

HOPETOUN PARK ESTATE

Hopetoun Park

Proposed Subdivision

DEVELOPMENT PLAN

for

Mr. I Closter

Prepared by:

**Millar & Merrigan Pty Ltd
Land Development Consultants
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16 October 2001

D Plan -

**Hopetoun Park Estate
Hopetoun Park
Proposed Subdivision**

DEVELOPMENT PLAN

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1. Introduction

1.1 Purpose of the report

This Development Plan is submitted in accordance with Schedule 2 to the Design and Development Plan Overlay. The development plan is to be read in conjunction with the planning application report, plan of subdivision 10932T3 and site context plan 10932LO1. The Development Plan accurately describes the environment, traffic, landscape, architecture and design, drainage and water, and essential service features to be incorporated in the development.

1.2 The subject land

The subject land is shown on the proposed subdivision plan (reference 10932T3) and is contained within the Certificate of Titles:

- Vol: 10154 Fol: 042
- Vol: 10154 Fol: 043
- Vol: 4721 Fol: 049
- Vol: 4721 Fol: 050

The subject land is shown as Lot B on PS333930U. The subject land abuts the Melton Reservoir to the south, the Werribee River to the south west, the Djerriwarrh Creek to the east, Hopetoun Park Road to the north and an existing subdivision to the west.

1.3 Sub Consultants

Sub consultants were engaged on various matters raised in this report. The following consultants undertook assessments and prepared reports:

- Robin Viney: Urban, Rural and Environmental Planner.
- Grogan Richards: Traffic Engineers.

2. Summary

a) Purpose

This report has been prepared to describe the development plans and effects of the proposed subdivision development on the site and surrounds of Hopetoun Park Estate.

b) Location

The location of the site is represented in the Site Context Plan. The total site area is 165 hectares.

c) Zoning and Overlays

The land is zoned Low Density Residential and is controlled by a Design and Development Overlay Schedule 2, Wildfire Management Overlay and partially controlled by a Environmental Significance Overlay Schedule 2 under the Moorabool Planning Scheme.

d) Topography

The subject land consists of a gently undulating plateau which falls sharply at the escarpment areas of the Werribee River, Melton Reservoir, and Djerriwarrh Creek.

e) Existing Use

The site has in past been used for sheep and cattle grazing and in recent times the land has been ploughed for crop raising.

f) Environmental Assets

An Environmental Management Plan has been prepared by Robin Viney Pty Ltd and should be read in conjunction with the Development Plan.

The subject land contains small areas of lignum wetlands and scattered grey box and sheoak sp.

g) The Development Plan

The Development Plan incorporates and accurately describes the matters stated in Schedule 2 to the Development Plan Overlay in relation to the proposed subdivision of Hopetoun Park Estate, Hopetoun Park.

3. Existing Conditions

3.1 Physical Environment

The subject land abuts the Werribee River to the south west, the Melton Reservoir to the south and the Djerriwarrh Creek to the east. The northern boundary is defined by Hopetoun Park Road and the Carberry Land.

3.1.1 Geology and Soils

The geology of the site consists of sands and gravels of Quaternary Age with volcanics of the truncated outlier of the Bullengarook lava flow covering. It is estimated that the gravely sediments are up to 10 metres thick.

3.1.2 Land Form

The land gently undulates upon a plateau with several small low lying areas which hold water for much of the year and contain remnant lignum. The land falls steeply in the escarpment areas to the waters edge of approximately 40 metres.

3.1.3 Drainage

The topography of the subject land facilitates the drainage of water runoff. The low lying areas containing remnant lignum hold water for much of the year.

A drainage strategy has been prepared for the development and should be read in conjunction with this Development Plan.

3.1.4 Landscape and Views

The subject land is located upon a plateau which provides dramatic views across the township of Bacchus Marsh, the Melton Reservoir and the Werribee River and Djerriwarrh Creek valleys. Development to the south of Melton Reservoir is minimal and the views from the site are greater than those to the site.

3.1.5 Vegetation

The site is largely vacant of original vegetation and the remaining vegetation is sparse. The plateau contains small areas of remnant lignum wetlands and a small number of remnant grey box and sheoak sp. The escarpment areas contain further eucalypt and casuarina sp, and also a number of weed species, including serrated tussock, boxthorn, artichoke thistle and horehound.

3.1.6 Land Capability

The subject land contains minimal site constraints which could place limitations upon future development. The land is largely vacant, generally flat and is connected to reticulated water and sewerage. It is submitted that the land is suitable and could sustain a low density rural subdivision. The escarpment areas could not sustain any development and any proposed development will be appropriately setback from these areas.

4. The Proposal

The proposal is for a 144 lot subdivision of Hopetoun Park Estate, Hopetoun Park. The proposal comprises of the following elements:

- The provision of more than 50 hectares of community/public open space which incorporates the escarpment areas.
- A density of 1.1 lots per hectare with a minimum lot size of 4083m² and maximum lot size of 1.550ha. The overall average lot size for the estate (including the existing stages) is 7,525m².
- The retention of significant existing native vegetation, namely lignum, within public open space.
- Minimal access points to the escarpment.

- The construction of a well designed vehicular and pedestrian circulation network, increasing accessibility.
- A minimum lot size of 1ha for allotments abutting the escarpment.
- The proposed development will be completed in nine stages. Stage 1 will release lots 30 – 47 and include the major remnant lignum areas. It is envisaged that each stage will release a variety of lots and each stage will include escarpment lots.

5. Planning Considerations

5.1 Environment

An Environmental Management Plan has been developed by Robin Viney Pty Ltd and should be read in conjunction with the Development Plan.

5.1.1 The construction details of pest animal control fencing around significant environmental features.

The proposed development of Hopetoun Park Estate includes the construction of a pest animal and safety fence for construction along the top of the escarpment preventing any future domesticated animals penetrating the escarpment area and disturbing the native flora and fauna within it. The fence will be open in style and be of a blending colour which will not hinder the aesthetic values from the lots and also from surrounding viewpoints, in particular the southern side of the waterways.

5.1.2 How areas of environmental significance will be protected using buffer zones.

A buffer zone will be provided between the escarpment and any future buildings located on the lots abutting the escarpment areas. The buffer zone will include the existing fire access track. The building envelope will allow for a 10 metre setback of all buildings located on these lots. The buffer zone and 10 metre setback restriction combined will reduce the likelihood of environmental degradation occurring in the escarpment areas.

5.1.3 How indigenous flora and fauna values will be retained, enhanced and protected.

The proposal makes provision for a centrally located public open space that incorporates a lignum conservation area of approximately 4 hectares in size. The lignum area will be retained and conserved as little other native vegetation exists within the subject land.

The escarpment area has been addressed as an area of environmental significance and the layout and design of the subdivision recognises the importance of the protection and enhancement of the area. Access points to the escarpment have been minimised for the protection of the community and escarpment. The steep terrain of the

escarpment inhibits public access to the water edge, and the access points to the escarpment only provide community viewpoints to the waterways and southern lands.

The detainment of public access to the escarpment will enable the regeneration and enhancement of native flora and fauna without further disturbance.

5.1.4 How land degradation will be controlled and degraded areas will be restored.

The subject land contains areas of degradation and typically occurs along the escarpment areas of the waterways. The Robin Viney prepared Environmental Management Plan identifies that significant environmental degradation is evident within the escarpment areas. It is proposed that a pest animal and safety fence is to be erected along the top of the escarpment. It is envisaged that the fence will prevent pest animals and human access to the escarpment areas and thus reducing the environmental effects upon the escarpment areas.

The existing remnant lignum areas will also be fenced off to minimise the environmental impacts of human access in these areas. The fencing will be rabbit proof preventing the additional environmental impacts caused by rabbit infestation.

The escarpment areas will be restored via a collaborative effort between the Department of Natural Resources (DNRE), Southern Rural Water and the residents of Hopetoun Park Estate. The restoration, conservation, and maintenance of the escarpment areas will be undertaken upon advice from the DNRE and Southern Rural Water.

5.1.5 How the keeping of animals and livestock and planting of non-indigenous flora by future owners will be controlled.

The proposed development will seek to control the presence of domestic animals and livestock within the development by creating restrictive covenants that require that all dogs and cats be registered with the Shire, that all domestic pets be contained within property boundaries, and that the grazing of large animals (including horses) only be allowed to occur on allotments greater than 1 hectare.

A Planting Guideline will be developed and distributed to residents of Hopetoun Park Estate. It is envisaged that the Guidelines will educate the residents and promote the planting of native trees, shrubs and grasses.

5.1.6 How noxious and environmental weeds and pest animals will be controlled including the need to minimise the spread of weeds and soil pathogens.

The plateau land contains areas of noxious weeds, in particular serrated tussock (*nasella* sp.), and recent measures such as ploughing have provided an effective management tool to control noxious weeds. It is envisaged that the eradication of weeds prior to residential development will reduce the need for ongoing future weed control.

The escarpment will be protected by a concerted effort between the Department of Natural Resources and Environment (DNRE), Southern Rural Water and the residents of Hopetoun Park Estate. Spot spraying will be implemented along the escarpment to eradicate pest species; however the steep terrain will make weed control difficult in some areas. The fragile and sensitive nature of the waterways also limits the aerial spraying of noxious weeds.

An Environmental Management Plan has been developed by Robin Viney Pty Ltd and should be read in conjunction with the Development Plan.

5.1.7 How environmental weeds and pest plants will be controlled.

As stated in 5.1.6 a concerted effort between the DNRE, Southern Rural Water and the residents of Hopetoun Park Estate will control the environmental weeds and pest plants within the proposed development.

5.2 Traffic

This section of the Development Plan should be read in conjunction with the Traffic Engineering Assessment prepared by Grogan Richards Pty Ltd.

5.2.1 Vehicular and pedestrian circulation networks.

The design of the vehicular and pedestrian circulation network incorporates the road and pedestrian network pattern of the abutting existing subdivision and future subdivision of the Carberry Land.

Vehicular circulation networks have continued the pattern of the neighbouring subdivision with the inclusion of a linked open space network to the existing subdivision in the west and the proposed subdivision to the north.

5.2.2 Traffic management measures.

The report prepared by Grogan Richards identifies the existing traffic volumes for the intersection of Hopetoun Park Road and the Western Freeway. The report indicates that the anticipated traffic generated from the proposed Hopetoun Park development is adequately catered for by the Hopetoun Park Road and Western Freeway intersection. The report states that the "overall intersection degree of saturation will reach 0.42, while the delay to right turners from Hopetoun Park Road will increase by 5.9 seconds. This result indicates that the intersection will operate well within capacity."

The Grogan Richards report recommends that "intersection safety could be enhanced through the installation of a speed warning device on the Western Freeway approach to Hopetoun Park Road from the west."

The existing traffic conditions at the intersection of Hopetoun Park Road and the Western Freeway will adequately cater for the anticipated traffic volumes generated by the proposed Hopetoun Park development. It is submitted that the proposed

Hopetoun Park development will not require additional traffic management measures following the results of the Grogan Richards Traffic Engineering Assessment report.

5.2.3 How vehicular access to each lot and building envelope will be located and constructed.

Vehicular access points will be generally located within 10m of a side boundary to each lot. Under this plan future purchases are encouraged to minimise the extent of paving to maximise infiltration of drainage water.

5.3 Landscape

5.3.1 How road and public open space areas will be landscaped with indigenous vegetation.

Street trees used will consist of indigenous species sowed from local seed sources where possible. Different species will be used to help delineate the hierarchy of the road network with large trees being used on the main road and smaller trees on side streets. Species will include Eucalypts, Acacia and Allocasuarina varieties.

Open space areas will be landscaped by undertaking a maintenance regime of weed removal and management in the first instance. Regeneration of indigenous species will be encouraged and where appropriate planting undertaken to supplement this regeneration and in particular to add species that are unrepresented or underrepresented in the landscape.

5.4 Architecture and design

5.4.1 Building envelopes for each lot including maximum building heights.

The proposed development of Hopetoun Park Estate includes building envelopes as shown on the proposed subdivision plan. Building setbacks of 10 metres are proposed from the escarpment, 10 metres from road reserves and 5 metres from side boundaries.

There is no height restrictions proposed for the development.

