

*noise assessment criteria as stipulated in the NSW Road Noise Policy being for existing residences affected by additional traffic on existing local roads generated by the proposed land use development. It is important that this is addressed prior to any approval being granted to the concept plan".*

These comments are particularly relevant due to the significant likely increase in traffic queuing in Richmond Avenue and in Artarmon Road due to the high volume of peak hour movements.

The existing approval states in the accompanying Statement of Commitments regarding a noise report:

*"Future applications for development will be accompanied by a Noise Report which demonstrates compliance with the relevant standards for internal amenity."*

There is no request to change this Commitment in the Modification. The need for this requirement is considered even more necessary with the requested addition of 110 dwellings.

### **23. Unit mix**

In the original Council submission, Council sought a unit mix in the development as follows:

One bedroom - up to 35%  
Two bedrooms - between 50% and 70%  
Three bedrooms - up to 20%

The proposed unit mix in the Modification is as follows:

One bedroom 33%  
Two bedroom 62%  
Three bedroom 5%

The existing approval states:

*"27. Future Development Applications for Stages 1 and 2 shall provide a variety of apartment types and sizes including studio, 1 bedroom, 2 bedroom, 3 bedroom and 3+ bedroom units. The proposed apartment mix is to be justified by consideration of population trends and market demands."*

Council seeks a more certain unit mix across this development site, catering to a mix of owners or tenants including couples and families. It is recommended that any approval of this Modification require the applicant to commit to providing a mix of unit sizes in the development, within the following ranges -

One bedroom - up to 35%  
Two bedrooms - between 50% and 70%  
Three bedrooms - up to 20%

### **24. Consultation with Council and the community**

Prior to the exhibition of the proposed Modification, Council and the community were informed of the proposed Modification by the proponent. However there has not been input by Council into the preparation of the new Concept or amendments made by the proponent as a result.



While the Modification may result in a better outcome with regard to certain design features, it does not satisfactorily address continuing concerns over number of dwellings, floor space ratio and height on the site. In addition further concerns have been raised in the Concept Plan Review carried out by Allen Jack and Cottier at Council's request.

It would appear that the Modification and accompanying Concept Plan is being driven by a desire to increase the dwelling yield rather than working within already established development parameters to achieve a well mannered solution acceptable to all stakeholders.

## **Conclusion**

Council does not support the Modification for the following reasons:

- The height, number of dwellings and floor space ratio is inappropriate in the context of the built form of surrounding development.
- The height, number of dwellings and floor space ratio will result in unacceptable amenity impacts for neighbouring residents and the local community in Artarmon.
- The additional height of the 12 storey towers will have a detrimental visual impact on the south eastern portion of the Artarmon Conservation Area.
- Concern is raised with the proposed child care centre on this site due to potentially damaging exposure to electromagnetic radiation from the adjoining transmissions tower.
- The additional number of dwellings resulting in a more intense use of the site will have significant adverse impacts on the local infrastructure including the local road network.
- The height of the buildings proposed, with particular reference to the tallest of the structures, dominate the central publicly accessible open space and as a result this is considered an inferior solution to the public park on the Artarmon Road frontage of the approved scheme.
- The increase in site density and yield is not supported by a proportionally equivalent public benefit.
- The public benefit of establishing pedestrian and cycling linkages to the open space network below the site is outweighed by the cost including land acquisition.
- Council objects to the viewing platform suspended over the Walter Street Reserve for liability reasons.
- Council objects to the removal of all trees within the site (with exception of those around the boundary), including the previously retained tree identified as T32.

If the Modification is to be supported, then further investigation and information is required regarding the following:

- Owners consent from Council for the inclusion of Scott Street in the Modification has not been obtained.
- The proposed modifications and potential amendments contained in the Allan Jack and Cottier Review.
- The offer of a VPA worth \$3 million is considered inadequate. Council would seek to enter into a VPA with the proponent in line with the existing agreed approach.
- An upgrade to the Artarmon Road / Willoughby Road intersection is required as a result of the original approval as well as the Modification. This cost is to be provided outside of any VPA. It is not considered acceptable to leave this matter unaddressed until development application stage. This issue is of such importance that it must be addressed now as supported by the Arup report.



