Kardinya District Centre
Precinct Structure Plan

October 2025 | 18-668

element. | PART OF SLR

Endorsement Page

This Structure Plan is prepared under the provisions of the City of Melville Local Planning Scheme No.6.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

04 NOVEMBER 2025

Signed for and on behalf of the Western Australian Planning Commission:

An officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose, in the presence of:

Rhianne Fiander

Witness

12 NOVEMBER 2025

Date

12 NOVEMBER 2035

Date of Expiry

Acknowledgment of Country

We acknowledge the custodians of this land, the Whadjuk Nyoongar and their Elders past, present and emerging. We wish to acknowledge and respect their continuing culture and the contribution they make to the life of this city and this region.

Document ID: '/Volumes/Element Advisory/Graphics/2018/18-668 Kardinya Shopping Centre/18-668 Kardinya PSP F7 251024/18-668 Kardinya PSP F7 251024.indd

Issue	Date	Status	Prepared by	Approved by	Graphic
9	17.04.22	Final V4	Callum Thatcher	David Read	SEA
10	17.04.22	Final V4	Callum Thatcher	David Read	SA
11	30.01.25	Final V5	Callum Thatcher	David Read	CB
12	09.06.24	Final V6	Callum Thatcher	David Read	CS
13	24.10.25	Final V7	Callum Thatcher	David Read	CB

Contents

Executive Summary

The Kardinya Precinct Structure Plan has been prepared in accordance with the requirements of the *Planning and Development (Local Planning Schemes) Regulations 2015* and State Planning Policy 4.2: Activity Centres for Perth and Peel (SPP 4.2), consistent with contempoary urban planning principles to guide future activity and development in the area over a 10-year timframe, generally described as Kardinya District Centre and surrounds. The PSP in implementation should result in a vibrant centre which is economically viable and sustainable with supporting residential density to capitalise on existing and future public transport infrastructure.

This PSP is intended to help facilitate the evolution of the Kardinya District Centre into a mixed-use activity centre that builds upon the existing (and any proposed) public transport infrastructure along South Street, its associated retail areas and residential frame. It is intended that increased residential densities within the locality will further contribute to the walkable catchment of the Centre and increase the patronage and viability of public transport infrastructure, thereby reducing car reliance and enhancing the vitality of local businesses.

The PSP has the potential to accommodate approximately 1,200 net dwellings throughout the Centre and immediately surrounding Residential Frame consistent with the minimum targets set by SPP 4.2.

This revised PSP has been prepared to incorporate all modifications requested by the City and Western Australian Planning Commission (WAPC).

Figure 1. Aerial Map

Part 1. Implementation

LEGEND

- PSP Boundary
- Residential
- Mixed Use
- Centre
- Key Public Space
- Landmark
- Full Movement Intersection
- R60 — Density code
- Public Open Space
- Non-Residential: 7 Storeys above NGL for Non-Residential
  Residential: 9 Storeys above NGL for Residential
  Landmark Site: 12 Storeys above NGL for Residential
- 4 storeys above natural ground level
- 3 storeys above natural ground level
- 2 storeys above natural ground level

Figure 2. PSP Map

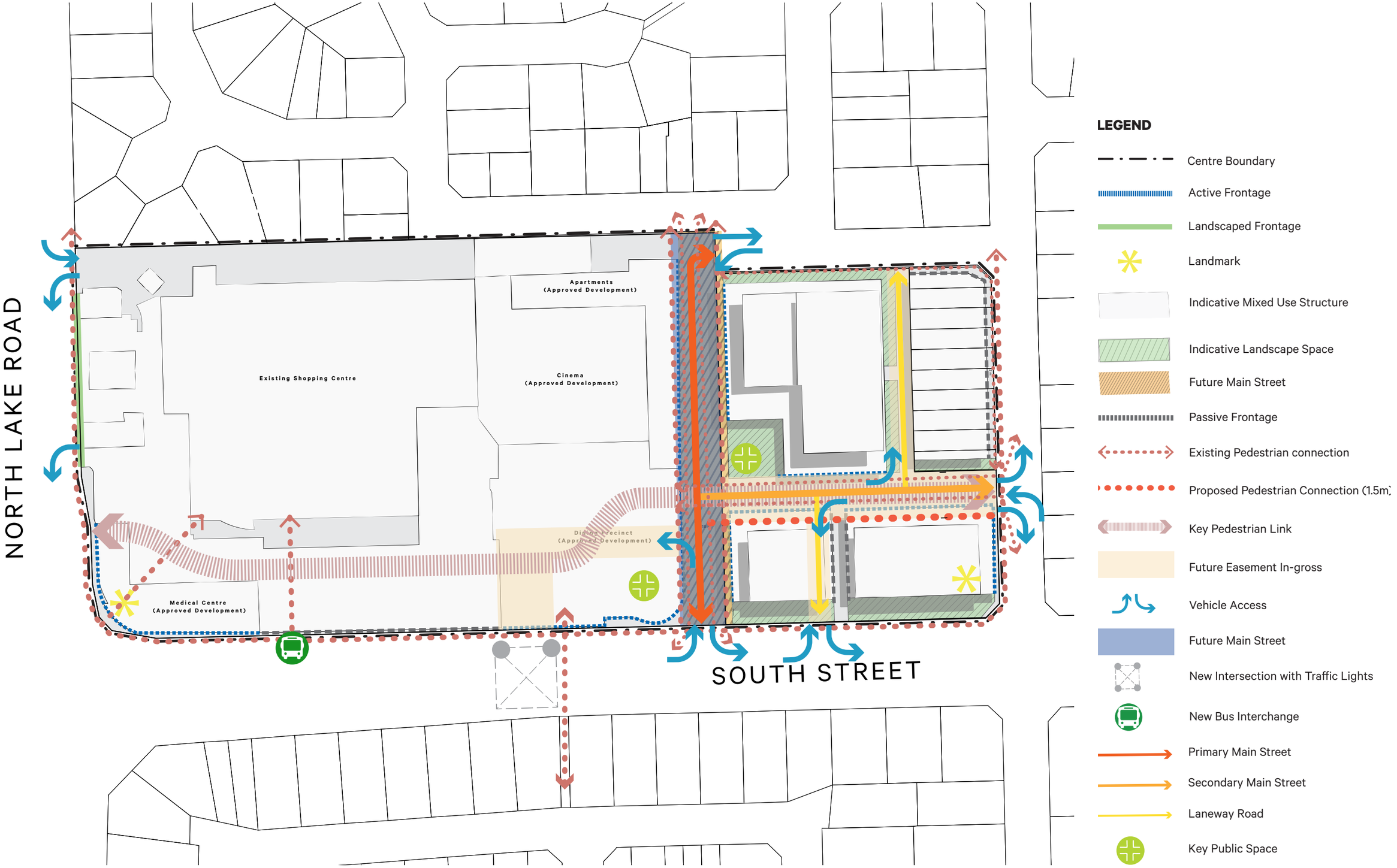


Figure 3. Centre Built Form

1. Implementation

1.1 PSP

This PSP applies to the Kardinya District Activity Centre and encompasses land generally within a 400 metre catchment to the north, east and south of the Kardinya Park Shopping Centre, in Kardinya, Western Australia. The PSP applies to all areas within the boundary identified on the PSP map (Figure 2).

1.2 Operation

This PSP comes into effect on the day it is approved by the WAPC, the date of which is outlined on the endorsement page. As per the deemed provisions, from the date of endorsement this PSP is to have effect for a period of 10 years, unless otherwise determined by the WAPC. Where there is an inconsistency with the City of Melville LPS6, then LPS6 shall prevail to the extent of any inconsistency. The provisions of the City of Melivlle's Local Planning Policies and the Residential Design Codes - Volume 1 and 2 apply unless varied as detailed within this PSP.

The PSP includes two parts in accordance with the WA Planning Manual – Guidance for Structure Plans. Part One contains the statutory provisions in relation to the implementation of the PSP compromising land use and built form provisions while Part Two provides explanatory information.

This PSP is intended to facilitate the evolution of the Kardinya District Centre into a mixed-use Activity Centre that builds upon the existing (and any proposed) public transport infrastructure along South Street, its associated retail areas and residential frame. The increased residential densities within the locality will further contribute to the walkable catchment of the District Centre and increase the patronage and viability of public transport infrastructure, thereby reducing car reliance and enhancing the vitality of local businesses.

Unless otherwise specified, the words and expressions used in this PSP shall have the respective meanings given to them in LPS6.

Noting this PSP is to be interpreted as limiting clause 43 of the deemed provisions that outlines that a decision-maker for an application for development approval or subdivision approval in an area that is covered by an PSP is to have due regard to, but is not bound by, the PSP when determining the application. Notwithstanding clause 43 of the deemed provisions, there are certain requirements within the PSP that require additional statutory weight given their importance of regulating development within the KPSP. In this respect, some KPSP provisions will be inserted into clause 33 of LPS6 - Additional site and development requirements for areas covered by structure plan, Precinct Structure Plan or local development plan.

1.3 Activity Centre Vision and Objectives

The vision for the Kardinya PSP is as follows:

> *'The Kardinya centre will be a vibrant and exciting focal point of entertainment, hospitality and retail services to create a contemporary, District Centre to accommodate all user's needs in the one location, supported by a higher density residential precinct.'*

Development in the PSP area shall align with the following objectives:

- To promote high quality, larger scale development within the Activity Centre in accordance with the specified built form controls.
- To deliver a District Centre which provides for improved local employment and amenities.
- To promote the development of a diverse mix of housing types, sizes and densities.
- To promote active and alternative forms of transport while mandating safe and convenient vehicular access to the Centre.
- To promote activation of the centre both in the day and evening through an inviting dining precinct and community meeting spaces.
- To remove historical land use and tenure constraints in the Centre which are inconsistent with the PSP vision, and to guide the provision of new and improved public access and tenure across the Centre.

Table 1. PSP Overview

Item	Data
PSP Area	63 Hectares
Estimated Dwelling Yield	718 Existing / 1,895 contemplated
Estimated Population by 2050	4,927 based on 2.6 persons per dwelling
Total Estimated Commercial Floorspace (Non-Residential)	42,393m^2 NLA (inc. 26,701m^2 retail NLA)
Estimated Public Open Space Reserves	23,000m^2
Verge Trees (Approximately)	Current: 200 Street Trees | Net Increase Projection 2050: 660

The plan estimates a total of 400 dwellings will be developed within the District Centre over the next 30 years by 2050. The PSP as a whole, has aimed to align the broader residential catchment to achieve a minimum of 30 dwellings per gross hectare by 2050, to align with targets for District Centres in the WAPC's SPP 4.2. This outcome would deliver on the expectations of Perth and Peel @3.5 million and the City's Local Planning Strategy to concentrate development in strategic Activity Centres and along transit corridors.

The PSP provides for growth of Kardinya District Centre to approximately 27,000m^2 of shop/retail floorspace, accommodating supermarkets, a discount department store and associated speciality stores and mini majors within the Core.

An overview of the key characteristics of the ACP is provided in Table 1 above.

1.4 Subdivision and Development Requirements

1.4.1 Precincts

The PSP has been divided into three precincts. The three precincts have been adopted to best respond to and guide the intended development outcomes expected for each precinct, these have been summarised below:

- Centre Core
- Mixed-Use
- Residential Frame

Table 2. Precinct Summary

Precinct	Proposed LPS6 Zone	Proposed Residential Density Code	Character Statement
Centre Core	C2	R-AC0	To provide the Core of the Activity Centre. A mixture of retail and commercial uses is envisaged in combination with medium to higher density residential development.
Mixed-Use	Mixed Use	R80	To provide a transitional interface between the Centre and surrounding residential development. The Mixed-Use zone is intended to provide a mixture of lower intensity commercial land uses, and medium rise building height to frame development along Gilbertson Road.
Residential Frame	Residential	R40, R60 and R80	To provide medium density housing within the immediate surrounds of the District Centre. The density codes nominated will provide some level of housing diversity, whilst remaining appropriate with the existing scale of the residential catchment.

1.4.2 Land Use Permissibility and Additional Land Uses

a) Land use permissibility in the Centre C2 zone shall be in accordance with the Zoning Table of LPS6 for the Centre C3 zone.

b) Land use permissibility in the Mixed Use precinct shall be in accordance with the Zoning Table of LPS6 for the Mixed Use zone.

c) Land use permissibility for the Residential Area shall be in accordance with the Zoning Table of LPS6 for the Residential zone.

1.4.3 Development Controls

Centre Core Precinct

Table 3. Centre Core Development Controls

Element	Controls
Residential Development	Residential density is R-AC0. All residential development shall be in accordance with development standards under the Residential Design Codes Volume 2 and relevant local planning policies, in addition to the following: Setbacks to Internal Streets (Centre Streets etc.) and External Streets (North Lake Road, South Street, Brophy Street and Gilbertson Road): • Nil setbacks are permitted. • Greater building setbacks may be considered where active uses are proposed (such as alfresco dining) or where a setback can facilitate greater interaction with the street. • Building Height: The maximum building height is nine storeys above natural ground level, and 12 storeys above natural ground level for the two Landmark Sites as shown in Figure 2 - Precinct Structure Plan Map. • Land Use: Residential land uses are not permitted on the ground floor with frontage to South Street, North Lake Road and Gilbertson Road or internal Centre streets.
Non-Residential Development	All non-residential development proposed within the Centre Core shall have regard to the requirements of the City of Melville Local Planning Policy 2.1 - Non-Residential Development and other relevant local and State Planning Policies. All non-residential development proposed within the Centre Core shall include the following: • Building Heights: The maximum building height is seven storeys above natural ground level. • Land Use: Land use permissibility is to be in accordance with C2 zone under LPS6.
Plot Ratio	No plot ratio applies. Development shall be controlled by setbacks and building height.
Frontages and Facade	A frontage type is proposed for areas in the Centre Core as shown in Figure 3. Frontage types have been identified to ensure activity and built form responds to create the desired street interface for the relevant street context. **Active Frontages** This frontage will cater for those areas that are projected to have frequent pedestrian movement, requiring street level activation, visual engagement, and main street principles to be incorporated into the built form, as shown in Figure 3. Development that occurs within these locations shall be in accordance with the following: Setbacks • Minimum nil setback to buildings from ground floor to fifth storey from Active Frontage. • Greater building setbacks may be considered where active uses are proposed (such as alfresco dining) or where a setback can facilitate greater interaction with the street. • Sixth storey and above requires a minimum 5 metre setback to the Active Frontage. Building Form • Building facades to incorporate variations in depth, height, colour, texture and/or materials. • Building facades to maximise engagement to the street by: – Appropriate facade glazing treatments; – Entrances and windows orientated towards the public realm; – Avoiding expanses of blank walls; and – Awnings being provided over adjacent roads or ROW along entire building frontage of 2.5 metre width to provide pedestrian shelter and avoid trees and critical infrastructure. Where this is not possible due to the width of the verge or any other factor, the awning is to be practical for weather protection. New awnings should be designed and sited to integrate with those of adjoining buildings and structures to provide continuous cover.

Element	Controls
Frontages and Facade (continued)	**Passive Frontages** This frontage type is proposed for areas which are highly visible, however do not necessarily accommodate highly active functions as shown in Figure 3. Highly quality design features are to be provided in facade elements. Development that occurs within these locations shall be in accordance with the following: <u>Setbacks</u> • A minimum 2 metre building setback is required to Gilbertson Road. • Building setbacks may be considered where active uses are proposed (such as alfresco dining) or where a setback can facilitate greater interaction with the street. <u>Building Form</u> • Building facades to incorporate variations in depth, height, colour, texture and/or materials. • Building facades to maximise articulation and architectural features to create visual interest. • Awnings being provided over adjacent roads or ROW along entire building frontage of 2.5 metre width to provide pedestrian shelter and avoid trees and critical infrastructure. Where this is not possible due to the width of the verge or any other factor, the awning is to be practical for weather protection. New awnings should be designed and sited to integrate with those of adjoining buildings and structures to provide continuous cover
	Landscaped Frontages This frontage type is intended to act as a visual buffer for future development and to improve the interface with the public domain. This frontage type is intended to buffer and / or screen the impacts of servicing back of house environments as well as improve interfaces that are otherwise restricted in providing a visually appealing environment. Development that occurs within these locations shall be in accordance with the following: • Extensive landscaping shall be provided for these frontages with a combination plantings and landscaping screens (both hard and soft) to buffer the building interface from abutting street frontages. Development that occurs within North Lake Road frontage shall be in accordance with the following: • Building facades to incorporate variations in depth, height, colour, texture and/or materials. • Windows at ground floor level shall remain visually permeable at all times. Development that occurs within Brophy Street frontage shall be in accordance with the following: • Building facades to maximise engagement to the street; • Appropriate facade glazing treatments; • Entrances and windows orientated towards the public realm; • Avoiding expanses of blank walls; and • Awnings being provided over adjacent roads or ROW along entire building frontage of 2.5 metre width to provide pedestrian shelter and avoid trees and critical infrastructure. Where this is not possible due to the width of the verge or any other factor, the awning is to be practical for weather protection. New awnings should be designed and sited to integrate with those of adjoining buildings and structures to provide continuous cover.
	Landmark Locations Built form at landmark location sites shall be treated with additional architectural emphasis such as distinctive roof forms and detailing, complemented by a contrast in materiality. Landmark locations sites are identified on Figure 2 (PSP Map). These sites are permitted with an additional three storeys for residential development (overall maximum 12 storey height for residential). <u>Setbacks</u> • A nil setback is permitted for landmark development sites. <u>Building Form</u> • Building façades to incorporate variations in depth, height, colour, texture and/or materials. • Windows at ground floor level shall remain visually permeable at all times. • Building facades to maximise engagement to the street. • Appropriate facade glazing treatments. • Expanses of blank walls are to be avoided.

Element	Controls
Key Public Spaces	Appropriately landscaped community / public space shall be provided for public use in accordance with Figure 3. Landscaping should include hardscape or other public treatments, in addition to vegetation.
Retail Floor Space Area	The total net lettable area of all existing and future shop retail development within the Centre Core shall not exceed 26,700sqm (existing: 15,233sqm). For the purposes of the PSP, NLA shop/retail floorspace is defined as per LPS6, but also excludes: • Loading and storage areas; • Any children's play area and/or equipment; and • All areas (including any alfresco seating areas) associated with eating and entertainment uses. Prior to the consideration of proposals for development which exceeds the shop/retail floorspace area identified above, the responsible authority will require the preparation of a Retail Sustainability Assessment (or similar), in accordance with SPP 4.2.
Non-Retail Floor Space Area	The total net lettable area of all future non-retail development within the Centre Core must not exceed 15,692sqm (existing: 9,692sqm).
Vehicle Parking and Access	Car parking for all residential development shall be provided in accordance with the requirements of the Residential Design Codes Volume 2. Car parking for all non-residential development shall be provided in accordance with the City of Melville Local Planning Policy 1.6 - Car Parking and Access unless otherwise approved by the decision maker. A Transport Plan that addresses vehicle access to/from and around the site, promotion of public transport, walking and cycling access and end of trip facilities, and freight deliveries/servicing shall accompany all development applications. Service vehicle routes and access points should be screened, combined and/or located away from areas of high pedestrian activity.
Pedestrian Access	Buildings shall provide clear, legible and accessible pedestrian entry points. Shopping malls shall provide connections to external streets to contribute to an integrated and permeable centre. A 1.5 metre pedestrian footpath is to be provided along the east-west main street connection
Centre Streets	The provision of Centre Street as part of future redevelopment shall be generally in accordance with the location and indicative alignment as shown within the PSP. The Centre streets may be retained in private ownership providing that legal instruments are put in place to allow for the City of Melville and public access at all times. As part of any development proposal incorporating provision of a centre street, a detailed landscaping plan shall be provided demonstrating provision of suitable landscaping including the provision of street trees.
Corner Streets	Buildings sited at an intersection (corner) between internal Centre streets or an intersection between Centre streets and Brophy Street, South Street, North Lake Road or Gilbertson Road or an intersection between any of Brophy Street, South Street, North Lake Road or Gilbertson Road, shall address all street frontages and provide a strong architectural element to create a local landmark such as distinctive roof forms and detailed, complemented by a contrast in materiality.
State Planning Policy 5.4 – Road and Rail Noise	Where a noise-sensitive land use is proposed within the policy's trigger distance of specified transport routes, an acoustic report shall be provided as part of a development application.
Sustainability	At a minimum, all new development shall achieve a 4-Star Green Star design rating under Green Building Council of Australia. Relevant certification/documentation is to be submitted as part of any development application demonstrating that the relevant requirements have been met.

**Comprehensive New Development is defined as development exceeding $500,000 in value.*

Mixed Use Frame Precinct

Table 4. Mixed-Use Precinct Development Controls

Element	Controls
Residential Development	All residential development shall be in accordance with development standards for the R80 code under the Residential Design Codes Volume 1 and Volume 2 and the City's relevant local planning policies including the following: • Building Heights: The maximum building height is 4 storeys above natural ground level.
Non-Residential Development	Non-residential development is to be in accordance with the City of Melville Local Planning Policy 2.1 – Non-Residential Development, other relevant local and state planning policies and the following: • Plot Ratio: Total plot ratio is 1.0. • Building Heights: The maximum building height is 4 storeys. • Land Use: Land use permissibility to be in accordance with the Mixed-Use zone outlined within Table 3 – Zoning Table of LPS6.
Ground Floor Land Uses & Ceiling Heights	Floor to floor heights for ground floors shall be a minimum of 4 metres to facilitate commercial activities. Residential land uses are not permitted on ground floors.
Facades and Frontages	The following design treatments shall be applied to all forms of development: • Development is to be of a high quality and all facades and frontages shall be designed and finished with high quality materials and finishes. • Building facades shall be articulated, coloured and detailed to contribute positively to the appearance of the streetscape. • Building facades and frontage should highlight a vertical emphasis wherever possible to help break up the appearance of buildings. This can be achieved through the shape and placement of windows and openings and the innovative use of building materials, colours and textures. • Windows are ground floor level shall remain visually permeable at all times in accordance with City of Melville Local Planning Policy 2.1 – Non-Residential Development. • Awnings shall be provided on buildings to provide shade and weather protection for pedestrians. The minimum depth of an awning is to be 2.5m. Where this is not possible due to the width of the verge or any other factor, the awning is to be practical for weather protection. New awnings should be designed and sited to integrate with those of adjoining buildings and structures to provide continuous cover.
Vehicle Parking and Access	Only one vehicular access shall be provided for each development site. Car parking for all residential development shall be provided in accordance with the requirements of the Residential Design Codes Volume 1 and Volume 2. Car parking for all non-residential development shall be provided in accordance with the City of Melville Local Planning Policy 1.6 - Car Parking and Access unless otherwise approved by the decision maker. A Transport Plan that addresses vehicle access to/from and around the site, promotion of public transport, walking and cycling access and end of trip facilities, and freight deliveries/servicing shall accompany all development applications.
Pedestrian Footpath	If no footpath exists within the road reserve, the City of Melville will require the provision of a footpath relative to the length of the lot frontage as a condition of development or subdivision approval or contributing to half the cost as determined by the City.
State Planning Policy 5.4 – Road and Rail Noise	Where a noise-sensitive land use is proposed within the policy's trigger distance of specified transport routes, an acoustic report shall be provided as part of a development application.
Street Trees	In circumstances where no street tree exists within immediate adjacent verge, the City of Melville will require the applicant to install a minimum of one street tree within the verge as a condition of development or subdivision approval. The applicant is required to maintain the street tree for a two-year period to the satisfaction of the City. The location and species of the verge tree is required to be confirmed by the City, prior to being undertaken.

Residential Frame Precinct

Table 5. Residential Frame Precinct Development Controls

Element	Controls
Residential Development	All residential development shall be in accordance with development standards under the Residential Design Codes Volume 1 and Volume 2 and the City's relevant local planning policies with the exception of the following: • **Orientation**: Residential development adjacent to open space shall be oriented to provide passive surveillance over the public domain. • **Boundary Walls:** Boundary walls are to be no higher than 3.5 metres or one storey. • **Lot Boundary Setbacks:** Side setbacks for R80 coded properties adjacent to properties not within the PSP boundary (to the south) shall be setback a minimum of 4 metres. • **Building Heights:** For R80 coded properties adjacent to properties not within the PSP boundary (to the south) the maximum building height is two storeys above natural ground level in order to provide the necessary scale of development adjacent to R25 coded properties.
Vehicle Access and Parking	**Vehicle Access** Vehicle access points shall generally be in accordance with the following: • Development Control Policy 5.1 – Regional Roads (Vehicular Access); and • Main Roads Driveway Policy where applicable. Prior to considering an application for development approval or in making a recommendation for subdivision approval for residential lots abutting the South Street road reservation, the City may require the preparation and approval of a Local Development Plan to coordinate access and egress and minimise crossovers to South Street. **Vehicle Parking** Car parking for all residential development shall be provided in accordance with the requirements of the Residential Design Codes. For apartments, at grade parking discouraged unless it is sleeved behind development. Parking is encouraged in basement or at 2-3 storeys above pedestrian level, with suitable screening provided.
Pedestrian Footpath	If no footpath exists within the road reserve, the City of Melville will require the provision of a footpath relative to the length of the lot frontage as a condition of development or subdivision approval or contributing to half the cost as determined by the City.
Street Trees	In circumstances where no street tree exists within immediate adjacent verge, the City of Melville will require the applicant to install a minimum of one street tree within the verge as a condition of development or subdivision approval. The applicant is required to maintain the street tree for a two-year period to the satisfaction of the City. The location and species of the verge tree is required to be confirmed by the City, prior to being undertaken.
State Planning Policy 5.4 – Road and Rail Noise	Where a noise-sensitive land use is proposed within the policy's trigger distance of specified transport routes, an acoustic report shall be provided as part of a development application.

Part 2: Explanatory Section

2. Introduction and Purpose

2.1 Overview

This section of the PSP intends to provide the rationale behind the provisions of Part One. The PSP will be used by the WAPC, DPLH and other state government agencies, the City, landowners, business owners and developers, to inform more detailed planning and provide certainty of what is envisaged for the Kardinya Activity Centre. The City's Local Planning Strategy seeks to concentrate population growth and development in Activity Centres and along public transport routes, which allows suburban areas to remain similar or the same as they are now.

The WAPC's Structure Plan Framework (August 2015) states that:

> *"An Precinct Structure Plan guides the types of land uses and the overall development (including built form) that is intended to occur within the Activity Centre. It can detail land use and infrastructure requirements as well as environmental assets, residential density, built form, infrastructure and access arrangements".*

The Kardinya 'District Centre' is one of six 'District Centres' in the City that are a prime focus for population growth and redevelopment. Background analysis work was completed for the Centre in 2013 (through the Local Commercial and Activity Centres Strategy – LCAS), including an opportunities and constraints analysis and initial visioning. The PSP is required to achieve the aims of the Local Planning Strategy and the LCAS for the following reasons:

Activity Centres such as Kardinya District Centre, are expected to assist in accommodating the in-fill dwelling targets set by the Central Sub-Regional Framework by 2050;

- The existing planning framework does not provide a vision for the Centre or planning controls for landowners to redevelop sites in accordance with an overarching vision for the Centre; and
- The WAPC SPP 4.2 requires that PSP's be prepared for all centres that are classified as 'District Centres' and above.

This PSP will be the read in conjunction with the City's LPS6, SPP42 and Peel and Residential Design Codes Vol.1 and Vol.2.

2.2 Vision

The Kardinya Activity Centre will continue to evolve as a mixed use centre that provides for the needs of the existing and future Kardinya community. The Centre vision is established as follows:

> *'The Kardinya centre will be a vibrant and exciting focal point of entertainment, hospitality and retail services to create a contemporary, localised centre to accommodate all user's needs in the one location, supported by a higher density residential precinct.'*

In structure planning terms this vision translates into a clear set of principles. The Kardinya Activity Centre will:

- Be a distinctive and attractive centre that capitalises on existing built assets.
- Have a spatial layout that facilitates the connectivity of the Centre with residential areas and other centres to support the intensification of employment, recreation and residential uses within the Centre over time.
- Improve the quality of pedestrian experiences to create a pleasant and attractive Activity Centre that people want to interact with.
- Fulfil its district function and complement the activities in surrounding centres.
- Provide for the evolution of the Centre to provide a truly mixed use, transit oriented and connected centre with high levels of amenity for existing and future residents.

2.3 Rationale for Precincts

The PSP is separated into three precincts (Core, Mixed-Use and Residential). Each of these precincts have their own function, features and purpose within the PSP which have been summarised below.

Centre Core

- Be the focal point of the PSP and surrounding residential areas of commercial activity and development intensity.
- Provide opportunities for local employment, amenities and services within a walkable catchment.
- Create opportunities for a range of housing types.
- Provide important pedestrian connections throughout the Centre and surrounding residential areas.
- Provide immediate access to public transport opportunities.

Mixed-Use

- Provide a transition between the development intensity of the Centre to surrounding residential properties.
- Create opportunities for ground floor activation to Gilbertson Road.
- To provide a built form that frames Gilbertson Road and the entry point of the Centre.
- Provide opportunities for medium density housing in a mixed-use format.

Residential

- To offer a diverse range of medium density grouped and multiple dwelling opportunities.
- To ensure built form and building height provides for an appropriate transition into surrounding existing residential areas.
- To provide a density that will support the viability and vitality of the Centre and will support public transport infrastructure and reduced car use.

2.4 Guiding Principles

Urbanism

With the implementation of in-fill in existing suburbs there has been some resistance to change to typically suburban low- density contexts. As clearly outlined within the City of Melville's Local Planning Strategy, the wider locality will need to change from a suburban to an urban environment over the next few decades and hence mitigating the impact of change on the existing suburban context is an important factor in the success to the implementation of this plan. Ultimately intensification of the area within direct walkability of the main attractor of activity which has excellent access to public transport, allows for the remainder of the suburban context to remain unchanged which will preserve larger areas of typically low-density housing stock areas.

Connectivity

The Kardinya Activity Centre has strong transportation networks linking the Centre with the broader region, into the surrounding residential areas and other Activity Centres. The Plan will promote increased walkability through the Centre and importantly aim to reconnect the two halves of the District Centre. Providing a critical mass of residential density in key locations will make the existing public transport services more viable in the locality. Over time, with increases to density, the patronage of the public transport servicing the area will increase which will provide the necessary nexus for additional investment in public transport infrastructure in the future (i.e., light rail or dedicated transit lanes).

Vibrancy

The Kardinya Activity Centre will provide a range of uses, at a variety of development intensities with activation throughout the day and into the evening in the Core of the Centre. The activated spaces, along with excellent building design, will ensure that actual and perceived safety is maximised for residents and visitors. This will be achieved through the concealment of car parking and by providing a more attractive pedestrian environment throughout the Centre.

The connection between the built form, network and land uses mix will create an environment where people can easily interact. The Centre will be highly used by the residents who live within the Activity Centre as well as the wider catchment area. It will become a key hub of activity for the community, where social networks can be developed and social transactions occur, resulting in a more connected and vibrant identity. As the Centre develops into an urban context, so too will economic and community relations, which in turn will deliver social and economic benefits to the locality.

Economic Growth

The Centre will contribute towards the daily and weekly shopping needs of the locality as well as providing additional local employment. The PSP will further create opportunities for further investment in the locality by a range of stakeholders through new housing and commercial opportunities.

2.5 Community and Stakeholder Engagement

The Kardinya PSP proposes a number of significant changes of how housing, activity and land use may change for the current and future residents of Kardinya and its surrounds. In anticipation of future statutory public consultation, it was identified that early community stakeholder consultation and communications would be critical to the success of the PSP process. Prior to consultation several technical studies were undertaken as part of catchment investigations, including transport, servicing and infrastructure and retail sustainability. These findings formed the basis of communications distributed via an online community survey, community open house session and other online collateral which is discussed in more detail below.

Extensive preliminary market research in early 2019 including primary and secondary (quantitative and qualitative) was executed by Close at Hand Consultants. Though this focussed on the Centre and its redevelopment, it included questions on the interest in on-site apartments as follows:

- A total of 26% of all respondents indicated that they are interested in buying or renting a residential apartment around a shopping centre, with 8% being 'very interested'. The closer the respondents lived to KPSC the higher their interest.
- 75% were interested in buying, rather than renting (which equals 19% of all respondents), and apartments in a price range between $250,000 and $500,000 were considered most popular (12% of all respondents would be interested).
- Qualitative feedback suggests that the area in general and the location at KPSC in particular are considered ideal for apartments.

The research also modelled and mapped where the Centre's clientele originates; the Centre has a very large catchment that live within walking distance. The research also shaped the DA, and therefore the Centrepiece of the Activity Centre in so far as it confirmed the desire for a true town-centre rather than a shopping centre.

Engagement activities for the Kardinya PSP included:

- Distribution of 5000 flyers to residents living approximately 400m from the shopping centre, as well as distribution within the shopping centre itself;
- Door-knocking of several hundred adjacent residential neighbours to inform them of the next stage of the project, managed by PR company Clint Ford & Associates;
- Developing additional PSP collateral for distribution on the existing project website, https://kardinyapark. news, as a single source of information;
- Produced Frequently Asked Questions for distribution online and in person to community and stakeholders;
- Release of a community online survey capturing the thoughts of 46 people; and
- Hosted a 4-hour community drop-in session, with the project team meeting over 191 shoppers and residents to view PSP plans and ask questions.

Analysis Limitations

One of the challenges identified by the project team was ensuring messaging for the PSP was not confused with the recent Kardinya Park Shopping Centre Development Application (DA). Separate public consultation was conducted by the City of Melville alongside the PSP engagement to encourage formal submissions from community members and stakeholders. Promotion for the public consultation process had also received local media attention and postings via the City of Melville social media. Dedicated PSP information has been available on https://kardinyapark.news/ since January 2020.

Online Community Surveys

element prepared and distributed the Kardinya PSP community survey between 23 January and 30 January 2020. The fifteen questions were a combination of qualitative and quantitative and leveraged off findings from technical studies. Participants were provided with background information to consider as they were completing their survey which mirrored that of the open house session displays (see below).

In total 46 responses were received which identified the following key themes below:

- A modest increase of appropriate density within the PSP was generally accepted by respondents. 45% of respondents (17) felt that the proposed densities were appropriate to address issues of urban sprawl, quality of life, access to facilities and/or population growth. A further 26% (10) said they were unsure about the proposed densities.
- Respondents were more likely to accept an increase in height/densities when there was assurance that new builds would be of high quality and not negatively impact existing residential houses in terms of character and traffic movement.
- Leafy green suburbs and a better pedestrian experience is highly valued by respondents. This included more provision for shade (i.e. street trees), seating and safer footpaths. Safe intersection and road crossing were consistently identified as improvements needed within the immediate area when accessing Kardinya Park Shopping Centre.
- When asked what long-term population growth issues are important to them the top response was access to nearby services followed closely by access to frequent public transport. The least important issue was an increase of investment opportunities. Conversely, almost all people who said that investment was very important to them was a current resident of Kardinya.
- Broad concerns and queries about how an increase in density and people living in the area may affect traffic movement, property prices, character and future demographics in the area. Roughly a quarter of respondents expressed concern for an increase in height and densities impacting on the surrounding neighbourhood.
- Public transport was the highest rated mode of transport currently operating within the Kardinya Activity Centre followed by walking, personal vehicle and finally cycling (discounting respondents who said they did not use that mode of transport).
- Demographic information collected during the survey revealed the following about respondents:
- Nearly two thirds (62%, 28) of respondents lived in Kardinya at the time of undertaking the survey.
- Survey respondents were most likely to have lived in their current suburb for over 20 years (41%, 19). Of those long-term residents, 74% (14) are currently living in the suburb of Kardinya.
- 80% of respondents considered themselves to live close to the shopping centre. Ten individuals (22%) said they lived within the 400m radius of the shopping centre.
- Most respondents (70%, 32) said that this was the first time they had engaged with either the redevelopment project or the PSP at the time of undertaking the survey. 11 individuals had engaged with the project team back in November 2019.

Community Open House

The project team hosted a Community Drop In session on the evening of Thursday 23 January 2020 from 3pm – 7pm. The session was hosted at Kardinya Park Shopping Centre in front of Kmart with a number of A0 posters detailing the drivers for the Kardinya PSP, considerations for planning for population growth, proposed R-Code changes, options for medium and medium-high density housing and a call to action for the community to give feedback on the proposed PSP.

In attendance from the project team was the project manager, three planners, an engagement specialist and a PR consultant. Community members and store owners were invited to 'drop in' at any time to view the posters, speak with a member of the project team, ask questions and pick up a set of FAQ's. In total approximately 191 people visited the project team during the drop-in session.

Conversations with community members highlighted the following sentiments as well as observations from the project team:

- Local community members were readily able to understand the need for considered planning for future housing, activity and land use to address the accepted reality of local population growth;
- The Kardinya Park Shopping Centre, and its potential redevelopment, is a valued asset in the community and any future density increases would be a drawcard for new residents;
- Many people viewed the PSP as a tool to help connect the shopping centre with those living south of South Street through improvements to the pedestrian/cycling links;
- Future medium-high density housing should be affordable, high quality and work well with the surrounding neighbourhood; and
- Some concern regarding the height of apartments closest to Kardinya Park impacting on traffic and current residents, including anti-social behaviour.

Overall, it was observed that community members were interested in future plans of the Activity Centre with most appreciating the need for in-depth investigations to accommodate a growing population.

2.6 Land Description

The Kardinya District Centre is a strategic Activity Centre located:

- Approximately 15 kilometres south-west of the Perth Central Business District;
- Approximately 7 kilometres east of Fremantle;
- Approximately 3.5 kilometres west of the Murdoch Train Station; and
- Located on an important public transport route – South Street – which provides bus services between Fremantle and Murdoch Station.

It is one of eight Activity Centres within (or partially within) the City of Melville. The land tenure is fragmented and under the ownership of many different landowners with approximately 718 residential dwellings within the PSP area.

The Kardinya PSP area has been guided by the performance targets under SPP 4.2 which sets out a 400 metre walkable catchment to define the boundary of the PSP from the Centre point of Kardinya District Centre. There have been extensive discussions with the City and WAPC as to the where the PSP boundary is defined. The PSP boundary was originally proposed in a manner that enabled intensity surrounding the Core and gradually transition building height to a lower density code. However, following the reduction in density, and upon further analysis with the City and WAPC, the decision to extend the boundary further east was made and to exclude the western residential catchment which the City had initially proposed to include. These decisions were largely based on the type of housing assessed as part of the analysis. The western residential catchment contains housing stock that is unlikely to be redeveloped due to profile of housing whereas the eastern housing age profile means density is more likely to occur.

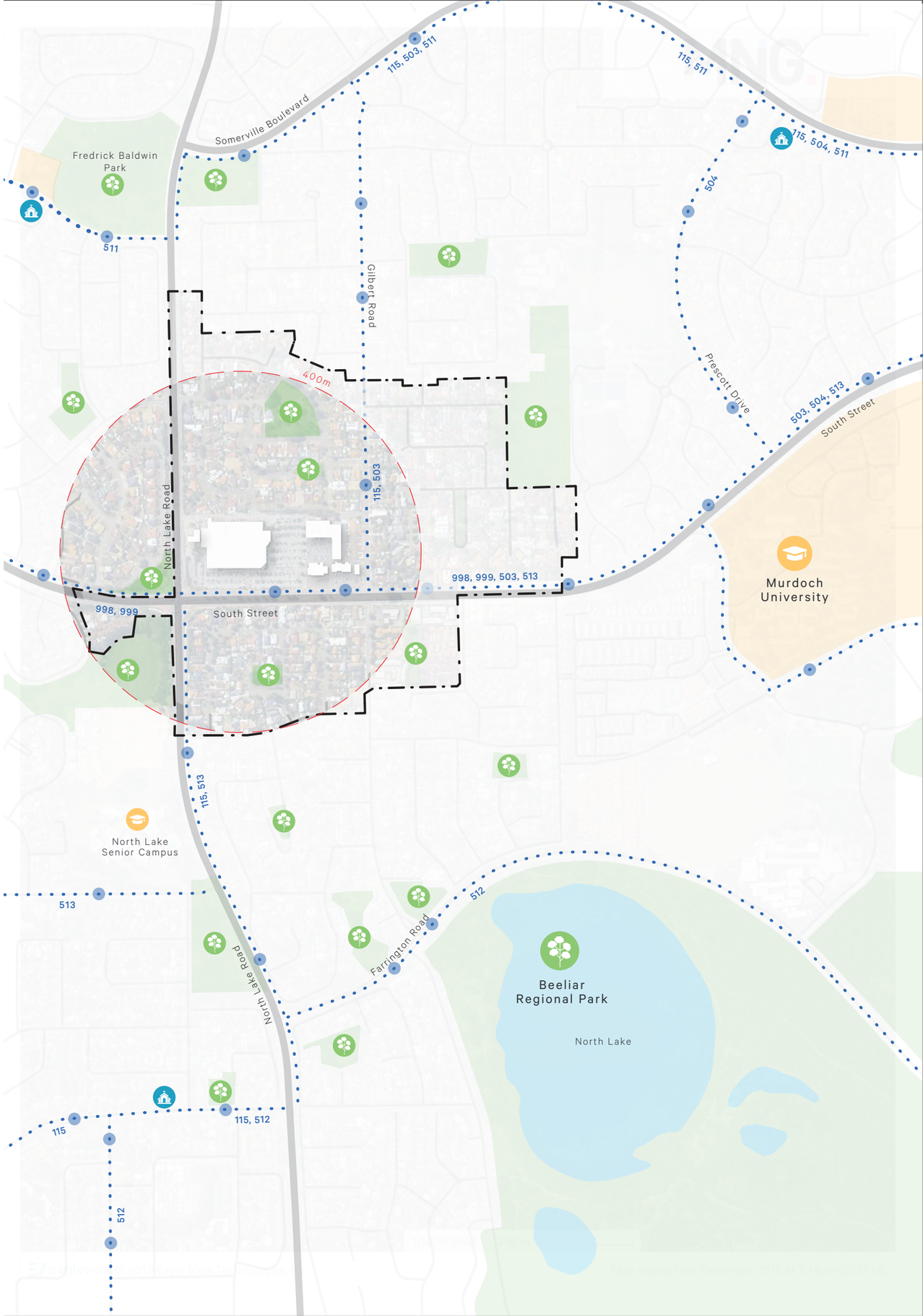
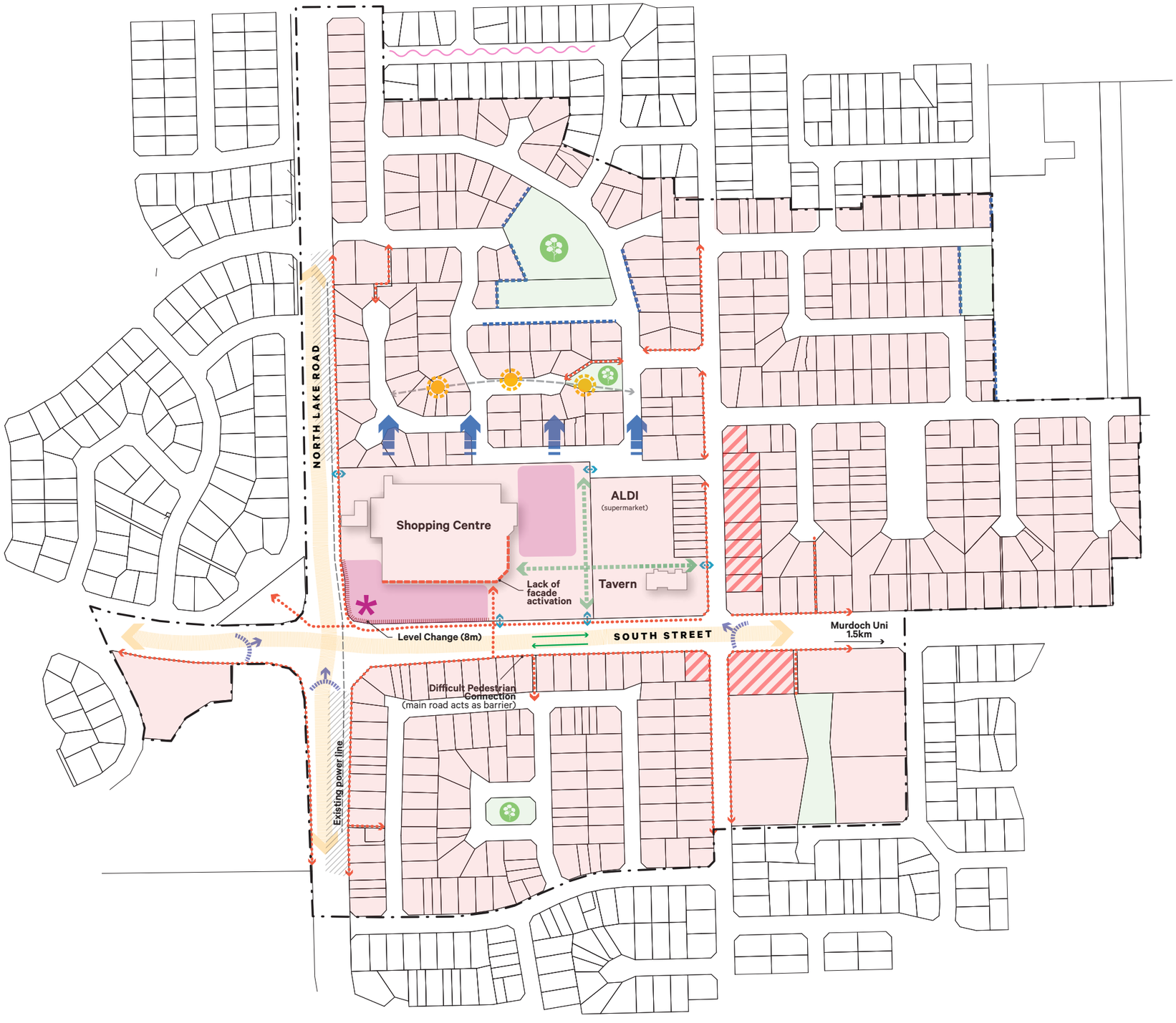


Figure 4. Local Context Map



LEGEND

- ACP Boundary
- Access Point
- Existing Buildings

Strengths

- Views to the city
- Northern solar aspect
- High frequency bus route
- Visual exposure from road
- Possible commercial

Weaknesses

- Pedestrian connections
- Poor residential interface
- Above ground power line

Opportunities

- Passive surveilance
- Upgraded open space
- Corner activation
- Development
- Main street
- Transition paint

Threats

- High traffic regional road
- High value development

Figure 5. SWOT Analysis

3. Demographic Profile

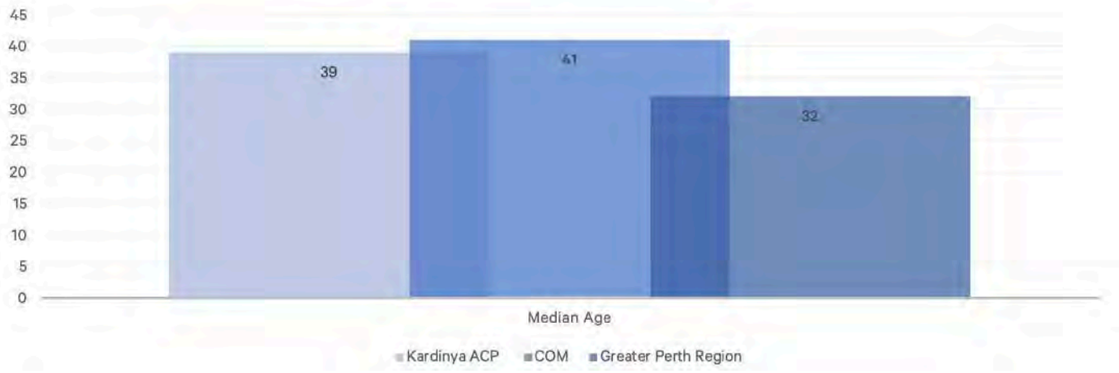
An analysis of the demographic profile has been provided to support the PSP. The PSP area has been compared to the wider City of Melville local government area and greater Perth region. The demographics have illustrated the following key points:

- The PSP area of Kardinya has a higher median age profile than the greater Perth region. Melville generally has a higher age demographic of which the PSP area is closely aligned to.
- 18-24 age profile is higher than both the wider City of Melville and greater Perth region.
- Group households are higher than both the Melville average and greater Perth region. This is likely attributed to the proximity to Murdoch University.
- The PSP area also has a slightly higher ratio of couples without children.
- Current residents within the PSP boundary, are more inclined to use public transport to get to work.

3.1 Median Age Group 2016

Table 6. Age Group Comparisons

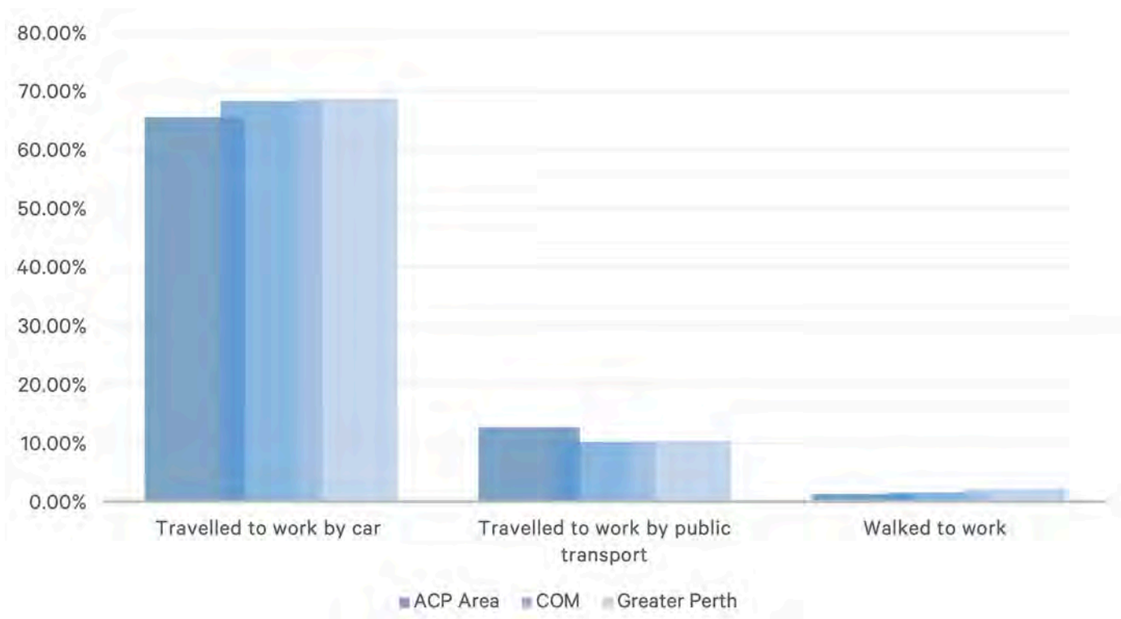
Median Age	PSP Area	COM	Greater Perth
0-4	5.35%	5%	6.5%
5-11	6.3%	8.3%	9.0%
12-17	5.7%	7.7%	7.2%
18-24	11.8%	9.5%	9.4%
25-34	17.7%	11.5%	15.8%
35-49	17.9%	19.6%	20.9%
50-59	11.6%	13.5%	12.2%
60-69	11.5%	11.8%	9.7%
70-84	9.8%	9.8%	7.5%
85 +	1.9%	3.3%	1.8%



3.2 Household Type 2016

Table 7. Age Group Comparisons

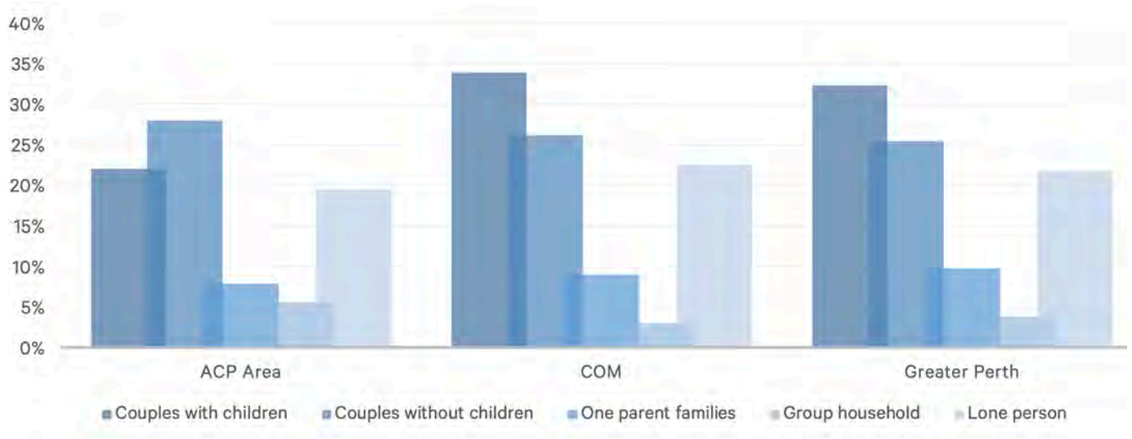
Household Type	PSP Area	COM	Greater Perth
Couples with children	22%	33.9%	32.3%
Couples without children	28%	26.2%	25.4%
One parent families	7.9%	9.0%	9.8%
Group household	5.6%	3.0%	3.8%
Lone Person	19.5%	22.5%	21.7%



3.3 Method of Travel to Work 2016

Table 8. Method of Travel

Method	PSP Area	COM	Greater Perth
Travelled to work by car	68.5%	68.3%	68.7%
Travelled to work by public transport	12.7%	10.2%	10.3%
Walked to work	1.3%	1.6%	2.1%



4. Planning Framework

4.1 State Planning Framework

A number of State strategic planning and policy directions have influenced the objectives and resulting provisions of the Kardinya PSP including the following documents.

4.1.1 Perth and Peel @ 3.5 Million and Central Sub-Regional Planning Framework

Perth and Peel @ 3.5 Million and the associated central sub-regional planning framework provides a high level, spatial vision for accommodating a rapidly expanding population within the Perth and Peel region and recognise the benefits of a more consolidated city whilst also acknowledging the need to provide both in-fill and greenfield development opportunities.

The Central Sub-Regional Planning Framework advocates for greater use of Activity Centres and transport corridors to support a diversity of higher-density accommodation. Activity Centres are identified as being close to transport, jobs and amenities but will need to develop in a way to minimise impact on existing industrial centres and the green network. The Framework applies 10 principles of urban consolidation, which provide the context to planning for infill development, including Kardinya.

The Central Sub-Regional Planning Framework identifies the Kardinya Shopping Centre as an Activity Centre with the aim of the Centre to allow more people to live closer to where they work to reduce distances travelled as well as to match quality infill with amenity by creating a mix of housing, workplaces, retail and entertainment venues. The framework provides an in-fill target for the whole of the City of Melville of approximately 18,500 dwellings by 2050, focussing on those areas identified for more appropriate infill (i.e. such as Kardinya Activity Centre). This PSP aims to provide 10% of the City of Melville's infill target by facilitating the development of a net dwelling increase of approximately 1,177 dwellings. In addition to increasing the development opportunities, the City is also striving to achieve a key objective of the Central Sub-Regional Framework, which is to strengthen key employment centres, including Activity Centres to meet the future needs of industry, commerce and the community.

4.1.2 Metropolitan Region Scheme

Under the Metropolitan Region Scheme (MRS) the Activity Centre area is zoned 'Urban' with the exception of South Street (Primary Regional Road reservation) and North Lake Road ('Other' Regional Road reservation). An Urban zoning acknowledges the area is capable of and identified for urban related land uses, such as residential, commercial and retail land uses.

Refer to Figure 8 – MRS Map Extract

4.1.3 State Planning Policy 4.2 – Activity Centres for Perth and Peel

In 2010, the WAPC released SPP 4.2 which specifies broad planning requirements for activity centre development and renewal. SPP 4.2 focuses on greater diversity in land use, consolidated retail development, quality urban design and walkability.

SPP 4.2 defines an Activity Centre as follows; "Activity Centres are community focal points. They include activities such as commercial, retail, higher-density housing, entertainment, tourism, civic/community, higher education, and medical services. Activity Centres vary in size and diversity and are designed to be well-serviced by public transport."

Kardinya Park Shopping Centre is formally recognised as an 'District' Activity Centre and this PSP has been prepared in accordance with the required format and provisions. District centres are defined under SPP 4.2 as follows:

> *"District centres have a greater focus on servicing the daily and weekly needs of residents. Their relatively smaller scale catchment enables them to have a greater local community focus and provide services, facilities and job opportunities that reflect the particular needs of their catchment".*

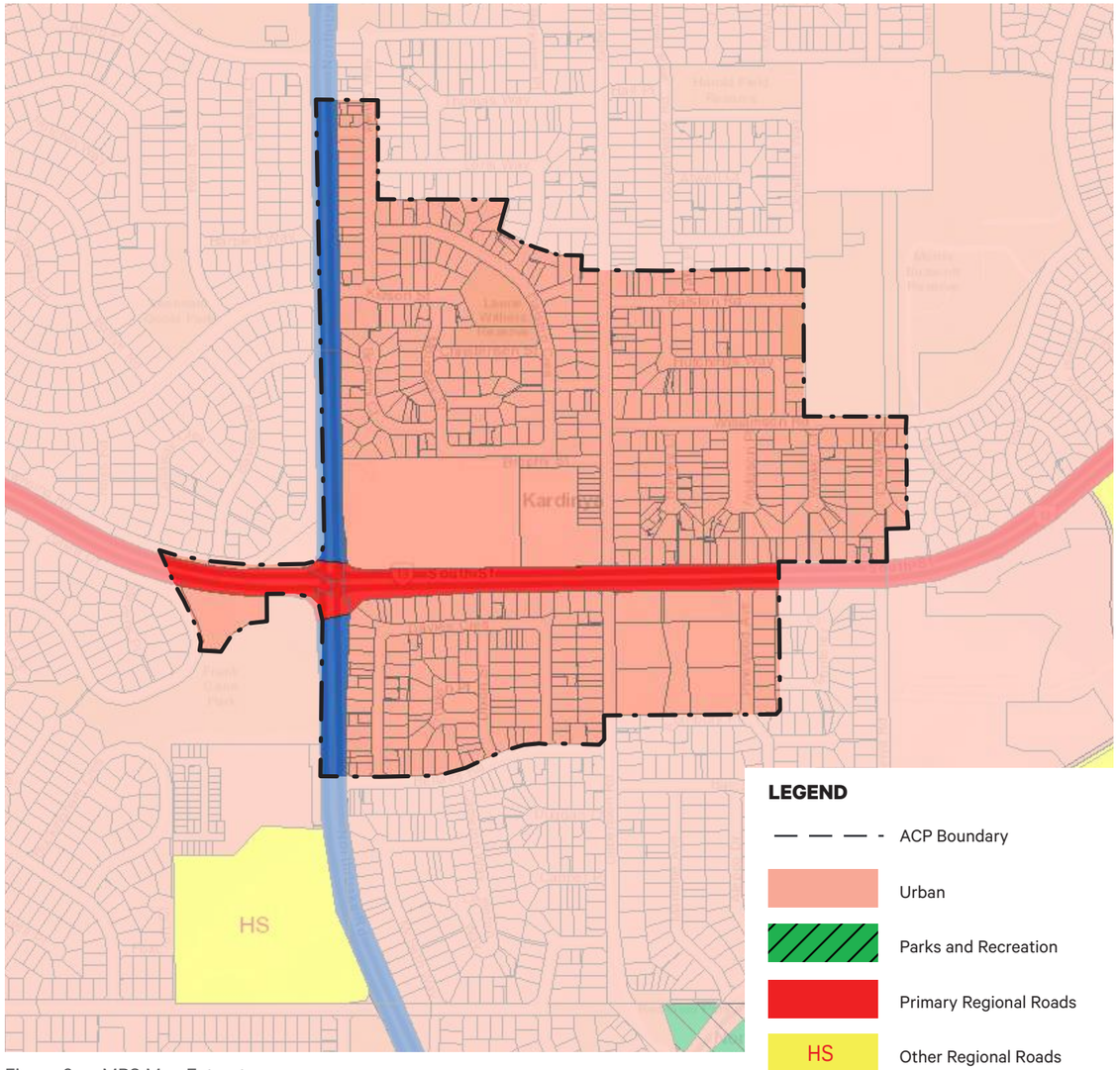


Figure 6. MRS Map Extract.

