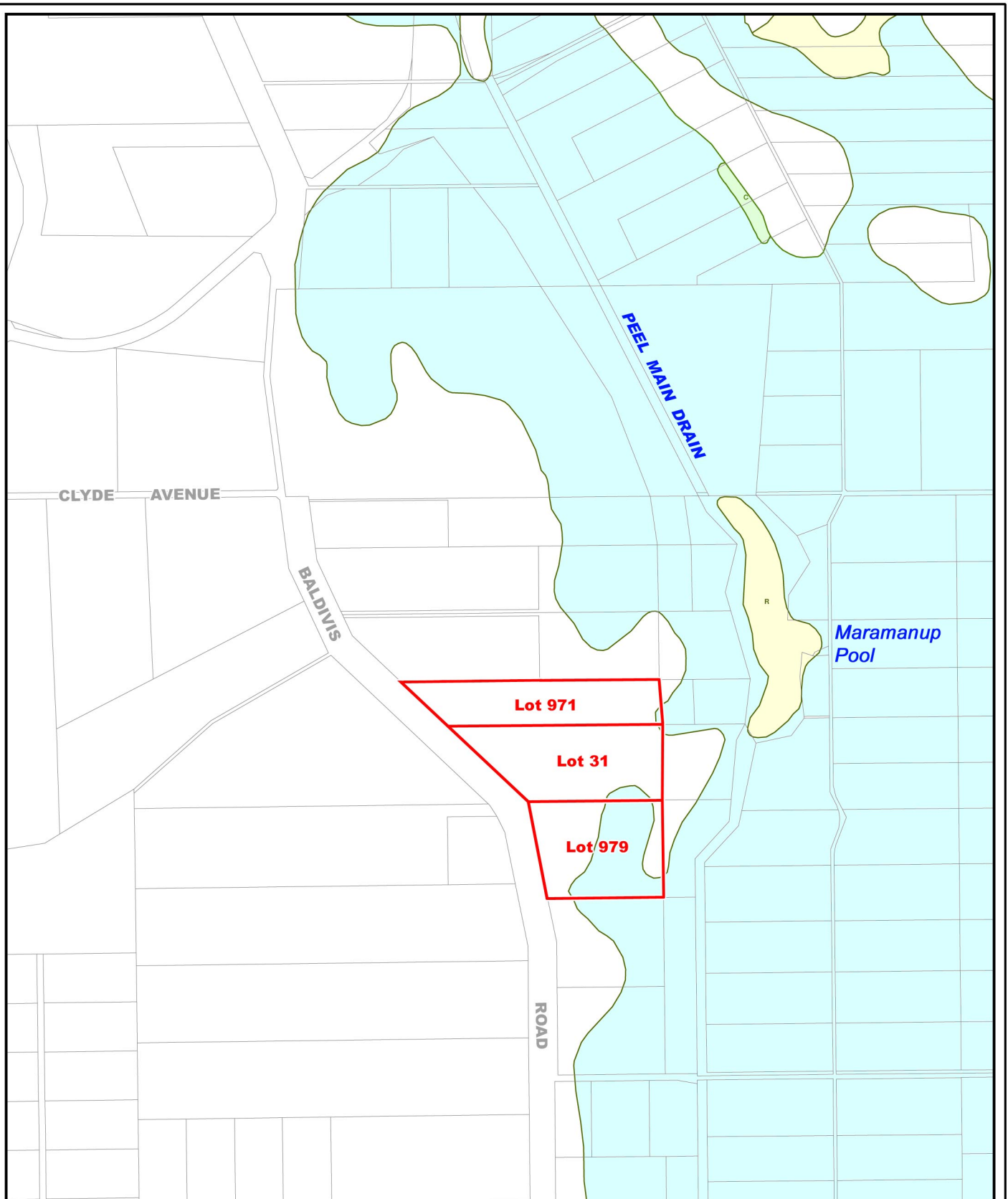
3.4 Surface and Groundwater Hydrology

The site is located within the surface water catchment of the Peel-Harvey Estuary, and is within the Water Corporation's Stakehill Groundwater Area (WAWA, 1988). Groundwater management of the area includes licensing for groundwater abstraction under certain circumstances, such as where large volumes of water are required for irrigation.

The Peel Main Drain is located to the east of the site. The drain connects Folly Pool and Maramanup Pool to the north & east of the study area, respectively. Approximately 50% of lot 979 is within the flood fringe of the Peel Main Drain (refer **Figure 4**) along with a small portion of Lot 31. The drain will eventually be separated from the site by the proposed Kwinana Freeway extension and detailed engineering design will identify the degree of fill required to achieve adequate separation of the ground water level. Greater comment on the management of this issue is provided at section 4.1.

A groundwater monitoring program was conducted from April 2004 to February 2005. The groundwater levels sourced from these bores were fluctuating in nature, ranging from 0.62 mbgl to 6.02 mbgl. These fluctuations are seasonal in nature. The direction of regional groundwater flow across the site is from west to east.

As indicated at section 3.3 above, a Drainage and Nutrient Management Plan has been prepared for the current CDP. This plan takes the above-mentioned factors into account and addresses:



LEGEND

- Conservation
- Resource Enhancement
- Multiple Use



0 200 600 1000m
Scale 1:17000

Figure 3

Wetlands Within and Near the Site

- Drainage design
- Stormwater Infiltration and swale design
- Western Australian Planning Commission and Department of Environment and Conservation policy requirements
- Water quality and management
- Nutrient management

The current DNMP will be reviewed in the context of the new LSP design as a condition of subdivision approval.

3.5 Biological Environment

3.5.1 *Vegetation*

A tree survey was undertaken by ENV Australia in September 2004 to identify and record the physical characteristics of trees remaining on site, and to report on their condition. A full copy of the survey is attached as **Appendix 2**.

Little native vegetation, understorey or remnant habitat has been retained over the site due to clearing for agricultural purposes over time.

The site is not within or directly abutting an area recommended for protection in *Bush Forever*. However, it does accommodate isolated tree specimens along with groups of remnant vegetation clumps and linear tree plantings. The 'Tramway Reserve' west of the study area also contains remnant vegetation.

A rare flora search of the subject land was undertaken in September 2004. Taylor Burrell Barnett has been advised that this search revealed no declared rare flora on site. A copy of the Flora Report attached as **Appendix 3**.

Given the generally cleared nature of the subject land together with its history of agricultural land use, the existing conservation values of the vegetation on-site is considered relatively low from both a regional and local perspective.

Nonetheless, the LSP seeks to retain remnant vegetation within public open space and road reserves where practicable. This is outlined in detail in section 5.3.1 of this report.

3.5.2 *Fauna*

Due to limited remnant vegetation within the subject area, the potential for habitats supporting threatened and priority fauna is considered low. Notwithstanding, the LSP design allows for habitat retention through remnant vegetation within open space and appropriate linkages between them through vegetation retention within road reserves where practicable (refer section 5.3.1).

It is considered unlikely that the proposed development will have a significant impact on fauna within the adjacent Tramway Reserve. Importantly, there will be minimal vegetation clearing within the reserve, with potential impact limited to path and road creation.

3.6 Social Environment

3.6.1 *Aboriginal Heritage & Culture*

The Department of Indigenous Affairs database has been accessed through input of the specific map coordinates for the site, and the resultant output confirms that no archaeological or ethnographic Aboriginal sites have been recorded within the project area.

The developer is aware of its obligations under the Act in the event that an Aboriginal site, artefacts or other material is uncovered during future subdivisional earthworks.

4.0 ENVIRONMENTAL MANAGEMENT

4.1 Wetland Protection

The EPA's objectives are to maintain the integrity, functions and environmental values of the wetlands on the Swan Coastal Plain. Approximately 50% of lot 979 contains a palusplain that corresponds to the flood plain of the Peel Main Drain. The palusplain also extends into a small portion of Lot 31.

The EPA's draft Guidance Statement No. 33 for Environment and Planning (1997) recommend that the wetland's management category and its existing functions should be used to determine how the wetland should be considered in relation to adjacent development.

The palusplain contained within the land holding has a 'Multiple Use' management classification (Hill *et al.*, 1996). 'Multiple Use' wetlands have low human use and conservation values, and the EPA (1997) may consider approving the partial filling of these wetlands and/or use as drainage basins provided:

- the wetland function is retained within the development;
- a wetland is constructed or rehabilitated to fulfil equivalent functions; or
- the additional water enhances the wetland and its function, and does not lead to a loss of water quality.

In this case, the vegetation surrounding the palusplain has been extensively cleared and is used for agricultural purposes. A limited portion of vegetation remains.

Given the limited conservation values of the remnant wetland area it is proposed to be partially filled to accommodate residential development and partially retained within an open space area. The section of wetland within open space shall be associated with revegetation through endemic reed species and retention of existing remnant vegetation. Water quality will be assured through an updated DNMP.

This approach (partial retention/upgrade and partial fill) to the multi-use wetland reflects the outcome that was previously approved via the prior CDP and associated subdivision approval.

4.2 Peel Main Drain Floodplain

A portion of the subject site is located within the 100-year floodplain of the Peel Main Drain as mapped by the (then) Water and Rivers Commission (WRC) (**Figure 4**). The floodplain is divided into a main floodway and a flood fringe. Development restrictions apply within floodplains to protect human lives, property and the environment.

Development is permitted within the flood fringe of the drain providing there is adequate vertical separation distance between the building floor level and the 100-year flood level. Project engineers Sinclair Knight Merz advise that the finished floor level of dwellings throughout the subject area will achieve such separation.

4.3 Surface Water and Groundwater Quality Control

4.3.1 *Potential Nutrient Export to the Peel-Harvey Estuary*

The subject site is located within the Swan Coastal Plain Catchment of the Peel-Harvey Estuary, which has a history of poor water quality. In this case, stormwater generated within the project will be collected, retained and treated on-site for storm events up to 1 in 10 years in POS. Furthermore, surface water flows and associated nutrient loads, which currently exit the site, will cease.

It is also important to note that the project will be connected to a reticulated sewer system that exports potential nutrient loadings from the source.

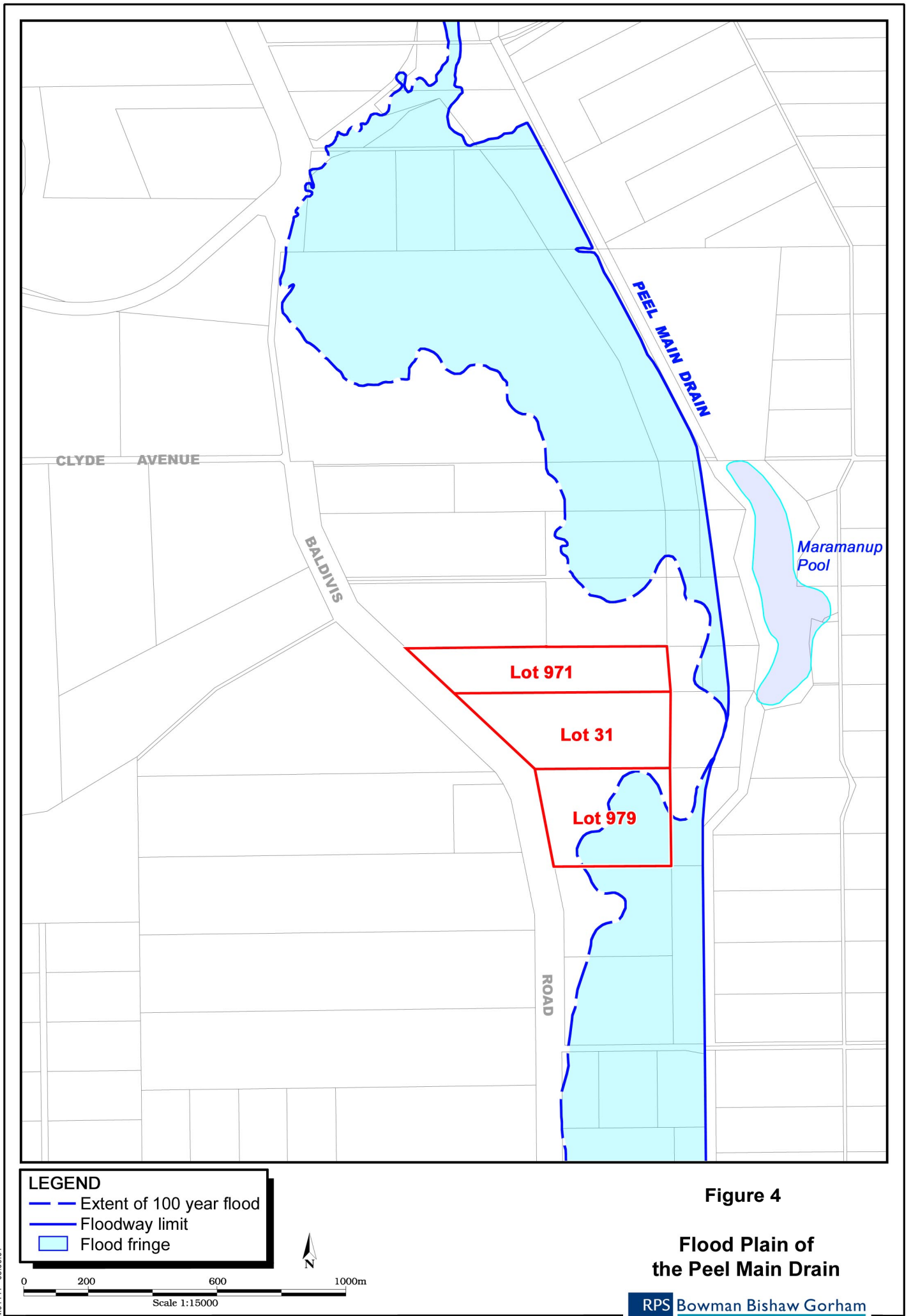


Figure 4

**Flood Plain of
the Peel Main Drain**

Acknowledging the design parameters and drainage management measures proposed it is reasonable to conclude that the change of land use from uncontrolled grazing to urban development has the potential to reduce the potential for nutrient export to the environment. We contend that this view has been broadly accepted by approval agencies in supporting the current CDP (June 2006) and associated subdivision.

As outlined previously in this report, the current Drainage and Nutrient Management Strategy will be reviewed to ensure appropriate treatment of drainage across the subject land to limit the potential for nutrient export from the site.

4.3.2 *Best Management Practices for Urban Stormwater*

Project engineers Sinclair Knight Merz confirm that the preliminary engineering design for the project reflects Water Sensitive Urban Design, applied through the following initiatives:

- Adopting a “progressive infiltration” approach whereby stormwater generated in each catchment is infiltrated at source through baseless side entry pits within the road network where possible (there are sandy soils and good vertical separation to groundwater through most of the site);
- The use of flush-edged kerbing adjacent to POS with cross-flow of water to grassed POS areas;
- Implementing a system of vegetated summer-dry infiltration structures in POS for the treatment and disposal of water that cannot be infiltrated at source;
- Infiltration on-site of stormwater generated from at least the 1:10 year ARI; and
- No direct discharge to the Peel Main Drain; any overflow from the final stormwater disposal structure in the south-east POS would be by overland flow following treatment.

The final design of the stormwater treatment train at the site will be prepared by the project engineers, with environmental input, in accordance with the objectives and principles outlined above, to meet the requirements of the City of Rockingham and the Department of Environment and Conservation.

4.3.3 *Vegetation and Flora*

As noted earlier in this report, significant effort will be made to retain vegetation wherever practicable throughout the Estate. **Figure 5** identifies those areas of trees and vegetation that are proposed to be retained within the development, where practicable.

The Tramway Reserve contains remnant vegetation in good condition but the Reserve itself does not form part of the development area. Two proposed access points traverse the Tramway Reserve. The southern access point is located within a cleared area, thereby avoiding the requirement for any significant area remnant vegetation to be removed. The northern access road is under construction, as approved under the previous CDP.

4.3.4 *Potential for Acid Sulphate Soils*

The WAPC published *Planning Bulletin No. 64 - Acid Sulphate Soils* in November 2003. The mapping accompanying the Bulletin indicates that the subject site is considered a Moderate to Low risk of actual Acid Sulphate Soils (AASS) and Potential Acid Sulphate Soils (PASS) at depths of greater than 3 m.

The development of the subject site will require excavation to depths greater than 3m for sewer installation, and associated dewatering. Consequently, the proponent will complete a Preliminary Site Assessment in accordance with WAPC Bulletin No. 64 and Department of Environment and Conservation requirements, to determine if specific management measures for ASS and/or PASS are required during development.

This investigation will be undertaken prior to excavation or dewatering at the site.

LEGEND

1

2

3

SURVEY POINTS

SURVEY POINTS WITH VEGETATION OR TREES RECOMMENDED FOR RETENTION

APPLICATION AREA

Nb: Carriageways shown are indicative only and will be refined at subdivision stage.



PROJECT

TREE SURVEY

HERITAGE PARK ESTATE - LOTS 31, 971 & 979 BALDIS ROAD
BALDIS

CLIENT	ROCKINGHAM PARK PTY LTD	DATE	22/06/2007
PLAN NUMBER	03/108/013A	SCALE	1:3500 @ A3
DESIGNED BY	PF	CHECKED BY	BDM
			NM

20m

0

20

40

60

80

100m

ALL AREAS AND DIMENSIONS DISPLAYED ARE SUBJECT TO FINAL SURVEY.

TAYLOR BURRELL BARNETT

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Figure 5

4.3.5 *Risk*

The CMS Gas Pipeline traverses land to the west of the site with the edge of the easement being approximately 230m from the proposed urban development at its closest point.

The EPA's draft Guidance Statement No. 50 for achieving EPA risk criteria for developments in proximity to existing and proposed High Pressure Gas Transmission Pipelines indicates that developments within 300m of the centre line of the pipeline requires the threats and risk management mitigation methods associated with the pipeline to be assessed using AS2885.1 (1997) and HB105 (1998). It is the responsibility of the proponent of a change in land use adjacent to the pipeline to liaise with the operator of the gas pipeline and request that they conduct these studies for the proposed change of land use.

This risk assessment can be conducted as a condition of subdivision, if required.

4.3.6 *Draft Statement of Planning Policy: Road and Rail Transport Noise 2005*

The policy aims to minimise the negative impacts of transport noise on adjacent development. It identifies a range of mechanisms (engineering, separation distances, notification and building design) to achieve such minimisation. The policy adopts a pragmatic approach to the application of these measures and encourages 'alternative' means to meet policy objectives.

With the future Kwinana Freeway reserve abutting the eastern boundary of the subject land, there is potential for some form of noise attenuation to be required.

In this regard, a Noise Assessment of Freeway Traffic was undertaken by Lloyd Acoustics in September 2006 (refer **Appendix 4**). The report relied on predictive noise modelling in light of the Freeway being unconstructed at this time. It took into account factors such as road pavement type and barrier walling constructed adjacent to the freeway by the developer and Main Roads Western Australia.

The report concluded that appropriate measures to achieve adequate noise attenuation for future residents would be available, particularly through housing design and specifications. These measures may be implemented at development application stage and/or via design guidelines for lots abutting the freeway reserve thereby ensuring compliance with the relevant noise-management standards and requirements.

In addition, it should be noted that the LSP design incorporates a number of larger lots (40 metres depth) at the eastern edge of the Estate. This would allow for greater separation distance between future development and the Freeway road pavement than would normally be available, further minimising the impact of road traffic noise on future residents.

It is accepted practice elsewhere adjacent to the Kwinana Freeway for residential allotments to abut the freeway reserve and for any bunding to be located within the reserve. An expectation for the same outcome to apply to Heritage Park is held by the landowner. The freeway reserve is wide enough to accommodate any noise attenuation measures such as bunding.