- Any upgrade of the Artarmon Road / Willoughby Road intersection is to include a pedestrian crossing on the southern side across Willoughby Road.
- A complete Artarmon Road / Willoughby Road intersection plan is required showing all affected land including all acquisition land and traffic related features. This plan is to clearly show:
  - What is impacted in any required acquisition land for road widening, including trees along the Willoughby Road / Bicentennial Reserve frontage.
  - Any replacement or make good works and tree plantings.
- Any assessment of public benefit should have regard to the loss and cost of public open space and affected trees to the community, with particular regard to Bicentennial Reserve. Concern is raised with the loss of any public open space intended to address traffic impacts directly the result of a proposed development.
- For the purposes of determining site area for floor space and landscaping calculations, the isolated Lot 12 DP 1162507 located to the south of the transmission tower is to be excluded.
- Further investigation regarding the suitability of the roundabout control where the proposed internal road meets Artarmon Road is required, including a concept plan of the proposed layout.
- An amended design should be prepared which demonstrates a service vehicle can safely pass an oncoming car, including the presence of vehicles parked on the internal street. Given some furniture removalist trucks may be larger/longer than an 8.8 metre long garbage truck, a 12.5 metre heavy rigid vehicle is to be adopted as the design vehicle.
- Further investigation is required into minimizing the loss 29 on-street car parking spaces, including into the roundabout control. Options should be examined and submitted for further assessment of this public domain issue prior to determination of the Modification.
- The 22 car spaces intended to compensate for the loss of parking on Artarmon Road and 7 car spaces in Richmond Avenue should be clearly identified adjacent the internal road on the development site. Furthermore these 29 car spaces should be designated as residents parking only, with residents of Artarmon Road (between Edward Street and Willoughby Road) eligible to park in the 22 car spaces near the Artarmon Road access point and residents in Richmond Avenue eligible to park in the 7 car spaces near the Richmond Avenue access point. This resident parking scheme would be implemented by Council following the occupation of the Channel 9 site.
- Any relocated on-street parking within the development site is to be in addition to any off-street car parking required by the Willoughby Development Control Plan. This is to be clearly stated and shown on plan.
- Complete information, including provision of a parking plan, should be provided regarding the location of visitor car parking, with a reasonable percentage to be provided at street level.
- Investigation is required into the possible impacts of queue lengths in Artarmon Road and related to the Artarmon Road / Willoughby Road intersection on the proposed development site Artarmon Road vehicle access and egress point.
- Public open space at the rear of the site should be provided in Stage 1 of the development.
- Council does not accept ownership and maintenance responsibilities of publicly accessible open space or the internal road network.
- Any management plan for the Walter Street Reserve or any other Council owned land does not require the agreement of the proponent or owner of the Modification site.

- The Proponent is to agree to a Section 94A contribution of 1% of development cost, an Affordable Housing contribution of 4% of overall residential GFA and ownership and management of all publicly accessible open space and roads within the site.
- The Modification Concept design must address the impacts of the telecommunications tower on the proposed development.
- A diversity of unit mix should be established across the site.

It is requested that the above issues be satisfactorily addressed prior to any approval of this Modification.





# 6-30 Artarmon Rd Willoughby Review

## Concept Plan Review



Prepared for Willoughby Council  
September 2016

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# Introduction 1

## 1.0 Introduction

Allen Jack + Cottier has been commissioned by Willoughby City Council to review the concept plan (S75W submission) for 6-30 Artarmon Rd, which was originally prepared by CHROFI.

The site is located on Sydney's North Shore and is currently occupied by the Nine Network Australia Television Studios. The Neighbourhoods surrounding the site are typical of the area, which features predominantly low-density residential properties and some high density residential housing to the east. The site is within a short distance of the major arterial roads; Willoughby Road, Artarmon Rd, and the Gore Hill Freeway.

### 1.1 Study Objective

This study involves a review of the proposed concept plan and associated design principles with particular reference to:

- Urban Design strategies / design drivers
- Open space and site linkages
- Built form principles
- Parking and vehicular access