This PSP has been developed with a diversity of uses and an appropriate distribution of services with respect for the hierarchy of Activity Centre in the wider metropolitan area. This will ensure that the implementation of this PSP does not impact adversely on the operations of other centres. SPP 4.2 provides residential density targets for each classification of Activity Centres. It is noted that based on these targets the resulting densities have been planned on the premise of achieving the density target of 30 dwellings per hectare within the Kardinya PSP area.

4.1.5 State Planning Policy 5.4 – Road and Rail Noise

The purpose of State Planning Policy 5.4 (SPP 5.4) is to minimise the adverse impact of road and rail noise on noise-sensitive land-use and/or development within the specified trigger distance of strategic freight and major traffic routes and other significant freight and traffic routes.

SPP 5.4 seeks to ensure that the community is protected from unreasonable levels of transport noise, whilst also ensuring the future operations of these transport corridors.

Urban consolidation brings challenges when planning for land near high frequency/impact transport corridors. SPP 5.4 aims to ensure acceptable levels of acoustic amenity can be achieved through consideration of interface issues that balances reasonable and practical considerations when noise- sensitive land-use and/or development is proposed in areas impacted by road and rail noise.

The objectives of SPP 5.4 are to:

a) "protect the community from unreasonable levels of transport noise;

b) protect strategic and other significant freight transport corridors from incompatible urban encroachment;

c) ensure transport infrastructure and land-use can mutually exist within urban corridors;

d) ensure that noise impacts are addressed as early as possible in the planning process; and

e) encourage best practice noise mitigation design and construction standards."

South Street is a 'Strategic freight and/or major traffic route' (trigger distance 300m from road carriage way edge) and North Lake Road is an 'Other significant freight/traffic route' (trigger distance 200m of road carriageway edge). Noise sensitive land uses (i.e. residential) which are proposed to increase in intensity (i.e. increased density) within the stipulated trigger distances will need to be assessed against this Policy accordingly which will generally require development to comply with quiet house requirements or other noise mitigation measures as specified within the relevant guidelines applicable to this Policy.

4.1.6 Murdoch Specialised Activity Centre Structure Plan

The Murdoch Specialised Activity Centre Structure Plan (MSACSP) was approved by the WAPC in 2014 and provides high level strategic guidance for the future of the Murdoch Precinct, however, also contains the strategic intent for the broader area surrounding Murdoch which extends to Kardinya. The structure plan sets out 8 precincts, of which Kardinya is contained within Precinct 8, defined as the Suburban Frame. The Suburban Frame covers an extensive area, that is spread across multiple suburbs which include, Bull Creek, North Lake, Bateman, Leeming and the northern part of Coolbellup.

The Suburban Frame precinct is set out within MSACSP as per the following:

> *"The surrounding residential suburbs largely abut the proposed strategic transit corridor along South Street. They present opportunities to increase densities and improve local convenience retail/ services. Particular support will be applied to the eastern corridor along South Street in the vicinity of Murdoch Station, where public transport journeys can be maximised and where there may be scope for redevelopment of more significant tracts of land for mixed use or high- density residential living. The activity nodes which house the two district shopping centres of Bull Creek and Kardinya present opportunities to evolve into local hubs with a mix of activities and more attractive urban form."*

Kardinya Shopping Centre is nominated within MSACSP as an activity node serving the district and neighbourhood catchment, playing a complimentary role to the Murdoch Activity Centre. Whilst the MSACSP core focus is on Murdoch, the Specialist Activity Centre Structure Plan, supports the redevelopment of smaller retail based centres into more diverse places of activity and urban form, of which is consistent with the intent of the proposed redevelopment of the Centre.

MSACSP contains no delineation of Precinct 8 as to how to approach density increases within this nominated area. Given the expansive area that is identified within MSACSP that relates to Precinct 8, the PSP has focused densification around the District Centre in accordance with SPP 4.2. It is deemed that the extent of which Precinct 8 extends should be fragmented, and subject to separate investigations, given the high level nature of the document, and limited strategic investigation on the wider frame area that has occurred via this document.

Kardinya District Centre and the wider residential catchment surrounding as indicated in the extracts, has been identified as a low-rise neighbourhood, with an intended height prescription between 2-3 storeys and 6 storeys in certain locations. The proposed PSP is largely consistent with these recommended heights, with a greater emphasis of concentrating density within the Centre.

MSACSP also prescribes for the Kardinya District Centre to achieve a minimum 35 dwelling per hectare. The total area of the District Centre is approximately 6.6ha which would require 231 dwellings to be built within the District Centre to achieve this target.

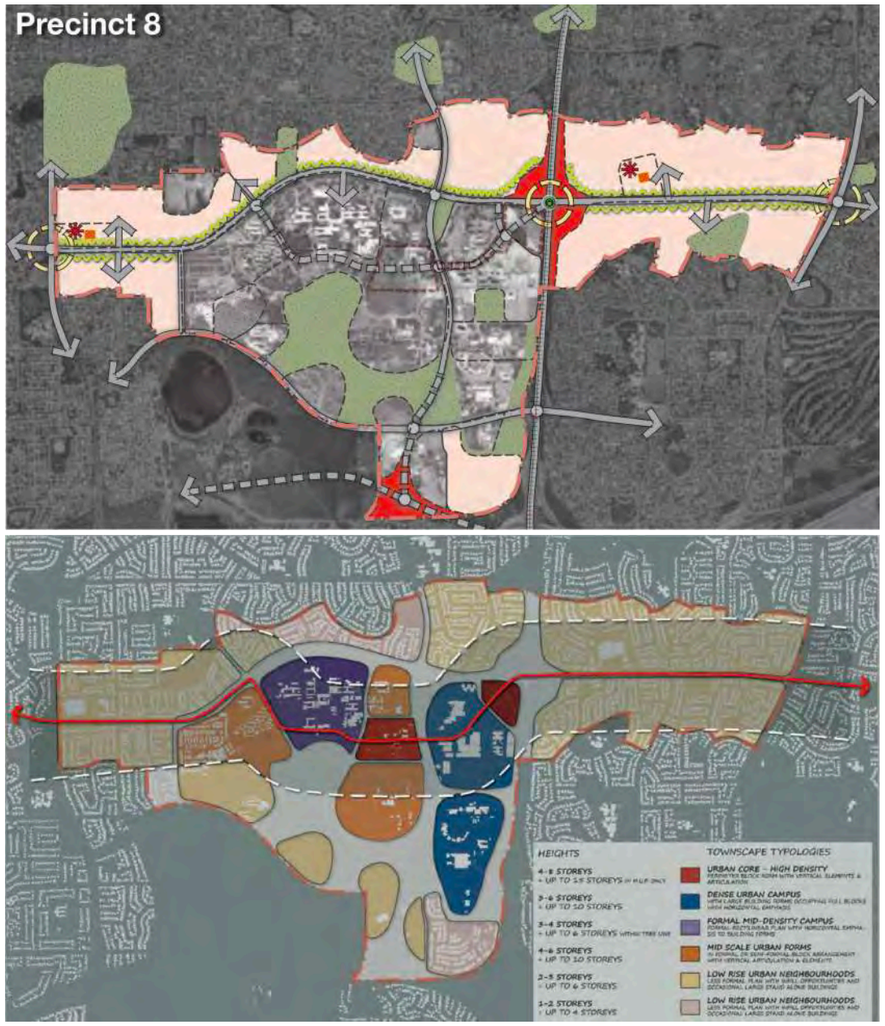


Figure 7. MSPSP Extract.

4.1.7 State Planning Policy 7.0 - Design of Built Environment

SPP 7.0 is a State Government State Planning Policy aimed at ensuring good design is at the forefront of all development in Western Australia. SPP 7.0 is to be given regard by decision making authorities during the consideration of strategic and statutory planning proposals. SPP 7.0 includes '10 Principles of Good Design' which developments are assessed against. This is typically assessed by Design Review Panels at Development Application stage to ensure a holistic assessment against a range of relevant design disciplines.

Future development proposals will be required to give regard to the 10 Principles of Good Design and likely referred to the City of Melville's Design Review Panel at their discretion.

4.1.8 Residential Design Codes (Vol.1 & Vol.2)

Volume 2 of the Residential Design Codes will apply to multiple dwelling and mixed-use development R80 and above. The policy guides apartment design and provides the necessary built form controls for the Kardinya Activity Centre. Volume 1 of the Residential Design Codes will apply to single, grouped dwellings and multiple dwellings within R60 and below coded areas.

4.1.9 Development Control Policy 1.6 – Planning to Support Transit Use and Transit Oriented Development

WAPC Development Control Policy 1.6 (DC1.6) seeks to maximise the benefits to the community of an effective and well used public transit system by promoting planning and development outcomes that will support and sustain public transport use. The objectives of DC 1.6 are as follows:

- *"To promote and facilitate the use of public transport as a more sustainable alternative to the private car for personal travel, to enhance community accessibility to services and facilities, including employment opportunities, community services and recreational facilities, and to improve equity in accessibility for those who do not own or have access to a car;*
- *To encourage spatial patterns of development that make it easier to plan and efficiently operate public transport services, and for the existing and potential users of public transport to access those services;*
- *To encourage balanced public transport patronage along transit corridors by creating places that are destinations as well as points of departure;*
- *To ensure the optimal use of land within transit-oriented precincts by encouraging the development of uses and activities that will benefit from their proximity and accessibility to public transport, and which will in turn generate a demand for the use of transit infrastructure and services;*
- *To ensure that opportunities for transit supportive development are realised, both on public and privately-owned land, and that transit infrastructure is effectively integrated with other development, to maximise safety, security and convenience for transit users; and*
- *To promote and facilitate walking and cycling within transit-oriented precincts by establishing and maintaining high levels of amenity, safety and permeability in the urban form, and to promote and facilitate opportunities for integrating transport modes by creating opportunities for convenient, safe and secure mode interchange."*

In addition, DCP 1.6 states:

> ***"Higher residential densities and mixed-use development in the walkable catchments of transit facilities have the potential to reduce car dependence; to increase accessibility for those without access to private cars; to reduce congestion on the road network and the demand for new road space; to reduce fuel consumption and air pollution; and to provide quality diverse and affordable forms of housing and development. These benefits combine to produce an attractive and viable alternative to car-based trips."***

The Kardinya PSP acknowledges and incorporates the above strategic direction throughout its various themes.

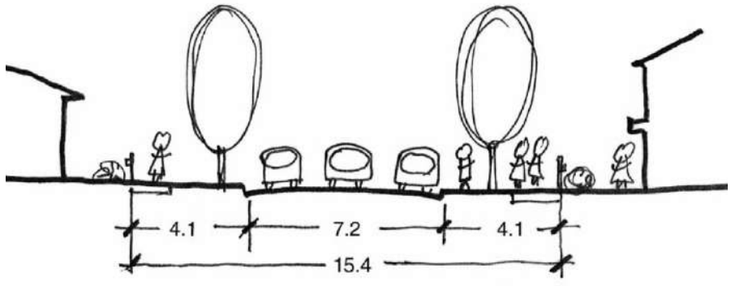
4.1.10 Liveable Neighbourhoods

Liveable Neighbourhoods (2009) is an operational development control policy and was prepared by the WAPC to implement the objectives of the State Planning Strategy. Liveable Neighbourhoods focuses on promoting walkable mixed-use neighbourhoods where daily needs are within walking distance of most residents and advocates to produce safer, healthier, more sustainable and connected communities. The provisions of this PSP are generally consistent with the objectives of Liveable Neighbourhoods including the following:

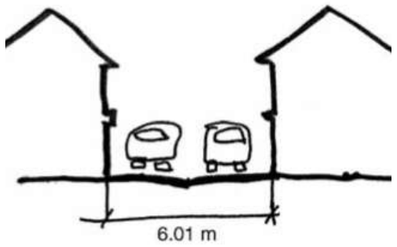
- *"To provide for an urban structure of walkable neighbourhoods clustering to form towns of compatible mixed-uses in order to reduce car dependency for access to employment, retail and community facilities;*
- *To ensure active street/land use interfaces with buildings fronting onto streets to improve personal safety through increased surveillance and activity;*
- *To facilitate new development which supports the efficiency of public transport systems and provides safe, direct access to the system for residents;*
- *To facilitate mixed-use urban development which provides for a wide range of living, employment and leisure opportunities capable of adapting over time as the community changes, and which reflects appropriate community standards of health, safety and amenity;*
- *To provide a variety of housing size and type to cater for the diverse housing needs of the community at a density that can ultimately support the provision of local services;*
- *To ensure cost-effective and resource-efficient development to promote affordable housing; and*
- *To maximise land efficiency wherever possible".*

It should be noted that Liveable Neighbourhoods is under review by the DPLH under the Stage 2 of Design WA – with the policy to be renamed 'Neighbourhood Design' and released as a new State Planning Policy. A draft has not yet been released for consultation at the time of drafting this PSP.

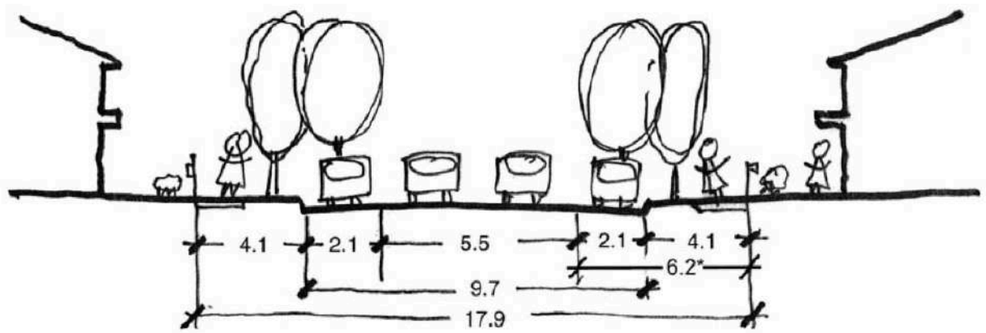
Liveable Neighbourhoods has been used guide the appropriate road widths for the Centre. A summary of the selected road widths have been provided.



East-West Connection



Laneway



Main Street North-South

Figure 8. Street Connection

4.2 Local Planning Framework

4.2.1 'Local Commercial Activity Centres Strategy 2013

The City of Melville commissioned a Local Commercial and Activity Centres Strategy (LCACS) in 2013 to provide a framework for future development that allows activity to respond to market needs while encouraging positive outcomes for better functioning Activity Centres whilst mitigating impact on existing areas. A key idea in the LCACS, which is also supported SPP4.2, is to better align employment with residential density which is considered to be one of the fundamental building blocks of sustainable urban form. There are a range of potential advantages associated with Activity Centre-based urban form including:

- *'Locating dwellings near daily or weekly destinations such as schools, employment, recreation, services and shops (or close to a low-cost, efficient transport network) effectively reduces the overall cost of housing. This effect has been quantified as the Housing and Transport Index. This may also provide more equitable access to goods and services for residents.*
- *Concentrating destinations at a node or along a corridor facilitates more efficient and less costly servicing via public transport, reducing the dependence of residents on private vehicles while maximising the catchment of potential users.*
- *Concentrating people in smaller areas of land reduces the need to continually expand the boundaries of the urban area, which will in turn reduce the need to use land valuable for habitat, agriculture or other natural resources use or conservation.*
- *Delivery of essential services, such as water, power, communications and waste removal services may be more efficient in an area of higher population density; and*
- *Reduce the consumption of resources, including water, fuel, electricity and building materials.'*

The LCAS outlines that the framework for assessment of existing Activity Centres within the City of Melville which is as follows:

- *Activity Centre functions – assigning if population driven or strategic and outlining if known the aspirations for future functions.*
- *Activity Centre user mix – split of residents, visitors, workers and enterprises.*
- *Activity Centre vision – sets out vision for each Activity Centre to assist in formulation of further planning framework.*
- *Areas of assessment – to guide the outcomes to be encourages and avoided in the formulation of framework (amenity, diversity, activation, access, resource use and economic performance). Activity Centre goals – assigned to each area of assessment relevant for statutory assessment.*
- *Minimum standards – for development within Activity Centres to achieve vision for the Activity Centre.*
- *Performance criteria – ideal standard of development to achieve vision for the Activity Centre.*

The above was used in the assessment of the Kardinya Activity Centre for the City's Local Planning Strategy.

4.2.2 City of Melville – Local Planning Strategy

The City's Local Planning Strategy (LPS) was endorsed by the WAPC on 19 January 2016. The LPS has identified that to achieve the aims of Perth and Peel @ 3.5 million, the intensification of the District Centres and use of the potential of public transport nodes and corridors is required. The LPS states that residential developments in the form of mixed use will be encouraged in line with SPP 4.2 to assist in managing/reducing the use of private transport but also encouraging the diversity of housing types in the local areas that are within the vicinity of high levels of amenity (i.e. services).

The City of Melville has six district centres within its boundaries. Many of these centres service a catchment that includes adjoining authorities. A focus of the LPS is to intensify these centres to encourage a better mix of activities including residential in order to consolidate their role as community focal points. Mixed use developments will be encouraged within Activity Centres as a way of intensifying their use. There will also be a trend to reduce the Frame areas around the Centres, which serve as a transition between the Centres and the surrounding residential areas in order to encourage a greater concentration of commercial development within the Centre whilst maintaining the residential densities within walking distance to support retail growth.

The LPS encourages transformation of district centres to fulfil their potential in terms of activity and density as per SPP 4.2. The LPS has namely highlighted these centres as places of opportunity for an increase in residential development to fulfil the in-fill targets set by the central sub-regional framework.

The LPS has also nominated properties along transit routes such as North Lake Road and South Street to be investigated for high density residential development. The LPS does not specifically identify these density targets, and it is understood this investigation into future up-coding is yet to commence to inform the preparation of this PSP. However, the PSP has acknowledged the vision of the City to provide density along these transit corridors and has reflected this vision and intent within the PSP, this will be discussed in further detail within the Urban Form section of the report.

Although the site is designated as a district centre, the City of Melville's Strategy has not identified the Kardinya Activity Centre as a 'strategic development area' within the Strategy. These Strategy areas were identified as they will likely require comprehensive strategic urban planning studies to facilitate the degree of change necessary to effectively achieve an acceptable level of urban density and land use diversity – i.e. potentially more work than that contained within an PSP.

Despite the subject Activity Centre being initially developed under a planning system that has been dominated by access for the private motor vehicle, the Kardinya Activity Centre has excellent access to existing and future public transport and has potential for expansion to facilitate anticipated levels of activity and density as specified with SPP 4.2.

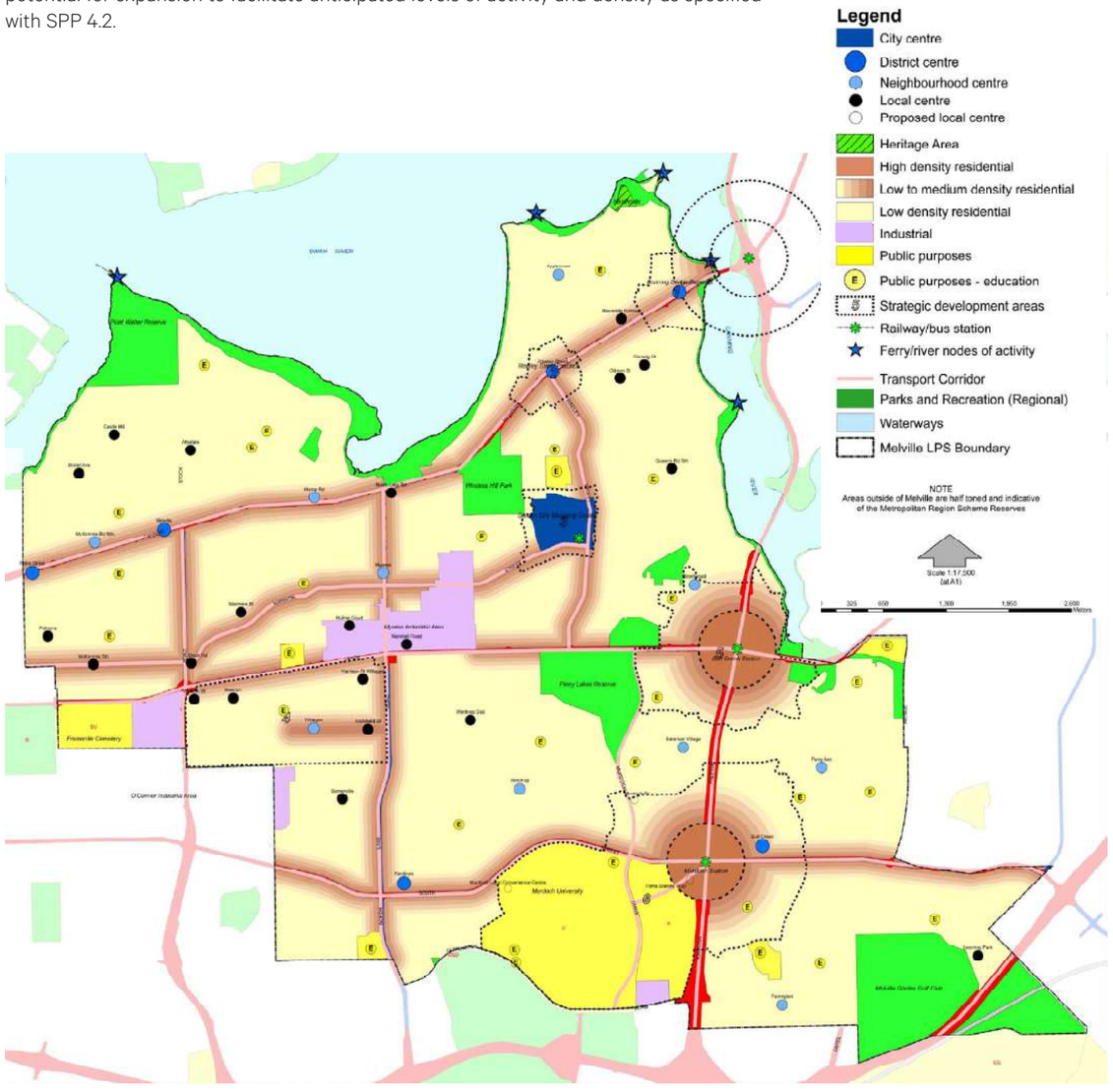


Figure 9. City of Melville Local Planning Strategy 2012 Map

4.2.3 City of Melville – Local Planning Scheme No. 6

LPS6 was Gazetted in May 2016 and provides the statutory planning framework for land use and development within the City of Melville.

The Kardinya PSP area contains 'Centre' and 'Residential' zones and local reserves. The Centre Core is currently zoned 'C3 – Other District Centres' under the City's LPS6 with an allocated residential density of R-AC0. Pursuant to the Scheme, the objective of the 'Centre' C3 zoning is to provide for district centre development focusing on weekly needs and services a wider district catchment for centres with no PSP. Further objectives for the Centre zone are as follows:

- *'To designate land for future development as a city centre or Activity Centre.*
- *To provide a basis for future detailed planning in accordance with the structure planning provisions of this Scheme or the Activity Centres State Planning Policy.*
- *To provide for a wide variety of active uses on street level which are compatible with residential and other non-active uses on upper levels.*
- *To allow for the development of a mix of varied but compatible land uses such as housing, offices, showrooms, shops, amusement centres, and eating establishments which do not generate nuisances detrimental to the amenity of the district or to the health welfare and safety of its residents.*
- *To ensure that development is not detrimental to the amenity of adjoining owners or residential properties in the locality.*
- *To ensure the design and landscaping of development provides a high standard of safety, convenience and amenity and contributes towards a sense of place and community.'*

The Scheme further provides specific development provisions for the C3 zoned Centres where an PSP is not provided. However, as this PSP will provide the necessary development controls, a more appropriate zoning for the 'Core' will be C2 which has the objective:

> *'District Centres subject to Precinct Structure Plans: to provide for District Centre development focusing on weekly needs and services a wider district catchment giving due regard to the relevant Precinct Structure Plans.'*

The Residential Precinct is currently zoned 'Residential' with various densities from R25 up to R80. The objectives of the Residential zone are as follows:

- *To provide for a range of housing and a choice of residential densities to meet the needs of the community.*
- *To facilitate and encourage high quality design, built form and streetscapes throughout residential areas.*
- *To provide for a range of non-residential uses, which are compatible with and complementary to residential development to promote sustainable residential development.*
- *To maintain the compatibility with the general streetscape, for all new buildings in terms of scale, height, style, materials, street alignment and design of facades.*

LPS6 text and map will be amended to reflect the proposed changes which include modifications to the Centre zone to C2, amending the residential zoning along Gilbertson Road to mixed-use and upcoding the residential frame.

4.2.4 City of Melville - Local Planning Policy 1.6: Car Parking and Access

LPP 1.6 prescribes requirements relating to non-residential car parking standards and vehicle access. Non-residential land uses will need to continue to conform to the requirements of LPP 1.6, in addition to vehicle access provisions being addressed as part of future development applications

4.2.5 City of Melville - Local Planning Policy 2.1: Non-Residential Development

LPP 2.1 provides built form guidance to non-residential development proposals. Future non-residential development will need to give regard to these provisions in addition to the built form standards within the PSP.

5. Centre Context

5.1 Regional and Local Context

The Activity Centre is generally bound by Thomas Way to the north, Gillet Drive to the west, Bellairs Road to the south, Pinewood Avenue to the south-east, Sexton Court to the east and Morris Buzacott to the north-east.

The shopping centre plays an important role as a focal point for the community. The residential typology is namely single detached residential with limited grouped or multiple dwelling development present within the Activity Centre area. The Centre is also well located within close proximity of a number of attractors such as Morris Buzacott Reserve, Alan Edwards Park, North Lake Senior High School, Kardinya Primary School, Fiona Stanley & St John of God Hospitals and Murdoch University. The Activity Centre is strategically positioned abutting two regional roads, North Lake Road running in a north-south direction and South Street running in an east-west direction which provides excellent connectivity throughout the Centre.

The Activity Centre has the opportunity to be highly connected and well-integrated within the immediate residential catchment as well to the broader regional network, with high frequency bus routes operating along South Street and Gilbertson Road, regional roads servicing the Centre and pedestrian corridors throughout adjoining residential areas. Currently the Core of the Centre has not been designed to optimise this opportunity with poor pedestrian linkages, customer difficultly with access and egress and a lack of recognition the existing site has for existing bus routes that operate along South Street.

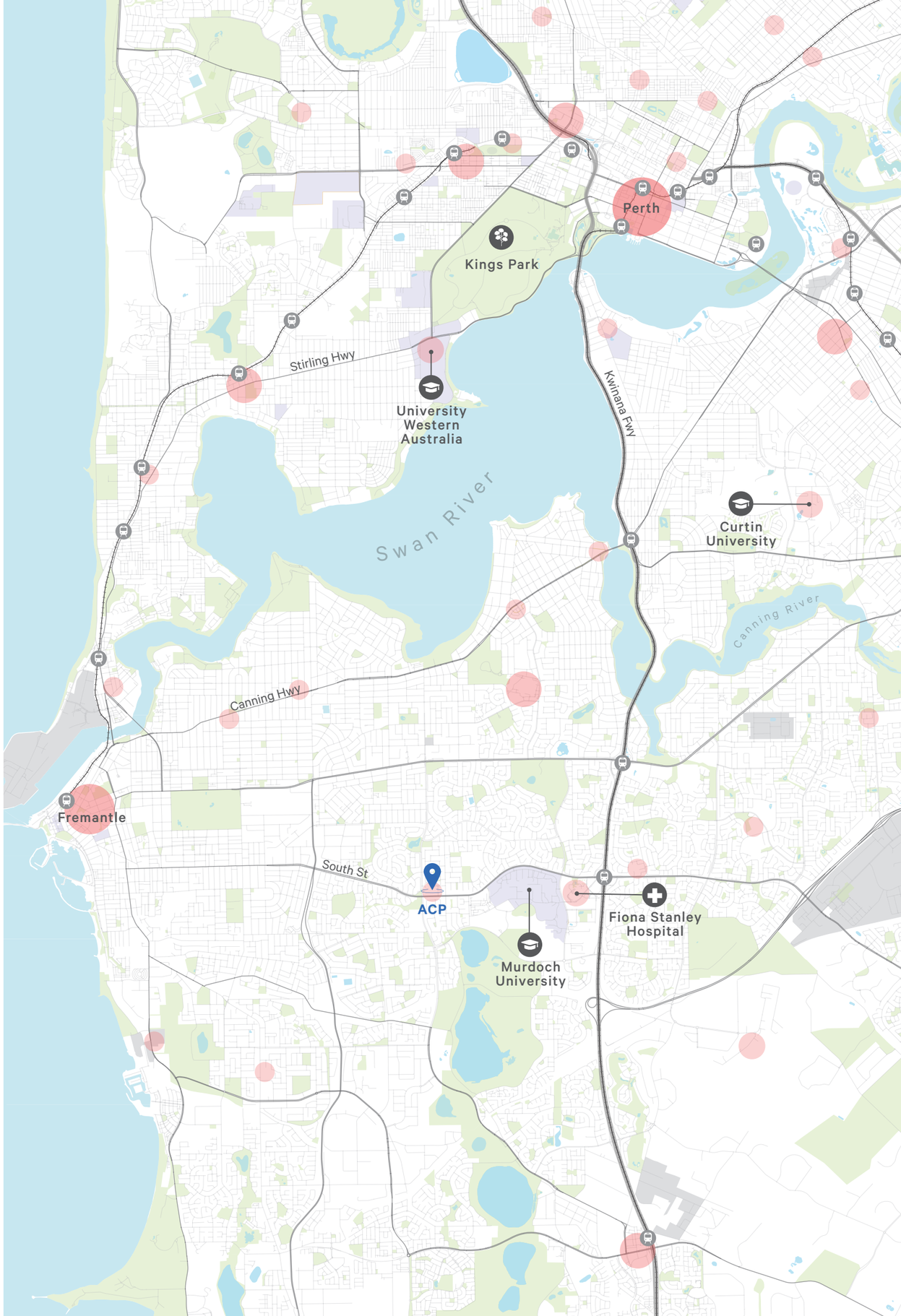


Figure 10. Regional Context Plan

5.2 Infrastructure

The PSP seeks to promote more efficient use of public infrastructure and existing local amenity (local and commercial) to achieve a more sustainable urban environment. The service capacity of existing infrastructure to accommodate proposed infill development within the next 30 years has been taken into consideration when planning for the future of the area.

Assessing the implications of the in-fill being provided in the context of the existing infrastructure provision allows for more certainty to servicing agencies in respect to forward planning and the allocation of funding and resources. Pritchard Francis civil engineering consultants have provided an engineering services report of the existing civil infrastructure services within the locality and the capacity of this infrastructure to cater for approximately 1,900 dwellings.

Projection as proposed within the PSP. It should be noted, Prichard Francis conducted their servicing investigation based on 1,856 dwellings, however, upon the amendments to the PSP boundary following feedback from DPLH, a minor increase in the approximate dwellings is projected. Given the minor increase, confirmation from Pritchard Francis confirmed the change in dwellings would not impact the servicing advice from providers, given the level of capacity within the area.

Refer to Appendix 3 – Pritchard Francis Servicing Report

Table 9. Servicing Summary

Sewerage reticulation
• The reticulation infrastructure in the catchment of the subject area can cater for the increased predicted flows; • The Le Suoef Drive pump station that serves the catchment and some down-steam headworks will need to be upgraded in the future; and • In regard to developers requirements as per above there should be no upgrading of reticulation infrastructure, but developers may be required to fund new, relations and/or protection of works depending on the development proposal taking place. The upgrading of the headworks infrastructure will be funded by Water Corporation.
Water reticulation
• Water reticulation does not seem to be a problem. A hydraulic consultant will be required to asses each individual development site in order to size the water and fire connections and review the water pressure and flow within the existing water mains to verify whether pumps and tanks are necessary to support a proposed development.
City of Melville Drainage Infrastructure
• An upgrade to the existing road reserve drainage networks should not be required, and all stormwater networks are appropriately sized to cater for the existing land uses and road reserve widths. An increase to the residential zoning will not impose additional load on the existing stormwater networks.
Gas Supply
• The existing and planned upgrades to gas infrastructure within the PSP area will sufficiently accommodate the proposed density increases.
Electrical supply
• The additional load that will be added to the network will be approximately 6.5MVA of design load. Network feeders are designed to cater for 10MVA of actual load and some provision for growth. • In the past when additional load is added to the network at a slower rate, approximately 1.5MWA per year (i.e. in-fill growth), this has been considered load growth and thus any major network reinforcement works that may be required to provide the capacity in the area is covered by Western Power. Based on the overall load profile and probability of a staged in-fill uptake in the area, large network upgrade costs would not be incurred.
Communications
• Kardinya has already been connected to NBN Co broadband under the Brownfields rollout with Fibre to the Node technology; • Developers have two obligations to provide fibre ready pit and pipe and to provide telecommunications infrastructure as is provided for other utilities, for new developments; • Assuming a mix of development by multiple homeowners and land developers the probability of Fibre to the Premises being delivered would increase with decision made on a commercial basis; • South street, North Lake road and Gilbertson Road are well services with large conduit routes, however other local streets are not regarded as fibre ready and cannot support a substantial increase in in cable infrastructure with some streets having asbestos in the telecommunications conduit infrastructure (which will increase costs associated with upgrade. Assuming road reserve are unchanged, telecommunication infrastructure is unlikely to require relocation from redevelopment.

5.3 Biodiversity and Natural Area Assets

The subject area is an existing urban area. Biodiversity and native habitat are limited to four local reserves, street trees and private gardens which contain a variety of introduced and native species. There are no sites within the subject area that are classified as geomorphic wetlands or bush forever sites.

5.4 Acid Sulphate Soils

A desktop search using Department of Water and Environmental Regulation Acid Sulphate Soils online mapping system has determined that there are no medium or high-risk Acid Sulphate Soils within the PSP area.

5.5 Site Contamination

A desktop search using Department of Water and Environmental Regulation (DWER) online mapping system has determined that there are no registered contaminated sites within the PSP area. There may be some sites which are contaminated but not listed. If contamination is found, it is required to be reported to DWER.

5.6 Heritage

There are no Aboriginal or European State or Local heritage listed buildings or sites within the subject area.

5.7 Bushfire Hazard

There are no bushfire prone areas as defined by Department of Fire and Emergency Services in the subject area.

5.8 Topography

The PSP area has a general fall from the south-west to the north with the north-west precinct having the steepest of falls. The western extent of the precinct has an RL of 49m AHD and the northern extent of the precinct has an RL of 10m AHD to demonstrate the level difference across the area.

Individual sites will need to address the slope across properties in new developments to appropriately manage stormwater and create useable spaces without compromising the streetscape and neighbouring property amenity through the use of extensive retaining.

5.9 Groundwater

The PSP area typically consists of sandy soils suitable for urban development due to high permeability and easy ability for excavation.

The Department of Water and Environmental Regulation indicate that the groundwater is likely to be encountered at RL 9.0m AHD in the eastern precinct and reduce down to RL 6.0m AHD in the western precinct of the PSP area. As most of the PSP area is above 10m AHD, the groundwater level will not impact the structural design or stormwater detention solution for these areas.

In the northern precinct, basement structures and stormwater detention will likely be difficult due to the small difference between the ground level and the groundwater level. This will likely manifest in car parking being provided at ground and in mezzanine levels for new developments unless more expensive water proofing and potential pumping of basements is proposed. Concealment of any at-ground or above ground car parking areas is mandated in the R-Codes for apartment and mixed use developments which will ensure good design outcomes will still be required from the outset.

6. Movement

6.1 Regional Perspective

Kardinya Activity Centre is a well-connected centre from a regional perspective. The site is connected by two regional roads, high frequency bus routes servicing the centre, and the external pedestrian movement throughout the area has opportunities for improvement to make the centre more pedestrian oriented. The movement analysis identifies existing site conditions, traffic generation and distribution, vehicle and pedestrian access points movement, key public transport routes as well as cycling conditions. The Kardinya District Centre is highly accessible with multiple regional roads surrounding the centre and proposed activity centre boundary. The road category can be summarised in the below table:

Table 10. Road Hierarchy

Street Name	MFRH Category (Metropolitan Functional Road Hierarchy)
South Street	Primary Distributor
North Lake Road	Distributor A
Le Souef Drive	Local Distributor
Gilbertson Road	Local Distributor
Petterson Avenue	Local Distributor
Other Roads	Access Roads

South Street is a Primary Regional Road Reservation which provides a substantial amount of traffic flow between Fremantle, Kwinana Freeway and the Canning Vale Industrial Area to the east. The road is controlled by Main Roads and has a speed limit of 70km/h and primarily serves traffic movement from an east to west direction, Canning Vale to Fremantle. South Street is designated as "High Priority Public Transport Corridor" and a "Bus Rapid Transit or Light Rail beyond 3.5 million". This would be a 'step up' from High Frequency Public Transport Corridor and suggests that measures such as signal for bus priority, dedicated peak hour bus lanes or bus queue jumps could be employed, or light rail infrastructure being implemented in the future to provide better connections between Fremantle and Murdoch activity centres. North Lake Road is an 'Other Regional Road' reservation and provides for some of the freight traffic from Fremantle to the north of the activity centre site as well as a medium to high portion of general traffic in the locality (with a District Distributor 'A' designation in the road hierarchy). The speed limit for North Lake Road is 70km/h and is the predominant connection from Cockburn Central to Alfred Cove, also servicing the Bibra Lake industrial area as well as Myaree commercial area positioned along Leach Highway.

From a Regional Planning Perspective, the Department of Transport released the Perth Transport Plan for 3.5 million and Beyond in August 2016. Transport @ 3.5 Million is modelled on the WAPC's draft Perth and Peel @ 3.5 Million planning frameworks of where people will live and work. Transport @ 3.5 Million provides a long-term plan to guide development of a strategic, sustainable and robust transport network for Perth and Peel. It describes a future transport network that provides people with more than one viable option for travelling to work, school and shops and for accessing services and recreational activities. The vision for Perth's transport network is to meet the following objectives:

- Optimise use of existing network as it grows;
- Integrate with land use with public and active transport as well as surrounding road networks;
- Deliver high frequency, 'turn up and go' mass rapid transit connected with effective public transport feeder services;
- Provide a safe, connected active transport network of primarily off-road cycleways and walkways; and
- Maintain a free-flowing freeway and arterial road network for the efficient distribution of people and freight.

The plan will guide future investment, planning and policy decisions for the metropolitan transport system, as well as inform local government planning, industry, developers and the community.

Refer to Appendix 2 – Transport Impact Assessment, Stantec

Refer to Figure 12 – PSP Existing Movement Map

6.2 Public Transport

There are five bus services that operate along South Street and Gilbertson Road. Currently, there are three bus stops located along South Street, two stops that are directly positioned outside the front of the Kardinya Park Shopping Centre, and a third located on the opposite side of South Street. The bus Routes 115, 513 and circle Route 999/998 all operate along South Street. Route 115 operates from Elizabeth Quay Bus Station and finishes at Hamilton Hill, Route 513 services Murdoch Station through to Fremantle and the circular Route 999/998 services the inner-metro area of Perth, completing a clockwise bus service, as far south as Murdoch and as far north as Stirling. All three of these services are considered high frequency bus routes during Monday to Friday. There is a fifth bus service Route 503 which predominantly services Murdoch Station to Bull Creek Station, this service is more infrequent being a more localised bus service. A summary of the bus service frequency is provided below:

Table 11. Bus Stops

Route	Weekday Peak	Weekday Off Peak	Weekend
999	5 – 10 minutes	15 minutes	15 – 30 minutes
998	5 – 10 minutes	15 minutes	15 – 30 minutes
115	15 minutes	15 minutes	30 minutes
503	10 – 20 minutes	60 minutes	No weekend service
513	10 - 15 minutes	30 – 60 minutes	60 minutes

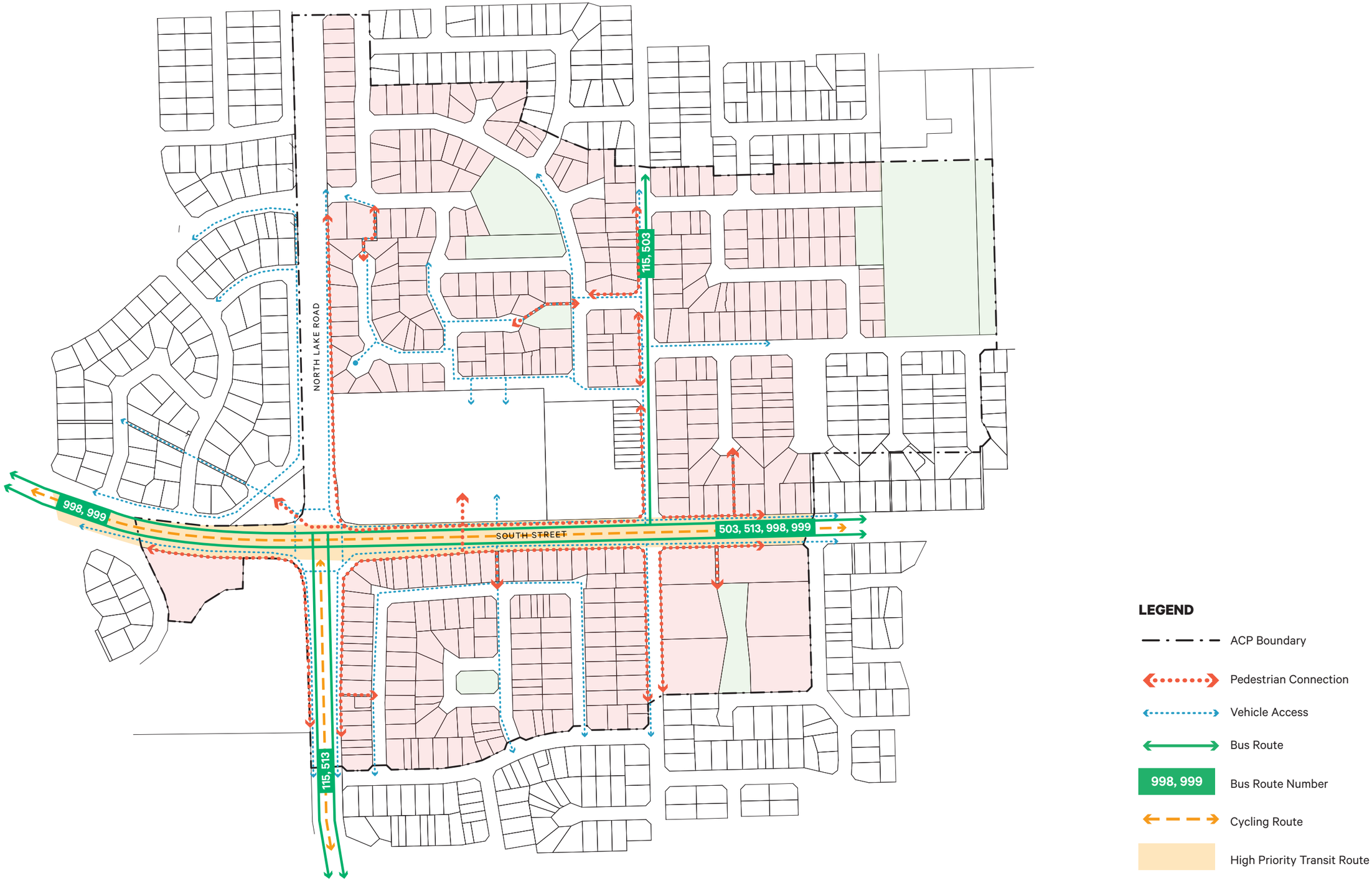


Figure 11. PSP Existing Movement Map

6.3 Pedestrian Movement

As Kardinya's population grows within the PSP area, there will be more emphasis on providing high quality and safe pedestrian and cycling infrastructure to encourage greater shift's to these modes of transportation as well as accessing public transport. The Activity Centre is divided by a number of sections by South Street, North Lake Road and Gilbertson Road creating both physical and psychological barriers (i.e. deemed too difficult to cross). There are two sets of traffic lights along South Street at the intersections with Gilbertson Road and North Lake Road.

Crossing South Street and North Lake Road is currently not inviting for pedestrians as there is significant priority for vehicles and a high-speed environment (70kmp/h). The surrounding residential areas have five (5) pedestrian access walkways (PAWs) that provide pedestrians access along Major Road throughout the Centre. Although these PAWs improve the pedestrian connectivity, these pedestrian accessways are not inviting in nature (see images below).

Hodgson Place PAW

Sexton Court PAW

Walker Court PAW

Along North Lake Road, South Street and Gilbertson Road footpath's have been provided with adequate width and condition. However, existing bus stops along South Street and Gilbertson Road often require public transport commuters to walk across intersections and into environments that are car dominated with no pedestrian right of way, which is unsafe and not convenient for commuters.

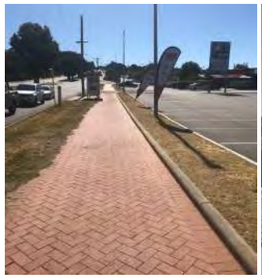
The provision of the signalised intersection at the mid-block of South Street will provide an essential improvement for pedestrian access that currently is dangerous and inconvenient for residents who live within the southern residential catchment that want to access the Centre via foot. The signalised intersection will provide a direct connection point to incentivise pedestrian access and will closely align with the existing PAW that allows pedestrians to access South Street from Davies Crescent.

The pedestrian experience is very poor in local streets with a lack of footpaths provided throughout the locality. This along with a lack of shade from street trees or building interface pacifies pedestrian movement throughout the PSP area. The pedestrian experience is proposed to be improved by the future redevelopment of the Kardinya Park Shopping Centre through improvements in pedestrian connections to existing footpaths in the area, bringing the building to the edges of the site to remove the need for pedestrians to walk through car parking areas and removal of topographical constraints through new buildings fitting into the existing topography.

There is also a new main street proposed as part of the shopping centre development between Lots 17 and 31 in the Centre Core which will provide further pedestrian connections in a north-south direction through the very centre of activity. Further improvements such as additional east-west connections from the eastern side of the Core will further enhance the pedestrian access and experience through these areas.

The local road network could be vastly improved with the provision of footpaths. Additionally, both major roads and local road network could benefit from additional shade being provided. These improvements would create pedestrian activity, access and amenity to promote walking as a form of transport and decrease the reliance on private vehicles. To achieve this, the PSP has proposed two key provisions for future infill development to be required to contribute and/or provide. The first provision pertains to footpaths. Footpaths within the local road reserves are extremely limited. The expectation is that at least one side of the road reserve is provided with a pedestrian footpath. In order for this to be achieved, and furthermore coordinated, the PSP is proposing for the applicant to provide a contribution relative to the length of the lot frontage, at half the cost determined by the City. Half the cost has been applied, to ensure that the first developers are not penalised to pay the full cost for one footpath. By requiring half the contribution shares the cost between both sides of the street. The second provision is street trees.

Requiring the developer to plant a street tree within the verge is essential to contributing to improving the overall tree canopy of the area. Applicants will be required to maintain the street tree for a period of two years to the satisfaction of the City. Both of these provisions will greatly assist in improving the pedestrian amenity of the area. Larger infrastructure contributions such as underground power, street lighting etc. could be implemented via the council adopting a special area rating. This would provide a suitable mechanism to deliver these improvements whilst engaging with the community to facilitate these upgrades.



6.4 Cycling

The surrounding road network has predominantly been designed for high volumes of cars and freight vehicles with little to no provision being made for cycling. Whilst the existing footpaths are wide enough for cycling and pedestrians to move cohesively, there is no safe opportunities for cyclists to ride without having conflict with pedestrians / vehicles. There are also multiple path deviations particularly along South Street that require cyclists to give way to cars. This is not ideal, given the volume of traffic along South Street. The Centre itself provides little opportunity for both staff and customers to cycle to the Centre with a lack of cycling infrastructure to support this mode of transport. Bicycle storage is rare with the Centre providing a lack of end of trip facilities.

The cycling and walking network plan provided as part of the Perth and Peel @ 3.5 million Transport Plan shows on-road cycling route improvements along both South Street and off-road improvements along North Lake Road. Due to both of these roads being regional roads, the implementation of these upgrades will require State and local government implementation due to the management/hierarchy of these roads. This plan is also consistent with the City of Melville's Bike Plan 2012. All other cycling paths within the PSP area are on-road with low traffic speeds generally preventing conflicts with vehicles. All new developments will be required to provide end of trip facilities and bicycle storage/parking as mandated within existing local planning policy. This will further encourage greater cycling patronage within as well as to and from the PSP area.

6.5 Vehicle Movement – Centre

The current vehicle movement within the Centre Core can be summarised as being convoluted in some instances dangerous for both vehicles and pedestrians. A summary of the current vehicle access points can be provided below:

Table 12. Vehicle Access and Egress

Street Reference	Reference	Details of Access / Egress Point	Proposed / Suggested Modifications
North Lake Road	**Access 1**	Left and right turn access point from North Lake Road. Currently is largely used by service vehicles gaining access to the one-way laneway that runs across the rear of Kardinya Park Shopping Centre. The access point is also used for access to the service station. Vehicles can access the car park of the Centre from this point.	• Proposed to remain and be utilised in a similar manner as currently seen with some slight modifications to improve its functionality. • Re-design the service station and convenience store, to improve safety for customers wanting to access / exit the Centre directly from North Lake Road. • Provide improved two-way access. • Provide a clearer segregation for services vehicles and customers.
	Access 2	Full movement access is existing. Currently a slip lane is provided along North Lake Road for vehicles turning right. Predominantly used for access to the service station.	• Proposed to be relocated further south from Access Point 1. • Proposed to be left in/left out only.
	Access 3	Left out onto North Lake Road. Predominantly utilised for customers existing out of the shopping centre and service station.	• Access to be removed. • Crossover can be rationalised with Access Point 2.
South Street	**Access 4**	Currently this access point is the key entry into the main car parking area and provides left in / left out movements. Vehicle movement from this ramp can be congested during peak periods given the run into the car park does not provide enough distance for vehicles to turn left or right once entering the Centre. This can have impacts to queuing to South Street.	• Major changes proposed to Access 4. • Access is to be moved further west along South Street to avoid banking to South Street. • A full-movement signalised intersection is proposed to be constructed at the mid-point of South Street. The intersection will not only improve movements into the Centre but will also enable improvements to pedestrians crossing South Street from the southern residential catchment.
	Access 5	The current arrangement of this access/egress point provides full movement (left in / left out & right in / right out). The right in/ out movements across multiple lanes of traffic has deemed by Main Roads as too dangerous to maintain.	• Access point will be retained. • Modified slip-lane • Improvements to pedestrian movement • Access will be made left-in / left out only. • Median island will be extended to prevent right in movements.
	Access 6	Left in / left out from South Street. Provides direct vehicle access into the Centre.	• The crossover Lot 17 from South Street has no slip lane for deceleration and has the potential to be impeded by buses stopping at the existing bus stop. Given the infrequency of use and that it is clearly visible whether the crossover is impeded whereby vehicles can readily access the main street access, no change is proposed to this crossover treatment. • It is also noted that the right turn crossover movement from Lot 17 to Gilbertson Road has the potential to impeded during peak times by queues from the Gilbertson Road / South Street lights. Given the highly functioning nature and accessibility to Brophy Street, no change is proposed to this crossover treatment.
Gilbertson Road	**Access 7**	Two way vehicle movement currently permitted. Both left and right in and out movements are permitted.	• The PSP is proposing to impose an easement in-gross within the east-west connection of 15.5m. The intent of this easement is to ensure that if the Centre undergoes redevelopment this connection remains to provide connectively to the north-south main street. • It is suggested upon any major development being proposed, that the City has the nexus to impose this easement in-gross to ensure a pedestrian footpath is provided.
	Access 8	Two way access road that provides direct connection to the 'main street' and furthermore acts as connection point to the Centre Core. Vehicle access allows direct movement both left and right movements onto Gilbertson Road.	• There are no proposed changes or suggested modifications proposed to the Brophy Street access point. The potential for future signage to be placed in this location to increase the relevance of this access leg, as currently it is underutilised as it provides essential secondary access to the Centre.

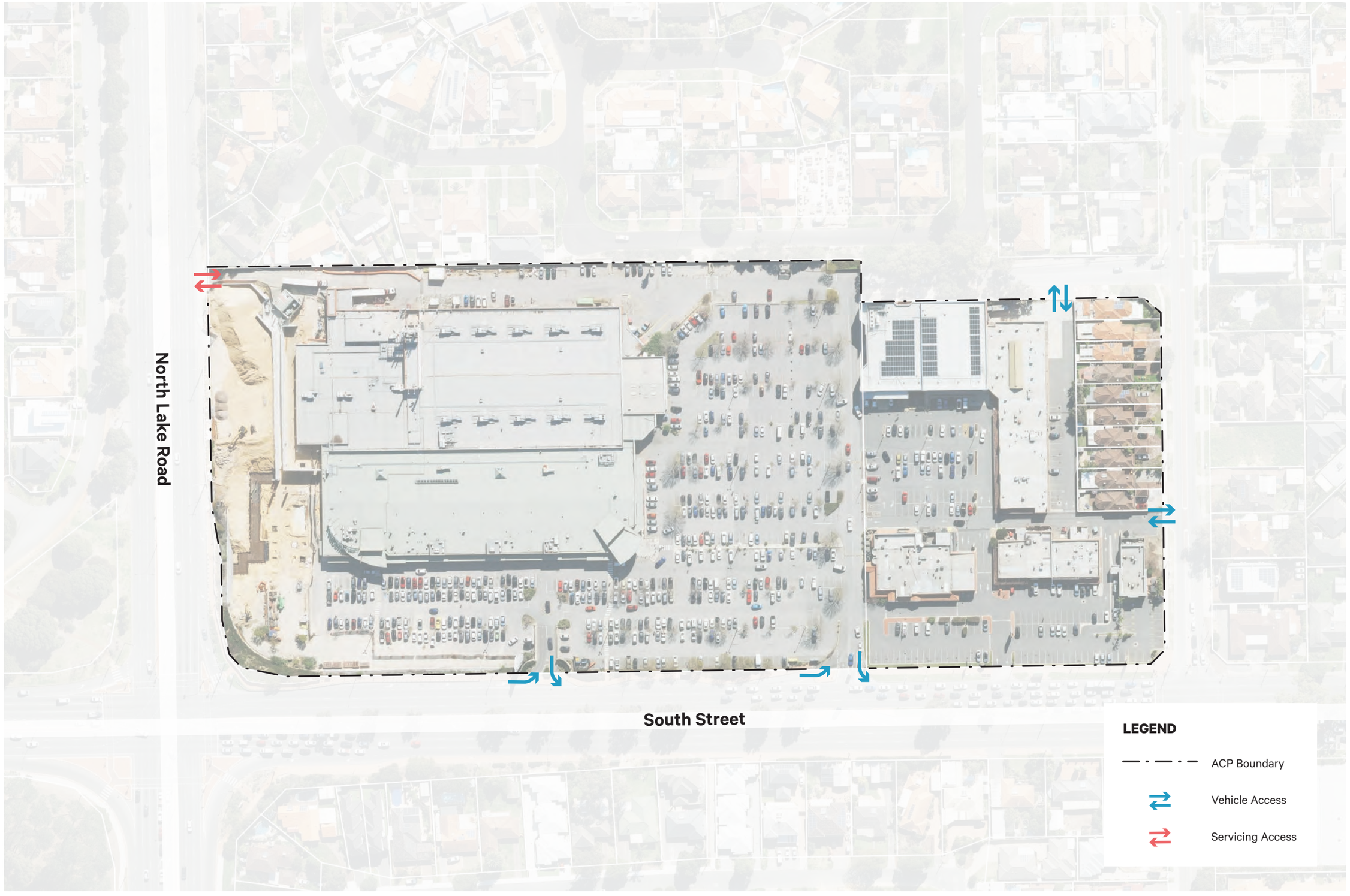


Figure 12. Existing Access Reference Map

6.6 Parking

Most of the car parking in the area is provided on private land and is therefore the responsibility of landowners and businesses. New development proposals will generally need to comply with the City's local planning policy – car parking and access with these individual developments to ensure that should a shortfall of off-street car parking be proposed there is minimal to no impact outside of the property where the development is proposed. Local road on-street car parking is currently not common/ widespread in the PSP area and therefore car parking restrictions are not in place within these streets – only on major roads to ensure the flow of traffic is maintained. Should car parking be foreshadowed as a problem for a development or a wider issue in the locality, there are a number of methods to address this issue outside of the controls of an PSP. The methods include:

- Requirement of a parking management plan with development applications/approvals to place responsibility for management and enforcement on the developments responsible for potential conflicts become a problem in the locality;
- Provision of on-street car parking restrictions to limit the time in which vehicles can be parked in the locality and areas in which cars can be parked; and
- Provision of parking within the verge areas to provide additional car parking which does not conflict with the flow of traffic. The verge widths of the local roads are approximately 5m and hence are wide enough to provide on-street car parking should the need arise in the future (1.5m footpath and 3m embayment widths).

In terms of overall car parking provision, as the need for parking intensifies and becomes more expensive in the short term, time limited managed parking throughout the locality both off-street and on-street will encourage rationalisation of car trips within as well as to and from the Centre and also encourages a greater use of walking, cycling and public transportation modes of transport. The TIA prepared by Stantec determined that an applied rate of 5.2 bays per 100sqm for the Centre would be deemed appropriate based on an applied peak period. Therefore, as suggest above, internal car parking management would be necessary through a car parking management plan to regulate parking demand within the Core area. Encouraging travel behaviour change by a Travel Smart Plan would also be necessary as reducing full time staff accessing the Centre via private vehicle puts an additional unnecessary demand on the current parking supply.

6.7 Traffic Analysis

The TIA prepared by Stantec, has prepared a detailed traffic project analysis of the signalised intersection performance based on the projected growth within the PSP. These findings have taken into consideration the referral comments provided by Main Roads Western Australia following the first advertisement period. A summary of the findings is provided within the table below:

- The majority of the intersections are currently performing at an acceptable Level of Service, except for the uncontrolled full movement South Street / Main Street intersection into Left In / Left Out intersection.
- The redevelopment of Kardinya Park Shopping Centre includes the signalisation of South Street / Shopping Centre intersection and modification of existing South Street / Main Street intersection into Left In / Left Out intersection.
- In 2033 (10 year horizon) scenario, the increase of traffic is expected to result in intersections along South Street, especially South Street / Gilbertson Road intersection to perform unsatisfactorily during the peak hours. This is likely due to the increased traffic volume from the residential development along Gilbertson Road.
- In the ultimate scenario (Scenario 3) the majority of the signalised intersections along South Street are likely to fail with Level of Service F. The poor performance of South Street / Gilbertson Road signalised intersection is likely due to the increase of residential density within the proposed ACSP, utilising Gilbertson Road as the main access.
- However, the impact of projected background traffic growth along South Street is expected to be the main factor which would result in poor intersection performances for signalised intersections along South Street within the PSP. This is demonstrated in Scenario 4 where the main intersections along South Street is still likely to perform poorly even without the proposed ACSP.

6.8 Vehicle Access for Residential Lots Abutting South Street

There a number of residential lots which currently take direct access from South Street, to the east of the Centre. Additional controls is in place for these lots to increase the ability for decision makers to preserve the primary function of South Street as a Primary Regional Road.

LPS 6 provides the City of Melville with the ability to require a Local Development Plan (LDP) to be prepared and approved for these lots, which can provide additional control over access and egress. LPS 6 states:

Prior to considering an application for development approval, or in making recommendations for subdivision of residential lots which abut the South Street road reservation, the Local Government may require the preparation and approval of a Local Development Plan to coordinate access and egress.