4.3.7 *Contamination*

The land holding has been cleared and used for pastoral purposes.

It is considered unlikely that significant soil or groundwater contamination would occur within the site as a result of pastoral use. However, if any soils are identified as showing signs of contamination during the development process, confirmatory sampling, analyses and assessment will be conducted.

4.4 Land Use Buffers

Land uses within 500m of the property boundary were investigated to determine the requirement for buffering from incompatible land uses, such as poultry farms, piggeries and market gardens; however no buffer requirements were identified.

The CMS Gas Pipeline traverses land west of the site, however, the associated easement is approximately 110m from the proposed urban area at the closest point. This distance is greater than the setbacks required for development calculated in accordance with the Draft EPA Guidance on 'Achieving EPA Risk Criteria for Development in Proximity to Existing and Proposed High Pressure Gas Transmission Pipelines' (EPA, 2000a).

5.0 PROPOSED SUBDIVISION & DEVELOPMENT ELEMENTS

The proposed LSP is attached as **Figure 6** and is discussed in detail below.

5.1 Design Principles

The proposed LSP has been formulated to achieve the following outcomes consistent with the principles outlined in Liveable Neighbourhoods:

- A permeable street design and layout that promotes walkability, particularly to proposed public open space, and commercial facilities in adjoining development areas.
- To facilitate a variety of lot sizes and housing types, which seek to maximise benefits in terms of public amenity and convenience by:
 - promoting medium-high density development around Public Open Space; and
 - utilising larger lots in areas where vegetation retention, drainage and buffering are factors.
- The creation of accessible, attractive and functional public open space, with its location and extent largely dictated by remnant bushland.
- The need to adequately accommodate stormwater drainage in accordance with defined requirements.
- The need to formulate a plan that is responsive to the physical characteristics of the site and the planning framework adopted for surrounding landholdings.

5.2 Residential Densities

The LSP proposes the creation of a range of lot sizes for a variety of dwelling and household types as follows:

- 203 R20 lots ranging from 450-864 m².
- 123 R30 lots ranging from 353-542 m².
- 31 R10 lots ranging from 1114-1841 m².
- Four (4) grouped dwelling sites with a coding of R40. The two sites abutting the Tramway Reserve would have a development potential of 14-17 dwellings while the eastern-most site would have a capacity of approximately eight dwellings. The southwest site would have a capacity of 16 dwellings.

5.2.1 Design

The proposed design seeks to be site-responsive above all other considerations, particularly in relation to the retention and integration of existing vegetation. The creation of safe, attractive residential streets and passive solar lot orientation are also key design objectives. The pattern of subdivision has been designed to offer a high level of amenity for future residents.

Significant opportunity exists for passive solar orientation to be achieved throughout the LSP area. The north-south alignment of street blocks has been optimised as much as practicable.

The design also facilitates integration of future residential development with the Tramway Reserve & public open space throughout the Estate. All open space areas, including the Tramway, will be overlooked by residential development to maximise surveillance of the public realm and promote use of the parks by surrounding residents. Such an outcome would also facilitate a desirable outlook for surrounding residents. Each of these elements is consistent with Liveable Neighbourhoods principles.

In some instances, direct frontage of lots to open space/vegetation retention areas has been proposed. Associated residential allotments would be subject to Detailed Area Plans post-subdivision to ensure appropriate interfacing with the public realm. Treatments would include a path system within the park to delineate public/private areas and permeable fencing to maximise surveillance.



The retention of vegetation has been a key influence in the road layout, lot configuration and positioning of POS generally. This is illustrated in **Figure 5**. Where possible, remnant vegetation will also be retained within road reserves.

5.2.1.1 **Adjoining Subdivision and Interface Considerations**

The LSP was prepared with due regard for the existing & proposed planning framework of the site and adjoining lands. The LSP street pattern provides the necessary parameters to ensure that the proposed northern primary school, local commercial centre and the adjacent future residential areas are well connected and integrated with the subject land.

The road connections proposed over Lot 3 by the respective landowner into the subject land have been reflected in the LSP. The street layout along the northern boundary provides the required road frontage to the proposed school site on Lot 6. It also achieves good pedestrian access to the school and appropriate lot orientation in accordance with Department of Education and Training requirements.

The southern entrance road into the subdivision extends almost the full width of the subject land, providing an effective interface with land to the immediate south. The roadway represents an appropriate delineation between urban and rural land uses.

The street layout has been designed such that it could extend in to Lots 986 and 993 should these lots be rezoned to Urban/Development at some time in the future. This provides potential for a fully connected and integrated urban cell north of Serpentine Road.

5.3 **Public Open Space**

The creation of accessible, attractive and functional Public Open Space (POS) is a key element of the LSP.

There are five areas of POS shown on the plan. POS Area 1 is a small parcel of 246 m² that forms part of a larger open space area on Lot 3 to the north. POS Area 2 (9,244 m²) is located towards the north of lot 971 and encompasses a stand of mature trees. An infiltration basin (approximately 2000 m²) will be located in this area of POS.

The remaining open space areas are similarly associated with the retention of remnant vegetation. Significantly, POS Areas 3 and 4 will be linked by two rows of established trees, providing both a visual greenway for residents and a habitat link. The retention of vegetation wherever practical reflects the City's *Statement of Planning Policy No. 3.11 - Landscaping Plans for New Subdivisions*.

POS 3 also incorporates an existing drainage area, which will be appropriately landscaped and add to the overall quality and amenity of the parkland by functioning as a water feature. There is ample provision for play space in the northern portion of the parkland.

All open space parcels satisfy the minimum preferred parkland size of 5,000 m² outlined in the City's *Statement of Planning Policy No. 3.4 - Public Open Space Provision in Residential Areas* with the exception of POS area No. 1, which will be amalgamated into a larger open space parcel thus satisfying Council's requirements.

A 6,085 m² infiltration basin will be located in POS Area No. 5. Sinclair Knight Merz has advised that where it is currently subject to 'seasonal inundation', the site will be re-engineered so as to eliminate inundation in the future. The engineering response will be to modify the finished level of the POS (where necessary) to achieve appropriate vertical separation from the groundwater table. This will mean that no portion of the open space will be wet or inaccessible to the public with the exception of the proposed infiltration basin, which may periodically contain stormwater and/or groundwater.

The specific detail of how the public open space areas will be designed (in terms of a definitive drainage solution, finished levels and landscape approach) will be determined through preparation of engineering drawings and landscape concepts at a later stage of the project.

Council's *Statement of Planning Policy 3.4 – Public Open Space Provision in Residential Areas* indicates that a 50m x 50m area for playgrounds should be provided in POS areas. Given the significance placed on retaining remnant vegetation across the Estate, however, it is not always practical (or desirable) to rigidly apply the 50m x 50m requirement. A summary of the function of each POS area in the context of the play space requirement is provided below and should be considered in the context of the plan included at **Appendix 5**:

POS 1: This park forms part of a larger POS, the bulk of which is situated on the lot immediately north. It is anticipated that active recreation space would be situated on the balance parkland associated with POS 1.

POS 2: Due to the location of a drainage basin in the eastern extent of the park, the most appropriate location for the play space is at the western end of the park land. However, the play space area would either need to contain trees or would result in an area of remnant vegetation being removed. Because active recreation needs would be met on parkland to the north associated with POS 1 and a nearby school site, greater weight should be given to the retention of vegetation in this instance. POS 2 was approved in its current configuration as part of the original CDP over the land.

POS 3: While not square in shape, 2,500m² of play area can be accommodated in the northern extent of the parkland. Such area is considered ample to accommodate play equipment while ensuring the retention of vegetation and a water feature.

POS 4: The primary purpose of this area is to provide local habitat/vegetation within the urban setting. It is linked via vegetated pedestrian way to POS 3 and the play space therein. POS 4 adds to the overall diversity of open space in Heritage Park.

POS 5: The drainage area within POS 5 has been orientated such that it allows for the protection of vegetation. Sufficient space for a pathway would be provided between the drainage area and those lots fronting onto the open space. With the extent of vegetation to be retained and the drainage area, there is insufficient area to provide for a 50 m x 50 m play space. However, POS 5 will be an attractive, high-amenity parkland that, along with the tramway, POS 4 and the vegetated path network of the locality, will create a very strong east-west ecological link across the LSP area. This is a key theme of the LSP.

Overall, the proposed Local Structure Plan provides an effective balance between active and passive recreation opportunities as well as local habitat protection, justifying a variation to the 50m x 50m play space requirement.

For the purposes of calculating POS provision, Sinclair Knight Merz has confirmed that seasonal inundation and stormwater drainage will be managed in such a way as to ensure that the functionality and accessibility of the proposed POS will not be comprised. The developer will claim 100% credit for the proposed POS, with exception of the proposed infiltration basins which will attract a 50% credit in accordance with the provisions of the City of Rockingham's *Statement of Planning Policy 3.4 – Public Open Space Provision in Residential Areas*.

The infiltration basins will be designed as per the specifications of the City of Rockingham's Technical Services Department and will be landscaped to blend in with existing and proposed vegetation. The basins will be unfenced and will contain water for short periods after a 1:10 year event.

The following tables illustrate how the proposed LSP would satisfy its POS obligations:

Table 2 – Subdivisible Area/POS Requirement

Description	Volume/Folio	Plan or Diagram	Area
Lot 31	2520/598	Plan 32048	12.9429 ha
Lot 971	2084/903	Plan 202758	10.4464 ha
Lot 979	2109/18	Plan 202758	11.9726 ha
Gross Subdivisible Area			35.3619 ha
Deductions Available			0.0 ha
NET SUBDIVISIBLE AREA (NSA)			35.3619 ha
POS REQUIREMENT (10% of NSA)			3.5362 ha

Table 3 – Public Open Space Schedule

Open Space	Total Area (m ²)	Portion Utilised for Infiltration Basin	Drainage Unclaimed as POS Credit (50% of C)	Total Area Towards POS Contribution (B Minus D)
(A)	(B)	(C)	(D)	(E)
1	246 m ²	Nil	Nil	246 m ²
2	9,244 m ²	2,045 m ²	1,022.5 m ²	8,221.5 m ²
3	5,920 m ²	Nil	Nil	5,920 m ²
4	5,346 m ²	Nil	Nil	5,346 m ²
5	2.1024 ha	6,085 m ²	3,042.5m ²	1.79815 ha
TOTAL	4.178 ha	8,130 m²	4,065 m²	3.7715 ha
POS PROVISION (total area provided/gross subdivisible area)				10.66%

5.3.1 Retention of Vegetation

As outlined previously in this report, a tree survey was carried out on 14 September 2004. The significant trees on each property were recorded with a GPS (GDA94) and mapped onto an aerial photograph. Characteristics that were recorded for each tree included species, height, condition, and approximate age.

The key findings of the survey are as follows:

- Based on the field survey, few trees are considered significant enough for incorporation into the LSP.
- Of 50 sites surveyed, 16 were considered to be worthy of consideration for retention. These sites may be divided into three categories:
 - Individual trees that are old and/or large that would be worth retaining as landscape features;
 - Rows of trees of the same species that would be appropriate to retain as a border for road verges or for providing shade; and
 - Areas of remnant vegetation that offer some degree of habitat by providing a diversity of tree and understorey species.

Each of the sites identified for possible retention are illustrated on **Figure 5**.

The majority of sites recommended for retention have been incorporated into either open space areas or road reserves to maximise the potential for retention. The ability to retain other vegetation, earmarked by the LSP as being within residential lots will be considered on a case by case basis bearing in mind the degree of site works required.

Notwithstanding the loss of some of the tree specimens identified for retention, it is considered that, overall, the LSP successfully retains a large proportion of the remnant vegetation on-site as a key design element of the overall plan.

5.4 Finished Topographic Levels

The existing contours allow for a reshaping of the site to provide a minimum separation of 1.2 metres from the proposed house pads to the AAMGL without the need for the importation of clean fill material (refer to Engineering Comment at **Appendix 6**). It is proposed to provide flat building lots for the residential sites with minimal need for retaining walls.

Every effort will be made to retain trees within the development where practicable, given the constraints of the necessary earthworks.

Appendix 7 superimposes finished levels over existing levels along with indicative areas of vegetation to be retained.

Vegetation within the Tramway reserve is to be retained. The long-section of the service road fronting the Tramway reserve would be designed to match as much as practicable the existing surface levels. It is expected that the City of Rockingham would allow some variation in the verge cross-fall from the fronting service road such that the impact on vegetation within the Tramway reserve would be avoided.

5.5 Traffic Considerations

5.5.1 Road Network

Baldivis Road runs north-south between Millar Road West and Karnup Road and currently provides an alternate route to Mandurah Road from the Kwinana Freeway/Safety Bay Road.

Baldivis Road is currently classified as a District Distributor 'A' under the Metropolitan Area Functional Road Hierarchy, and is under the care and control of the City of Rockingham. The most recent traffic counts, collected by Main Roads WA in August 2006, are summarised in **Table 4**. These traffic counts reveal that north of Sixty Eight Road, Baldivis Road is currently carrying approximately 8,500 vehicles per day (vpd).

Table 4 – Baldivis Road Traffic Volumes [Source: Main Roads WA]

TIME PERIOD	TRAFFIC VOLUME (TWO-WAY)
Morning peak hour:	537
Evening peak hour:	753
DAILY TOTAL	8,595

The road network within the subdivision has been designed in accordance with the principles of *Liveable Neighbourhoods*, which promotes highly interconnected and permeable street systems. The result is a highly legible internal road network with traffic distributed through a flatter hierarchy of streets. Roads have been designed with short sections between junctions and slow points (i.e. bends) to control vehicle speeds. The main internal north-south route has been designed to accommodate a bus route.

Two connections are proposed onto Baldvis Road, in keeping with *Liveable Neighbourhoods*. Maximising the number of local road connections to the sub arterial network is considered an appropriate outcome to avoid unnecessary travel on local roads.

The locations of the proposed connections to Baldvis Road have been assessed to ensure adequate sight distance is available. The Safe Intersection Sight Distance (SISD) as determined by *Austroads Guide to Traffic Engineering Practice Part 5: Intersections at Grade*, is dependant on the speed limit and the nature of the road, as shown in **Table 5**.

Table 5 Safe Intersection Sight Distance – Minimum Requirements

Speed Limit (Km/Hr)	Sight Distance	
	Rural Environment	Urban Environment
70 km/hr	140	130
80 km/hr	175	165

In the worst case, assuming the speed limit is not lowered from 80 km/hr and that the rural environment is maintained along Baldvis Road, a SISD of 175m would be required either side of each of the proposed local road connections.

Based on the (horizontal) alignment of Baldvis Road shown in the LSP and the draft Baldvis South District Structure Plan, both proposed connections to Baldvis Road have sufficient sight distance to meet the minimum SISD requirements.

5.5.2 Site Access

Baldvis Road is currently constructed as a two-lane, un-kerbed single carriageway road. A typical cross section is shown in **Figure 7**. The posted speed limit is currently 80 km/hr.

There are two vehicular access/egress points proposed to service the consolidated land parcel; both are via Baldvis Road.

The northern access enters the site at the boundary between Lot 971 and 31, whilst the southern access enters the site towards the southern boundary of Lot 979. These locations have been chosen in order that vehicular traffic generated by this subdivision will not conflict with vehicles entering Baldvis Road from the west (as is proposed in the Draft Baldvis District Structure Plan).



Figure 7 - Baldvis Road Cross-Section

5.5.3 *Trip Generation*

Traffic volumes have been taken into account assuming that adjoining Lot 993 to the south may be developed at some time in the future for residential purposes. It should be not that such assumption has been made to fully account for potential road impacts rather than pre-empt a particular planning outcome over land that does not form part of the LSP.

The northern connection to Baldivis Road is expected to carry in the order of 2,000 vehicles per day (vpd) while the southern access road would accommodate approximately 1,500 vpd. All other roads would accommodate less than 1000 vpd.

The precise alignment of a required sewer line will be determined at detail design/engineering stage. The approximate alignment has been identified on the LSP.

5.5.4 *Trip Distribution*

It is assumed (refer **Appendix 6**) that of the trips generated within the estate, approximately 20-25% would be destined for the wider Baldivis area for shopping, schooling and recreation.

Approximately 45% of trips would be directed towards Kwinana Freeway (travelling north), Rockingham regional centre and Rockingham Train Station. These trips would utilise Baldivis Road.

The remaining vehicular trips would be directed southwards along Baldivis Road to Mandurah and Kwinana Freeway (southern extension).

It is considered that the subdivision of Lots 3, 971 and 979 Baldivis Road will have a minimal impact on and will be easily accommodated by the surrounding regional road network.

5.5.5 *Intersection Control*

There will be a requirement to upgrade Baldivis Road as part of subdivisional works.

The two proposed road connections to Baldivis Road pass through the existing Tramway Reserve.

The design of the northern entry road has been endorsed as part of the existing Commission subdivision approval, with the intersection comprises a 4-way roundabout. The roadway is currently under construction.

The southernmost entry road will be subject to further Council approval, with its design based on the Commission's *DC 2.6 – Residential Road Planning*.

The majority of intersections within the subdivision are three-way junctions, which are intended to operate under priority (Give Way) control, subject to site-specific issues such as sight distance.

5.5.6 *Bicycle & Pedestrian Movement Systems*

It is anticipated that an appropriate pedestrian/ cycle pathway system will be constructed within the subdivision as a condition of approval. The location of such paths is shown on the LSP. Paths will be constructed to integrate with the Tramway Reserve, and will be integrated in the wider network proposed for the district.

The pathway system will consist of 2.0 m and 2.10 m wide dual use paths, 1.5 m wide footpaths and a 2.0 m wide bridal trail in the Tramway Reserve.

5.6 *Utility Services*

5.6.1 *Sewerage Reticulation*

Feedback from the project engineers has been provided at **Appendix 6**.

The north-western portion of the subject land may be serviced by a gravity sewer flowing northwards to the Rivergums estate via Lots 3, 5 and 6 to the north.

The southeastern extent of the site is to be serviced via a temporary pump station gravitating into a future main sewer along the eastern side of the subject land.

Ultimately the main gravity sewer will discharge into a permanent pumping station in the Rivergums.

The precise alignment of a required sewer line will be determined at detailed design/engineering stage. The approximate alignment has been identified on the LSP.

5.6.2 *Water Reticulation*

The Water Corporation has advised that water supply for the landholding would be provided from the Tamworth Scheme, the headworks of which are located to the west of the development.

In Stage 1 of the project, a 200 mm main will be extended from the intersection of Clyde Avenue and Baldivis Road to service the entire landholding.

An overall reticulation strategy plan is awaiting endorsement by the Water Corporation.

5.6.3 *Stormwater Drainage*

Stormwater drainage is outlined in **Appendix 6**:

The Water Corporation has confirmed that the land holding falls within the Mundijong Drainage Scheme. As such, all runoff from the site must be compensated to pre development levels.

The City of Rockingham has advised that all stormwater generated from the development is to be retained within the development site through the use of retention basins.

In general, infiltration of stormwater at source is proposed using accepted and proven 'water sensitive design' techniques including the use of soakwell side entry pits and 'leaky' stormwater drainage pipes that allow for a distributed progressive infiltration system.

Based on the topography of the land and the current subdivision layout, the site has been divided into two stormwater catchment areas. Although for the 100 year event, the development will form one single treatment with runoff flow from west to east. The stormwater drainage system will be catered for through a piped drainage system discharging into the northern most POS in Lot 971 and also eastwards into an infiltration basin located in the POS area of Lot 979.