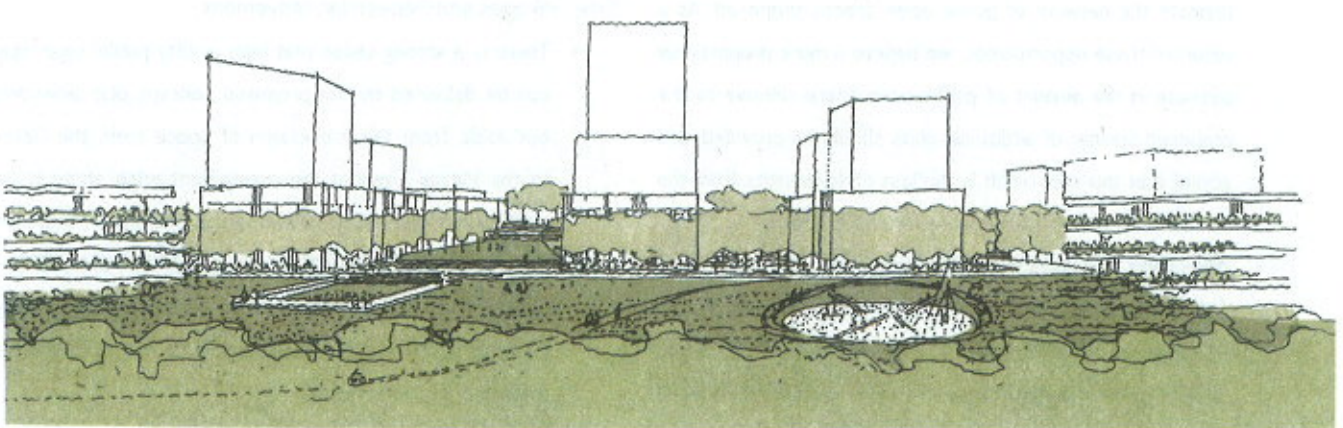
## 1.2 Background

The site was acquired in August 2015 with an approved Part 3A Concept Plan. The new owner undertook a design-led process that led to a design excellence competition, won by CHROFI. A S75W Modification Application was subsequently prepared by CHROFI to modify the existing concept plan approval by adding an extra 110 to the 400 approved units and increasing the maximum height from 8 to 12 storeys. The resulting FSR increased from 1.20:1 to 1.50:1.

### 1.3 Study Process

This study is a review of the proposed concept plan and involved the following:

- Telephone briefing followed by review of the following documentation including examination of the urban design and architectural design principles underlying the nature of the proposal.
  - Concept Plan Report (dated 14.07.2016), prepared by CHROFI
  - Council Presentation-Draft (dated 18.03.2016), prepared by CHROFI
  - Traffic Impact Assessment Review (Draft 2), prepared by ARUP
  - Submission to MP10\_0198 S.75W Modification 1 (Part 3A) prepared by Willoughby City Council (dated September 2016 - Version 3).
- Review of the proposal against industry best practices for urban design, residential apartment design and public amenity.
- Preparation of this Concept Plan Review Report.





# Design Principles and Strategies 2

## 2.1 Urban Design and Site Strategies

### Key design moves

- The proposed modification to the approved concept plan begins with a series of urban design moves that generate the framework for the overall site strategy. Beginning with the identification of views to the distant landmarks, these moves are a well-founded urban design approach.
- The resulting network of public and private spaces is created by the modified street network and re-location of the large open space on the site. On the face of it, this generates more open area than the approved scheme. And even more importantly, allows greater potential for diversity between these spaces.
- Urban design gestures of this nature are important to the success of developments where new levels of density are proposed. They increase permeability for pedestrians on such sites and this generates mutual benefits for the private and public spaces of the urban environment.

### Public open space

- The provision of public open spaces with distinct characters (Village Square, Gateway, Village Green, and Village Lawn) in the proposed amendment is a stronger strategic site response than the approved concept plan.
- However, council's clarification of the open space calculation provided by the application correctly identifies that the overall quantum of public open space (hard and soft) has only increased by 9.1% in the proposed concept plan, while the number of units has increased by 27.5%.
- Notwithstanding the overall merits of the the urban design approach, we have identified in this report opportunities to improve the network of public open spaces proposed. As a result of these opportunities, we believe a more proportional increase in the amount of public open space relative to the proposed number of additional units should be provided, and accept that this may result in the loss of some units from the number proposed in the concept plan ammendment.
- Willoughby City Council (Council) has noted in its submission that it is concerned that the approved park location and orientation on Artarmon Rd provided a stronger sense of public ownership than the proposed modification. We believe however, that the revised orientation is still capable of achieving this,

and that the landmark view created along Village Green to the south would even enhance it. Furthermore, there are potential noise and safety issues for users in the approved park location, as it has a significant frontage to Artarmon Road and streets bounding all its sides.

- However, the formal style and programme of the proposed Village Green that is indicated in the modified concept plan is generating public space with seemingly similar uses to the Village Lawn provided on the edge of the escarpment. The result is that Village Lawn is the more desirable of the two spaces, and this weakens the Village Green as a key piece of public open space in spite of the key urban gesture, endorsed above, that is driving it.
- Further review of the Village Green's programme and design could provide an opportunity to create a public open space with a more unique character that still respects the urban gesture of a view corridor to the south.
- Although height and scale are discussed below, we also note council's concern for the width of the Village Green being too narrow with regard for the height of the tower forms on each of its side. We disagree that this space needs to be wider. The scale of space provided in the proposed concept allows sufficient room for solar access, a variety of uses, and the provision of the intended view corridor. A further consideration of the programme for the Village Green, as discussed above, will improve the risk of spatial perception that council's Open Space Section has raised.

### Site Linkages and Pedestrian Movement

- There is a strong sense that high quality public open spaces can be delivered by the proposed concept plan amendment, but aside from the procession of space from the Gateway to the Village Lawn at the escarpment edge, there is not a corresponding sense of pedestrian site linkages elsewhere on the site. Many of the pedestrian routes between buildings are designed as private gardens with communal paths, and have buildings at little more than complying Apartment Design Guide separations on either side.
- We believe that the proposed concept plan has a potential for

# Design Principles and Strategies 2

better site linkages and developing these should begin with a clarification of the differing role and nature of the two main site entry spaces; Gateway and Village Square.