The purpose of a LDP for these lots is to contain provisions relating to the coordination of vehicle access, and for those provisions to result in reduced and rationalised access to South Street. Further, the amalgamation of lots or shared access in the form of laneways, reciprocal access easements, common property accessways etc are generally supported and encouraged as a means of reducing the creation of new access points and rationalising existing access points to South Street. The LDP may provide details to achieve this, for example showing garage and crossover locations, require reciprocal access, or show where lots must site development to enable multiple lots to share an access point.

The reduction and rationalisation of access points to South Street is also supported by the R-Codes and WAPC Policy No. DC 5.1 - Regional Roads (Vehicular Access).

6.9 PSP Response – Movement

The PSP aims to reinforce a hierarchy of street networks; upgrades to facilitate better prioritisation of pedestrian and cycle movements and over time devoting less space to private vehicle movements and reduce the visibility of car parking. The PSP recommends that ongoing liaison should be had between the City of Melville, Public Transport Authority, Main Roads WA and Department of Transport to implement infrastructure and related initiatives.

Table 13. Movement Implementation

Action	Response	Stakeholder
Increasing density and mixed-use development in close proximity to the Centre and corridors, will encourage walking and cycling within the Kardinya Activity Centre.	This is a medium to longer term projection and is one that requires many stakeholders to deliver. It is essential that sound, well-designed development outcomes are supported by the determining authorities, to achieve the density targets within SPP 4.2.	All
The Centre Core shall improve and implement the following infrastructure as the Core undergoes redevelopment: • Creating of two vibrant main street environments that are consistent with Liveable Neighbourhoods. • Enhance pedestrian linkages and accessibility into the Centre. • Provide adequate end-of-trip facilities consistent with the City's local planning policies. • Provide a built-form that encourages safe pedestrian movement and activity. • Implement Travel Smart Plans to aim to reduce car dependency. • Enhance vehicle access and egress both around and within the District Centre Improve way finding signage.	This is a short-medium term goal for the site. These principles have shaped the Development Application for the redevelopment of Kardinya Park Shopping Centre and have provided the foundation for the Centre to be reconnected. This PSP will greatly assist the City and determining authorities, in providing the mechanism to implement these principles when the Centre redevelops into the future.	Landholders, Local Government, WAPC
Improve the public realm by providing improved footpaths and shade trees.	This a short-medium term goal. The PSP will provide the mechanism to improve the public realm environment as infill development occurs within the PSP.	Landholders, City of Melville and WAPC
Investigate improved public transport service options which include: • Increase bus frequencies for routes 512 and 115; • Provide safer and more convenient bus shelters/stops; and • Investigate a rapid bus route along South Street.	As density increases within Kardinya, the demand for public transport will increase, as well as the reduction of private car usage. In this regard, providing for improved bus services particularly along South Street will be required to be investigated, as the area develops.	Public Transport Authority, Landholders and City of Melville
Provide full movement signalised intersection at the mid-block between the intersection of North Lake Road, South Street and Gilbertson Road.	This is a short term goal and is proposed to undertaken in conjunction with the redevelopment of Kardinya Park Shopping Centre. This intersection will provide full movement vehicle access into the Centre as well as enable pedestrians to cross safely with the lights.	Main Roads, Kardinya Park Shopping Centre Landowner
Closing the South Street right-in/right-out vehicle movement from Main Street to become left-in/left-out only.	To restrict vehicles turning across three lanes of traffic, this vehicle access island is proposed to be closed, at the request of Main Roads.	Main Roads, Kardinya Park Shopping Centre Landowner

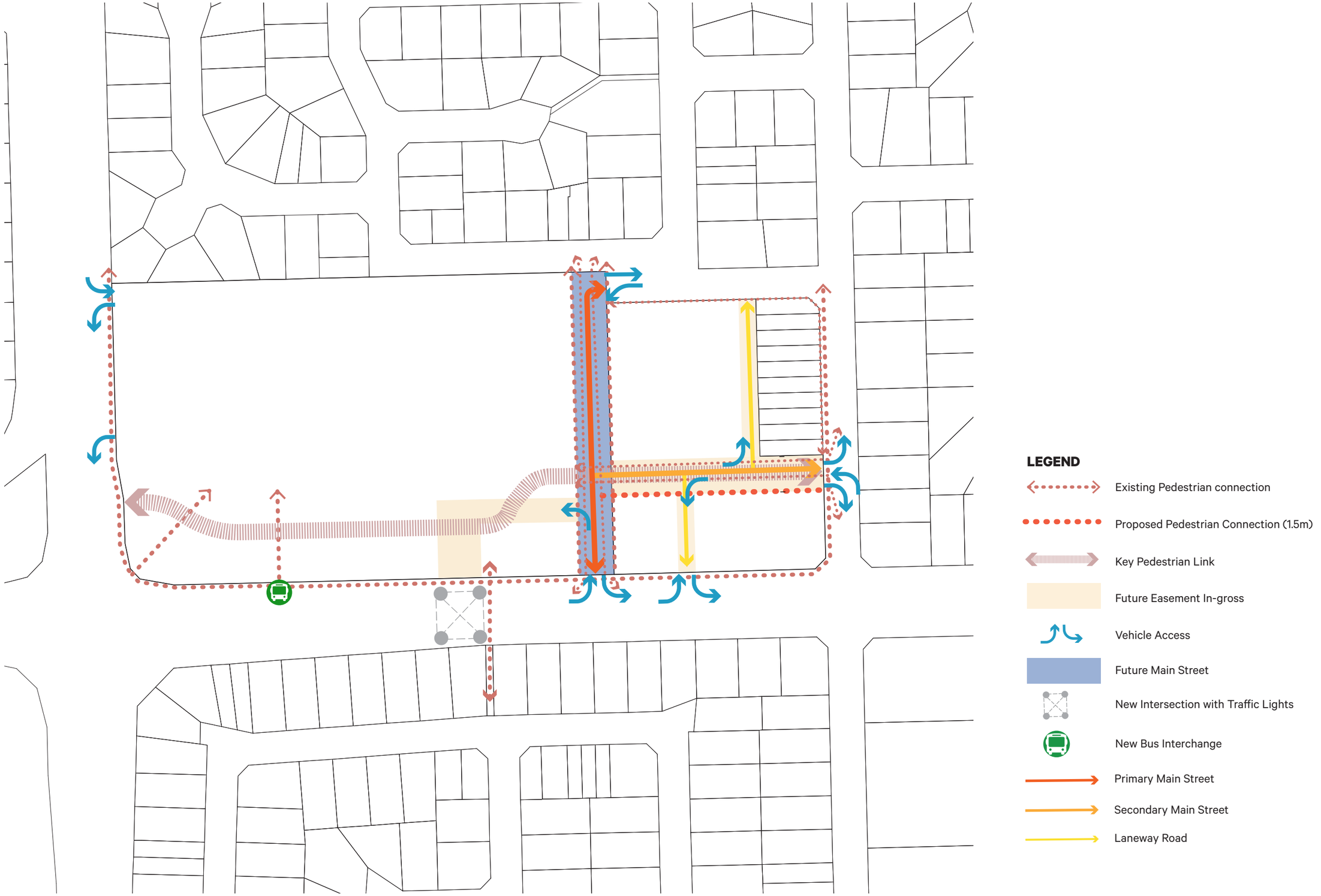


Figure 13. Proposed Access Map

7. Activity

The current performance of City of Melville Activity Centres was assessed in the Local Planning Strategy using a scoring system out of 10 as recommended within the Local Commercial and Activity Centres Strategy (LCACS 2013). This provides an understanding of the current potential for activity within centres and provides a framework to develop future expectations for Activity Centre performance. Kardinya District Activity Centre's economic sustainability performance shows the most obvious weakness is in the intensity of both low residential density and number of jobs. Kardinya has the lowest jobs per hectare of the City of Melville district centres with a score of 3.1 out of 10. In terms of residential density, it performs relatively poorly with a score of 3.0 out of 10.

As stated within the Strategy, Kardinya scored relatively poorly in the mixed-use category with 6.5, indicating that retail is the dominant employment type of the Centre. Similarly, the equitability index at 7.0 is consistent with what would be expected of a mid-sized shopping mall, with limited employment outside of retail, cafes and other food outlets. Both the Intensity and Diversity scores indicate that a greater level of residential density is required to be provided to improve the performance of the District Centre in its role with the Activity Centre hierarchy.

Kardinya's overall score for employment was 4.3. Kardinya has the lowest total amount of jobs of all the District Centres in the City of Melville with a total count of approximately 900 jobs within the Centre. Employment quality was relatively low with 12% strategic employment, equating to a score of 6.5. The shopping centre redevelopment will assist in provision of a number of additional jobs but also the diversity of the jobs provided with a range of additional non-retail uses proposed as part of the redevelopment.

By way of comparison, the Booragoon Secondary Centre has a score of 5.3, Bull Creek has a score of 5.1, Petra Street has a score of 4.8 and Melville has a score of 4.3. This indicates that the Centre is not performing well within the hierarchy with the PSP well placed to deliver improvements in these key areas through increases to residential density, diversification in employment offering and the on-flow effects to the promotion of transport infrastructure provision (see above movement section).

Table 14. Kardinya Current Performance, Source: Pracys 2013

Principle	Metric	Metric Score	Total Score
Intensity	Residential Density	3.0	**2.0**
	Jobs per Hectare	1.0	
Diversity	Mixed Use	6.5	**6.8**
	Equitability Index	7.0	
Employment	Quantum	2.0	**4.3**
	Quality	6.5	
Accessibility	Distance from CBD (kms)	4.5	**4.3**
	Transport Infrastructure	4.0	

The PSP identifies three sub-areas being the Centre Core, Mixed-Use and wider Frame. The Centre Core is intended to provide the largest supply of retail floor space, and commercial land uses that will predominantly service the daily and weekly needs of the community. The Mixed-Use Precinct along Gilbertson Road is proposed to contain smaller commercial tenancies to interface with the Centre Core and provide some level of ground floor activation. The Residential Precinct will provide a range of dwelling types. The density indicated has been aligned to the requirements of SPP 4.2 for a District Centre targeting 30 dwellings per hectare within a 400-metre catchment.

As the zoning of the Core will need to change to 'C2 – Centre Zone' under LPS6 to reflect the PSP over the area, there is a requirement to assign the land use permissibility within the PSP. A review of the City's Local Planning Scheme zone table shows many of the existing and likely future land uses as either P, D or A land uses within the Centre C3 zone and are appropriate and hence this PSP will adopt land use permissibility's of the C3 zone for the Core of the PSP.

7.1 Land Use Diversity

Kardinya is designated as a District Centre under SPP 4.2 Activity Centres hierarchy. District Centres are fourth highest in the hierarchy, playing an important role providing the daily and weekly needs of residents within the catchment. The hierarchy allocates different levels of community needs, employment growth and a diversity of goods and services to measure the importance of Activity Centres, and its role in servicing the local community. The table below summaries the District Centre performance targets in accordance with SPP 4.2.

Table 15. SPP 4.2 District Centre Targets

Area of Focus	District Centre Targets
Service Population	20,000 – 50,000 people
Walkable Catchment	400 metres
Transport connectivity and accessibility	Bus network
Typical retail development	Discount Department Stores Supermarkets Convenience goods Small scale comparison shopping Personal services Some Speciality shops
Typical office development	District level office development, local professional services
Residential density target (gross ha)	20 (minimum) 30 (ideal)
Diversity performance target – mix of land uses (centre size – shop-retail floor space component)	Above 100,000m^2 – 50% 50,000m^2 – 100,000m^2 – 40% 20,000m^2 – 50,000m^2 – 30%. 10,000m^2 – 20,000m^2 – 20% Less than 10,000m^2 – N/A

7.2 Residential Land Use Profile

Currently, the layout of Kardinya maintains a very traditional suburban layout, consisting of a box shopping centre with a small array of speciality tenancies, surrounded by low density housing. The current dwelling per hectare of Kardinya is severely underperforming, when assessed against the criteria of SPP 4.2, at approximately 9.4 dwellings per hectare within a 400m walkable catchment. The surrounding residential profile has seen slight density increases with the gazettal of LPS6 in 2016, with properties located in close proximity to South Street being rezoned to R50. However, the residential character, notwithstanding this density increase has remained as a similar dwelling typology for the majority of the surrounds of the District Centre.

There was however an exception to the dwelling profile, which can be defined by the residential catchment to the west of North Lake Road. This residential profile was extensively different to the housing profile south of South Street, and within the immediate surrounds of the District Centre. Block sizes were generally at a minimum 200m^2 larger on average, housing stock appeared to be much more modern, whether this be via renovation or demolish and rebuilds and the general road layouts and varying topography, provided an additional constraint to redevelopment potential.

In this regard this residential area west of North Lake Road was excluded from being included within the PSP. The remainder of the residential profile clustered, south of South Street and north and east of Kardinya District Centre, maintained a much greater housing profile consistency, providing the ability for the residential area to be grouped into one precinct, rather than being segregated based on built-form or historical profiles. A streetscape audit east of the District Centre has been undertaken within the Urban Form section of this report to outline how and why the PSP boundary was defined as submitted. There are distinctive housing profile changes as the distance from Kardinya District Centre expands. This is discussed further below.

7.3 Centre Land Use Profile

The existing District Centre is limited in the diversity in land uses that are provided. This limited diversity of selection and activity has been a key concern from local residents and was raised frequently during the community consultation period. Kardinya Park Shopping Centre is the clear focal point and heart of the District Centre, providing an array of anchor tenancies such as Coles and K-Mart, whilst also providing multiple smaller speciality tenancies. The redevelopment of Kardinya Park Shopping Centre is an effort to address this concern and proposes a multitude of land uses such as health and wellness and entertainment uses to appeal to a wider demographic.

Aside from ALDI the adjacent centre mostly consists of smaller office spaces, consulting rooms, retail and eateries. With the projected density growth within the next 30 years, there remains adequate retail capacity in addition to the proposed retail growth within the DA for the adjacent site to expand. Whilst it is not projected for the adjacent lot to accommodate the level of retail floor space Kardinya Park Shopping Centre generates, it is expected smaller retail and non-retail based tenancies will be provided to meet the vision of a mixed-use District Centre. This has been the key intent behind segregating the Core within the Centre. Table 19 summarises the projected retail and non-retail growth that could be accommodated following the build out of the Centre by 2030.

Table 16. Existing Land Use Diversity

PLUC Code	Planning Land Use Category (PLUC)	Centre Core Precinct Floorspace	Mixed-Use Precinct Floorspace	Residential Precinct Floorspace
PRI	Primary/Rural	0	0	0
MAN	Manufacturing/Processing/Fabrication	0	0	0
STO	Storage/Distribution	750m^2 (archival approval)	0	0
SER	Service Industry	149m^2	0	0
SHP	Shop/Retail	16,012m^2	0	200m^2
RET	Other/Retail	200m^2	0	0
OFF	Office/Business	2,988m^2	570m^3	0
HEL	Health/Welfare/Community Services	0	600m^2	0
ENT	Entertainment/Recreational/Cultural	0	0	350m^2
UTE	Utilities/Communications	0	0	0
Total		**20,099m^2**	**1,170m^2**	**550m^2**

Table 17. Potential Floorspace

Precinct	Existing Floorspace Breakdown		Projected 2030 and Beyond	
Centre Core	Retail: 15,233m^2	Non-Retail: 9,693m^2	Retail: 26,701m^2	Non Retail: 15,692m^2

Based on the retail and non-retail floorspace projections the land use breakdown far exceeds the diversity performance outlined within SPP 4.2 of 30%. 58% of the total commercial floor area will be allocated to non-retail floor space. At the current stage, the non-retail floorspace is unknown of what the make-up of this area will be. However, it is envisioned that a mixture of office and entertainment land uses occupy the District Centre as the density and residential population growth increases over the life cycle of the PSP.

7.4 Land Use Clusters

Within the PSP boundary the land use clusters have defined how the precincts are separated (Core, Mixed-Use Residential). Generally, the District Centre contains the majority of the commercial activity in the Centre Core. There are, however, some smaller commercial land uses such as a child care centre, office and shop land uses (petrol station and beauty spa) along Gilbertson Road and fronting South Street. To align the PSP to accord with this, a Mixed Use is proposed for properties that directly interface with the Centre along Gilbertson Road.

7.5 Retail

The Kardinya District Centre was developed as a suburban 'box' shopping centre but has begun the process to transform into a more diverse Activity Centre with the proposed shopping centre redevelopment. This development application was submitted with a supported Retail Sustainability Assessment to demonstrate the existing capacity to provide additional retail floorspace based on a number of factors.

The City's Local Commercial Activity Centres Strategy (2013) conversely states that the Centre does not have capacity to expand unless there are increases in catchment (through population increase) or significant attractors are provided. This LCACS was prepared and made assumptions based on a number of errors such as including existing non-retail floorspace as retail floorspace, not taking into consideration the daily influx of persons from a wider catchment from surrounding attractors (e.g. Murdoch University, Fiona Stanley Hospital and St John of God's), lack of nearby competing district centres and high accessibility from a regional road network (South Street and North Lake Road). Regardless, the redevelopment of the Kardinya Park Shopping Centre will provide additional attractors through diversification of non-retail offerings and the proposed density increases will provide a population increase to improve the catchment.

The proposed expansion of the Kardinya Park Shopping Centre will provide an anchor for additional density in this location as the level of amenity associated with the expansion will be attractive for investment outside of the Core area. Retail and commercial markets require critical mass. The co-location of a number of retail and entertainment businesses not only lifts the profile of a centre but facilitates the provision of services and amenity that contribute equally to overall amenity, attractiveness and desirability of a centre for development to occur within the residential precinct. This will provide the necessary increase in catchment area.

A Retail Sustainability Assessment has been conducted for the proposed shopping centre expansion with the following key findings of relevance:

- ***Centre Mix:*** *The Kardinya Park District Centre is currently a relatively small centre focussed on convenience food retail, homewares and specialty uses. A review of the floorspace mix compared to centre averages illustrates that the Centre has a relatively low level of floorspace across a range of categories, including food retail, food catering, apparel and homewares, and no mini- majors. The proposed development aligns with these observed gaps. While the composition of out-of-centre retail floorspace is unconfirmed, it is likely to be focussed on additional specialty floorspace that is not strongly represented in the local area.*
- ***Catchment:*** *Kardinya Park's location at the intersection of two major road routes and tenant mix that includes, for instance, the only Kmart between Booragoon and Rockingham supports an expanded catchment – particularly to the south and west where there are limited comparable centres.*

- ***Redevelopment Activity:*** *Re-zoning and state and local government focus on infill development is driving increased development activity and population growth. There are several infill precincts under development such as Kardinya Heights (300 residents), Gallery (250 residents) and the Murdoch Health and Knowledge Precinct. In addition, re-zoning of areas surrounding Kardinya Park is supporting small scale sub-divisions and unit development, with forecasts developed for the City of Melville and City of Cockburn indicating population growth of 54% in Willagee, 13% in Kardinya and 61% in Coolbellup. Furthermore, historical population growth and gentrification has seen significantly increased and changing spending patterns which is supporting retail floorspace need at Kardinya Park. Additionally, the PSP includes a residential zoning increase on 51ha of residential land that is set to be equivalent to 1,216 dwellings (net of current dwellings).*
- ***Worker and Student Population:*** *In addition to the resident catchment, Kardinya Park benefits from proximity to Murdoch University, the Murdoch Health and Knowledge Precinct and numerous service industry and industrial areas (such as Bibra Lake and O'Connor) which accommodate approximately 57,500 jobs.*
- ***Retail Spend:*** *Over the five years to 2023, annual retail expenditure generated by residents in the main trade area is forecast to increase by an average of $14 million p.a. (1.2% p.a.). With population growth forecast to increase after 2023, expenditure is forecast to increase at a rate of $26 million p.a. in the five years to 2028.*
- ***Retail Need:*** *The existing hierarchy has been established for more than four decades and there has been limited expansion of retail floorspace in the area; particularly over the past two decades. Combined with changing spending patterns (e.g. more food and entertainment spending), there is significant forecast growth in floorspace need in the trade area equating to approximately 45,000 sqm of retail floorspace. The proposed development is expected to accommodate a relatively small proportion of this forecast additional need.*
- ***Benefits:*** *The proposed development will partly address this observed retail need and will also include a range of non-shop retail uses that will help activate the Centre day and night. The improved mix and desirability of the Centre will support increased infill development, a revitalisation of the Activity Centre and complement the Murdoch University and Garden City developments. Importantly, the redevelopment will also support a range of additional ongoing employment opportunities (estimated at 785 jobs).*
- ***Retail Turnover Impact:*** *This analysis demonstrates that there will be sufficient market demand to support the proposed scale of additional PLUC 5 (shop retail) uses within the Kardinya Park Shopping Centre without having a significant impact on the sustainability of centres within the Activity Centre hierarchy. The analysis found that the impacts will be moderate and distributed across a range of centres given the proposed expansion predominantly includes retail categories that are not adequately provided by other district and lower order centres in the area.*

Source: Kardinya Activity Centre Retail Sustainability Assessment – Prepared by Urbis for Dato Holdings Pty Ltd dated January 2020.

The LCAS also states that the vision for the future of the Centre should be considered in the context of the role the Centre is playing in meeting local demand for goods and services, and the role it plays in the overall Activity Centre hierarchy. Given the factors listed above from the RSA and the increase in floor space proposed still being within the acceptable limits for a district centre, the Activity Centre will function into the future at a district level without competing with other district centres or disrupting activity levels within nearby Activity Centre of differing hierarchy.

Refer to Appendix 1 – Retail Sustainability Assessment (Urbis)

7.6 Community Infrastructure

Much of the community infrastructure for the existing PSP catchment is contained within an agglomeration of community facilities at Morris Buzacott Reserve. This includes an existing bowling club, community centre and sporting facilities (junior football and hockey facilities). It is anticipated that this will service the current and future catchment from a community infrastructure perspective. It is also noted there are multiple surrounding facilities within a 3km radius beyond the immediate PSP catchment such as Lakeside Recreational Centre, Samson Recreation Centre as well as Murdoch University proving a range of sporting and cultural facilities.

7.7 Employment

Perth and Peel @ 3.5 million central sub-regional framework has identified an overarching vision and key objectives for the economic development in relation to the future growth of the Perth and Peel regions. A key objective of the framework is to improve:

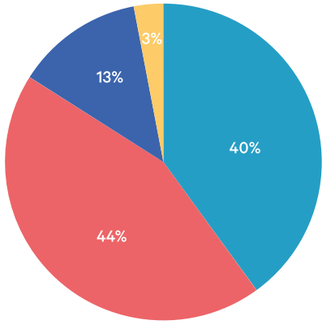
- 'access to a wider range of jobs by providing for an urban environment and dwelling options attractive to a range of workers and consumers;
- the relationship between where people live and work, and reduce commuting impacts and the associated costs; and
- the distribution of employment across Perth and Peel with a focus on the creation of strategic employment opportunities within the Activity Centres, while maximising use of existing infrastructure, that can complement and support existing regional-level facilities, which will result in the agglomeration of uses.'

The central sub-regional framework has further objectives to:

- 'encourage and facilitate growth for the purpose of delivering employment opportunities;
- create employment opportunities within the local area sub-region which utilises local labour force skills to increase employment self-sufficiency within the local government area; and
- cultivate and strengthen relationships with key stakeholders.'

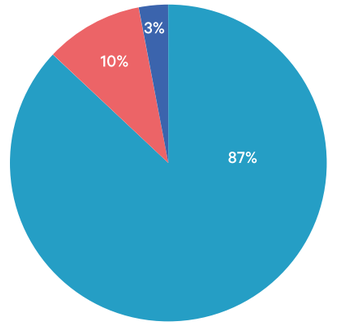
As of the 2016 census, there were 4,884 people who reported being in the labour force who live in Kardinya (suburb). Of these 53.8% were employed full time, 34.4% were employed part-time and 7.6% were unemployed which is relatively consistent with the Western Australian averages.

The most common occupations in Kardinya included Professionals 25.8%, Clerical and Administrative Workers 15.1%, Technicians and Trades Workers 13.4%, Managers 11.6%, and Sales Workers 10.4%. The number of professionals in the locality is proportionally higher than the state average of 20.5% with slightly higher family and household income than the Western Australia averages.



Family Composition – Kardinya

- Couple family without children
- Couple family with children
- One parent family
- Other family



Dwelling Typology (occupy) – Kardinya

- Separate house
- Semi-detached, row or terrace house, townhouse etc
- Flat or apartment
- Other dwelling

Source: ABS 2016

The expansion of the retail, entertainment and commercial functions within the Core of the site will provide further employment opportunities within the locality for not only Kardinya, but also the wider region. As stated within the RSA, there is projected to be an additional 745 jobs to be created as a result of the PSP implementation namely in retail and office/medical and other non-retail activity proposed within the Core Precinct of the PSP area. Implementation namely in retail and office/medical and other non-retail activity proposed within the Core Precinct of the PSP area.

7.8 Dwellings and Population

The main principle of infill development is to facilitate medium to higher densities close to areas of public transport and amenity, including retail and public open space. The PSP provides redevelopment opportunities and housing choice within the Centre Core, Mixed Use precinct and surrounding Residential Frame.

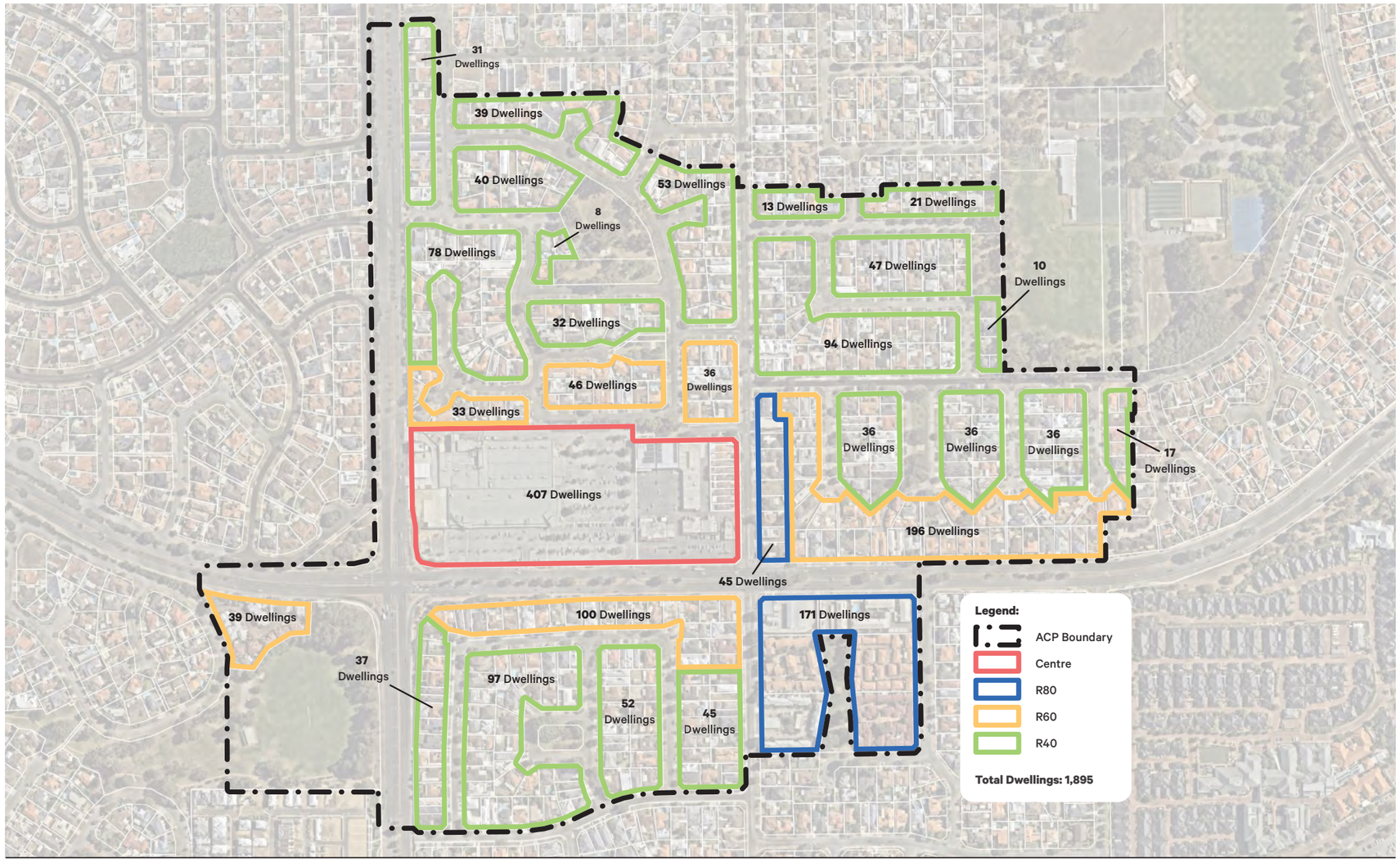
The existing suburb of Kardinya has 86.7% of all occupied dwellings being separate houses with 91% of the separate houses having 3 or 4-bedrooms according to the 2016 census data (note: 9.3% of all dwellings are not occupied). This indicates a distinct lack of diversity of housing stock. When considering the household composition is 40% couples and 13.4% one parent families, Kardinya as a suburb is in need for increased diversity of housing stock to cater

for the household mix currently present (ABS, 2016).

Densities are proposed to range from R40 up to R80 outside of the Centre Core. Within the District Centre itself a building height up to 12 storeys is contemplated guided by specific built form controls to reconnect and activate the Centre. The gross area of the Kardinya PSP is approximately 63 hectares. The area is generally based on a 400 metre radius from the centre point of the District Centre. The western residential catchment of North Lake Road has not been included in the density changes due to the difficulties in pedestrian access to the Centre as well as the relatively high quality and age of the housing stock – making redevelopment of this area unlikely. It is also noted within the MSACSP, this area is excluded from being subject to density increases.

The PSP provides for an additional 1,195 dwellings, taking the total number to 1,895 dwellings, equating to approximately 32 dwellings per gross urban hectare. The current density is approximately 10.8 dwellings per gross hectare.

Year	Projected Dwellings
2025-2030	397
2030-2035	758
2035-2040	1,137
2040-2045	1,516
2045-2050	1,895



8. Urban Form

8.1 Urban Structure, Character and Built Form

The Perth and Peel @ 3.5 Million Central Sub-Regional Framework identifies South Street as an 'Urban Corridor' as it is also a high-frequency public transit corridor, and is therefore highly suitable for increased residential density, with potential for mixed land uses along Gilbertson Road.

In recent years, the concept of urban corridors has been promoted as a way of achieving integrated land use and transport outcomes. Urban corridors provide a connection between train stations and Activity Centres and operate not just as roads for the movement of vehicles or reserves for major infrastructure but provides locations for increased and diversified places for people to live and work, where appropriate. It is important that intensifying development does not adversely impact upon the efficient operation of the local and regional transport network. Maintaining and enhancing the urban amenity is also a key objective when considering areas for intensification.

The predominant building typology in the study areas is detached single dwelling houses (86.7%). There are a number of grouped dwelling sites to the south-east of the Activity Centre area which are less likely to change over time due to land fragmentation (strata titled). Single houses in the study area are predominantly single-storey, with newer residential developments leaning towards two-storeys. Existing retail and commercial buildings are typically internalised or surrounded by car parking to the front and servicing to the rear. The building form varies; however, majority is aging and single storey in nature with poor pedestrian amenity/access to and around these buildings.

The provision of new urban form will need to seek to implement an urban edge and provide higher density housing which is appropriate for the urban corridor context (in terms of residential amenity). The Activity Centre response will seek to create controls which are in line with SPP 7.0 and SPP 4.2 in terms of intensity, function and form.

8.2 Precincts

8.2.1 Centre Core

The Centre Core is the focal point of the PSP area. The Centre Core is intended to provide the greatest intensity of commercial land uses and activity and is provided with a range of opportunities to develop into a highly vibrant and active District Centre that services a multitude of community needs.

Existing Built Form Layout and Structure

The Centre Core is the focal point of the PSP area. The Centre Core is intended to provide the greatest intensity of commercial land uses and activity and is provided with a range of opportunities to develop into a vibrant and active District Centre that services a multitude of community needs. Currently however, the Centre Core contains existing box shopping centres (both Aldi and Kardinya Park) surrounding by open air car parking areas. The Centre is also heavily separated which is largely due to the various ownership patterns. This has created a disconnect between the Centres which has largely impeded the development potential of this District Centre. The key aspects of the Centre Core which require the highest level of attention are summarised below:

- The pedestrian connection between the two sites is lacking. The Centres are both internalised and have little consideration to the public realm and pedestrian experience. This impacts the way in which the Centre is experienced and used which is mostly a car dominated environment.
- Vehicle access and egress is considered to be dangerous. The Centre is lacking in being able to safely allow customers to get into and out of the Centre particularly from South Street at peak periods.
- The existing built form provides no clear delineation of land use activity, vehicle or pedestrian movement. Both halves of the District Centre effectively are orientated away from each other as opposed to linking the built form to one another to create a uniform Centre.
- The District Centre is dominated by exposed car parking. This is continuous to all street edges, which is exacerbated by the significant fall from North Lake Road. The future built form needs to respond to this and provide adequate building interfaces that help soften this interface on the streetscape environment.
- The Centre lacks activity and passive spaces that support customers to stay within the Centre for longer periods of time. Providing various land uses that provide a level of recreation is critical to the success of the Centre which is supported by passive spaces.

Ownership and Anchor Tenancies

Kardinya District Centre contains multiple anchor tenancies. This includes Coles, Aldi and K-Mart. Within Kardinya Park there exists multiple smaller tenancies to services weekly shopping needs. Lot 31 contains a Tavern, a range of food and beverage tenancies and medical services.

Heritage, Underutilised Land & Reuse

The Centre Core contains no heritage listed buildings. The Centre Core is largely full tenanted, with little to no unused buildings and/or tenancies on-site. As mentioned, whilst the District Centre is largely occupied by buildings, the Centre Core is lacking development intensity given the site is located on an Urban Corridor and has excellent proximity to surrounding amenities. In this respect, it is considered that both lots are currently underutilising their land with the lack of development intensity, land use diversity and the extent of open air car parking which dominants the Centre. There is the potential for the Centre Core to build up rather than out and maximise the location of the Centre.

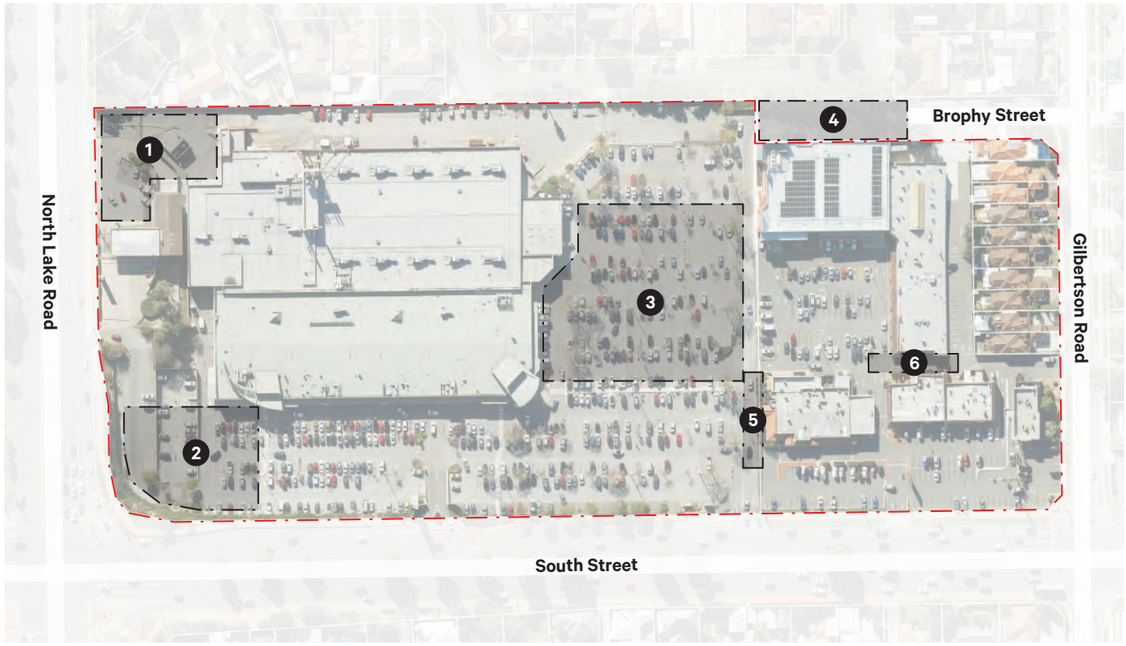


Figure 14. Existing Built Form Map

8.2.2 Mixed Use

The Mixed-Use Precinct located along Gilbertson Road was identified as an opportunity by the City, to provide increased development potential immediately adjacent to the Centre Core. This zone will provide an important transition to the development intensity of the Centre Core, whilst also help frame Gilbertson Road with some building height and potential activation for those lots which immediately abut the Centre. The Mixed-Use zone also provides the opportunity to provide a more commercially focused zone which will be more consistent with the existing land uses and development that has already occurred along Gilbertson Road.

Existing Built Form Layout and Structure

The properties proposed to be rezoned to a Mixed-Use zone currently contain various built form outcomes and housing types which results in a varied streetscape. The building height along this portion of Gilbertson Road mostly consists of single storey residential, however there is a four storey mixed use building, as well as two storey commercial office building. There are multiple sites which have been subdivided into a grouped dwelling format. The development outcomes which have occurred along Gilbertson Road are not considered to have been the most suitable development products with respect to how this development interfaces with the Centre Core. Notwithstanding this, these products have been development prior to SPP 7.0 being released.

Ownership and Anchor Tenancies

The ownership pattern for this precinct is largely independent. There are no significant land holdings held by an individual. This means that development is likely to occur on a site by site basis, however with the uplift in density there is the potential for landowners to group together to create more significant redevelopment opportunities.

Heritage, Underutilised Land & Reuse

There is no local or State registered Heritage buildings along this portion of Gilbertson Road. There is only one vacant site at No.78 Gilbertson Road. It is not viewed for this land to be underutilised, however there are obvious redevelopment opportunities that could occur once the PSP is approved to assist to frame the Centre Core with suitably scaled development.

8.2.3 Residential

The Residential Precinct has been grouped as one precinct given there is no specific additional controls required based on locational factors to facilitate appropriate development. The content of Vol. 2 of the R-Codes (SPP 7.3) requires that apartment & grouped dwelling development takes into consideration the site and wider context when designing a new development which is further supported by the 10 key design principles as contained within SPP 7.0.

The revised densities that have been nominated are in response to the community feedback received during the public advertisement period. Whilst the uplift in density is far less significant, their remains the opportunities for some redevelopment to occur, whilst at the same time does not compromise the existing amenity of the residential character. With the SPP 7.3 coming into effect, and the impending Medium Density Codes, this will largely regulate to a high standard the development outcomes that are contemplated. Notwithstanding this, some specific controls have been inserted into Part 1 to ensure every development gives back to the public realm through the contribution of street trees and pedestrian footpaths which are currently greatly lacking within the Residential Precinct. The objectives of the Residential zone are below:

- To offer a diverse range of medium density grouped and multiple dwelling housing opportunities.
- To ensure built form and building height provides for appropriate transition into surrounding existing residential areas.
- To provide a density that will support the viability and vitality of the Centre and will support public transport infrastructure and reduced car use.

Existing Built Form Layout and Structure

The wider residential area has been grouped as one precinct given there is no large change of character throughout the catchment. Whilst each residential area (north, south, east and west) has been discussed independently, it is considered appropriate to group together as one precinct. The existing built form of the residential catchment is dominated by single and grouped dwellings, often single storey products. Unfortunately, the wider catchment has seen limited quality infill developments, which is largely due to the limited density increases restricting the viability of more densely built development products.

The layout of the wider residential area is a combination of cul-de-sac subdivisions that feed out onto larger more traffic centric environments such as Gilbertson and Williamson Road. Pedestrian movement is also limited. There is a lack of pedestrian footpaths particularly within the local road network, and existing PAW's which provide pedestrian access to North Lake Road and South Street lack passive surveillance and activation.

Whilst the layout and structure of the residential area is largely already defined, by providing an increase in residential density and improvements to the public realm will enhance how pedestrians traverse throughout the wider residential catchment.

Heritage, Underutilised Land & Reuse

There are no State or local heritage listed buildings within the residential catchment that require special consideration within the PSP. The surrounding residential catchment would necessitate being considered as underutilised. Whilst it is noted the residential density needs to increase, the surrounding residential land is deemed to provide an optimal use of the existing land supply surrounding the Centre.

8.3 Defining the PSP Boundary

A high level of investigation and analysis has been undertaken to best define the PSP boundary. Whilst SPP 4.2 prescribes a 400m walkable catchment from a District Centre to achieve 30 dwellings per hectare, it was determined that this did not necessarily create the most appropriate streetscapes and building interfaces.

It has also been recognised following input from the City, their desires to increase densities along transit corridors such as South Street and North Lake Road. The current LPS identifies lots fronting South Street and North Lake Road as 'high density residential'. Whilst the LPS does not specifically define the City's expectation of density along the transit corridor it is anticipated a density between R40 – R80 would be appropriate in ensuring that any future up-coding the City undertakes, will align with what is envisioned under this PSP and SPP 7.3 for a 'high density residential' street noting that the height of 4 storeys is considered more acceptable due to the need to transition height down to single residential. This will prevent the need for any future amendments and ensure a consistent approach between the two investigation processes.

A further consideration of defining the PSP boundary was understanding where the boundary finished. Following the resolution by the WAPC it was determined that amendments were required to extend further east along Williamson Road and not include any residential properties west of North Lake Road.

A detailed analysis was undertaken to limit the impacts of density on properties located outside of the PSP boundary. The analysis prepared below was conducted on the northern, eastern, southern and western residential areas to ascertain how to best define the PSP boundary and transition building height to properties on the periphery. Whilst a key emphasis was placed on ensuring the PSP boundary was guided by the 400 metre walkable catchment, this didn't always provide the best outcome and future interface. In this regard, a detailed site analysis and street audit was conducted to assess, where required, where the PSP boundary should conclude. This analysis looked at site features such as roads, POS and existing PAW's that would assist in buffering and transitional density.

The summary below explores the key characteristics of the following street environments and their level of appropriateness to buffer the transitional density.

8.3.1 Eastern Residential Catchment

The eastern residential catchment includes Burney Court, Hodgson Place, Walker Court and Sexton Court immediately east of the Centre, and Ochiltree Way to the north-east.

- The primary intent of concluding the eastern residential catchment along Sexton Court, was to capture properties which fronted South Street. This will enable suitable provisions to be inserted into the PSP and implemented via Scheme Amendment 15 to encourage alternative access arrangement as opposed to South Street being these properties only way of obtaining access and egress. This has significant implications to the flow of traffic along South Street and potential safety risks for vehicles turning directly off and into South Street. This was a key consideration by the WAPC and Main Roads Western Australia.
- Properties which directly front South Street have been allocated a residential density of R60, consistent with the City's Local Planning Strategy. An R60 density code will provide medium density housing opportunities whilst be appropriate to lower coded properties. The intent will also encourage redevelopment to improve vehicle access arrangements from South Street. Without this uplift, the existing situation is likely to remain.
- It is also important to note that more intensive forms of development are also encouraged near PAW's. This will assist in providing passive surveillance and help improve the usability of these pedestrian access points overtime.
- The housing stock throughout this section of Kardinya is mixed. There have already been properties which have been subdivided at the current density code. A slight increase is proposed from R20 to R40 for properties which are located away from South Street. This will provide increased flexibility in lot yield, but at the same time does not comprise existing suburban amenity.

Figure 15. Eastern Catchment Map

8.3.2 Northern Residential Catchment

The northern residential catchment is bound by Piercy Court and Dalston Crescent. The following analysis is provided below:

- The northern residential catchment is viewed as the most accessible catchment to the Centre based on the street layout and connectivity to the District Centre. Therefore, there remains opportunities for redevelopment and development intensity to occur.
- The housing type in this location is also the most likely to see redevelopment in the short term given its age. This has already started to occur with multiple subdivisions taking place.
- This area is greatly lacking pedestrian footpaths and streetscape amenity. This largely due to the cul-de-sac nature of the subdivision.
- At an R40 density code, there remains the opportunity to create redevelopment opportunities, however, maintains the suburban characteristics.
- To maintain consistent streetscapes, the R40 density has been stopped mid-block, to preserve the traditional streetscape along Loris Way. The R40 area is proposed to further extend along North Lake Road with the PSP boundary using Piercy Court to separate the R40 density from the adjacent R25 zoned lots.
- Some lots with an R60 density code will provide medium density housing opportunities.

Figure 16. Northern Catchment Map

8.3.3 Western Residential Catchment

The western residential catchment includes one lot located on Gillet Drive fronting South Street. The following analysis is provided below:

- This lot was included within the western residential catchment given the strategic development opportunity it presented. The lot is situated on South Street, and is also directly abutting a significant portion of POS. An R60 density code is also more consistent with the current residential yield on the subject site.
- The remaining western residential catchment has been excluded from the PSP.
- The primary reason for this exclusion is that this catchment of housing is unlikely to provide any infill development at this current point in time. This subdivision occurred after the northern, eastern and southern residential catchments. Therefore, the age profile of the homes is different to what is seen in the other surrounding catchments.
- The western catchment also has redevelopment constraints. The undulating nature of the land means that any infill development would need to account for significant site works. This can have negative implications to the development outcomes that occur.
- This catchment has also seen more substantial investment into the homes with larger lot sizes being retained, and contemporary housing occurring without the need for an increase in the density codes to promote new development.
- The catchment is also segregated from Kardinya as a District Centre by North Lake Road with only one safe crossing point. The southern catchment is similar, however, given its direct interface with Kardinya, there are greater crossing points with access to Gilbertson Road, the proposed new traffic lights, as well as the existing crossing point on the corner of North Lake Road and South Street.

Figure 17. Western Catchment Map

8.3.4 Southern Residential Catchment

The southern residential catchment is bound by North Lake Road, Bellairs Road and Pinewood Avenue. The following analysis is provided:

- The southern residential catchment maintained a similar approach to density as the eastern residential catchment.
- Consistent with the City's Local Planning Strategy, a density of R60 was selected to provide a medium rise environment to South Street.
- The large land parcels bound by South Street, Gilbertson Road and Pinewood Avenue will remain unchanged with an applied density code of R80.
- Lots which are set-in from South Street are proposed to have a density code of R40. Similar to the other catchments infill development is already starting to occur under the current density code. An R40 density code will provide added development flexibility which will potentially incentivise front loaded grouped dwelling type outcomes as opposed to rear battle-axe subdivision.
- The boundary for the southern residential catchment was easily defined given the clear road structure which has enabled roads to help separate infill development outcomes from remaining lower density coded lots.

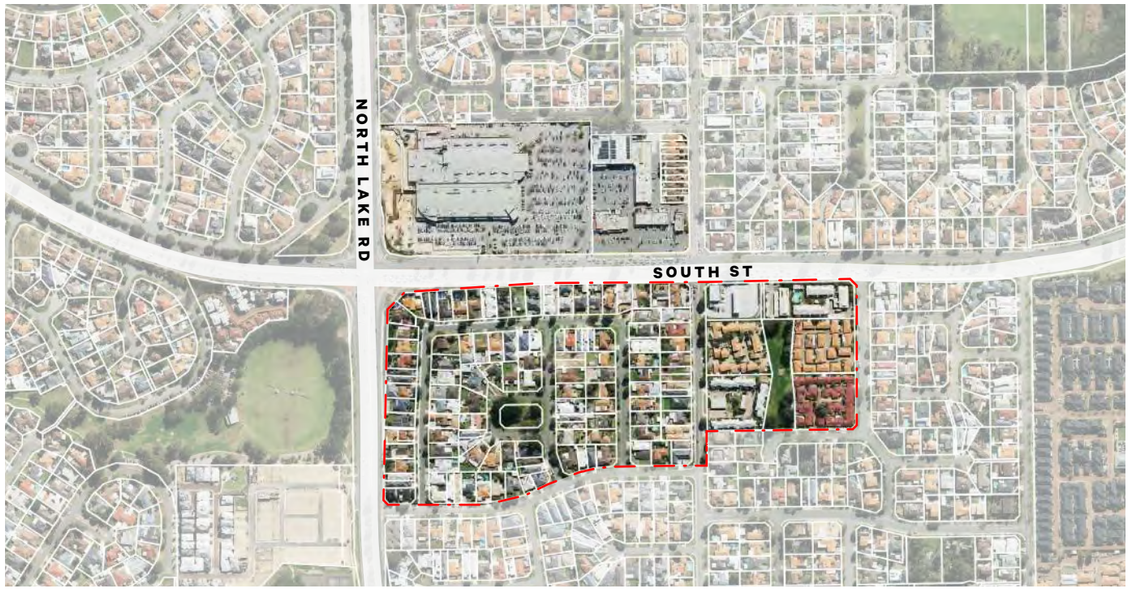


Figure 18. Southern Catchment Map

8.4 Residential Frame & Mixed-Use Precinct Development Controls

To demonstrate the difference in controls between the current and proposed density codes the following tables have been provided below. It is noted that SPP 7.3, Vol.2 is only applicable for development occurring within R40 and above.

Table 18. SPP 7.3 (Vol.2) Primary Controls (Multiple Dwellings)

Density Code	Minimum Primary Setback Control	Building Height (storeys)	Plot Ratio
R40	4m	2	0.6
R60	2m	3	0.8
R80	2m	4	1.0

Table 19. R-Codes Volume 1 Primary Controls (Grouped Dwellings)

Density Code	Minimum Primary Setback Control	Building Height (storeys)	Minimum & Average Lot Size
R40	4m	2	Minimum Lot Size: 180m^2 Average Lot Size: 220m^2
R60	2m	2	Minimum Lot Size: 120m^2 Average Lot Size:150m^2
R80	1m	2	Minimum Lot Size: 100m^2 Average Lot Size:120m^2

R40 Example Source MGP Property

R60 Example Parcel Property

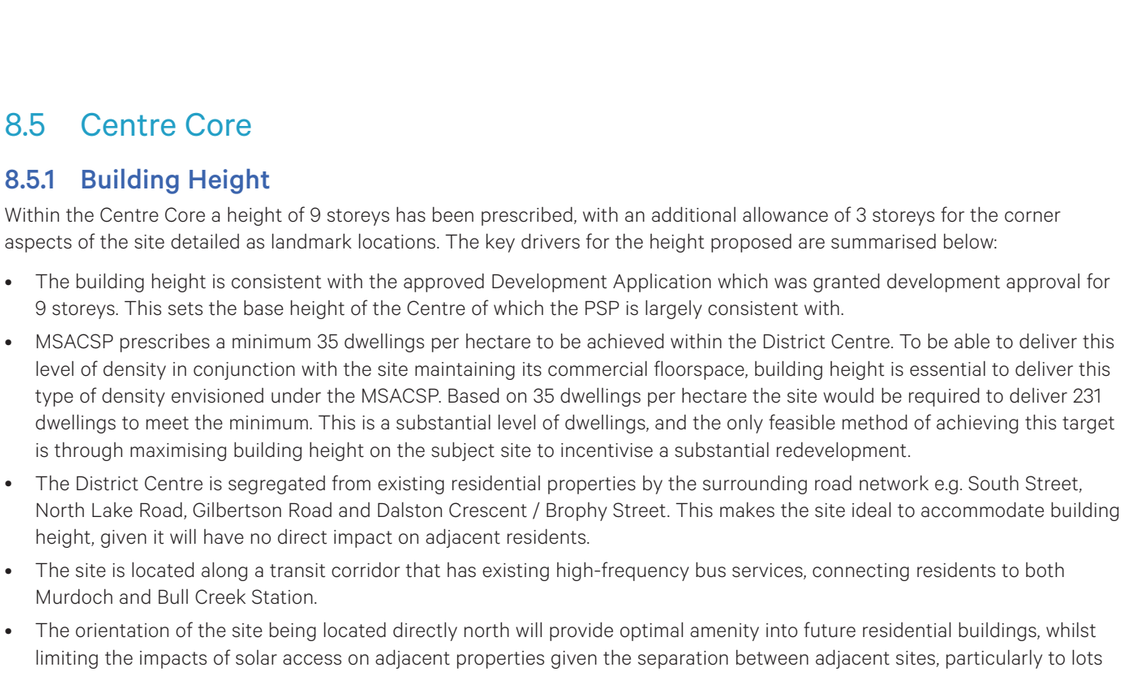
R80 Example Source Baltinas

8.5 Centre Core

8.5.1 Building Height

Within the Centre Core a height of 9 storeys has been prescribed, with an additional allowance of 3 storeys for the corner aspects of the site detailed as landmark locations. The key drivers for the height proposed are summarised below:

- The building height is consistent with the approved Development Application which was granted development approval for 9 storeys. This sets the base height of the Centre of which the PSP is largely consistent with.
- MSACSP prescribes a minimum 35 dwellings per hectare to be achieved within the District Centre. To be able to deliver this level of density in conjunction with the site maintaining its commercial floorspace, building height is essential to deliver this type of density envisioned under the MSACSP. Based on 35 dwellings per hectare the site would be required to deliver 231 dwellings to meet the minimum. This is a substantial level of dwellings, and the only feasible method of achieving this target is through maximising building height on the subject site to incentivise a substantial redevelopment.
- The District Centre is segregated from existing residential properties by the surrounding road network e.g. South Street, North Lake Road, Gilbertson Road and Dalston Crescent / Brophy Street. This makes the site ideal to accommodate building height, given it will have no direct impact on adjacent residents.
- The site is located along a transit corridor that has existing high-frequency bus services, connecting residents to both Murdoch and Bull Creek Station.
- The orientation of the site being located directly north will provide optimal amenity into future residential buildings, whilst limiting the impacts of solar access on adjacent properties given the separation between adjacent sites, particularly to lots South of the Centre.
- Allowing for an additional 3 storeys on the corner elements of the site, will highlight the entry to the District Centre, and help enhance the architectural features to the public realm.
- The site is strategically located in close proximity to large employment nodes such as Fiona Stanley Hospital and Murdoch University of which there is currently an undersupply of higher density units within the immediate vicinity of the area.



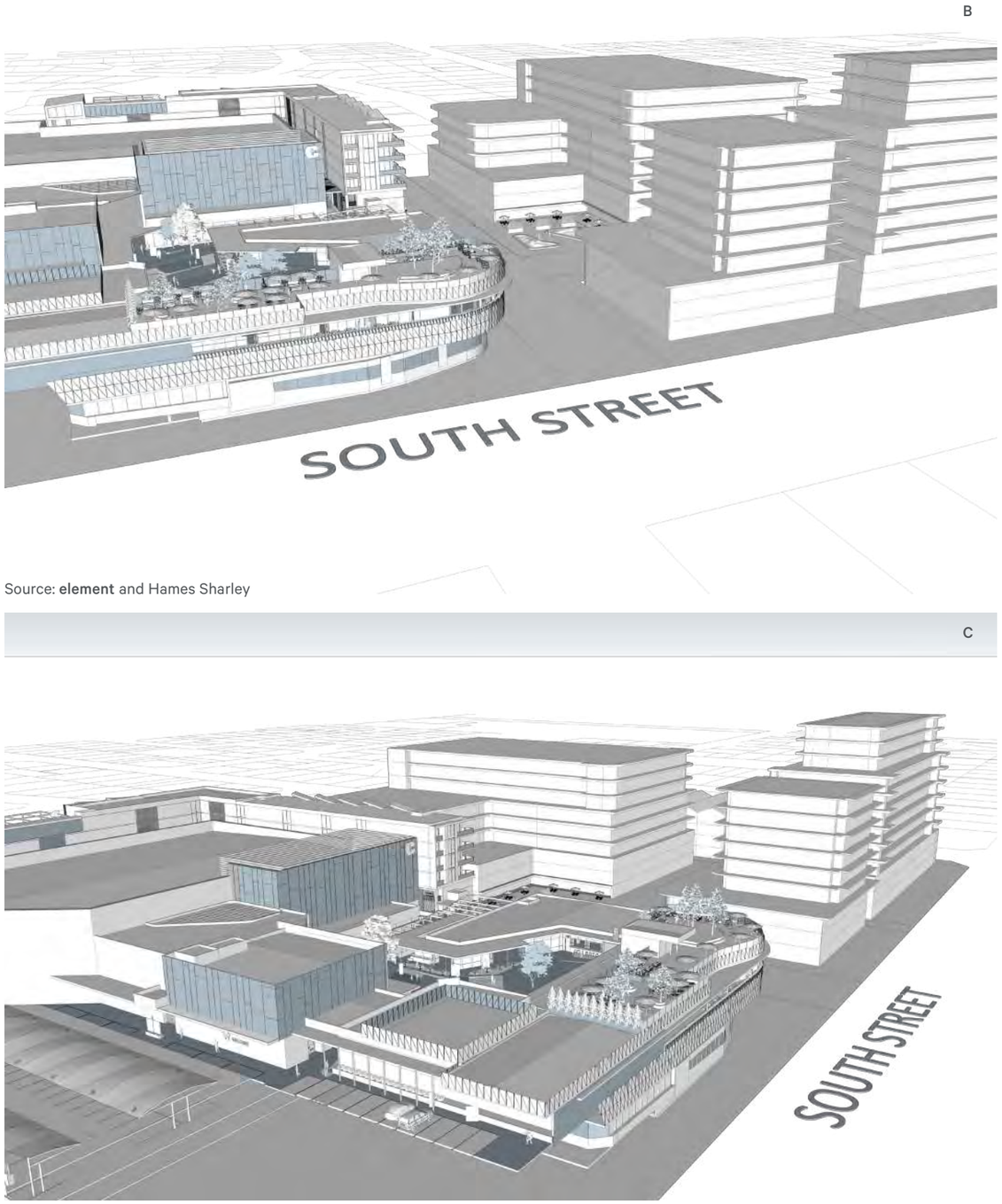


Figure 19. Concept Massing A, B, C. Source: **element** and Hames Sharley

Source: **element** and Hames Sharley

8.5.2 Street Interface & Site Specific Controls

The street interface and site specific controls are targeted towards Lot 31 rather than Lot 17 (Kardinya Park). This is largely due to the fact the owners have substantially commenced a significant redevelopment of the Centre. Given that this outcome is largely fixed for the foreseeable future, the Part 1 controls are specific to promoting redevelopment of the adjacent site. A detailed summary and overview of the site specific controls is provided below:

- A critical focus of the controls is ensuring that any subsequent redevelopment that occurs does not compromise the principles that were presented within the Development Application. The premise of this was to concentrate development along and within the two site connection points which run in a north-south and east-west direction.
- It is considered that there are significant development opportunities along these connection points to provide a main street atmosphere and importantly reconnect the two sites to become one District Centre. To achieve this, appropriate road widths should be provided in accordance with Liveable Neighbourhoods to create well considered streetscape environments that are supported by pedestrian footpaths, street trees and on-street parking to contribute to this vibrancy.
- The east-west connection should be protected by an easement in gross to ensure the City and public have unrestricted access.
- The remaining connections are for laneway access. This is to be provide existing/future residential access to future development as well maintain service connections to the existing/proposed developments.
- The public space area is proposed to provide a passive recreation space for customers and potential residents. Given the sites direct north-south orientation it is important that natural light is capable of entering this space during winter periods.
- To enhance the main street connections, all podiums aspects which orientate onto both main streets must provide activation.
- The landmark height is proposed to provide addition incentive to create a built form that is articulated and enhances the corner aspect of the site should redevelop occur. These upper floors are required to be setback to assist in mitigating building bulk whilst providing an appealing corner aspect that addresses the street.
- The controls set out within Part 1, prescribe no plot ratio for the Centre Core. The intent behind this, is to allow for flexible redevelopment opportunities that are not confined to a broad plot ratio control. In this regard, the layout of development on Lot 31 will be restricted to two halves, as the access will be required to be retained. This automatically defines the footprint of the site, along with the northern portion of Lot 31, also being required to retain the north-south internal road connection. Development in this area will be capped at a height of 9 storeys.