5.4.2 Materials and colours that buildings will be restricted to.

The proposed development of Hopetoun Park Estate will include restrictions upon the materials and colours of buildings. These will particularly relate to outbuildings.

5.4.3 The potential for building site excavation.

The site has a low potential for any significant excavation associated with the construction of dwellings. The relatively flat slopes allow for a variety of construction techniques with no or little excavation required.

5.4.4 The location and type of street signs and street names.

Street names will be based on local or regional historical and cultural aspects. Names will be submitted to Councils Street Name Committee for approval. The location and type of street signs and light poles will be determined during the detailed design and submitted to Council for approval.

5.4.5 Future subdivision.

The proposed lots will not be subject to further subdivision.

5.5 Drainage and water conservation and protection.

5.5.1 The land capability.

The subject land is serviced with reticulated water and sewerage and could theoretically sustain a higher density development. It is submitted that the proposed development will not degrade the environment and that the land is capable of sustaining a 144 lot subdivision. It is submitted that the stormwater runoff will be effectively controlled within the site to minimise the potential environmental impacts on the Melton Reservoir and associated waterways.

The subject land is relatively flat with areas that gently undulate and contains few site constraints which could impede the proposed 144 lot subdivision of the Hopetoun Park Estate. The proposed development has identified the remnant lignum areas and escarpment areas as areas that cannot be developed and the design of the proposed subdivision incorporates these site constraints.

5.5.2 How overland drainage lines will be protected.

Drainage design will seek to mimic the existing natural systems with particular care being taken to preserve the lignum conservation areas. The Drainage Strategy should be read in conjunction with this plan.

5.6 How essential services will be provided.


All essential services will be provided via underground reticulation. Reticulated sewer, water, electricity, etc are available to the land.

THIS PLAN IS SUBJECT TO THE APPROVAL OF VARIOUS STATUTORY AUTHORITIES.

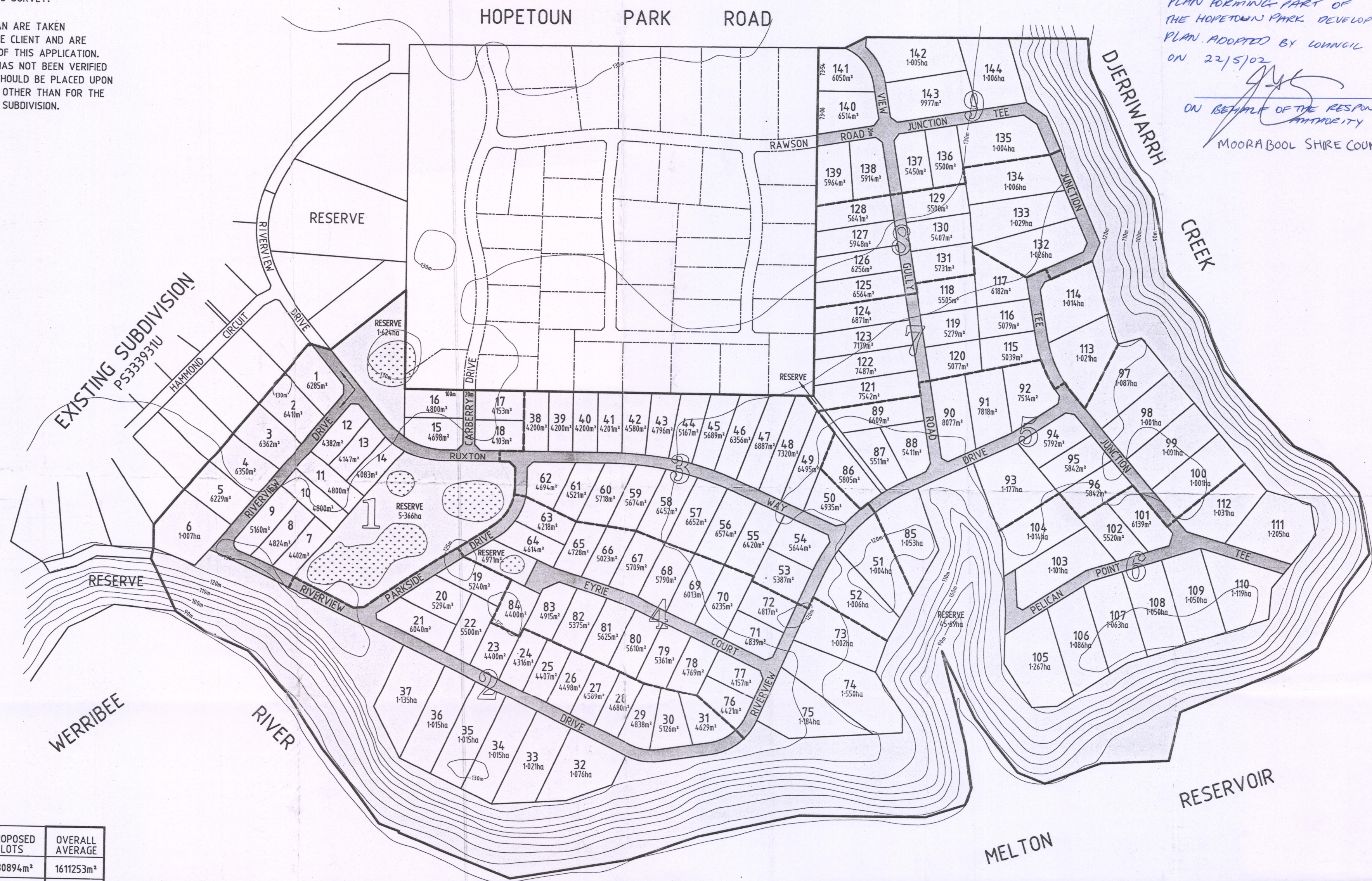
DIMENSIONS HEREON ARE SUBJECT TO SURVEY.

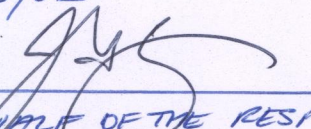
THE CONTOURS SHOWN ON THIS PLAN ARE TAKEN FROM INFORMATION SUPPLIED BY THE CLIENT AND ARE SUITABLE ONLY FOR THE PURPOSE OF THIS APPLICATION. THE ACCURACY OF THE CONTOURS HAS NOT BEEN VERIFIED BY THIS OFFICE AND NO RELIANCE SHOULD BE PLACED UPON SUCH CONTOURS FOR ANY PURPOSE OTHER THAN FOR THE PURPOSE OF THIS APPLICATION FOR SUBDIVISION.

CONTOUR INTERVAL 5 METRE.

 EXISTING LIGNUM

C/T. VOL.10154 FOL.042
C/T. VOL.10154 FOL.043
C/T. VOL.4721 FOL.049
C/T. VOL.4721 FOL.050
LOT B ON PS333930U
CLOSED GOVT. ROADS



THIS PLAN IS 2 OF 2
BEING THE APPROVED
PLAN FORMING PART OF
THE HOPETOUN PARK DEVELOPMENT
PLAN ADOPTED BY COUNCIL
ON 22/5/02

ON BEHALF OF THE RESPONSIBLE
AUTHORITY
MOORABOOL SHIRE COUNCIL

	PS333930	PS333931	PROPOSED LOTS	OVERALL AVERAGE
AREA OF LOTS	465508m ²	163851m ²	980894m ²	1611253m ²
No. OF LOTS	52	18	144	214
AVERAGE AREA	8952m ²	9103m ²	6812m ²	7525m ²

Merrigan
Land Development Consultants
TOWN PLANNING
URBAN DESIGN
CIVIL ENGINEERING
LAND SURVEYING
PROJECT MANAGEMENT

MILLAR & MERRIGAN PTY. LTD. ACN 005 541 668

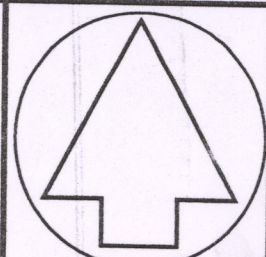
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TOTAL SITE AREA : 165ha

No. OF LOTS : 144

DENSITY : 1.1 LOTS/ha

AVERAGE LOT AREA : 6812m²



PROPOSED SUBDIVISION

HOPETOUN PARK ESTATE

HOPETOUN PARK ROAD, HOPETOUN PARK

SHIRE OF MOORABOOL

DESIGNED
GDJ
12/9/2001
DRAWN
GDJ
13/9/2001
CHECKED

SCALE 1:5000
SHEET 1 OF 1
DRAWING No.
10932T3

VERSION: 2, 17/10/2001

Neil M Craigie Pty Ltd

ACN 074 582 282 ABN 29 074 582 282

Waterway Management Consultants

HOPETOUN PARK ESTATE

SURFACE WATER MANAGEMENT STRATEGY

(DRAFT REPORT)

25/2/02

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1. INTRODUCTION

The Hopetoun Park Estate is located in the north-west sector of the confluence of the Werribee River and the Djerriwarrah Creek at Melton Reservoir. It covers an area of about 165 ha including about 46 ha of reserves along the frontages of the Djerriwarrah Creek and the Werribee River.

Key issues to be addressed are the management of excess surface runoff water and stormwater pollutants generated from the proposed development. All allotments are to be sewered.

2. DEVELOPMENT PROPOSALS

It is intended to create 144 residential allotments of size between about 0.4 ha and 1.6 ha which equates to an average lot density of about 0.9 lots/ha. The approximate land uses are as summarised in Table 1. Impervious area within allotments has been assumed to be 625 m²/lot, comprising houses, garages, outbuildings, driveways and other paved areas.

TABLE 1 LAND USE AREAS IN HOPETOUN PARK ESTATE		
Segment	Area (ha)	Impervious Area (ha)
Lots	98.6	9
Roads	13.0	4
Internal Reserves	7.7	0
River Frontage Reserves	45.7	0
Total	165.0	13 (7.9%)

It is proposed that the surface water management system will be comprised of a mixture of minor local pipelines under road pavements (with some minor pipes through allotments), vegetated swales and bioretention/infiltration swales along all road reserves, an ephemeral wetland, and overland discharge via existing gully lines.

3. SURFACE WATER MANAGEMENT DESIGN OBJECTIVES

The key design objectives to be met with the Hopetoun Park Estate surface drainage system will be as follows:

- Provision of drainage services to all allotments and road pavements in accord with contemporary service standards (ie., ≤ 5 year ARI capacity drainage systems to serve allotments and road pavements, all floor levels to have at least 300 mm freeboard above 100 year ARI flood levels, all constructed floodways and roads used as such to comply with floodway safety guidelines);
- Protection of frontage reserves along Werribee River and Djerriwarrh Creek from erosion threats arising from stormwater discharge;
- Effective stabilisation of all drainage outlets to the Werribee River or Djerriwarrh Creek and prevention of erosion damage;
- Effective treatment of discharge water quality to maintain existing rural runoff standards.

This report deals only with the latter three objectives. Design of drainage services and determination of flood levels and floor levels is to be carried out by Millar & Merrigan P/L.

4. WATER QUANTITY MANAGEMENT

4.1 Potential Impact of Development

Published figures indicate that mean annual runoff from the rural catchments in this locality approximates 25 mm (about 5% of mean annual rainfall).

Water balance analyses have been carried out using 7 day Melton Reservoir rainfall and evaporation data for the period 1988-1997 inclusive. The results summarised in Table 2 show that under existing (pre-development) conditions the property could have been expected to yield on average about 53 ML/year of surface runoff to the Werribee River which equates to an average of about 5.5% of mean annual rainfall over the modelled period. Runoff events were modelled as occurring in just 40 out of a possible 520 weeks over the period which corresponds well with observations of runoff behaviour in the region.

Negligible or zero runoff was predicted for four of the 10 years. Neglecting zero runoff years, the mean annual runoff was 75 ML/year (8.5% of mean annual rainfall).

With full development in place, runoff yield is predicted to increase by about 75% over the 10 year period, to a mean annual total of about 93 ML/year (about 10.5% of mean annual

Alternatively or as well, the rain tank could be plumbed to provide a toilet flushing supply for the house. Consumption of water would increase compared with garden watering usage alone, because toilet flushing volume does not reduce during the wet seasons.