- Considering the gradient of Artarmon Road and the likelihood that Village Square will be the dominant entry point for pedestrians approaching from the east (Willoughby Road), it would appear that the Gateway space could compress, without affecting the urban gesture/view corridor to the south. And there should therefore be a stronger link between Village Square and Gateway along the street and across the site.
- As such, the current position of the basement vehicular entry near the Village Square is constraining the proposed pedestrian route that leads to Buildings B, E and F.

## Tree Management

- Council has noted that Tree #32 near the middle of the site was retained in the approved concept plan and we agree with the position that this should be carefully considered for retention in the proposed concept plan.
- Aside from the merit of Tree #32 in its own right, we believe its retention provides an opportunity to address the urban design and site strategies items raised above (ie. its use along a more significant site linkage from Village Square into the site, and the provision of a greater proportion of public open space) and we accept that this may result in the loss of some units from the number proposed in the concept plan amendment.

## 2.2 Built Form Strategies

### Density / Number of Dwellings

- Council has broadly noted opposition to the proposed increase in density/number of dwellings on account of the traffic impacts caused and the limited capacity in Willoughby Road bus services. And has rejected the argument of design excellence for increased density.
- We initially clarify our understanding that although there are requirements in the approved concept plan for design excellence, these are applicable to the future building designs. In the case of the proposed amendment to the concept plan, we understand that the argument of design excellence is offered with regard for the overall site strategy, as well as implied for

the future building design approvals.

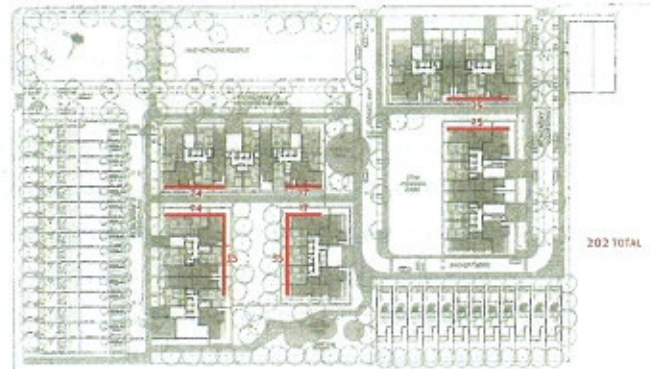
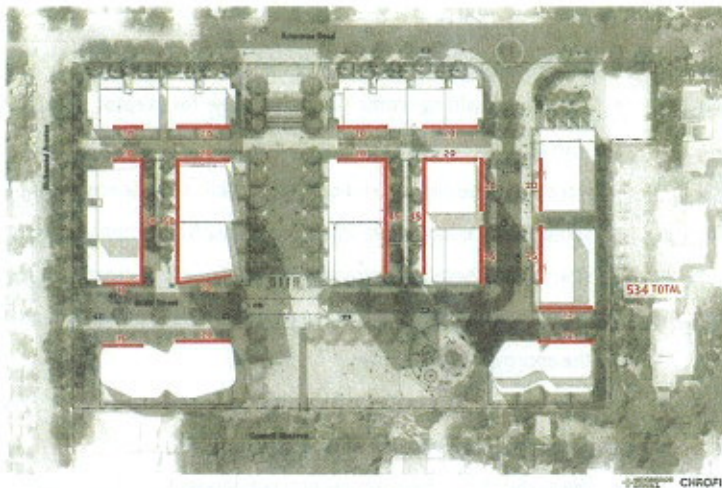
- The taller building forms proposed allow for greater density with a concurrent decrease in site area taken up by roads and an increase in the amount and quality of public open space. Whilst some aforementioned weaknesses exist with the proposed open spaces, the overall site strategy and public benefit created by it in the proposed amendment is a commendable improvement on the approved concept plan.

### Height, Solar Access and Visual Bulk/Scale

- We understand the reservations put forward by council with respect to the height of the buildings proposed in the amended concept plan. Namely that they are beyond the existing planning controls of the residential zoning context of the site. However, the proposed concept plan employs a number of strategies to mitigate the perceived impacts of the additional height that we commend.
- The scaling of the built forms contains the highest buildings to the centre of the site, where they have the least impact on the surrounding low density residential context, and avoid any significant change to the overshadowing of neighbouring dwellings caused by the approved concept plan. The design strategy to address the residential scale of Artarmon Road and Richmond Avenue is also an important success of both the approved and proposed concept plans.
- The visual impact study also demonstrates that the taller building forms result in a reduction in visual bulk compared to the approved concept. This improves visual impact from more distant views, including from within the Artarmon Conservation Area.
- The proposed concept plan has demonstrated that the overshadowing impact of Building J on the neighbouring sites along Walter Street is a near neutral impact in comparison to the approved concept plan. However, we note that this is a net impact across a number of properties and whilst the overshadowing by Building J will improve the overshadowing for some, there are some negative impacts for individual properties. In light of the extensive public consultation to date, this demands closer analysis by the applicant to demonstrate an acceptable result has been achieved.