Source: **element** and Hames Sharley

A summary of the frontage types which will help guide the design response is summarised below:

- **Active Frontage:** This frontage is for highly projected pedestrian environments where a high level of activation and clear visual engagement with the street is required. Built form in these locations shall be developed with nil setbacks, optimal ground floor engagement and centre piece podiums.
- **Passive Frontage:** This frontage type is proposed for areas which are highly visible but do not necessarily accommodate highly active functions. High quality design features are to be provided in facade elements in these locations. Built form in these locations shall be developed with maximum articulation, reduction in building mass directly abutting the street, and high use of awnings to accommodate the pedestrian environment.
- **Landscaped Frontages:** This frontage type is intended to attractively buffer and screen building facades that are restricted in providing a high quality interface such as a servicing areas. It is intended the landscape frontage will provide a combination of screening techniques, both hard and soft features to create interesting and attractive facades that are otherwise left untreated and create an unsightly environment.

Active Frontage


Passive Frontage


Landscaped Frontage

8.5.3 Environmental and Amenity Impacts

The PSP will be reliant on the City's Planning Scheme to guide incompatible land uses within both the Centre Core, Mixed-Use and Residential Precincts. The land use permissibility will remain unchanged for all three precincts, and therefore there will be no subsequent environmental or amenity impacts. In this respect the PSP is not required to develop controls to preserve amenity and land use incompatibility.

8.5.4 Public Spaces – Residential Precinct

Kardinya is well serviced by POS. The adjustment to the PSP boundary has meant that some of the previously included POS is now not explicitly included within the PSP boundary. Notwithstanding this, many of these POS areas are immediately adjacent or in close proximity to the PSP boundary. A summary is provided below:

Within the PSP Boundary

- Laurie Withers Reserve (11,646m^2) – Located within the northern residential catchment. Small residential reserve with a playground and seating areas. It is well vegetated with mature trees and surrounded entirely by residential properties.
- Hodgson Place Park (2,200m^2) – Located in the eastern residential catchment. Small park with used for dog walking, children's playground and seating areas. It is well vegetated with mature trees surrounded by residential properties.
- Harry Patterson Park (4,877m^2) – pocket park, with communal family facilities and playgrounds.
- Jack O'Keefe Reserve (1,581m^2) – pocket park with mature vegetation, located within the southern residential catchment.
- Morris Buzacott Reserve (2,768m^2) – Small portion of this reserve included within the PSP boundary. This POS leads into a much more significant sporting oval located within the eastern boundary of the PSP area. Large sporting oval, with communal family gathering facilities.

Immediately surrounding the PSP

- Morris Buzacott Reserve (148,000m^2) – Significant sporting oval located directly east of the PSP boundary area. This POS is provided with playground equipment, toilets, AFL oval, public seating and venue hire facilities.
- Alan Edwards Reserve (50,000m^2) – Located on the southwest corner of North Lake Road and South Street. Reserve contains a large sporting orientated park which caters for AFL and cricket to the eastern side inclusive of pavilion for sporting clubs. There is also more vegetated open space for light exercise and dog walking provided to the western side of the park along with a playground and seating area. There is a significant level difference to the south of the open space with the open space sitting substantially lower than the properties to the south.

The PSP is well serviced with POS to support additional infill. Whilst the revised PSP area has been reduced in the amount of POS, the PSP boundary is not a barrier to current/future residents being able to have access to these POS spaces.

8.5.5 Public Spaces – Centre Core

Whilst traditional POS remains highly important for the growth of a community, the District Centre has limited to no public community spaces that combine landscape, recreation and entertainment into one space. Currently, the District Centre is largely defined by attracting shoppers to undertake their weekly shop and leave without having any sense of engagement or activity. Whilst this may appeal to some of the demographic of Kardinya, there remains a large percentage of existing residents who are seeking more activity and vibrancy, rather than needing to travel to other centres. To deliver this, well-designed public spaces will be vital to the success of the District Centre moving forward, as the population increases, and the demographic changes. The current DA for the Kardinya Park will deliver active public spaces in the food and beverage areas for social interaction and community gatherings.

The PSP will help facilitate the creation of numerous public spaces to improve customer experience and greatly improve the level of recreation and entertainment opportunity to contribute to the sense of place of the District Centre. These public spaces will require a high level of detailing to facilitate activity and develop a sense of place. Design elements such as landscaping, public seating and artwork that can be used in conjunction with active land uses. A summary of these potential public space areas are summarised below:

- The north-south connection is an essential vehicle and pedestrian connection for both Lot 31 and Lot 17 as well as providing accessibility for residents to the north of the Centre from Dalston Crescent and beyond. The right-of-way, whilst is under the ownership of Lot 17, provides reciprocal access right to Lot 31. This connection is the most strategically positioned aspect of the site which is the primary reason as to why this access road is proposed to become a 'future main street'. The objective

for this space is to create a pedestrian centric environment that seeks to reconnect both Lot 31 with Lot 17. The built-form should have active ground floor frontages, weather awnings, street trees and the ability to on-street park. The main street will be supported by a direct connection to larger anchor tenancies, whilst providing a separate shopping, food, beverage and entertainment environment. Hames Sharley have provided some visioning images to demonstrate the potential future interface between the two sites.

Source: **element** and Hames Sharley

- The east-west connection currently provides secondary horizonal road access to link mostly cars from Gilbertson Road into the site. This internal road is currently dominated by private vehicle usage, with very limited pedestrian opportunity given the lack of footpaths, canopy and being generally dominated by private vehicle usage. Whilst the current usage is an undesirable characteristic of the District Centre, there is a large opportunity to further link the two sites, given the proximity this entry has to the intersection of Gilbertson Road and South Street. This will provide the opportunity particularly for those residents who live south of South Street, to cross with the traffic lights and walk to this connection. This will remove the need for residents to walk along South Street, which is a highly exposed road network, and is considered an undesirable pedestrian environment. In addition to this, there is also a large catchment of residents who live east of the Centre, that will provide a direct and linear pedestrian route to the north-south main street. A circular bus route between Murdoch and Bull Creek train station also stops directly outside of this access point. This further reinforces this corridor as a future linkage opportunity. The future redevelopment of Kardinya Park has also recognised this opportunity and has directly located the stair-case that connects Lot 17 and Lot 31 to the entertainment and leisure precinct to the align with the site corridor of pedestrians approaching from Gilbertson Road.
- The existing centre is positioned towards the rear of the site and provides little to no interface with the wider public realm. The South Street corner is underwhelming upon approach, with exposed car parking dominating the interface. To address this, there is a key opportunity for the site to emphasis the street corners, particularly where the proposed main street is located to provide that sense of arrival and activity. A key opportunity exists to provide clear signage and active land uses on this street corner that are directly accessible from the main street via the centrally located stairs to signify the entry into the Centre.
- This public space is aimed to include community benefit land uses, food and beverage, causal alfresco seating and landscaped areas accessible to the public. This space, is ideally positioned to contribute to the activity of Kardinya Park Shopping Centre and will also improve the activity and vibrancy to the periphery of Lot 31, further contributing to enhancing the connection between these two sites. Hames Sharley have provided some indicative imagery as seen with the Development Application, of what is intended of the South Street main street corner.

Source: **element** and Hames Sharley

- The current building interface along the east-west corridor connection is extremely limited in activity and surveillance. Large portions of exposed car parking are on display upon approach which creates an unsightly pedestrian environment. Whilst car parking is essential to the current operation of the Centre, as the density increases and the Centre evolves it is envisioned that the demand for car parking bays will eventually reduce, and furthermore, can be designed in a more effective manner to be sleeved by building facades. To contribute to the main street activity, it is envisioned that whilst there should active uses to the ground floor to complete the main street, there may be an opportunity for the area behind to be used as an active public space. This space may include space for a pocket park, informal dining seating or a flexible space for customers, employees or market stalls. It is envisioned that this space will provide a key opportunity to be used in conjunction with the existing Tavern and the proposed food, beverage and entertainment precinct, whilst contributing to the vibrancy of the main street.

8.6 Landscaping

The PSP is proposing to improve the public realm of both the wider residential catchment as well as improve connections within the District Centre. Landscaping plays a significant role in providing shade, habitat for fauna, reducing the heat island effect and providing general amenity within the Centre. In this regard the PSP promotes the retention, replacement or offset of trees on development sites where achievable.

The landscaping pallet of the District Centre has been defined by the approved Development Application which provides the foundation for a north-south Main Street connection and an east-west connection through to Gilberton Road.

Plan E has provided an indicative landscaping strategy of how the Centre could reconnect via upgrading the road treatment, providing street trees and enhancing pedestrian connections.

The broader residential area has also been investigated. As noted, the public realm environment is generally poor, with a lack of pedestrian footpaths and shade trees. Part 1 of the PSP proposes two key provisions to enhance this environment through developers contributing to a footpath and secondly providing a street tree when each lot is redeveloped. Three streets were nominated as performing particularly poorly, Bersica Court, Davis Crescent and Hutchings Way. The cross-sections provided demonstrate how these streets would be transformed via the provision of a footpath and trees being placed within the verge. Plan E has provided some indicative cross-sections based on the current road width.

LEGEND

01 THE PAVING PATTERN IS AN OVERSIZED ABSTRACT VERSION OF THE PATTERENED CONCRETE WITHIN THE ELP & PEDESTRIAN SPINE IN THE SHOPPING CENTRE

02 RAISED INTERSECTION SIGNIFIES A CHANGE IN TRAFFIC SPEED & ENHANCES THE PEDESTRIAN CONNECTIVITY TO KARDINYA PARK

03 RETAINED STREET TREES WITH RAIN GARDENS PROVIDE AN INSTANT ESTABLISHED FEEL

04 NEW STREET TREE PLANTING ENHANCES THE STREET AND MITIGATES THE HEAT ISLAND EFFECT

05 NEW POCKET PARK

06 SLOPED TURF BREAKOUT SPACE FOR EXPLORATORY PLAY AND INFORMAL SEATING

07 RAISED PLANTERS PROVIDE INFORMAL SEATING OPPORTUNITIES AND ADDITIONAL TREE PLANTING TO CREATE A COMFORTABLE MICRO CLIMATE

08 NEW PEDESTRIAN CROSSING

09 BICYCLE PARKING TO MEET COUNCIL RECOMMENDATIONS

10 FEATURE SHADE STRUCTURE WITH CREEPER PLANTING AND RAISED PLANTERS UNDERNEATH THEM THAT PROVIDE SEATING OPPORTUNITIES

Figure 20. Landscaping Strategy for Activity Centre. Source: Plan E

SECTION A-A
BERSICA COURT

SECTION A-A

VERGE	ROAD	VERGE	FP.
5 M	7,5 M	3,5 M	1,5 M

TOTAL ROAD RESERVATION WIDTH
17,5 M

SECTION B-B
DAVIES CRESCENT

SECTION B-B

VERGE	ROAD	VERGE	FP.
5,3 M	7,5 M	3,8 M	1,5 M

TOTAL ROAD RESERVATION WIDTH
18,1 M

SECTION C-C
HUTCHINGS WAY

SECTION C-C

VERGE	ROAD	VERGE	FP.
5 M	7,5 M	4 M	1,5 M

TOTAL ROAD RESERVATION WIDTH
18 M

Figure 21. Landscaping Street Sections. Source: Plan E

8.7 Key Nodes, Landmarks and View Corridors

The PSP area has some opportunities for new developments to capitalise on views to the City to the north and to the escarpment to the east due to the undulating topography from the south-west down to the northern parts of the PSP area. There are also changes to the topography through the site which will require detailed site analysis when designing new multiple dwelling developments to ensure that views of significance are maintained for future developments and also to ensure that landmarks can be created to assist with wayfinding through the Activity Centre.

Volume 2 of the R-Codes now includes provisions around site analysis and design response to require developments to response to the physical elements of the site and desired local character of the locality. This will help identify the key nodes, opportunities for landmarks to be created and developed upon as well and ensuring any view corridors are maintained where possible.

Figure 22. Landmark figure

8.8 PSP Response – Urban Form

- Protect and enhance the main street connections (north-south and east-west) given their value to the District Centre becoming reconnected. To ensure that adequate infrastructure can be accounted for within these road reservations, additional road width has been proposed to accordance with Liveable Neighbourhoods to allow for pedestrian footpaths, landscaping and on-street parking.
- Ensure that any future redevelopment of the District Centre appropriately addresses the internal connections, wider public domain and surrounding development through suitable façade treatments and setback controls.
- Ensure quality design that incorporates, celebrates and responds sensitively to the existing residential character and fabric within the suburb with appropriate transitions in building height and bulk and scale.
- Make provision for public spaces that provide passive recreational activities for customers and surrounding residents.
- Provide a human scale within the pedestrian environment and improve the overall pedestrian environment with upgraded streetscapes, greater weather protection and increased levels of activity (perceived or actual) for passive surveillance.
- Ensure built form responds to existing important vistas and vantage points (sight lines/ views) where available.
- Ensure new buildings reflect and respond to the natural local variation in topography and landform.
- Facilitate iconic development to create visual cues that assist with wayfinding and the formation of memorable elements within the Activity Centre.
- Promote improved streetscapes throughout the Residential Precinct by mandating the provision of street trees and footpaths to improve the pedestrian experience.
- Provide opportunities for a multitude for housing types and land uses to occupy the Centre as well as surrounding precincts within the Activity Centre.

9. Resource Conservation

Developments within the Kardinya Activity Centre will increase the viability and efficiency of existing infrastructure within the locality. Accordingly, the PSP will implement an aspect of sustainable development through more efficient use of urban land and resources by intensifying and consolidating land uses, including housing, which are located adjacent to public transport, employment, retail and commercial activity. The PSP will encourage active modes of transport which assist in reducing the dependence on private vehicles (and the associated emissions) and overall energy consumption within the locality in its implementation.

Further to this, the implementation of Vol. 2 of the R-Codes will also ensure that apartment developments within the PSP Area will have more sustainable design features implemented within new buildings, including energy and water conservation.

9.1 Water Management and Conservation

The planning and design of new developments will need to consider the contribution of the development to the water cycle and incorporates effective water management techniques that support quality of life and the provision of green space while moving towards a sustainable rate of water consumption. Ultimately as cost of water provision and consumption increase, market forces will dictate that developments are built to decrease on-going water consumption as an attractor for buyers and occupiers of new apartment developments.

Stormwater management is another important aspect of water sensitive design and plays a vital role in protecting building storm flooding and managing the water cycle, improving water quality, protecting ecosystems and improving urban amenity. The Department of Water and Environmental Regulation has defined a framework for the management of small, minor and major rainfall events in urban areas which have been incorporated into the provisions of the R-Codes relevant to residential and mixed- use development. Ecological protection is the desired outcome for management of a small event, which means that development should have sufficient stormwater infiltration and deep soil to manage a small rainfall event on-site. Serviceability and amenity are the desired outcomes for managing minor rainfall events on site.

It is expected any commercial development demonstrates that a 1:100 ARI 24hr stormwater event is fully contained within the property boundary. A stormwater management plan shall be submitted at the time of a building permit to demonstrate compliance with AS 3500. Residential lots located below road level shall have drainage system designed to carter for a 1:100 ARI 24hr stormwater event, however properties that are above road level shall manage stormwater to a 1:20 ARI 1hr storm event.

Design guidance within the R-Codes encourages the use of potable water on-site to be reduced through means of water recycling, rainwater harvesting and the use of greywater systems, efficient 'water wise' irrigation and water fittings and planting of drought tolerant vegetation. The design guidance also goes onto encourage greater accountability for water use by installing individual water metering. Element 4.16 of Vol. 2 of the Residential Design Guides sets out three objectives pertaining to managing stormwater and reducing consumption. This will be the key statutory mechanism to impose best water management practices and shall be determined on a case by case scenario.

These measures when implemented will ensure decreased water consumption and efficient use throughout the water cycle to improve the sustainability of developments.

9.2 Energy Efficiency

As energy demand and costs rise, so does the imperative to reduce energy consumption. Good design can deliver energy efficient dwellings that are attractive, healthy, and comfortable. Air-conditioning, water heating and lighting account for the majority of energy use in a typical apartment and hence reducing these costs through more sustainable design will have significant flow on effects for the on-going affordability for apartments in the locality.

To ensure future development within the Centre Core is guided by a sustainability target, a 4 Star Green Star rating has been imposed as a requirement to be addressed by any future development that may occur within the Centre Core.

Buildings will need to be designed to increase the thermal performance and incorporate energy efficient fixtures as per the requirements of Vol. 2 of the R-Codes through the requirement for new apartment developments to include at least one energy initiative to assist in reducing energy consumption or having all dwellings exceed the minimum NATHERS requirement for apartments. Examples of energy initiatives are the use of ceiling fans in habitable rooms, hot water systems more efficient than electric storage units, provision of external clothes drying, use of photovoltaic array for communal services, installation of a lift with regenerative breaking and solar powered lighting in communal areas.

The design of new apartment developments will need to be naturally cross ventilated and orientated to have access to winter sun for the majority of apartments which will further reduce reliance on mechanical ventilation and air conditioning. Having more openable windows in appropriate locations to take advantage of prevailing cool winds drastically decreases the reliance apartments will have on air conditioning to cool and improve air quality within apartments. Conversely, having balconies, other outdoor living areas and living areas within apartments oriented to have access to winter sun for a number of hours throughout the day will reduce reliance on heating and improve the amenity of these apartments.

Another more indirect method to improve the energy efficiency of apartments is to reduce the urban heat island effect through the provision of deep soil area and retention of mature trees for new developments. This will provide more shade and greater opportunities for landscaping on development sites to both improve the appeal and amenity of the sites but also the tree canopy across the suburb as it transitions from suburban to urban.

Volume 1 of the R-Codes incorporates provisions relating to deep soil areas, minimum tree requirements and encouraging sustainable design practices, mandating solar access and natural ventilation requirements. These elements will contribute to promoting sustainable development outcomes for single and grouped dwellings as well as multiple dwellings (R60 and below). All mixed use and apartment buildings within the Kardinya Activity Centre will need to comply with the Building Code of Australia to incorporate energy efficient initiatives into these buildings. This will ensure that public buildings across the Activity Centre will incorporate efficiency measures into:

- Building Fabric;
- External Glazing (excluding shopfronts);
- Building Sealing;
- Air Movement;
- Air-Conditioning and Ventilation Systems;
- Artificial Lighting and Power;
- Hot Water Supply; and
- Street Awnings

As the Activity Centre matures, it is expected the standards of the Building Code of Australia will be amended to increase building standards for greater sustainability, so that when future development and redevelopment occurs, these developments be more sustainable than those being built today.

9.3 Water-Wise Landscaping

The City's local planning policy 2.1 (LPP 2.1) sets out within clause 6.5 the requirement for landscaping plans to incorporate the use of low maintenance, water wise plants with a preference to West Australian species. Whilst this provides the instrument to inform landscaping plans, LPP 2.1 does not prescribe any species to help guide and inform the detailed selection of native species. Whilst each landscaping plan is considered on its merits, and plant selection is based on the availability of species dependant on the season, a preferred plant species schedule is provided below, to inform future landscaping plans.

Carpobrotus

Scaevola aemula mass

Sedum Rubrotinctum

Anigozanthos

Dianella Petite Marie

Syzygium smithii

Cupaniopsis Anacardioides

Gleditsia Triacanthos

Harpullia Pendula

9.4 PSP Response

Vol.1 and 2 of the R-Codes will provide adequate control for new developments to align with sustainability requirements. The use of design review to ensure the implementation of natural ventilation, solar access, energy efficiency and water conservation will promote these measures from the outset of apartment design rather than after-thoughts when the design has advanced past the point of effective implementation. These measures will increase the sustainability and reduce the on-going costs for these apartments considerably.

Further to this, the increasing costs of energy, water servicing and consumption and waste collection will likely result in landowners and businesses installing water saving fixtures, renewable energy generating devices (namely solar panels), thicker glazing and more efficient heating and air conditioning systems in existing buildings to reduce these on-going costs for the operations of these buildings.

10. Implementation

The primary implementation measure is the scheme amendment which has now been gazetted, and changes the zonings and densities so that LPS 6 is consistent with the PSP.

10.1 Statutory Planning Controls

This PSP is the principal planning document for this Activity Centre. Residential Design Codes Vol.1 and Vo.2, the LPS6 and the City's policies will also apply to development in this Activity Centre, unless specifically varied by this plan. The plan, as endorsed by the WAPC, is a document which planning decision-makers are to give due regard to when making decisions regarding land use, subdivision or development in the PSP area.

10.2 Zoning

This plan does not automatically change the zoning of land. Scheme Amendment 15 has been gazetted to facilitate the required modifications to the residential densities and zoning the Centre to be C2. The permissibility of each land use is stated within the Scheme for the Centre 'C2' and Residential zones and will not require amendment to facilitate the intended outcomes of this PSP as the PSP proposes to designate the land use permissibility of the C3 centre zone.

10.3 Monitoring and Review

This plan should be reviewed and updated as and when required. It is not intended to be a static document. Any amendments to the PSP will need to follow the procedures outlined in the *Planning and Development (Local Planning Scheme) Regulations 2015.*

10.4 Duration of the PSP

As per clause 44 of the Deemed Provisions within the *Planning and Development (Local Planning Schemes) Regulations 2015*, the PSP will have effect for a period of 10 years after approval from the WAPC. During this 10-year period, the PSP may be revoked or extended by the WAPC as necessary, depending on the change of legislation, market conditions and/or strategic planning framework change.

10.5 Collaborative Working

Throughout the preparation of the PSP, the project team have been directly liaising with government bodies who have relevant input into the document.

Table 20. Summary of Collaboration

Stakeholders	Meeting Date	PSP Input
Public Transport Authority	19 November 2019	• Discussed the relocation of bus stops surrounding the Kardinya District Centre to improve both pedestrian connectivity as well as improve vehicle safety. • Improvements to the quality and safety of bus stops. • Current servicing of Kardinya and community usage of the stops along South Street. • Opportunities to improve pedestrian movement across South Street and improve pedestrian safety.
Department of Transport	4 November 2019	• Discussed the preparation of Travel Smart Plans and Parking Management solutions to improve efficiency of the centres car parking. • Expectations on reducing the overall car parking rate for the Centre, and the ongoing management. • Transport and technology initiatives that will influence the accessibility to the Centre and surrounding employment nodes. • Improvements to legibility throughout the site based on the current arrangement of access points. • Facilitating safe pedestrian crossings across South Street to connect with existing bus stops.
Main Roads	19 November 2019	• Treatments and improvements to access points along South Street. • Intersection performances i.e. North Lake Road and Gilbertson Road. • Discuss opportunities to facilitate pedestrian movement across South Street.
City of Melville	15 January 2020 3 February 2020	• Proposed zoning, density and projections. • Density compatibility with the Local Planning Strategy, particularly along urban corridors. • Transitioning building height and developing cohesive street interfaces. • Methods to promote public realm upgrades e.g. footpaths and street trees.
Department of Planning, Lands and Heritage	15 January 2019	• Consistency between the proposed PSP and MSACSP. • Transitioning building height and creating consistent streetscape interfaces. • Methods of restricting vehicle access onto South Street from existing lots. • Defining the 400 metre walkable catchment, and how far the PSP boundary should extend. • Retail floor space predications and consistency with the Activity Centre Hierarchy.
Department of Planning, Lands and Heritage	6 May 2021	• Review City of Melville modifications to Precinct Structure Plan.
Department of Planning, Lands and Heritage	22 October 2021	• Review Scheme Amendment documentation and amendments to Precinct Structure Plan.

10.6 Priority Actions

The table below sets out actions required to be completed and their priority to assist in the orderly and proper implementation of the PSP. The timing of each action will be broken down into three timeframes:

- Short Term: 1-2 years
- Medium Term: 3-5 years
- Long Term: 5+ years

Table 21. Summary of Collaboration

Actions	Timing	Responsible Authority
Local Planning Scheme Amendment	Completed	Landowner City of Melville Western Australian Planning Commission
Commence works for the Centre Core, including: • Development of the main street concept; • Improve pedestrian connectivity within, around and into the site; • Redesigned access point for the Centre; • Construction of a new PTA bus-stop on the corner of South Street and North Lake Road; • Improvements to the built-form of the Centre to the public realm in particular on the corner of South Street and North Lake; • Improvement of end-of-trip facilities; • Substantially increase the availability of cycling facilities; • Improvements to Kardinya Park Shopping Centre interface with the public realm and surrounding residential properties; • Aim to reconnect the Centre via pedestrian crossing and enhance street connections; • Improve car-parking design within Kardinya Park; and • Investigate sustainability initiatives for Kardinya Park Shopping Centre e.g., PV cells, stormwater retention initiatives and water rise irrigation.	Short Term	Landowner City of Melville Public Transport Authority
Prepare a Travel Smart Plan and Parking Management Plan for Kardinya Park.	Short Term & Ongoing	Landowner City of Melville Department of Transport
City of Melville to investigate underground power and improving street lighting via a special area rating being adopted.	Short – Medium Term	City of Melville
The Centre to provide a signalised full movement intersection at the mid-block of South Street (between North Lake Road and Gilbertson Road).	Short – Medium Term	Landowner Main Roads
At the request of Main Roads, vehicle access to South Street is to be restricted to left-in/left-out only. This mean the closure of the median island which currently enables right turn vehicle movements.	Short – Medium Term	Landowner Main Roads
Implementation of public-realm upgrades within the Residential Precinct (footpaths and street trees).	Medium – Long Term	City of Melville
Public Transport Authority to investigate increasing bus frequencies for routes 512 and 115.	Medium – Long Term	Public Transport Authority
Public Transport Authority and Main Roads to investigate dedicated AM and PM peak hour bus lanes along South Street.	Medium – Long Term	Public Transport Authority Main Roads
Development and improvements of the east-west main street connection. Which include: • Improvements to landscaping (shade trees and rain gardens) • Implement a paving concept consistent with the Development Approval for Kardinya Park • Provide dual sided pedestrian footpaths.	Medium – Long Term	Landowner
Investigate a high-capacity public transport route connecting Kardinya Centre with Murdoch Station.	Medium – Long Term	Public Transport Authority City of Melville Main Roads

11. Project Team

Town Planning	element. the art and science of place
Project Architect	Hames Sharley
Traffic	ptg consulting
Retail	URBIS
Servicing	pritchard francis Celebrating 40 years
Project Manager	ARIA projects
Engagement	Clint Ford & Associates LOBBYING. COMMUNICATIONS. STRATEGY.

Appendix 1 - Urbis Retail Needs Assessment

URBIS

KARDINYA PARK

ACTIVITY CENTRE RETAIL SUSTAINABILITY ASSESSMENT

PREPARED FOR

DATO HOLDINGS PTY LTD

JANUARY 2020

CONTENTS

EXECUTIVE SUMMARY

KEY FINDINGS

The analysis and findings outlined in this report indicate that the proposed redevelopment within the Kardinya Park District Centre will deliver a net community benefit. The key findings supporting this conclusion are summarised below.

- **Centre Mix**: The Kardinya Park District Centre is currently a relatively small centre focussed on convenience food retail, homewares and specialty uses. A review of the floorspace mix compared to centre averages illustrates that the centre has a relatively low level of floorspace across a range of categories, including food retail, food catering, apparel and homewares, and no mini-majors. The proposed development aligns with these observed gaps. While the composition of out-of-centre retail floorspace is unconfirmed, it is likely to be focussed on additional specialty floorspace that is not strongly represented in the local area.

- **Catchment**: Kardinya Park's location at the intersection of two major road routes and tenant mix that includes, for instance, the only Kmart between Booragoon and Rockingham supports an expanded catchment – particularly to the south and west where there are limited comparable centres.

- **Redevelopment Activity**: Re-zoning and state and local government focus on infill development is driving increased development activity and population growth. There are several infill precincts under development such as Kardinya Heights (300 residents), Gallery (250 residents) and the Murdoch Health and Knowledge Precinct. In addition, re-zoning of areas surrounding Kardinya Park is supporting small scale sub-divisions and unit development, with forecasts developed for the City of Melville and City of Cockburn indicating population growth of 54% in Willagee, 13% in Kardinya and 61% in Coolbellup. Furthermore, historical population growth and gentrification has seen significantly increased and changing spending patterns which is supporting retail floorspace need at Kardinya Park. Additionally, the activity centre plan includes a residential zoning increase on 51ha of residential land that is set to be equivalent to 1,216 dwellings (net of current dwellings).

- **Worker and Student Population:** In addition to the resident catchment, Kardinya Park benefits from proximity to Murdoch University, the Murdoch Health and Knowledge Precinct and numerous service industry and industrial areas (such as Bibra Lake and O'Connor) which accommodate approximately 57,500 jobs.

- **Retail Spend**: Over the five years to 2023, annual retail expenditure generated by residents in the main trade area is forecast to increase by an average of $14 million p.a. (1.2% p.a.). With population growth forecast to increase after 2023, expenditure is forecast to increase at a rate of $26 million p.a. in the five years to 2028.

- **Retail Need**: The existing hierarchy has been established for more than four decades and there has been limited expansion of retail floorspace in the area; particularly over the past two decades. Combined with changing spending patterns (e.g. more food and entertainment spending), there is significant forecast growth in floorspace need in the trade area equating to approximately 45,000 sq.m of retail floorspace. The proposed development is expected to accommodate a relatively small proportion of this forecast additional need.

- **Benefits**: The proposed development will partly address this observed retail need and will also include a range of non-shop retail uses that will help activate the centre day and night. The improved mix and desirability of the centre will support increased infill development, a revitalisation of the activity centre and complement the Murdoch University and Garden City developments. Importantly, the redevelopment will also support a range of additional ongoing employment opportunities (estimated at 785 jobs).

- **Retail Turnover Impact**: This analysis demonstrates that there will be sufficient market demand to support the proposed scale of additional PLUC 5 (shop retail) uses within the Kardinya Park Shopping Centre without having a significant impact on the sustainability of centres within the activity centre hierarchy. The analysis found that the impacts will be moderate and distributed across a range of centres given the proposed expansion predominantly includes retail categories that are not adequately provided by other district and lower order centres in the area.

Overall, the proposed expansion is expected to deliver a significant range of direct and demonstrable benefits for the community whilst maintaining a sustainable existing and planned activity centre hierarchy.

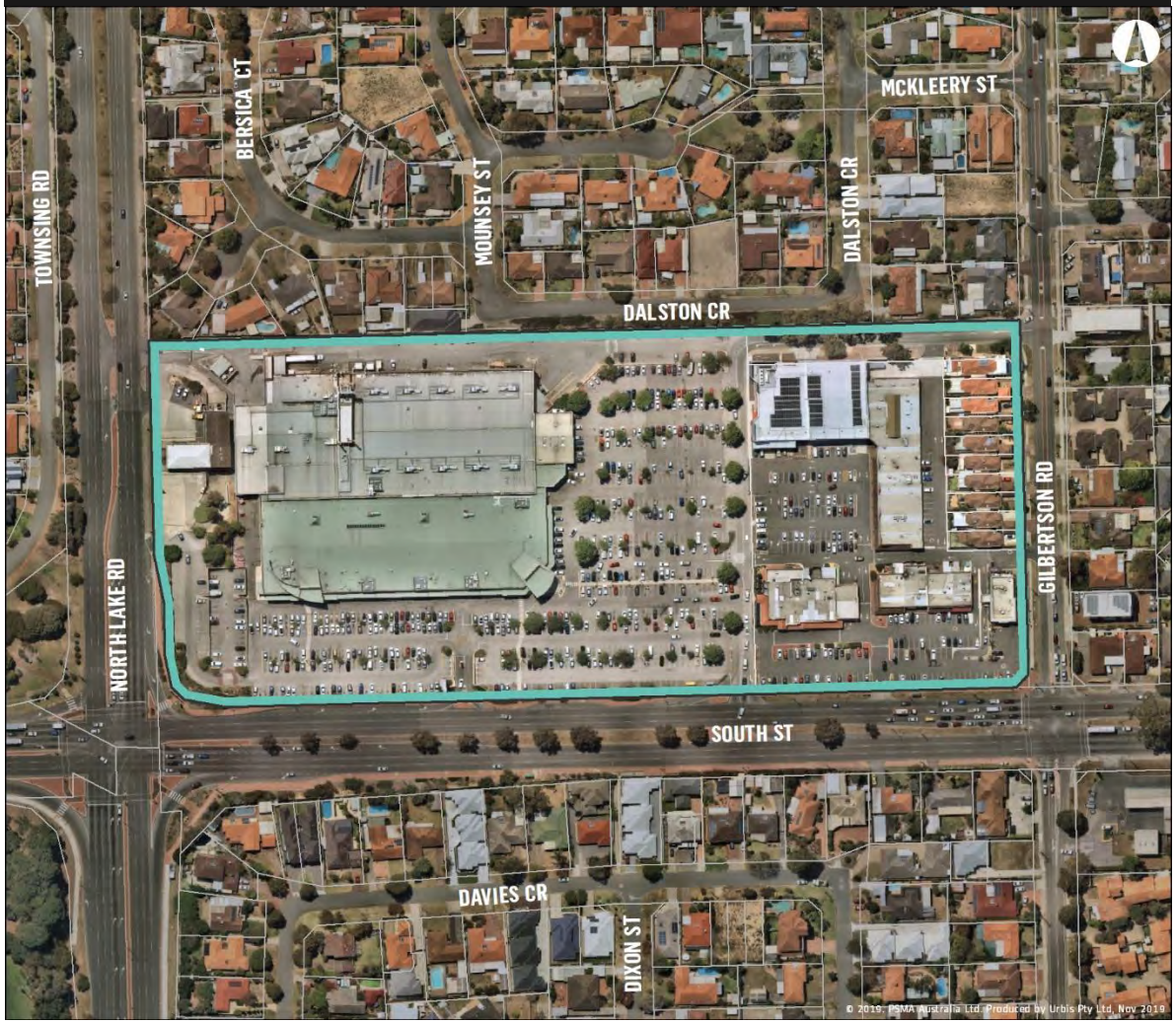
INTRODUCTION
STUDY BACKGROUND, PURPOSE AND STRUCTURE

STUDY BACKGROUND

BACKGROUND

- Kardinya and surrounding suburbs within the City of Melville are gentrifying and densifying areas in Perth's inner south western corridor. Infill precincts and redevelopment of large blocks have helped increase the resident population and the City of Melville Local Planning Scheme envisages further significant population growth. At the same time, the area's proximity to employment precincts and amenity have supported gentrification, with the average income for workers living in the area growing strongly over the past decade.
- Against this backdrop, the retail environment is fast changing in response to changing consumer spending habits.
- The activity centre offering however has not kept pace with population and income growth and changing spending habits. Many centres were built more than four decades ago and have not been substantially redeveloped since the 1990s.
- Kardinya Park Activity Centre, a popular District Centre which is anchored by the Kardinya Park Shopping Centre, is one of these centres. The activity centre is well-located and accessible in an area with very limited access to entertainment and food and beverage options. As such, the owner of Kardinya Park Shopping Centre is proposing a redevelopment which will incorporate a wider range of uses that are undersupplied in the area.

KARDINYA PARK ACTIVITY CENTRE

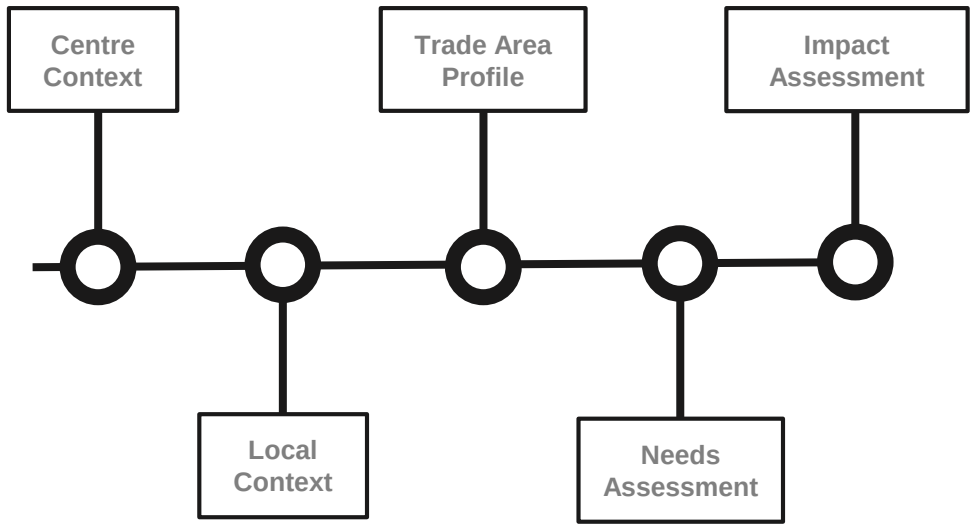


STUDY PURPOSE AND APPROACH

APPROACH

- Urbis was engaged to inform the redevelopment proposal and the development application process.
- This retail sustainability assessment (RSA) was developed to assess the proposed expansion, with focus afforded to the need for the development and the impacts on the activity centre hierarchy and local community.
- The RSA was developed in line with the requirements of SPP 4.2 Activity Centres for Perth and Peel and the City of Melville Local Commercial Strategy.
- This study included the following tasks.
  - ***Centre context*** – assessment of centre performance, mix and other attributes;
  - ***Local context*** – assessment of the competitive environment and urban development context;
  - ***Trade area profile*** – assessment of the attributes of the defined trade area;
  - ***Needs assessment*** – assessment of floorspace needs in the trade area; and
  - ***Impact assessment*** – assessment of expected impacts of the proposed redevelopment.

STUDY TASKS



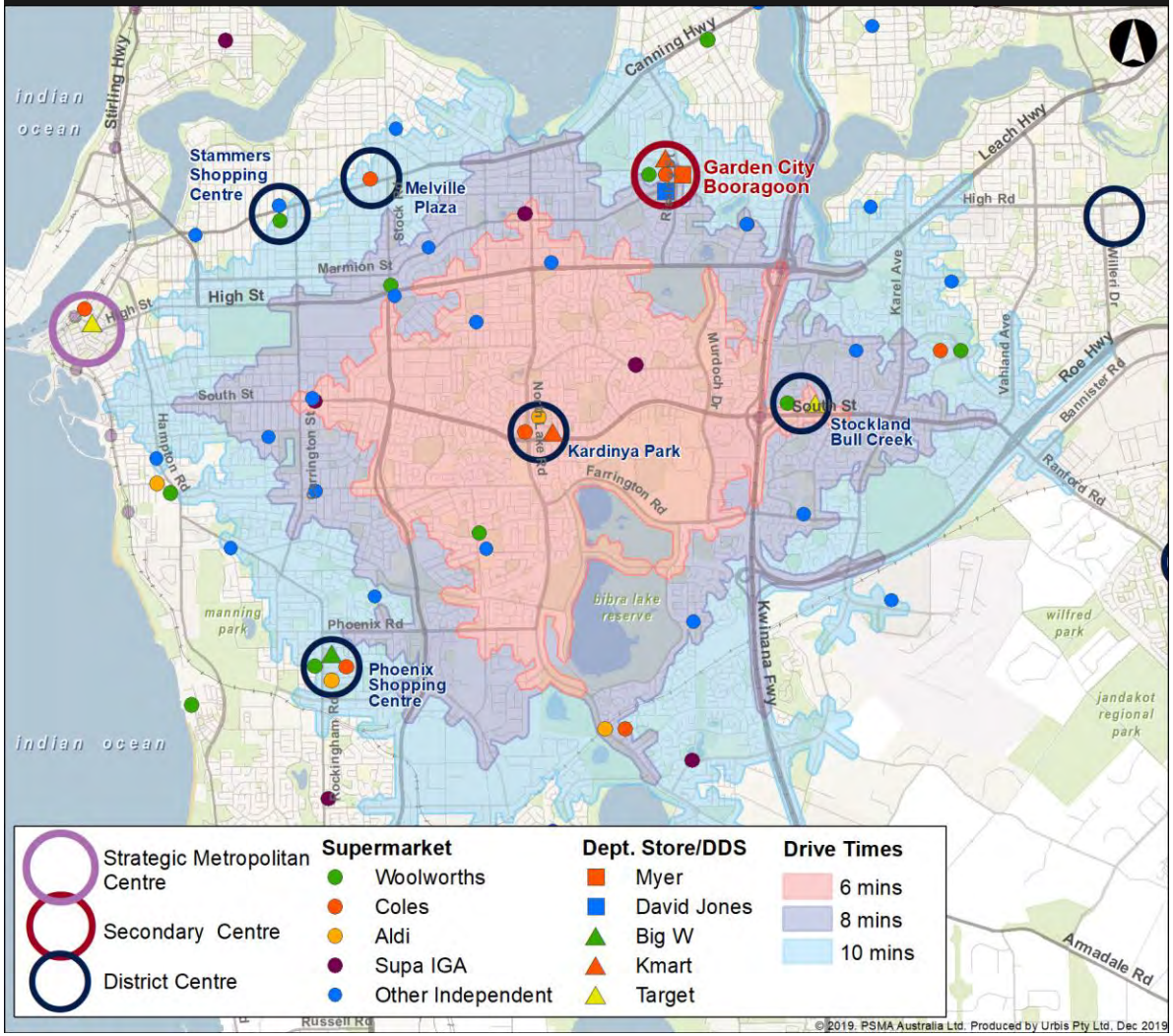
SECTION ONE
CENTRE CONTEXT

ACTIVITY CENTRE LOCATION

KEY INSIGHTS

- A review of the accessibility and transport context of Kardinya Park found that is has a range of positive location attributes which support the performance of this activity centre and the viability of the proposed expansion.
- The key attributes are noted below.
  - **Road Network**: Kardinya Park is located on the corner of South Street and North Lake Road. These are major roads with traffic volumes in excess of 30,000 daily vehicle movements. This supports passing trade and a broad catchment.
  - **Public Transport Provision**: Bus services regularly connect residential areas, Murdoch University and the Murdoch Train Station to this centre. It is also understood that there is a preliminary investigation for a light transit route connecting Murdoch Train Station and Fremantle.
  - **Pedestrian / Cycle Network**: There is an existing path network adjacent to major roads such as North Lake Road.
  - **Physical Barriers**: There are few physical barriers affecting access to this centre apart from Beeliar Regional Park, the Kwinana Freeway and Roe Highway which could act as a barrier for residents to conveniently access the centre.
- Overall, the centre is highly accessible which supports an extended catchment area, particularly to the south and west.

DRIVE-TIME TO KARDINYA PARK ACTIVITY CENTRE



SHOPPING CENTRE COMPOSITION

KEY INSIGHTS

- The Kardinya Park District Centre is currently a relatively small centre focussed on convenience food retail, homewares and specialty uses.
- The Kardinya Park Shopping Centre accommodates much of the retail offering in the activity centre. This centre was developed in 1976 and underwent an expansion in 1999.
- The shopping centre accommodates:
  - A well-performing small-format Coles Supermarket;
  - The only Kmart between Booragoon and Rockingham;
  - Specialty food retail (e.g. small Asian grocer, butcher etc.);
  - Several cafes and take-away / dine-in stores;
  - Mycar (formerly Kmart Tyre & Auto);
  - Numerous retail services; and
  - A low relatively low level of apparel and other retailers.
- A review of the floorspace mix compared to centre averages illustrates that the centre has a relatively low level of floorspace across a range of categories, including food retail, food catering, apparel and homewares, and no mini-majors. The proposed development aligns with these observed gaps.
- Furthermore, according to the Land Use and Employment Survey (DPLH), the mix across the entire activity centre was found to be below average compared to other district centres across Perth (see slide 12).

FLOORSPACE MIX COMPARISON, KARDINYA PARK SHOPPING CENTRE, 2018

	Kardinya Park		Single DDS Based Centres
	GLA (sq.m)	% of Total GLA	GLA (sq.m)
Majors:			
DDS/s	**6,880**	**50%**	**6,458**
Supermarket/s	**2,802**	**21%**	**5,335**
Other Major/s	**0**	**0%**	**100**
Mini Major/s	**0**	**0%**	**1,557**
Retail Specialties:			
Food Retail	960	7%	482
Food Catering	385	3%	772
Apparel	1,017	7%	1,478
Homewares	0	0%	539
Leisure/General	542	4%	655
Retail Services	1,057	8%	644
Total Retail Specialties	**3,961**	**29%**	**4,576**
Total Retail	**13,643**	**100%**	**18,020**

Source: Urbis Retail Benchmarks, Dato Holdings

SHOPPING CENTRE SURVEY

KEY INSIGHTS

- A survey on the shopping habits of residents in the surrounding area was conducted earlier in 2019.
- The survey confirmed that Kardinya Park was a dominant activity centre for residents in the primary catchment, with 62% of respondents identifying it as their primary shopping centre to go to.
- Kmart was stated as a key draw to for both local shoppers in the primary and secondary trade areas, while also being a big attractor for residents outside of the trading area, with 46% of respondents outside of the trade area stating that the presence of the Kmart was the main reason they shopped at Kardinya Park. This confirms that the Kmart provides a key point of difference and helps meet an unmet need particularly in the areas to the west and south.
- Note, the trade area is subsequently re-defined in Section Four based on the input from this survey.

MOST FREQUENTLY VISITED DEPARTMENT STORE (% OF RESPONDENTS), 2019

	NET	Kardinya (Suburb)	Primary Trade Area (excl Kardinya)	Secondary Trade Area (excl. Primary Trade Area)	Outside Secondary Trade Area
Kmart Kardinya (Kardinya Park Shopping Centre)	51%	81%	60%	53%	20%
Kmart Booragoon (Garden City Shopping Centre)	15%	5%	16%	14%	20%
Myer Booragoon (Garden City Shopping Centre)	8%	6%	6%	8%	12%
Big W Cockburn (Cockburn Gateway SC)	7%	3%	3%	6%	14%
Target Bull Creek (Stockland Bull Creek SC)	4%	2%	2%	3%	7%
Big W Spearwood (Phoenix Shopping Centre)	3%	2%	3%	4%	5%
Reject Shop (any store)	2%	0%	1%	2%	3%
Target Fremantle (Adelaide St)	2%	0%	0%	4%	2%
Target Cockburn (Cockburn Gateway SC)	1%	1%	2%	0%	2%
Harvey Norman (any store)	1%	1%	1%	3%	0%
David Jones Booragoon (Garden City Shopping Centre)	1%	0%	1%	0%	2%

Source: Kardinya Park Shopping Centre Area Survey – Close at Hands Consultants, 2019

PROPOSED ACTIVITY CENTRE DEVELOPMENT

KEY INSIGHTS

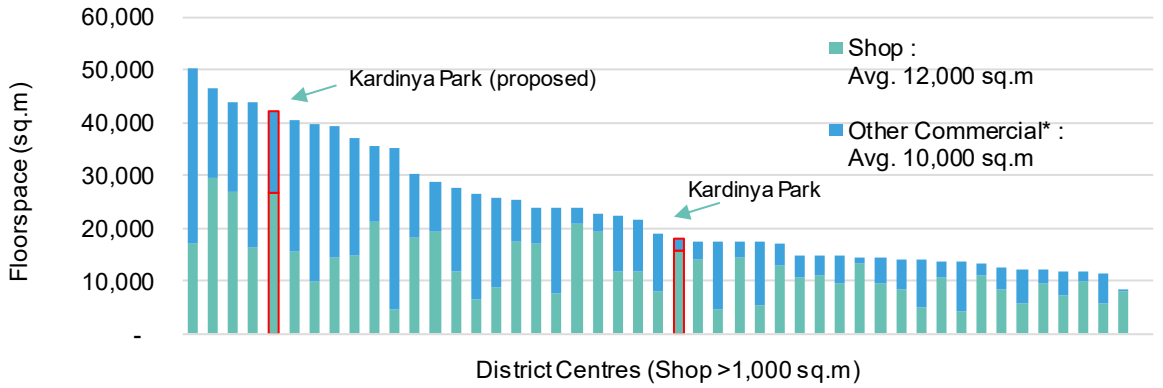
- Stakeholder, customer and community engagement identified the need for a greater range of entertainment, food and beverage and specialty uses in addition to residential development. This engagement informed the development of a redevelopment plan that is expected to include some of the following components:
  - A cinema complex;
  - A food and beverage precinct;
  - A specialty grocer;
  - Additional specialty stores;
  - Private recreation facilities;
  - Medical centre;
  - Gym;
  - Expanded service station and convenience store;
  - Residential apartments; and
  - Re-located Mycar with car wash.
- The volume of floorspace expected to be added to the Activity Centre area outside of the shopping centre is intended to be approximately 7,000sq.m by 2030, with 3,000sq.m being retail floorspace, and 4,000sq.m being non-retail floorspace.
- Following the increase, the activity centre is expected to be below the scale of the larger district centres such as Baldivis and East Victoria Park. Furthermore, the centre is expected to continue to function as a district centre as described in SPP 4.2 Activity Centres in Perth and Peel.

EXISTING AND PROPOSED FLOORSPACE (GLA), KARDINYA PARK SHOPPING CENTRE

	Existing	Proposed	Centre Build Out
	2019	*2022*	*2030*
Shopping Centre	**13,776**	**27,936**	**30,936**
Retail	13,776	21,244	22,244
Non-Retail	0	6,692	8,692
Other ACP	**4,457**	**4,457**	**11,457**
ACP Retail	1,457	1,457	4,457
ACP Non-retail	3,000	3,000	7,000
Total Activity Centre Floorspace	**18,233**	**32,393**	**42,393**
Total Retail Floorspace Assessed	*15,233*	*22,701*	*26,701*

Source: DATO Holdings

DISTRICT CENTRE FLOORSPACE COMPARISON, PERTH, 2015-17



** Other Retail; Entert. / Rec / Cultural; Office / Business; Health / Welfare / Comm.; Service Industry*
Source : Urbis

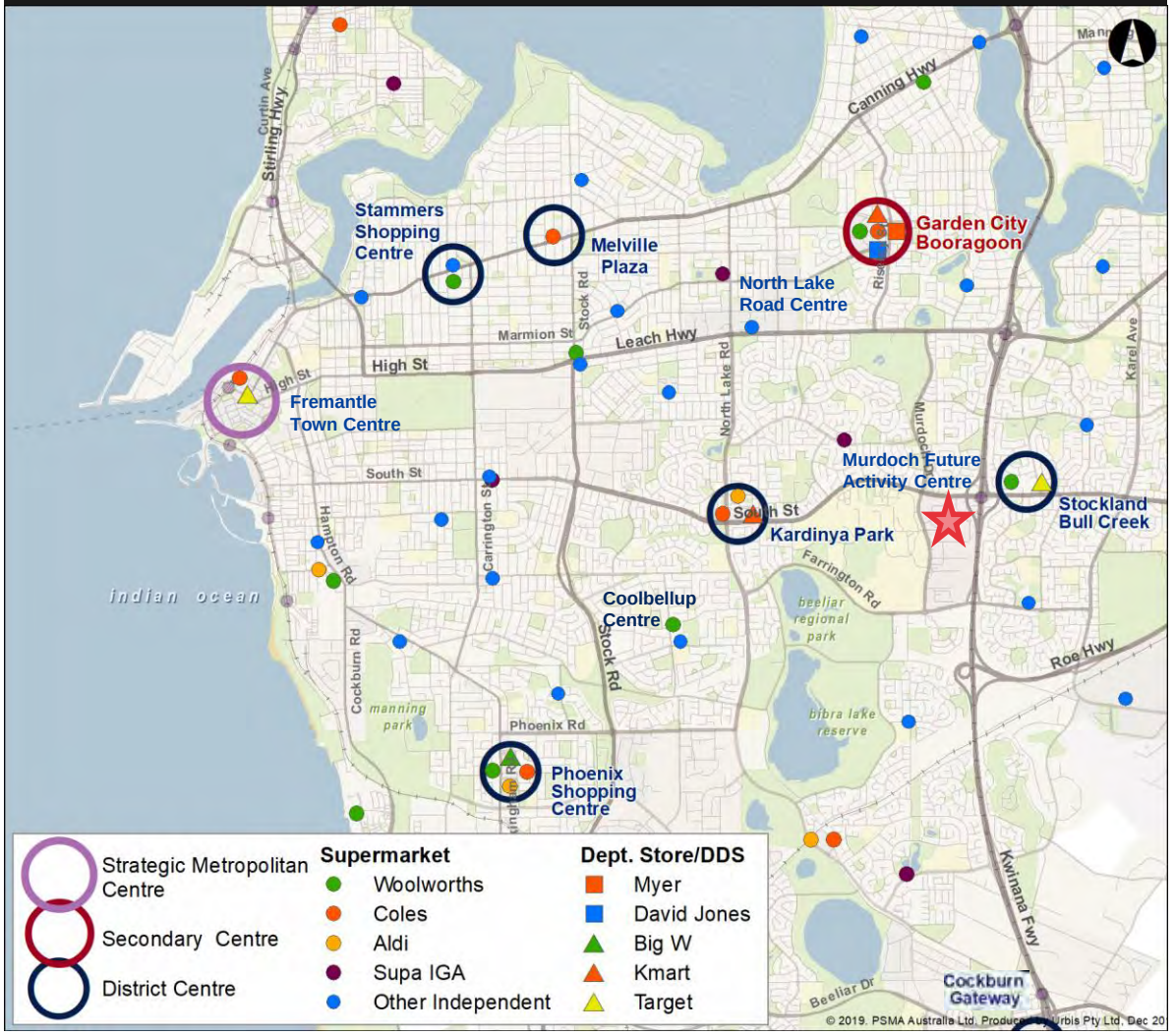
SECTION THREE
LOCAL CONTEXT

COMPETITION

KEY INSIGHTS

- There is an established hierarchy of centres in the wider area which influence the role and viability of the Kardinya Park activity centre. Key findings are noted below.
  - **Higher Order Centres**: There are several significant activity centres within the wider area that play a regional role; namely, Garden City and the Fremantle town centre.
  - **Other District Centres**: Stockland Bull Creek is the most proximate district centre to Kardinya Park. This centre is anchored by a Woolworths and a Target and benefits from a captive catchment that extends eastward. Further south, Phoenix Shopping Centre caters to residents in the growing areas of Coogee and Spearwood. There are limited entertainment and food catering offerings within these centres.
  - **Local and Neighbourhood Centres**: There are numerous supermarket-anchored local and neighbourhood centres in the surrounding area. Proximate full-line supermarket-anchored centres however are limited to the recently expanded Coolbellup Shopping Centre.
- The role and offering of the Garden City secondary centre is expected to limit the draw of Kardinya Park from areas north of Leach Highway. Meanwhile, the Bull Creek and Phoenix district centres will limit the catchment east of Kwinana Freeway and west of Stock Road.
- It should be noted that there is expected to be a substantial volume of floorspace in the Murdoch specialised activity centre area that will be developed over the next two decades.

ACTIVITY CENTRE HIERARCHY



COMPETITION

MAJOR CENTRES

	Distance from Kardinya Park (km)	Year of Refurbishment	Retail GLA	Major Tenants
Strategic Metropolitan Centre				
Fremantle Town Centre	8.1	2019	65,023	Coles, Target
Secondary Centre				
Garden City	5.5	2019	58,615	Myer, David Jones, Coles, Woolworths
Cockburn Gateway	9.7	2015	44,825	Coles, Woolworths,
District Centre				
Stockland Bull Creek	4.3	1996	16,209	Woolworths, Target
Livingston Marketplace	10.8	2004	15,541	Woolworths, Big W
Melville Plaza	6.5	1999	8,627	Coles
Phoenix Shopping Centre	6.5	2009	20,826	Coles, Big W
Stammer's Shopping Centre	7.6	-	8,748	Woolworths

Source: Urbis, PCA Shopping Centres Database, DPLH Perth Land Use and Employment Survey 2015/17

COMPETITION

KEY INSIGHTS

- The existing hierarchy has been established for more than four decades and there has been limited expansion of retail floorspace in the area; particularly over the past two decades. There are however several key retail expansions which have implications for the proposed expansion at Kardinya Park. The key developments assumed are noted in the table and summarised below.
  - **Garden City**: AMP recently sold a 50% stake in the Garden City Shopping Centre to Scentre Group. As such, existing expansion plans are likely to change and / or be delayed and therefore this assessment assumed the expansion would be complete by 2024.
  - **Fremantle Town Centre**: The King's Square development is expected to add retail floorspace to Fremantle by 2021. The Woolstores centre is expected to bring an additional supermarket to the town centre and additional retail specialties (this redevelopment is proposed to significantly decrease the size of the discount department store).
  - **Davis Park, Beaconsfield**: A draft structure plan indicates an expansion of the Fifth Avenue Activity Centre could form part of the initial stages of this infill development. The proposed expansion is assumed to be complete by 2023.
  - **Murdoch Specialised Activity Centre**: Retail floorspace as part of the development of the Murdoch specialised activity centre is set to take place over the next 15-20 years, in line with the likely development timeframes of the commercial floorspace. We have assumed an initial retail development by 2023, and a portion of total development to be operational by 2030.

KEY PLANNED DEVELOPMENTS

Development	Impact Year	Description	Floorspace Expansion
Garden City Booragoon	2024	Prior to the part sale to Scentre Group. AMP progressed with plans to redevelop Garden City.	4,000sq.m Department Store, 6,000sq.m DDS, 7,500sq.m Supermarket, 5,000sq.m Mini-majors, 17,500sq.m Total Retail Specialties
Woolstores Shopping Centre Development	2025	The application proposes to redevelop the existing Woolstores Shopping Centre and to construct a new six (6) level mixed use building at 28 (Lot 1) Cantonment Street Fremantle	3,400sq.m Supermarket, 3,277 sq.m Retail Specialties, removal of Department Store and Discount Department Store
The Heart of Beaconsfield	2023	Expansion of beaconsfield local centre to include a supermarket, and specialties	2,800sq.m Supermarket, 1,800sq.m Retail Specialties
King's Square Fremantle (FOMO)	2021	Redevelopment of King's square to offer additional office and retail floorspace, focussed on creating a food and beverage precinct.	20,800sq.m of office space, 5,500sq.m retail floorspace
Murdoch Mixed-Use Precinct Retail Centre	2023	Initial retail development as part of the Murdoch Specialised Activity Centre to include 2 convenience focussed supermarket centres	3,000sq.m supermarket, 206sq.m food retail, 779sq.m food catering, 667sq.m general retail, 320sq.m retail services, and 300sq.m of non-retail floorspace
Murdoch Specialised Activity Centre	2030+	Development includes the remainder of Murdoch specialised activity centre retail floorspace (total of 29,755 minus the Mixed-use retail precinct) set to be developed within the core of the precinct, totalling 24,484sq.m.	We have estimated that 12,242sq.m (50%) of floorspace would be developed by 2030.