4.2.2 Evapotranspiration

A remnant ephemeral wetland is proposed to be retained and utilised as part of the surface water management system. At full storage level it will occupy at least 1 ha of land with a catchment area of 17 ha. A water balance analysis showed that surface water runoff from the catchment would be reduced by 3 ML/year (30% for its local catchment) on average, due to evapotranspiration losses alone.

Parallel studies are being carried out to confirm appropriate operating requirements so that the increased supply of water to this wetland can be managed without prejudicing its remnant environmental values.

4.2.3 Infiltration

The water balance modelling results in Table 1 assume that all of the runoff generated from the impervious areas will be discharged at the catchment outlet. For lined drainage systems this assumption will hold reasonably true. However for unlined drainage systems with high potential for surface infiltration, as will be provided in Hopetoun Park Estate, a lesser discharge figure would be expected.

Along all road reserves it is proposed to use gently sloped vegetated swales in lieu of narrow table drains or pipes.

Wherever the road frontage is coincident with the frontage reserves for the Werribee River or Djerriwarrh Creek, it is proposed to construct bioretention/infiltration trenches. These will assist in compliance with water quality management objectives but they will also maximise the potential for discharge of runoff water by means of seepage processes over wide frontage areas. There will not be any direct pipe discharge over the escarpments.

All runoff water in excess of that which can be discharged by means of seepage will be conveyed via the swale drains in the road reserves towards the existing gully line between Lots 85 and 93. However some provision will also be made for very shallow broad overtopping of vegetated swales along the escarpments in appropriate locations in the event of major floods. These areas and the gully line will be a focus for revegetation work.

rainfall), with runoff occurring in 363 weeks out of the possible 520 weeks over the period. Due to the effect of impervious areas, the modelling predicted no years of zero runoff.

**TABLE 2 WATER BALANCE MODEL RESULTS
HOPETOUN PARK ESTATE**

Year	Rain (mm)	Evaporation (mm)	Existing Conditions		Fully developed Conditions	
			Surface Runoff (ML)	No. of Surface Runoff Weeks	Surface Runoff (ML)	No. of Surface Runoff Weeks
1988	464	1209	12		53	
1989	547	1065	126		167	
1990	490	1102	8		52	
1991	490	1185	47		89	
1992	627	930	205		248	
1993	565	999	28		78	
1994	325	1132	0		27	
1995	601	1007	99		148	
1996	440	1058	0		39	
1997	313	1211	0		27	
Totals	4861	10899	525	40	928	363
Average	486	1090	53		93	
Maximum	627	1211	205		248	
Minimum	313	930	0		27	

4.2 Options to reduce runoff discharge

4.2.1 Consumptive Uses

It is highly probable that most residents will install rain tanks to store roof runoff and provide water supply for garden watering and/or for internal toilet flushing.

A water balance simulation has been carried out to assess the impact of a 20,000 litre (0.02 ML) rain tank with 400 m² roof catchment area and garden watering area of 1,000 m². The results are summarised as follows:

- Mean annual runoff input from the roof area to the tank was 0.17 ML/year
- Potential irrigation demand was 0.38 ML/year
- Mean annual tank spill was 0.05 ML/year.

Hence if used for garden watering, a 20,000 litre rain tank can provide for a water consumption of up to 0.12 ML/year, which equates to a potential 17 ML/year if tanks were installed and used correctly on all allotments. The supply volume provided is well short of the potential watering demand so it is possible that twin tanks could be installed on some properties. This would increase consumptive use.

At this time the available information indicates that erosion threat along this gully line and slope stability threat along the escarpments are minimal, owing to the presence of shallow underlying rock. However, further geotechnical investigation is being carried out to:

- ascertain the need for additional stabilisation work along this gully line;
- confirm stability of the escarpment slopes with the proposed seepage discharge trench systems in place.

Final design plans will be developed accordingly, after completion of these investigations.

4.2.4 Conclusion

Taking into account the proposed form of drainage system and the very high likelihood that most roof runoff water will be directed into tanks for irrigation of gardens and/or toilet flushing, it is considered that the impact of the proposed development on increased volume of runoff will not of itself be significant. Also provided that erosion potential is effectively mitigated, there should not be any need for flood retarding storage to be provided.

5. WATER QUALITY MANAGEMENT

5.1 Treatment Options

The Victorian Urban Stormwater Best Practice Environmental Management Guidelines (USBPEMG, 1999) promote the use of a broad range of water quality and quantity management systems under the banner of Water Sensitive Urban Design (WSUD).

WSUD has five objectives:

1. Protect natural systems,
2. Integrate stormwater treatment into the landscape,
3. Protect receiving water quality,
4. Reduce runoff and peak flows,
5. Add value while minimising development costs

Constructed wetlands are one WSUD approach, where management response is concentrated into one or more defined areas. Such wetlands are an example of a regional scale WSUD technique.

Other techniques that are currently being actively promoted by many municipalities and agencies such as MWC, focus on the site or precinct scale and are aimed at reducing runoff peaks, delaying runoff response and minimising transportation of sediments through

the use of "natural" drainage line treatments, swale/trench infiltration systems, grass buffer strips and the like. These techniques have good potential for reducing the hydraulic and pollutant loads and hence area of treatment wetlands. WSUD techniques that can be applied at the site or precinct scale, offer potential for achieving required water quality treatment with reduced impact on developable land yield.

Table 3 provides an overview of the general applicability of the range of WSUD techniques, within the Hopetoun Park Estate.

TABLE 3 Application of WSUD techniques to Hopetoun Park Estate			
Scale of Application	WSUD Technique	Applicability to Hopetoun Park Estate (H - High, M - Medium, L - Low)	Discussion
Site	Rain tanks - garden water	H	Reduces mains water use if used properly which is more likely with large lots. Likely to be successful especially if promoted and encouraged by agencies.
	Rain tanks - toilet flushing	H	Reduces mains water use and runoff. Requires agency assistance and promotion to enhance voluntary uptake.
	Roof water direct to normal gardens	H	Low cost, reduces runoff from site. Likely to be very effective on large lots, especially to landscaped areas. Needs soil with acceptable drainage characteristics.
	Roof water direct to constructed raingardens	L	Costly and unlikely to be viable or effective compared to simple garden disposal on large lots
	Greywater to gardens	M	Health and maintenance concerns. Special approvals and monitoring required but effectively covered if septic tank systems used.
	Split Pipe systems	L	Unlikely to be viable or effective on large lots
	Parking Lot Storage	L	No significant water quality benefits. Nuisance to owners at the lot scale.
	Porous pavements	L	High maintenance problems, noisy in residential environment. Possible structural problems in local soils
	Grass buffer strips	M	Subject to traffic damage if not suitably protected. Problems with buildup of retained sediment along edge of pavement. Space is available along all internal roadways.
	Vegetated swales	M-H	Subject to traffic damage if not suitably protected. Can have problems with buildup of retained sediment but not to the extent of the grass buffer strips. Space is available along most internal roadways.
	Bioretention systems	L	Costly. Lower pollutant loads do not justify use. Requires dedicated space and specialised vegetation and maintenance to function correctly. Subject to blockage by excess sediment load unless protected during estate and building construction phase.

TABLE 3 Application of WSUD techniques to Hopetoun Park Estate			
Scale of Application	WSUD Technique	Applicability to Hopetoun Park Estate (H - High, M - Medium, L - Low)	Discussion
Precinct	Grass buffer strips	M	Subject to traffic damage if not suitably protected. Problems with buildup of retained sediment along edge of pavement. Space is available along all internal roadways.
	Vegetated swales	H	Subject to traffic damage if not suitably protected. Can have problems with buildup of retained sediment but not to the extent of the grass buffer strips. Space is available along all internal roadways and Pt Cook Road frontage. Will be particularly applicable as a boundary treatment to natural wet zones
	Bioretention systems	L	Use is unlikely to be justifiable in low density area. Subject to traffic damage unless suitably protected. Subject to blockage by excess sediment load unless protected during estate and building construction phase.
	Ephemeral waterways/ ponds	M	If constructed with "leaky" bases can function similarly to bioretention systems. Requires careful design to avoid problems arising from isolated pockets of retained water (eg., mosquitos and weeds), or from seasonal waterlogging.
	Park/Urban Forest supply	M	Opportunity to discharge shallow drainage systems to urban forest zone in main park area in south-west.
	Porous pavements	L	High maintenance problems, noisy in residential environment. Possible structural problems in local soils
	Water features (small ponds)	L	Require reasonably good quality water supply or pretreatment wetlands. Not effective as reuse (irrigation) storages in residential areas without severely compromising aesthetics. Will likely dry out completely in this environment with possible cracking problems.
	Parking Lot storage	L	No significant water quality benefits. No major parking areas proposed in the estate.
	Gross Pollutant Traps	L	Litter and sediment movement should be minimised with appropriate design in low density environment.
	Split pipe systems	L	Not justified in low density developments.
Regional	Gross Pollutant Traps	L	Litter and sediment movement should be minimised with appropriate design in low density environment.
	Constructed wetlands	L	Costly. Lower pollutant loads do not justify use in low density residential environment. Only suitable location is in 5.366 ha reserve where remnant environmental values preclude alteration to create artificial treatment wetland.

TABLE 3 Application of WSUD techniques to Hopetoun Park Estate			
Scale of Application	WSUD Technique	Applicability to Hopetoun Park Estate (H - High, M - Medium, L - Low)	Discussion
	Lakes/ponds water features	L	Require reasonably good quality water supply or pretreatment wetlands. Not very effective as reuse (irrigation) storages in residential areas without severely compromising aesthetics. Space is insufficient along river frontage reserves. Water supply likely to be deficient to support permanent ponds so that problems with cracking of soils are likely.
	Use of natural ephemeral wetlands	H	Would provide retardation storage for the estate and effectively deal with all residual quality problems in its catchment. Partly effective in reducing water volume by evaporation and infiltration. Subject to constraint posed by need to protect remnant environmental values
	Split pipeline systems	L	Not justified in low density developments
	Irrigation ponds	L	Not attractive components of residential area due to water level drawdown and exposure of mud banks. No space available in site.

5.2 Treatment Efficiencies

Recent research work carried out as part of the Association of Bayside Municipalities Stormwater Implementation Project (ABMSIP, September 2001) has established relationships for effectiveness of various WSUD techniques. A given size (area) of a particular WSUD technique within a development is expressed as a percentage of contributing impervious area in its catchment, and then converted to an Equivalent Percentage Treated Area (EPTA), and hence to an Equivalent Treatment Area (ETA). The mitigation target is set according to the objectives contained in the USBPMG (1999). All pervious areas are considered to be 100% EPTA. The relative effectiveness of some of these techniques, derived from data modelling presented in the ABMSIP report are summarised in Table 4. These figures should be treated as indicative only and further research work is required to confidently establish the relative performance of WSUD techniques.

TABLE 4 WATER QUALITY TREATMENT EFFICIENCY OF SOME WSUD TECHNIQUES		
WSUD Technique	Efficiency compared to constructed wetland	Comment
Constructed wetland	1.0	Area is measured at NTWL+0.5 m
Bioretention Swale	1.1	Area is full width of infiltration zone of swale
Vegetated Swale	0.2	Area is full width of swale at 300 mm depth
Ponds, storage tanks	0.7	Area is measured at NTWL

NTWL = Normal Top Water Level (m)

For the Hopetoun Park Estate the proposed impervious area will rise from zero at present to about 9 hectares in the future. The summation of contributing EPTA's for all WSUD techniques must add up to 9 ha to fully comply with the USBPMG objectives.

Using the published estimating relationships from the ABMSIP report it is possible to more clearly delineate the likely feasible techniques that could be applied on the Hopetoun Park Estate. (Note: the estimating relationships provided in the ABMSIP report have been developed for the eastern bayside area of Melbourne. Mean annual runoff (MAR in ML/ha) is significantly higher there than in the Melton area. For an equivalent development density the MAR in the Melton area is at most about 75-80% of the eastern bayside suburbs. Hence in the absence of local information, the EPTA estimates provided in the ABMSIP report have been factored up accordingly by 1.2. This factoring is carried out at the end of the options analyses in Table 5.)