The infiltration basin within the POS of Lot 971 will be constructed and shaped as part of Heritage Park Stage 1 works. A significant area of natural vegetation has been retained within the POS area.

The infiltration basin within Lot 979 due to the low level of the contours and the minimal separation to the AAMGL would need to be created by use by an impounding bund in the order of 2 metres high, to accommodate the required storage volume. The bund would be a maximum of 1:6 batter and would be landscaped to blend with the natural vegetation. Storm events in excess of the 10 year recurrent interval would be discharged from the infiltration basin into the existing flood plain via a bubble-up.

The approximate 5000 m² drainage requirements could be easily accommodated without loss of significant trees and within the allowable 25% area of the POS to the western part of the POS area. The landscaping of the bunds would add further screening to that already provided by the existing trees located closer to the internal residential road system.

It should be noted that the northern-most (Stage 1) POS area and retention basin therein have been approved by the City and are under construction. The overall drainage strategy is illustrated in the Outline Drainage Concept Plan at **Appendix 7**.

5.6.4 Gas Supply

Highbury Park Estate to the west of the subject land has constructed gas infrastructure in proximity to the proposed entry road for Heritage Park, allowing for the extension of gas supplies.

5.6.5 Power Reticulation

There are currently high voltage (22kV) distribution aerial lines located along Baldivis Road that are fed from Mandurah. Western Power has confirmed that there is adequate capacity to provide the development with a high voltage point of supply.

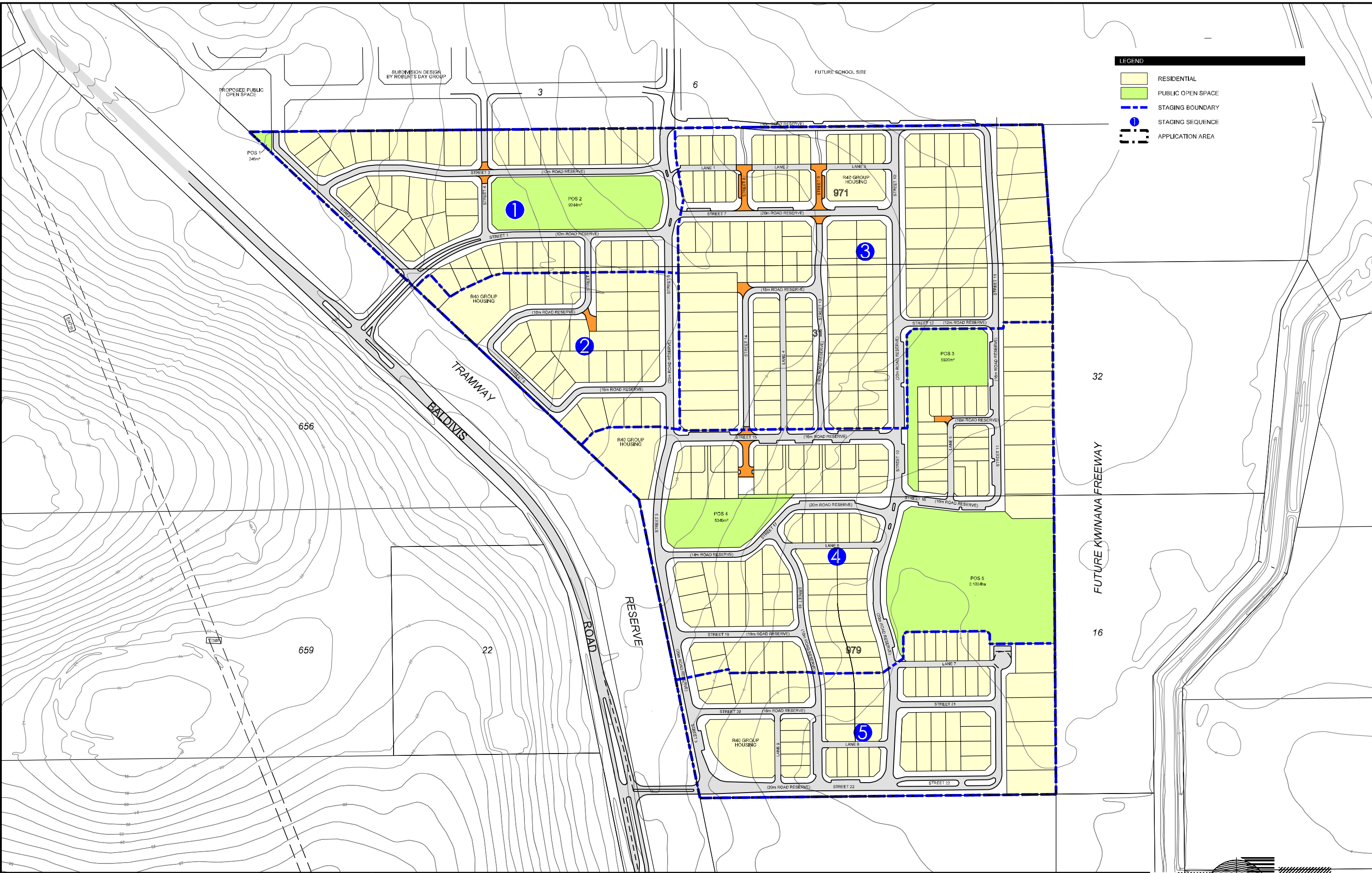
A connection to the high voltage aerial lines and associated high voltage equipment within the development would be covered under Western Power's System Charge policy. As with typical residential developments, each residential lot and street lighting would be reticulated via an underground low voltage system.

5.6.6 Telecommunications

There is Telstra distribution network located along Baldivis Road that Telstra has confirmed has adequate capacity to service the proposed development.

5.7 Staging of Development

Stage 1 of the development has commenced in the north-western section of Heritage Park Estate. An indicative layout for future stages is provided at **Figure 8 - Indicative Staging Plan**.



PROJECT

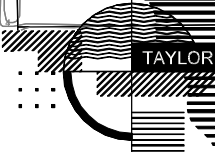
Indicative Staging Plan

HERITAGE PARK ESTATE - LOTS 31, 971 & 979 BALDIVIS ROAD
BALDIVIS

CLIENT	DATE
ROCKINGHAM PARK PTY LTD	22/06/2007
PLAN NUMBER	SCALE
03/108/012A	1:3500 @ A3
DESIGNED BY	CHECKED BY
PF	BDM
	YH
	MGA 94
	8DM

20m 0 20 40 60 80 100m

ALL AREAS AND DIMENSIONS DISPLAYED ARE SUBJECT TO SURVEY.



TAYLOR BURRELL BARNETT
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Figure 8

6.0 CONCLUSION

The Local Structure Plan is considered to be a capable and appropriate planning outcome for the subject land, taking into account recent zoning changes and the expansion of the Urban zone.

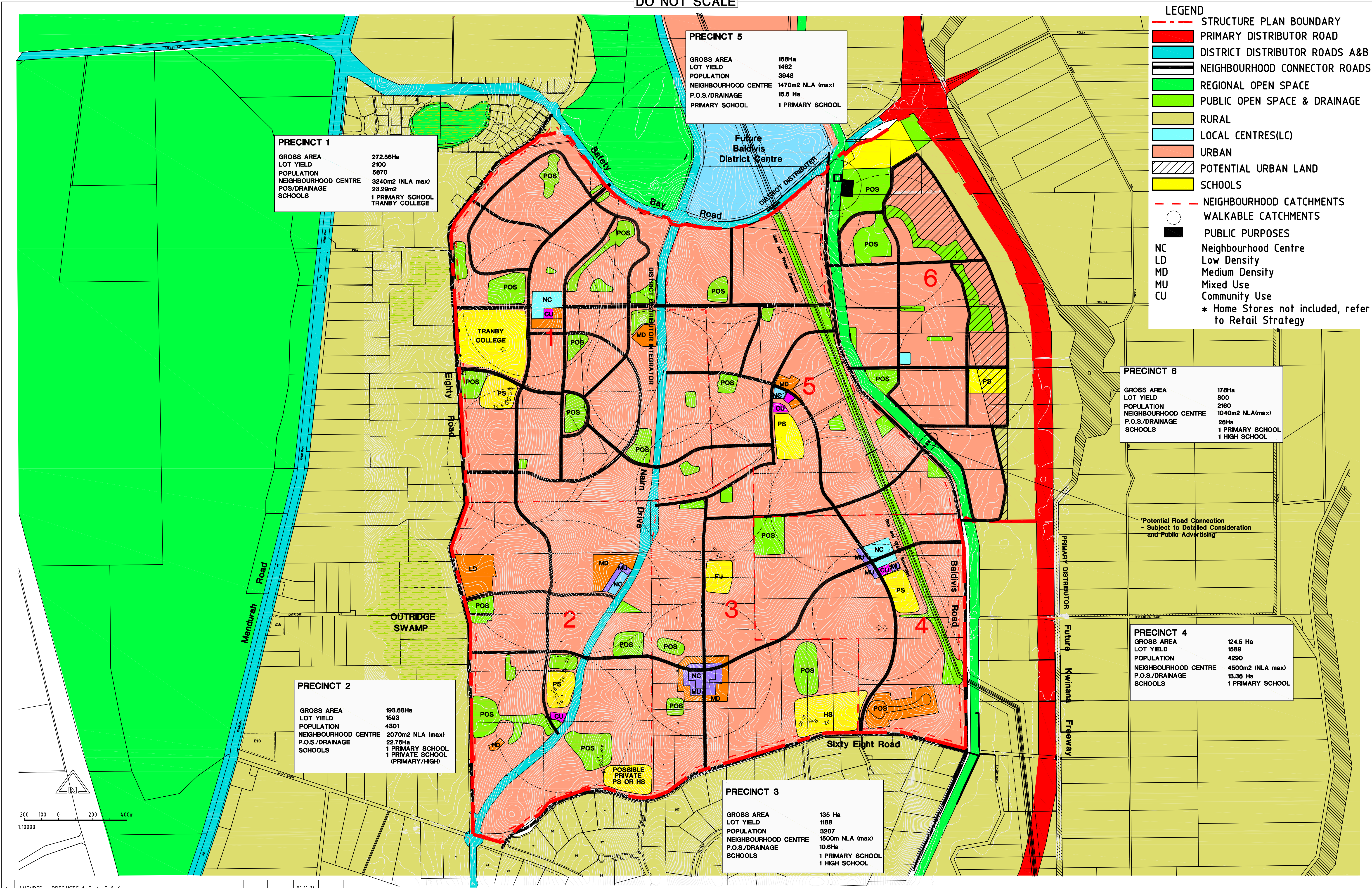
In undertaking an assessment of the LSP we request that the following key issues be acknowledged:

- Remnant vegetation and significant trees have been incorporated within the design wherever practicable.
- The proposed LSP for Heritage Park Estate reflects core principles of the draft Baldivis (South) District Structure Plan.
- The proposed Estate will integrate with developments planned on adjoining landholdings.
- The subject land is relatively free of development or land use constraints and is well-suited for urban development.
- The proposed LSP complies with the prevailing policy framework.
- The subject land is located within a future neighbourhood context that will allow convenient access to proposed retail, transit, recreational, education and other community facilities, which warrants a range of density codes ranging from R10 to R40 to allow a mix of lot sizes for various housing types.

APPENDIX 1

Draft Baldivis (South) Structure Plan

DO NOT SCALE



L	AMENDED - PRECINCTS 1, 3, 4, 5 & 6			01.11.04	
K	AMENDED - PUBLIC OPEN SPACE & PRECINCT 6 URBAN AREA			02.08.04	
J	AMENDED - PUBLIC OPEN SPACE			09.07.04	
I	AMENDED - PRECINCT 3, 4 & 5			30.04.04	
H	AMENDED - PRECINCT 6/FINAL PLAN			07.11.03	
G	AMENDED - PRECINCT 4 ,LOCAL CENTRE & MEDIUM DENS LOCATION			07.08.02	
No.	Revision	—Revise on CAD do not amend by hand	Engineer	Approved	Date
					M/Film

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Drawing File No.

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CONSULTING ENGINEERS • ENVIRONMENTAL SCIENTISTS & PLANNERS • PROJECT MANAGERS
ACN 008 488 373

PERTH • BUNBURY • GERALDTON • KALGOORLIE

Scale 1:10000

Drawn/ Traced SLB 20.02.01
Design Engineer
Check Engineer
Approved

This Drawing must not be used for Construction unless signed as Approved

Client and Job CITY OF ROCKINGHAM

Title SOUTH BALDIVIS
DISTRICT STRUCTURE PLAN

Size A1
Drg. No. 6110614-P5

Rev L

APPENDIX 2

ENV Australia Tree Survey Results

TREE SURVEY – LOTS 31, 971 & 979 BALDIVIS ROAD, BALDIVIS

On behalf of :

TAYLOR BURRELL BARNETT

Prepared by:

ENV Australia

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04.112/RP001 Oct 2004	FINAL Approved for Issue :
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Australia

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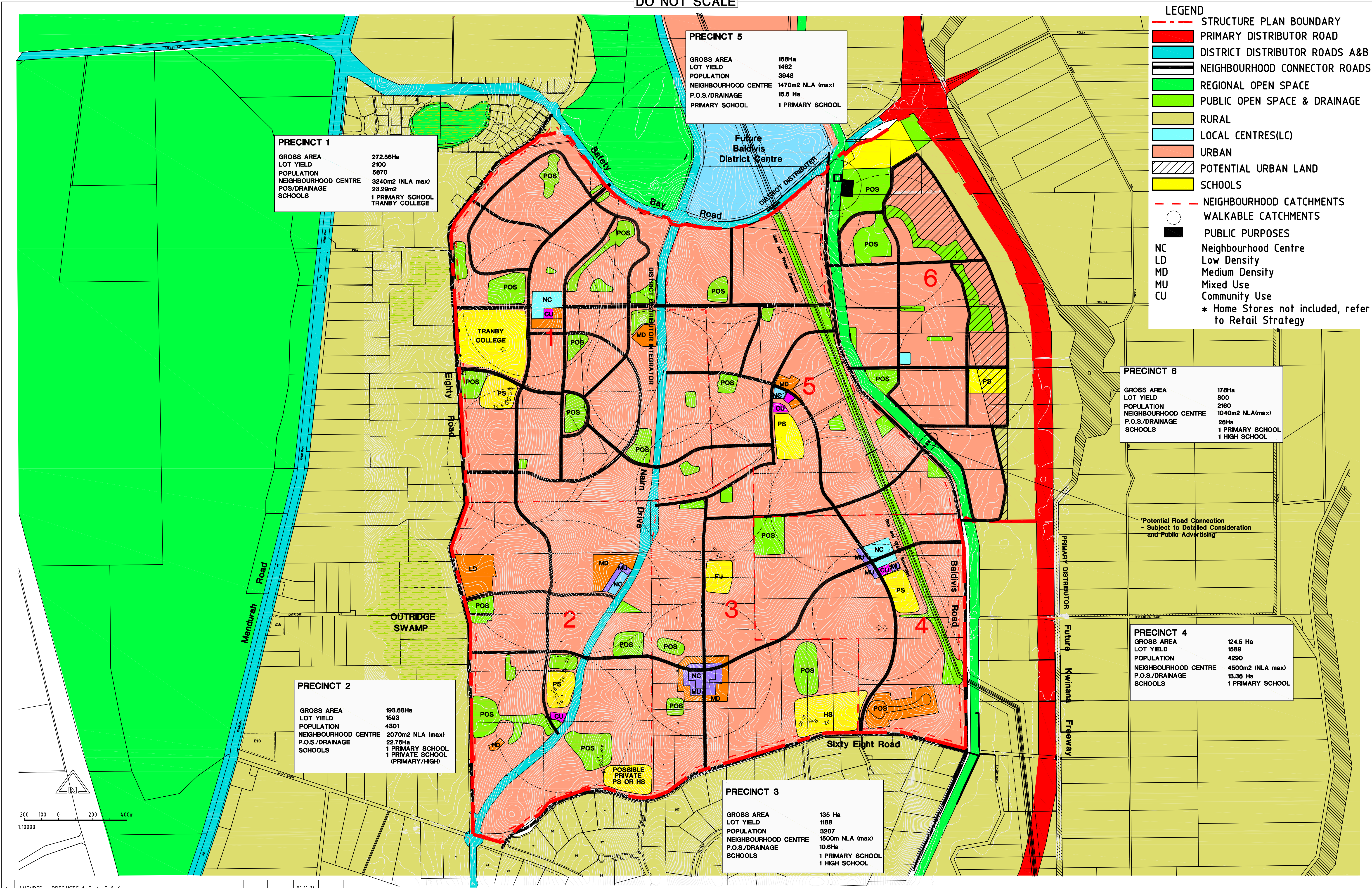
FIGURES

FIGURE 1	SITE LOCATION
FIGURE 2	SURVEY POINTS

APPENDICES

APPENDIX A	SITE PHOTOGRAPHS
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DO NOT SCALE



L	AMENDED - PRECINCTS 1, 3, 4, 5 & 6			01.11.04	
K	AMENDED - PUBLIC OPEN SPACE & PRECINCT 6 URBAN AREA			02.08.04	
J	AMENDED - PUBLIC OPEN SPACE			09.07.04	
I	AMENDED - PRECINCT 3, 4 & 5			30.04.04	
H	AMENDED - PRECINCT 6/FINAL PLAN			07.11.03	
G	AMENDED - PRECINCT 4 ,LOCAL CENTRE & MEDIUM DENS LOCATION			07.08.02	
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Check Engineer
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Client and Job CITY OF ROCKINGHAM

Title SOUTH BALDIVIS
DISTRICT STRUCTURE PLAN

Size A1
Drg. No. 6110614-P5

Rev L

STATEMENT OF LIMITATIONS

Scope of Services

This environmental site assessment report (“the report”) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV.Australia Pty Ltd (ENV) (“scope of services”). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise stated in the report, ENV has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to ENV.

Environmental Conclusions

In accordance with the scope of services, ENV has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of ENV or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

ENV will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

1. INTRODUCTION

ENV. Australia Pty Ltd (ENV) was commissioned by Taylor Burrell Barnett to undertake a site inspection of Lots 31, 971 and 979 Baldivis Road, Baldivis to identify and record the physical characteristics of trees located within the area subject of a CDP. The aim of the survey is to determine whether there are any trees suitable for retention as part of the development of the site for residential purposes.

The three properties are located within the City of Rockingham and comprise approximately 35 ha in area. The majority of the site has been parkland cleared and is utilised for agricultural purposes

2. METHODOLOGY

The assessment of the properties was carried out on 14 September 2004. An experienced botanist traversed the survey area on foot and by vehicle where access permitted. The dominant trees on each property were recorded with a GPS (GDA94) and then mapped onto an aerial photograph. All other vegetation evident in the aerial was also visited and recorded. Characteristics that were recorded for each tree included:

- Species;
- Height;
- Condition; and
- Approximate age.

3. RESULTS

The following tables summarise the details of each vegetated area within the three lots; this includes areas that didn't contain trees (eg shrubs and fruit trees). Each site is indicated in Figure 2.