# Design Principles and Strategies 2



## Building Separation

- The comments above have affirmed our support for the quality of public spaces created by the proposed concept plan. And it is also clear that this has been done with a built form that meets Apartment Design Guide requirements for solar access, privacy, and residential amenity more generally.
- Building separation requirements more specifically, have also been adhered to. However the diagrams above illustrate the general impact that the overall change in density has on the collection of built forms, in a way that goes beyond the minimum requirements of the Apartment Design Guide. The building frontages highlighted in red denote where a building facade is facing another building less than 25m away, in the proposed concept plan on the left and the approved plan on the right.
- Although many of the proposed units face onto the new public spaces and Scott Street, and not into the narrower communal spaces, there is a marked increase from the approved scheme in the length of building forms that face other building forms.
- Whilst the minimum separations have been achieved, we believe the resulting outlook from many units will be of lesser quality. And that more broadly, the collection of built forms in the proposed concept plan will appear too closely spaced when viewed from the new public domain on the site.
- In addition to this, the proposed concept plan is unclear about the potential impact Building J could have on the outlook of the southern building on the adjacent property (Castle Vale Development), and we believe that this should be clarified by the applicant.

- We acknowledge that modification of the building forms to reduce the negative affect of consistently providing minimum building separations may result in the loss of some units from the number proposed in the concept plan amendment.

## Building Articulation

- The approach to articulation and scale of the perimeter building forms that face the existing low scale residential context is successful in the proposed concept plan. However, in light of the above comments about the consideration that is due for the relationship between Village Square and the Gateway, we are concerned that the lowest level of the Artarmon Road facing buildings (Building A and B), may not be an appropriate response in the case of Building B only.
- We suspect the pedestrian route along Artarmon Road at this point may require an approach that creates more privacy for the Building B units that face the street, and the sunken courtyard unit style on the bottom level will result in a minimal amount of public space along the Artarmon Road frontage of this building. We therefore suggest removing the lower level of Building B where it faces the street.
- The distinct character proposed for Buildings H and J is also noted as a successful component of the proposed scheme

## 2.3 Transport Strategies

Notwithstanding the competency of the assessment provided by ARUP in relation to the traffic and transport issues of the proposed concept plan, we have provided comment below on two items that we believe have an important impact on site and building design strategies in residential development where higher densities are proposed.

# Design Principles and Strategies 2

## Vehicular Address and Parking Access

- The provision of a single entry/exit point for the subterranean parking of 510 units can prove to be problematic in our experience. The vehicle access point provided is well located on the site, but it limits the sense and understanding of address for residents. The further a resident lives away from the point of entry to the carpark, the greater this effect will be.
- Additionally, this single vehicle access point can lead to congestion within the site carpark at peak times.

## Visitor Parking

- As noted in council's comments and extracts from ARUP's Traffic Impact Assessment there in, kerbside visitor parking is preferable to a basement location. The ability to provide this will be limited by the need to accommodate on-street parking that will be lost from Artarmon Road and Richmond Avenue.