6. PROPOSED SURFACE WATER MANAGEMENT STRATEGY

The preferred strategy is illustrated on Figure 1. Its primary components are:

1. A remnant ephemeral wetland is proposed to be retained and utilised within a reserve of 5.366 ha area, as part of the surface water management system.

All stormwater from its local catchment will be passed through this wetland which will enhance infiltration and evapotranspiration water losses as well as achieving compliance with best management practice for water quality. Parallel studies are being carried out to confirm appropriate operating requirements so that the increased supply of water to this wetland can be managed without prejudicing its remnant environmental values.

2. Rain tanks will be strongly encouraged on all allotments for garden watering and toilet flushing. All roof water is to be conveyed to tanks, or failing this direct to gardens, with no piped outfalls leaving the allotment areas.
3. Along all road reserves it is proposed to use gently sloped vegetated swales in lieu of conventional narrow table drains or pipes.
4. Wherever the road frontage is coincident with the frontage reserves for the Werribee River or Djerriwarrh Creek, it is proposed to construct bioretention/infiltration trenches instead of the vegetated swales.

These will assist in compliance with water quality management objectives but they will also maximise the potential for discharge of runoff water by means of seepage processes over wide frontage areas. There will not be any direct pipe discharge over the escarpments.

5. All runoff water in excess of that which can be discharged by means of seepage will be conveyed via the swale drains in the road reserves towards the existing gully line between Lots 85 and 93. However some provision will also be made for very shallow broad overtopping of swales along the escarpments in appropriate locations in the event of major floods.

These areas and the gully line will be a focus for revegetation work. At this time the available information indicates that erosion threat along the gully line and slope stability threat along the escarpments are minimal, owing to the presence of shallow underlying rock. However, further geotechnical investigation is being carried out to:

- ascertain the need for additional stabilisation work along this gully line;
- confirm stability of the escarpment slopes with the proposed seepage discharge trench systems in place.

Final design plans will be developed accordingly, after completion of these investigations.

6. The strategy avoids the need for any wetland or pond construction along the frontages of either the Werribee River or Djerriwarrh Creek.

Soil conditions are not conducive to construction of water retaining ponds, especially where large drawdowns can be expected due to long periods without significant runoff input as will be the case here.

Table 5 itemises the strategy components and lists the relevant ETA's. When appropriately scaled-up as shown, the total ETA for the preferred options exceeds the requirement to comply with current best practice management for water quality.

The final management strategy will be adjusted after completion of current wetland environment and geological investigations, preliminary civil designs and further discussions with Council and DNRE.

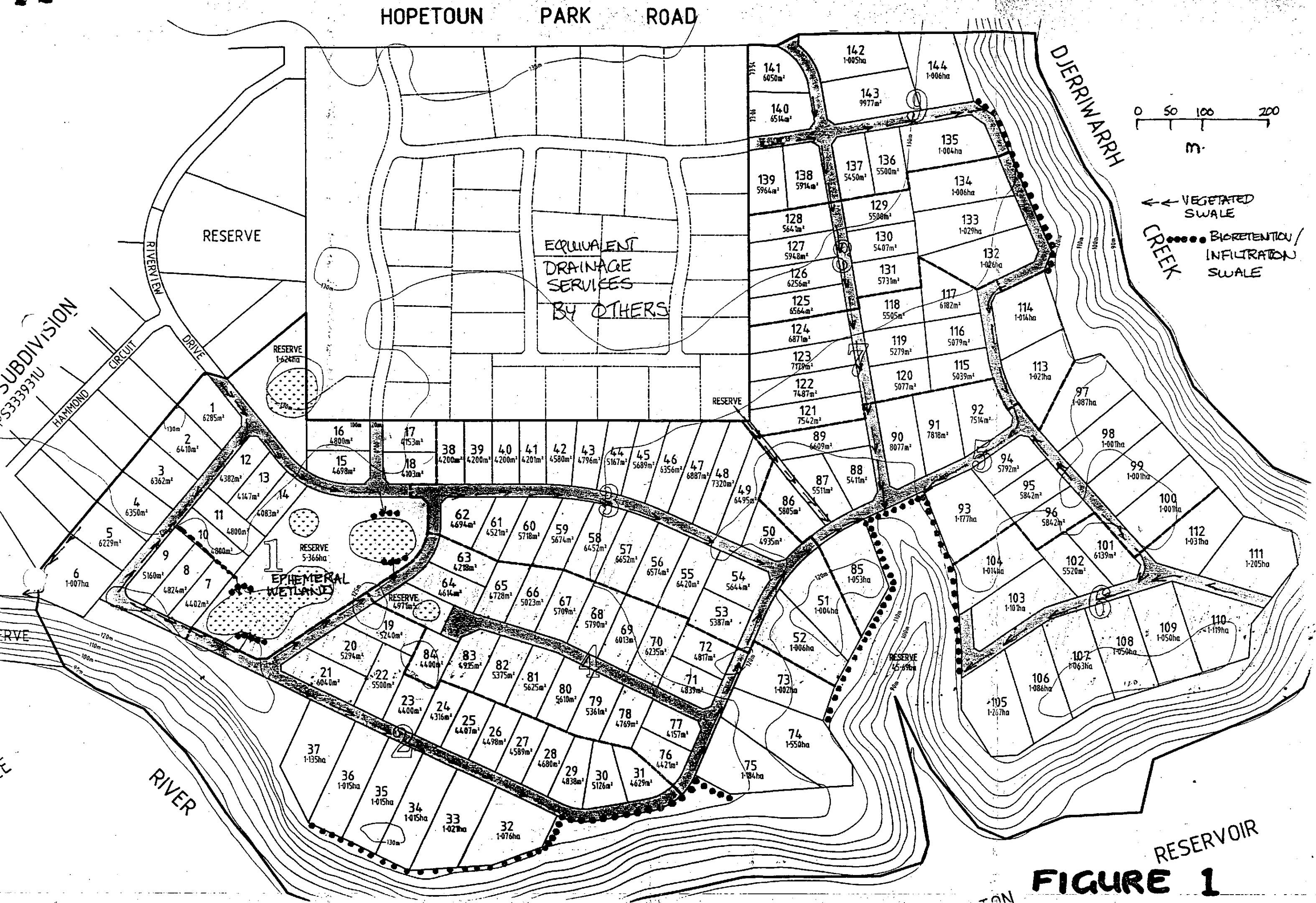
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TABLE 5 PREFERRED SURFACE WATER MANAGEMENT STRATEGY FOR THE HOPETOUN PARK ESTATE

Estate Component	Catchment Area (ha)	Impervious area (ha)	Options	Treatment area available (ha)	EPTA (% catchment)	ETA (ha)	Comment
Lots 5 and 6	1.63	0.13	Grassed swale to existing drainage outfall at rear of Hammond Circuit	120 m @ 1 m wide = 120 m ² (9.2% catchment)	30	0.04	Mowable grassed swale along rear of Lot 6
			Roof water to gardens and raintanks	2 lots @ 10 m ² /lot = 20 m ² (1.5% catchment)	60	0.08	Will also adequately reduce volume of runoff
Totals	1.63	0.13				0.12	Total ETA=0.12*1.2=0.14 ha OK (*)
Wetland Reserve catchment	17.00	1.67	Ephemeral wetland in main reserve area	1 ha (>50% of catchment)	100%	1.67	Effective stand-alone measure for water quality. Also very effective in mitigating runoff volume.
			Vegetated swales along all road reserves (1 side only)	1200 m @ 1 m wide = 0.12 ha (7% catchment)	30	0.50	Primarily mowable grassed swales. Only required to provide drainage capacity but must be stable.
			Roof water to gardens and raintanks	14 lots @ 10 m ² /lot = 140 m ² (0.8% catchment)	35	0.58	Main effect will be to reduce volume of runoff
Totals	17.00	1.67				1.67	Total ETA=1.67*1.2=2.00 ha OK (*)
Balance of development	100.67	7.20	Vegetated swales along road reserves (1 side only)	4500 m @ 1 m wide = 0.45 ha (6% catchment)	30	2.16	Mowable grassed swales and vegetated swales, possibly including gravel in base.
			Bioretention/infiltration trenches along road reserves at drainage outlet frontages	600 m @ 0.6 m wide = 360 m ² (0.5% catchment)	60	4.32	Designed to encourage deeper infiltration and discharge of water over wide frontage areas via seepage.
			Roof water to gardens and raintanks	98 lots @ 10 m ² /lot = 980 m ² (1.4% of catchment)	17	1.22	Important measure for reducing runoff water volume
Totals	119.3	13.00				6.48	Total ETA=6.48*1.2=7.8 ha OK (*)

(*) The total ETA has been factored up by 1.2 to account for Melton MAR differences.

Counted towards total ETA for relevant catchment area



HOPETOUN PARK ESTATE

TRAFFIC MANAGEMENT PLAN Version 2

This Traffic Management Plan Version 2 dated 13 March 2002, supersedes and replaces Section 5.2 Traffic of the Development Plan dated 16 October 2001.

EXECUTIVE STATEMENT

The Traffic Management Plan Version 2 addresses a number of internal traffic management measures and the traffic management conditions at the intersection of Hopetoun Park Road and Western Highway which is external to the development as prescribed in Schedule 2 of the Development Plan Overlay of the Moorabool Planning Scheme. The above mentioned intersection is some two kilometres north of the development. The Hopetoun Park Development, Part 1 abuts the local road, Riverview Drive.

Traffic management provisions already completed by the developer include constructing the roundabout at the intersection of Riverview Drive and Hopetoun Park Road and the widening and asphalt sealing of Hopetoun Park Road to provide a 7.3m wide trafficable width between this roundabout and the Western Highway.

The Grogan Richards Traffic Management Assessment remains valid and is included in this Traffic Management Plan Version 2. Traffic count surveys have now been undertaken on the Western Highway to ascertain the traffic speed profiles the intersection should be designed to in regards to Safe Intersection Sight Distance (SISD) in line with the AustRoads design guidelines. The main concern relates to eastbound traffic and in particular the right (south) eastbound traffic lane which has been identified as the more critical. The posted speed limit is 90kph while the posted advisory speed is 80kph due to the steep curved road alignment. The Grogan Richards assessment concluded the left (north) eastbound lane satisfies the AustRoads SISD for 90kph (210 metres) and the right (south) eastbound lane with a reduced SISD of 190 metres only meet the requirements for 86kph. *

A subsequent "24 hour speed summary survey" carried out over a 7 day period by Traffic Engineering Services reveals a large percentage of vehicles travelling this section of the Western Highway do so at speed well in excess of the posted speed limit with 23.8% of traffic in the left lane and 49.1% of traffic in the right lane exceeding the 90kph posted speed limit and a very high (3%) of traffic in the right lane exceeding 120kph. The traffic count reports the 85th percentile speed, the design speed for AustRoads design purposes, in the eastbound left lane is 94kph and 98kph in the eastbound right lane hence the required SISD is 240 metres to satisfy 98kph under AustRoads guidelines. The existing SISD is 190 metres as reported in the Grogan Richards Assessment. This higher speed situation requires the Hopetoun Park Road intersection to be relocated some 50 metres

further to the east to satisfy AustRoads Guidelines. This will result in a staggered-T intersection with Longforest Road.

The existing intersection has a very low accident record during the past 10 years (two casualty accidents of low accident severity i.e. classified as "Other injury" – below Killed and Serious Injury).

This improvement to the existing intersection may be of short term benefit only as the traffic flow patterns in the area will change considerably with the implementation of the Western Highway deviation to the south of the current Western Highway. If Federal funding becomes available prior to the intersection improvement as proposed being implemented this matter could be reviewed.

The traffic volumes and traffic distribution considerations at the Hopetoun Park Road / Western Highway intersection used in this Traffic Management Plan allow for the total precinct including the 80 odd existing residential landholdings plus an additional allowance of 153 residential allotments in the Hopetoun Park Development Part 1 plus an additional allowance for 54 future residential allotments to the immediate north.

INTERNAL VEHICLE AND PEDESTRIAN NETWORK

Riverview Drive will initially provide the main access to the subdivision with the provision of a circulating roadway along Weir Gully Road connecting to Hopetoun Park Road as stage construction progresses. Upon completion of the whole subdivision these two roads will provide all access to this subdivision along with a further connecting road to be provided as part of Part 2 development.