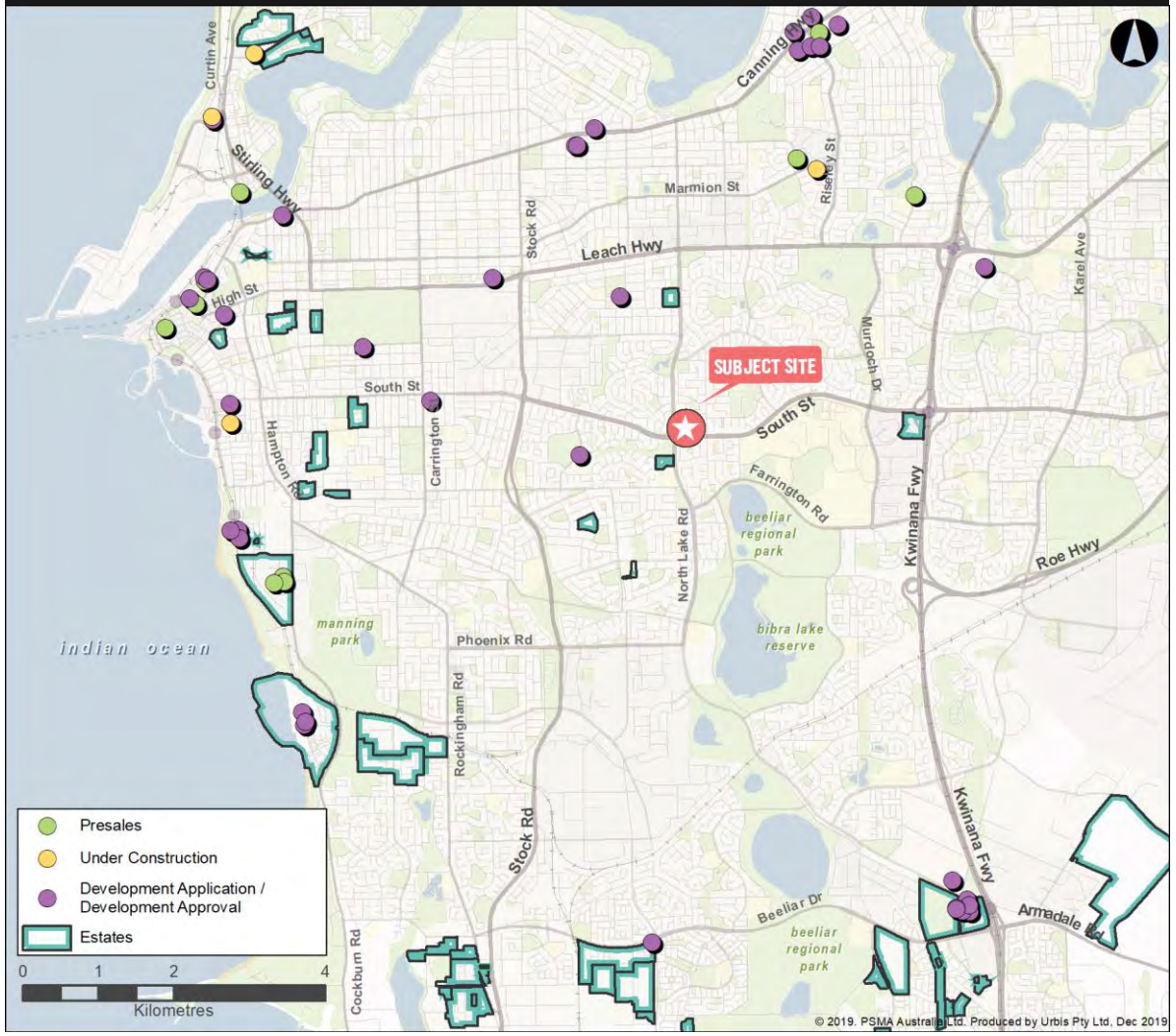
Source: Urbis, Cordell Connect

DEVELOPMENT CONTEXT

KEY INSIGHTS

- Kardinya and the immediately adjacent suburbs are relatively low density urban areas which developed in the 1960s and 1970s. Re-zoning and state and local government focus on infill development however is driving increased development activity and population growth.
- Several key infill developments of relevance are noted below.
  - **Kardinya Heights**: This infill development is approximately 70% sold and expected to accommodate 300 residents at build-out.
  - **Murdoch Health and Knowledge Precinct**: This long term State Government-led development is expected to accommodate apartments, student housing, aged care, local convenience retail, office and further health services.
  - **Gallery (Carawatha)**: The existing public open space along North Lake Road (2km north of Kardinya Park) is currently under development, with the first lots expected to be developed in 2020. This development is expected to accommodate approximately 250 residents at build-out.
- There area a number of active and pending apartment developments (minimum 25 apartments) in the broader area. The near term outlook for apartment development in the immediate area of the centre is however limited by current zoning.
- These infill developments are expected to support near term population growth and spending at the Kardinya Park Shopping Centre.

INFILL PRECINCT MAP



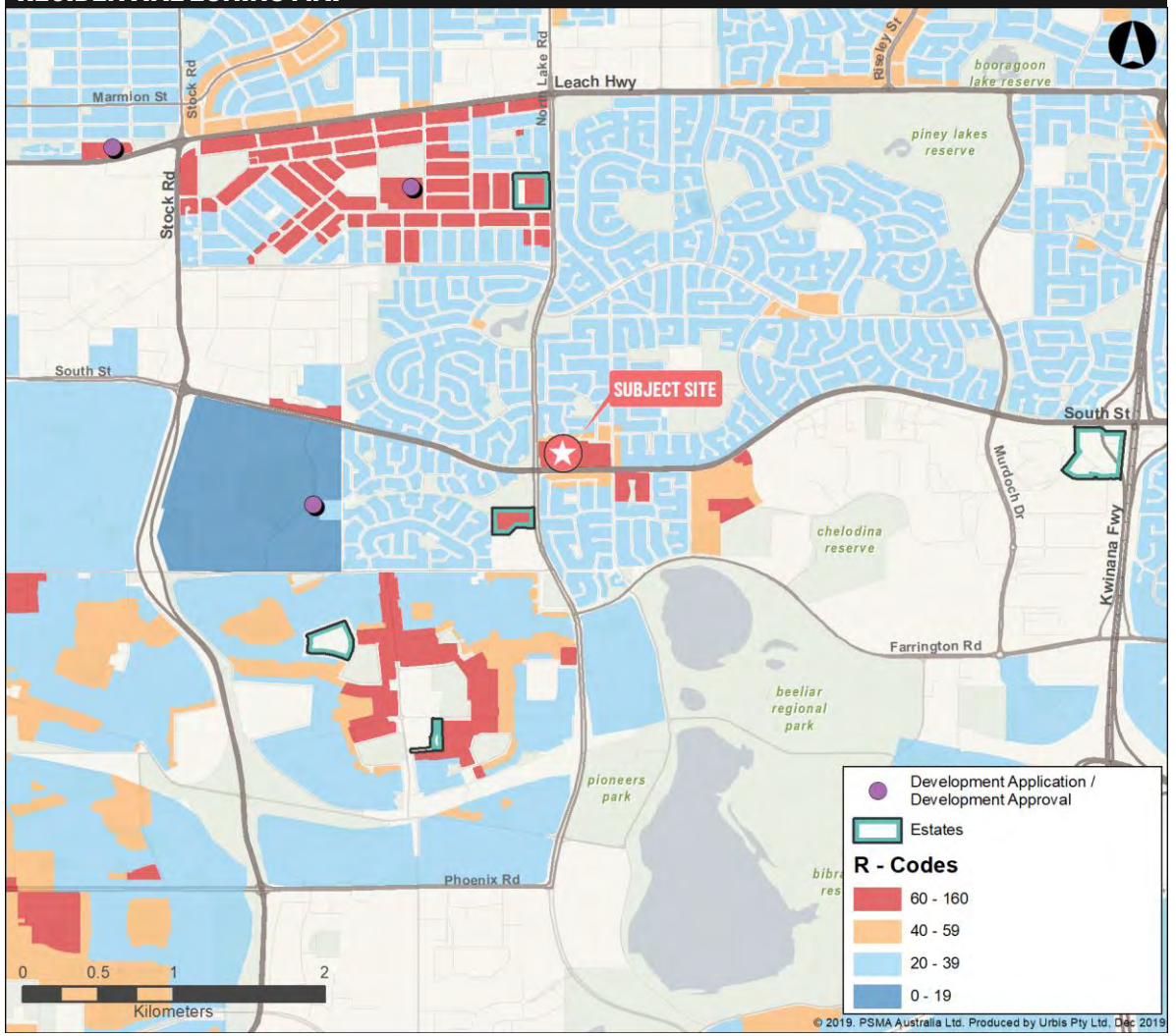
Source: Urbis

DEVELOPMENT CONTEXT

KEY INSIGHTS

- Re-zoning of areas surrounding Kardinya Park is supporting small scale sub-divisions and unit development.
- The City of Cockburn increased zoning in the Coolbellup suburb and this is supporting low rise apartment / unit development, townhouses and sub-divisions. As a result, .id Consulting forecasts developed for the City show that this area is expected to see its population increase 60.9% between 2019 and 2041.
- The City of Melville increased zoning in the north of Willagee and this is supporting increased development alongside the Carawatha development. Forecasts developed for the City of Melville show that this suburb is expected to see its population increase 53.7% between 2019 and 2036.
- Within the suburb of Kardinya, zoning supports moderate sub-division of existing large lots. Whilst the level of development based on current zoning is limited in the near term, the suburb is expected to experience moderate population growth as a result. Forecasts developed for the City of Melville show that this area is expected to see its population increase 13% between 2019 and 2036.
- 51ha of land surrounding the activity centre is expected to see a zoning increase with the adoption of the ACP, which will be equivalent to approximately 1,216 net dwellings being added to the primary catchment of the centre (at a 50% uptake rate), which is broadly equivalent to 3,040 additional residents in the primary catchment when the development is realised.

RESIDENTIAL ZONING MAP



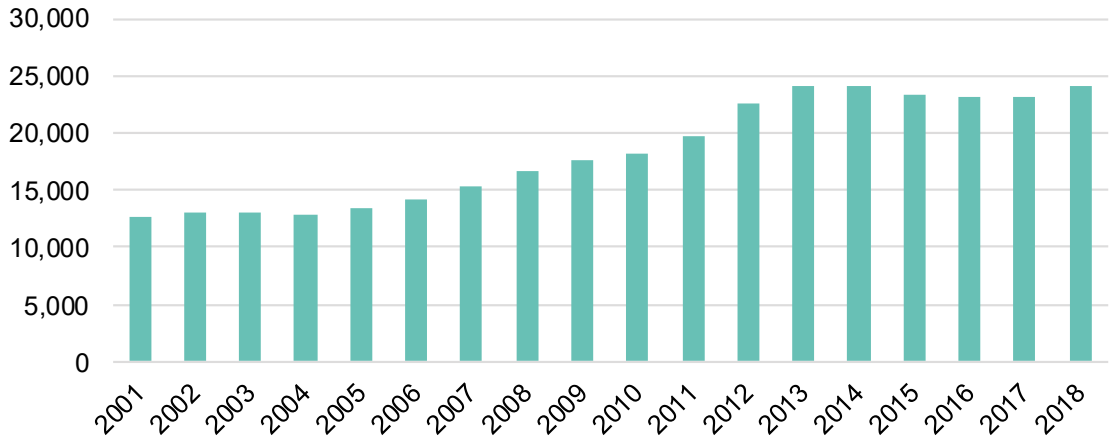
Source: Urbis, DPLH, Local Schemes

STUDENT/WORKER CATCHMENT

KEY INSIGHTS

- In addition to the resident catchment, Kardinya Park benefits from proximity to Murdoch University, the Murdoch Health and Knowledge Precinct and numerous service industry and industrial areas such as Bibra Lake and O'Connor.
- There are estimated to be approximately 24,000 students enrolled at Murdoch University, with the vast majority studying at the South Street campus. Murdoch University is increasing its efforts to attract international students and is expected to continue to support increased student numbers over the coming years.
- There are number of key employment precincts in the wider area that accommodated an estimated 57,500 workers in 2016.

STUDENT ENROLMENTS, MURDOCH UNIVERSITY, 2001-18



Source: Murdoch University Annual Reports, 2001-2018

ESTIMATED JOBS BY AREA, 2016

Region	Workers
Fremantle	16,587
Booragoon	7,109
Murdoch - Kardinya	13,618
Bibra Industrial	8,988
O'Connor (WA)	4,338
Melville	6,902

Source: ABS Census of Population and Housing, 2016

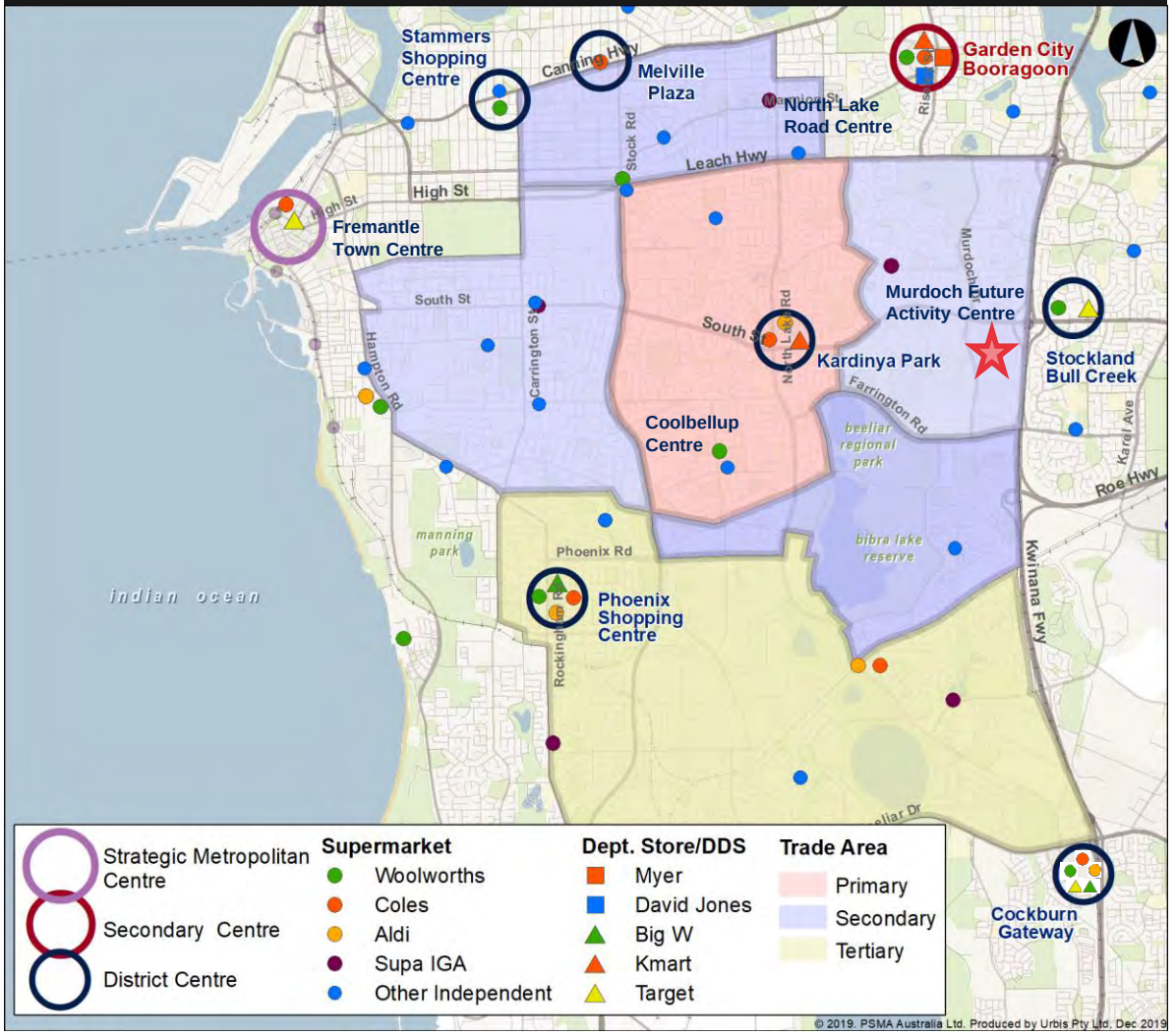
SECTION THREE
TRADE AREA PROFILE

TRADE AREA DEFINITION

KEY INSIGHTS

- The defined trade area for Kardinya Park was based on:
  - The supply and mix of retail at the Kardinya Park activity centre and at surrounding centres;
  - The accessibility of the centre compared to other centres;
  - Physical barriers that may limit access (such as Kwinana Freeway);
  - Surveying of residents in surrounding areas; and
  - Previously defined trade areas for this centre.
- Limited comparable offerings to the west and accessibility along South Street suggest that the centre services residents located in suburbs to the west such as Beaconsfield and Hilton. This is confirmed by the resident survey which demonstrated that the centre is well used by residents in this trade area.
- Whilst the centre is easily accessible to areas to the east, its catchment is expected to be limited by the offering at Stockland Bull Creek.
- A secondary north trade area was defined for the parts of Melville and Palmyra located north of Leach Highway to reflect the accessibility of the centre. The market shares for this trade area are however expected to be relatively low.
- A tertiary trade area has been defined to the south. This tertiary trade area was defined based on relatively high usage noted in the resident survey (primarily driven by the Kmart offering – the only Kmart between Booragoon and Rockingham) and accessibility via North Lake and Stock Roads (on average, the drivetime is less than 10 minutes for residents in this trade area).

TRADE AREA, KARDINYA PARK ACTIVITY CENTRE



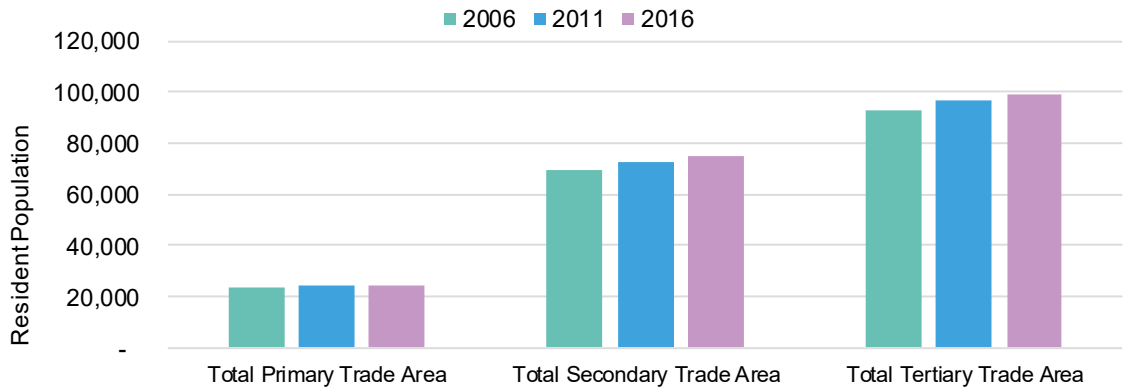
Source: Urbis

RESIDENT POPULATION

KEY INSIGHTS

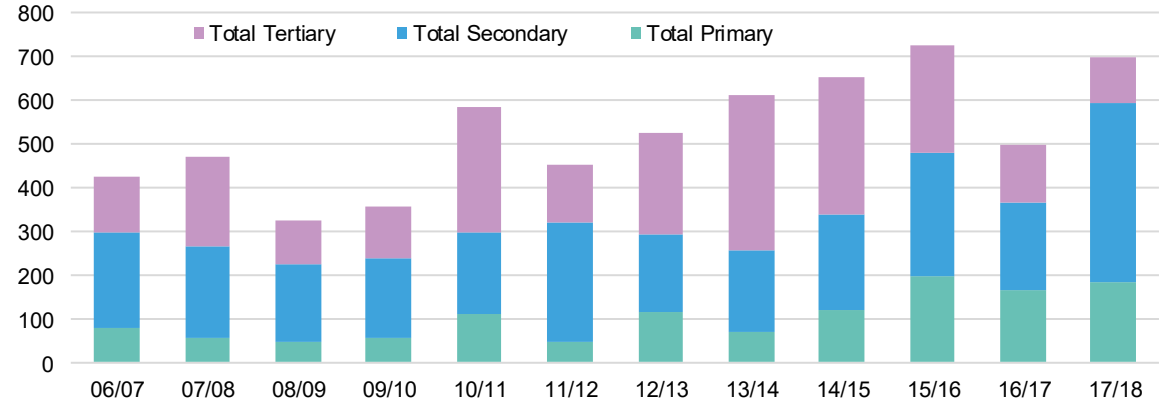
- The aforementioned infill developments and re-zoning has supported notable population growth over the past decade.
- The estimated resident population within the main trade area grew by 8.4% from 2006 to 2016. A more recent decline in population was influenced by inflated rental vacancies which were above 5% in 2017 in the surrounding area (defined as postcode 6163). The vacancy rate as of September 2019 had declined to 2.0%.
- The population in the trade area is expected to continue to grow in the near term as a result of building activity equivalent to approximately 700 dwelling approvals in 2017/18, including approximately 200 dwelling approvals within the primary trade area.

HISTORICAL POPULATION GROWTH, TRADE AREA



Source: ABS

DWELLING APPROVALS, TRADE AREA, 2006-18



Source: ABS

RESIDENT POPULATION

KEY INSIGHTS

- The forecast resident population in the trade area is based on the following information.
  - The latest Estimated Resident Population (ERP) figures to June 2018 (released by the ABS). This latest data is provided at a Statistical Area 1 (SA1) geography level, thus providing an accurate estimate of resident population for the trade area.
  - New dwelling approvals data prepared by the ABS to June 2018. This data provides an indication of potential short term dwelling development activity and resident population growth.
  - Small Area Forecast Information (SAFI) prepared by .id Consulting (which also supplies population forecasts to the City of Melville.
  - A review and analysis of current and proposed residential developments in the catchment area, including the zoning increase in the ACP area.
- Currently (at June 2018) the main trade area's population is estimated at approximately 78,430 people. As noted above, the resident population was estimated to have declined primarily due to inflated rental vacancy rates which have subsequently declined by three percentage points over the past two years in the Kardinya area (according to SQM Research). The rental vacancy decline alone is estimated to equate to approximately 250 dwellings in the main trade area.
- Moderate population growth is assumed over the 2018-23 period equivalent to 542 residents per annum. This is expected to be supported by growth within the primary catchment in developments such as Gallery and small-scale developments in the suburb of Coolbellup and Willagee. The Secondary West trade area is also expected to have notable growth supported by infill developments.

RESIDENT POPULATION GROWTH

	2013	2018	2023	2028	13-18	18-23	23-28
Primary:							
Primary	25,940	25,250	26,460	28,360	-138	242	380
Secondary:							
East	11,480	10,930	11,560	12,770	-110	126	242
North	15,190	15,250	15,480	15,650	12	46	34
West	20,160	20,380	21,370	22,470	44	198	220
South	6,850	6,620	6,650	6,800	-46	6	30
Total Secondary	**53,680**	**53,180**	**55,060**	**57,690**	**-100**	**376**	**526**
Main Trade Area	**79,620**	**78,430**	**81,520**	**86,050**	**-238**	**618**	**906**
Tertiary:							
South	27,160	27,520	30,180	33,930	72	532	750
Total Trade Area	**106,780**	**105,950**	**111,700**	**119,980**	**-166**	**1,150**	**1,656**

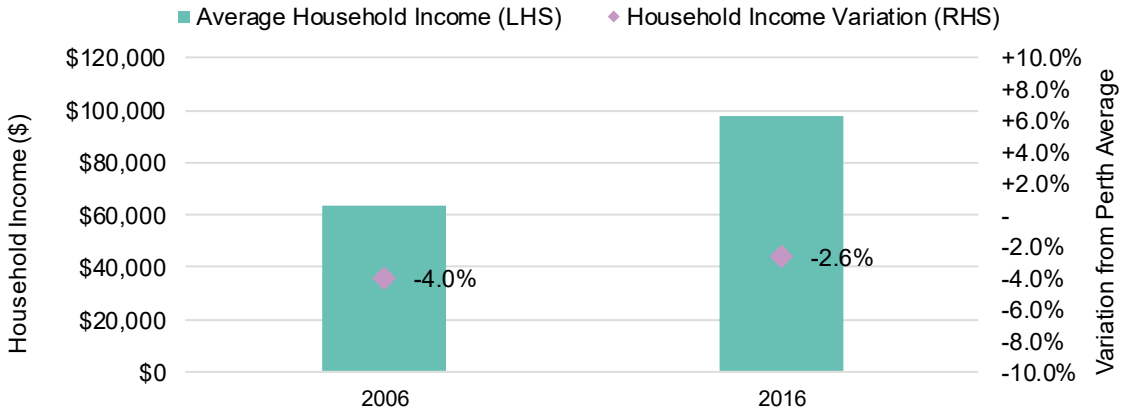
Source: Urbis, SAFi, ABS

RESIDENT ATTRIBUTES

KEY INSIGHTS

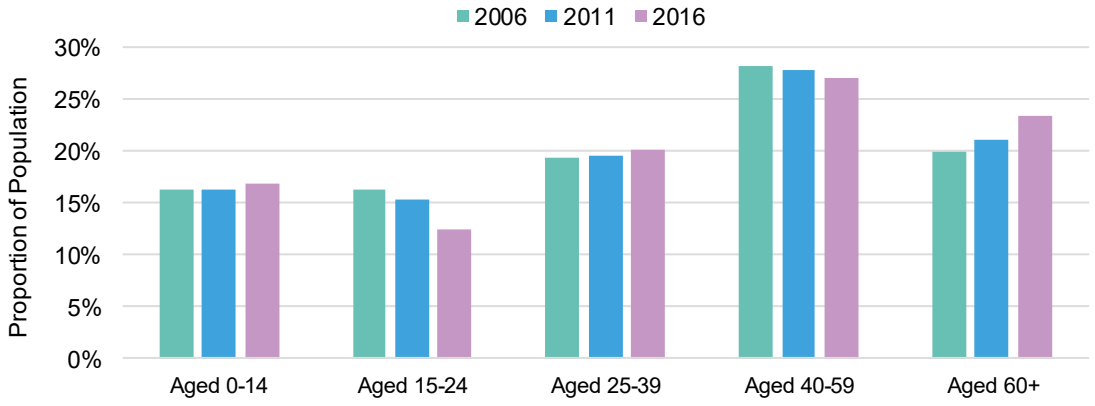
- Residents in the catchment have become more affluent in the period from 2006 to 2016. Over this period, the average household income in the Kardinya main trade area increased at a substantial rate – growing from $62,000 to $97,000 (an increase of 56%). The variance from the Perth average also declined from being 4% below the Perth average in 2006 to being 2.6% below in 2016.
- The age profile of residents in the catchment changed substantially from 2006 to 2016, with the proportion of residents aged over 60 increasing substantially while the proportion of young adult residents aged between 15-24 declined.

CHANGE IN INCOME, 2006-2016, TRADE AREA



Source: ABS Census of Population and Housing

CHANGE IN AGE PROFILE, 2006-2016, TRADE AREA



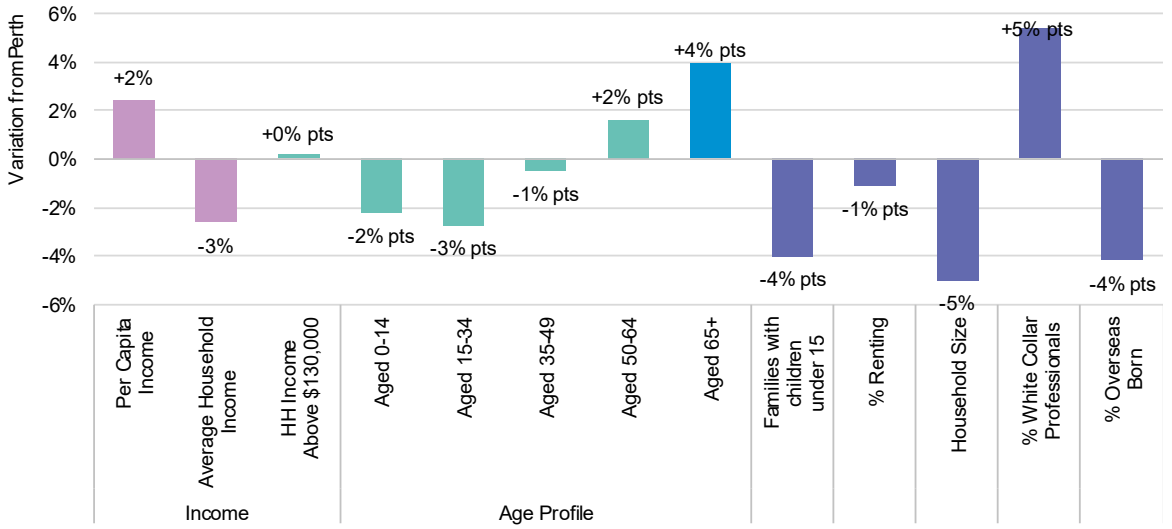
Source: ABS Census of Population and Housing

RESIDENT ATTRIBUTES

KEY INSIGHTS

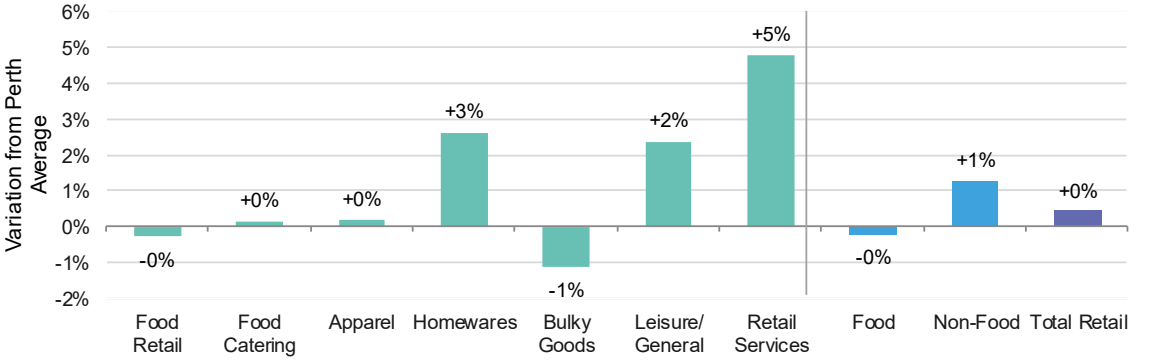
- The level of future expenditure and retail demand in the trade area will be influenced by the socio-economic profile of current and future residents.
- Based on data from the 2016 Census of Population and Housing, the demographics of the catchment area reflect the established nature of the area with a high representation of older residents and lower representation of young families.
- Trade area residents are estimated to have moderately above average retail expenditure compared to the metropolitan Perth average (0.5% above). There is estimated to be a particularly higher level of spending on retail services (e.g. hairdressers, nail salons) and leisure and homewares goods and services.
- The retail spending market was estimated using MarketInfo – a micro-simulation model developed by MDS Market Data Systems Pty Ltd. This model is based on information from the ABS' Household Expenditure Survey (HES), the Census of Population and Housing and other information sources that provide up-to-date information on changes in spending behaviour and/or income levels (e.g. Australian National Accounts, Australian Taxation Statistics, etc.). MarketInfo is used widely by stakeholders in the retail industry and by other consultants preparing Retail Sustainability Assessments/Economic Impact Assessments.
- The model uses micro-simulation techniques to combine propensity to spend on particular commodities with the socio-economic characteristics of individuals to derive spending per capita estimates on a small area basis (i.e. the Statistical Area 1 level).

KEY DEMOGRAPHIC CHARACTERISTICS, MAIN TRADE AREA RESIDENTS



Source: ABS, Urbis

EXPENDITURE PER CAPITA VARIATION, MAIN TRADE AREA RESIDENTS



Source: ABS, Urbis

RESIDENT EXPENDITURE

KEY INSIGHTS

- The current and forecast annual retail spend generated by residents in the trade area was estimated. In the year to June 2018, retail expenditure was estimated at $1,375 million in the main trade area.
- The forecast growth in retail expenditure by trade area residents was influenced by the following assumptions and inputs.
  - Forecast population growth outlined above (e.g. ~0.8% per annum over 2018-23 period in the main trade area).
  - Retail spend per capita of 0.4% p.a. and 0.9% p.a. over the 2018-23 and 2023-28 periods respectively. The forecasts allow for lower growth in the short term in line with the current softer economic environment and the expectation for more normalised growth (particularly wages growth) from 2023 onwards. Growth rate assumptions vary across retail categories, with growth rates forecast to be strongest for food retail and food catering over the 2013-28 period.
  - No allowance for future inflation, with future spending expressed in constant 2018 dollar terms.
- Over the five years to 2023, annual retail expenditure generated by residents in the main trade area is forecast to increase by an average of $14 million p.a. (1.2% p.a.). With population growth forecast to increase after 2023, expenditure is forecast to increase at a rate of $26 million p.a. in the five years to 2028.

ESTIMATED RETAIL SPENDING BY PRODUCT GROUP ($2018), TRADE AREA

	Food Retail	Food Catering	Apparel	Home-w ares	Bulky Goods	Leisure/ General	Retail Services	**Total Retail**	*Annual Growth*	=	*Pop Growth*	+	*Per Cap Spend Growth*
Primary Trade Area:													
2013	165	42	36	28	43	43	14	**371**					
2018	172	42	33	25	38	44	13	**369**	*-0.1%*		*-0.5%*		*0.4%*
2023	183	45	36	27	41	48	14	**394**	*1.3%*		*0.9%*		*0.4%*
2028	203	52	41	31	47	54	16	**442**	*2.3%*		*1.4%*		*0.9%*
Main Trade Area:													
2013	512	132	114	90	139	137	46	**1,171**					
2018	540	135	108	81	124	144	44	**1,176**	*0.1%*		*-0.3%*		*0.4%*
2023	570	144	114	87	132	153	47	**1,247**	*1.2%*		*0.8%*		*0.4%*
2028	620	161	127	98	147	170	51	**1,375**	*2.0%*		*1.1%*		*0.9%*
Total Trade Area:													
2013	685	171	147	116	180	177	59	**1,536**					
2018	728	176	139	105	163	188	56	**1,555**	*0.2%*		*-0.2%*		*0.4%*
2023	779	191	149	114	175	202	60	**1,670**	*1.4%*		*1.1%*		*0.4%*
2028	863	217	169	130	198	229	67	**1,873**	*2.3%*		*1.4%*		*0.9%*

Source: Urbis, Marketinfo, ABS

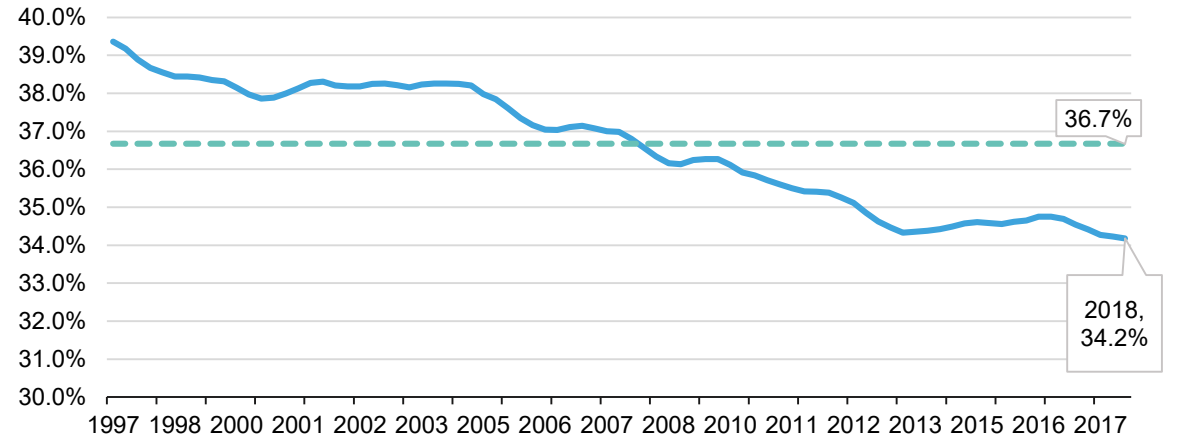
SECTION FOUR
NEEDS ASSESSMENT

CONSUMER SPENDING

KEY INSIGHTS

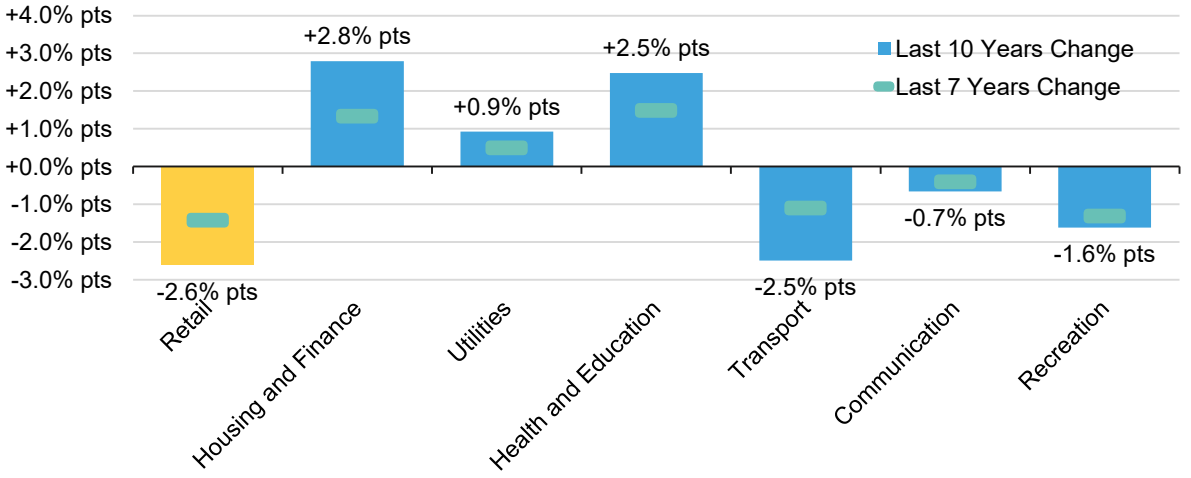
- Retail is a rapidly evolving sector and a key driver of this change is consumer spending patterns.
- Influenced by economic, social, technology and other factors, the overall share of household spending to retail declined by approximately 6 percentage points over the past two decades.
- Private schooling, health, mortgages, electricity prices and other costs now consume a much greater share of household budgets. This is a trend that has played out nationally and within Perth.
- A further influencing factor has been deflation within certain retail categories which has been influenced by price competition and import markets.
- Overall, the reduced share of spending to retail is driving a need for centres to truly re-position as activity centres with a diverse range of uses.

RETAIL SHARE OF HOUSEHOLD SPENDING, AUSTRALIA, 1997-2018



Source: Urbis, ABS

HOUSEHOLD SPENDING CHANGE BY CATEGORY, AUSTRALIA, 2018



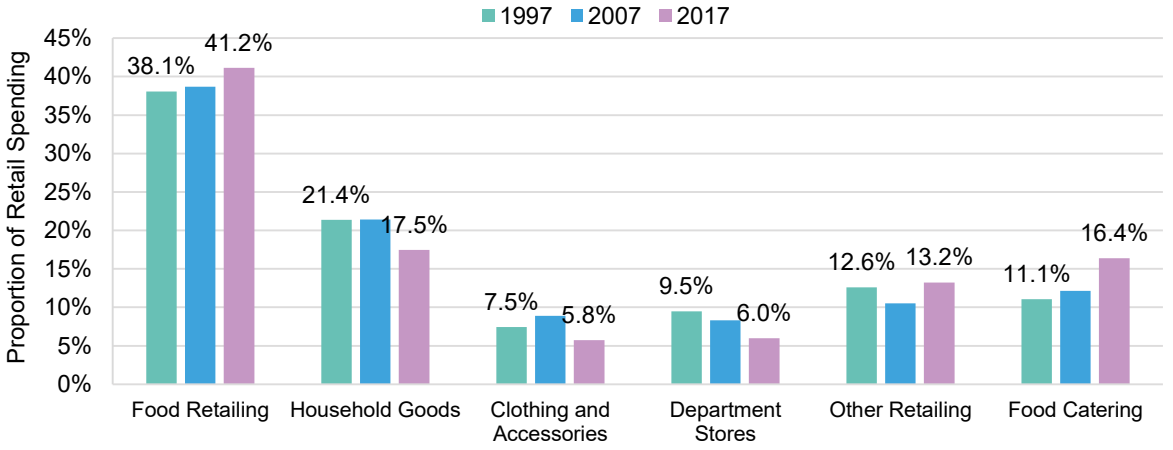
Source: Urbis, ABS

CONSUMER SPENDING

KEY INSIGHTS

- Within the retail spending market, there are mixed fortunes across retail categories.
- Of note to the expansion proposal for Kardinya Park, consumers are prioritising food and dining with spending increasing at above average rates for this category at the expense of apparel categories.
- Categories such as apparel are being particularly influenced also by online spending which has created a greater imperative for centres to diversify tenancies.
- As a result in the significant shift in retail expenditure, retail gaps have emerged in established markets across the country. This is relevant for Kardinya Park and the established retail hierarchy which to date is based primarily on a mix of retail that was appropriate two decades ago.

RETAIL SPENDING SHARES BY CATEGORY, WESTERN AUSTRALIA



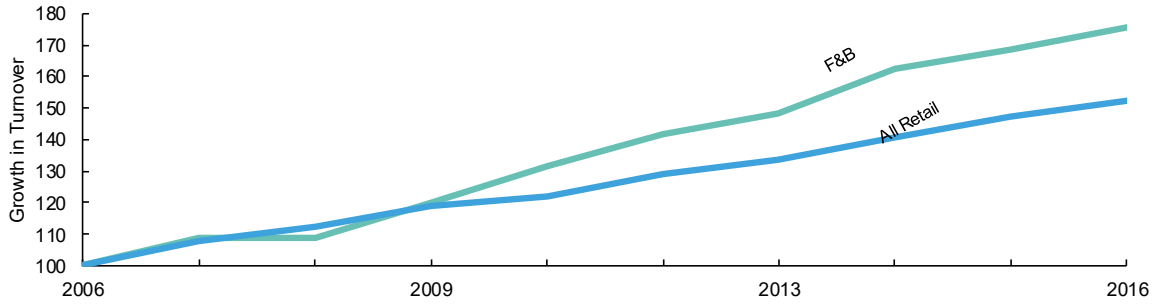
Source: Urbis, ABS

CONSUMER SPENDING

KEY INSIGHTS

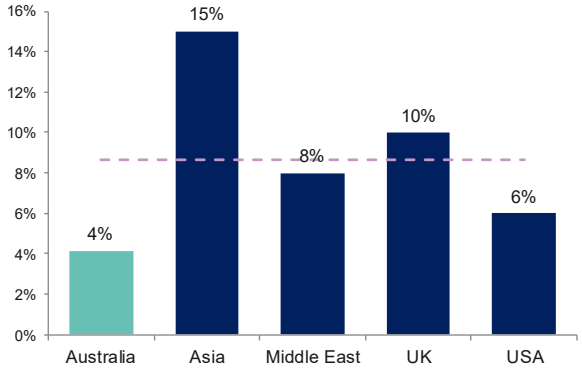
- Urbis has completed research on the importance of entertainment and leisure precincts at centres to remain relevant.
- Food and beverage turnover for centres has been growing at a faster rate than the turnover growth rate for retail in general in the period from 2006 to 2016. This growth has begun to be met by expanding food and beverage options at large regional centres, but has not been pursued by smaller centres as aggressively.
- Internationally, Australian retail centres fall behind their international counterparts in terms of the proportion of food and beverage floorspace. Given that Asian retail centres have food and beverage floorspace accounting for 15% of total retail floorspace, the potential opportunity being missed by Australian centres is considerable.

GROWTH IN SHOPPING CENTRE TURNOVER, AUSTRALIA, 2006-16

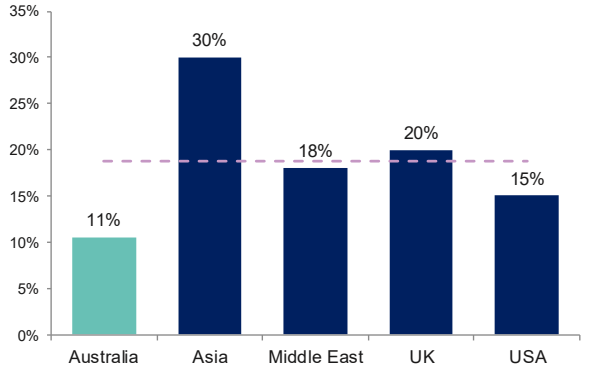


Source: Urbis

CENTRE F&B FLOORSPACE (% OF TOTAL)



CENTRE F&B FLOORSPACE (% OF SPECIALTY)



Source: Urbis
n.b. F&B excludes supermarket and grocer turnover

FUTURE RETAIL MARKET

KEY INSIGHTS

- The main trade area will eventually accommodate upwards of 86,050 residents by 2028 which would generate over $1.38 billion in retail expenditure (in 2018 dollar terms). This market size will support a range of additional supermarkets, convenience based retailing, food catering tenancies, homewares and apparel retailers, non-retail services, and entertainment, commercial and community facilities.
- Kardinya Park will need to play a role in providing shops and facilities that adequately address the requirements of residents within the trade area, students and workers.
- An estimate of indicative supportable floorspace for relevant PLUC 5 (shop retail) was undertaken based on retail expenditure forecasts and the application of average sales densities informed by the Urbis Shopping Centre Benchmarks survey. The analysis found that the quantum of supportable floorspace is expected to increases significantly across a range of categories.
  - Food catering – up 4,200 sq.m over 2013-28 period in the total trade area.
  - Leisure / general – up 8,500sq.m over 2013-28 period in the total trade area.
  - Food Retail – up 18,600sq.m over 2013-28 period in the total trade area.

SUPPORTABLE FLOORSPACE CAPACITY (SQ.M GLA)

	Food Retail	Food Catering	Apparel	Home-w ares	Leisure/ General	Retail Services	**Total Retail**
Primary Trade Area:							
2013	17,407	5,962	10,270	5,570	7,124	2,355	**48,688**
2018	18,139	6,033	9,556	4,933	7,409	2,225	**48,295**
2023	19,297	6,486	10,242	5,337	7,941	2,370	**51,673**
2028	21,343	7,369	11,584	6,117	8,981	2,656	**58,050**
Main Trade Area:							
2013	53,927	18,810	32,667	18,061	22,813	7,703	**153,980**
2018	56,882	19,250	30,725	16,184	24,010	7,364	**154,415**
2023	60,003	20,523	32,652	17,363	25,511	7,775	**163,827**
2028	65,312	22,961	36,374	19,594	28,392	8,575	**181,208**
Total Trade Area:							
2013	72,151	24,457	41,921	23,217	29,567	9,766	**201,080**
2018	76,644	25,196	39,686	20,935	31,320	9,392	**203,173**
2023	82,009	27,215	42,705	22,744	33,713	10,036	**218,423**
2028	90,844	30,935	48,301	26,063	38,122	11,233	**245,498**

Source: Urbis

CINEMA CAPACITY

KEY INSIGHTS

- Our assessment of cinema capacity within the total trade area suggests that approximately 10 screens could currently be supported in the trading area.
- While there are no cinemas within the trade area itself, the 8-screen cinema complex at Hoyts Garden City, and the 4-screen complex at Hoyts Fremantle would currently be catering to part of this demand within the trade area
- Given that the catchment for this cinema would extend further south than the trade area for the retail centre does (there are no cinemas to the south before Rockingham) there is likely capacity for a 6-7 screen cinema offering integrated into the food and beverage precinct.

CINEMA CAPACITY ANALYSIS

	2018	2023	2028	2033
Trade Area Population	105,950	111,700	119,980	126,684
Australia Capital City Average Per 100k People	*9*	*9*	*9*	*9*
Supportable Screens	9.5	10.1	10.8	11.4

Source: Urbis

SECTION FIVE
IMPACT ASSESSMENT

IMPACT ASSESSMENT METHODOLOGY

Impact Assessment Overview

An impact assessment is expected to provide an indication of the trading environment and average trading conditions within which retailers operate, and implications for likely turnover declines or gains on average for the retailers involved.

Key Assumptions of an Assessment

Because an impact assessment forecasts how groups of people are likely to alter their shopping behaviour in response to a given change in the competitive environment, it is not possible to estimate individual retailer impacts or each group of retailers in each location.

Therefore in any impact assessment of this type it is not possible to estimate impacts on any specific individual retailer. The impact on any one individual retailer or any small group of retailers in a given location would depend on many factors (e.g. retailer profitability), some of which are within their control. The actions which each of these retailers take will determine the eventual impact on each, and furthermore the actions which they each take will also determine the eventual impact on the other retailers involved.

All of these factors need to be kept in mind when considering the likely impact of any relocation and expansion of a retailer within the existing retail network. Existing retailers are not passive participants but rather will play a major role in the eventual impact which they will experience.

Shopper behaviour is related to the satisfaction of particular requirements. Decisions made regarding where to shop are based on a number of judgements, including relative accessibility, availability of particular retailers, convenience, variety, carparking and others. As a result, residents like to spread their purchases across a wide variety of shopping centres and areas, and use the full range of facilities available to satisfy particular needs.

The method of analysis used to assess the impacts on individual centres from a retail development is based on a 'competitive usage' model. This model is based on the principle that if shoppers choose to direct some of their retail expenditure to the subject development proposal, then they will reduce their expenditure at other centres in a similar proportion to their usage of each centre or location (reflected by each centre's market share from the various trade area sectors). In assessing the potential impacts on other centres in the hierarchy we have adopted a 'turnover allocation approach'.

The assessment of impacts on specific retail centres relies upon an understanding of the existing turnover and level of usage of centres in the trade area and beyond. The model estimates the degree to which various shopping locations within and beyond the trade area are used for retail shopping, by allocating a proportion of turnover to each trade area sector (i.e. source of sales). These estimates result in market share calculations for each competitive centre, and thereby form the basis of which the impact of the proposed retail development is distributed to all other centres used by residents of the trade area for retail shopping. This is commonly referred to as the 'one-off' impact.

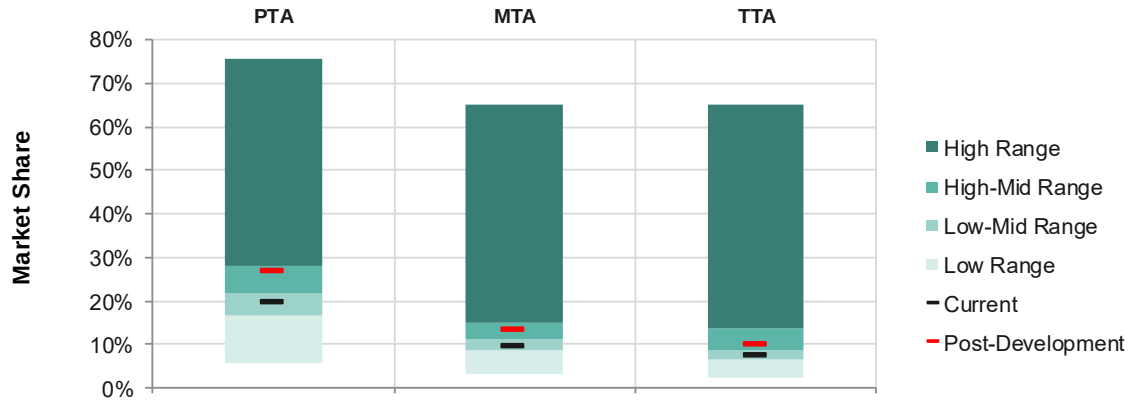
It is also relevant to consider the dollar impacts in relation to the turnover that would potentially be generated by these and other shopping centres over the intervening period. The impact analysis therefore details the turnover change, or net impact, which is expected for each centre/location, expressed as a reduction in turnover and as a percentage of the turnover level for each centre.

CENTRE FORECASTS

KEY INSIGHTS

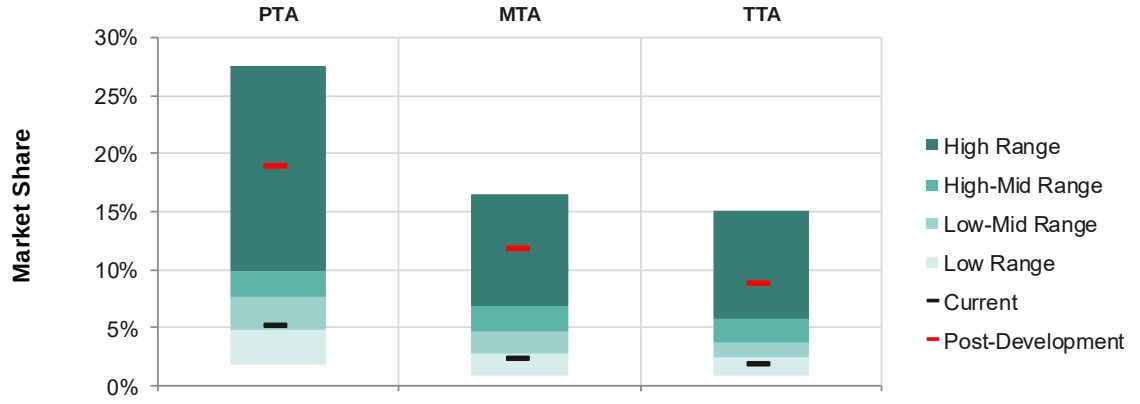
- Currently, the activity centre is estimated to have a low level of food retail and food catering market share compared to other sub-regional centres across Australia (being in the lowest quartile for both categories across all catchment boundaries).
- Following the redevelopment, market shares are expected to increase substantially for food catering while food retail is likely to remain in the lower bands post-development given the relatively small increases in this category.
- The relatively high food catering market share reflects the expected limited offering within other centres.

FOOD RETAIL BENCHMARK, SUB-REGIONAL CENTRES



Source: Urbis

FOOD CATERING BENCHMARK, SUB-REGIONAL CENTRES



Source: Urbis

CENTRE FORECASTS

KEY INSIGHTS

- Overall, retail market shares at the Kardinya Park Activity Centre are expected to increase substantially for food catering floorspace in the primary trade area, with total centre shares increasing from 5.2% to 17.7% in the primary catchment post development.
- Total retail market shares are expected to grow from 15.5% to 20.8% in the primary catchment following the development.
- The centre is additionally expected to benefit from trade outside the catchment related to workers, students and other visitors to the centre in addition to resident growth.

MARKET SHARES, KARDINYA PARK SHOPPING CENTRE

	Food Retail	Food Catering	Apparel	Home-w ares	Bulky Goods	Leisure/ General	Retail Services	**Total Retail**
Primary								
Current TO	19.6%	5.2%	21.3%	12.7%	4.3%	8.1%	41.7%	**15.5%**
No Development (2030)	19.3%	5.0%	20.8%	12.4%	4.2%	7.9%	40.8%	**15.1%**
Development (2030)	25.2%	17.7%	20.0%	16.6%	2.7%	15.9%	55.1%	**20.8%**
Total Trade Area								
Current TO	7.6%	1.8%	9.8%	5.7%	1.9%	3.7%	16.1%	**6.3%**
No Development (2030)	7.4%	1.8%	9.4%	5.5%	1.9%	3.5%	15.7%	**6.0%**
Development (2030)	10.1%	8.7%	9.5%	7.7%	1.3%	7.4%	22.2%	**8.9%**

Source: Urbis

FORECAST SPENDING, KARDINYA PARK SHOPPING CENTRE

	Food Retail	Food Catering	Apparel	Home-w ares	Bulky Goods	Leisure/ General	Retail Services	**Total Retail**
Primary								
Current TO	34	2	7	3	2	4	6	**57**
No Development (2023)	41	3	9	4	2	4	7	**70**
Development (2023)	53	10	9	5	1	9	9	**96**
Total Trade Area								
Current TO	55	3	14	6	3	7	9	**97**
No Development (2023)	66	4	17	8	4	8	11	**118**
Development (2023)	90	20	17	11	3	18	16	**174**

Source: Urbis

INDICATIVE CENTRE PERFORMANCE

KEY INSIGHTS

- The turnover of each relevant impacted centre has been estimated using a combination of available published data from the Property Council's survey of shopping centres and from annual reports.
- Where published data was not available, Urbis retail benchmarks were used to generate a turnover volume consistent with other centres with same components (e.g. single supermarket based centres, single DDS based centres).
- The turnover per square metre of GLA does not necessarily imply whether a centre is trading well given it is influenced by the tenancy mix. However, relevant centres are, on average, seen to be trading above Australian benchmark levels. Thus, the impact of the proposed expansion is considered to be less significant than it would for a lower performing centre.
- It should be noted that the Murdoch specialised activity centre features an indicative level of current turnover which is comprised of the small retail offering currently on the Murdoch university campus.

KEY IMPACTED CENTRES

	Current (2019)		
	Estimated Retail Turnover ($M)	Retail GLA (sq.m)	Turnover per Sq.m of GLA ($)
Kardinya Park	***108.1***	***15,223***	***$7,103***
Strategic Metropolitan Centre			
Fremantle Town Centre	459.1	65,023	$7,061
Specialised Activity Centre			
Murdoch Specialised Activity Centre*	12.1	1,500	$8,067
Secondary Centre			
Garden City	610.2	58,615	$10,410
Cockburn Gateway	361.7	44,825	$8,068
District Centre			
Stockland Bull Creek	105.5	16,209	$6,509
Livingston Marketplace	101.7	15,541	$6,544
Melville Plaza	87.0	8,627	$10,086
Phoenix Shopping Centre	110.1	20,826	$5,287
Stammers Shopping Centre	81.4	8,748	$9,305
Neighbourhood Centre			
North Lake Road	34.3	3,136	$10,938
Coolbellup Shopping Centre	60.3	6,700	$8,997

Source: Urbis

TURNOVER IMPACTS, 2030

KEY INSIGHTS

- Impacts on competing centres in 2030 are expected to be relatively modest, with the Fremantle Town Centre, and Garden City expected to experience the largest turnover impact (in dollar terms) due to the food and entertainment offerings in these centres.
- In smaller centres, the impacts are relatively subdued due to the proposed floorspace increases predominantly being in the retail specialties and food catering categories.
- The Kardinya Park expansion is unlikely to undermine the future development of the Murdoch Specialised Activity Centre, given fact that a large portion of expenditure the Murdoch development will capture will be from students, and workers in the future commercial development within the precinct.
- There are expected to be additional impacts than those identified in the table. This relates to spending impacts on, for instance, retailers in the Perth CBD and smaller centres.

IMPACT ON COMPETING CENTRES, 2030

	Est. Retail Turnover ($M)			Turnover ($M)		Impact (%)	
	Current 2019	Pre-Dev 2030	Post-Dev. 2030	Current 2019	Pre-Exp 2030	Current 2019	Pre-Exp 2030
	(1)	(2)	(3)	(4)=(3)-(1)	(5)=(3)-(2)	(6)=(4)/(1)	(7)=(5)/(2)
Kardinya Park	***108.1***	***126.2***	***195.4***	***+87.3***	***+69.2***	***+80.7%***	***+54.8%***
Strategic Metropolitan Centre							
Fremantle Town Centre	459.1	487.5	480.3	+21.2	-7.1	+4.6%	-1.5%
Specialised Activity Centre							
Murdoch Specialised Activity Centre*	12.1	170.6	167.7	+155.6	-2.9	+1286%	-1.7%
Secondary Centre							
Garden City	610.2	1008.8	994.2	+384.0	-14.6	+62.9%	-1.4%
Cockburn Gateway	361.7	457.5	452.4	+90.7	-5.1	+25.1%	-1.1%
District Centre							
Stockland Bull Creek	105.5	128.9	124.2	+18.7	-4.7	+17.8%	-3.6%
Livingston Marketplace	101.7	123.0	122.1	+20.5	-0.9	+20.1%	-0.7%
Melville Plaza	87.0	97.8	94.7	+7.7	-3.1	+8.9%	-3.2%
Phoenix Shopping Centre	110.1	145.0	140.5	+30.4	-4.6	+27.6%	-3.1%
Stammers Shopping Centre	81.4	93.6	90.7	+9.3	-2.9	+11.4%	-3.1%
Neighbourhood Centre							
North Lake Road	34.3	39.4	38.1	+3.7	-1.3	+10.9%	-3.4%
Coolbellup Shopping Centre	60.3	71.7	68.9	+8.6	-2.8	+14.3%	-4.0%

**The 'current' offering at the Murdoch specialised activity centre is the existing IGA express within the university campus, and the associated food & beverage offerings.*
Source: Urbis

EMPLOYMENT GENERATION

KEY INSIGHTS

- Employment opportunities within the main trade area are somewhat limited, with most residents travelling outside of the catchment to work in major employment centres in Fremantle or inner Perth.
- An expansion of floorspace in the local area however allows more people to be employed closer to home.
- During the construction phase, the development is likely to yield approximately 620 construction jobs (in terms of full-time equivalent job years) given the substantial level of investment ($118m). This includes approximately 150 direct jobs.
- In terms of ongoing jobs, the retail expansion is likely to yield an additional 395 jobs. The non-retail uses are expected to support approximately 350 additional jobs in the centre.
- It should be noted that this development impact does not include the residential development that is likely due to occur following the increase in residential zoning on 51ha of residential land surrounding the activity centre, which will involve the development of 1,856 new dwellings (1,216 net dwellings).