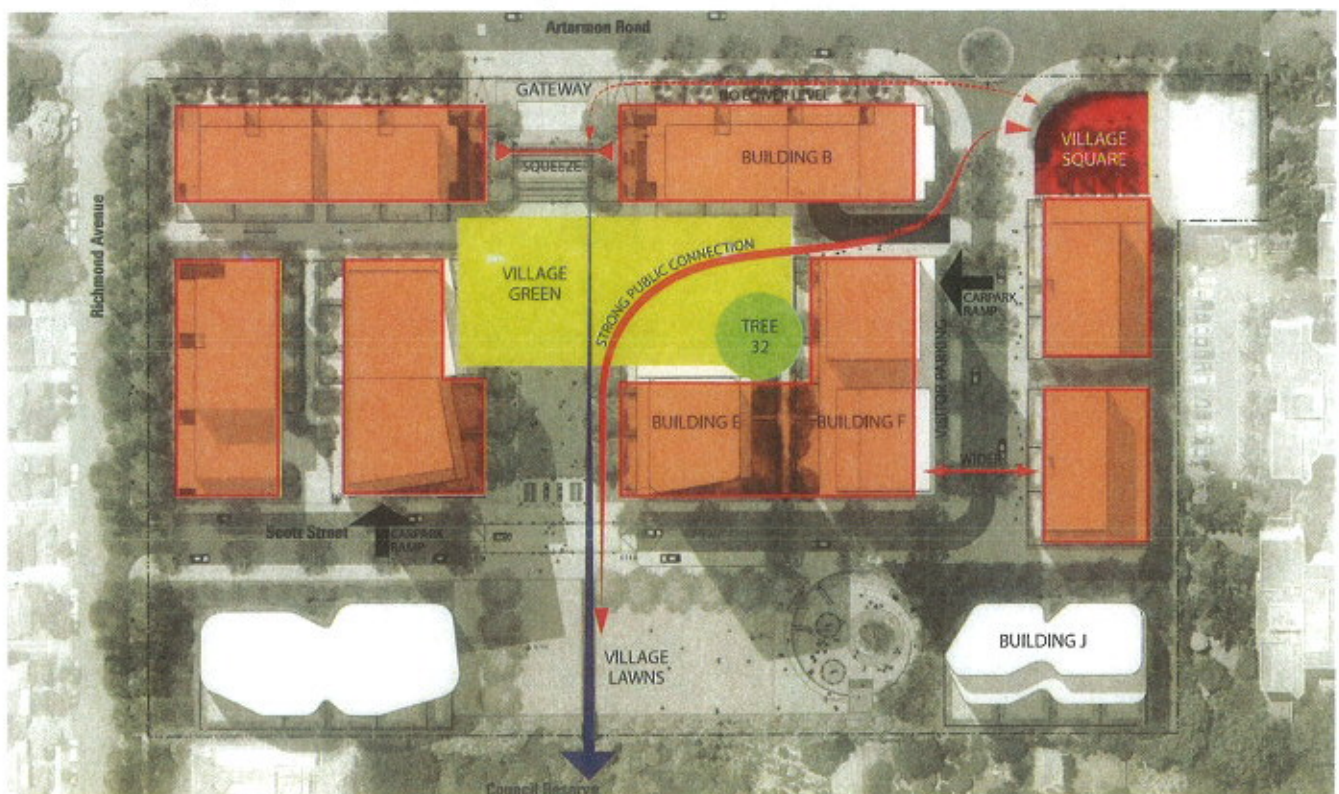




## 3.1 Conclusions

In light of the concept plan review provided above, ten conclusions are provided here and illustrated generally in the diagram below. We believe that incorporation of these matters into an amended version of the proposed concept plan may require a reduction in the vicinity of 30 apartments to the total number of dwellings in the proposed concept plan.

1. Allen Jack + Cottier believe that additional public open space, more commensurate with the proposed increase in dwelling numbers, should be provided in the proposed concept plan.
2. More careful consideration for the programme/uses of Village Green is required to better inform the design of this public open space so that it creates a more diverse contribution to the public open space and maintains the view corridor identified in the overall site planning strategy.
3. Further assessment of anticipated pedestrian traffic should be used to inform the design strategies of Village Square and the Gateway as the two major pedestrian access points to the site. And by virtue of this, site linkages that improve pedestrian access the rest of the site should be incorporated into the public open space design.
4. Retention of Tree #32 should be considered for its own merits and as an opportunity for it to contribute to improved site linkages and additional public open space.
5. Modification of the proposed forms (Buildings E and F) around Tree #32 and potential site linkages should also be undertaken to reduce the overall length of building frontage provided on the site with minimal separation to other buildings. We believe the length of building facades facing other buildings less than 25m away could be reduced by some 200m.
6. The applicant should be required to demonstrate the relative impacts of Building J on the outlook from units in the adjacent Castle Vale Development and the solar access to the properties along Walter Street.
7. The units facing Artarmon Road on the lowest level of Building B should be removed to improve this building's relationship with the low scale residential context of Artarmon Road.
8. The proposed vehicular entry near Village Square should be moved to conceal it in/under a built form and minimise encroachment on open spaces/site linkages.
9. A second vehicle access point to the subterranean parking that improves the sense of address and traffic impacts in peak times should be provided.
10. The building separation along Scott Street should be widened to allow for a larger provision of kerbside visitor parking.



Willoughby City Council  
**6-30 Artarmon Road, Willoughby**  
Traffic Impact Assessment Review

Issue | 15 September 2016

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 250602-04

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**ARUP**



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# 1 Introduction

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## 1.1 Background

Arup Pty Ltd was engaged by Willoughby City Council to provide independent advice in relation to a Traffic Impact Assessment submitted to support a modification to the approved concept plan for the Channel 9 campus at 6-30 Artarmon Road, Willoughby. The modification application seeks to:

- Replace the concept approval layout for 7 building envelopes with heights up to 8 storeys with an amended concept layout for 10 building envelopes with heights up to 12 storeys;
- Increase maximum number of dwellings from 400 to 510 (an additional 110);
- Increase maximum gross floor area from 35,886m<sup>2</sup> to 45,876m<sup>2</sup> (an additional 9,990m<sup>2</sup>);
- Increase public open space through an amended configuration and layout;
- Amend the approved site access and internal road layout;
- Allow for non-residential uses including local retail, office, community or child care uses; and
- Provide new public benefits towards upgrades to the local road network, bushland regeneration and access towards Walter Street Reserve.