The proposed road network layout has been designed to provide a self regulating arrangement in terms of traffic behaviour with a combination of curved and straight alignments and all intersecting roadways to be T-intersections with the exception of one cross road. The use of additional traffic management devices, i.e. restrictive devices, are unnecessary considering the location of the subdivision and volume of traffic generated.

Provision for pedestrian access to all reserves, both within the subdivision and the abutting Werribee River and Djerriwarrh Creek, have been provided at several locations. Several existing lignum sites have been incorporated into the proposed reserves.

VEHICULAR ACCESS TO EACH BUILDING LOT

It is proposed to provide each building lot with the following access facility –

- 3m wide crossover with 2m radii returns
- construction material will be crushed rock or an approved alternative
- a culvert located in the table drain will provide stormwater drainage at each crossover
- Each crossover will be located 5 to 20m from the side boundary or as per the engineering drawings

EXTERNAL TRAFFIC MANAGEMENT MEASURES

WESTERN HIGHWAY / HOPETOUN PARK ROAD INTERSECTION

(a) Traffic Management Report

Grogan Richards Pty Ltd were retained by Millar & Merrigan Pty Ltd to provide a traffic engineering assessment for the Hopetoun Park Estate. This report accompanied the Outline Development Plan prepared by Millar & Merrigan Pty Ltd, Drawing No. 10932T1 and describes the anticipated development traffic. A copy of this report is attached and marked Annexure A.

In the course of preparing this report the site and its surrounding environs were inspected, plans of the proposal reviewed, and relevant traffic data collected and analysed.

The report concluded –

- *The proposed 145 lot subdivision is likely to generate a daily flow of approximately 1,015 vehicle movements, which can be accommodated by the external road network without significant effect on traffic conditions.*
- *The Hopetoun Park Road and Western Highway intersection has sufficient capacity to cater for the anticipated development traffic.*

(b) Speed Profile

A traffic count has been conducted over a period of one week at a location 200m west of the intersection by Traffic Engineering Services primarily to determine the 85th percentile speed in both east bound lanes. This report also provides Traffic classification results reported as Survey period Averages, 24 hour Speed Summary, 24 hour Volume Summary and 24 hour Vehicle Type Summary. A copy of the report is attached as Annexure B and indicates that the 85th percentile speed in the left lane is 94kph and 98kph in the right lane. This information has been used to determine the location of the Hopetoun Park Road / Western Highway intersection as shown in the proposed functional layout as discussed below.

(c) Median Width

The median width at the existing intersection is 5.90m (measured between centreline of lane lines). The Road Design Guideline standard specifies 7.00m wide as desirable and 6.00m minimum. This desirable width has been proposed in the functional layout plan discussed below.

(d) Safe Intersection Sight Distance (SISD)

The current SISD (obstruction free) is approximately 185m measured using driver eye height of 1.15m which does not satisfy the AustRoads Guideline for the signed legal speed (i.e. 90kph). Austroads Guide to Traffic Engineering Practice Part 5 specifies SISD required for V90kph is 210m and 250m for V100kph. The measured 85th percentile speed condition (98kph) has been satisfied in the proposed functional layout discussed below.

(e) Functional Layout

A proposed functional layout (Drawing No. 10932E/00/R/-) has been produced using base plans obtained from VicRoads and is attached marked Annexure C and is based on the following features –

- “Staggered T” type intersection with 50m between Longforest Road and Hopetoun Park Road legs.
- Two through lanes have been maintained along Western Highway in both directions
- Left turn lanes have been provided for both Longforest Road (existing) and Hopetoun Park Road (proposed)
- A 7m wide median in the vicinity of the right turn lanes has been provided with 3.0m wide “back to back” turn lanes and a 1m wide residual median
- All turn lanes provided are V90kph to V20kph i.e. 134m long as per Austroads Guide to Traffic Engineering Practice Part 5
- Hopetoun Park Road has been realigned to match the existing roadway (approximately 220m in length)

Note – a detailed feature and level survey will be required, to identify the exact location of Hopetoun Park Road to satisfy the measured 85th percentile speed, prior to detailed design being undertaken.



**PROPOSED RESIDENTIAL SUBDIVISION
HOPETOUN PARK ESTATE, HOPETOUN PARK**

TRAFFIC ENGINEERING ASSESSMENT

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Date: _____

Authorised by: _____

Date: _____

14 September 2001

GR Ref: 101514REP001MIL.doc/RE/lw



1. INTRODUCTION

Grogan Richards Pty Ltd was retained by Millar & Merrigan Pty Ltd to provide a traffic engineering assessment for a proposed residential subdivision on land known as the "Hopetoun Park" Estate, Hopetoun Park.

This report has been prepared to accompany the Outline Development Plan prepared by Millar & Merrigan Pty Ltd, Drawing No. 10932T1, and describes the anticipated development traffic.

In the course of preparing this report, the subject site and its surrounding environs have been inspected, plans of the proposal reviewed, and relevant traffic data collected and analysed.

2. BACKGROUND AND EXISTING CONDITIONS

2.1. Location and Land Use

The subject site, known as the "Hopetoun Park" Estate, is located on the south side of Hopetoun Park Road, Hopetoun Park.

The subject land is generally irregular in shape, and has an overall area of 165ha.

The subject land is bounded on the south by the Melton Reservoir and to the east by the Djerriwarrh Creek. The land use surrounding the site comprises a mixture of farms and low-density dwellings.

The location of the subject land and its surrounding environs is depicted in Figure 1.



CLICK ON LINK TO GO TO LOCALITY PLAN

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Figure 1: Locality Plan

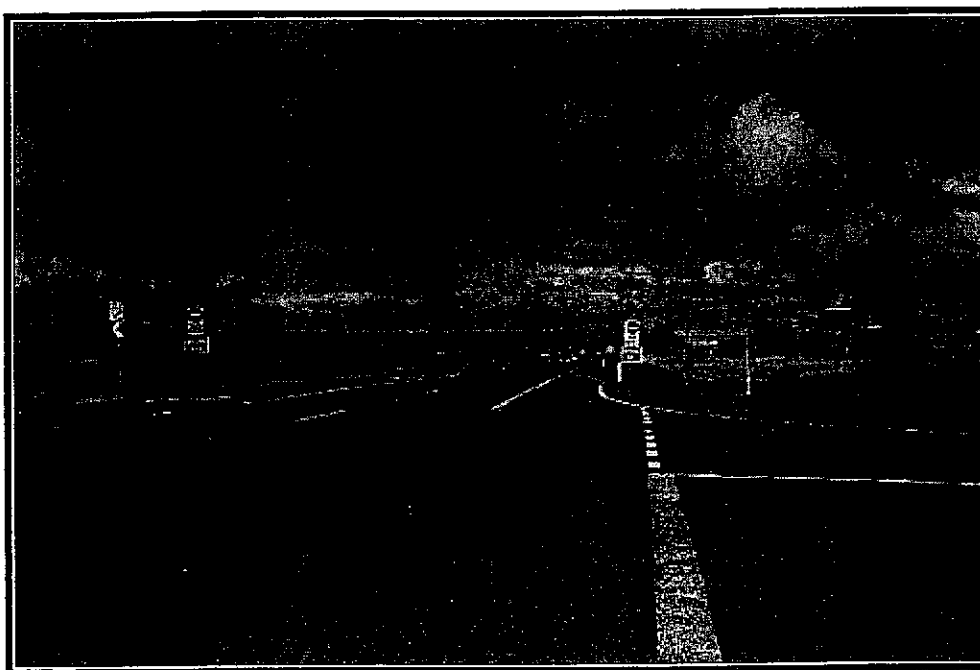
2.2. Road Network

The subject site has two road frontages, with the northern boundary abutting Hopetoun Park Road and the western boundary abutting Riverview Drive. A description of the surrounding road network is detailed below:

Western Freeway is classified as a national highway with all works funded by the Federal Government. The highway forms a vital link between Melbourne and Adelaide.

At the intersection with Hopetoun Park Road, Western Freeway has a left-turn deceleration lane, a right-turn lane and two through lanes in both directions, as depicted in Photograph 1 and Photograph 2. These turning lanes provide diverging access to Hopetoun Park Road for users of the proposed residential subdivision.

There is unrestricted sight distance to the eastern approach along the alignment of Western Freeway for traffic utilising the access into and out of Hopetoun Park Road.



**Photograph 1: Western Freeway
Eastern Approach to Hopetoun Park Road.**



Photograph 2: Western Freeway
Western Approach to Hopetoun Park Road

Hopetoun Park Road is classified as a local road under the road hierarchy classification. However the road functions as a sub-arterial road.

Hopetoun Park Road is divided into a sealed section and an unsealed section. The sealed section of Hopetoun Park Road connects Western Freeway in the north to Riverview Drive in the south. The unsealed section of Hopetoun Park Road is located east of Riverview Drive.

The road pavement of Hopetoun Park Road at its intersection with Riverview Drive has been constructed to a trafficable width of 7.3m, as depicted in Photograph 3. Hopetoun Park Road provides access to 9 abutting properties.

A roundabout is installed at the intersection of Hopetoun Park Road and Riverview Drive.



Photograph 3: Looking north along the alignment of Hopetoun Park Road

Riverview Drive is classified as a local street and has a length of approximately 360 metres. It connects Hopetoun Park Road in the north and terminates just south of Hammond Circuit.

Riverview Drive has a pavement width of 7m with unsealed shoulders on either side, as depicted in Photograph 4.



Photograph 4: Riverview Drive

2.3. Traffic Volumes

Grogan Richards Pty Ltd commissioned Data Collection Services to undertake peak hour turning movement counts at the intersection of Western Freeway/Hopetoun Park Road/Long Forest Road. The traffic counts were conducted on Friday 24th of August 2001 between 7:00am and 9:30am, and between 3:30pm and 6:00pm.

The peak hour results of the survey are shown in Figure 2 and Figure 3.

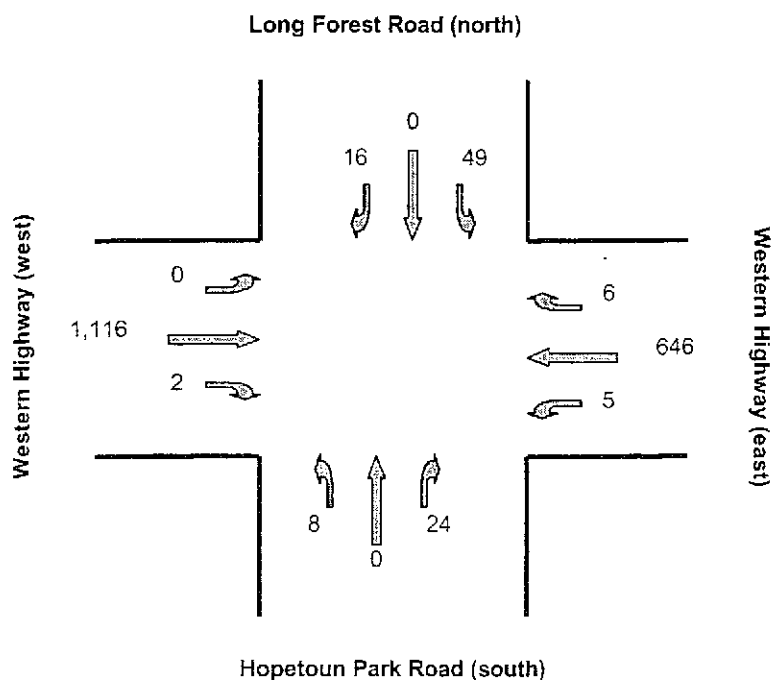
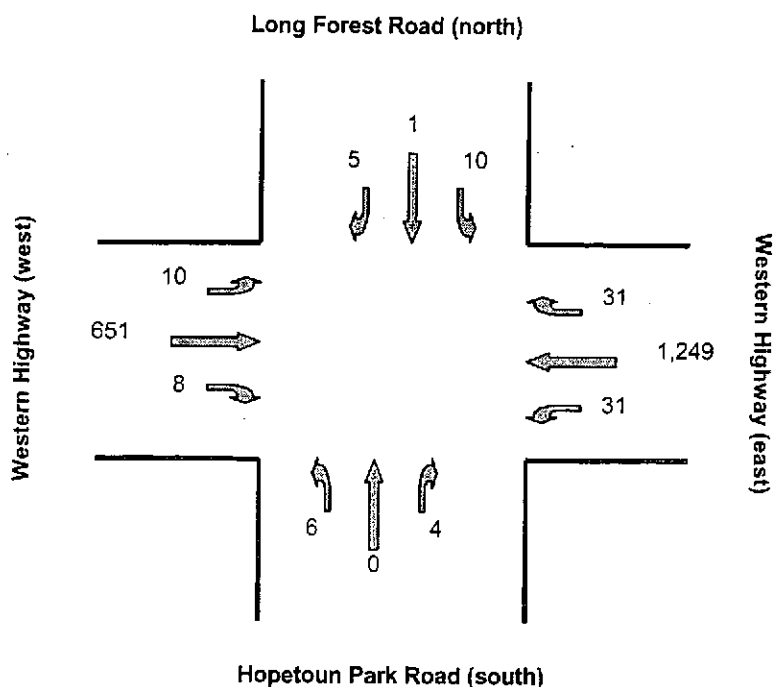