CONSTRUCTION PHASE EMPLOYMENT

Impact Summary	Direct Effect	Supply-Chain Effect	Consumption Effect	Total Effect
Output ($M)	$118.2	$134.5	$56.3	$309.1
Employment (Jobs)	150	307	163	620
Wages and Salaries ($M)	$11.7	$28.0	$12.7	$52.5
Value-added ($M)	$24.9	$51.1	$29.8	$105.8

Source: Urbis, Remplan

ESTIMATED ADDITIONAL ONGOING EMPLOYMENT

Expansion Category	Land Use	SQ.M Per Employee	Expansion Floorspace	Estimated Jobs
Retail Expansion	Shop Retail	29	11,468	395
Commercial Office/Medical/Other Non-retail	Commercial	27	8,237	305
Cinema	Entertainment	93	4,100	44
Motor Vehicle Repair / Car Wash	Service	115	355	3
Total Jobs		**32**	**24,160**	**745**

Source: Urbis, DPLH Perth Land Use and Employment Service

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Appendix 2 - Stantec Traffic Impact Assessment

Revised Kardinya Activity Centre Structure Plan

Transport Impact Assessment

Prepared for: Dato Holdings Pty Ltd

Ref: 304900178 / CW1087800 | Date: 18 December 2023

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
A	14/01/2022	Draft	AT / BS	SJL		
B	25/01/2022	For Issue	BS	SJL		
C	18/12/2023	Updates	DR	BS	SJL	

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Acknowledgment of Country

In the spirit of reconciliation, Stantec acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples.

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1. Introduction

1.1 Background

Dato Holdings Pty Ltd has commissioned Stantec now Stantec to prepare a Transport Report in support of the Structure Plan for the Kardinya Activity Centre. This report has been prepared to complete the 'Movement' component of the Structure Plan, in accordance with *State Planning Policy 4.2 Activity Centres for Perth And Peel*.

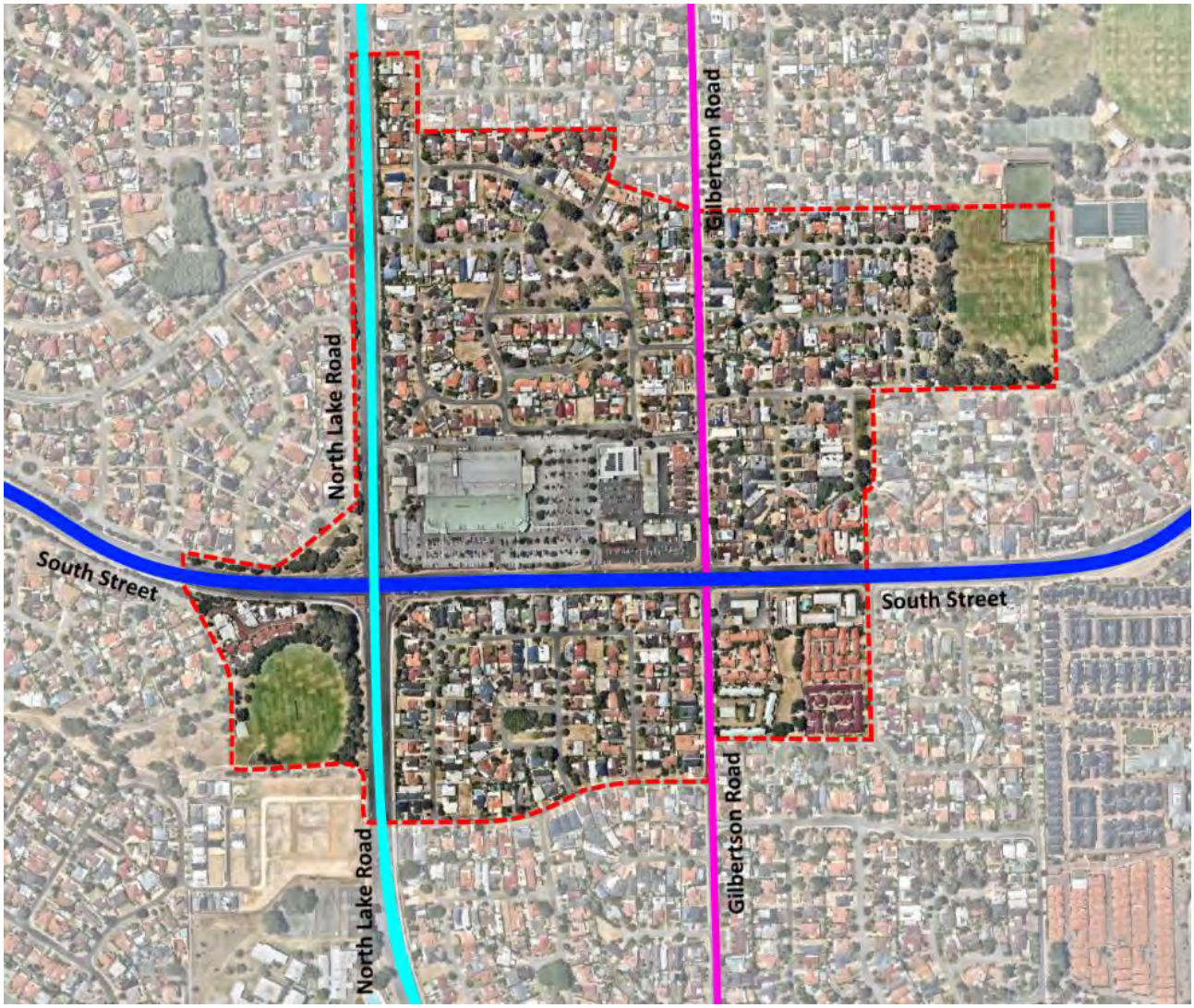
This report includes consideration of transport requirements, opportunities, constraints and assessment of potential future development scenarios both in the medium and long-term.

1.2 Activity Centre Context Plan

Kardinya Activity Centre is located within the City of Melville, 1.5km to the west of Murdoch University, 2km east of O'Connor Industrial Area, approximately 14km south of Perth CBD, 6.5km east of Fremantle.

The proposed structure plan includes the expanding Kardinya Shopping Centre, as well as the area in the vicinity which currently comprises commercial development and residential neighbourhoods.

Figure 1-1 Kardinya Activity Centre Site Location



Source: Metromap 2021

1.3 Points of Arrival

The points of arrival experienced by visitors to the Activity Centre is influenced by their chosen transport mode. As such, the key entrance locations should be designed to accommodate the desired transport modes.

1.3.1 Private Vehicles

The main approach routes to the Kardinya Activity Centre includes South Street from the west and east, and North Lake Road from the north and south. South Street bisects the Activity Centre and is a preferred route for local traffic accessing the Activity Centre as it is connected to the Kwinana Freeway further east.

Gilbertson Road acts as a local distributor, connecting residential areas with the major road links.

1.3.2 Public Transport

The Activity Centre benefits from excellent opportunities for public transport services, with bus stops located along South Street, connecting major attractors outside of the Activity Centre. These bus stops, and the pathways in their immediate vicinity define the point of arrival for public transport trips.

1.3.3 Pedestrians and Cycling

The existing environment along the Primary Road network is not conducive to pedestrian and cycling trips for the majority of purposes. These roads are hostile for on-road cycling and have limited provision within the verge area to attract active transport users.

As such, active transport to the Activity Centre is expected to be dominated by short-distance trips from the adjacent residential catchments. Key points of arrival are therefore related to crossing points at intersections and mid-block.

1.4 Key Sites

Key sites within the Activity Centre core include the Kardinya Shopping Centre and adjacent commercial developments. These sites are located on the north and south side of South Street.

2. Existing Situation

2.1 Road Network

The road classification within proposed Kardinya Activity Centre has been extracted from MRWA Road Information Mapping System, as shown in **Table 2-1**.

Table 2-1 Road Hierarchy

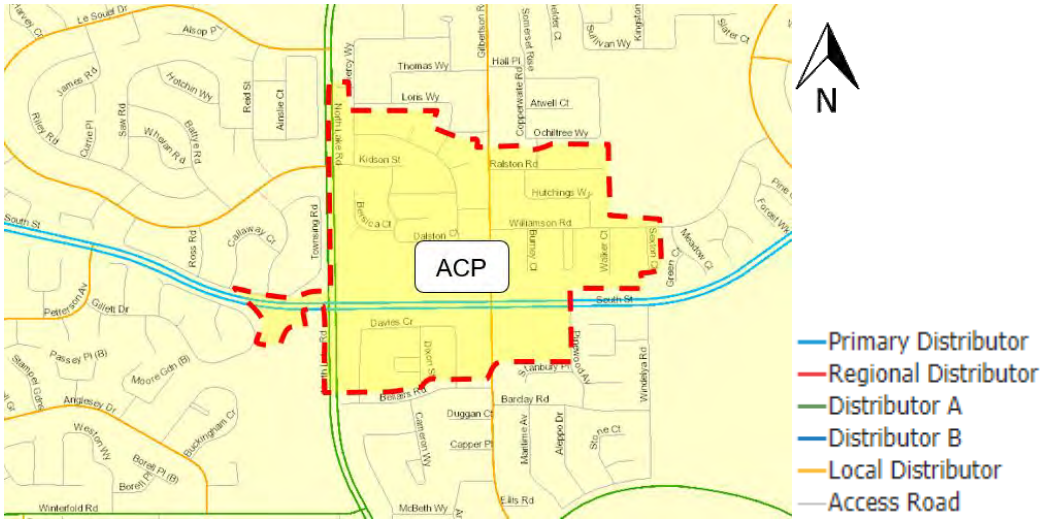
Street Name	MRFH Category
South Street	Primary Distributor
North Lake Road	Distributor A
Le Souef Drive	Local Distributor
Gilbertson Road	Local Distributor
Other Roads	Access Road

These road hierarchy definitions have been extracted as follows:

- Primary Distributors: Provide for major regional and inter-regional traffic movement and carry large volumes of generally fast-moving traffic. Some are strategic freight routes and all are State Roads. They are managed by Main Roads Western Australia.
- Regional Distributor: Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by local government.
- District Distributor A: Carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- District Distributor B: Perform a similar function to type A District Distributors, but with reduced capacity due to flow restrictions caused by frequent property accesses and roadside parking in many instances. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between built up area land-use cells and generally not through them, forming a grid which would ideally space them about 1.5 kilometres apart. They are managed by Local Government.
- Local Distributors: Carry traffic within a cell and link District Distributors or Primary Distributors at the boundary, to access roads. The route of Local Distributors should discourage through traffic so that the cell formed by the grid of higher order distributor roads, only carries traffic belonging to, or serving the area. Local Distributors should accommodate buses, but discourage trucks. They are managed by Local government.
- Access Roads: Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. In urban areas, these roads are bicycle and pedestrian friendly, with aesthetics and amenity also important. Access Roads are managed by local government.

Figure 2-1 shows the MRWA Road Hierarchy map for Kardinya Activity Centre.

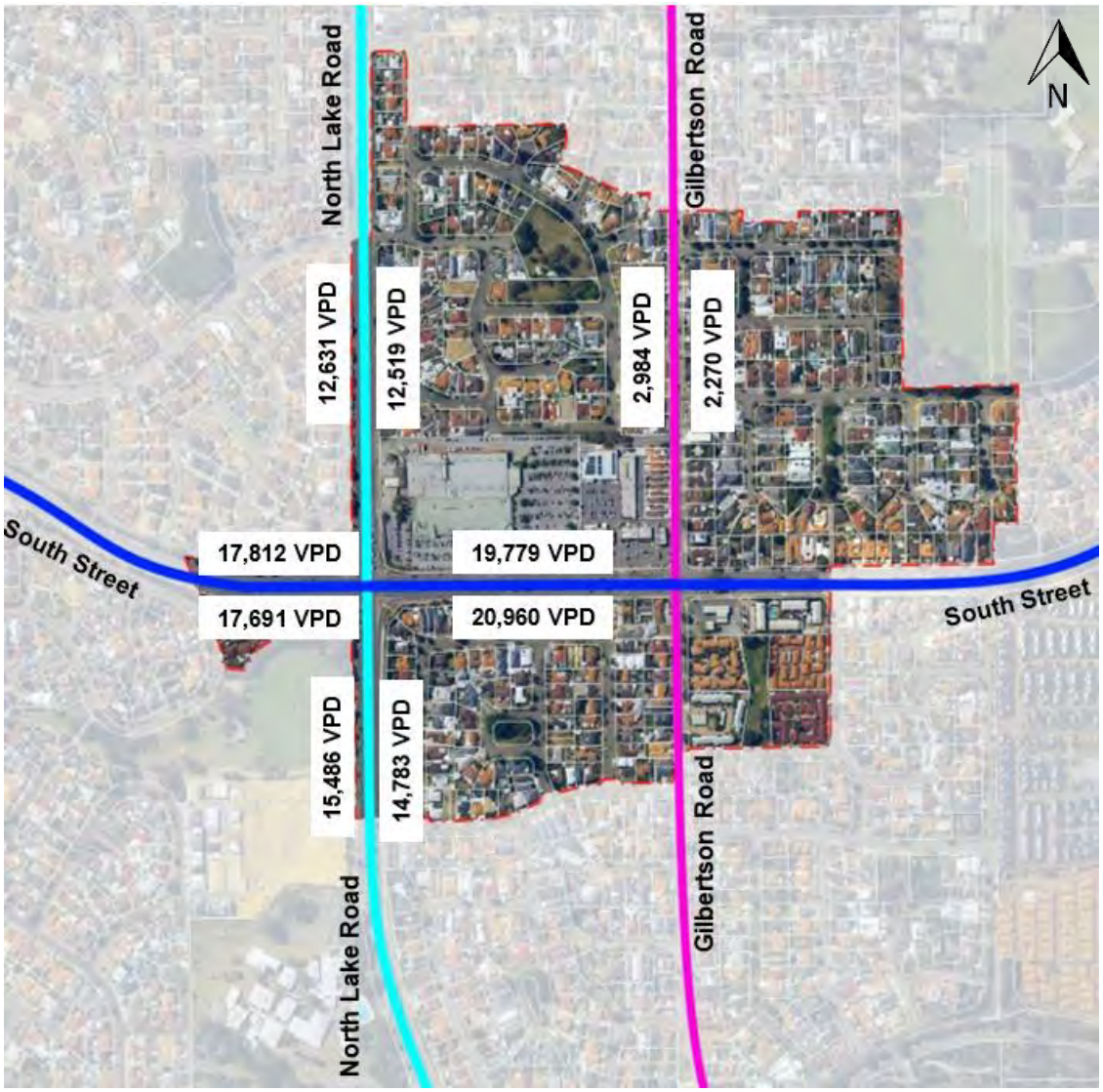
Figure 2-1 Main Roads Functional Road Hierarchy



2.2 Traffic Volumes

The existing traffic volumes has been obtained from Main Roads WA Traffic Map, as shown in **Figure 2-2**.

Figure 2-2 Existing Traffic Volumes



Source: Metromap & Traffic Map

2.3 Transport Mode Share

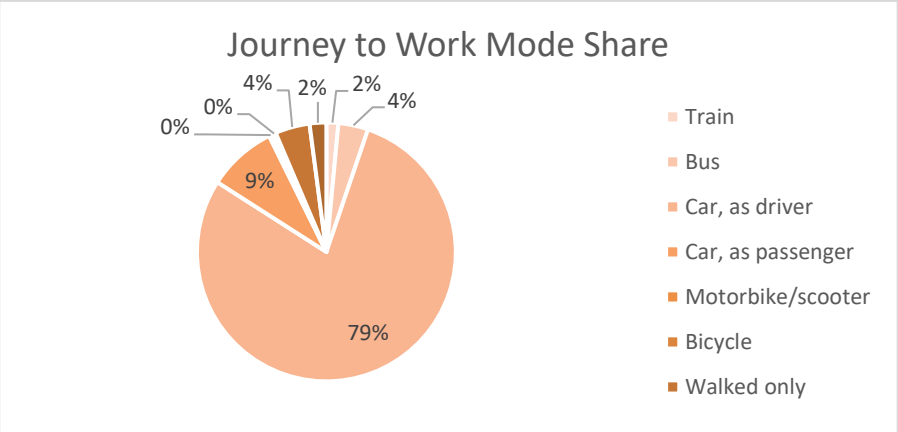
2.3.1 Employees

The existing journey to work transport mode share pattern for the Murdoch – Kardinya area was obtained from Australian Bureau of Statistics 2016 (ABS) is shown in **Figure 2-3**.

Based on the census data, approximately 88% of the existing "journey to work" trips are by private vehicle, either as a driver or passenger, and only approximately 6% by public transport along with small percentage of active transport mode share. These percentages only include those who physically go to work and do not include those who work from home or did not work on the day of ABS survey being carried out.

It should be noted that this data represents the "employee" as residents of Murdoch – Kardinya, who do not necessarily work within Murdoch – Kardinya area.

Figure 2-3 Journey to work Mode Split (Murdoch-Kardinya)



2.3.2 Residential Journey to Work

The transport mode share for existing residents in Murdoch - Kardinya has been extracted from ABS Census data (2016). While "journey-to-work" does not represent the entirety of travel, it is the dominant trip purpose both during the peak period and across the day. Based on the data from Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07) and NSW 2008/09 Household Travel Survey Summary Report 2010 Release, both of the documents have the similar distribution of trips purpose. The studies also reported that work related trips have the highest proportion of 33% in between peak hours compared to other mode shares. These distribution percentages are being implemented in this case to illustrate the mode of transportation in Murdoch - Kardinya (refer to **Table 2-2** below). Further discussion is shown in **Section 7.3**.

Table 2-2 Mode of Transportation (Kardinya)

Car as Driver Trips by Purpose (approximate)*	Work	Education	Other
Daily	20%	15%	65%
Peak hours	33%	14%	53%

Employee journey to work presents the greatest opportunity for mode shift during the peak hours as it typically occurs regularly and at a consistent time of day. However, journey to work would only make up to approximately 20% of the total daily destination trip. Conversely the travel behaviour of shoppers is generally more constrained by external factors, such as route choice, trip chaining requirements and infrequent and unfamiliar destinations. Mode shift opportunity for Education/School trips are also restricted by external factors.

2.3.3 Future Mode Share

A target private vehicle mode share has been established for these "journey to work" trips: decreasing from 88% (current) to 73% (future) in line with similar Activity Centre locations. This change is related to expected improvements in public transport infrastructure, and the effects of densification and parking constraint on residential household behaviour.

To accommodate the shift from driving within a private vehicle to public and active transport modes, as well as the overall growth in travel demand for the ACSP, improvements in sustainable transport provision are recommend in **Section 3** and **Section 4**.

3. Proposed Developments

A projected development scenario has been described by the Kardinya ACSP, consisting of intensification of existing retail development and residential land uses, as follows:

- The progressing expansion of Kardinya Shopping Centre to provide approximately an additional:
  - 6,000 m2 non-retail floorspace
  - 4,000 m2 shop/retail floorspace
- Residential densification resulting in a projected net increase of approximately 400 dwellings by 2031 (35% of the total ACSP projected residential dwelling increase)

This Transport Report has been undertaken to determine the needs of the potential mix of land uses, and the associated broad-scale traffic impacts of intensification in this area. The distribution of these land uses is described in the ACSP, and shown below, **Figure 3-1**.

Figure 3-1 Proposed ACSP Land Uses

Source: Kardinya Activity Centre Structure Plan

4. Public Transport

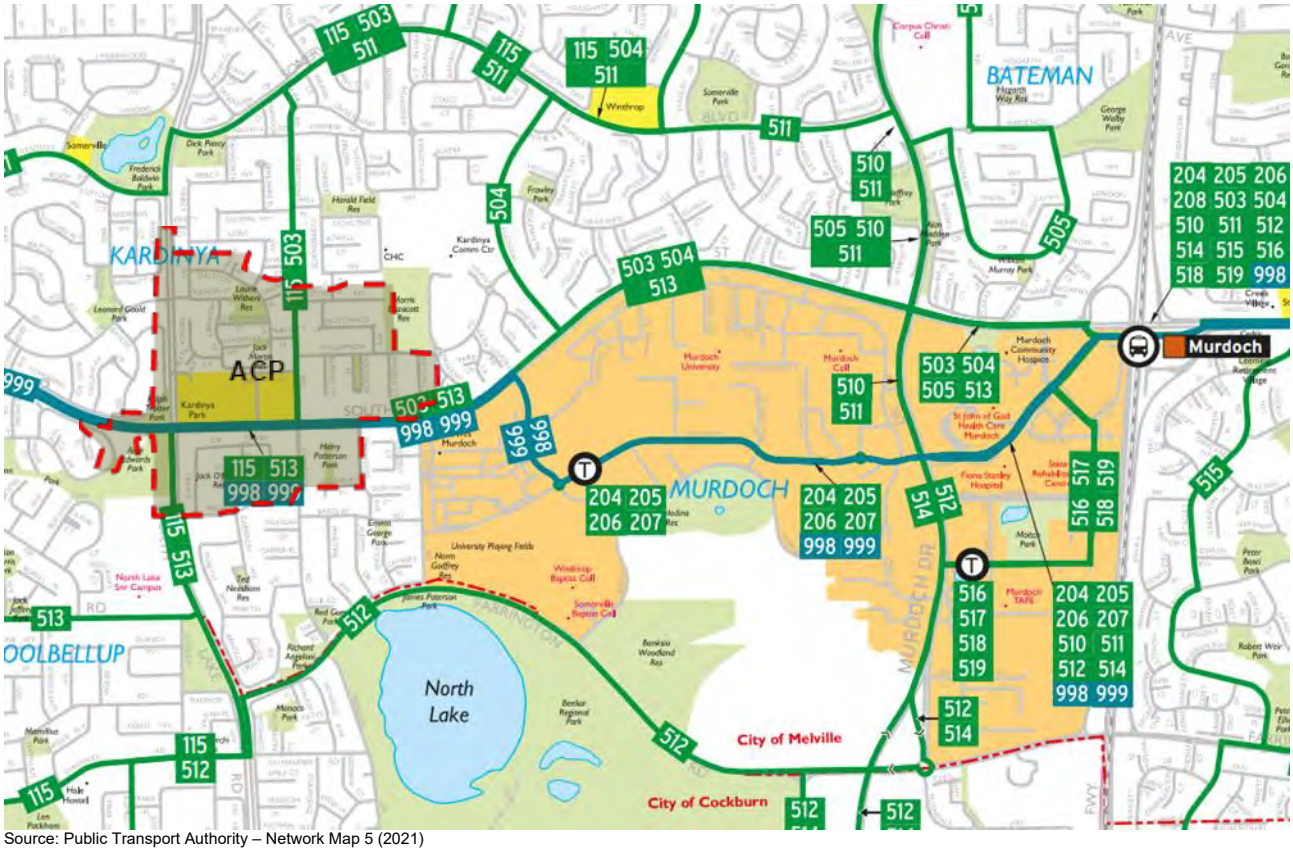
4.1 Existing Public Transport Facilities

The existing public transport facilities in the vicinity of the Activity Centre are shown in **Figure 4-1**. The Activity Centre is serviced by Bus Route 115, 503, 513, 998 and 999, which provides connection to Fremantle, Murdoch Station, Bull Creek Station, and South Perth. The existing bus service frequency is described in **Table 4-1**.

The nearest train station (Murdoch Station) is located approximately 2.5km east of the Activity Centre and provides a north-south regional connection along the Mandurah train line.

Overall, the Site benefits from excellent public transport services which are high frequency and easily accessible.

Figure 4-1 Public Transport Network



Source: Public Transport Authority – Network Map 5 (2021)

Table 4-1 Bus Services Frequency

Route	Frequency		
	Weekday Peak	**Weekday Off Peak**	**Weekend**
998	10 mins	15 mins	15-30 mins
999	10 mins	15 mins	15-30 mins
115	15 mins	20 – 30 mins	30 mins
503	10 – 15 mins	20 – 40 mins	N/A
513	15 mins	20 – 30 mins	60 mins

4.2 Regional & Structure Plan Public Transport Strategies

4.2.1 Short to Medium Term – Changing Travel Behaviour

The strategy for the short to medium term is to increase the use of the existing services, while allowing for new bus route along North Lake Road connecting Kardinya to catchments to the north and south.

To encourage public transport modes, a number of measures are proposed as part of the ACSP, including the provision of premium bus stops and improving service frequency. To fully support public transport modes as a viable and attractive alternative to private vehicles, **bus frequencies would need to be increased** to 10 mins during peak hour for bus Routes 513 and 115.

4.2.2 Short to Medium Term – Bus Stops improvement

The **construction of premium bus stops** with a larger seating and sheltered area than the existing standard bus stop on South Street would improve the quality of public transport amenity and enhance these points of arrival for PT users.

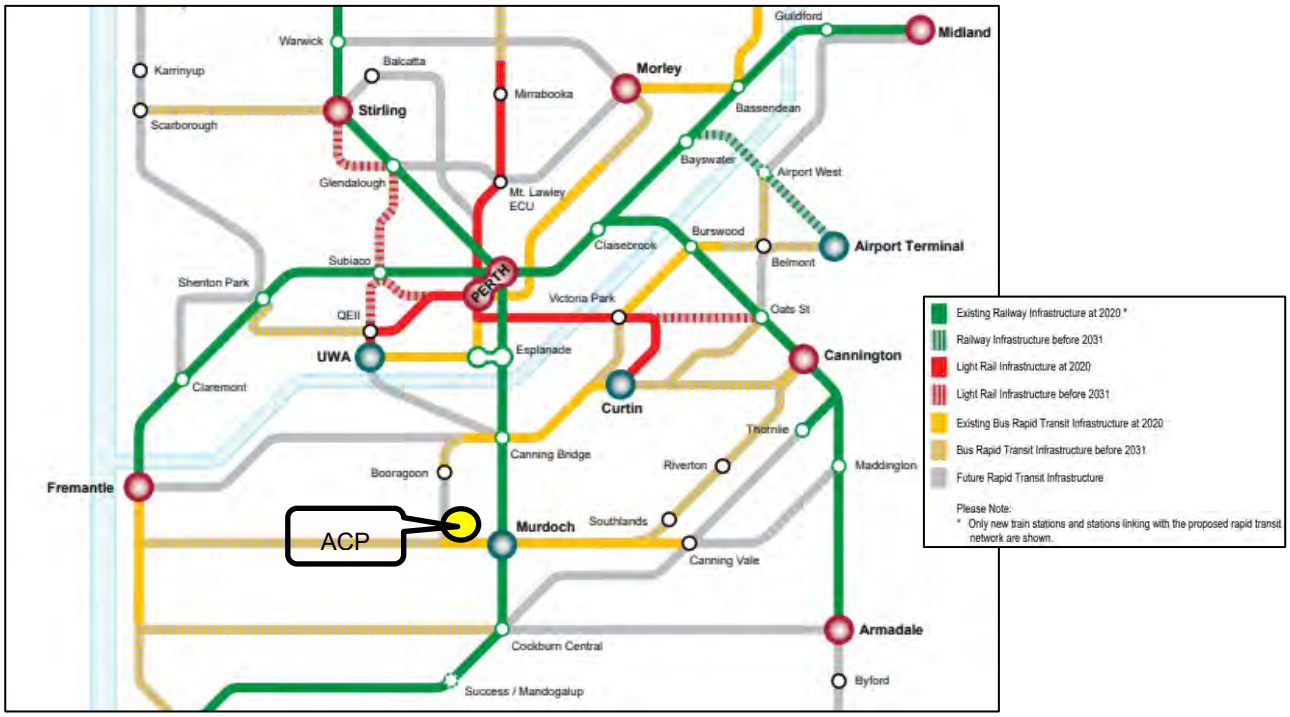
Relocation of the existing bus stop (number 10489) to the west has been proposed (currently located approximately 200m east of North Lake Road, along South Street) to provide improved access to the Kardinya Shopping Centre. Improvements at the new location, including at grade access for pedestrians into the shopping centre complex and infrastructure upgrades will increase pedestrian amenity and safety when accessing the bus stop. The proposal to relocate the stop closer to the North Lake Road intersection will promote increased use of the South Street / North Lake Road signalised intersection for improved pedestrian safety when crossing the 6 lane South Street carriageway.

4.2.3 Long Term – Bus Rapid Transit

The long-term plan for the ACSP reflects the Department of Transport's *Public Transport for Perth in 2031,* anticipating a **high-capacity public transport (BRT/LRT) route connecting Kardinya Centre with Murdoch Station**. It is expected that high frequency collector bus services would then connect users to this future express service, creating an efficient and attractive service for a wide range of trip purposes.

The future plan sourced from the *Department of Transport* is shown in **Figure 4-2**. The aim of rapid transit is to deliver something akin to a suburban light rail service. BRT would run on a limited stop, express service basis, providing a convenient, reliable service with as little interruption to journeys as possible. It is assumed BRT vehicles will have higher priority over traffic along the BRT route. This would entail provision of bus lanes and signal phasing that would allow bus priority through selected signalised intersections.

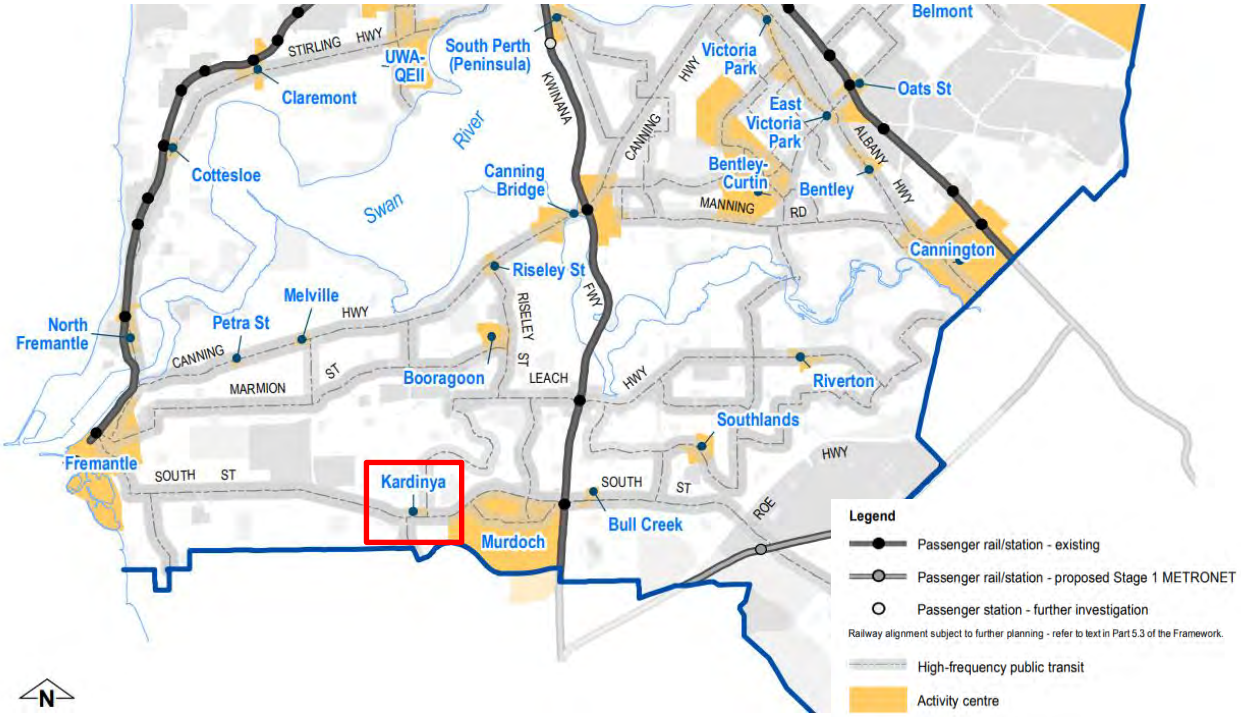
Figure 4-2 Future Public Transport Network Plan



Source: Department of Transport – Public Transport for Perth in 2031

The above changes are identified in **Figure 4-3** for public transport within the ACSP and surrounds.

Figure 4-3 Public Transport Infrastructure – Existing and Proposed



Source: Perth / Peel 3.5 million – Central Sub-regional Planning Framework March 2018

5. Active Transport

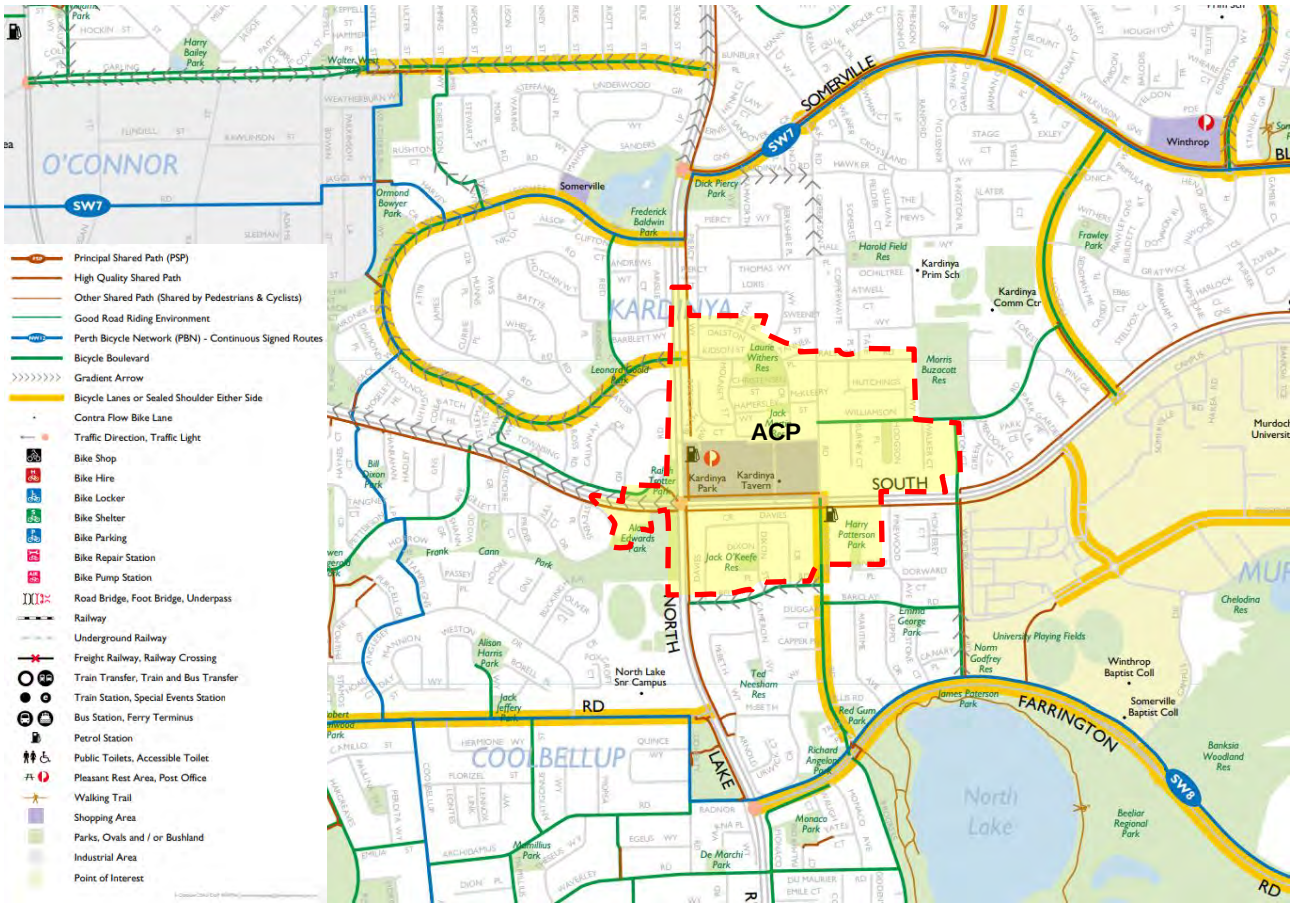
5.1 Existing Active Transport Provision

The cycle network in the vicinity of the Activity Centre is shown in **Figure 5-1** as defined by the Department of Transport's *Perth, Fremantle, and Stirling: Perth Bike Map.*

Shared paths exist along South Street and North Lake Road, provided rudimentary cycling access to and from the Site. The network of cycling facilities is discontinuous and compromised by the high-speed, high volume road environments of North Lake Road and South Street.

Beyond the immediate vicinity of the ACSP, on-road sealed shoulders and quiet streets support connection to regional cycling facilities to the Murdoch Activity Centre and Kwinana Freeway.

Figure 5-1 Cycle Network in the vicinity of the Site



Source: Department of Transport – Swan and Stirling Bike Maps

5.2 Structure Plan Active Transport Strategies

5.2.1 Pedestrian Access – Improved Pedestrian Servicing Across South Street

According to City of Melville's *Local Planning Strategy 2016*, the Kardinya ACSP is a key destination for north-south pedestrian movements across South Street. A significant volume of pedestrians currently cross South Street at-grade to access the Shopping Centre or adjacent bus stops. The lack of supportive crossing represents a safety risk and may have contributed to a fatal pedestrian crash in 2017.

To improve the pedestrian amenity and safety, **the bus stop** located approximately 200 metres east of North Lake Road is proposed to be moved approximately 100 metres to the west. Due to the rising grade along South Street, this new location will provide for the opportunity for direct pedestrian at grade access into the shopping centre via the covered multi-level car park structure. The relocated stop will also provide further incentive for pedestrians to utilise the signalised crossing opportunities at the intersection of South Street and North Lake Road, which already provides a safe and attractive pedestrian crossing facility, supporting non-car access to key destinations in the ACSP.

Correspondence received from the PTA indicated that they weren't opposed to the proposal and the design was modified to consider any comments and concerns made. Key issues that were accommodated were the ability to stack buses within the bus embankment and the ability for safe pedestrian access.

5.2.2 Cycling – TravelSmart Innovation ('Your Move')

Figure 5-2 Existing Bike Racks

The *City of Melville Bike Plan (2012)* sets out a strategic vision for the continued development and promotion of cycling including the initiation of TravelSmart innovations towards cycling. Some of the proposed strategic objectives include improved signage and line markings, cycling path replacements, resealing of shared paths and bicycle lanes at locations identified within the Plan.

Figure 5-3 Prioritised Proposed Projects

Source: City of Melville Bike Plan (2012)

The *City of Melville Bike Plan 2012* contains the following recommended infrastructure upgrades as prioritised project list:

- Upgrade of the South Street shared path to a wider cross section that allows 2m segregated cycle lanes and up to 3.5m shared paths. Also construct the missing link in the shared path on the southern side of South Street between Prescott Drive and Discovery Way; and
- Adding an additional commuter friendly PBN route along North Lake Road consist of mainly signs and markings, and upgrade of substandard sections of the shared path up to 3.5m width.

Work is currently taking place in collaboration between the Department of Transport and the City of Melville to determine a combined Long-Term Cycle Network (LTCN). This will form the basis for long-term decision-making on cycling infrastructure within the City and across the Perth Metropolitan Area.

6. Parking Calculation

6.1 Methodology

A parking demand assessment methodology has been completed for the non-residential land uses within the ACSP. This analysis includes an understanding of the influence of mixed-use development on internal trip containment and shared parking, creating a reasonable benchmark for *free and unconstrained* parking demand. This assessment has been used to inform the provision of parking, vehicle trip generation (and the impacts of traffic growth on the road network), and the requirements for sustainable transport.

6.2 Nomenclature

6.2.1 Parking Supply

Parking supply is the total quantum of parking spaces that are built or available within the study area, regardless of whether or not they are utilised. Parking supply only includes marked spaces and does not include areas designated for standing vehicles.

6.2.2 Parking Demand

Parking demand is the accumulation of vehicles parked within the study area at a point in time. Parking demand includes all parking associated with the associated land uses, whether in an off-street facility, parked illegally, parked on-street or in remote parking lots. Parking demand does not include standing vehicles awaiting the pick-up or drop-off of passengers.

6.2.3 Shared Parking

Shared parking is parking that is used by 2 or more land uses instead of restricting parking to the exclusive use of a single land use - the more exclusive the parking is, the less effective it becomes for the development as a whole.

6.2.4 Reciprocal Parking

Reciprocal parking occurs when a visitor has more than one purpose within an area and hence only one trip is required to serve two or more purposes. The degree of reciprocal parking occurring depends on the type of land use in the vicinity and the time of day.

The most important component to determine the rates of reciprocal parking is the proximity of the sympathetic land uses. As all development within the Kardinya ACSP is generally located within acceptable walking distances, and all parking within the precinct can be assumed to be publicly accessible, trips made within the precinct are expected to be largely undertaken by foot or by bicycle. This trips therefore do not require a parking space, and do not generate traffic impacts.

6.3 Anticipated Future Parking Demand

The calculated non-residential parking demand was determined using the methodology described above, with land use and dwelling yields as defined in the Kardinya ACSP.

6.3.1 Residential

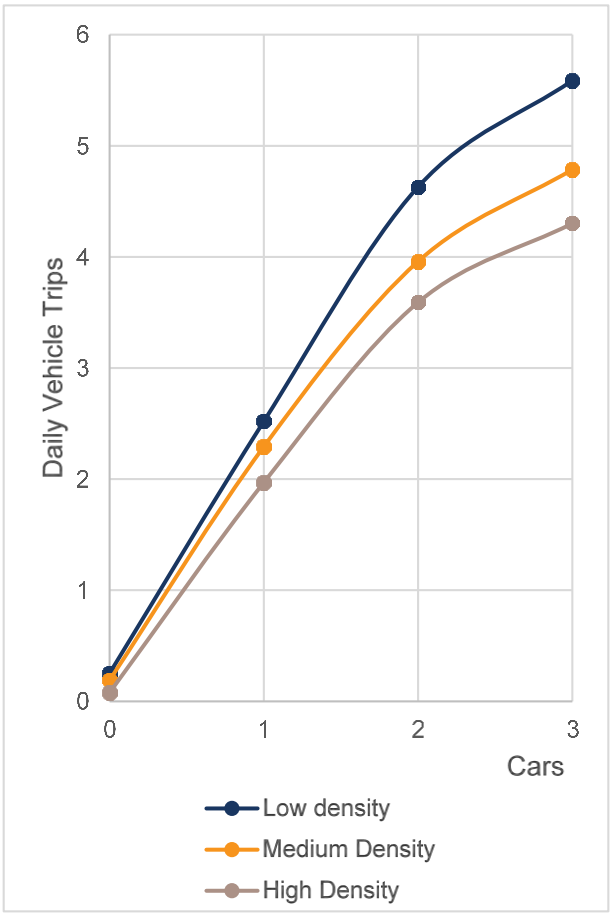
Residential parking within the Activity Centre is expected to be provided as per State Planning Policy 7.3. Whilst the Activity Centre's location in the regional context means that a high volume of regional traffic may be generated by residential development, resulting in a significant effect on local intersections, SPP7.3 allows for reduced parking in areas where there is a high level of access to high frequency of public transport such as Kardinya Activity Centre. This includes the need to only provide an average of 0.75 bays per 1-bedroom apartment and only 1 bay per apartment for dwellings with 2 or more bedrooms.

To further minimise the impact of traffic it is proposed to allow grouped dwellings within the activity centre to also have one dedicated car parking bay only.

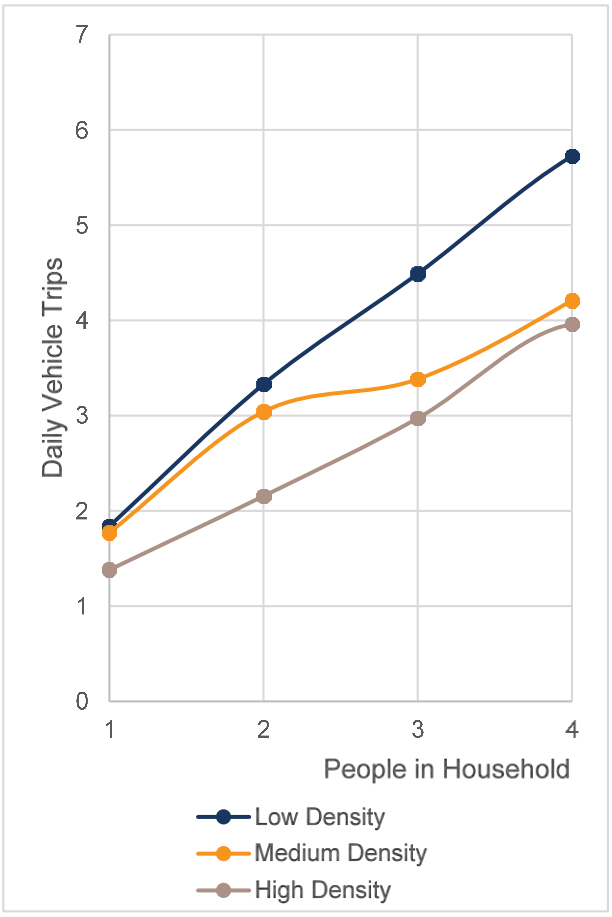
This would assist in supporting a sustainable transport environment by reducing private vehicle ownership by residents, resulting in a decrease in private vehicle mode share, vehicle trip generation and congestion. This effect is clearly illustrated by the results of the Victorian Integrated Survey of Travel and Activity (VISTA), as shown in **Figure 6-1** below.

Figure 6-1 Average Household Vehicle Trip Generation Rates (VISTA)

Vehicle Trip Generation by Car Ownership



Vehicle Trip Generation by Household Size



Source: Victorian Integrated Survey of Travel and Activity (VISTA)

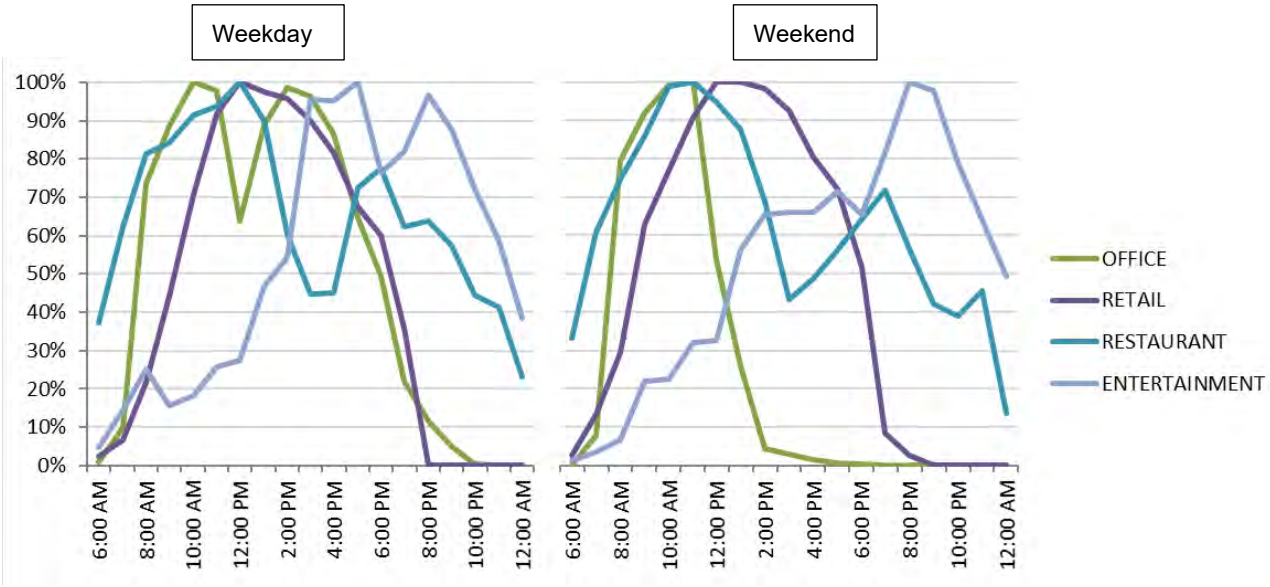
6.3.2 Commercial

It is expected that the parking demand rate for commercial will reduce as the commercial component within the ACSP expands. This is mainly due to greater opportunity for reciprocal and shared parking within the Centre and is consistent with experiences in major centres across Australia.

This effect is compounded by the influence of improved sustainable transport infrastructure, providing safe and attractive alternatives to driving for all trip purposes.

An assessment of the parking requirement for the land uses within the Activity Centre has been undertaken, including time-of-day profiles for parking generation, as shown in **Figure 6-2**.

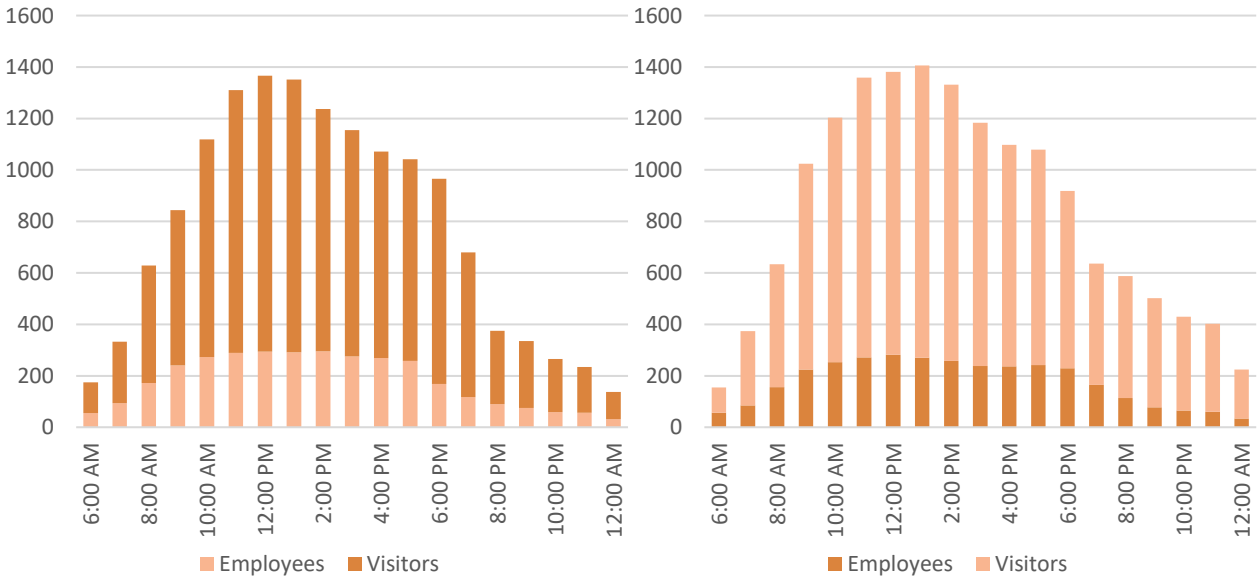
Figure 6-2 Time-of-day profile for Land Use Categories



Based on the information, an uncalibrated peak parking demand of approximately 1,200 parking bays over all commercial sites within the ACSP has been identified, suggesting that an ultimate non-residential parking supply of 1,350 on-street and off-street spaces would be sufficient (considering the efficiency of parking across the Precinct). This represents an average supply rate of approximately 5.2 spaces per 100sq.m, including all public and private supply.

The expected use of these bays is shown in **Figure 6-3**, for a typical weekday and weekend period.

Figure 6-3 Time-of-day utilisation by trip Purpose



Internal parking management would need to be designed to support this requirement, mainly through duration restrictions; but over time, paid parking and pricing mechanisms may be required to ensure operational efficiencies and encourage behaviour change.

This could also include a form of demand responsive pricing (DRP). That is, parking pricing levels set such that demand peaks at approximately 85-90% occupancy. This could involve different fees at different times of day, or different days of the week, and include a mechanism to modify prices on a periodical basis to maximise the utility of the parking.

By restraining parking supply through capacity restraint and timed parking, and in the longer term, paid parking, further activity growth in the precinct will be accompanied by expansion in non-car transport modes. This forms a sustainable development pattern that is consistent with the goals of the WAPC SPP 4.2: Activity Centres for Perth and Peel as well as the City of Melville's Sustainability Policy.

The balance between ensuring an accessible and viable shopping and behaviour change needs to be carefully managed and assessed regularly during the operational phase of the development.

As part of the DA approval for the Kardinya Shopping Centre redevelopment, a meeting with the Department of Transport was arranged where the department suggested a parking provision rate of around **4.2 bays/100m2** was appropriate. This rate has been applied consistently across large shopping Centres in Perth in an effort to minimise the excessive parking supply, as described in the *Department of Transport Parking Guidelines for Large Shopping Centres*.

For more information for the Kardinya Park Shopping Centre redevelopment, refers to the Development Approval Transport Impact Assessment.

7. Traffic Analysis

A desktop model of the Kardinya Activity Centre was developed in order to determine the impact of the planned development on intersection performances and road capacities. SCATS data for the signalised intersections was sourced from MRWA and supplementary traffic count data was used to determine the turning movements proportions at critical intersections in and around the Activity Centre.

7.1 Trip Generation

The 2033 trip generation for the Activity Centre is based on the land use and dwelling yields as defined by The Activity Centre Structure Plan.

The trip generation for the additional residential developments have been calculated utilising the trip generation rate suggested in the Institute of Engineering (ITE) trip generation manual.

The trip generation for commercial land uses have been calculated based on the *WAPC Transport Impact Assessment Guidelines Volume 5: Technical Guidance (2016).*

A summary of the ultimate dwelling yields is shown in **Figure 7-1**.

Figure 7-1 Projected Dwelling Yield by Block

Source: Kardinya District Centre – Activity Centre Plan December 2021 & City of Melville Intramaps

The AM Peak, PM peak daily traffic generation rates are shown in **Table 7-1**. The directional distribution is shown in **Table 7-2** and the total trip generation is calculated in **Table 7-3**.

Table 7-1 Trip Generation Rate

Project	Land Use	Source	Yield	AM Peak	PM Peak	Daily
				Per dwelling / Per 100sqm		
Additional ACP Residential Dwelling	Single Dwelling (R40, R60, R80)	RTA / ITE 210	1,177 Dwellings	0.5	0.5	5
	Residential (Mid Rise - KPSC)	RTA / ITE 221	78 Dwellings	0.4	0.4	4
	Commercial	WAPC	3,000 sqm	2.00	2.00	9.00

Table 7-2 Directional Distribution

Land Use	AM Peak		PM Peak		Daily	
	In	Out	In	Out	In	Out
ACP Residential	26%	74%	64%	36%	50%	50%
ACP Commercial	80%	20%	20%	80%	50%	50%

Table 7-3 Gross Total Estimated Trip Generation

Land Use	AM Peak		PM Peak		Daily	
	In	Out	In	Out	In	Out
Additional Residential Dwellings	183	436	377	212	2942	2942
Commercial	48	12	12	48	135	135

7.2 Reciprocal and Shared Demand for Non-residential Developments

The Activity Centre benefits from the proximity of residential, commercial, and retail uses, which promotes an internal walkable catchment that reduces the requirement for private vehicle transport. Additionally, a variety of retail and recreational uses in close proximity supports trip chaining, eliminating the need to make multiple car trips to fulfil daily tasks.

In order to capture the consistency between the parking demand calculations and trip generation calculation, a reduction was applied to account for these internal walking trips within the Kardinya Activity Centre.

Calculations from the Reciprocal Parking Model indicate the scale of internal trip capture for the future Centre, as shown in **Table 7-4**. This indicates the proportion of trips to and from the generators and attractors within the Activity Centre, which do not contribute any traffic to the road network.

Note that within this assessment, a reduction factor has only been applied to the component of traffic generated by non-residential developments within the Kardinya Activity Centre.

Table 7-4 Traffic Generation Reciprocal Factors (Non-residential developments)

Land Use	AM Peak	PM Peak	Daily
Proportion of Internal trip capture	16%	31%	26%

7.3 Transport Mode and Reciprocal Demand Factors

As discussed in **Section 2.3** it is expected that the private vehicles demand for both residents and employees within the Activity Centre will be significantly reduced.

As discussed in **Section 2.3.1**, the current mode share for journey to work to the Site is represented by 88% private vehicles. In the future, with public transport improvements and rising popularity of ride sharing services, an 18% private vehicle mode share shift is targeted, resulting in private mode share for journey to work of 70%.

This reduction would translate to approximately 6% mode shift for the existing 33% journey to work trip during peak hours.

The reduced traffic generation for each land uses within the Activity Centre is presented in **Table 7-5**.

Table 7-5 Kardinya Activity Centre Proposed Development Traffic Generation

Land Use	AM Peak	PM Peak	Daily
Residential Traffic Generation			
Residential (1,177 Additional Dwellings)	588	588	5885
Impact of Journey to Work Mode Shift	*-6%*		
Modelled Residential Traffic Generation	**553**	**553**	**5,486**
Non-Residential Traffic Generation			
Land Use	**AM Peak**	**PM Peak**	**Sat Peak**
Kardinya Park Shopping Centre (Full Redevelopment) – included in background traffic	634	1,710	2,133
Other Commercial Developments	60	60	120
Internal Trip Proportion	*16%*	*31%*	*26%*
Modelled Commercial Traffic Generation	**583**	**1,221**	**1,667**

7.4 Trip Distribution and Assignment

The nature of the traffic entering and exiting the network was disaggregated to assess whether the traffic was purely regional, purely local or a mix of the two, in which case a proportion of local traffic was determined. Vehicle trips were then distributed to the boundary road network.

The existing road use shows a high volume of regional trips currently using South Street and North Lake Road. This traffic is expected to increase in the short-term future as additional regional connections are made. It is expected however that over time, as population density increases and improved alternative transport modes and links are established, a shift away from the use of private car trips will result in a slowed or even a possible retraction in traffic growth over the longer term. Given that both aforementioned major roads bisect the Kardinya Activity Centre, this highlights the importance of proper long-term regional transport planning to support developments of this type.

The ACP has been divided into 4 zones of proposed residential developments for trip distribution as shown in **Figure 7-2**.

Figure 7-2 ACP Zoning Map

7.5 Traffic Operations Assessment

7.5.1 Key assumptions

Assumptions used in undertaking the SIDRA analysis are detailed below:

- The traffic volumes used in the analysis are from MRWA Traffic Map and Kardinya Shopping Centre.
- The future traffic growth rate of 1.65% per annum for South Street and 1% per annum for remaining roads have been adopted for future scenarios (2033 & 2050).
- Heavy vehicle percentage at South Street and North Lake Road was obtained from Traffic Map traffic data. The future scenarios are assumed to have similar proportion of heavy vehicles.
- For robust assessment, it is assumed that the peak traffic generation of developments within the ACP coincide with the adjacent road network peak periods (8:00AM & 4:00PM).

7.5.2 Intersection Performance

SIDRA outputs for each approach to evaluate the impact of the increased volumes anticipated for the ultimate development scenario (including background), are presented in the form of Degree of Saturation (DOS), Average Delay, Level of Service (LOS) and 95th Percentile Queue. A definition of these characteristics are as follows:

- Degree of Saturation (DOS): is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow, up to one for saturated flow or capacity. The theoretical intersection capacity is exceeded for an un-signalised intersection where DOS > 0.80;
- 95% Queue: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;
- Average Delay: is the average of all travel time delays for vehicles through the intersection. An un-signalised intersection can be considered to be operated at capacity where the average delay exceeds 40 seconds for any movement;
- Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. **Table 7-6** provides a description of the different levels of service.

Table 7-6 Level of Service (LoS) Performance Criteria

LOS	Description	Signalised Intersection	Unsignalised Intersection
A	Free-flow operations (best condition)	≤10 sec	≤10 sec
B	Reasonable free-flow operations	10-20 sec	10-15 sec
C	At or near free-flow operations	20-35 sec	15-25 sec
D	Decreasing free-flow levels	35-55 sec	5-35 sec
E	Operations at capacity	55-80 sec	35-50 sec
F	A breakdown in vehicular flow (worst condition)	≥80 sec	≥50 sec

For the purpose of this assessment, vehicle LoS is deemed acceptable if the intersection operated at a LoS E or better and the delays/queues generated by individual turning movements are not deemed to negatively impact adjacent intersections. These criteria are consistent with the intended operation of Kardinya Activity Centre with a focus on pedestrian connectivity and sustainable transport modes.