3.1 LOT 31

Site	Coordinate	Species	Height (m)	Health	Age	Comments
1	E 389 804 N 6420 656	<i>Eucalyptus marginata</i> <i>Xylomelum occidentale</i>	8 6	H	M	
2	E 389 863 N 6420 639	<i>Jacksonia furcellata</i> <i>Acacia pulchella</i>				Shrub land without trees
3	E 389 928 N 6420 590	<i>Eucalyptus marginata</i>	8	H	M	See Appendix A - Photo 1
4	E 389 981 N 6420 614	<i>Eucalyptus marginata</i>	7	H	M	
5	E 390 123 N 6420 602	Fruit trees				
6	E 390 157 N 6420 556	Non Endemic tree species				
7	E 390 119 N 6420 561 E 390 118 N 6420 431 E 390 011 N 642 0431	Non Endemic tree species	10-12	H	M	See Appendix A - Photo 2
8	E 390 177 N 6420 446	<i>Astartea</i> sp, <i>Kunzea ericifolia</i> and <i>Jacksonia furcellata</i>				Shrub land without trees
9	E 390 256 N 6420 502	Non endemic tree species	13	H	M	
10	E 389 972 N 6420 481	<i>Eucalyptus marginata</i>	3-7	H	Y	
11	E 389 929 N 6420 422 E 389 934 N 6420 462	<i>Eucalyptus marginata</i> <i>Banksia attenuata</i>	7 8	H H	M	

Site	Coordinate	Species	Height (m)	Health	Age	Comments
12	E 389 915 N 6420 432	Fruit trees				
13	E 389 815 N 6420 469	Banksia ilicifolia Banksia attenuata	7 7	H H	M M	
14	E 389 791 N 6420 487	Eucalyptus marginata, Xylomelum occidentale	9 9	H H	M M	
15	E 389 772 N 6420 499	Eucalyptus marginata	13	H	O	
16	E 389 740 N 6420 528	Eucalyptus marginata Xylomelum occidental	5 5	H H	Y Y	
17	E 389 735 N 6420 534	Eucalyptus gomphocephala Banksia grandis Banksia ilicifolia Xylomelum occidentale Banksia ilicifolia Eucalyptus marginata Corymbia calophylla	20 8 7 8 7 8	H H H H H H	M M M M M M	See Appendix A - Photo 3
18	E 389 727 N 6420 543	Banksia ilicifolia	13	H	M	
19	E 389 682 N 6420 584	Banksia grandis	7	H	M	
20	E 389 631 N 6420 657	Pinus pinaster	15	H	M	See Appendix A - Photo 4
21	E 389 744 N 6420 660	Non endemic tree species	16	H	M	See Appendix A - Photo 5
22	E 389 760 N 6420 599	Eucalyptus marginata, Xylomelum occidental	10 7	H H	M M	

3.2 LOT 971

Site	Coordinate	Species	Height (m)	Health	Age	Comments
23	E 389 857 N 642 0674	<i>Eucalyptus marginata</i>	8-13	H	M	
24	E 389 773 N 6420 684	<i>Eucalyptus marginata</i>	6-13	S	M	Area is mostly planted shrubs with a few unhealthy Jarrahs
25	E 389 765 N 6420 751	<i>Eucalyptus marginata</i> , <i>Xylomelum occidentale</i> <i>Banksia ilicifolia</i>	11 8 6	H H H	M	No significantly tall trees but is worth retaining. See Appendix A - Photo 6
26	E 389 489 N 6420 781	<i>Eucalyptus marginata</i> <i>Banksia grandis</i> <i>Xylomelum occidentale</i> <i>Corymbia calophylla</i>	8-13 7 7 17	H H H H	M	
27	E 389 513 N 6420 744	<i>Banksia grandis</i> <i>Banksia menziesii</i>	6 6	H H	M	Continuation of vegetation community in road reserve
28	E 389 621 N 6420 674	<i>Eucalyptus marginata</i> <i>Banksia grandis</i>	6-16 7	H H	Y-M	
29	E 389 598 N 6420 668	<i>Eucalyptus marginata</i> <i>Allocasuarina fraseriana</i> <i>Banksia grandis</i> <i>Banksia attenuata</i>	7 7 6 7	H H H H	M	
30	E 389 560 N 6420 791	<i>Eucalyptus gomphocephala</i>	20	H	O	See Appendix A - Photo 7
31	E 389 594 N 6420 785	<i>Eucalyptus gomphocephala</i>	20	H	O	See Appendix A - Photo 7

Site	Coordinate	Species	Height (m)	Health	Age	Comments
32	E 389 675 N 6420 771	<i>Eucalyptus marginata</i>	7-13	H	Y-M	
33	E 389 855 N 6420 754	<i>Eucalyptus marginata</i>	14	H	M	Approx. 8 trees
34	E 389 921 N 6420 724	Introduced trees	20	H	O	
35	E 389 864 N 6420 789	<i>Eucalyptus marginata</i>	11	H - SS	M	Several trees
36	E 389 933 N 6420 801	Non Endemic tree species	10	H	M	
37	E 389 990 N 6420 680	Introduced trees & <i>Eucalyptus arginate</i> , <i>Xylomelum occidentale</i>	15	H	M	Area part of garden of dwelling
38	E 390 093 N 6420 728	Mixed planted non-endemic trees	10	H	M	Have been planted sporadically through paddock. See Appendix A – Photo 8

3.3 LOT 979

Site	Coordinate	Species	Height (m)	Health	Age	Comments
39	E 389 902 N 6420 306	<i>Corymbia calophylla</i>	14	H	O	
		<i>Eucalyptus marginata</i>	14	H	O	
40	E 389 889 N 6420 297	<i>Corymbia calophylla</i>	20	H	O	See Appendix A – Photo 9
41	E 389 880 N 6420 295	<i>Corymbia calophylla</i>	20	H	O	
42	E 389 881 N 6420 320	<i>Corymbia calophylla</i> <i>Eucalyptus marginata</i>	10-15	H	M-O	Old trees have snapped off in the past and have reshooted

Site	Coordinate	Species	Height (m)	Health	Age	Comments
43	E 389 881 N 6420 265	<i>Corymbia calophylla</i>	10	H	M	Ba is bent over
		<i>Eucalyptus marginata</i>	18	H	M	
		<i>Banksia attenuata</i>	4	SS	M	
		<i>Banksia menziesii</i>	7	SS	M	
44	E 389 864 N 6420 370	<i>Eucalyptus marginata</i>	8	H	M	All are multi-stemmed
45	E 389 918 N 6420 402	<i>Eucalyptus marginata</i>	7	H	M	Trees are dominated by <i>Kunzea ericifolia</i>
46	E 389 928 N 6420 360	<i>Eucalyptus marginata</i>	10	H	M	
47	E 390 176 N 6420 376	<i>Eucalyptus rudis</i>	17	H	M-O	Understorey contains <i>Regalia ciliata</i> , <i>Astartea</i> sp. and <i>Kunzea</i> sp. See Appendix A – Photo 10
48	E 390 227 N 6420 298	<i>Eucalyptus rudis</i>	11	H	M	
49	E 390 053 N 6420 215	<i>Eucalyptus rudis</i>	8-13	H- SS	M	
50	E 389 930 N 6420 142	Stand of dead trees	-	D	-	

Key to Table**Health Age****H:** Healthy**SS:** Slightly Stressed**S:** Stressed**D:** Dead**Y:** Young- < 10 years**M:** Mature- between 10 and 30 years**O:** Old - between 30 and 50 years old**VO:** Very old- beyond 50 years old

4. DISCUSSION

It is evident from the field survey that there are few trees that may be considered significant for incorporation into the development plan for the three lots. From the 50 sites surveyed, 15 were considered to be worthy of consideration for retention. They have been divided into three categories:

- Individual trees that are old and/or large that would be worth retaining as features;
- Rows of trees of the same species that would be appropriate to retain as a border for road verges or for providing shade; and
- Areas of remnant vegetation that offer some degree of habitat by providing a diversity of tree and understorey species.

The locations of these are below:

Individual Trees:

Site	Coordinate	Species	Height (m)	Health	Age
17	E 389 735 N 6420 534	<i>Eucalyptus gomphocephala</i>	20	H	M
18	E 389 727 N 6420 543	<i>Banksia ilicifolia</i>	13	H	M
19	E 389 682 N 6420 584	<i>Banksia grandis</i>	7	H	M
30		<i>Eucalyptus gomphocephala</i>	20	H	O
31		<i>Eucalyptus gomphocephala</i>	20	H	O
39	E 389 902 N 6420 306	<i>Corymbia calophylla</i>	14	H	O
		<i>Eucalyptus marginata</i>	14	H	O
40	E 389 889 N 6420 297	<i>Corymbia calophylla</i>	20	H	O
41	E 389 880 N 6420 295	<i>Corymbia calophylla</i>	20	H	O

Rows of trees of the same species:

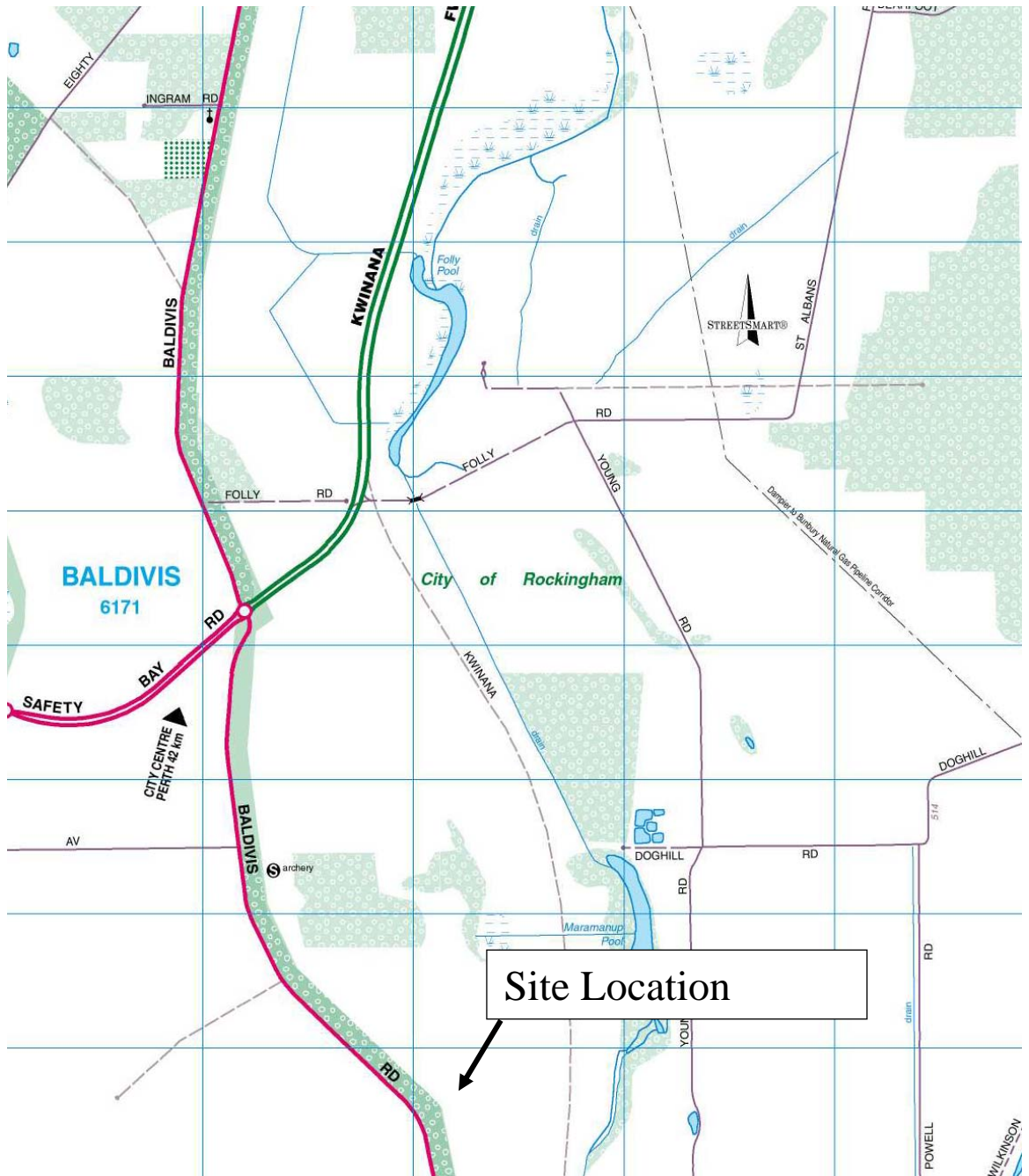
Site	Coordinate	Species	Height (m)	Health	Age
6 & 7	E 390 119 N 6420 561 E 390 118 N 6420 485 E 390 011 N 642 0431	Introduced trees	10-12	H	M
9	E 390 256 N 6420 502	<i>Eucalyptus camaldulensis</i> subsp. <i>camaldulensis</i>	13	H	M
20	E N	<i>Pinus pinaster</i>	15	H	M
34		Introduced trees	20	H	O

Areas of remnant vegetation:

Site	Coordinate	Species	Height (m)	Health	Age
17	E 389 735 N 6420 534	<i>Eucalyptus gomphocephala</i>	20	H	M
18	E 389 727 N 6420 543	<i>Banksia ilicifolia</i>	13	H	M
19	E 389 682 N 6420 584	<i>Banksia grandis</i>	7	H	M
25	E 389 800 N 6420 685	<i>Eucalyptus marginata</i> , <i>Xylomelum occidentale</i> <i>Banksia ilicifolia</i>	11 8 6	H H H	M
47	E 390 176 N 6420 376	<i>Eucalyptus rudis</i>	17	H	M-O

The vegetation at sites 17, 18 and 19 is in good condition and is the same vegetation community as the tramway reserve. Although it has a high percentage of weed infestation it does contain native understorey. Site 25 is the largest area of vegetation within the three lots and therefore it's recommended that it be retained. The site doesn't contain high numbers of native understorey species, but does offer some degree of habitat, it could also be used as public open space. Site 47 is a low lying area and contains typical dampland species, therefore it would be advantageous to use the area for drainage purposes. The vegetation includes *Regelia ciliata*, *Astartea* sp., *Kunzea* sp. and various sedge species.

FIGURES



TITLE: Figure 1 - Site Location

CLIENT: Taylor Burrell Barnett

DRAWN BY: NW

CHECKED BY: NW

JOB NUMBER: 04.112

DATE: 21/9/2004

REPORT ISSUE: Draft

SCALE: NTS





Figure 2: Survey Point Locations

Client: Taylor Burrell Barnett

Job #: 04.112

Date: 23/09/2004

Drawn by: SD

Status: Final

Checked by: NW



APPENDIX A



Photo1: Lot 31 – Site 3



Photo 2: Lot 31 – Site 7



Photo 3: Lot 31 – Site 17



Photo 4: Lot 31 – Site 20



Photo 5: Lot 31 – Site 21



Photo 6: Lot 971 – Site 25



Photo 7: Lot 971 – Site 30 & 31



Photo 8: Lot 971 – Site 38



Photo 9: Lot 979 - Site 40



Photo 10: Lot 979 – Site 47

APPENDIX 3
Arthur Weston – Flora Survey

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Consulting Botanist

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8 Pitt Street
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4 January 2005

Kathy Choo
RPS Bowman Bishaw Gorham,
Environmental Management Consultants
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SUBIACO WA 6904

Tel. (08) 9382 4744; Fax. (08) 9382 1177
Email: kc@bbg.net.au

Your Ref: M04151

Dear Kathy,

Rare Flora Searches
Lots 971, 31 and 979 Baldivis Road, East Baldivis

Introduction

The project was to undertake a rare flora search of Lots 971, 31 (formerly 972) and 979 Baldivis Road, Baldivis. The principal flora, though not the only flora, to be searched for were the Declared Rare Flora orchids *Caladenia huegelii* and *Drakaea elastica*. The first flowers in September-October, and the second flowers in October-November.

Lots 971, 31 and 979 are on the east side of Baldivis Road between 1 km and 2 km southeast of Safety Bay Road.

Methods

In August 2004, prior to undertaking searches for rare flora on these three lots, searches of three databases were carried out by the Wildlife Branch of the Department of Conservation and Land Management. These three Department of Conservation and Land Management (CALM) databases are *Threatened (Declared Rare) Flora* (Summary of Threatened Flora Data), *Declared Rare and Priority Flora List* and *Western Australian Herbarium Specimen* (WAHERB). The searches were for Declared Rare and Priority Flora taxa recorded in the general vicinity of Lots 971, 31 and 979. Two database searches were done, on 10 August and on 30 August. The parameters used for the searches are:

(1) 10 August 2004:

Baldivis:

Coordinates: 32° 18' – 32° 22' and 115° 46' – 115° 54'

(2) 30 August 2004:

Baldivis:

Coordinates: 32°17'00" - 32°22'00" and 115°49'00" - 115°51'00"

Names: Baldivis

The first search resulted in five species, and the second resulted in three. These species, their conservation codes and the searches that resulted in them are:

• <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (GJK 5026)	P1	(1)
• <i>Caladenia huegelii</i>	DRF	(1)
• <i>Dillwynia dillwynioides</i>	P3	(1), (2)
• <i>Drakaea elastica</i>	DRF	(1)

• <i>Goodenia filiformis</i>	P3	(2)
• <i>Stylidium longitubum</i>	P3	(1),(2)

Searches for rare and otherwise significant flora, particularly these six species, and potential habitats (vegetation units and condition) for them were undertaken on the three lots by Arthur Weston and two assistants on 30 September 2004, after first ascertaining that one of the two principal species being searched for, *Caladenia huegelii*, was then in full flower (in the Jandakot area). The other principal species, the *Drakaea*, should have been readily identifiable from its leaves had any of the plants been in the bushland.

For the sake of perspective and comparison, we also searched for the *Caladenia* and others of the six species in the strip of better condition bushland bordering Baldivis road. We found none there.

Habitats (Vegetation)

There is very little remnant native bushland in the three lots, and what is there is patchy and generally in condition of Completely Degraded (to Degraded). The 1:250,000 scale 1980 map (Pinjarra sheet) of System 6 vegetation complexes by Heddle, Loneragan and Havel shows the vegetation of the lots as being in the Karakatta Vegetation Complex – Central and South (49), even though no tuart trees were seen in the vegetation there.

The bushland remaining in the three lots comprises flooded gum woodland in the northeastern part of Lot 979 and patches in the western parts of the three lots of mainly Jarrah (and less Marri) Low Woodland to Low Open Forest, with *Allocasuarina fraseriana* and with areas of *Banksia menziesii* and *Banksia attenuata*. There are also a few trees of *Banksia ilicifolia* and *Xylomelum occidentale*. The understorey has a few native shrubs and herbaceous plants in it, but it is weedy and the larger jarrah trees have been felled. There are a few isolated marri and jarrah trees in the eastern part of Lot 971 that have the native lily *Sowerbaea laxiflora* growing densely under their canopies.

The eastern, low-lying part of Lot 979 has *Eucalyptus rudis* (flooded gum) Woodland to Low Woodland over *Astartea ?affinis* Open to Closed Heath that is in a regeneration phase. The *Astartea* is related to *Astartea fascicularis* but its flowers are smaller and it will grow to become a rigid shrub over 2 m tall with a woody, twisted trunk. The few plants beneath the *Astartea* are in openings and are weeds. There are virtually no other native plants in the understorey.

There were also a few thickets of spearwood (*Kunzea glabrescens*).

Rare or Otherwise Significant Flora

We found no Priority Flora, Declared Rare Flora or Threatened Ecological Communities during our searches, nor did we find habitats, even the spearwood thickets, I thought likely to be suitable for *Caladenia huegelii*, for *Drakaea elastica* or for the other species searched for. The species we found nearest to being Priority Flora was *Cartonema philydroides*, a species which was deleted as Priority Flora several years ago. Several plants of this species were found in eastern parts of Lots 971 and 31.

If you have any question about any aspect of this report, please do not hesitate to phone me.