Figure 2: Western Hwy/Hopetoun Park Road/Long Forest Road
Existing Peak Hour Traffic Volumes (7:30am – 8:30am)
Friday 24 August 2001



**Figure 3: Western Hwy/Hopetoun Park Road/Long Forest Road
Existing Peak Hour Traffic Volumes (4:30pm – 5:30pm)
Friday 24th August 2001**

Results of the surveys indicate that Hopetoun Park Road, south of Western Freeway carries 39 vehicles per AM peak hour and 49 vehicles per PM peak hour. Based upon these peak hour volumes it is estimated that Hopetoun Park Road, south of Western Freeway, would typically carry between 400 and 500 vehicles per weekday (2-way over a 24 hour period).

Based on the survey results, Western Freeway, east of Hopetoun Park Road, carries 1,846 vehicles per AM peak hour, and 1,976 vehicles in the PM peak hour. It is estimated that Western Freeway, east of Hopetoun Park Road, is carrying around 19,000 vehicles per weekday.

3. THE HOPETOUN PARK ESTATE TRAFFIC CHARACTERISTIC

3.1. Traffic Generation and Distribution

In order to determine the traffic generation of the Hopetoun Park Estate, surveys were undertaken by Data Collection Services, on behalf of Grogan Richards Pty Ltd, on Friday, 24th of August 2001, during peak periods. All traffic entering and exiting the Hopetoun Park Estate via Hopetoun Park Road was recorded during peak periods, providing an indication of the traffic generating characteristics of the Hopetoun Park Estate.

The Hopetoun Park Estate has a number of existing residences on-site, which comprise of 71 occupied low-density residential dwellings.

The results of the traffic counts are summarised in Table 1. Full detail of the traffic counts is attached as Appendix A.

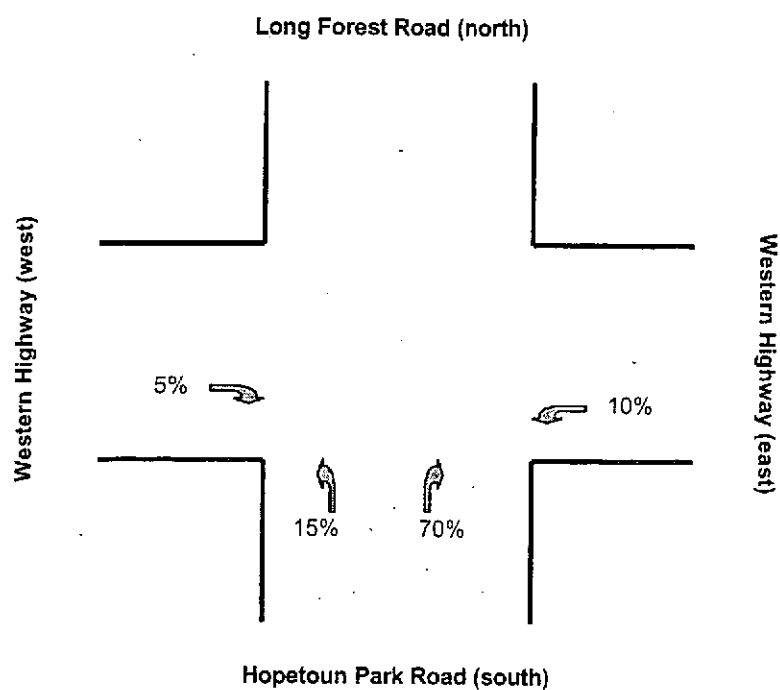
**Table 1: Summary Traffic Count Results
The Hopetoun Park Estate**

<i>Peak Period</i>	<i>In</i>	<i>Out</i>	<i>Total</i>
7:15am-8:15am	7	33	40
4:30pm-5:30pm	40	10	50

Reference to Table 1 indicates an AM peak flow volume of 40 vehicles was recorded between 7:15am and 8:15am entering and exiting the Hopetoun Park Estate. This is equivalent to a traffic generation rate of 0.56 vehicle movements per fully occupied dwelling per AM peak hour.

A PM peak hour flow of 50 vehicles was recorded between 4:30pm and 5:30pm entering and exiting the site, which equates to 0.70 vehicle movements per fully occupied dwelling per PM peak hour.

The following traffic distribution is derived from the traffic surveys.



**Figure 4: Development Traffic Distribution
AM Peak**

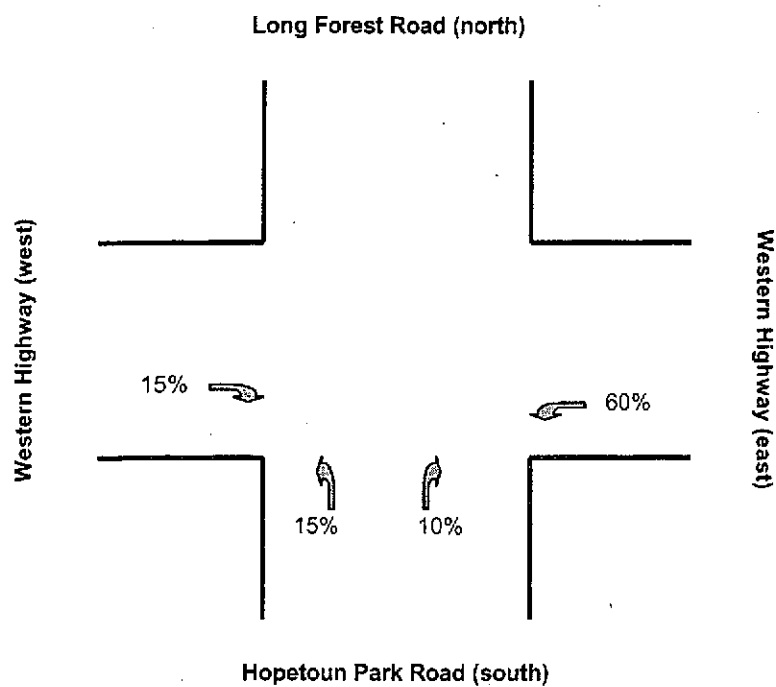


Figure 5: *Development Traffic Distribution
PM Peak*



3.2. Accident Statistics

Accident statistics for the surrounding road network of the site were obtained from the VicRoads online Crashstats database.

The VicRoads accident database indicates that the Hopetoun Park Road, Western Freeway and Long Forest Road intersection has experienced two casualty accidents in the ten-year periods between 1 January 1991 and 31 December 2000.

The VicRoads database records the accident severity with the following four categories.

1. Killed
2. Serious injury
3. Other injury
4. Not injured.

The accident database reveals that the two casualty accidents on record, were both "other injury", which indicates low level of injury.

It is concluded that the subject site does not have a significant accident history.



4. THE PROPOSED DEVELOPMENT

4.1. Description

The Development Plan, prepared by Millar & Merrigan Pty Ltd, Drawing No. 10932T1, indicates that the subject land will be subdivided into 145 rural residential allotments. The proposed allotments have an average lot size of 6,990 square metres. Each allotment is expected to accommodate a single detached dwelling.

4.2. Access into the Site

All vehicle access to the site will occur via Hopetoun Park Road, which connects with the Western Freeway.



5. TRAFFIC CONSIDERATIONS

5.1. Traffic Generation

Grogan Richards Pty Ltd has recently undertaken traffic surveys of the Hopetoun Park Estate which indicate a peak daily traffic generation rate of around 7 vehicle movements per dwelling.

For the purposes of this assessment a daily traffic generation rate of 7 vehicle movements per dwelling and peak hourly generation of 0.7 vehicle movements per dwellings have been adopted. Applying these design rates to the proposed residential subdivision (145 allotments) yields a daily traffic generation of 1,015 vehicle movements, and a peak generation of 102 vehicle movements, being generated to/from the site.

5.2. Traffic Distribution

The traffic distribution along Western Freeway is based upon traffic surveys undertaken at the existing Hopetoun Park Road and Western Freeway Intersection.

Figure 6 and Figure 7 show the anticipated post development traffic flows at the Hopetoun Park Road, Western Freeway intersection.

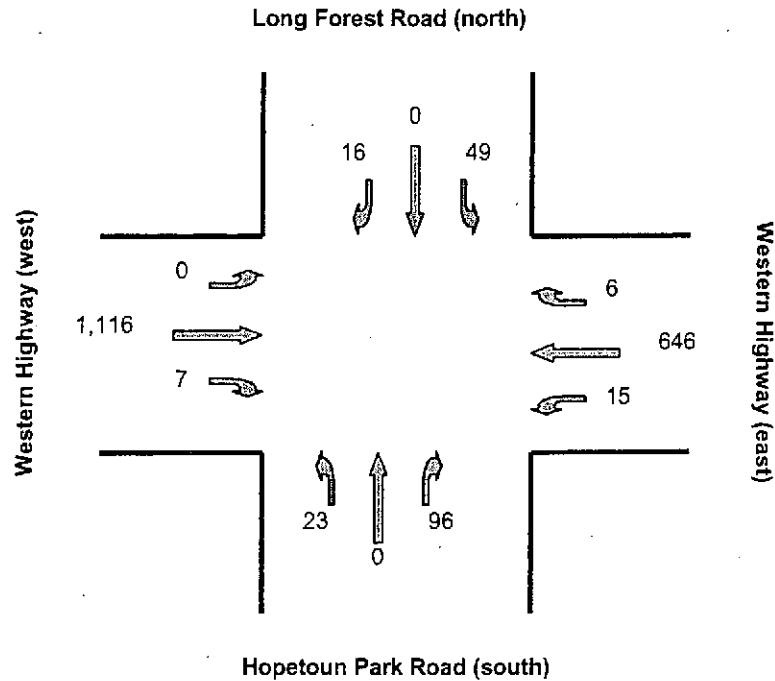


Figure 6: AM Peak Hour Traffic Volumes
Post Hopetoun Park Development

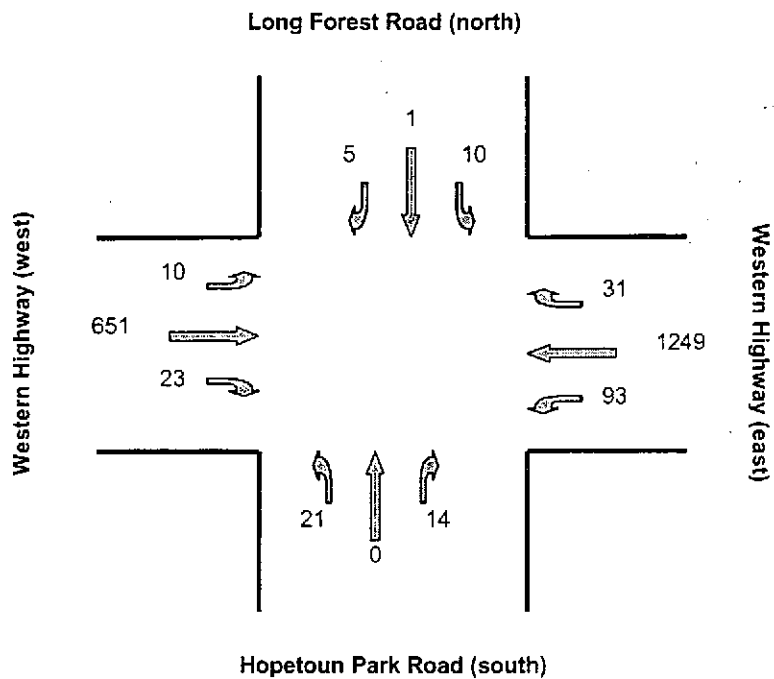


Figure 7: PM Peak Hour Traffic Volumes
Post Hopetoun Park Development



The effects of the anticipated development traffic on operation of the Hopetoun Park Road and the Western Freeway intersection is summarised in Table 2.