## 1.2 Planning History

The Channel 9 Campus at 6-30 Artarmon Road, Willoughby (the Site) was the subject of a Part 3A Concept Plan Approval (MP10\_0198) (Concept Plan Approval) that was approved by the Planning Assessment Commission on 23 December 2014. The Concept Plan Approval provides for:

- Five residential buildings and two rows of terrace houses amounting to 400 dwellings, and 500m<sup>2</sup> GFA for non-residential uses;
- Retention and adaptive re-use of No 6 Artarmon Road;
- New internal roadways; and
- A through-site link.



## 1.3 Report Scope

This report assesses the traffic and transport impacts of the proposed modification to the approved concept plan for the site, with consideration to the following issues:

- Site access
- Internal circulation
- Parking availability and provision
- Operation of the local road network

## 1.4 Documents Reviewed

This traffic assessment is based on the following documents:

Table 1 Previous reports

Report Date	Report Title	Prepared By	On Behalf Of
19 March 2013	Traffic Assessment	AECOM	Nine Network Australia Pty Ltd
15 July 2013	Independent Transport Assessment	Arup	Department of Planning and Environment
19 August 2013	Transport and Accessibility Impact Assessment for PPR	AECOM	Nine Network Australia Pty Ltd
18 July 2016	Transport Impact Assessment	GTA Consultants	Euro Properties and Lotus Property Fund No.8 (LEPC9)

## 2 Transport Assessment

### 2.1 Revised Concept Plan

The revised concept plan for the site is presented in Figure 1 below. Two vehicular site entry points are proposed, those being:

- Artarmon Road / Site entry (roundabout control - 40m west of Scott Street)
- Richmond Avenue / Site entry (priority control – 100m south of Artarmon Road)



Figure 1 Revised concept plan

Source: CHROFI

Given the slope of Artarmon Road (approximately 10% gradient) the provision of a roundabout to provide controlled entry and exit from the site may not be appropriate. The Austroads Guide to Road Design (Part 4B – Roundabouts) notes that *“Generally, it is desirable that the gradient on approaches to roundabouts be limited to 3% to 4% and should not exceed 6%”*. Treatments may include the installation wide splitter islands and blisters to reduce vehicle speeds on approach. This will have implications for the roundabout design – requiring a larger footprint compared to a typical roundabout. Therefore further investigation regarding the suitability of roundabout control at this location is required, including a concept plan of the proposed layout.



## 2.2 Internal Traffic Circulation

The revised master plan proposes similar access arrangements to that in the approved concept plan – that being a two-way internal road that links the two access points on Artarmon Road and Richmond Avenue. While the location of the entry points have shifted slightly from those in the approved concept plan (see Figure 2), this is not expected to have a significant impact on the operation of the road network. The relocation of the Artarmon Road access point further east improves the site distance for vehicles departing the site and turning right towards Willoughby Road. As previously noted in Arup's 2013 study, based on the requirements outlined in Austroads Guide to Road Design, with a road design speed of 50km/h, a safe intersection sight distance (SISD) upwards of 100m is required. The relocation of the site access point achieves this distance.