Sincerely,

Arthur

APPENDIX 4

Acoustics Report (Sept 06)

Noise Impact Assessment

Heritage Park Estate

Adjacent the Future Kwinana Freeway Extension

Prepared For

RPS Bowman Bishaw Gorham
&
Rockingham Park Pty Ltd

September 2006

Reference: 607576-01 draft

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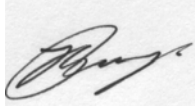
Lloyd
Acoustics



Member of the Association of Australian Acoustical Consultants – (AAAC)

Report: 607576-01 draft

This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd Acoustics Pty Ltd ACN 097 356 093 and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Approved for Issue:	Terry George	
Position:	Project Director	
Date:	6 September 2006	

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1	INTRODUCTION	1
2	DEFINITIONS	2
3	METHODOLOGY	3
3.1.1	Ground Topography, Road Design & Cadastral Data	3
3.1.2	Traffic Data	4
3.1.3	Ground Attenuation	5
3.1.4	Parameter Conversion	5
4	CRITERIA	6
5	RESULTS	7
6	DISCUSSION	21

APPENDICES

- A Proposed Subdivision Layout and Lot Numbers – *Figures A01 and A02*
- B Noise Zoning Map

1 INTRODUCTION

Heritage Park Estate is a proposed subdivision in the suburb of Baldivis, Western Australia. The eastern side of the subdivision abuts the road reserve for the future Kwinana Freeway Extension (between the Safety Bay Road and Karnup Road interchanges) – refer *Figure 1.1* below for general locality map and *Appendix A* for subdivision layout.

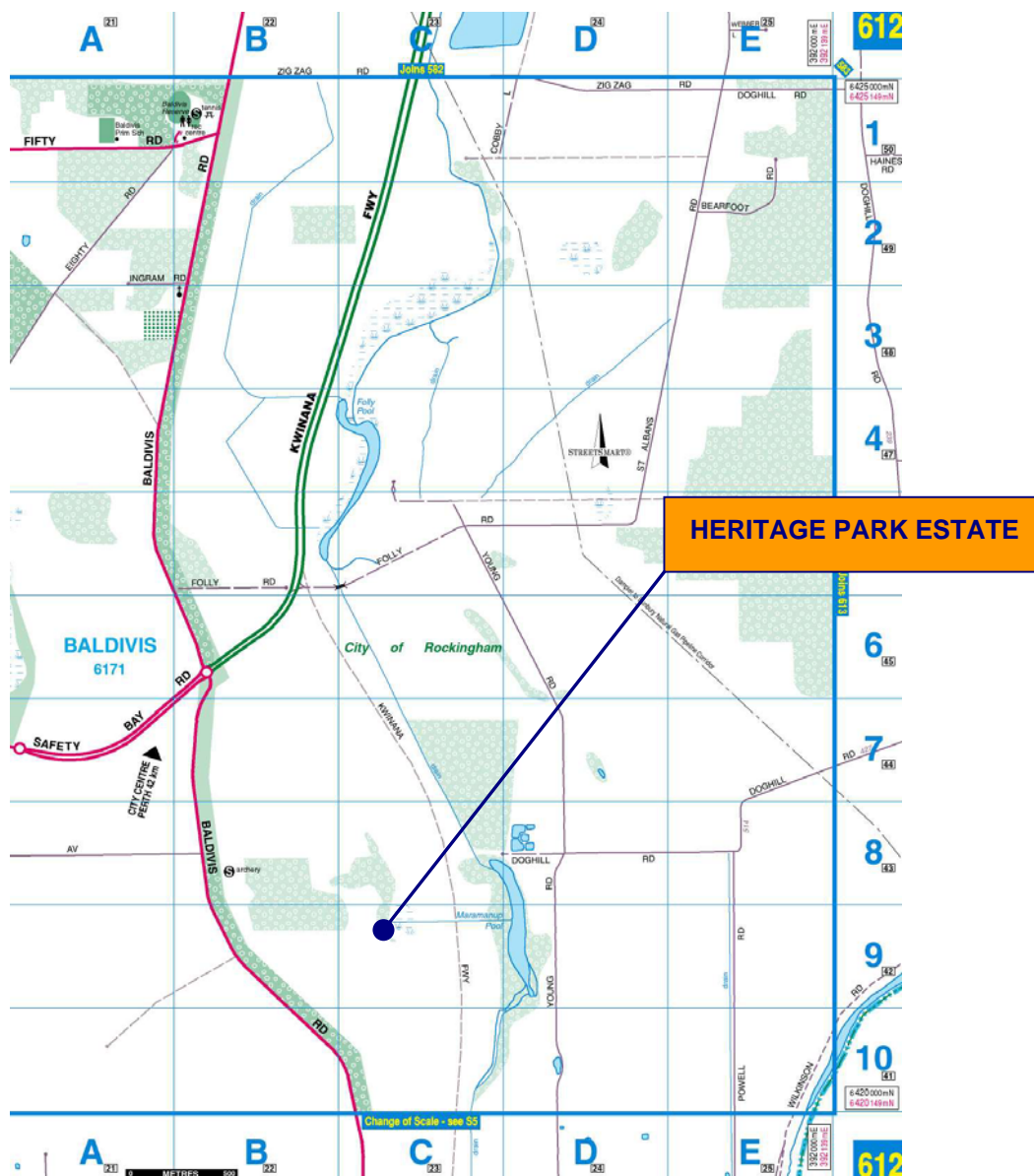


Figure 1.1 – Subdivision Locality

As such, consideration has been given to the noise impact from the future road to the future residences. Determination of the impact and subsequent noise control recommendations has been based on criteria within the Western Australian Planning Commission's (WAPC) draft *Statement of Planning Policy: Road and Rail Transport Noise*.

2 DEFINITIONS

The following is an explanation of the terminology used throughout this report.

a *Decibel*

The decibel (dB) describes the sound pressure level of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

b *A-Weighting*

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound pressure level is described as L_A dB or dB(A).

c L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 per cent of the measurement period and is considered to represent the “intrusive” noise level.

d L_{Aeq}

The L_{Aeq} level represents the A-weighted average noise energy during a measurement period.

e $L_{A10,18hour}$

The $L_{A10,18\text{ hour}}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00 am and midnight. It is this parameter that the noise model calculates.

f $L_{Aeq,8hour}$

The $L_{Aeq,8hour}$ level is the logarithmic average of the hourly L_{Aeq} levels from 10.00 pm to 6.00 am on the same day. This value is determined by converting the calculated $L_{A10,18hour}$ value based on equations involving traffic volumes and percentage heavy vehicles within the respective time periods.

g $L_{Aeq,16hour}$

The $L_{Aeq,16hour}$ level is the logarithmic average of the hourly L_{Aeq} levels from 6.00 am to 10.00 pm on the same day. This value is determined by converting the calculated $L_{A10,18hour}$ value based on equations involving traffic volumes and percentage heavy vehicles within the respective time periods.

3 METHODOLOGY

As the road is yet to be constructed, noise level monitoring at the site has not been undertaken but rather the assessment has relied upon predictive noise modelling.

The computer programme *SoundPLAN 6.1* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- ❑ Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three allows for less barrier attenuation for high level sources. Note that corrections are applied to the exhaust of -8.0 dB (based on *Transportation Noise Reference Book, Paul Nelson, 1987*) and to the engine source of -0.8 dB, required to provide consistent results with the CoRTN algorithms for the no barrier scenario.
- ❑ An adjustment of -1.7 dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at a height of 1.4 metres above ground floor level and at 1.0 metre from the building façade. In line with standard prediction methodology undertaken in Western Australia, the noise above the ground floor, particularly for two storey premises has not been considered.

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc and are discussed below.

3.1.1 Ground Topography, Road Design & Cadastral Data

Noise modelling is 3-dimensional so that landmarks such as hills and buildings are taken into account. The relative levels of the lots have not been finalised, however are currently expected to be at 5.5m for flood requirements. The design of the future road is based on that provided by MRWA to the proponents in the tender phase and may be subject to change by the successful team. Lloyd Acoustics worked with Main Roads Western Australia (MRWA) during the tender phase and therefore had the design information on file.

The noise wall design put to the proponents near this subdivision was 2 metres high (relative to the nearest carriageway) and at a distance of 20 metres from the edge of carriageway. This design was based on achieving Exposure Level 2 (refer *Section 4*) at existing residences, rather than the proposed subdivision. Based on the proposed subdivision layout, it is more logical for the noise wall to be situated on the boundary of the subdivision, thereby forming the rear fence. Thus, for the purposes of this study, the section of MRWA proposed wall adjacent this subdivision has been relocated to the subdivision boundary.

From the proposed road design, *SoundPLAN* calculates the road gradient. A correction is then applied where a carriageway has a positive gradient.

3.1.2 Traffic Data

Traffic data includes:

- Road Surface –

The noise relationship between different road surface types is shown below in *Table 3.1*.

Table 3.1 – Noise Relationship Between Different Road Surfaces

Road Surfaces					
Chip Seal			Asphalt		
14mm	10mm	5mm	Dense Graded	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-1.5 dB	-2.5 dB

The road surface in the area of interest is proposed as being open graded asphalt.

- Vehicle Speed – 100km/hr
- Traffic Volumes –

Table 3.2 – Traffic Volumes and Percentage Heavy Vehicle

Section	Year 2011		Year 2031	
	Day (0600 hours to midnight)	Night (2200 to 0600 hours)	Day (0600 hours to midnight)	Night (2200 to 0600 hours)
Kwinana Freeway - Safety Bay Road to Karnup Road				
Volumes	33725	1775	55670	2930
Percentage Heavy Vehicles	7	16	7	15

Note that since traffic volumes increase through to the Year 2031, only this year has been considered.

3.1.3 Ground Attenuation

The ground attenuation has been assumed to be 0.25 (25%) within the road reserve, 0.5 (50%) throughout the subdivision, except for the public open space which was set to 1.00 (100%) and 0.9 (90%) outside of the subdivision. Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

3.1.4 Parameter Conversion

The CoRTN algorithms were originally developed to calculate the $L_{A10,18\text{hour}}$ noise level. The WAPC draft policy however uses $L_{Aeq,16\text{hour}}$ and $L_{Aeq,8\text{hour}}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). Guidance to the relationship between these parameters has been taken from *Converting the UK Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping*; TRL Limited which provides the following equations:

$$L_{Aeq,Day} = 0.99 \times L_{A10,18\text{hour}} + 10 \log \left(\frac{p_{16} N_{16} V_{16}^2}{p_{18} N_{18} V_{18}^2} \right) - 1.72$$

$$L_{Aeq,Night} = 0.99 \times L_{A10,18\text{hour}} + 10 \log \left(\frac{p_8 N_8 V_8^2}{p_{18} N_{18} V_{18}^2} \right) + 1.75$$

where:

p = percentage heavy vehicles for period

N = total vehicles for time period

V = vehicle speed for time period

It has generally been found that the equation for $L_{Aeq,night}$ over-predicts the noise level difference, such that a 2 dB adjustment has been made to be conservative. Similarly, the $L_{Aeq,Day}$ noise level difference marginally over-predicts, so this value is fixed at 2 dB. The relationships used in the modelling between the three parameters are shown below in Table 3.3.

Table 3.3 – Derived Relationships Between Different Parameters

Road Section	$L_{A10,18\text{hour}} - L_{Aeq,16\text{hour}}$, dB		$L_{Aeq,16\text{hour}} - L_{Aeq,8\text{hour}}$, dB	
	2011	2031	2011	2031
Kwinana Freeway – Safety Bay Road to Karnup Road	2.0	2.0	5.8	6.1

As noted in Section 4 below, the difference between the $L_{Aeq,16\text{hour}}$ and $L_{Aeq,8\text{hour}}$ criteria is 5 dB. Traffic volumes in 2031 are higher than in 2011. Therefore, it is the 2031 daytime noise levels that dictate compliance or otherwise.

4 CRITERIA

The criteria contained within the *Statement of Planning Policy: Road and Rail Transportation Noise* are shown below in *Table 4.1*.

Table 4.1 – External Noise Exposure Level Criteria (dB)

Time Period	Exposure Level 1 (target)	Exposure Level 2	Exposure Level 3
Day (16 hour) 6.00 am to 10.00 pm	Less than L_{Aeq} 55	L_{Aeq} 55-60	Above L_{Aeq} 60
Night (8 hour) 10.00 pm to 6.00 am	Less than L_{Aeq} 50	L_{Aeq} 50-55	Above L_{Aeq} 55
Additional criteria for railways	Less than L_{Amax} 55	L_{Amax} 75-80	Above L_{Amax} 80

Exposure Level 1 (Target) refers to a level of outdoor noise that is considered a desirable target for residential and other noise-sensitive development. It will apply primarily to integrated greenfields planning of road or rail infrastructure and adjoining development. In situations where either infrastructure or residential development is already in existence, achievement of this target may not be practicable.

Where residential or other noise-sensitive development is proposed on a site, which is subject to Exposure Level 1, no action is required under this policy in relation to the management or amelioration of transport noise. However, it needs to be recognised that, because some people are more sensitive to noise than others, a proportion of the population may still be affected by noise which falls within Exposure Level 1.

Exposure Level 2 refers to a level of outdoor noise exposure that would be acceptable for residential and other noise-sensitive development, subject to appropriate measures to ameliorate noise impact.

For road or rail infrastructure with a noise exposure level in this range, new noise sensitive development should be designed and constructed so as to comply with:

- ❑ The 'target' Exposure Level 1 for required outdoor living areas; and
- ❑ The 'satisfactory' criteria under Australian Standard 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*, for indoor areas.

Exposure Level 2 generally represents the maximum noise exposure for proposed new road or rail infrastructure and noise-sensitive development on land adjoining such infrastructure, but may not be practicable for many of the existing major road and rail corridors.

Exposure Level 3 refers to a level of outdoor noise exposure that is not generally regarded as acceptable for conventional residential or other noise-sensitive development.

For new or upgraded roads and railways where the predicted noise levels are in this range at nearby noise-sensitive sites, noise management measures in conjunction with the new or upgraded infrastructure are mandatory, with the objective of achieving Exposure Level 2 or better.

For existing road or rail infrastructure with a noise exposure level in this range, new noise sensitive development should where practicable, be designed and constructed so as to comply with:

- ❑ The 'target' Exposure Level 1 for required outdoor living areas; and
- ❑ The 'satisfactory' criteria under Australian Standard 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*, for indoor areas.

In determining the practicability of compliance with the criteria, it needs to be recognised that a significantly higher level of noise attenuation would generally be required for sites affected by Exposure Level 3 compared to Exposure Level 2. Accordingly, it may not always be practicable to achieve compliance with the criteria, although special attention should be given to meeting the indoor standards.

The implementation of noise control measures is determined to be reasonable and practicable with reference to:

- ❑ The effectiveness of the proposed measure(s) including a comparison of predicted noise levels with or without the specified measure(s);
- ❑ The estimated cost of the measure(s) and, if applicable, the distribution of such costs between the owner/developer and the agency responsible for the relevant transport infrastructure;
- ❑ The amenity impacts of the measure(s) including appearance, access, surveillance and security, landscape/streetscape, vegetation etc;
- ❑ Traffic safety; and
- ❑ Community acceptance.
- ❑ Practicability of proposed amelioration measure(s) also requires that there are no unreasonable physical, legal or financial impediments to their implementation.

5 RESULTS

The results of the noise modelling are shown below in *Table 5.1*. These present the predicted 2031 noise levels for a boundary noise wall ranging in height from 2.5 to 4.0 metres. Note that the proposed MRWA walls either side of this development are also included in the calculations.

Table 5.1 – Predicted 2031 Noise Levels

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 82	N	52.2	46.1	52.2	46.1	52.2	46.1	52.2	46.1
Lot 83	N	52.3	46.2	52.3	46.2	52.3	46.2	52.3	46.2
Lot 84	N	52.5	46.4	52.5	46.4	52.5	46.4	52.5	46.4
Lot 85	N	52.6	46.5	52.6	46.5	52.6	46.5	52.6	46.5
Lot 86	N	52.9	46.8	52.9	46.8	52.9	46.8	52.8	46.7
Lot 87	N	53.2	47.1	53.2	47.1	53.2	47.1	53.2	47.1
Lot 88	N	53.3	47.2	53.3	47.2	53.3	47.2	53.3	47.2
Lot 89	N	53.5	47.4	53.5	47.4	53.5	47.4	53.5	47.4
Lot 90	N	53.7	47.6	53.7	47.6	53.7	47.6	53.7	47.6
Lot 91	N	54.0	47.9	54.0	47.9	54.0	47.9	53.9	47.8
Lot 92	N	54.4	48.3	54.4	48.3	54.4	48.3	54.3	48.2
Lot 93	N	54.6	48.5	54.6	48.5	54.5	48.4	54.5	48.4
Lot 94	N	54.8	48.7	54.7	48.6	54.7	48.6	54.7	48.6
Lot 95	N	55.0	48.9	55.0	48.9	55.0	48.9	54.9	48.8
Lot 96	N	55.3	49.2	55.3	49.2	55.3	49.2	55.2	49.1

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 157 & Co	E	52.8	46.7	52.8	46.7	52.7	46.6	52.5	46.4
Lot 166	E	55.1	49.0	55.1	49.0	54.7	48.6	54.1	48.0
Lot 168	E	55.2	49.1	55.2	49.1	54.8	48.7	54.3	48.2
Lot 170	E	55.2	49.1	55.1	49.0	54.8	48.7	54.3	48.2
Lot 172	E	54.9	48.8	54.8	48.7	54.6	48.5	54.1	48.0
Lot 175	E	54.9	48.8	54.9	48.8	54.7	48.6	54.2	48.1
Lot 176	N	55.9	49.8	55.9	49.8	55.9	49.8	55.8	49.7
Lot 177	N	56.2	50.1	56.2	50.1	56.2	50.1	56.1	50.0
Lot 178	N	56.5	50.4	56.5	50.4	56.5	50.4	56.4	50.3
Lot 180	E	54.7	48.6	54.7	48.6	54.6	48.5	54.4	48.3
Lot 182	E	54.9	48.8	54.9	48.8	54.8	48.7	54.4	48.3
Lot 186	S	54.2	48.1	54.1	48.0	53.8	47.7	53.3	47.2
Lot 189	S	54.7	48.6	54.7	48.6	54.4	48.3	53.8	47.7
Lot 191	E	57.1	51.0	57.0	50.9	56.8	50.7	56.1	50.0
Lot 191	S	55.1	49.0	55.1	49.0	54.9	48.8	54.2	48.1
Lot 191	E	57.3	51.2	57.2	51.1	57.0	50.9	56.3	50.2