**Table 2: Post Hopetoun Park Development Traffic Conditions
Right Turn From Hopetoun Park Road**

	Existing Conditions	Future Conditions	Change
AM Peak			
Degree of Saturation	0.10	0.42	+0.32
Delay (seconds)	52.4	58.3	+5.9
Overall DS	0.29	0.42	+0.13
PM Peak			
Degree of Saturation	0.05	0.13	+0.08
Delay (seconds)	54.5	58.5	+4.0
Overall DS	0.33	0.33	0

The above table shows that the proposed development peak hour traffic generation is adequately catered for by the Hopetoun Park Road and Western Freeway intersection.

The overall intersection degree of saturation will remain below 0.42, while the delay to right turners from Hopetoun Park Drive will increase by 5.9 seconds. This result indicates that the intersection will operate well within capacity.



5.3. Other Developments

To follow...



5.4. Djerriwarrh Creek Realignment

VicRoads have developed and are gradually implementing the "Western Highway M8/A8 Corridor Strategy", which affects the Western Highway / Freeway between Deer Park and the South Australian Border.

The corridor strategy includes the proposed realignment of the Western Highway in the vicinity of Djerriwarrh Creek. This proposal will bypass that section of the Western Freeway that intersects with Hopetoun Park Road, and will greatly reduce traffic volumes along the current Western Freeway alignment.

The project will cost upwards of \$50M, and is dependent upon Federal Government allocation of funds.

Planning for the realignment of the Djerriwarrh Creek section of the Western Freeway (Highway) will occur in the 2002/3 financial year, with construction expected to occur between 2003 and 2010.

5.5. Hopetoun Park Road / Western Freeway Intersection

Vehicles entering the Western Freeway from Hopetoun Park Road have greater than 250 metres sight distance available toward the east. The sight distance toward the west is limited to 190 metres for traffic in the nearest (southern) eastbound lane, and is limited to 210 metres for traffic in the furthest (north) eastbound lane.

The Western Freeway (Highway) has a speed limit of 90 kilometres per hour in the vicinity of the Hopetoun Park Road. Around 220 metres west of the intersection and advisory speed of 80 kilometres per hour is applicable, associated with the steep curved road alignment through "Anthony's Cutting".

The AustRoads text "Intersections at Grade", Part 5 specified the sight distance requirements summarised in Table 3.

Table 3: Sight Distance Requirements

	Speed Zone (kmh-1)	
	90	80
Rural Stopping Sight Distances (m)		
Normal	140	115
Alerted	130	105
Safe Intersection Sight Distance (m)		
Rural	210	175

Sight distances available east of Hopetoun Park Road along the Western Freeway satisfies all requirements for an 80 kilometres per hour design speed. The required 210 sight distance to the west is satisfied for a 90 kilometres per hour design speed for the left (north) eastbound lane, but is not satisfied for the right (south) eastbound lane.

The required stopping distance for eastbound 90 kilometre per hour traffic (130 to 140 metres) is easily satisfied by the available sight distance (190 to 210 metres).

The stopping sight distances defined by Austroads provide sufficient distance for a vehicle travelling at the design speed to stop before reaching the conflict point. The Safe Intersection Sight Distance allows for the stopping distance plus an additional 3 seconds of travel at the design speed.

The AustRoads stopping sight distances assume no other evasive action by the car on the major road. The Western Freeway eastbound carriageway has two traffic lanes allowing vehicles to overtake, thus affording increased opportunity for evasive action.

It is concluded that there is adequate sight distance west of Hopetoun Park Road along the Western Freeway to allow safe intersection operation.

6. CONCLUSIONS

Having evaluated the proposed development, it is concluded as follows:

- The proposed 145 lot subdivision is likely to generate a daily flow of approximately 1,015 vehicle movements, which can be accommodated by the external road network without significant effect on traffic conditions.
- The Hopetoun Park Road and Western Freeway intersection has sufficient capacity to cater for the anticipated development traffic.

Time Period	In	Out	Total
7:00am-7:15am	2	7	9
7:15am-7:30am	2	12	14
7:30am-7:45am	1	6	7
7:45am-8:00am	4	6	10
8:00am-8:15am	0	9	9
8:15am-8:30am	2	11	13
8:30-8:45am	2	4	6
8:45am-9:00am	2	6	8
9:00am-9:15am	0	3	3
9:15am-9:30am	4	1	5
Peak Hour	7	33	40



7:15am-8:15am			
3:30pm-3:45pm	9	5	14
3:45pm-4:00pm	5	2	7
4:00pm-4:15pm	4	3	7
4:15pm-4:30pm	8	2	10
4:30pm-4:45pm	11	1	12
4:45pm-5:00pm	9	1	10
5:00pm-5:15pm	12	2	14
5:15pm-5:30pm	8	6	14
5:30pm-5:45pm	8	0	8
5:45pm-6:00pm	7	1	8
Peak Hour 4:30pm-5:30pm	40	10	50

TRAFFIC ENGINEERING SERVICES

P. O. Box 1

Mt Clear VIC 3350

1 February 2002

Mr Norm Bettess
Millar & Merrigan
P.O.Box 247
Croydon VIC 3136

RECEIVED

DATE 4.2.02 REF.

NB

Dear Mr Bettess

TRAFFIC COUNT DATA

Please find enclosed traffic classification results, (collected by machinery calibrated to Austroads standards) separated by direction and reported as Survey Period Averages, 24Hour Speed Summary, 24 Hour Volume Summary and 24 Hour Vehicle Type Summary.

Survey Locations:

	<i>Site No</i>	<i>Road Name</i>	<i>Location</i>
1	10376	WESTERN HIGHWAY 46Km	200 M West of Long Forest Rd
2	10377	WESTERN HIGHWAY 46Km	200 M West of Long Forest Rd

If you have any queries regarding the above matter or require any further counts please contact Mr Rod Fox on telephone (03)53 301265 Mob 0419 528579.

Yours faithfully



Rod Fox

Traffic Engineering Services

24 Hour Volume Summary

***Road Name** : WESTERN HIGHWAY 46 KM EB LL
***Road Number** : 2520
***Location** : 200 Metres West of Long Forest Road
***Kilometre Ref** : 46.00 km from Melbourne
***Site Number** : 10376
***Map Reference** : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool Shire Council
***Region** : Western
***Direction** : East Bound Left Lane

Date	DOY	DOW	24hr Total	12hr Total	Peak am Hour	Peak pm Hour	1 Hour Avg
24/Jan/2002	24	Thu	8207	5880	556 (07-08)	534 (17-18)	490
25/Jan/2002	25	Fri	8595	6003	530 (08-09)	543 (17-18)	500
26/Jan/2002	26	Sat	7601	5482	523 (11-12)	532 (17-18)	456
27/Jan/2002	27	Sun	8856	6351	555 (11-12)	756 (18-19)	529
28/Jan/2002	28	Mon	10056	7556	600 (11-12)	914 (16-17)	629
29/Jan/2002	29	Tue	8181	5885	585 (08-09)	518 (16-17)	490
30/Jan/2002	30	Wed	8232	5881	558 (07-08)	544 (17-18)	490

***Averages**

5 day Average - **8654**
7 day Average - **8532**
Weekend Average - **8228**
AM Peak Hour - **600** (Mon 11-12)
PM Peak Hour - **914** (Mon 16-17)

Legend:

DOY = Day of Year, DOW = Day of Week.

12Hr Total = Total Volume for the period 0700 Hrs to 1900 Hrs (7am to 7pm).

Peak am = Maximum 1 hour Volume for period Midnight to Midday.

Peak pm = Maximum 1 hour Volume for period Midday to Midnight.

1 Hour Average = Average Hourly Volume for period 0700 hrs to 1900 hrs (7am to 7pm).

Hour (15-16) = Hour during which peak 1 hour volume occurred.

Job Number:- , Previous T.I.D.E.S. Number:- , Machine Asset Number:-

Comments:-

Printing Date - 01/02/2002 (08:42).

Traffic Engineering Services

24 Hour Vehicle Type Summary

***Road Name** : WESTERN HIGHWAY 46 KM EB LL
***Road Number** : 2520
***Location** : 200 Metres West of Long Forest Road
***Kilometre Ref** : 46.00 km from Melbourne
***Site Number** : 10376
***Map Reference** : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool Shire Council
***Region** : Western
***Direction** : East Bound Left Lane

Date	DOY	DOW	24hr Total	Cars	Trks	Art	% Cars	% Comm
24/Jan/2002	24	Thu	7151	6688	208	255	93.5	6.5
25/Jan/2002	25	Fri	7570	7084	223	263	93.6	6.4
26/Jan/2002	26	Sat	7205	6895	131	179	95.7	4.3
27/Jan/2002	27	Sun	8671	8426	101	144	97.2	2.8
28/Jan/2002	28	Mon	9673	9268	167	238	95.8	4.2
29/Jan/2002	29	Tue	7226	6762	211	253	93.6	6.4
30/Jan/2002	30	Wed	7176	6713	208	255	93.5	6.5
*Averages				5 day	7 day	Weekend		
Cars only	(Percentage of 24Hr Total)			94.0%	94.7%	96.5%		
Commercial	(Percentage of 24Hr Total)			6.0%	5.3%	3.5%		

Legend:

Region = VicRoads Region, DOY = Day of Year, DOW = Day of Week.

Trks = Trucks, Art = Articulated Vehicles.

%Cars = Number of CARS as a Percentage of the 24 hour total.

%Comm = Number of Commercial (i.e. TRUCKS plus ARTICULATED) Vehicles as a Percentage of the 24 hour total.

Comments:-

Printing Date - 01/02/2002 (08:42).

----- Traffic Engineering Services -----

24 Hour Speed Summary

***Road Name** : WESTERN HIGHWAY 46 KM EB LL
***Road Number** : 2520
***Location** : 200 Metres West of Long Forest Road
***Kilometre Ref** : 46.00 km from Melbourne
***Site Number** : 10376
***Map Reference** : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool Shire Council
***Region** : Western
***Direction** : East Bound Left Lane
***Speed Limit** : 90 km/hr

Date	DOY	DOW	24hr Total	Mean	85%	Std Dev	% > lmt	% > lmt+10	% > lmt+30
24/Jan/2002	24	Thu	8207	81.64	94.19	12.11	24.4	8.8	0.8
25/Jan/2002	25	Fri	8595	81.73	94.07	11.90	24.8	8.9	0.6
26/Jan/2002	26	Sat	7601	83.27	94.21	10.56	25.0	9.5	0.9
27/Jan/2002	27	Sun	8856	83.35	93.16	9.47	22.5	7.4	0.6
28/Jan/2002	28	Mon	10056	83.78	94.15	10.00	26.0	9.0	0.7
29/Jan/2002	29	Tue	8181	81.80	93.98	11.75	23.9	8.6	0.9
30/Jan/2002	30	Wed	8232	81.56	94.16	12.16	24.3	8.8	0.8

*Averages		5 day	7 day	Weekend
Mean Speed	(km/hr)	82.1	82.4	83.3
85th Percentile	(km/hr)	94.1	94.0	93.7
Over Limit	(Percentage of 24Hr Total)	24.7%	24.4%	23.8%

Legend:

Region = VicRoads Region.

DOY = Day of Year.

DOW = Day of Week.

Mean = Arithmetic Average of Speeds (km/hr).

85% = 85th Percentile (km/hr) (i.e. Speed at which 85 percent of vehicles are travelling).

% > lmt = Number of VEHICLES whose speed is greater than the speed limit expressed as a Percentage of the 24 hour total.