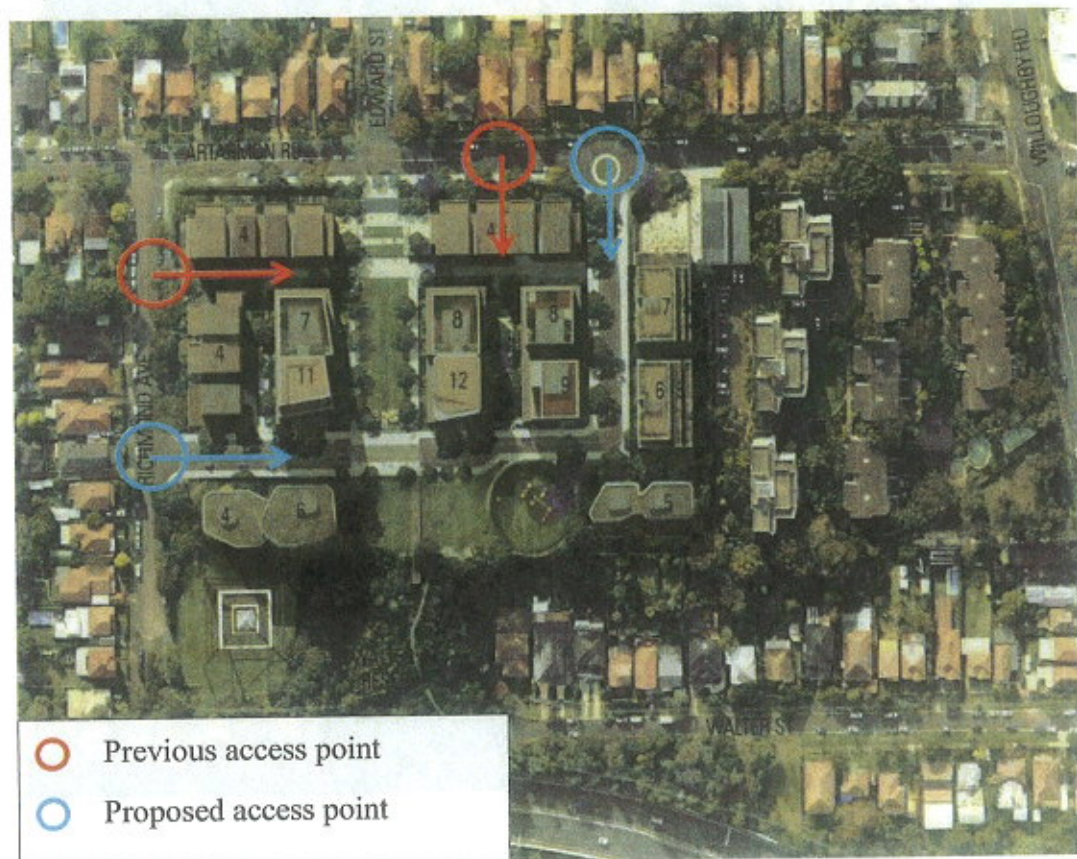


Figure 2 Site access points



The design of the internal road system has been reviewed against relevant standards and guidelines. While the internal road allows for two standard cars to pass one another at any one time, vehicle swept path analysis indicates a 9.8m long garbage vehicle crosses the road centre line when manoeuvring within the site. This is illustrated in Figure 3, and would mean that a standard car could not pass this vehicle type when driving within the site – creating safety issues. The vehicle swept path diagram provided by the applicant does not indicate any on-street parking bays on the internal road within the site.

An amended design should be prepared which demonstrates a service vehicle can safely pass an oncoming car, including the presence of vehicles parked on the internal street.

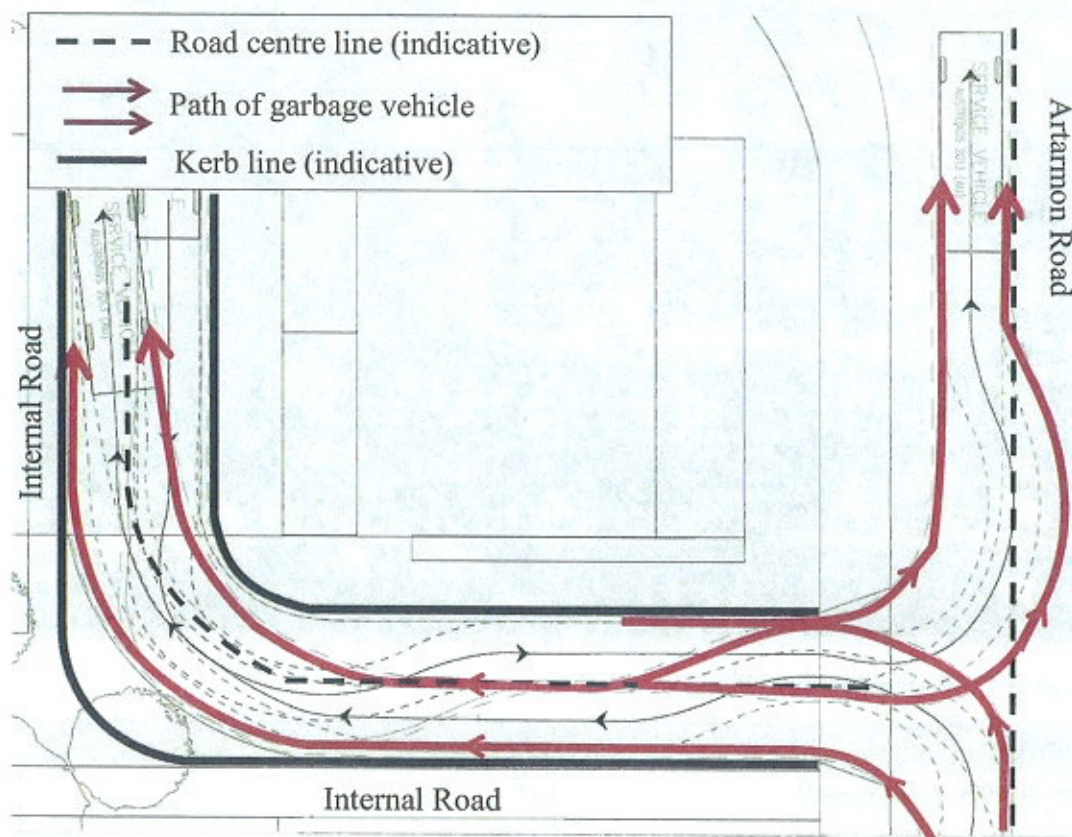


Figure 3 Vehicle swept path analysis

A further issue with the internal road design noted in this review included that a medium rigid vehicle (8.8m long garbage truck) was adopted as the largest design vehicle. Given some furniture removalist trucks may be larger/longer than this, a 12.5m heavy rigid vehicle is typically adopted as the design vehicle.