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 193	E	57.2	51.1	57.1	51.0	57.0	50.9	56.3	50.2
Lot 196	E	57.6	51.5	57.5	51.4	57.3	51.2	56.8	50.7
Lot 197	N	56.8	50.7	56.8	50.7	56.8	50.7	56.7	50.6
Lot 198	E	58.0	51.9	57.9	51.8	57.8	51.7	57.4	51.3
Lot 198	N	57.2	51.1	57.1	51.0	57.1	51.0	57.0	50.9
Lot 199	E	59.9	53.8	59.0	52.9	58.1	52.0	57.2	51.1
Lot 200	E	60.4	54.3	59.5	53.4	58.6	52.5	57.7	51.6
Lot 201	E	60.7	54.6	59.7	53.6	58.8	52.7	57.9	51.8
Lot 202	E	60.8	54.7	59.8	53.7	58.9	52.8	58.0	51.9
Lot 203	E	60.9	54.8	59.9	53.8	58.9	52.8	58.1	52.0
Lot 204	E	61.0	54.9	60.0	53.9	59.0	52.9	58.1	52.0
Lot 205	E	61.0	54.9	60.0	53.9	59.0	52.9	58.1	52.0
Lot 206	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0
Lot 207	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0
Lot 208	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0
Lot 209	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 210	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0
Lot 211	E	60.9	54.8	59.9	53.8	59.0	52.9	58.1	52.0
Lot 212	E	60.9	54.8	59.9	53.8	58.9	52.8	58.1	52.0
Lot 213	E	60.9	54.8	59.9	53.8	58.9	52.8	58.0	51.9
Lot 214	E	60.9	54.8	59.8	53.7	58.9	52.8	58.0	51.9
Lot 215	S	58.8	52.7	57.9	51.8	57.1	51.0	56.4	50.3
Lot 215	E	61.1	55.0	60.0	53.9	59.0	52.9	58.0	51.9
Lot 216	E	57.1	51.0	57.0	50.9	56.9	50.8	56.2	50.1
Lot 216 & Co	S	54.0	47.9	53.9	47.8	53.7	47.6	53.2	47.1
Lot 216 & Co	N	54.7	48.6	54.6	48.5	54.4	48.3	53.9	47.8
Lot 223	E	55.0	48.9	55.0	48.9	54.8	48.7	54.3	48.2
Lot 226	S	54.9	48.8	54.6	48.5	54.1	48.0	53.6	47.5
Lot 228	N	53.9	47.8	53.8	47.7	53.6	47.5	53.2	47.1
Lot 229	S	55.9	49.8	55.5	49.4	55.1	49.0	54.5	48.4
Lot 230	E	57.2	51.1	57.0	50.9	56.9	50.8	56.2	50.1
Lot 231	E	57.2	51.1	57.0	50.9	56.8	50.7	56.2	50.1

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 235	E	55.5	49.4	55.3	49.2	54.9	48.8	54.2	48.1
Lot 276	E	52.1	46.0	52.1	46.0	52.0	45.9	51.7	45.6
Lot 276 & Co	N	52.0	45.9	52.0	45.9	51.7	45.6	51.4	45.3
Lot 276 & Co.	S	51.6	45.5	51.4	45.3	51.1	45.0	50.7	44.6
Lot 277	E	55.7	49.6	55.4	49.3	54.9	48.8	54.3	48.2
Lot 277	S	54.0	47.9	53.7	47.6	53.2	47.1	52.7	46.6
Lot 299	E	55.2	49.1	55.0	48.9	54.6	48.5	54.0	47.9
Lot 300	E	55.2	49.1	55.0	48.9	54.6	48.5	54.0	47.9
Lot 302 & Co.	E	52.3	46.2	52.3	46.2	52.3	46.2	52.1	46.0
Lot 306 & Co.	E	52.8	46.7	52.8	46.7	52.7	46.6	52.4	46.3
Lot 310 & Co.	E	52.8	46.7	52.7	46.6	52.6	46.5	52.4	46.3
Lot 313	E	55.3	49.2	55.1	49.0	54.6	48.5	54.0	47.9
Lot 314	E	55.3	49.2	55.0	48.9	54.6	48.5	54.0	47.9
Lot 315	E	55.3	49.2	55.0	48.9	54.6	48.5	54.0	47.9
Lot 316	E	55.2	49.1	55.0	48.9	54.5	48.4	53.9	47.8
Lot 317	E	55.1	49.0	54.9	48.8	54.4	48.3	53.8	47.7

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 318	E	55.0	48.9	54.9	48.8	54.4	48.3	53.8	47.7
Lot 319	E	54.9	48.8	54.9	48.8	54.4	48.3	53.7	47.6
Lot 325	S	53.6	47.5	53.4	47.3	53.1	47.0	52.6	46.5
Lot 326	N	54.7	48.6	54.4	48.3	54.0	47.9	53.5	47.4
Lot 327	N	55.1	49.0	54.8	48.7	54.3	48.2	53.8	47.7
Lot 328	S	54.0	47.9	53.8	47.7	53.5	47.4	53.0	46.9
Lot 329	S	54.5	48.4	54.2	48.1	53.9	47.8	53.5	47.4
Lot 330	N	55.6	49.5	55.2	49.1	54.7	48.6	54.2	48.1
Lot 331	N	56.1	50.0	55.6	49.5	55.2	49.1	54.5	48.4
Lot 332	S	55.2	49.1	54.8	48.7	54.5	48.4	54.0	47.9
Lot 333	S	56.1	50.0	55.7	49.6	55.2	49.1	54.6	48.5
Lot 333	E	58.8	52.7	58.1	52.0	57.6	51.5	56.8	50.7
Lot 334	N	57.0	50.9	56.4	50.3	55.9	49.8	55.2	49.1
Lot 334	E	59.1	53.0	58.4	52.3	57.8	51.7	57.0	50.9
Lot 335	N	53.8	47.7	53.6	47.5	53.2	47.1	52.8	46.7
Lot 336	N	54.0	47.9	53.8	47.7	53.4	47.3	53.0	46.9

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 337	N	54.5	48.4	54.1	48.0	53.8	47.7	53.3	47.2
Lot 338	N	55.0	48.9	54.6	48.5	54.2	48.1	53.7	47.6
Lot 339	N	55.6	49.5	55.1	49.0	54.7	48.6	54.2	48.1
Lot 340	N	56.4	50.3	55.8	49.7	55.2	49.1	54.7	48.6
Lot 341	N	57.0	50.9	56.4	50.3	55.9	49.8	55.2	49.1
Lot 342	S	54.1	48.0	53.8	47.7	53.4	47.3	52.9	46.8
Lot 343	S	54.3	48.2	54.0	47.9	53.6	47.5	53.1	47.0
Lot 344	S	54.6	48.5	54.4	48.3	54.0	47.9	53.4	47.3
Lot 345	S	55.0	48.9	54.7	48.6	54.2	48.1	53.7	47.6
Lot 346	S	55.2	49.1	54.9	48.8	54.5	48.4	53.9	47.8
Lot 347	S	55.4	49.3	55.0	48.9	54.6	48.5	54.1	48.0
Lot 348	S	55.7	49.6	55.3	49.2	54.9	48.8	54.4	48.3
Lot 349	S	56.3	50.2	55.9	49.8	55.4	49.3	54.8	48.7
Lot 350	E	61.0	54.9	59.9	53.8	58.9	52.8	58.0	51.9
Lot 351	E	60.7	54.6	59.8	53.7	58.8	52.7	57.9	51.8
Lot 352	E	60.9	54.8	59.9	53.8	58.9	52.8	58.0	51.9

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 359	N	52.9	46.8	52.7	46.6	52.3	46.2	51.9	45.8
Lot 359 & Co.	E	54.7	48.6	54.6	48.5	54.2	48.1	53.5	47.4
Lot 415	E	54.2	48.1	54.1	48.0	53.8	47.7	53.4	47.3
Lot 422	SE	54.2	48.1	54.1	48.0	53.7	47.6	53.3	47.2
Lot 436	E	53.8	47.7	53.7	47.6	53.4	47.3	53.1	47.0
Lot 438	E	53.7	47.6	53.6	47.5	53.3	47.2	52.9	46.8
Lot 439	SE	53.8	47.7	53.7	47.6	53.3	47.2	53.0	46.9
Lot 444	E	54.2	48.1	54.1	48.0	53.9	47.8	53.6	47.5
Lot 444	S	52.4	46.3	52.4	46.3	52.4	46.3	52.3	46.2
Lot 445	S	52.0	45.9	52.0	45.9	52.0	45.9	52.0	45.9
Lot 446	S	51.8	45.7	51.8	45.7	51.8	45.7	51.8	45.7
Lot 447	S	51.6	45.5	51.6	45.5	51.6	45.5	51.5	45.4
Lot 448	S	53.8	47.7	53.8	47.7	53.8	47.7	53.8	47.7
Lot 450	S	53.9	47.8	53.9	47.8	53.9	47.8	53.8	47.7
Lot 451	S	54.9	48.8	54.9	48.8	54.9	48.8	54.9	48.8
Lot 451	E	56.5	50.4	56.5	50.4	56.4	50.3	56.1	50.0

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 454	N	53.7	47.6	53.6	47.5	53.3	47.2	52.8	46.7
Lot 454	E	55.9	49.8	55.9	49.8	55.7	49.6	55.3	49.2
Lot 457	N	52.9	46.8	52.8	46.7	52.4	46.3	52.0	45.9
Lot 462	SE	53.9	47.8	53.8	47.7	53.6	47.5	53.3	47.2
Lot 464	SE	53.9	47.8	53.8	47.7	53.5	47.4	53.2	47.1
Lot 466	E	55.7	49.6	55.7	49.6	55.5	49.4	55.0	48.9
Lot 466	E	55.8	49.7	55.8	49.7	55.6	49.5	55.0	48.9
Lot 466 & Co.	S	53.9	47.8	53.8	47.7	53.4	47.3	52.9	46.8
Lot 477	E	55.7	49.6	55.7	49.6	55.6	49.5	54.9	48.8
Lot 477 & Co	N	53.3	47.2	53.2	47.1	52.9	46.8	52.4	46.3
Lot 480	E	53.4	47.3	53.4	47.3	53.3	47.2	53.1	47.0
Lot 483	E	53.6	47.5	53.6	47.5	53.6	47.5	53.4	47.3
Lot 486	E	53.9	47.8	53.9	47.8	53.9	47.8	53.7	47.6
Lot 489	N	53.9	47.8	53.8	47.7	53.4	47.3	52.9	46.8
Lot 490	N	54.1	48.0	53.9	47.8	53.5	47.4	53.0	46.9
Lot 491	N	54.1	48.0	54.0	47.9	53.7	47.6	53.1	47.0

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 492	N	54.3	48.2	54.2	48.1	53.8	47.7	53.3	47.2
Lot 493	E	55.9	49.8	55.9	49.8	55.7	49.6	55.1	49.0
Lot 493	N	54.4	48.3	54.4	48.3	54.0	47.9	53.5	47.4
Lot 494	E	55.9	49.8	55.9	49.8	55.6	49.5	55.0	48.9
Lot 497	E	55.8	49.7	55.8	49.7	55.6	49.5	54.9	48.8
Lot 498	E	56.0	49.9	55.9	49.8	55.6	49.5	54.9	48.8
Lot 501	E	55.9	49.8	55.9	49.8	55.6	49.5	55.0	48.9
Lot 504	E	55.8	49.7	55.8	49.7	55.6	49.5	55.0	48.9
Lot 504 & Co	N	52.3	46.2	52.3	46.2	52.2	46.1	51.9	45.8
Lot 504 & Co.	S	53.1	47.0	53.1	47.0	52.8	46.7	52.3	46.2
Lot 505	N	55.6	49.5	55.2	49.1	54.8	48.7	54.3	48.2
Lot 506	N	56.6	50.5	56.1	50.0	55.6	49.5	55.4	49.3
Lot 507	E	57.3	51.2	57.0	50.9	56.7	50.6	56.2	50.1
Lot 508	E	61.0	54.9	59.9	53.8	58.9	52.8	58.0	51.9
Lot 509	E	60.8	54.7	59.8	53.7	58.8	52.7	58.0	51.9
Lot 510	E	57.5	51.4	57.2	51.1	56.9	50.8	56.4	50.3

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 511	E	57.4	51.3	57.2	51.1	56.9	50.8	56.2	50.1
Lot 512	E	57.4	51.3	57.2	51.1	56.9	50.8	56.3	50.2
Lot 513	E	57.4	51.3	57.2	51.1	56.9	50.8	56.3	50.2
Lot 514	E	60.7	54.6	59.7	53.6	58.8	52.7	57.9	51.8
Lot 515	E	60.8	54.7	59.8	53.7	58.8	52.7	57.9	51.8
Lot 516	E	57.5	51.4	57.2	51.1	57.0	50.9	56.3	50.2
Lot 517	E	57.5	51.4	57.2	51.1	57.0	50.9	56.3	50.2
Lot 518	E	57.5	51.4	57.2	51.1	57.0	50.9	56.3	50.2
Lot 519	E	57.5	51.4	57.3	51.2	57.0	50.9	56.3	50.2
Lot 520	E	60.8	54.7	59.8	53.7	58.8	52.7	57.9	51.8
Lot 521	E	60.8	54.7	59.8	53.7	58.8	52.7	57.9	51.8
Lot 522	E	57.5	51.4	57.2	51.1	57.0	50.9	56.5	50.4
Lot 523	E	57.5	51.4	57.3	51.2	57.0	50.9	56.5	50.4
Lot 524	E	57.5	51.4	57.3	51.2	57.0	50.9	56.4	50.3
Lot 525	E	57.5	51.4	57.3	51.2	57.0	50.9	56.6	50.5
Lot 526	E	60.8	54.7	59.7	53.6	58.8	52.7	57.9	51.8

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 527	E	60.8	54.7	59.7	53.6	58.7	52.6	57.8	51.7
Lot 528	E	57.5	51.4	57.3	51.2	57.0	50.9	56.6	50.5
Lot 529	E	57.6	51.5	57.3	51.2	57.0	50.9	56.5	50.4
Lot 530	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 531	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 532	E	60.7	54.6	59.7	53.6	58.7	52.6	57.8	51.7
Lot 533	E	60.8	54.7	59.7	53.6	58.7	52.6	57.8	51.7
Lot 534	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 535	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 536	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 537	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 538	E	60.8	54.7	59.7	53.6	58.7	52.6	57.7	51.6
Lot 539	E	60.7	54.6	59.7	53.6	58.7	52.6	57.8	51.7
Lot 540	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 541	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 542	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 543	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5

Lot No.	Side of House	2.5m High Boundary Wall		3.0m High Boundary Wall		3.5m High Boundary Wall		4.0m High Boundary Wall	
		L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB	L _{Aeq,16hour} , dB	L _{Aeq,8hour} , dB
Lot 544	E	60.7	54.6	59.7	53.6	58.7	52.6	57.8	51.7
Lot 545	E	60.7	54.6	59.6	53.5	58.7	52.6	57.8	51.7
Lot 546	E	57.6	51.5	57.3	51.2	57.0	50.9	56.6	50.5
Lot 547	E	57.5	51.4	57.3	51.2	57.0	50.9	56.6	50.5
Lot 548	E	57.5	51.4	57.3	51.2	57.0	50.9	56.7	50.6
Lot 549	E	57.5	51.4	57.2	51.1	56.9	50.8	56.6	50.5
Lot 550	E	60.6	54.5	59.6	53.5	58.6	52.5	57.8	51.7
Lot 551	E	60.4	54.3	59.4	53.3	58.5	52.4	57.8	51.7
Lot 552	E	57.3	51.2	57.1	51.0	56.8	50.7	56.5	50.4
Lot 553	E	57.1	51.0	56.9	50.8	56.7	50.6	56.4	50.3
Lot 554	S	56.0	49.9	55.9	49.8	55.9	49.8	55.9	49.8
Lot 555	S	56.6	50.5	56.6	50.5	56.5	50.4	56.5	50.4
Lot 556	E	60.3	54.2	59.7	53.6	59.1	53.0	58.6	52.5
Lot 556	S	57.8	51.7	57.8	51.7	57.7	51.6	57.7	51.6

Notes:

- Noise levels within the EL1 range are shaded green, noise levels within the EL2 range are shaded orange and noise levels within the EL3 range are shaded blue.

6 DISCUSSION

The WAPC draft Policy requires noise levels, as a minimum, to be within Exposure Level 2, being less than 60 dB $L_{Aeq,16hour}$ and 55 dB $L_{Aeq,8hour}$. Where practicable, noise levels are to be within the Exposure Level 1 range, being less than 55 dB $L_{Aeq,16hour}$ and 50 dB $L_{Aeq,8hour}$. From *Table 5.1* above, it is evident that even with a 4 metre high barrier (considered to be the highest practicable barrier forming a residential boundary wall), the Exposure Level 1 target cannot be achieved at all future residences.

It is therefore considered that the minimum objective of this study is to satisfy Exposure Level 2 in the Year 2031. Furthermore, any houses within Exposure Level 2 (refer *Appendix B*) will need to be built to a higher acoustic standard, referred to as quiet house design, to satisfy acceptable internal noise levels.

Thus, the following is recommended:

- ❑ A wall be constructed that has no gaps, is 3.0 metres in height (relative to the assumed lot level of 5.5m) and has a surface mass of at least 15kg/m²;
- ❑ Memorials placed on all titles of lots within Exposure Level 2 and prospective purchasers advised of quiet house design requirements and likely cost implications;
- ❑ Houses within Exposure Level 2 are to be constructed using quiet house design principles consisting of:
 - Double brick or concrete construction;
 - Awning style windows with 6.38mm laminated glass to habitable rooms (including kitchens). Window sizes to be as small as practicable;
 - External doors to be solid timber with frame and bottom acoustic seals and glass thickness as noted above;
 - Preference should be given to hinged doors, however any sliding door to be equivalent to Boral Window Systems sliding door fitted with Q-Lon 69650 seals with a D9652 sump sill;
 - Ceiling to be insulated;
 - Eaves enclosed;
 - Forced ventilation installed to allow windows to remain closed, noting that the ventilation itself may require acoustic treatment;
 - Consider locating non-noise-sensitive rooms closest to the Freeway (e.g. bathrooms, laundries, toilets, storage, carport);
 - Wet area windows are not to have any fixed openings;
 - Outdoor entertaining areas to be shielded by the house by either being on the western side or in an alcove on the northern or southern sides; and
 - Multiple storey dwellings are not recommended but if proposed, these dwellings will require a specific acoustic assessment, particularly to the upper floor, which does not receive the full benefit of the boundary wall.

The final point above notes that a multiple storey dwelling must have a specific acoustic assessment undertaken. This assessment is to be done by a suitably qualified acoustic consultant who is a member of the Australian Acoustical Society and/or Association of Australian Acoustical Consultants. The requirement for the assessment will need to be enforced by the local authority.

Similarly, there may be some benefit in an owner of a proposed single storey dwelling within Exposure Level 2 having an acoustic assessment undertaken. Such an assessment may show that based on the design of the proposed dwelling, the quiet house design principles nominated above can be relaxed or alternatively if the owner is sensitive to noise, the assessment can provide options to improve the acoustic amenity rather than just satisfying the minimum requirements.