7.6 Impact of Future Volumes using Existing Intersection Geometry

SIDRA intersection operation analysis was undertaken for a series of critical intersections with peak hour traffic volumes determined through the desktop modelling process described above. Intersection was assessed for the ultimate demand scenario including redistribution of regional traffic. Restrictions on parking quantum were translated into peak demand reductions on a 1:1 proportional basis. For the purpose of this, locations assessed included the following intersections:

- North Lake Road / Access 1
- South Street / North Lake Road
- South Street / Access 3
- South Street / Main Street (Access 4)
- South Street / Gilbertson Road
- Gilbertson Road / Brophy Street
- Gilbertson Road / Williamson Road

SIDRA analysis will be conducted for the following scenarios:

- Scenario 1 – 2021 Background Traffic with existing intersection layout
- Scenario 2 – 2033 Background Traffic with growth + Completion of Kardinya Park Shopping Centre only
- Scenario 3 – 2033 Background Traffic + Completion of Kardinya Park Shopping Centre + 35% projected ACSP residential development
- Scenario 4 – 2050 Background Traffic with growth + Full ACSP Build-out
- Scenario 5 – 2050 Background Traffic with growth only

7.6.1 Scenario 1 – 2021 Background Traffic with existing intersection layout

The SIDRA analysis results of the current background traffic on the existing intersection layouts are outlined in the following sections.

7.6.1.1 South Street / North Lake Road Intersection

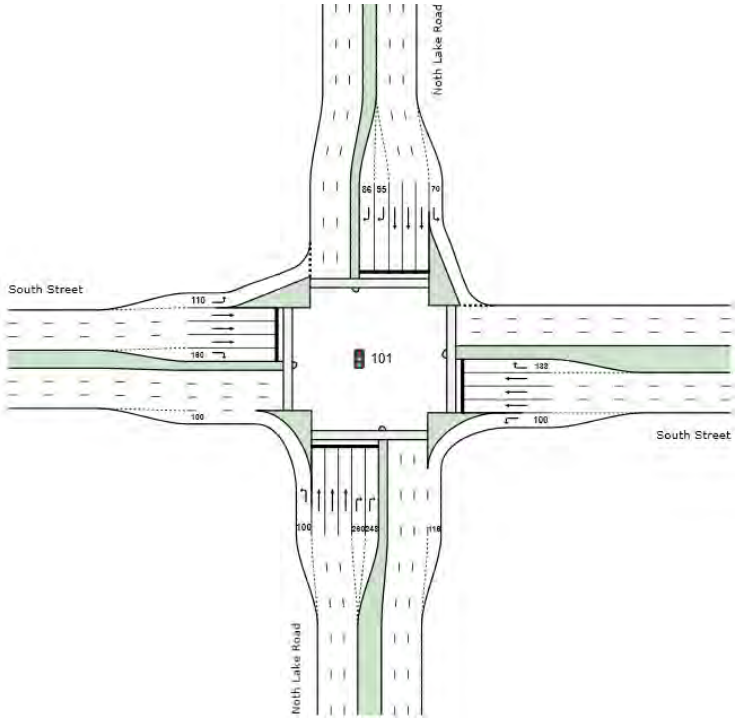
The South Street / North Lake Road represents a major entry point to the Activity Centre. Both South Street and North Lake Road currently carry large volumes of regional traffic. The existing South Street / North Lake Road intersection has three through lanes in each direction as well as additional dedicated turning pockets.

The SIDRA analysis for existing background traffic shown in **Table 7-7** indicates the intersection is currently performing within the acceptable level of service.

Table 7-7 SIDRA Analysis – South Street / North Lake Road – (Scenario 1-2021 Background)

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	L	0.157	6.7	A	0	0.11	6.7	A	0
	T	0.908	68.4	E	123	0.781	51.9	D	58.9
	R	0.855	65.3	E	87.8	0.855	64.4	E	61.7
East: South Street	L	0.185	6.7	A	0	0.258	6.7	A	0
	T	0.501	41	D	64.2	0.497	31.3	C	59.7
	R	0.726	44.8	D	28.2	0.682	31.7	C	32.4
North: North Lake Road	L	0.142	6.7	A	0	0.131	6.7	A	0
	T	0.4	46.6	D	40.4	0.852	56.6	E	68.3
	R	0.146	48.5	D	13.9	0.343	52.4	D	20.8
West: South Street	L	0.097	6.7	A	0	0.094	6.7	A	0
	T	0.907	70.2	E	110.7	0.824	50.2	D	84.4
	R	0.935	91.2	F	34.4	0.856	66.5	E	51.2
All vehicles		0.935	49.6	D	123	0.856	40.9	D	84.4

Figure 7-3 South Street / North Lake Road – Existing Intersection Layout



7.6.1.2 South Street / Main Street Intersection (Access 4)

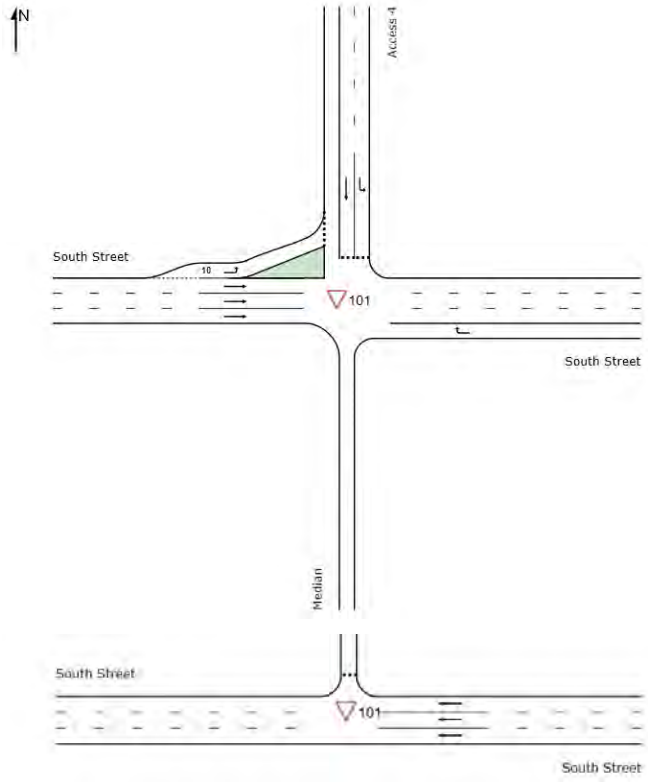
The existing South Street / Main Street intersection is a mid-block access point to the Kardinya Shopping Centre. The intersection has been set up in a network analysis, representing a staged crossing and including interactions with the upstream signals at South Street / North Lake Road. In the 2031 scenario, this intersection is modelled as a LI/LO as proposed within the Kardinya Shopping Centre Redevelopment proposal.

Table 7-8 SIDRA Analysis – South Street / Main Street – Existing Geometry (Scenario 1-2021 Background)

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	R	0.63	34.3	D	8.1	0.435	22	C	5.2
	T	0.211	0	A	0	0.262	0	A	0
North: Main Street	L	0.126	7.3	A	1.4	0.115	6.6	A	1.2
	R	0.902	106.3	F	14.3	1.267	331.8	F	67.7
West: South Street	L	0.083	7	A	0.8	0.093	7	A	1
	T	0.266	2.2	A	0	0.216	0	A	0

Table 7-8 indicates that the intersection is currently performing unsatisfactorily during the peak periods. Stantec has previously conducted a traffic survey at this intersection where significant delays were observed consistent with the SIDRA. It is noted that this intersection will be modified into a LI/LO intersection, which will significantly improve the intersection performance.

Figure 7-4 South Street / Main Street Access – Existing SIDRA Intersection Layout



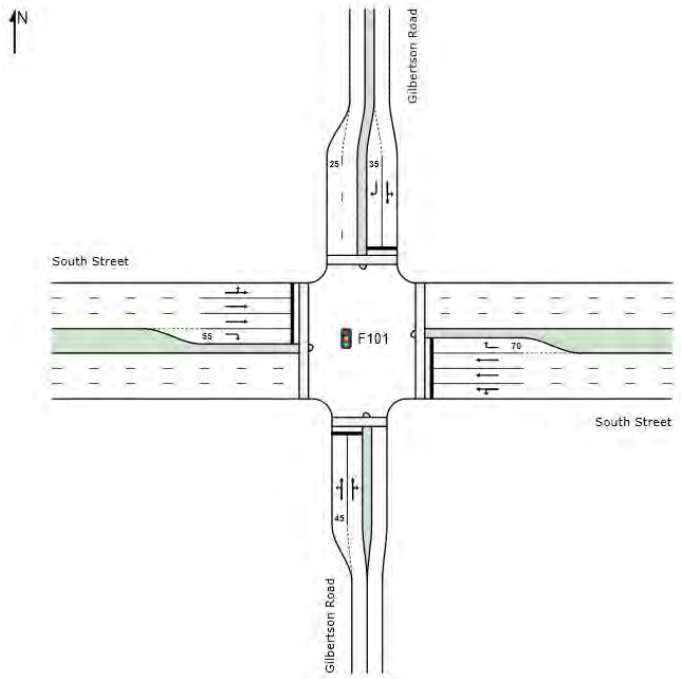
7.6.1.3 South Street / Gilbertson Road Intersection

The South Street / Gilbertson Road intersection is a major intersection connected to the residential area on the eastern section of the Activity Centre. **Table 7-9** shows that the intersection is currently performing within the acceptable LoS and delay during the peak hours, which was also observed during the site visit conducted by Stantec Team.

Table 7-9 SIDRA Analysis – South Street / Gilbertson Road – Existing Geometry (Scenario 1-2021 Background)

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.511	51.2	D	70.4	0.745	62	E	50.1
	T	0.353	44.9	D	49.2	0.531	53.9	D	35.6
	R	0.401	54	D	36.8	0.461	58.5	E	26.4
East: South Street	L	0.529	37	D	124.6	0.787	42.8	D	190.5
	T	0.529	30.6	C	126.4	0.787	36.2	D	193.3
	R	0.357	36.6	D	15.9	0.399	34.4	C	18.6
North: Gilbertson Road	L	0.061	46.4	D	7.6	0.081	43.2	D	9.3
	T	0.212	43.4	D	28.7	0.228	40.1	D	28.5
	R	0.804	68.9	E	55.4	0.651	50.1	D	39.7
West: South Street	L	0.788	31.7	C	164.8	0.779	31.7	C	136.3
	T	0.788	25.2	C	166.4	0.779	25.2	C	138
	R	0.254	33.5	C	13.5	0.465	32	C	23.3
All vehicles		0.804	32.7	C	166.4	0.787	34.6	C	193.3

Figure 7-5 Existing South Street / Gilbertson Road Intersection Layout



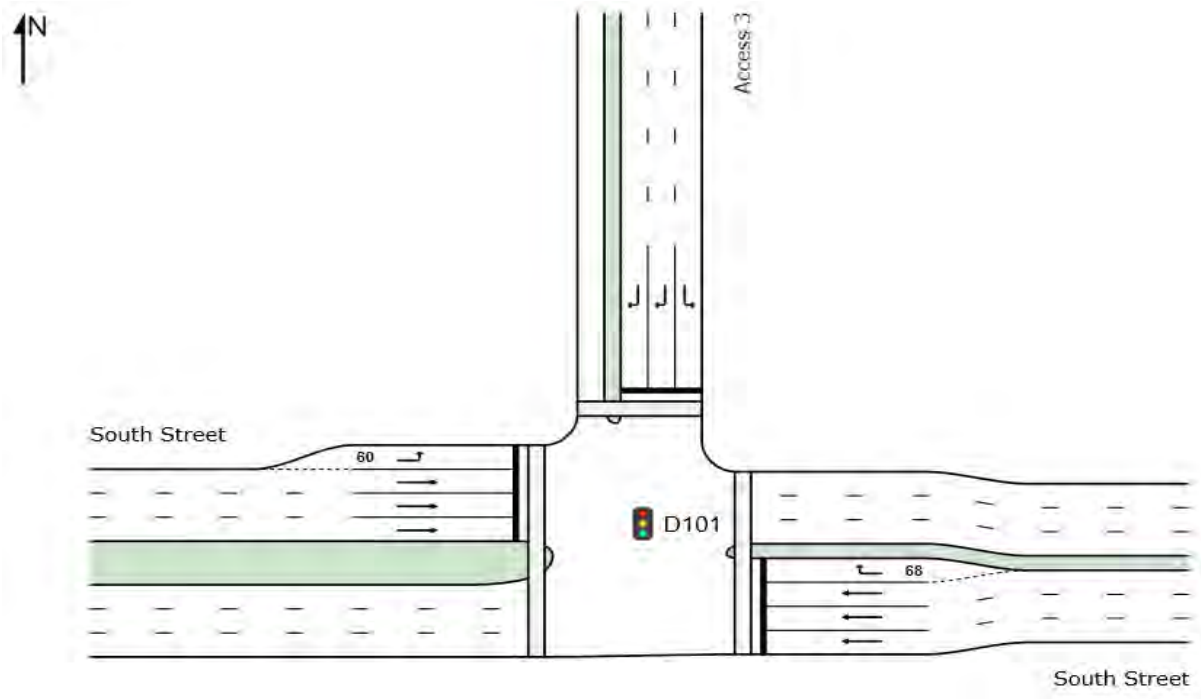
7.6.2 Scenario 2 – 2033 Background Traffic with Growth Only

In this scenario, a 1.65% per annum regional background traffic growth has been applied along South Street as advised by Main Roads WA. The background traffic growth for the remaining roads is assumed to be 1% per annum.

During the assessment process of the Development Application (DA) for the redevelopment of Kardinya Park Shopping Centre, Main Roads WA required that a set of signals to be installed by the developer, as a condition of the DA approval. Hence, signalisation of the car park access into the shopping centre, located in between the existing South Street / North Lake Road intersection & South Street / Gilbertson Road intersection has been proposed.

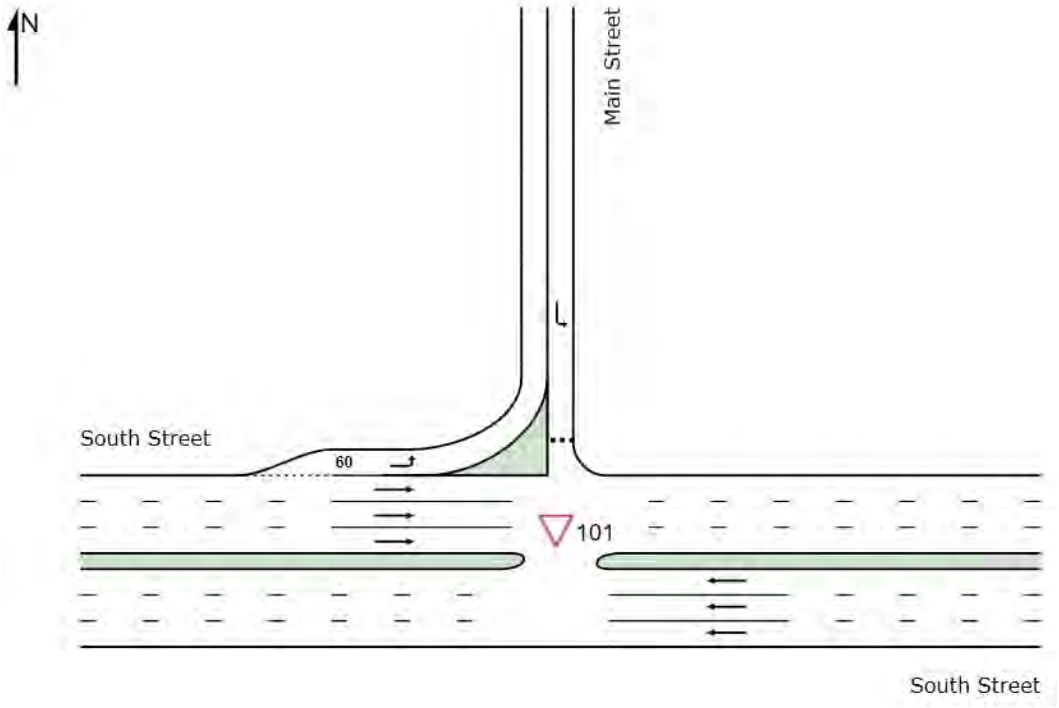
This signal proposal has been consulted and is supported by Main Roads WA and other authorities and will be constructed during the redevelopment of Kardinya Shopping Centre. The SIDRA layout of the proposed intersection is shown in **Figure 7-6**.

Figure 7-6 South Street / Access 3 (Signalised)



As a result of the intersection upgrade (Signalisation) of South Street / Access 3, the existing full movement South Street / Main Street intersection will be modified into 'Left-in Left-out only'. This modification was a requirement to satisfy Main Roads WA assessment conditions at the time of Development Approval. The SIDRA intersection of the modified intersection is shown in **Figure 7-7**.

Figure 7-7 South Street / Main Street (Shopping Centre Access 4)



The projected traffic distribution of the road network in the 10-year horizon scenario is shown in **Figure 7-8** and the SIDRA Network Layout is shown **Figure 7-9**.

A summary of the intersection performance is shown in **Table 7-10** with a detailed intersection movement performance summary in the following sections.

Table 7-10 Scenario 2 – 2033 Background Traffic with Growth Only Intersection Performance Summary

Intersection	AM peak			PM Peak		
	Max DOS	Delay (s)	LOS	Max DOS	Delay (s)	LOS
North Lake Road / Access 1	0.275	0.5	NA	2.08	20.5	NA
South Street / North Lake Road	0.934	60.5	LOS E	1.417	237.2	LOS F
South Street / Access 3	0.682	10.8	LOS B	1.084	125.8	LOS F
South Street / Access 4 (Main Street)	0.354	0.2	NA	0.423	0.5	NA
South Street / Gilbertson Road	0.795	45.9	LOS D	1.038	62.5	LOS E
Gilbertson Road / Brophy Street	0.195	1	NA	0.343	2.4	NA
Gilbertson Road / Williamson Road	0.183	0	NA	0.239	0	NA

As shown in the table above, the majority of the intersections adequately with the exception of South Street / North Lake Road where volumes are almost at capacity and the average level of delay is greater than one minute.

Figure 7-8 Road Network Traffic Distribution – Scenario 2 (2033)

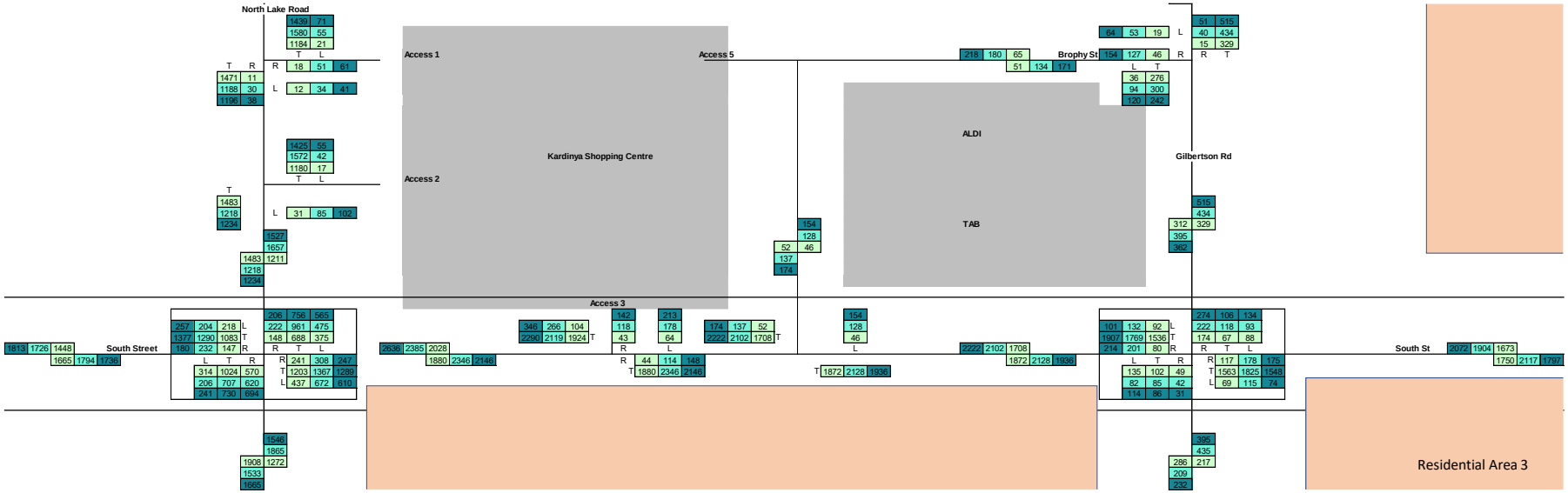
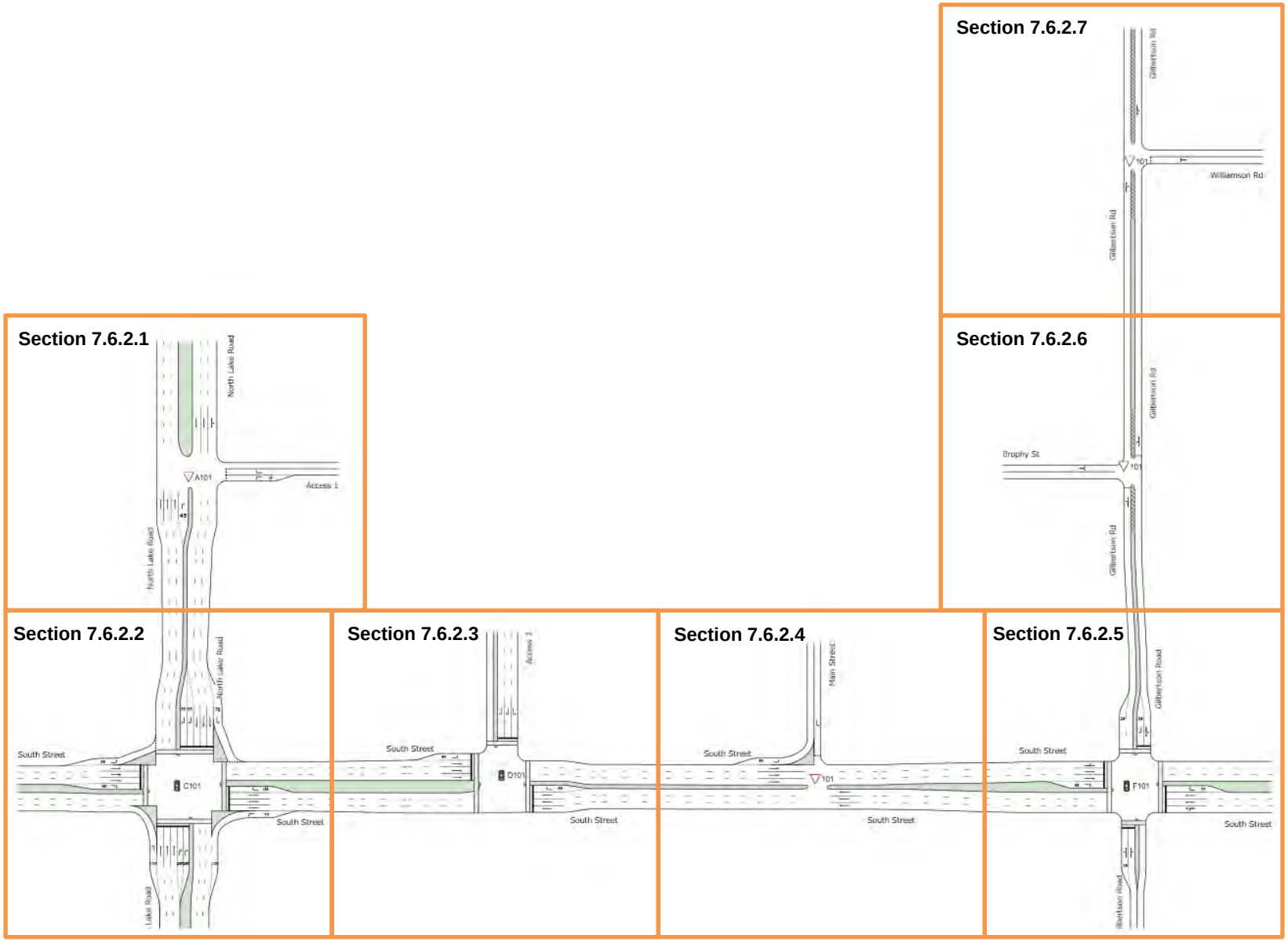


Figure 7-9 SIDRA Network Layout (Scenario 2)



7.6.2.1 North Lake Road / Access 1

The AM and PM peak SIDRA outputs for the North Lake Road / Access 1 intersection in Scenario 2 is shown in Table 7-11.

Table 7-11 North Lake Road / Access 1 (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	T	0.275	0	LOS A	0	0.218	0	LOS A	0
	R	0.067	25.2	LOS D	0.5	0.472	72.6	LOS F	3.3
East: Access 1	L	0.015	5.7	LOS A	0.1	0.069	5.4	LOS A	0.4
	R	0.211	44.5	LOS E	1.7	2.08	1116.3	LOS F	64.9
North: North Lake Road	L	0.22	6.5	LOS A	0	0.348	6.6	LOS A	0
	T	0.22	0	LOS A	0	0.348	0.1	LOS A	26.2
All vehicles		0.275	0.5	NA	1.7	2.08	20.5	NA	64.9

As shown in the table above, the movements experiencing higher levels of delay are the North Lake Road, southern approach right-turn and the Access 1 right-turn. These are considered to be within the acceptable range as there is ample capacity on these movements to accommodate higher volumes of traffic.

7.6.2.2 South Street / North Lake Road

The AM and PM peak SIDRA outputs for the South Street / North Lake Road intersection in Scenario 2 is shown in Table 7-12.

Table 7-12 South Street / North Lake Road (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	L	0.183	6.7	LOS A	0	0.12	6.7	LOS A	0
	T	0.928	82.2	LOS F	142.6	1.002	117.2	LOS F	111.9
	R	0.907	87.1	LOS F	110.8	1.417	456	LOS F	302.6
East: South Street	L	0.256	7.3	LOS A	0	0.374	7.4	LOS A	0
	T	0.921	80.8	LOS F	174.9	0.942	78.2	LOS E	185
	R	0.934	96.4	LOS F	92.4	1.375	412.5	LOS F	185
North: North Lake Road	L	0.432	29.4	LOS C	75.3	1.13	169.8	LOS F	190
	T	0.609	57.6	LOS E	72.7	1.386	415.1	LOS F	190
	R	0.232	62.5	LOS E	21.5	0.25	53.6	LOS D	29.8
West: South Street	L	0.218	20.4	LOS C	33.8	0.177	15.3	LOS B	24.7
	T	0.739	51.8	LOS D	116	1.407	438.5	LOS F	499.9
	R	0.57	71.1	LOS E	47.3	1.089	178.7	LOS F	132.6
All vehicles		0.934	60.5	LOS E	174.9	1.417	237.2	LOS F	499.9

As shown in the table above, the majority of movements experience relatively high average delays with the southern and eastern approaches almost at capacity.

7.6.2.3 South Street / Access 3

The AM and PM peak SIDRA outputs for the South Street / Access 3 intersection in Scenario 2 is shown in Table 7-13.

Table 7-13 South Street / Access 3 (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	T	0.682	9	LOS A	70	1.084	151.7	LOS F	70
	R	0.340	82.8	LOS F	14.9	0.83	89	LOS F	37.9
North: Access 3	L	0.261	64.4	LOS E	18.9	1.081	179.4	LOS F	102.6
	R	0.533	88.8	LOS F	8.1	0.912	101.7	LOS F	23.8
West: South Street	L	0.077	10.9	LOS B	8.2	0.191	12.4	LOS B	23.1
	T	0.558	7.4	LOS A	95.4	1.026	109.6	LOS F	185
All vehicles		0.682	10.8	LOS B	95.4	1.084	125.8	LOS F	185

As shown in the table above, there are high levels of delay on the Access 3 exit and the South Street eastern approach right-turn. The volume to capacity ratios are considered to be acceptable.

7.6.2.4 South Street / Main Street (Access 4)

The AM and PM peak SIDRA outputs for the South Street / Main Street (Access 3) intersection in Scenario 2 is shown in Table 7-14.

Table 7-14 South Street / Main Street (Access 4) (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	L	0.354	0	LOS A	45	0.375	0	LOS A	125
North: Main Street	L	0.138	7.7	LOS A	3.2	0.423	10.8	LOS B	13.1
West: South Street	L	0.029	4.8	LOS A	0	0.074	4.8	LOS A	0
	T	0.323	0	LOS A	52.1	0.378	0	LOS A	70
All Vehicles			0.354	0.2	NA	52.1	0.423	0.5	NA

As shown in the table above, the intersection performance is excellent across all movements.

7.6.2.5 South Street / Gilbertson Road

The AM and PM peak SIDRA outputs for the South Street / Gilbertson Road intersection in Scenario 2 is shown in Table 7-15.

Table 7-15 South Street / Gilbertson Road (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.617	72.8	LOS E	72.1	0.375	70.4	LOS E	42.2
	T	0.783	73.9	LOS E	86.3	0.663	69.8	LOS E	69.3
	R	0.783	78.5	LOS E	86.3	0.663	74.4	LOS E	69.3
East: South Street	L	0.795	47.9	LOS D	280.2	0.913	63.6	LOS E	418.9
	T	0.795	41.1	LOS D	282	0.913	57.1	LOS E	422.4
	R	0.790	85.2	LOS F	68.9	0.744	76.4	LOS E	99.5
North: Gilbertson Road	L	0.305	45.1	LOS D	63.7	0.727	56.5	LOS E	101.3
	T	0.305	40.5	LOS D	63.7	0.727	51.9	LOS D	101.3
	R	0.580	48.1	LOS D	74.7	0.873	71.5	LOS E	121.6
West: South Street	L	0.786	48	LOS D	274.5	0.909	62.9	LOS E	411.2
	T	0.786	40.7	LOS D	276.9	0.909	55.8	LOS E	415
	R	0.534	79.6	LOS E	43.8	1.038	146.6	LOS F	166.5
All vehicles		0.795	45.9	LOS E	282	1.038	62.5	LOS E	422.4

As shown in the table above, the delays and queues are relatively high for all approaches in addition to the approaches being close to practical capacity.

7.6.2.6 Gilbertson Road / Brophy Street

The AM and PM peak SIDRA outputs for the Gilbertson Road / Brophy Street intersection in Scenario 2 is shown in Table 7-16.

Table 7-16 Gilbertson Road / Brophy Street (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.174	4.6	LOS A	0	0.214	4.6	LOS A	0
	T	0.174	0	LOS A	0	0.214	0	LOS A	0
North: Gilbertson Road	T	0.195	0.1	LOS A	0.6	0.275	0.3	LOS A	1.8
	R	0.195	4.7	LOS A	0.6	0.275	5.4	LOS A	1.8
West: Brophy Street	L	0.087	5.7	LOS A	1	0.343	6.6	LOS A	4.1
	R	0.087	7.8	LOS A	1	0.343	10.8	LOS B	4.1
All vehicles		0.195	1	NA	1	0.343	2.4	NA	4.1

As shown in the table above, all approaches perform excellent.

7.6.2.7 Gilbertson Road / Williamson Road

The AM and PM peak SIDRA outputs for the Gilbertson Road / Williamson Road intersection in Scenario 2 is shown in Table 7-17.

Table 7-17 Gilbertson Road / Williamson Road (Scenario 2) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	T	0.165	0	LOS A	0	0.195	0	LOS A	0
	R	0.165	4.7	LOS A	0	0.195	5.5	LOS A	0
East: Williamson Street	L	0.002	5.7	LOS A	0	0.003	6.1	LOS A	0
	R	0.002	7.5	LOS A	0	0.003	8.9	LOS A	0
North: Gilbertson Road	L	0.183	4.1	LOS A	0	0.239	4.1	LOS A	0
	T	0.183	0	LOS A	0	0.239	0	LOS A	0
All vehicles		0.183	0	NA	0	0.239	0	NA	0

As shown in the table above, the intersection performance is excellent on all approaches.

7.6.3 Scenario 3 – 2033 Background + 35% Residential Development + Kardinya Shopping Centre Redevelopment

A summary of the intersection performance is shown in **Table 7-18** with a detailed intersection movement performance summary in the following sections.

Table 7-18 Scenario 3 – Scenario 2 + 35% ACP Intersection Performance Summary

Intersection	AM peak			PM Peak		
	Max DOS	Delay (s)	LOS	Max DOS	Delay (s)	LOS
North Lake Road / Access 1	0.277	0.5	NA	1.825	16.5	NA
South Street / North Lake Road	1.025	89.6	LOS F	1.439	241.8	LOS F
South Street / Access 3	0.914	26.7	LOS C	1.091	131.2	LOS F
South Street / Access 4 (Main Street)	0.364	0.2	NA	0.413	0.5	NA
South Street / Gilbertson Road	0.939	64.3	LOS E	1.128	140.5	LOS F
Gilbertson Road / Brophy Street	0.237	1.6	NA	0.434	3.2	NA
Gilbertson Road / Williamson Road	0.202	0.5	NA	0.247	0.4	NA

As shown in the table above, the South Street / North Lake Road and South Street / Gilbertson Road intersections experience high average levels of delay and have reached practical capacity.

Figure 7-10 Road Network Traffic Distribution – Scenario 3 (2033)

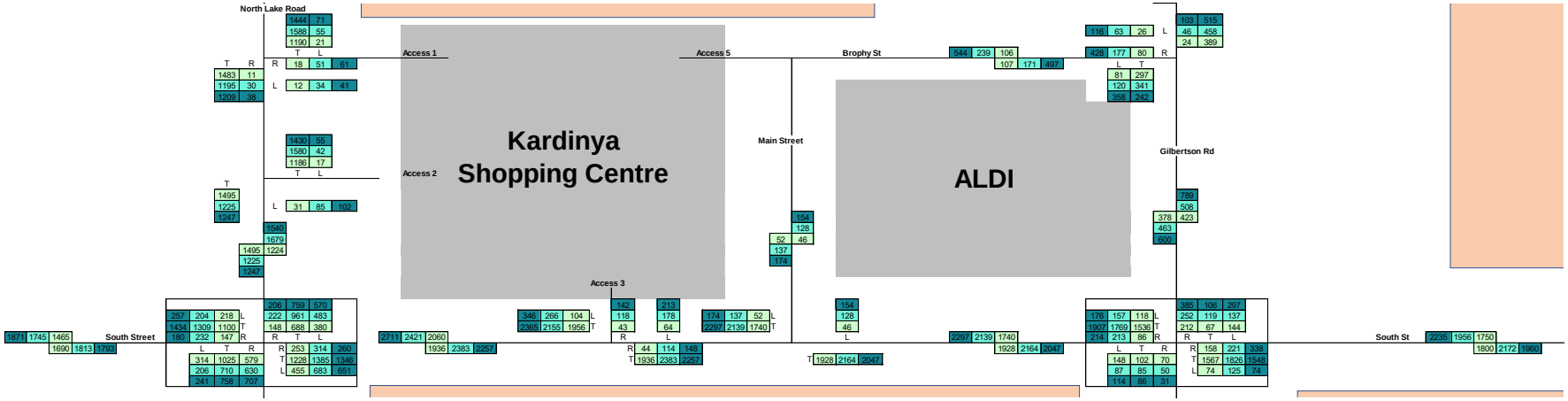
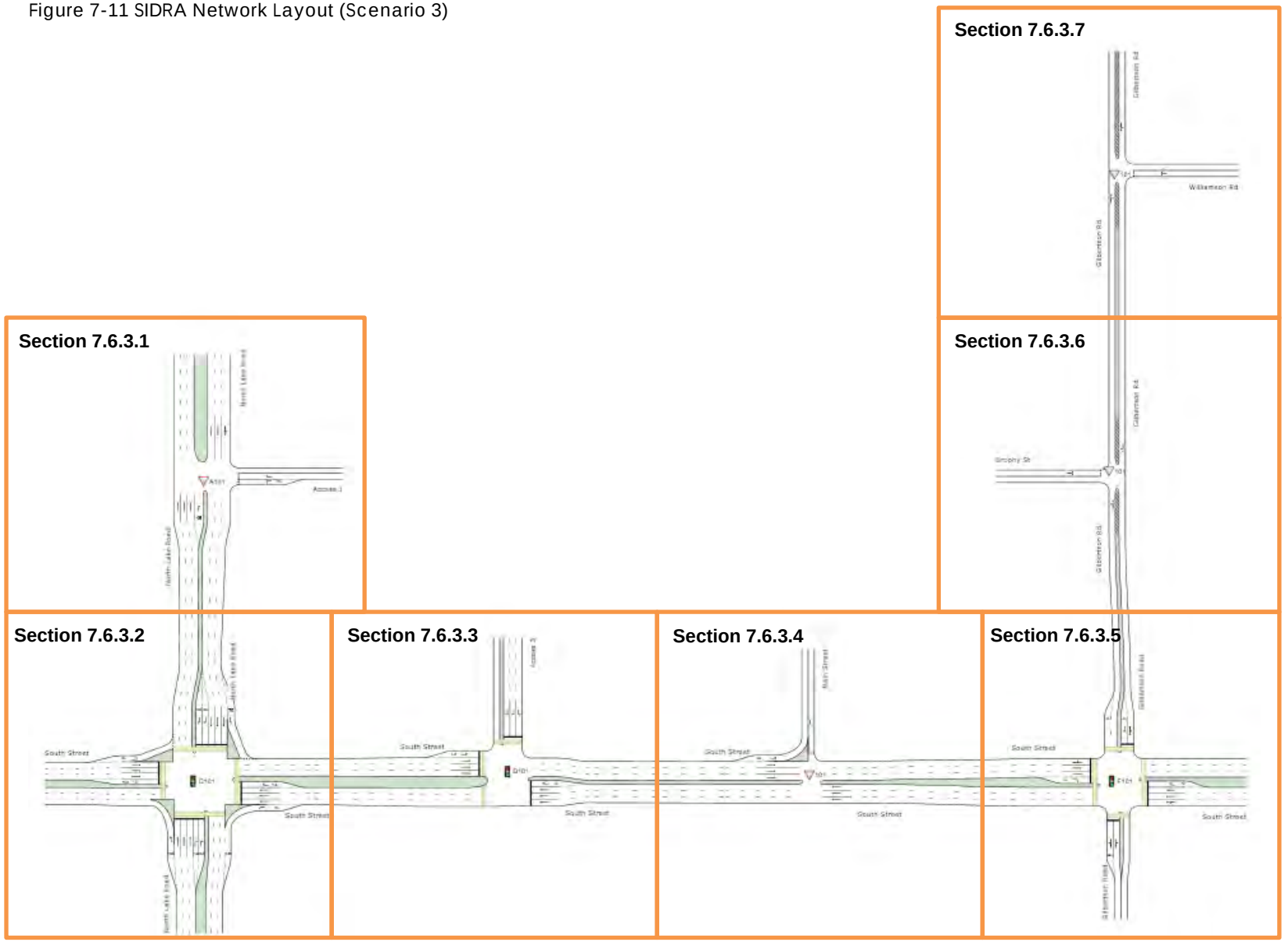


Figure 7-11 SIDRA Network Layout (Scenario 3)



7.6.3.1 North Lake Road / Access 1

The AM and PM peak SIDRA outputs for the North Lake Road / Access 1 intersection in Scenario 3 is shown in Table 7-19.

Table 7-19 North Lake Road / Access 1 (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	T	0.277	0	LOS A	0	0.215	0	LOS A	0
	R	0.067	25.4	LOS D	0.5	0.423	65.1	LOS F	2.9
East: Access 1	L	0.015	5.7	LOS A	0.1	0.097	6.7	LOS A	0.5
	R	0.214	45.2	LOS E	1.8	1.825	888.6	LOS F	57.2
North: North Lake Road	L	0.221	6.5	LOS A	0	0.301	6.5	LOS A	4
	T	0.221	0	LOS A	0	0.301	0	LOS A	40.9
All vehicles		0.277	0.5	NA	1.8	1.825	16.5	NA	57.2

In comparison to Scenario 2, there is a minor difference on performance, showing the ACP has little to no impact on this intersection.

7.6.3.2 South Street / North Lake Road

The AM and PM peak SIDRA outputs for the South Street / North Lake Road intersection in Scenario 3 is shown in Table 7-20.

Table 7-20 South Street / North Lake Road (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	L	0.183	6.7	LOS A	0	0.12	6.7	LOS A	0
	T	1.018	123.2	LOS F	173.7	1.006	119.2	LOS F	113.5
	R	1.024	138	LOS F	158.4	1.404	444.7	LOS F	303.9
East: South Street	L	0.26	7.3	LOS A	0	0.376	7.4	LOS A	0
	T	0.982	102.4	LOS F	185	0.958	81.7	LOS F	185
	R	1.025	136.5	LOS F	125.2	1.385	421.3	LOS F	185
North: North Lake Road	L	0.45	39.8	LOS D	67.2	1.109	152.2	LOS F	190
	T	0.665	60.7	LOS E	73.8	1.386	415	LOS F	190
	R	0.174	56.6	LOS E	18.5	0.244	52.7	LOS D	29.5
West: South Street	L	0.215	20.7	LOS C	33.7	0.177	15.3	LOS B	24.7
	T	1.004	116.9	LOS F	196.6	1.439	466	LOS F	531.9
	R	0.596	72.2	LOS E	47.8	1.089	178.7	LOS F	132.6
All vehicles		1.025	89.6	LOS F	196.6	1.439	241.8	LOS F	531.9

In comparison to Scenario 2, there is an increase in average delays on most movements with the most notable change being the South Street western approach through movement going from a LOS D to a LOS F. However, ACP has minimal impact on the overall performance of the intersection.

7.6.3.3 South Street / Access 3

The AM and PM peak SIDRA outputs for the South Street / Access 3 intersection in Scenario 3 is shown in Table 7-21.

Table 7-21 South Street / Access 3 (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	T	0.791	10.8	LOS B	70	1.091	157.1	LOS F	70
	R	0.340	82.8	LOS F	14.9	0.83	89	LOS F	37.9
North: Access 3	L	0.473	68.7	LOS E	20.2	1.081	179.4	LOS F	102.6
	R	0.602	90.6	LOS F	8.1	0.912	101.7	LOS F	23.8
West: South Street	L	0.077	10.9	LOS B	8.2	0.184	12	LOS B	20.9
	T	0.914	39.3	LOS D	185	1.034	115.5	LOS F	185
All vehicles		0.914	26.7	LOS C	185	1.091	131.2	LOS F	185

In comparison to Scenario 2, there is a minor difference on performance, showing the ACP has little to no impact on this intersection.

7.6.3.4 South Street / Main Street (Access 4)

The AM and PM peak SIDRA outputs for the South Street / Main Street (Access 3) intersection in Scenario 3 is shown in Table 7-22.

Table 7-22 South Street / Main Street (Access 4) (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	L	0.364	0	LOS A	0	0.394	0	LOS A	0
North: Main Street	L	0.136	7.7	LOS A	5.7	0.413	10.4	LOS B	22.5
West: South Street	L	0.029	4.8	LOS A	0	0.071	4.8	LOS A	0
	T	0.329	0	LOS A	70	0.367	0	LOS A	70
All Vehicles		0.364	0.2	NA	70	0.413	0.5	NA	70

In comparison to Scenario 2, there is a minor difference on performance, showing the ACP has little to no impact on this intersection.

7.6.3.5 South Street / Gilbertson Road

The AM and PM peak SIDRA outputs for the South Street / Gilbertson Road intersection in Scenario 3 is shown in Table 7-23.

Table 7-23 South Street / Gilbertson Road (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.612	71.1	LOS E	78.2	0.63	79.9	LOS E	48.6
	T	0.939	93.9	LOS F	114.4	1.128	203.5	LOS F	135.2
	R	0.939	98.5	LOS F	114.4	1.128	208.1	LOS F	135.2
East: South Street	L	0.913	70.6	LOS E	362.2	1.076	157.6	LOS F	660.7
	T	0.913	64	LOS E	364.5	1.076	152.5	LOS F	666.9
	R	0.924	97.2	LOS F	102.7	0.882	86	LOS F	136
North: Gilbertson Road	L	0.48	42.5	LOS D	85.5	0.763	53.7	LOS D	121.7
	T	0.48	37.9	LOS D	85.5	0.763	49.2	LOS D	121.7
	R	0.700	45.7	LOS D	89.5	0.930	77.2	LOS E	147.7
West: South Street	L	0.902	68.5	LOS E	348.5	1.07	154.1	LOS F	647.1
	T	0.902	61.4	LOS E	352	1.07	148.5	LOS F	654.6
	R	0.498	77.3	LOS E	46.2	1.079	173.8	LOS F	194.5
All vehicles		0.999	45.9	LOS E	364.5	1.128	140.5	LOS F	666.9

In comparison to Scenario 2, there is an increase in average delays on most movements with the most notable changes being on the South Street western approach with all movements experiencing an additional 20s average delay. Overall the ACP has a slight impact on the performance of this intersection.

7.6.3.6 Gilbertson Road / Brophy Street

The AM and PM peak SIDRA outputs for the Gilbertson Road / Brophy Street intersection in Scenario 3 is shown in Table 7-24.

Table 7-24 Gilbertson Road / Brophy Street (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.212	4.6	LOS A	0	0.25	4.6	LOS A	0
	T	0.212	0	LOS A	0	0.25	0	LOS A	0
North: Gilbertson Road	T	0.237	0.2	LOS A	1.1	0.297	0.5	LOS A	2.3
	R	0.237	5.3	LOS A	1.1	0.297	5.9	LOS A	2.3
West: Brophy Street	L	0.164	5.8	LOS A	1.9	0.434	7.6	LOS A	6.9
	R	0.164	9	LOS A	1.9	0.434	12.9	LOS B	6.9
All vehicles		0.237	1.6	NA	1.9	0.434	3.2	NA	6.9

In comparison to Scenario 2, there is a minor difference on performance, showing the ACP has little to no impact on this intersection.

7.6.3.7 Gilbertson Road / Williamson Road

The AM and PM peak SIDRA outputs for the Gilbertson Road / Williamson Road intersection in Scenario 3 is shown in Table 7-25.

Table 7-25 Gilbertson Road / Williamson Road (Scenario 3) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	T	0.183	0.1	LOS A	0.4	0.227	0.2	LOS A	0.9
	R	0.183	5	LOS A	0.4	0.227	5.7	LOS A	0.9
East: Williamson Street	L	0.042	5.9	LOS A	0.5	0.02	6.3	LOS A	0.2
	R	0.042	8.3	LOS A	0.5	0.02	9.6	LOS A	0.2
North: Gilbertson Road	L	0.202	4.1	LOS A	0	0.247	4.1	LOS A	0
	T	0.202	0	LOS A	0	0.247	0	LOS A	0
All vehicles		0.202	0.5	NA	0.5	0.247	0.4	NA	0.9

In comparison to Scenario 2, there is a minor difference on performance, showing the ACP has little to no impact on this intersection.

7.6.4 Scenario 4 – 2050 Background Traffic with Growth Only

A summary of the intersection performance is shown in Table 7-26 with a detailed intersection movement performance summary in the following sections.

Table 7-26 Scenario 3 – 2050 Background Traffic with Growth Only Intersection Performance Summary

Intersection	AM peak			PM Peak		
	Max DOS	Delay (s)	LOS	Max DOS	Delay (s)	LOS
North Lake Road / Access 1	0.406	0.8	NA	4.728	54.9	NA
South Street / North Lake Road	1.504	285	LOS F	1.686	395.8	LOS F
South Street / Access 3	1.036	91.3	LOS F	0.938	41.1	LOS D
South Street / Access 4 (Main Street)	0.384	0.2	NA	0.426	0.5	NA
South Street / Gilbertson Road	1.014	95.5	LOS F	1.251	237.7	LOS F
Gilbertson Road / Brophy Street	0.355	2	NA	0.541	2.7	NA
Gilbertson Road / Williamson Road	0.22	0	NA	0.281	0	NA

As shown in the table above, by 2050, the impact of the growth of background traffic causes the failure of the South Street / North Lake Road, South Street / Access 3 and South Street / Gilbertson Road intersections with very high average levels of delay and the volumes exceed the capacity.

Figure 7-12 Road Network Traffic Distribution – Scenario 4 (2050)

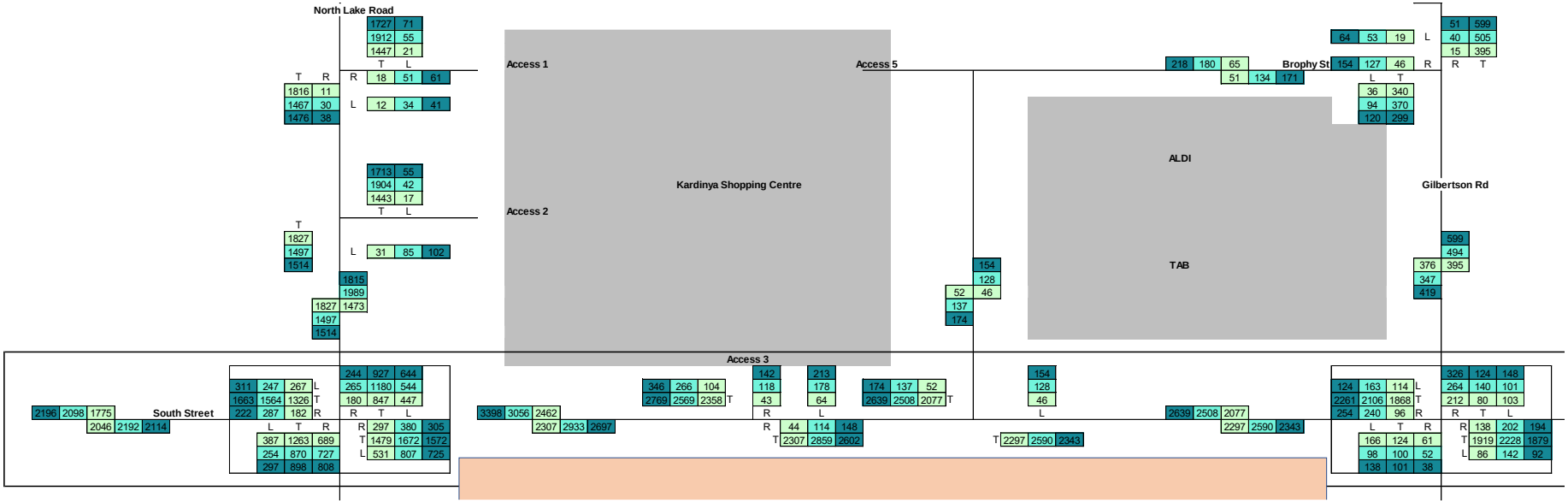
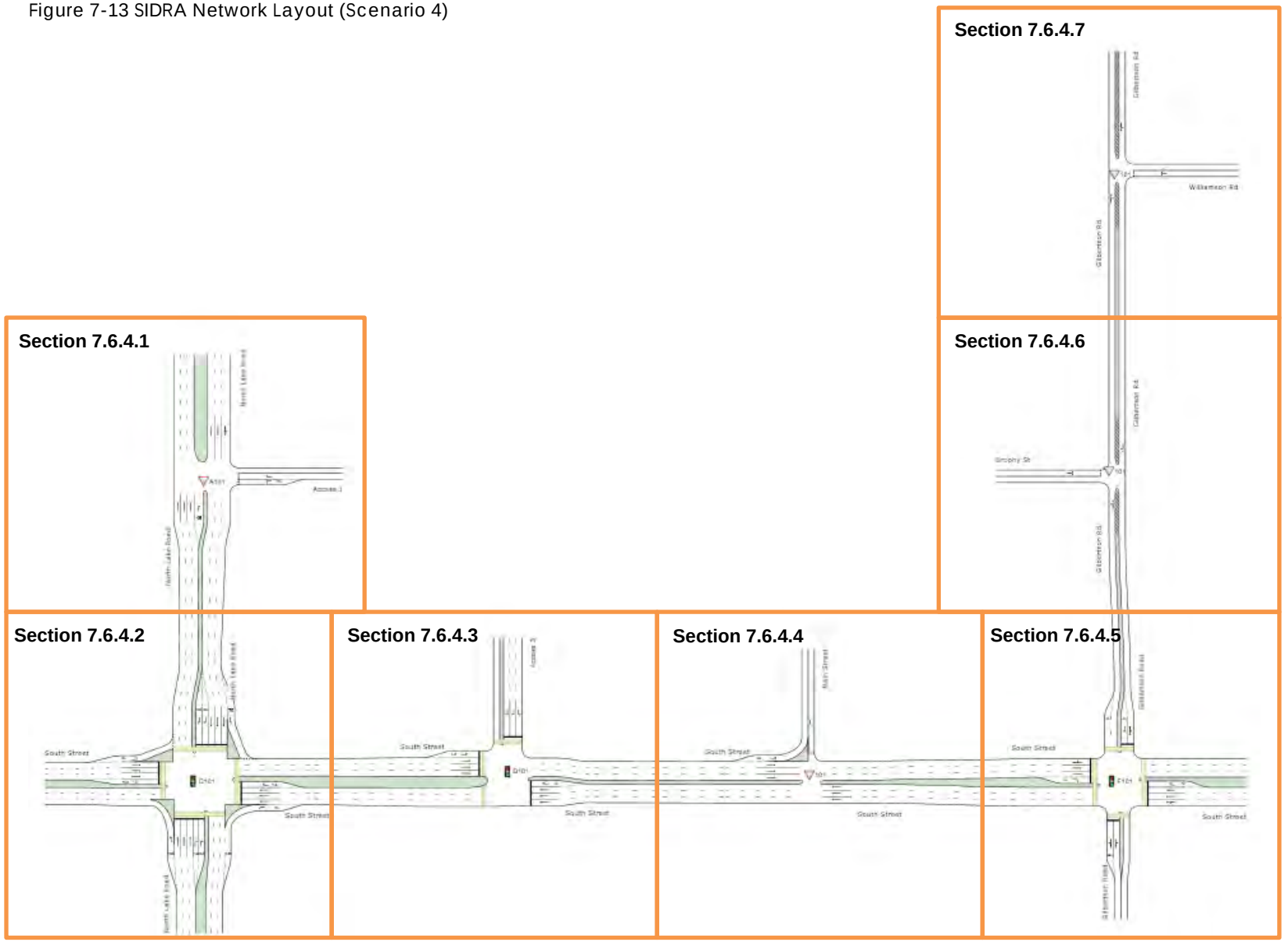


Figure 7-13 SIDRA Network Layout (Scenario 4)



7.6.4.1 North Lake Road / Access 1

The AM and PM peak SIDRA outputs for the North Lake Road / Access 1 intersection in Scenario 4 is shown in Table 7-27.

Table 7-27 North Lake Road / Access 1 (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	T	0.29	0	LOS A	0	0.248	0	LOS A	0
	R	0.096	38.8	LOS E	0.6	0.851	210.3	LOS F	6.5
East: Access 1	L	0.017	6.4	LOS A	0.2	0.116	7.8	LOS A	6.6
	R	0.406	97.1	LOS F	3.3	4.728	3526.5	LOS F	106.3
North: North Lake Road	L	0.272	6.5	LOS A	0	0.36	6.5	LOS A	126.6
	T	0.272	0	LOS A	0	0.36	0.1	LOS A	202.3
All vehicles		0.406	0.8	NA	3.3	4.728	54.9	NA	202.3

As shown in the table above, there are high delays on the right-turn exit from Access 1 in both peaks and in the PM peak for the North Lake Road southern approach right-turn. This is likely due to the queue on North Lake Road blocking the access, resulting in vehicles unable to turn-out of the access. In reality, Vehicle queueing on North Lake Road is likely to keep clear of the access allowing vehicles to enter and exit the Access 1 if required. Furthermore, the median island is wide enough to perform staged crossings which would significantly improve the performance of this intersection.

7.6.4.2 South Street / North Lake Road

The AM and PM peak SIDRA outputs for the South Street / North Lake Road intersection in Scenario 4 is shown in Table 7-28.

Table 7-28 South Street / North Lake Road (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	L	0.225	6.7	LOS A	0	0.148	6.7	LOS A	0
	T	1.491	505.6	LOS F	434.7	1.174	237.3	LOS F	202
	R	1.490	518.4	LOS F	357.7	1.662	669.7	LOS F	423.5
East: South Street	L	0.286	7.3	LOS A	0	0.361	7.4	LOS A	0
	T	0.995	102.1	LOS F	185	0.896	61.2	LOS E	185
	R	1.433	459.3	LOS F	185	1.620	624.2	LOS F	185
North: North Lake Road	L	1.131	172.8	LOS F	190	1.459	457.7	LOS F	190
	T	1.059	150.6	LOS F	164	1.637	632.6	LOS F	190
	R	0.203	52.9	LOS D	23.8	0.298	54.3	LOS D	36.1
West: South Street	L	0.237	16.6	LOS B	34.8	0.211	14.8	LOS B	29.3
	T	1.504	522.8	LOS F	513.1	1.686	683.6	LOS F	709.7
	R	0.954	104.8	LOS F	76.3	1.599	606.3	LOS F	313.4
All vehicles		1.504	285	LOS F	513.1	1.686	395.8	LOS F	709.7

As shown in the table above, the intersection approaches and the majority of the movements may perform at a very poor level with excessive delays and volumes over the capacity of the road.

7.6.4.3 South Street / Access 3

The AM and PM peak SIDRA outputs for the South Street / Access 3 intersection in Scenario 4 is shown in Table 7-29.

Table 7-29 South Street / Access 3 (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	T	1.036	111.7	LOS F	70	0.936	46.7	LOS D	70
	R	0.308	82.5	LOS F	13.4	0.668	85.7	LOS F	29.8
North: Access 3	L	0.473	68.7	LOS E	20.2	0.938	100.4	LOS F	75.5
	R	0.609	90.8	LOS F	8	0.717	82.9	LOS F	21
West: South Street	L	0.066	10.3	LOS B	6.2	0.167	13.7	LOS B	21.8
	T	0.982	74.7	LOS E	185	0.884	28.3	LOS C	185
All vehicles		1.036	91.3	LOS F	185	0.938	41.1	LOS D	185

As shown in the table above, most of the movements experience high delays and have volumes at or near capacity.

7.6.4.4 South Street / Main Street (Access 4)

The AM and PM peak SIDRA outputs for the South Street / Main Street (Access 3) intersection in Scenario 4 is shown in Table 7-30.

Table 7-30 South Street / Main Street (Access 4) (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	L	0.384	0	LOS A	27.8	0.353	0	LOS A	0
North: Main Street	L	0.141	8	LOS A	4.9	0.426	11	LOS B	13
West: South Street	L	0.026	4.8	LOS A	0	0.063	4.8	LOS A	0
	T	0.346	0	LOS A	70	0.386	0	LOS A	70
All Vehicles		0.384	0.2	NA	70	0.426	0.5	NA	70

As shown in the table above, the intersection performance is good.

7.6.4.5 South Street / Gilbertson Road

The AM and PM peak SIDRA outputs for the South Street / Gilbertson Road intersection in Scenario 4 is shown in Table 7-31.

Table 7-31 South Street / Gilbertson Road (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.778	75.4	LOS E	92.3	0.709	81.5	LOS F	55.8
	T	1.014	127.6	LOS F	145.8	1.251	302.6	LOS F	189.6
	R	1.014	132.2	LOS F	145.8	1.251	307.2	LOS F	189.6
East: South Street	L	1.008	110.3	LOS F	565.1	1.223	275.9	LOS F	1052.4
	T	1.008	105	LOS F	568.6	1.223	270.3	LOS F	1062
	R	1.009	128.9	LOS F	104.8	0.806	78.8	LOS E	116.5
North: Gilbertson Road	L	0.408	43.4	LOS D	74.3	0.786	57.7	LOS E	119.1
	T	0.408	38.8	LOS D	74.3	0.786	53.1	LOS D	119.1
	R	0.754	49.6	LOS D	94.2	1.052	137.4	LOS F	214.2
West: South Street	L	0.988	99.1	LOS F	522.7	1.194	251.5	LOS F	977.6
	T	0.988	92.1	LOS F	527	1.194	245.6	LOS F	987.9
	R	0.695	83	LOS F	54.5	1.220	283.7	LOS F	287.4
All vehicles		1.014	95.5	LOS F	568.6	1.251	237.7	LOS F	1062

As shown in the table above, all movements experience high average delays with some approaching 5-minutes. Additionally, the capacity is reached on the majority of movements. The intersection may need to be upgrade for the increased capacity.