% > lmt+30 = Number of VEHICLES whose speed is greater than the speed limit plus 30 kph expressed as a Percentage of the 24 hour total.

Printing Date - 01/02/2002 (08:42).

Traffic Engineering Services

Survey Period Averages

***Road Name** : WESTERN HIGHWAY 46 KM EB LL
***Road Number** : 2520
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***Site Number** : 10376
***Map Reference** : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool Shire Council
***Region** : Western
***Direction** : East Bound Left Lane
***Speed Limit** : 90 km/hr
***Survey Period** : 7 Days (24 Jan 2002 to 30 Jan 2002)

***Volume Count**

	5 day	7 day	Weekend
24 Hour Average - (All Vehicles)	8654	8532	8228
1 Hour Average - (12hr day [07:00- > 19:00hrs])	519	512	492

***Length Classification**

24 Hour Average - (Cars Only)	7303	7405	7660
24 Hour Average - (Trucks Only)	203	178	116
24 Hour Average - (Articulated Only)	252	226	161
Cars only (Percentage of 24Hr Total)	94.0%	94.7%	96.5%
Commercial (Percentage of 24Hr Total)	6.0%	5.3%	3.5%

***Speed Classification**

Mean Speed (km/hr)	82.1	82.4	83.3
85th Percentile (km/hr)	94.1	94.0	93.7
Over 90 km/hr (Percentage of 24Hr Total)	24.7%	24.4%	23.8%
Over 100 km/hr (Percentage of 24Hr Total)	8.8%	8.7%	8.4%
Over 120 km/hr (Percentage of 24Hr Total)	0.8%	0.8%	0.8%

Legend:

1 Hour Average = Average Hourly Volume for period 0700hrs->1900hrs (7am to 7pm).

Cars Only = Number of CARS as a Percentage of the 24 hour total.

Commercial = Number of Commercial (i.e. TRUCKS plus ARTICULATED) Vehicles as a Percentage of the 24 hour total.

Mean Speed = Arithmetic Average of Speeds - Kilometers per Hour.

85th Percentile = Speed at which 85 percent of vehicles are travelling.

Over 90 km/hr = number of vehicles whose speed is greater than the speed limit expressed as a percentage of the 24 Hour Total.

Over 100 km/hr = number of vehicles whose speed is greater than the speed limit + 10 km/hr expressed as a percentage of the 24 Hour Total.

Over 120 km/hr = number of vehicles whose speed is greater than the speed limit + 30 km/hr expressed as a percentage of the 24 Hour Total.

Comments:-

Printing Date - 01/02/2002 (08:42).

Traffic Engineering Services

24 Hour Volume Summary

***Road Name** : WESTERN HIGHWAY 46 KM EB RL
***Road Number** : 2520
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***Kilometre Ref** : 46.00 km from Melbourne
***Site Number** : 10377
***Map Reference** : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool shire Council
***Region** : Western
***Direction** : East Bound Right Lane

Date	DOY	DOW	24hr Total	12hr Total	Peak am Hour	Peak pm Hour	1 Hour Avg
24/Jan/2002	24	Thu	5749	4397	521 (06-07)	396 (17-18)	366
25/Jan/2002	25	Fri	6295	4839	517 (07-08)	446 (17-18)	403
26/Jan/2002	26	Sat	3973	3145	375 (11-12)	303 (17-18)	262
27/Jan/2002	27	Sun	5164	3985	308 (11-12)	614 (18-19)	332
28/Jan/2002	28	Mon	7015	5670	404 (11-12)	914 (16-17)	472
29/Jan/2002	29	Tue	6113	4750	641 (07-08)	400 (17-18)	395
30/Jan/2002	30	Wed	6061	4607	553 (07-08)	400 (17-18)	383

***Averages**

5 day Average - **6246**
7 day Average - **5767**
Weekend Average - **4568**
AM Peak Hour - **641** (Tue 07-08)
PM Peak Hour - **914** (Mon 16-17)

Legend:

DOY = Day of Year, DOW = Day of Week.

12Hr Total = Total Volume for the period 0700 Hrs to 1900 Hrs (7am to 7pm).

Peak am = Maximum 1 hour Volume for period Midnight to Midday.

Peak pm = Maximum 1 hour Volume for period Midday to Midnight.

1 Hour Average = Average Hourly Volume for period 0700 hrs to 1900 hrs (7am to 7pm).

Hour (15-16) = Hour during which peak 1 hour volume occurred.

Job Number:- , Previous T.I.D.E.S. Number:- , Machine Asset Number:-

Comments:-

Printing Date - 01/02/2002 (08:42).

----- Traffic Engineering Services -----

24 Hour Vehicle Type Summary

***Road Name** : WESTERN HIGHWAY 46 KM EB RL
***Road Number** : 2520
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***Site Number** : 10377
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***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool shire Council
***Region** : Western
***Direction** : East Bound Right Lane

Date	DOY	DOW	24hr Total	Cars	Trks	Art	% Cars	% Comm
24/Jan/2002	24	Thu	5718	5119	418	181	89.5	10.5
25/Jan/2002	25	Fri	6263	5645	431	187	90.1	9.9
26/Jan/2002	26	Sat	3959	3721	155	83	94.0	6.0
27/Jan/2002	27	Sun	5159	4931	152	76	95.6	4.4
28/Jan/2002	28	Mon	7003	6655	220	128	95.0	5.0
29/Jan/2002	29	Tue	6087	5548	382	157	91.1	8.9
30/Jan/2002	30	Wed	6030	5431	418	181	90.1	9.9

*Averages		5 day	7 day	Weekend
Cars only	(Percentage of 24Hr Total)	91.2%	92.2%	94.8%
Commercial	(Percentage of 24Hr Total)	8.8%	7.8%	5.2%

Legend:

Region = VicRoads Region, DOY = Day of Year, DOW = Day of Week.

Trks = Trucks, Art = Articulated Vehicles.

%Cars = Number of CARS as a Percentage of the 24 hour total.

%Comm = Number of Commercial (i.e. TRUCKS plus ARTICULATED) Vehicles as a Percentage of the 24 hour total.

Comments:-

Printing Date - 01/02/2002 (08:42).

Traffic Engineering Services

24 Hour Speed Summary

*Road Name : WESTERN HIGHWAY 46 KM EB RL
 *Road Number : 2520
 *Location : 200 Metres west of Long Forest Road
 *Kilometre Ref : 46.00 km from Melbourne
 *Site Number : 10377
 *Map Reference : Map 78 Ref A.0-4.9 (VicRoads Country Directory)
 *Counter Type : ARCHER 69 60
 *Survey Date : January 2002
 *Municipality : Moorabool shire Council
 *Region : Western
 *Direction : East Bound Right Lane
 *Speed Limit : 90 km/hr

Date	DOY	DOW	24hr Total	Mean	85%	Std Dev	% > lmt	% > lmt+10	% > lmt+30
24/Jan/2002	24	Thu	5749	88.12	98.07	9.60	43.9	20.0	2.6
25/Jan/2002	25	Fri	6295	88.29	98.30	9.66	45.2	19.8	3.0
26/Jan/2002	26	Sat	3973	89.48	98.70	8.90	49.7	22.9	3.1
27/Jan/2002	27	Sun	5164	89.68	98.08	8.10	48.5	21.0	3.0
28/Jan/2002	28	Mon	7015	90.23	98.67	8.14	53.2	24.2	3.0
29/Jan/2002	29	Tue	6113	88.13	97.67	9.21	43.7	18.6	2.2
30/Jan/2002	30	Wed	6061	87.83	98.16	9.96	43.5	19.7	2.6

*Averages		5 day	7 day	Weekend
Mean Speed	(km/hr)	88.5	88.8	89.6
85th Percentile	(km/hr)	98.2	98.2	98.4
Over Limit	(Percentage of 24Hr Total)	45.9%	46.8%	49.1%

Legend:

Region = VicRoads Region.

DOY = Day of Year.

DOW = Day of Week.

Mean = Arithmetic Average of Speeds (km/hr).

85% = 85th Percentile (km/hr) (i.e. Speed at which 85 percent of vehicles are travelling).

% > lmt = Number of VEHICLES whose speed is greater than the speed limit expressed as a Percentage of the 24 hour total.

% > lmt+30 = Number of VEHICLES whose speed is greater than the speed limit plus 30 kph expressed as a Percentage of the 24 hour total.

Printing Date - 01/02/2002 (08:42).

Traffic Engineering Services

Survey Period Averages

***Road Name** : WESTERN HIGHWAY 46 KM EB RL
***Road Number** : 2520
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***Counter Type** : ARCHER 69 60
***Survey Date** : January 2002
***Municipality** : Moorabool shire Council
***Region** : Western
***Direction** : East Bound Right Lane
***Speed Limit** : 90 km/hr
***Survey Period** : 7 Days (24 Jan 2002 to 30 Jan 2002)

*Volume Count

	5 day	7 day	Weekend
24 Hour Average - (All Vehicles)	6246	5767	4568
1 Hour Average - (12hr day [07:00->19:00hrs])	403	373	297

*Length Classification

	5 day	7 day	Weekend
24 Hour Average - (Cars Only)	5679	5292	4326
24 Hour Average - (Trucks Only)	373	310	153
24 Hour Average - (Articulated Only)	166	141	79
Cars only (Percentage of 24Hr Total)	91.2%	92.2%	94.8%
Commercial (Percentage of 24Hr Total)	8.8%	7.8%	5.2%

*Speed Classification

	5 day	7 day	Weekend
Mean Speed (km/hr)	88.5	88.8	89.6
85th Percentile (km/hr)	98.2	98.2	98.4
Over 90 km/hr (Percentage of 24Hr Total)	45.9%	46.8%	49.1%
Over 100 km/hr (Percentage of 24Hr Total)	20.5%	20.9%	21.9%
Over 120 km/hr (Percentage of 24Hr Total)	2.7%	2.8%	3.0%

Legend:

1 Hour Average = Average Hourly Volume for period 0700hrs->1900hrs (7am to 7pm).

Cars Only = Number of CARS as a Percentage of the 24 hour total.

Commercial = Number of Commercial (i.e. TRUCKS plus ARTICULATED) Vehicles as a Percentage of the 24 hour total.

Mean Speed = Arithmetic Average of Speeds - Kilometers per Hour.

85th Percentile = Speed at which 85 percent of vehicles are travelling.

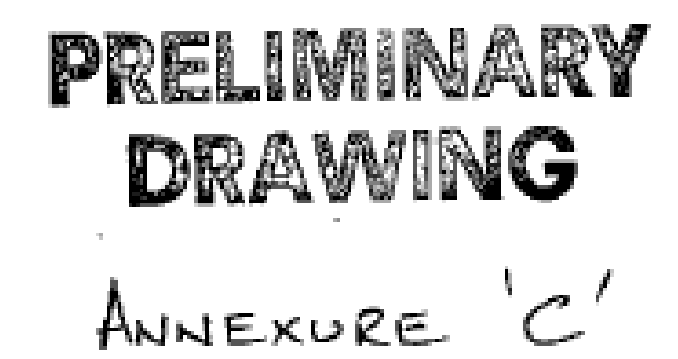
Over 90 km/hr = number of vehicles whose speed is greater than the speed limit expressed as a percentage of the 24 Hour Total.

Over 100 km/hr = number of vehicles whose speed is greater than the speed limit + 10 km/hr expressed as a percentage of the 24 Hour Total.

Over 120 km/hr = number of vehicles whose speed is greater than the speed limit + 30 km/hr expressed as a percentage of the 24 Hour Total.

Comments:-

Printing Date - 01/02/2002 (08:42).



Quality System
Quality
Endorsed
Company

WESTERN HIGHWAY
LONGFOREST ROAD INTERSECTION
PROPOSED FUNCTIONAL LAYOUT

MILLAR & MERRIGAN AUTHORISE THE USE OF THIS
DRAWING ONLY FOR THE PURPOSE DESCRIBED BY THE
STATUS STAMP SHOWN ABOVE IN RED>

CAD FILE: 10932TR00A.DWG
SCALE 1 : 1000
SHEET 1 OF 1
DRAWING No> 10932E/00/R/-
REVISION No>
Original Sheet Size A1