APPENDIX A

Proposed Subdivision Layout and Lot Numbers

Figures A01 and A02

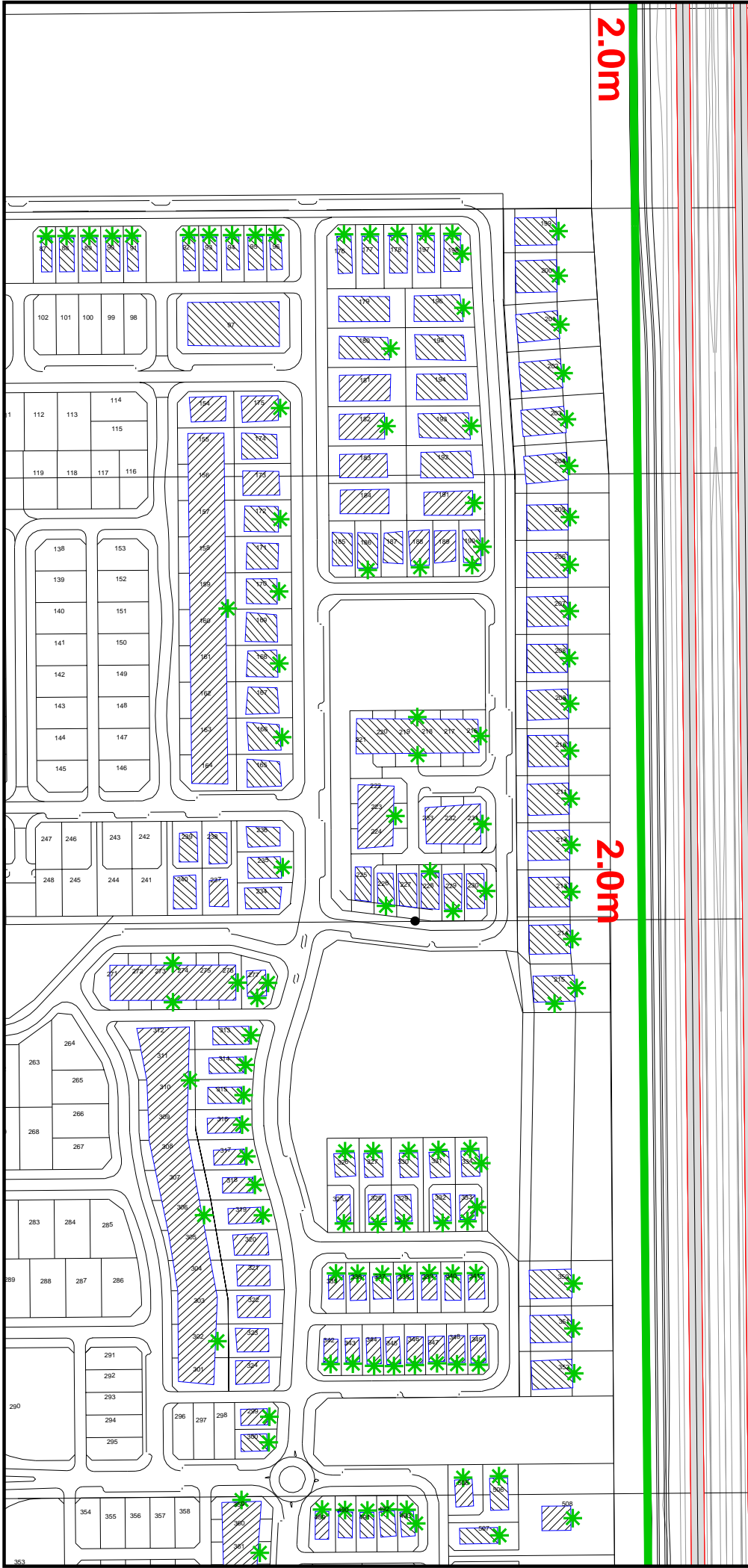


FIGURE A01

**HERITAGE PARK
PROPOSED
SUBDIVISION
(North)**

**SHOWN WITH
CURRENT MRWA
NOISE WALL
DESIGN**

**Wall heights
relative to height of
nearest lane.**

**Main road surface is
open graded asphalt**

**Walls are 20m from
nearest lane.**

Job No. 607576
Client: RPS BBG
Project Engineer: TG



Signs and symbols

- Building
- Receiver
- Road Source
- Road Design
- Change of Height
- Wall



Length scale 1:3000



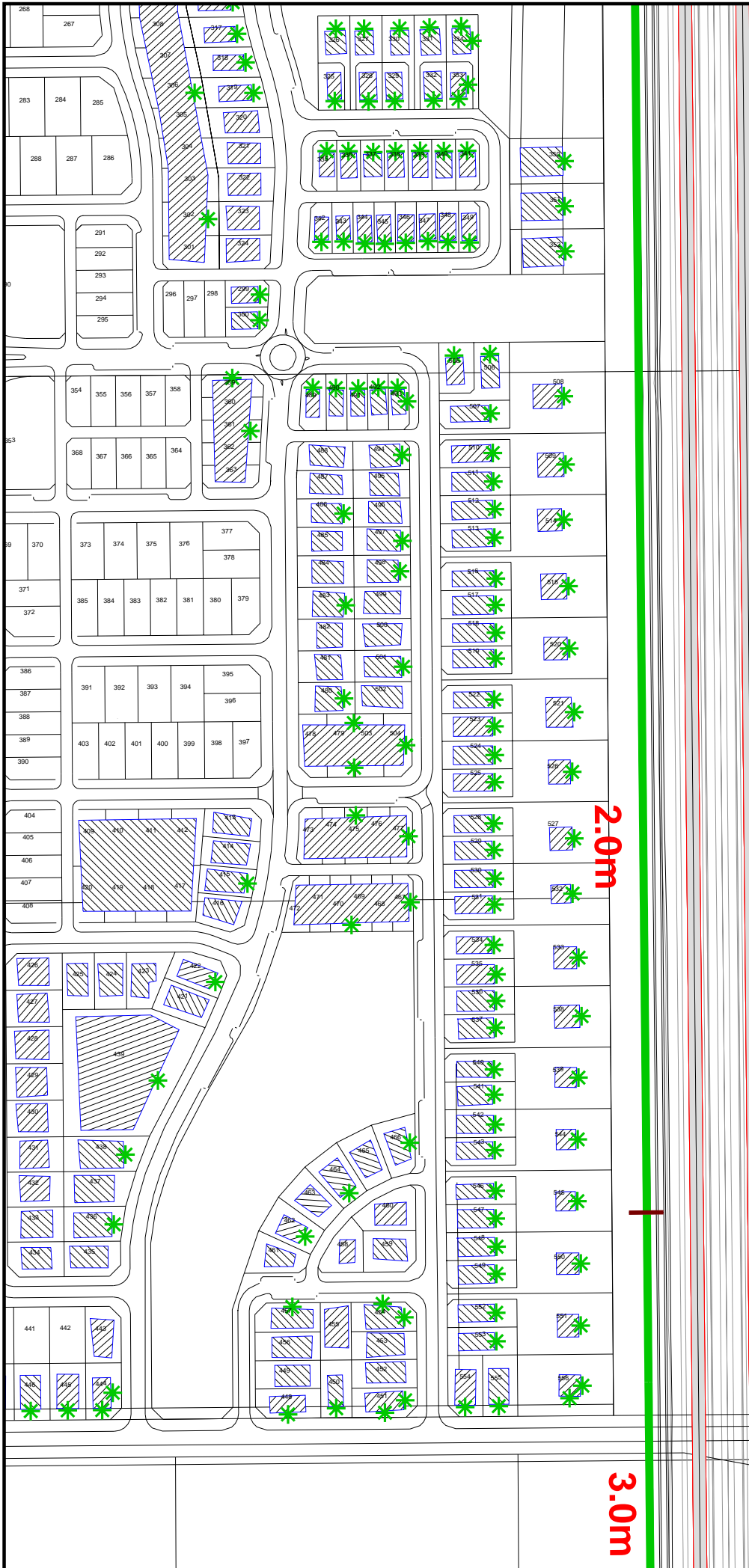


FIGURE A02

**HERITAGE PARK
PROPOSED
SUBDIVISION
(South)**

**SHOWN WITH
CURRENT MRWA
NOISE WALL
DESIGN**

**Wall heights
relative to height of
nearest lane.**

**Main road surface is
open graded asphalt**

**Walls are 20m from
nearest lane.**

Job No. 607576
Client: RPS BBG
Project Engineer: TG

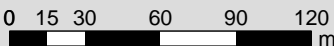


Signs and symbols

- Building
- Receiver
- Road Source
- Road Design
- Change of Height
- Wall



Length scale 1:3000



APPENDIX B

Noise Zoning Map

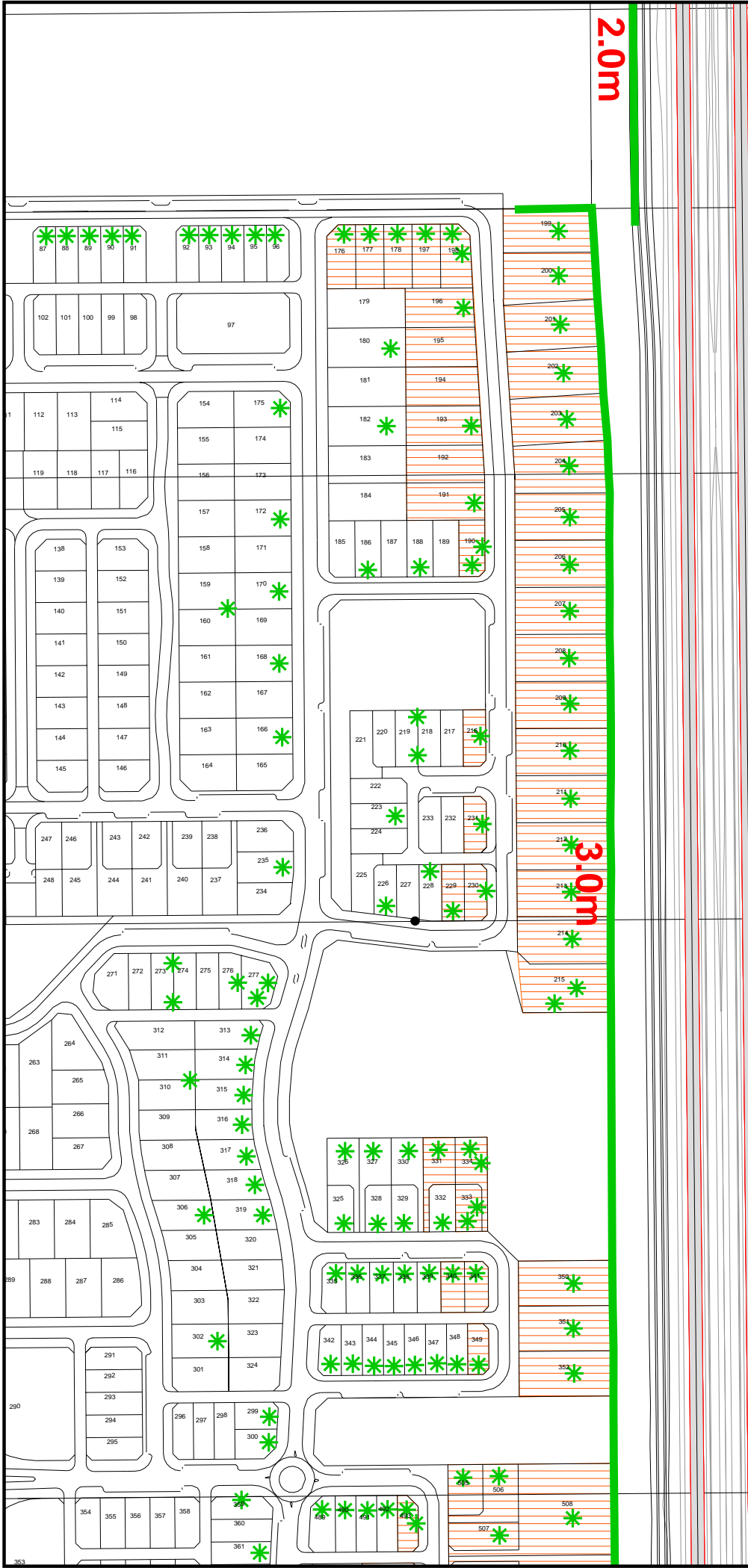


FIGURE B01

**HERITAGE PARK
PROPOSED
SUBDIVISION
(North)**

**SHOWN WITH
PROPOSED 3m HIGH
NOISE WALL ON
SUBDIVISION
BOUNDARY**

**Boundary wall height
relative to assumed
lot level of 5.5m.**

**Main road surface is
open graded asphalt.**

**(Assumed buildings
removed for clarity)**

Job No. 607576
Client: RPS BBG
Project Engineer: TG



Signs and symbols

- Building
- Receiver
- Road Source
- Road Design
- Change of Height
- Wall
- Lot in Exposure Level 2



Length scale 1:3000

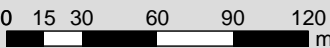


FIGURE B02

**HERITAGE PARK
PROPOSED
SUBDIVISION
(South)**

**SHOWN WITH
PROPOSED 3m HIGH
NOISE WALL ON
SUBDIVISION
BOUNDARY**

**Boundary wall height
relative to assumed
lot level of 5.5m.**

**Main road surface is
open graded asphalt.**

**(Assumed buildings
removed for clarity)**

Job No. 607576
Client: RPS BBG
Project Engineer: TG

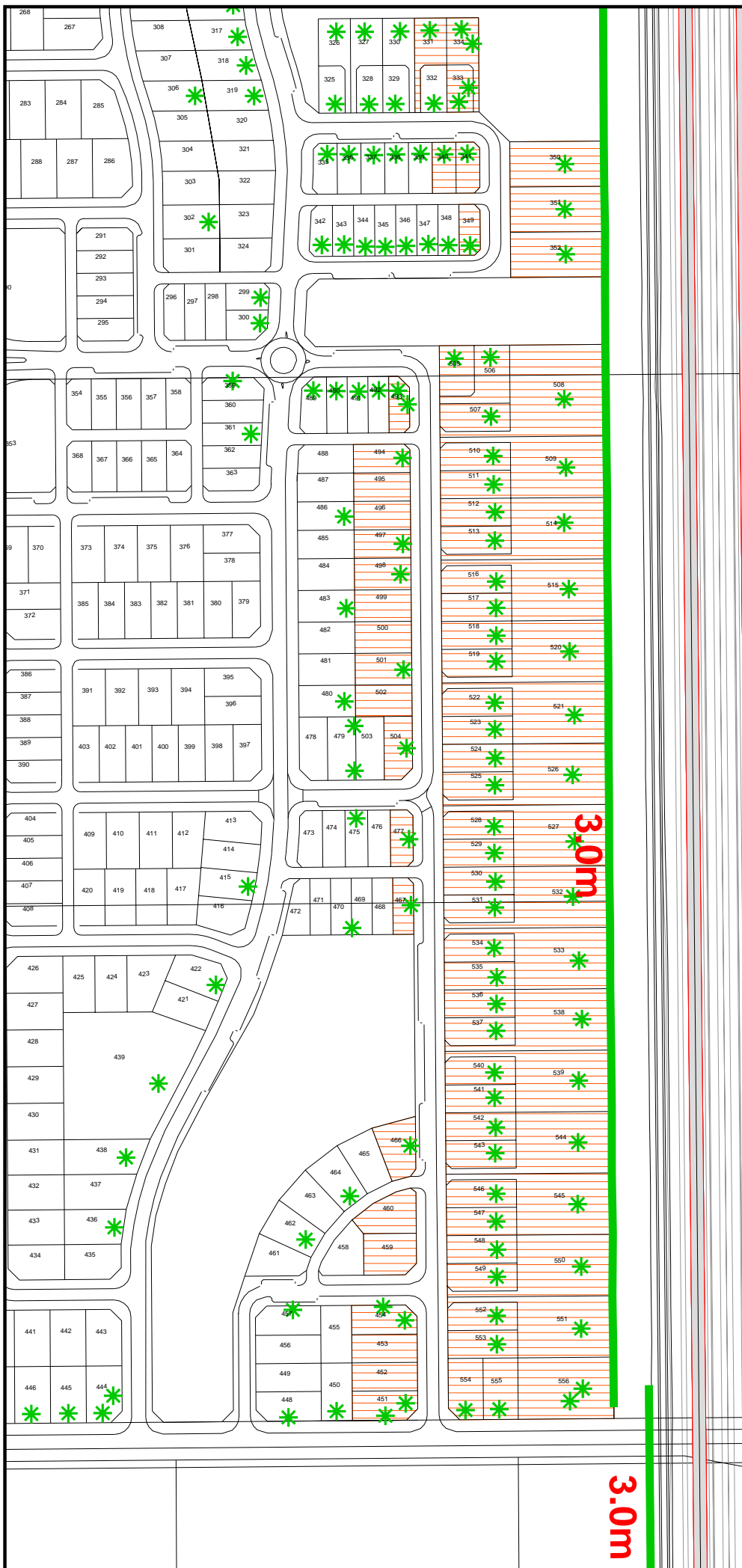


Signs and symbols

-  Building
-  Receiver
-  Road Source
-  Road Design
-  Change of Height
-  Wall
-  Lot in Exposure Level 2




Length scale 1:3000





APPENDIX 5

Indicative POS Layout



 APPLICATION AREA

 DRAINAGE

 POTENTIAL PLAY SPACE

PROJECT

Indicative Public Open Space Layout

HERITAGE PARK ESTATE - LOTS 31, 971 & 979 BALDIVIS ROAD

BALDIVIS

CLIENT	ROCKINGHAM PARK PTY LTD	DATE	22/06/2007
PLAN NUMBER	03/108/	SCALE	1:4000 @ A3
DESIGNED BY	PF	CHECKED BY	PF
		DRAWN BY	18

20m 0 20 40 60 80 100m

ALL AREAS AND DIMENSIONS DISPLAYED ARE SUBJECT TO DEMO SURVEY.

 **TAYLOR BURRELL BARNETT**

Town Planning and Design

187 Roberts Road Subiaco
Western Australia 6008
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APPENDIX 6

SKM Engineering Report

Sinclair Knight Merz
7th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
Perth WA 6001 Australia

Tel: +61 8 9268 4400
Fax: +61 8 9268 4488
Web: www.skmconsulting.com

Mr Peter Fitzgerald
Taylor Burrell Barnett
Town Planning and Design
187 Roberts Road
SUBIACO WA 6008

20 Mar. 07

L02jktRevisedServicingReport120307PF.doc
DE3095

Dear Peter,

***LOTS 31, 971, 979 BALDIVIS ROAD, BALDIVIS
ENGINEERING SERVICES AND DEVELOPMENT ISSUES***

Further to your request, Sinclair Knight Merz (SKM) are pleased to provide a servicing advice report to be included in the revised subdivision plan for the proposed residential development of the above landholding (Heritage Park Estate) yielding approximately 352 residential lots. The subject site is generally bounded by Baldivis Road to the west, proposed Peel Deviation reserve to the east, and private lots to the north and south. The development is based upon a subdivision plan provided by Isla Fisher of Taylor Burrell Barnett dated 8 August 2006 (TBB ref 03/108/008B).

The following sections discuss the servicing strategies and assumptions used in the preliminary SKM project feasibility report dated 2005.

EARTHWORKS

The subject site can be described as generally flat based upon public domain contour information provided on the MGA Town Planners documentation, falling from approximately 10mAHd at the north western corner of lot 971, to approximately 5mAHd to the south east of lot 979.

At the time of preparing this report, geotechnical investigation has been undertaken for the extent of the landholding, with the exception of the previous rural buffer zone, located adjacent to the proposed freeway reserve. The geotechnical report indicated the site is predominantly sand and all material on the site is suitable for use in residential development. Based upon anecdotal information, it is assumed that the eastern portion of the site consists of similar material and is also be suitable for residential development.

The Water & Rivers Commission Perth Groundwater Atlas indicates that the AAMGL varies from 6mAHd along Baldivis Road to Approximately 4mADH along the eastern side of the landholding. The groundwater flow is generally from west to east. The 100 year flood level for the Serpentine Main Drain System also provides another constraint for constructed lot levels within the proposed development. Information provided by The Department of Water indicated this level is in the order of 4mADH along the development boundary.

The existing contours allow for a reshaping of the site to provide a minimum separation of 1.2 metres from the proposed house pads to the AAMGL and Main Drain 100 year flood level without the need for the importation of clean fill material. It is proposed to provide flat building lots for the residential sites without the need for retaining walls.



SEWERAGE RETICULATION

Since the preliminary report, the Water Corporation has advised that the landholding can fall into two separate sub-catchments within the landholding. The north-western portion of the site can be serviced via a direct gravity sewer flowing north into the 'Rivergums' development. A deep gravity sewer will be constructed through neighbouring properties to the north (Lot 3, 5 and 6) to connect into the live sewer system.

The south-eastern portion of the site will be served by either a temporary or interim sewer pump station which ultimately gravitates into a future gravity main sewer, proposed along the eastern side of the land holding. The Water Corporation has yet to advise on the likely outfall path for this portion of development, however a service easement for the future 1200mm dia sewer gravity main within Lot 971, 31 and 979 may need to be allowed for.

The advise from the Water Corp is that the main gravity sewer will discharge into the permanent sewage pumping station (Type 90) located within the "River Gums" residential development. In the interim, a temporary sewage pumping station (Type 40) is proposed to be located to the east of the land holding in the POS area within either lot 31 or lot 979, together with a temporary pressure rising main discharging into the gravity main servicing the north-west sewer catchment.

WATER RETICULATION

The Water Corporation has advised that water supply for the landholding would be provided from the Tamworth Scheme. As part of the current Stage 1 works for Heritage Park, a 200mm main will be brought down from the intersection of Clyde Avenue and Baldivis Road, servicing the extent of the landholding. An overall water reticulation strategy plan for the proposed subdivision has been submitted and considered by the Water Corporation. SKM do not anticipate any issues to arise for water reticulation.

ROADWORKS

The City of Rockingham has confirmed that no upgrade of Baldivis Road will be required as part of the development (the same situation occurred with the "River Gums" development to the north).

The intersection of the northern entry road has been resolved as a four way roundabout as part of the previous WAPC subdivision approval and is currently under construction. The southern entry road intersection treatment will be subjected to future council approval. The widths of the internal roads will be assessed based on the requirements of the policy DC 2.6.

The main internal north south route has been re-routed to make it more direct and to accommodate a bus route as part of the current subdivision approval. The 20 m road reserve width is more than adequate to accommodate a bus route provided that there is no roundabout.



STORMWATER DRAINAGE

The Water Corporation has confirmed that the land holding falls within the Mundijong Drainage Scheme. As such, all runoff from the site must be compensated to pre development levels. The City of Rockingham has advised that all stormwater generated from the development is to be retained within the development site through the use of retention basins.

In general, infiltration of stormwater at source is highly recommended and this would be catered for through the use of soakwell side entry pits and “leaky” stormwater drainage pipes that have in the past been approved by the City of Rockingham.

Based upon the topography of the land and the current subdivision layout, the site has been divided into two stormwater catchment area. Although for the 100 year event, the development will form one single treatment with runoff flow from west to east. The stormwater drainage system will be catered for through a piped drainage system discharging into the northern most POS in Lot 971 and also eastwards into an infiltration basin located in the POS area of Lot 979.

The infiltration basin within the POS of lot 971 will be constructed and shaped as part of Heritage Park Stage 1 works. A significant area of natural vegetation has been retained within the POS area.

The infiltration basin within Lot 979, due to the low level of the contours and the minimal separation to the AAMGL, would need to be created by use by an impounding bund in the order of 2 metres high, to accommodate the required storage volume. The bund would be a maximum of 1:6 batter and be landscaped to blend in with the natural vegetation. Storm events in excess of the 10 year recurrent interval would be discharged from the infiltration basin into the existing flood plain via a bubble up.

The approximate 5,000m³ drainage requirements could be easily accommodated without loss of significant trees and within the allowable 25% area of the POS to the eastern part of the proposed POS area. The landscaping of the bunds would add further screening to that already provided by the existing trees located closer to the internal residential road system.

GAS SUPPLY

Alinta have confirmed that the Highbury Park development immediately west of Baldivis Road has constructed gas infrastructure up to the entry road of the Heritage Park development.

POWER RETICULATION

There are currently high voltage (22kV) distribution aerial lines located along Baldivis Road that are fed from Mandurah. Western Power has confirmed that there is adequate capacity to provide the development with a high voltage point of supply.

A connection to the high voltage aerial lines and associated high voltage equipment within the development would be covered under Western Power’s System Charge policy. As with typical residential developments, each residential lot and street lighting would be reticulated via an underground low voltage system.



TELECOMMUNICATIONS

There is Telstra distribution network infrastructure located along Baldivis Road that Telstra have confirmed has adequate capacity to service the proposed development.

PROXIMITY TO PROPOSED FREEWAY RESERVE

With respect to the adjacent Kwinana Freeway reserve, the established pattern of subdivision elsewhere along the freeway includes residential lots abutting the reserve itself. It is the landowner's expectation to continue this pattern at Heritage Park.

Discussions with Main Roads WA to date have not raised any concern with respect to such outcome, with interface levels and possible cost sharing for a noise wall at the Freeway interface currently underway. The freeway reserve is wide enough to accommodate such wall along with any additional engineering requirements such as bunding.

We understand that an acoustic report has undertaken, which makes recommendations as to the measures that should be implemented to achieve/maintain appropriate noise levels.

Should you have any queries or wish to discuss any other matter, please do not hesitate to contact the undersigned.

Yours faithfully

Jack Tse

Civil Engineer

Phone: 08 9268 4373

Fax: 08 9268 4488

Mobile: 0418 694 515

E-mail: jtse@skm.com.au



Date 13 March 2007
Project No De02858
Subject **Traffic generation review of Heritage Plains Lot 31 971& 979**

1. Trip generation

The development of Lots 31, 971 and 979 Baldivis Road as outlined in the subdivision plan includes 352 lots, comprising:

- 348 single residential lots
- 4 group housing lots (R40)

Assuming one dwelling on each single residential lot, and a total of 44 dwellings on the group housing lots (based on the total lot area of approximately 10,900 sqm and proposed R40 density), the development has the potential for a total of 392 dwellings.

A trip rate of 7 motorised trips per single lot and 5 trips per group dwelling per day is considered appropriate, resulting in a total of approximately $348 \times 7 + 44 \times 5 = 2656$ trip productions per typical weekday as shown in Table 1.

Table 1 Trip Generation

	Single	Group Housing	Total
No. dwellings	348	44	392
Motorised trip rates	7	5	-
Generated trips	2436	220	2656

2. Trip Distribution

Of the trips produced by the residential population within the Lots 31, 971 and 979, it has been assumed 20-25% will travel within the wider South Baldivis District Structure Plan area, with the purpose of shopping, school, recreation and social activities.

Vehicle trips having the destination of Kwinana Freeway (Perth City direction), Rockingham Regional Centre and Rockingham Train Station will travel via Baldivis Road north. It has been assumed that these trips will constitute 45% of the total trips.



Vehicle trips having the destination of Mandurah and Kwinana Freeway south extension will travel via Baldivis Road south. It has been assumed that these trips will constitute 30-35% of the total trips. The trip distribution is shown in **Table 2**.

Table 2 Trip Distribution

	Local Trips	North of Baldivis Rd	South of Baldivis Rd	Total
Distribution Percentage	20%	45%	35%	100%
No. vehicle trips over	531	1195	930	2,656

3. Traffic volumes

Should the land holding at Lot 986 be ultimately developed to similar residential level, the southern access road will likely to serve dwelling in this area and therefore traffic generated by Lot 986 area should also be taken into account. Assume similar development density, Lot 986 will include approximately 150 dwellings, generating approximately 1,000 vehicle trips per weekday. The impact of potential development at Lot 993, bordered by Baldivis Road and Serpentine Road, has not be assessed in this report.

Considering the proximity of the future school to the north of the site, there will be some additional traffic using the northern access road during school days.

It is therefore considered that the proposed northern connection to Baldivis Road is forecast to carry approximately 2,000 vpd, while the southern connection is forecast to carry approximately 1,500 vpd. All the other roads within the subdivision are forecast to carry less than 1000vpd.

Forecast traffic volumes for the higher order roads within the subdivision and section of Baldivis Road bordering the development area are shown in **Figure 1**.

Esta Jiang

Traffic Engineer

SINCLAIR KNIGHT MERZ

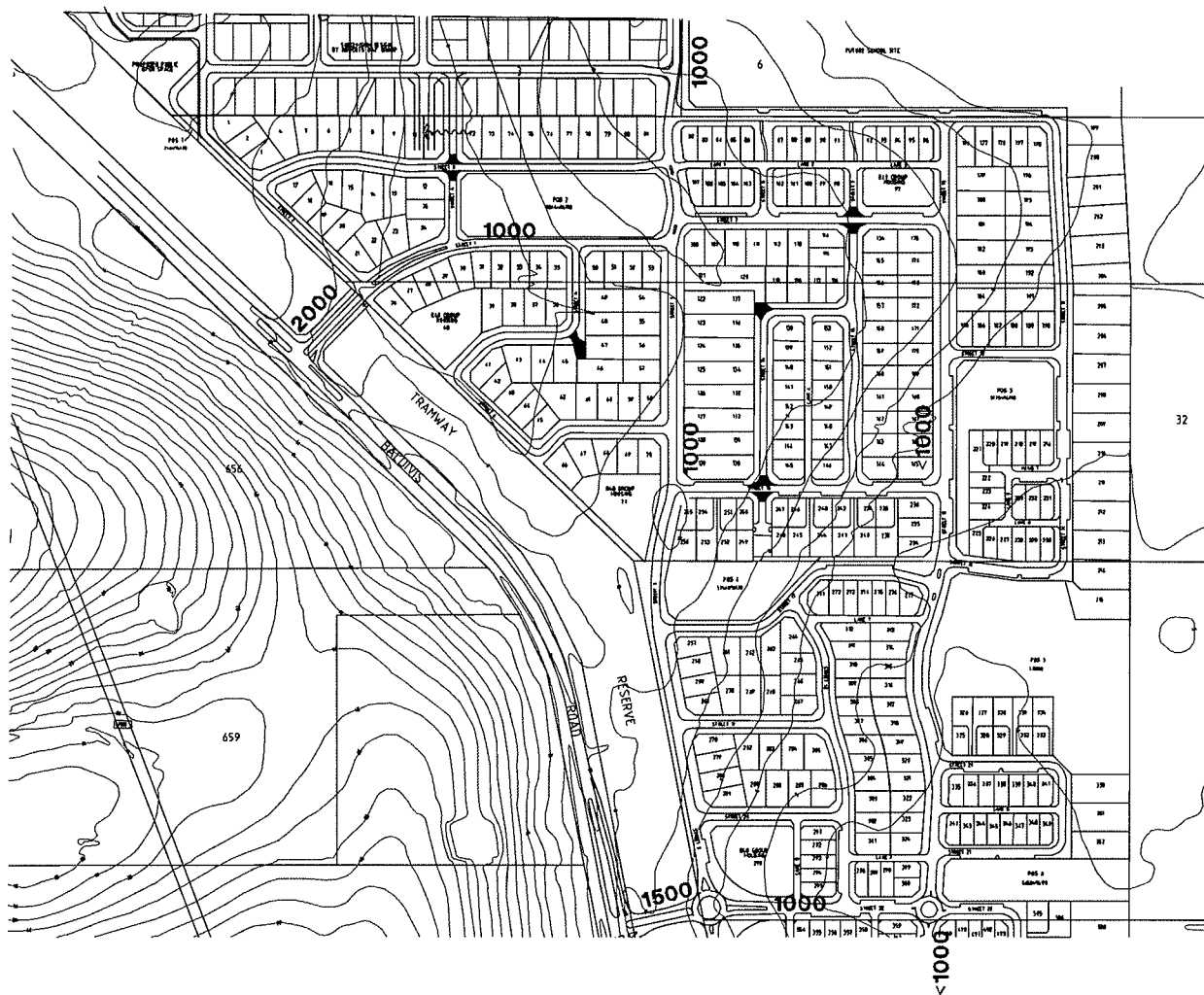
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Figure 1 Traffic Volumes

SINCLAIR KNIGHT MERZ

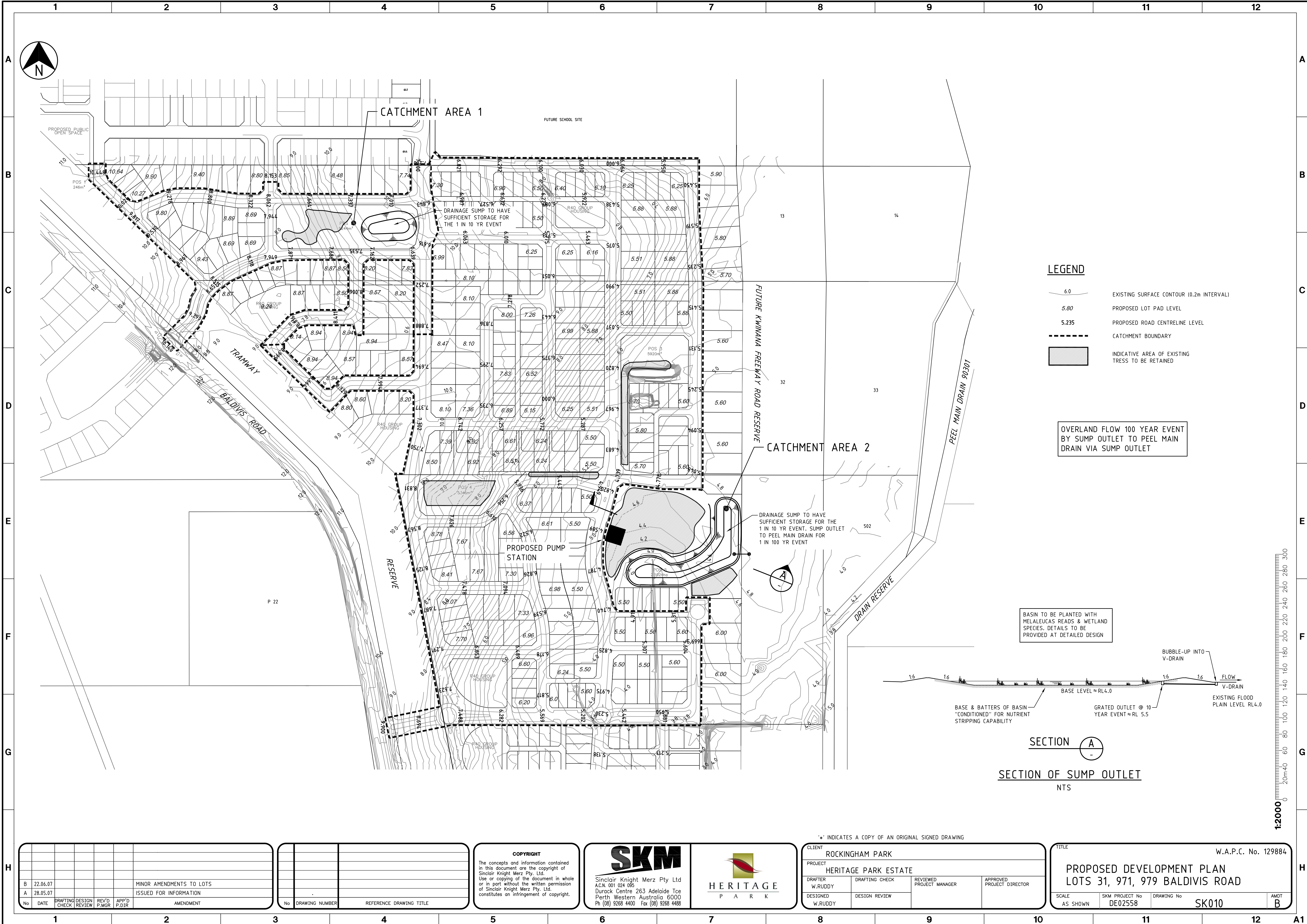
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<p>CLIENT</p> 	<p>TITLE</p> <p>LOTS 31, 971 & 979 BALDIVIS ROAD FORECAST TRAFFIC VOLUMES</p>	
<p>SINCLAIR KNOX HIRE Sincalr Knight Ware Pty Ltd A/CN. 901 540 999</p> <p>Durack Centre 253 Adelaide Tce Perth Western Australia 6000 Telephone (08) 9205 4400 Facsimile (08) 9205 4488</p>	<p>DRAWN: W.RUDDY</p>	<p>PROJECT MANAGER: J.TSE</p>
	<p>DATE: 14.03.07 SCALE: NTS</p>	<p>PROJECT DIRECTOR: G.ALEXANDER</p>
	<p>CHECKED: J.TSE</p> <p>DESIGN ENG.: J.TSE</p>	<p>DRAWING No. AMDT</p> <p>FIGURE 1</p>

APPENDIX 7

Proposed Finished Levels & Indicative Drainage Strategy



LEGEND

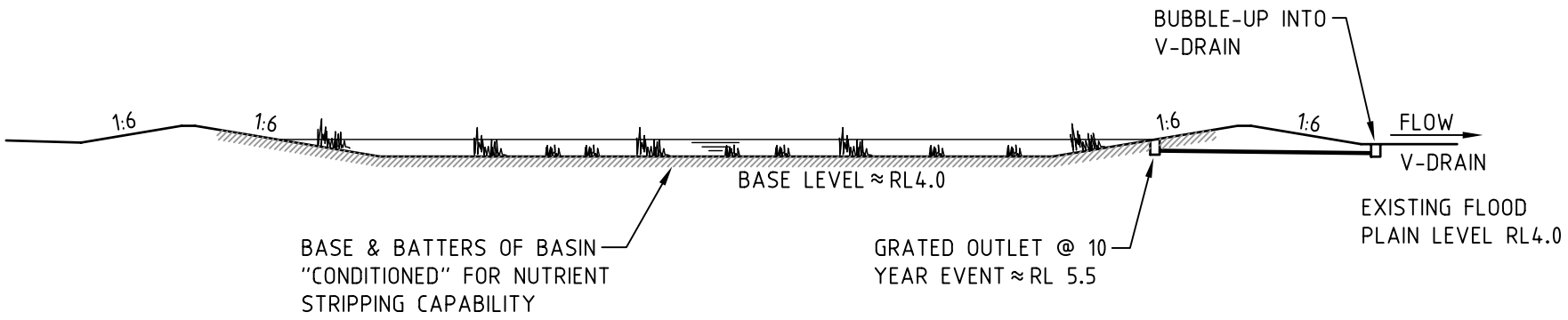
- 6.0 EXISTING SURFACE CONTOUR (0.2m INTERVAL)
- 5.80 PROPOSED LOT PAD LEVEL
- 5.235 PROPOSED ROAD CENTRELINE LEVEL
- CATCHMENT BOUNDARY
- INDICATIVE AREA OF EXISTING TRESS TO BE RETAINED

OVERLAND FLOW 100 YEAR EVENT
BY SUMP OUTLET TO PEEL MAIN
DRAIN VIA SUMP OUTLET

BASIN TO BE PLANTED WITH
MELALEUCAS READS & WETLAND
SPECIES. DETAILS TO BE
PROVIDED AT DETAILED DESIGN

SECTION A

SECTION OF SUMP OUTLET
NTS



* INDICATES A COPY OF AN ORIGINAL SIGNED DRAWING

B 22.06.07						MINOR AMENDMENTS TO LOTS	
A 28.05.07						ISSUED FOR INFORMATION	
No	DATE	DRAFTING	DESIGN	REV'D	APP'D	AMENDMENT	
		CHECK	REVIEW	P.MGR	P.DIR		

No	DRAWING NUMBER	REFERENCE DRAWING TITLE

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HERITAGE
P A R K

CLIENT ROCKINGHAM PARK			
PROJECT HERITAGE PARK ESTATE			
DRAFTER W.RUDDY	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
DESIGNED W.RUDDY	DESIGN REVIEW		

TITLE PROPOSED DEVELOPMENT PLAN LOTS 31, 971, 979 BALDIVIS ROAD				W.A.P.C. No. 129884
SCALE AS SHOWN	SKM PROJECT No DE02558	DRAWING No SK010	AMDT B	