7.6.4.6 Gilbertson Road / Brophy Street

The AM and PM peak SIDRA outputs for the Gilbertson Road / Brophy Street intersection in Scenario 4 is shown in Table 7-32.

Table 7-32 Gilbertson Road / Brophy Street (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.192	4.6	LOS A	0	0.2	4.6	LOS A	0
	T	0.192	0	LOS A	0	0.2	0	LOS A	0
North: Gilbertson Road	T	0.232	0.1	LOS A	0.6	0.314	0.3	LOS A	1.8
	R	0.232	5	LOS A	0.6	0.314	5.3	LOS A	1.8
West: Brophy Street	L	0.355	6.7	LOS A	3.8	0.541	8.6	LOS A	5.2
	R	0.355	9.9	LOS A	3.8	0.541	13.8	LOS B	5.2
All vehicles		0.355	2	NA	3.8	0.541	2.7	NA	5.2

As shown in the table above, the intersection performance is good.

7.6.4.7 Gilbertson Road / Williamson Road

The AM and PM peak SIDRA outputs for the Gilbertson Road / Williamson Road intersection in Scenario 4 is shown in Table 7-33.

Table 7-33 Gilbertson Road / Williamson Road (Scenario 4) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	T	0.187	0	LOS A	0	0.188	0	LOS A	0
	R	0.187	5.2	LOS A	0	0.188	6	LOS A	0
East: Williamson Street	L	0.003	6	LOS A	0	0.003	6.6	LOS A	0
	R	0.003	8.4	LOS A	0	0.003	9.6	LOS A	0
North: Gilbertson Road	L	0.22	4.1	LOS A	0	0.281	4.1	LOS A	0
	T	0.22	0	LOS A	0	0.281	0	LOS A	0
All vehicles		0.22	0	NA	0	0.281	0	NA	0

As shown in the table above, the intersection performance is good.

7.6.5 Scenario 5 – Ultimate Scenario with Full ACSP Built-out

A summary of the intersection performance is shown in Table 7-34 with a detailed intersection movement performance summary in the following sections.

Table 7-34 Scenario 5 – Scenario 4 + 100% ACP Intersection Performance Summary

Intersection	AM peak			PM Peak		
	Max DOS	Delay (s)	LOS	Max DOS	Delay (s)	LOS
North Lake Road / Access 1	0.454	0.9	NA	1.825	16.5	NA
South Street / North Lake Road	1.217	151.2	LOS F	1.439	241.8	LOS F
South Street / Access 3	0.946	33.2	LOS C	1.091	131.2	LOS F
South Street / Access 4 (Main Street)	0.362	0.2	NA	0.413	0.5	NA
South Street / Gilbertson Road	1.329	291.8	LOS F	1.128	140.5	LOS F
Gilbertson Road / Brophy Street	0.598	2.6	NA	0.434	3.2	NA
Gilbertson Road / Williamson Road	0.269	1.2	NA	0.247	0.4	NA

In comparison to Scenario 4, the South Street / North Lake Road and South Street / Access 3 intersections perform better. However, there is a notable increase in averages delays at the South Street / Gilbertson Road intersection in the AM peak only, the performance in the PM peak is better than Scenario 4.

Figure 7-14 Road Network Traffic Distribution – Scenario 5 (2050)

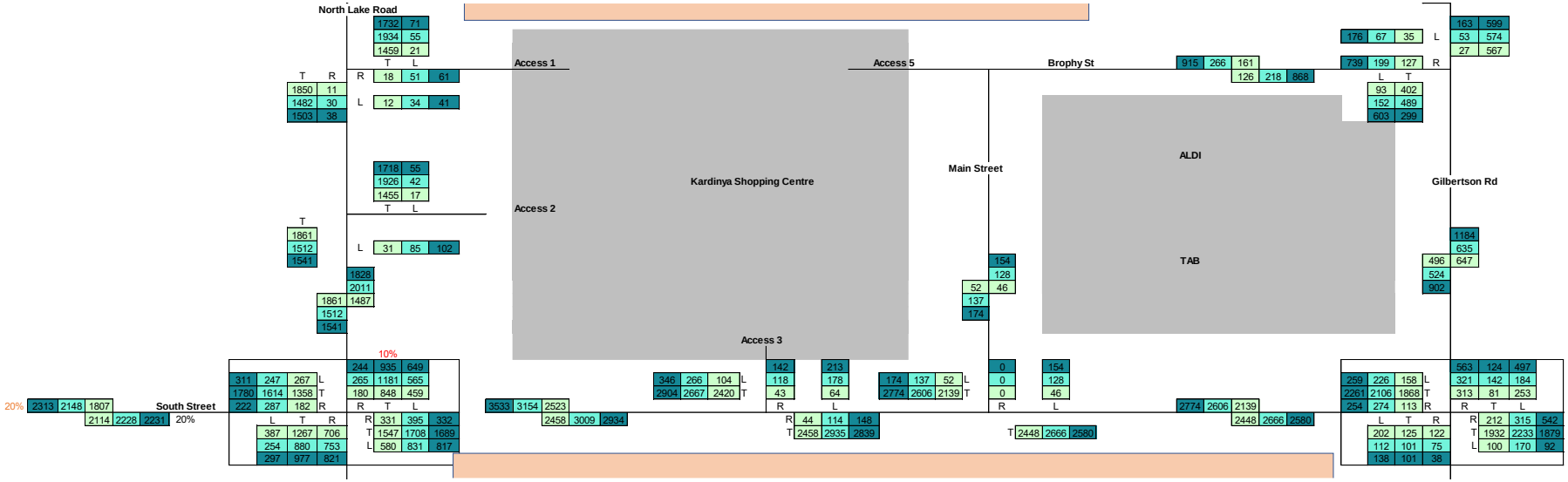
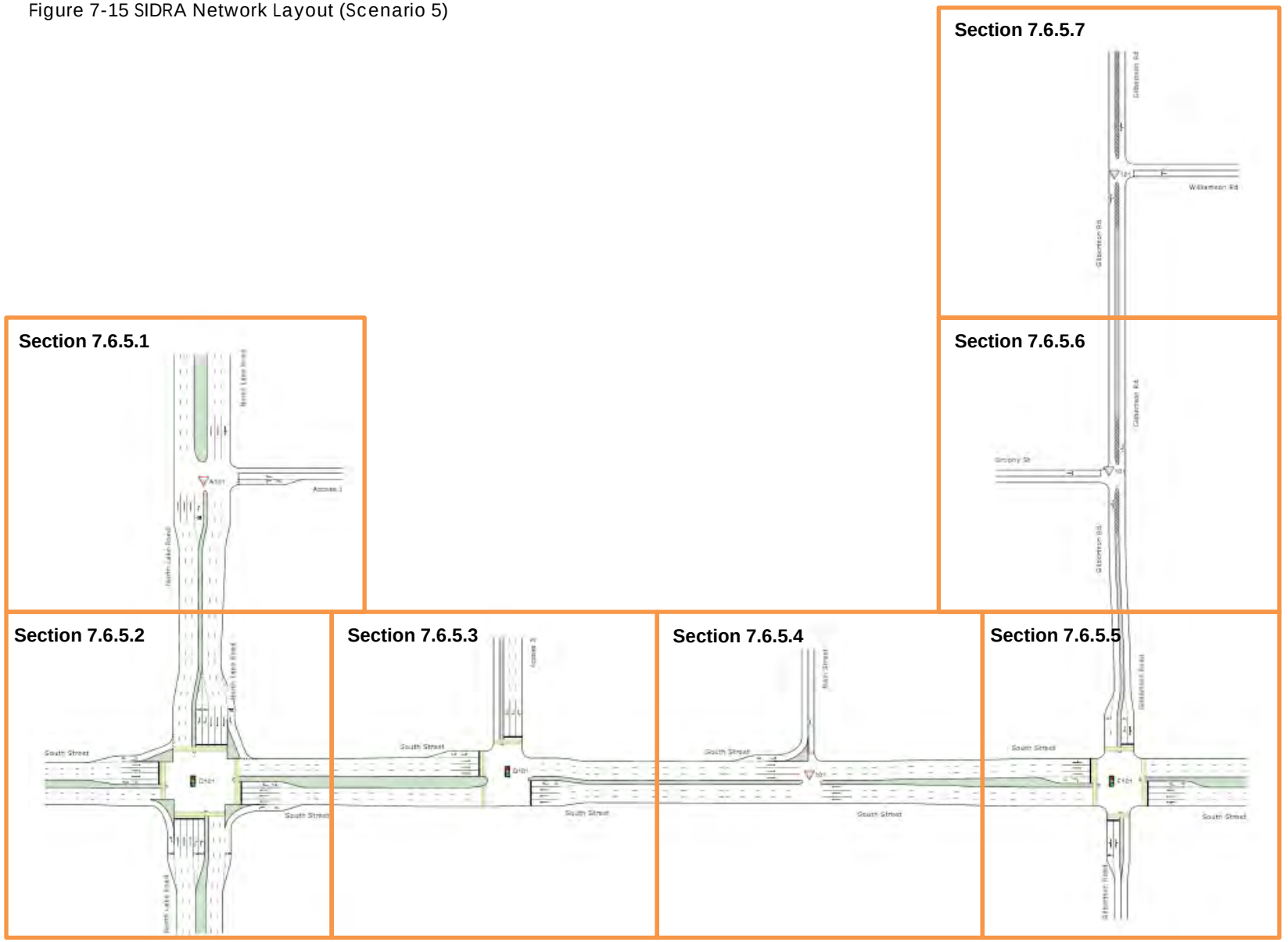


Figure 7-15 SIDRA Network Layout (Scenario 5)



7.6.5.1 North Lake Road / Access 1

The AM and PM peak SIDRA outputs for the North Lake Road / Access 1 intersection in Scenario 5 is shown in Table 7-35.

Table 7-35 North Lake Road / Access 1 (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	T	0.262	0	LOS A	0	0.215	0	LOS A	0
	R	0.093	41.7	LOS E	0.6	0.423	65.1	LOS F	2.9
East: Access 1	L	0.039	7.3	LOS A	0.2	0.097	6.7	LOS A	0.5
	R	0.454	112.6	LOS F	3.7	1.825	888.6	LOS F	57.2
North: North Lake Road	L	0.323	6.5	LOS A	0	0.301	6.5	LOS A	4
	T	0.323	0.1	LOS A	0	0.301	0	LOS A	40.9
All vehicles		0.454	0.9	NA	3.7	1.825	16.5	NA	57.2

The intersection performance is largely similar to the ones presented for Scenario 4, without the ACP.

7.6.5.2 South Street / North Lake Road

The AM and PM peak SIDRA outputs for the South Street / North Lake Road intersection in Scenario 5 is shown in Table 7-36.

Table 7-36 South Street / North Lake Road (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: North Lake Road	L	0.225	6.7	LOS A	0	0.12	6.7	LOS A	0
	T	1.189	247.9	LOS F	313.2	1.006	119.2	LOS F	113.5
	R	1.217	281	LOS F	306.6	1.404	444.7	LOS F	303.9
East: South Street	L	0.258	7.4	LOS A	0	0.376	7.4	LOS A	0
	T	0.9	77.8	LOS E	166.8	0.958	81.7	LOS F	185
	R	1.180	245.1	LOS F	167.6	1.385	421.3	LOS F	185
North: North Lake Road	L	0.822	54.4	LOS D	123.8	1.109	152.2	LOS F	190
	T	0.805	64.9	LOS E	102.7	1.386	415	LOS F	190
	R	0.239	58.3	LOS E	25.3	0.244	52.7	LOS D	29.5
West: South Street	L	0.261	21.1	LOS C	40.7	0.177	15.3	LOS B	24.7
	T	1.203	260.8	LOS F	410.1	1.439	466	LOS F	531.9
	R	0.854	85.1	LOS F	67.2	1.089	178.7	LOS F	132.6
All vehicles		1.217	151.2	LOS F	410.1	1.439	241.8	LOS F	531.9

In comparison to Scenario 4, all movements perform better in both peaks.

7.6.5.3 South Street / Access 3

The AM and PM peak SIDRA outputs for the South Street / Access 3 intersection in Scenario 5 is shown in Table 7-37.

Table 7-37 South Street / Access 3 (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	T	0.669	8.2	LOS A	70	1.091	157.1	LOS F	70
	R	0.267	82.1	LOS F	11.6	0.83	89	LOS F	37.9
North: Access 3	L	0.473	68.7	LOS E	20.2	1.081	179.4	LOS F	102.6
	R	0.536	88.9	LOS F	8.7	0.912	101.7	LOS F	23.8
West: South Street	L	0.06	11.9	LOS B	8.4	0.184	12	LOS B	20.9
	T	0.946	56.2	LOS E	185	1.034	115.5	LOS F	185
All vehicles		0.946	33.2	LOS C	185	1.091	131.2	LOS F	185

In comparison to Scenario 4, all movements perform better in the AM peak. Whereas larger delays are experienced in the PM peak.

7.6.5.4 South Street / Main Street (Access 4)

The AM and PM peak SIDRA outputs for the South Street / Main Street (Access 3) intersection in Scenario 5 is shown in Table 7-38.

Table 7-38 South Street / Main Street (Access 4) (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
East: South Street	L	0.362	0	LOS A	0	0.394	0	LOS A	0
North: Main Street	L	0.135	7.7	LOS A	12.8	0.413	10.4	LOS B	22.5
West: South Street	L	0.024	4.8	LOS A	0	0.071	4.8	LOS A	0
	T	0.325	0	LOS A	70	0.367	0	LOS A	70
All Vehicles		0.362	0.2	NA	70	0.413	0.5	NA	70

In comparison to Scenario 4, there are minor changes and the intersection continues to perform in an good condition.

7.6.5.5 South Street / Gilbertson Road

The AM and PM peak SIDRA outputs for the South Street / Gilbertson Road intersection in Scenario 5 is shown in Table 7-39.

Table 7-39 South Street / Gilbertson Road (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	1.018	134.7	LOS F	162.2	0.63	79.9	LOS E	48.6
	T	1.309	353.5	LOS F	338.8	1.128	203.5	LOS F	135.2
	R	1.309	358	LOS F	338.8	1.128	208.1	LOS F	135.2
East: South Street	L	1.297	341.4	LOS F	997.2	1.076	157.6	LOS F	660.7
	T	1.297	335.7	LOS F	1004.6	1.076	152.5	LOS F	666.9
	R	1.329	373.4	LOS F	296	0.882	86	LOS F	136
North: Gilbertson Road	L	0.713	39.3	LOS D	135	0.763	53.7	LOS D	121.7
	T	0.713	34.7	LOS C	135	0.763	49.2	LOS D	121.7
	R	1.149	207.7	LOS F	304.7	0.930	77.2	LOS E	147.7
West: South Street	L	1.27	319.2	LOS F	939	1.07	154.1	LOS F	647.1
	T	1.27	312.8	LOS F	950.2	1.07	148.5	LOS F	654.6
	R	0.701	81.2	LOS F	63.5	1.079	173.8	LOS F	194.5
All vehicles		1.329	291.8	LOS F	1004.6	1.128	140.5	LOS F	666.9

The increase in ACP traffic is likely to result in a worse intersection performance. However, the intersection is likely to require an upgrade even with just the background growth as demonstrated in Scenario 4.

7.6.5.6 Gilbertson Road / Brophy Street

The AM and PM peak SIDRA outputs for the Gilbertson Road / Brophy Street intersection in Scenario 5 is shown in Table 7-40.

Table 7-40 Gilbertson Road / Brophy Street (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	L	0.215	4.6	LOS A	0	0.25	4.6	LOS A	0
	T	0.215	0	LOS A	0	0.25	0	LOS A	0
North: Gilbertson Road	T	0.338	0.2	LOS A	1.3	0.297	0.5	LOS A	2.3
	R	0.338	5.6	LOS A	1.3	0.297	5.9	LOS A	2.3
West: Brophy Street	L	0.598	10.1	LOS B	5.4	0.434	7.6	LOS A	6.9
	R	0.598	16.2	LOS C	5.4	0.434	12.9	LOS B	6.9
All vehicles		0.598	2.6	NA	5.4	0.434	3.2	NA	6.9

The overall intersection performance likely to remain good.

7.6.5.7 Gilbertson Road / Williamson Road

The AM and PM peak SIDRA outputs for the Gilbertson Road / Williamson Road intersection in Scenario 5 is shown in Table 7-41.

Table 7-41 Gilbertson Road / Williamson Road (Scenario 5) SIDRA Outputs

Intersection Approach	Movement	AM peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South: Gilbertson Road	T	0.207	0.4	LOS A	1	0.227	0.2	LOS A	0.9
	R	0.207	5.9	LOS A	1	0.227	5.7	LOS A	0.9
East: Williamson Street	L	0.142	6.7	LOS A	1.6	0.02	6.3	LOS A	0.2
	R	0.142	10.3	LOS B	1.6	0.02	9.6	LOS A	0.2
North: Gilbertson Road	L	0.269	4.1	LOS A	0	0.247	4.1	LOS A	0
	T	0.269	0	LOS A	0	0.247	0	LOS A	0
All vehicles		0.269	1.2	NA	1.6	0.247	0.4	NA	0.9

Slight increase in delay is expected, while the intersection performance is still very good.

7.6.6 Overall Intersections Performance

As the majority of the density is allocated to the east side of the ACSP, the traffic volume along Gilbertson Road is expected to increase significantly. The majority of the intersections are expected to experience high degree of saturation and bad Level of Service due to the significant increase of background traffic.

To better understand the impact of background traffic growth on the overall road network within the ACSP, especially intersections along South Street, a scenario 4 in **Section 7.6.4**Error! Reference source not found. is assessed.

This SIDRA scenario assumed that only Kardinya Park Shopping Centre development was undertaken, without the ACSP proposal. The signalisation of the Shopping Centre Access 3 and modification of existing Main Street intersection to LI/LO were included.

This scenario included a 1.3% per annum regional background traffic growth has been applied along South Street as advised by Main Roads WA. The background traffic growth for the remaining roads is assumed to be 1% per annum.

It is noted that the existing South Street / North Lake Road signalised intersection and South Street / Gilbertson Road signalised intersection are likely to perform unsatisfactorily with LoS F during the peak hour

Therefore, it can be concluded that with the suggested background growth rate of 1.3% per annum, even without the ACP, intersections along South Street are likely to experience significant traffic growth in assessment year 2050 which will require extensive road upgrades for this level of growth to be suitably accommodated.

7.6.7 SIDRA Analysis Summary

The SIDRA analysis results are summarised as the following:

- The majority of the intersections are currently performing at an acceptable Level of Service, except for the uncontrolled full movement South Street / Main Street intersection.
- The redevelopment of Kardinya Park Shopping Centre includes the signalisation of South Street / Shopping Centre intersection and modification of existing South Street / Main Street intersection into LI/LO intersection.
- In 2033 (10-year horizon) scenario, the increase of traffic is expected to result in intersections along South Street, especially South Street/ Gilbertson Road intersection to perform unsatisfactorily during the peak hours. This is likely due to the increased traffic volume from the residential development along Gilbertson Road.
- In the Ultimate scenario (Scenario 3), the majority of the signalised intersections along South Street are likely to fail with Level of Service F. The poor performance of South Street / Gilbertson Road signalised intersection is likely due to increase of residential density within the proposed ACSP, utilising Gilbertson Road as the main access.
- However, the impact of projected background traffic growth along South Street is expected to be the main factor which would result in poor intersection performances for signalised intersections along South Street within the ACP. This is demonstrated in Scenario 4 where the main signalised intersections along South Street is still likely to perform poorly even without the proposed ACSP.

8. Service / Loading

8.1 Service / Delivery

Freight and deliveries destined for the Activity Centre can take advantage of the high-capacity regional road network within the area, including South Street, North Lake Road, Leach Highway and Kwinana Freeway.

Commercial and retail deliveries are expected to be serviced by on-site loading docks or loading bays to limit the impact on boundary roads and conflicts between heavy vehicles and vulnerable road users.

8.2 Regional Road Freight

Kardinya Activity Centre's location along South Street, as well as its proximity to the O'Connor industrial area is likely to result in a high frequency of bypass freight trips. Long-term investigation of an alternative freight route to assist in improving road conditions in the vicinity, while reducing the intrinsic risks associated with operating in a mixed-traffic environment.

9. Conclusions

The Kardinya Activity Centre Structure Plan envisages to achieve a high-quality transport environment, where integrated network of transport modes encompassing private vehicles, public transport, cycling, and walking modes are proposed.

Parking demand has been chosen as the focus for mode shift. Parking provision for both residential and commercial within the Activity Centre is proposed to be restricted to a maximum rate determined for general land uses, and partly offset through public provision.

For the purpose of this assessment, all internal trips between land uses within the Activity Centre, are assumed to be taken by non-car modes. However, for robust assessment, this reduction is only reflected onto non-residential traffic generation, with approximately 16% during the AM peak and 31% during the PM peak.

SIDRA analysis results show that the following intersections may perform unsatisfactorily upon the ultimate buildout of the Activity Centre:

- South Street / North Lake Road Intersection
- South Street / Gilbertson Road Intersection

However, this is mainly due to the growth rate used for the regional traffic carried along South Street, which does not factor in any potential behaviour change in private vehicle use over the next 30 years.

South Street / Gilbertson Road intersection could be improved by upgrading the intersection layout and signal phasing.

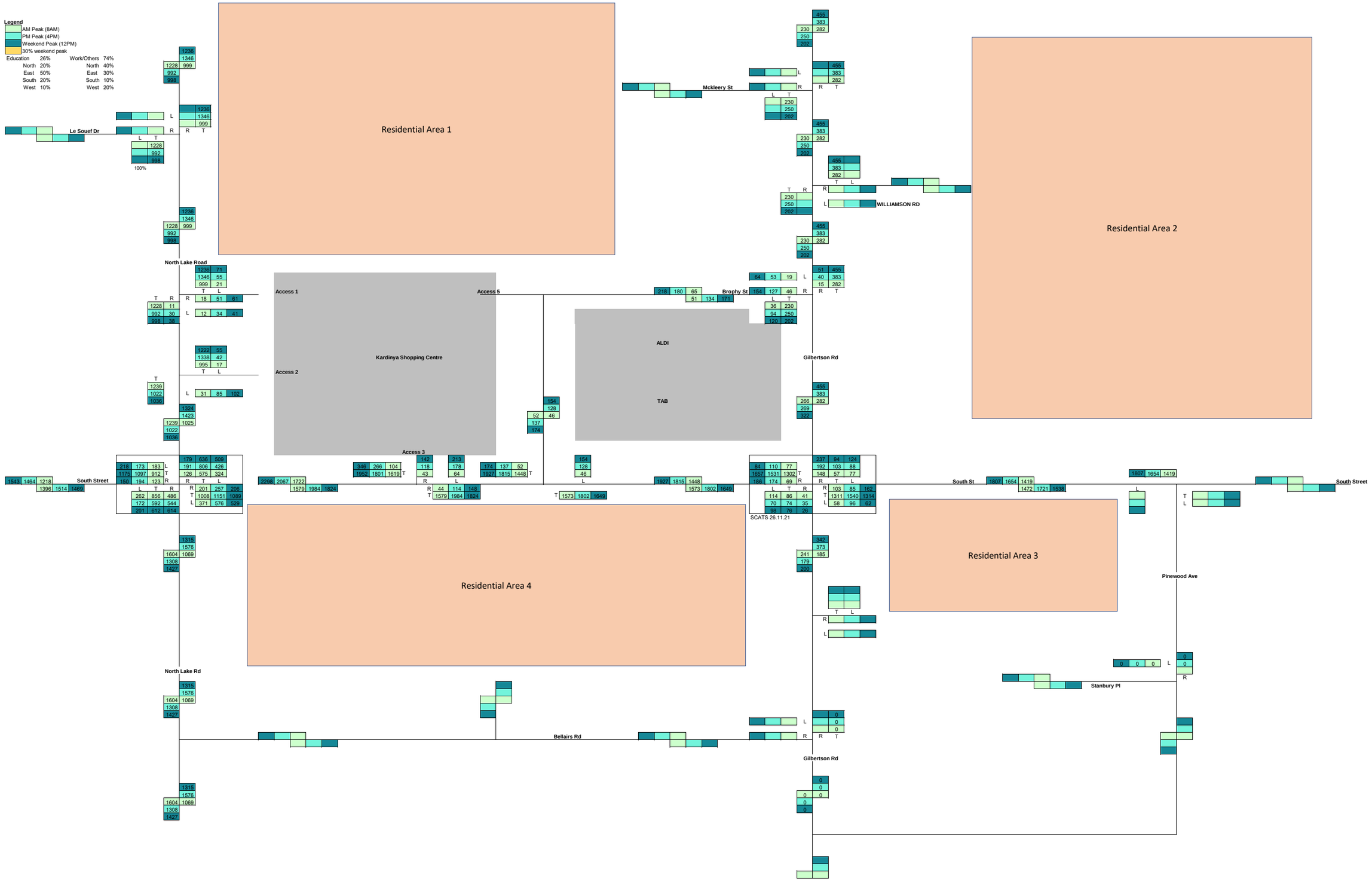
Drivers are likely to change their travel behaviour when the road network is saturated by increased traffic volume. Additionally, higher residential density which represents a higher number of public transport patrons will trigger the requirement for better public transport facilities, providing the impetus to accelerate the planning of the high-capacity public transport (BRT/LRT) route connecting Kardinya Centre with Murdoch Station.

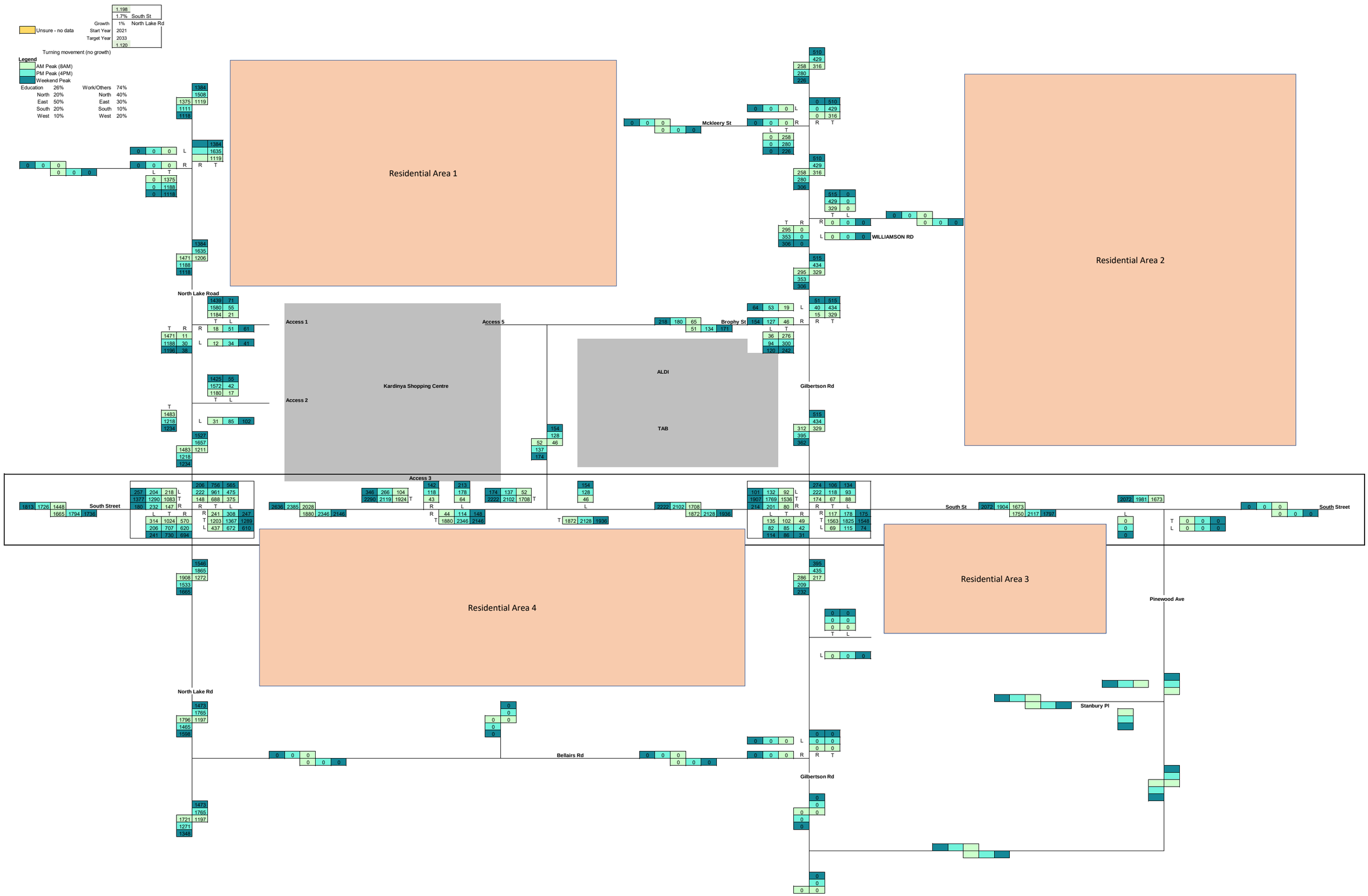
The proposal within the ACSP will increase the residential density, which will then activate the need for this BRT/LRT. This proposal is expected to shift majority of the private vehicle traffic to public transport, which will result in major transport mode shift.

Appendices

We design with community in mind

Appendix A Traffic Distribution


Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak (12PM)
30% weekend peak
Education 26%
North 20%
East 50%
South 20%
West 10%
Work/Others 74%
North 40%
East 30%
South 10%
West 20%
Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Le Souef Dr
Mckleery St
WILLIAMSON RD
North Lake Road
Access 1
Access 2
Access 3
Access 5
Kardinya Shopping Centre
ALDI
TAB
Brophy St
Gilbertson Rd
South Street
South St
Bellairs Rd
Pinewood Ave
Stanbury Pl
SCATS 26.11.21
100%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Growth 1%
Start Year 2021
Target Year 2033
Turning movement (no growth)
Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak
Education 26%
North 20%
East 50%
South 20%
West 10%
Work/Others 74%
North 40%
East 30%
South 10%
West 20%
South St
North Lake Rd
Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Mckleery St
WILLIAMSON RD
Brophy St
Gilbertson Rd
Access 1
Access 2
Access 3
Access 5
Kardinya Shopping Centre
ALDI
TAB
South Street
Bellairs Rd
Pinewood Ave
Stanbury Pl

Unsure - no data

Growth 1%
Start Year 2021
Target Year 2050

Turning movement (no growth)

Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak

Education	29%	Work/Others	71%
North	20%	North	40%
East	50%	East	30%
South	20%	South	10%
West	10%	West	20%

South St
North Lake Rd
Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Mckleery St
WILLIAMSON RD
Brophy St
Gilbertson Rd
Access 1
Access 2
Access 3
Access 5
Kardinya Shopping Centre
ALDI
TAB
South Street
Bellairs Rd
Pinewood Ave
Stanbury Pl

%Factor 35%

Zone	Trip Generation AM IN	AM OU	PM IN	PM OU	Weekend	Weekend	Trips to be included AM IN	AM OU	PM IN	PM OU	Weekend	Weekend OUT
Additi												

Legend
- AM Peak (8AM)
- PM Peak (4PM)
- Weekend Peak

Work/Others 74%
North 20%
East 50%
South 10%
West 20%

1.159
1.3% South St
Growth
Start Year 2023
Target Year 2033
1.122
Turning movement (no growth)

Growth 1% North Lake Rd
Start Year 2021
Target Year 2023
1.020

Growth 1% North Lake Rd
Start Year 2023
Target Year 2033
1.100

Growth 1.3% South St
Start Year 2021
Target Year 2023
1.026

Growth 1.3% South St
Start Year 2023
Target Year 2033
1.130

Residential Area 1

Residential Area 2

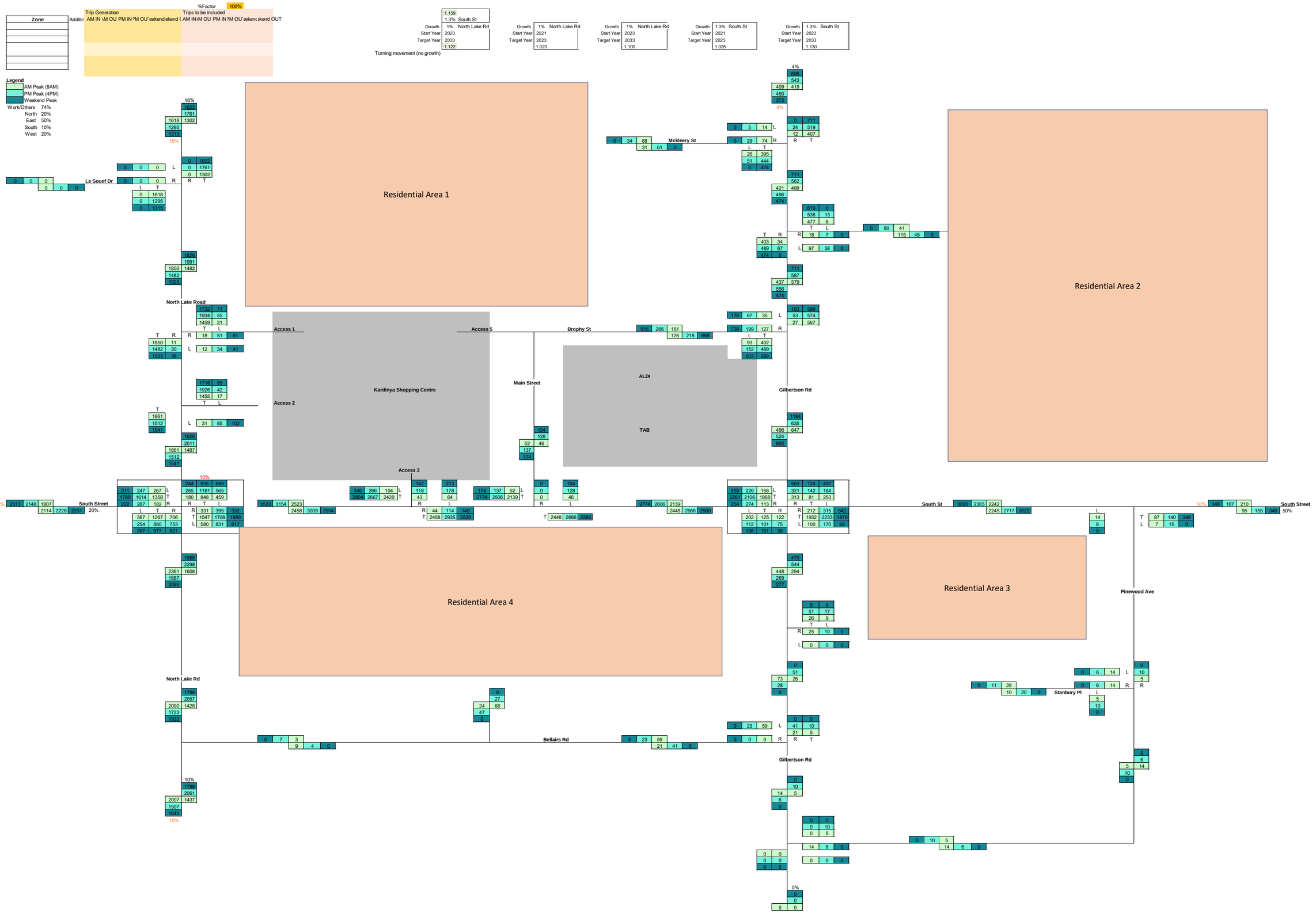
Residential Area 3

Residential Area 4

Kardinya Shopping Centre

ALDI

Mckleery St
Le Souef Dr
Williamson Rd
North Lake Road
Access 1
Access 2
Access 3
Access 5
Brophy St
Main Street
Gilbertson Rd
South Street
South St
Pinewood Ave
Stanbury Pl
Bellairs Rd
North Lake Rd
Gilbertson Rd


%Factor 100%
Zone
Trip Generation
Trips to be included
Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak
Work/Others 74%
North 20%
East 50%
South 10%
West 20%
Turning movement (no growth)
1.159
1.3% South St
Growth 1% North Lake Rd
Start Year 2023
Target Year 2033
1.122
Growth 1% North Lake Rd
Start Year 2021
Target Year 2023
1.020
Growth 1% North Lake Rd
Start Year 2023
Target Year 2033
1.100
Growth 1.3% South St
Start Year 2021
Target Year 2023
1.026
Growth 1.3% South St
Start Year 2023
Target Year 2033
1.130
Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Kardinya Shopping Centre
ALDI
TAB
Le Souef Dr
North Lake Road
Mckleery St
Brophy St
Main Street
Gilbertson Rd
South Street
South St
Access 1
Access 2
Access 3
Access 5
North Lake Rd
Bellairs Rd
Pinewood Ave
Stanbury Pl

Appendix B SIDRA Results

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	372	3.0	368	3.0	0.195	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
3	R2	1	1.0	1	1.0	0.195	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	43.1
Approach		373	3.0	369 N1	3.0	0.195	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
East: Williamson Rd														
4	L2	1	1.0	1	1.0	0.003	6.1	LOS A	0.0	0.0	0.49	0.60	0.49	24.3
6	R2	1	1.0	1	1.0	0.003	8.9	LOS A	0.0	0.0	0.49	0.60	0.49	26.6
Approach		2	1.0	2	1.0	0.003	7.5	LOS A	0.0	0.0	0.49	0.60	0.49	25.6
North: Gilbertson Rd														
7	L2	1	1.0	1	1.0	0.239	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.6
8	T1	452	3.0	452	3.0	0.239	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach		453	3.0	453	3.0	0.239	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
All Vehicles		827	3.0	823 N1	3.0	0.239	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [AM Peak 2033- Access 1 - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1548	5.0	1548	5.0	0.275	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
3	R2	12	0.0	12	0.0	0.067	25.2	LOS D	0.1	0.5	0.84	0.94	0.84	22.8
Approach		1560	5.0	1560	5.0	0.275	0.2	NA	0.1	0.5	0.01	0.01	0.01	69.2
East: Access 1														
4	L2	13	0.0	13	0.0	0.015	5.7	LOS A	0.0	0.1	0.43	0.59	0.43	22.6
6	R2	19	0.0	19	0.0	0.211	44.5	LOS E	0.2	1.7	0.91	0.97	0.97	17.7
Approach		32	0.0	32	0.0	0.211	29.0	LOS D	0.2	1.7	0.72	0.82	0.75	18.2
North: North Lake Road														
7	L2	22	10.0	22	10.0	0.220	6.5	LOS A	0.0	0.0	0.00	0.03	0.00	38.6
8	T1	1246	5.0	1246	5.0	0.220	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.3
Approach		1268	5.1	1268	5.1	0.220	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.2
All Vehicles		2860	5.0	2860	5.0	0.275	0.5	NA	0.2	1.7	0.01	0.02	0.01	67.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: C101 [AM Peak 2033- South Street - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	331	3.0	331	3.0	0.183	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.1
2	T1	1078	5.0	1078	5.0	* 0.928	82.2	LOS F	19.3	142.6	1.00	1.06	1.30	17.4
3	R2	600	3.0	600	3.0	* 0.907	87.1	LOS F	15.3	110.8	1.00	0.97	1.28	16.6
Approach		2008	4.1	2008	4.1	0.928	71.2	LOS E	19.3	142.6	0.84	0.95	1.08	21.3
East: South Street														
4	L2	460	3.0	460	3.0	0.256	7.3	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1266	5.0	1266	5.0	* 0.921	80.8	LOS F	23.6	174.9	1.00	0.98	1.15	22.0
6	R2	254	3.0	254	3.0	* 0.934	96.4	LOS F	12.8	92.4	1.00	0.94	1.23	7.2
Approach		1980	4.3	1980	4.3	0.934	65.7	LOS E	23.6	174.9	0.77	0.88	0.89	23.6
North: North Lake Road														
7	L2	395	3.0	395	3.0	0.432	29.4	LOS C	10.4	75.3	0.69	0.86	0.69	19.1
8	T1	724	5.0	724	5.0	0.609	57.6	LOS E	9.8	72.7	0.96	0.81	0.96	27.3
9	R2	156	3.0	156	3.0	0.232	62.5	LOS E	3.0	21.5	0.89	0.76	0.89	25.3
Approach		1275	4.1	1275	4.1	0.609	49.5	LOS D	10.4	75.3	0.87	0.82	0.87	25.7
West: South Street														
10	L2	229	3.0	229	3.0	0.218	20.4	LOS C	4.7	33.8	0.50	0.71	0.50	39.8
11	T1	1140	5.0	1140	5.0	0.739	51.8	LOS D	15.7	116.0	0.96	0.84	0.96	24.3
12	R2	155	3.0	155	3.0	0.570	71.1	LOS E	6.5	47.3	0.98	0.81	0.98	29.3
Approach		1524	4.5	1524	4.5	0.739	49.0	LOS D	15.7	116.0	0.90	0.82	0.90	26.5
All Vehicles		6787	4.2	6787	4.2	0.934	60.5	LOS E	23.6	174.9	0.84	0.88	0.94	23.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47

West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [AM Peak 2033- Access 3 - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	1979	5.0	1979	5.0	* 0.682	9.0	LOS A	9.5	70.0	0.54	0.50	0.54	23.1
6	R2	46	0.0	46	0.0	* 0.340	82.8	LOS F	2.1	14.9	1.00	0.75	1.00	5.1
Approach		2025	4.9	2025	4.9	0.682	10.7	LOS B	9.5	70.0	0.55	0.50	0.55	20.7
North: Access 3														
7	L2	67	0.0	67	0.0	0.261	64.4	LOS E	2.7	18.9	0.92	0.76	0.92	2.9
9	R2	45	0.0	45	0.0	* 0.533	88.8	LOS F	1.2	8.1	1.00	0.75	1.07	2.3
Approach		113	0.0	113	0.0	0.533	74.2	LOS E	2.7	18.9	0.95	0.75	0.98	2.6
West: South Street														
10	L2	109	0.0	109	0.0	0.077	10.9	LOS B	1.2	8.2	0.26	0.67	0.26	33.6
11	T1	2025	5.0	2025	5.0	0.558	7.4	LOS A	12.9	95.4	0.44	0.40	0.44	40.8
Approach		2135	4.7	2135	4.7	0.558	7.6	LOS A	12.9	95.4	0.43	0.42	0.43	40.3
All Vehicles		4273	4.7	4273	4.7	0.682	10.8	LOS B	12.9	95.4	0.50	0.47	0.50	28.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Main Street - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	1971	5.0	1971	5.0	0.354	0.0	LOS A	6.1	45.0	0.00	0.00	0.00	59.8
Approach		1971	5.0	1971	5.0	0.354	0.0	NA	6.1	45.0	0.00	0.00	0.00	59.8
North: Main Street														
7	L2	48	0.0	48	0.0	0.138	7.7	LOS A	0.5	3.2	0.53	0.76	0.53	22.3
Approach		48	0.0	48	0.0	0.138	7.7	LOS A	0.5	3.2	0.53	0.76	0.53	22.3
West: South Street														
10	L2	55	0.0	55	0.0	0.029	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	1798	5.0	1798	5.0	0.323	0.0	LOS A	7.0	52.1	0.00	0.00	0.00	59.8
Approach		1853	4.9	1853	4.9	0.323	0.2	NA	7.0	52.1	0.00	0.02	0.00	57.5
All Vehicles		3872	4.9	3872	4.9	0.354	0.2	NA	7.0	52.1	0.01	0.02	0.01	58.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: F101 [AM Peak 2033- South Street / Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	142	2.0	142	2.0	0.617	72.8	LOS E	6.2	44.2	1.00	0.81	1.00	16.9
2	T1	107	2.0	107	2.0	* 0.783	73.9	LOS E	7.4	52.9	1.00	0.91	1.15	16.7
3	R2	52	2.0	52	2.0	0.783	78.5	LOS E	7.4	52.9	1.00	0.91	1.15	26.0
Approach		301	2.0	301	2.0	0.783	74.2	LOS E	7.4	52.9	1.00	0.86	1.08	18.7
East: South Street														
4	L2	73	2.0	73	2.0	0.795	47.9	LOS D	23.3	171.7	0.95	0.86	0.95	34.6
5	T1	1645	5.0	1645	5.0	* 0.795	41.1	LOS D	23.4	172.8	0.93	0.84	0.93	27.4
6	R2	123	3.0	123	3.0	* 0.790	85.2	LOS F	5.8	42.2	1.00	0.87	1.19	16.7
Approach		1841	4.7	1841	4.7	0.795	44.3	LOS D	23.4	172.8	0.93	0.84	0.95	26.7
North: Gilbertson Road														
7	L2	93	3.0	93	3.0	0.305	45.1	LOS D	5.4	39.1	0.79	0.72	0.79	28.8
8	T1	71	3.0	71	3.0	0.305	40.5	LOS D	5.4	39.1	0.79	0.72	0.79	26.7
9	R2	183	3.0	183	3.0	* 0.580	48.1	LOS D	6.3	45.8	0.93	0.80	0.93	10.9
Approach		346	3.0	346	3.0	0.580	45.7	LOS D	6.3	45.8	0.87	0.76	0.87	20.4
West: South Street														
10	L2	97	3.0	97	3.0	0.786	48.0	LOS D	17.0	125.0	0.95	0.86	0.95	10.3
11	T1	1617	5.0	1617	5.0	0.786	42.9	LOS D	17.0	125.0	0.96	0.87	0.96	30.3
12	R2	84	2.0	84	2.0	0.534	84.9	LOS F	3.9	27.7	1.00	0.78	1.00	18.0
Approach		1798	4.8	1798	4.8	0.786	45.1	LOS D	17.0	125.0	0.96	0.86	0.97	28.7
All Vehicles		4286	4.4	4286	4.4	0.795	46.9	LOS D	23.4	172.8	0.95	0.84	0.96	26.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											
P3	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38

West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	38	2.0	38	2.0	0.174	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	48.6
2	T1	291	3.0	291	3.0	0.174	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	47.9
Approach		328	2.9	328	2.9	0.174	0.5	NA	0.0	0.0	0.00	0.06	0.00	48.1
North: Gilbertson Rd														
8	T1	346	3.0	346	3.0	0.195	0.1	LOS A	0.1	0.6	0.05	0.02	0.05	45.8
9	R2	16	2.0	16	2.0	0.195	4.7	LOS A	0.1	0.6	0.05	0.02	0.05	47.7
Approach		362	3.0	362	3.0	0.195	0.3	NA	0.1	0.6	0.05	0.02	0.05	46.4
West: Brophy St														
10	L2	20	5.0	20	5.0	0.087	5.7	LOS A	0.1	1.0	0.43	0.67	0.43	41.9
12	R2	48	5.0	48	5.0	0.087	7.8	LOS A	0.1	1.0	0.43	0.67	0.43	41.9
Approach		68	5.0	68	5.0	0.087	7.2	LOS A	0.1	1.0	0.43	0.67	0.43	41.9
All Vehicles		759	3.1	759	3.1	0.195	1.0	NA	0.1	1.0	0.06	0.10	0.06	46.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	311	3.0	311	3.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
3	R2	1	1.0	1	1.0	0.165	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	43.1
Approach		312	3.0	312	3.0	0.165	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
East: Williamson Rd														
4	L2	1	1.0	1	1.0	0.002	5.7	LOS A	0.0	0.0	0.43	0.56	0.43	25.9
6	R2	1	1.0	1	1.0	0.002	7.5	LOS A	0.0	0.0	0.43	0.56	0.43	27.8
Approach		2	1.0	2	1.0	0.002	6.6	LOS A	0.0	0.0	0.43	0.56	0.43	27.0
North: Gilbertson Rd														
7	L2	1	1.0	1	1.0	0.183	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.6
8	T1	346	3.0	346	3.0	0.183	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach		347	3.0	347	3.0	0.183	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
All Vehicles		661	3.0	661	3.0	0.183	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: A101 [PM Peak 2033- Access 1 - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1251	5.0	1222	5.0	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
3	R2	32	0.0	31	0.0	0.472	72.6	LOS F	0.5	3.3	0.97	1.02	1.12	10.6
Approach		1282	4.9	1253 N1	4.9	0.472	1.8	NA	0.5	3.3	0.02	0.02	0.03	64.7
East: Access 1														
4	L2	36	0.0	36	0.0	0.069	5.4	LOS A	0.1	0.4	0.39	0.60	0.39	23.4
6	R2	54	0.0	54	0.0	2.080	1116.3	LOS F	9.3	64.9	1.00	2.00	5.07	1.0
Approach		89	0.0	89	0.0	2.080	671.9	LOS F	9.3	64.9	0.76	1.44	3.20	1.1
North: North Lake Road														
7	L2	58	10.0	58	10.0	0.348	6.6	LOS A	0.0	0.0	0.00	0.09	0.00	37.8
8	T1	1663	5.0	1663	5.0	0.348	0.1	LOS A	3.5	26.2	0.00	0.02	0.00	68.8
Approach		1721	5.2	1721	5.2	0.348	0.3	NA	3.5	26.2	0.00	0.02	0.00	66.6
All Vehicles		3093	4.9	3064 N1	4.9	2.080	20.5	NA	9.3	64.9	0.03	0.06	0.10	30.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [PM Peak 2033- South Street - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	217	3.0	217	3.0	0.120	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.2
2	T1	744	5.0	744	5.0	1.002	117.2	LOS F	15.1	111.9	1.00	1.17	1.59	13.1
3	R2	653	3.0	653	3.0	* 1.417	456.0	LOS F	41.8	302.6	1.00	1.74	3.00	3.8
Approach		1614	3.9	1614	3.9	1.417	239.4	LOS F	41.8	302.6	0.87	1.32	1.95	7.7
East: South Street														
4	L2	707	3.0	673	3.0	0.374	7.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1439	5.0	1369	5.0	0.942	78.2	LOS E	25.0	185.0	0.98	1.09	1.28	22.5
6	R2	324	3.0	308	3.0	* 1.375	412.5	LOS F	25.5	185.0	1.00	1.67	2.86	1.7
Approach		2471	4.2	2351 N1	4.2	1.375	101.8	LOS F	25.5	185.0	0.70	1.01	1.12	17.0
North: North Lake Road														
7	L2	500	3.0	500	3.0	1.130	169.8	LOS F	26.2	190.0	1.00	1.22	1.99	3.4
8	T1	1012	5.0	1012	5.0	* 1.386	415.1	LOS F	25.7	190.0	1.00	1.89	2.88	5.5
9	R2	234	3.0	234	3.0	0.250	53.6	LOS D	4.1	29.8	0.83	0.77	0.83	27.7
Approach		1745	4.2	1745	4.2	1.386	296.4	LOS F	26.2	190.0	0.98	1.55	2.35	5.9
West: South Street														
10	L2	215	3.0	215	3.0	0.177	15.3	LOS B	3.4	24.7	0.39	0.67	0.39	44.6
11	T1	1358	5.0	1358	5.0	* 1.407	438.5	LOS F	67.6	499.9	1.00	2.12	2.94	4.0
12	R2	244	3.0	244	3.0	1.089	178.7	LOS F	18.3	132.6	1.00	1.23	1.91	15.4
Approach		1817	4.5	1817	4.5	1.407	353.6	LOS F	67.6	499.9	0.93	1.83	2.50	5.4
All Vehicles		7646	4.2	7526 N1	4.3	1.417	237.2	LOS F	67.6	499.9	0.86	1.40	1.92	7.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [PM Peak 2033- Access 3 - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2469	5.0	2325	5.0	* 1.084	151.7	LOS F	9.5	70.0	1.00	1.55	1.76	2.0
6	R2	120	0.0	113	0.0	0.830	89.0	LOS F	5.4	37.9	1.00	0.84	1.14	4.8
Approach		2589	4.8	2439 N1	4.8	1.084	148.8	LOS F	9.5	70.0	1.00	1.52	1.73	2.1
North: Access 3														
7	L2	187	0.0	187	0.0	* 1.081	179.4	LOS F	14.7	102.6	1.00	1.30	1.96	1.1
9	R2	124	0.0	124	0.0	0.912	101.7	LOS F	3.4	23.8	1.00	1.03	1.59	2.0
Approach		312	0.0	312	0.0	1.081	148.4	LOS F	14.7	102.6	1.00	1.19	1.82	1.3
West: South Street														
10	L2	280	0.0	260	0.0	0.191	12.4	LOS B	3.3	23.1	0.31	0.69	0.31	31.7
11	T1	2231	5.0	2074	5.0	1.026	109.6	LOS F	25.0	185.0	1.00	1.37	1.54	6.0
Approach		2511	4.4	2334 N1	4.4	1.026	98.8	LOS F	25.0	185.0	0.92	1.30	1.40	6.7
All Vehicles		5412	4.3	5084 N1	4.6	1.084	125.8	LOS F	25.0	185.0	0.96	1.40	1.59	3.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Main Street - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2240	5.0	2090	5.0	0.375	0.0	LOS A	16.9	125.0	0.00	0.00	0.00	59.7
Approach		2240	5.0	2090[N1]	5.0	0.375	0.0	NA	16.9	125.0	0.00	0.00	0.00	59.7
North: Main Street														
7	L2	135	0.0	135	0.0	0.423	10.8	LOS B	1.9	13.1	0.61	0.89	0.80	17.8
Approach		135	0.0	135	0.0	0.423	10.8	LOS B	1.9	13.1	0.61	0.89	0.80	17.8
West: South Street														
10	L2	144	0.0	137	0.0	0.074	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2213	5.0	2104	5.0	0.378	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.7
Approach		2357	4.7	2241[N1]	4.7	0.378	0.3	NA	9.5	70.0	0.00	0.03	0.00	55.3
All Vehicles		4732	4.7	4466[N1]	5.0	0.423	0.5	NA	16.9	125.0	0.02	0.04	0.02	55.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [PM Peak 2033- South Street / Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	86	2.0	86	2.0	* 1.424	458.4	LOS F	11.0	78.6	1.00	1.64	3.13	3.6
2	T1	89	2.0	89	2.0	1.225	280.8	LOS F	13.0	93.0	1.00	1.55	2.47	5.6
3	R2	44	2.0	44	2.0	1.225	285.3	LOS F	13.0	93.0	1.00	1.55	2.47	10.2
Approach		220	2.0	220	2.0	1.424	351.4	LOS F	13.0	93.0	1.00	1.58	2.73	5.4
East: South Street														
4	L2	121	2.0	121	2.0	1.517	539.0	LOS F	103.7	763.3	1.00	2.55	3.20	6.0
5	T1	1921	5.0	1921	5.0	* 1.517	533.9	LOS F	103.7	763.3	1.00	2.50	3.21	3.2
6	R2	187	3.0	187	3.0	1.420	451.2	LOS F	23.2	168.1	1.00	1.58	3.02	3.7
Approach		2229	4.7	2229	4.7	1.517	527.2	LOS F	103.7	763.3	1.00	2.43	3.19	3.4
North: Gilbertson Road														
7	L2	98	3.0	98	3.0	0.847	66.8	LOS E	9.6	69.3	0.89	0.91	1.11	23.1
8	T1	124	3.0	124	3.0	0.847	62.2	LOS E	9.6	69.3	0.89	0.91	1.11	21.8
9	R2	234	3.0	234	3.0	* 1.489	504.3	LOS F	22.8	165.0	1.00	1.95	3.21	1.2
Approach		456	3.0	456	3.0	1.489	289.8	LOS F	22.8	165.0	0.95	1.44	2.19	4.6
West: South Street														
10	L2	139	3.0	134	3.0	0.780	41.1	LOS D	17.0	125.0	0.90	0.83	0.90	11.9
11	T1	1862	5.0	1794	5.0	0.780	38.8	LOS D	17.0	125.0	0.94	0.86	0.94	32.0
12	R2	212	2.0	204	2.0	* 1.529	542.3	LOS F	17.5	125.0	1.00	1.67	3.24	3.8
Approach		2213	4.6	2132 N1	4.6	1.529	87.1	LOS F	17.5	125.0	0.95	0.93	1.16	18.0
All Vehicles		5118	4.4	5037 N1	4.4	1.529	311.8	LOS F	103.7	763.3	0.97	1.67	2.22	5.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	99	2.0	96	2.0	0.214	4.6	LOS A	0.0	0.0	0.00	0.13	0.00	48.0
2	T1	316	3.0	306	3.0	0.214	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	46.0
Approach		415	2.8	401 N1	2.8	0.214	1.1	NA	0.0	0.0	0.00	0.13	0.00	47.1
North: Gilbertson Rd														
8	T1	457	3.0	457	3.0	0.275	0.3	LOS A	0.2	1.8	0.13	0.05	0.13	41.0
9	R2	42	2.0	42	2.0	0.275	5.4	LOS A	0.2	1.8	0.13	0.05	0.13	47.2
Approach		499	2.9	499	2.9	0.275	0.8	NA	0.2	1.8	0.13	0.05	0.13	44.0
West: Brophy St														
10	L2	56	5.0	56	5.0	0.343	6.6	LOS A	0.5	4.1	0.51	0.77	0.63	39.7
12	R2	134	5.0	134	5.0	0.343	10.8	LOS B	0.5	4.1	0.51	0.77	0.63	39.7
Approach		189	5.0	189	5.0	0.343	9.6	LOS A	0.5	4.1	0.51	0.77	0.63	39.7
All Vehicles		1103	3.2	1090 N1	3.3	0.343	2.4	NA	0.5	4.1	0.15	0.20	0.17	43.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	400	3.0	387	3.0	0.227	0.2	LOS A	0.1	0.9	0.09	0.03	0.09	46.5
3	R2	25	1.0	24	1.0	0.227	5.7	LOS A	0.1	0.9	0.09	0.03	0.09	41.1
Approach		425	2.9	412 N1	2.9	0.227	0.6	NA	0.1	0.9	0.09	0.03	0.09	46.0
East: Williamson Rd														
4	L2	14	1.0	14	1.0	0.020	6.3	LOS A	0.0	0.2	0.47	0.63	0.47	25.5
6	R2	3	1.0	3	1.0	0.020	9.6	LOS A	0.0	0.2	0.47	0.63	0.47	27.5
Approach		17	1.0	17	1.0	0.020	6.9	LOS A	0.0	0.2	0.47	0.63	0.47	26.0
North: Gilbertson Rd														
7	L2	4	1.0	4	1.0	0.247	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.5
8	T1	464	3.0	464	3.0	0.247	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.5
Approach		468	3.0	468	3.0	0.247	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.4
All Vehicles		911	2.9	897 N1	2.9	0.247	0.4	NA	0.1	0.9	0.05	0.03	0.05	46.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [AM Peak 2033- Access 1 - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1561	5.0	1561	5.0	0.277	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
3	R2	12	0.0	12	0.0	0.067	25.4	LOS D	0.1	0.5	0.84	0.94	0.84	22.7
Approach		1573	5.0	1573	5.0	0.277	0.2	NA	0.1	0.5	0.01	0.01	0.01	69.2
East: Access 1														
4	L2	13	0.0	13	0.0	0.015	5.7	LOS A	0.0	0.1	0.43	0.59	0.43	22.6
6	R2	19	0.0	19	0.0	0.214	45.2	LOS E	0.3	1.8	0.91	0.97	0.97	17.6
Approach		32	0.0	32	0.0	0.214	29.4	LOS D	0.3	1.8	0.72	0.82	0.75	18.0
North: North Lake Road														
7	L2	22	10.0	22	10.0	0.221	6.5	LOS A	0.0	0.0	0.00	0.03	0.00	38.6
8	T1	1253	5.0	1253	5.0	0.221	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.3
Approach		1275	5.1	1275	5.1	0.221	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.2
All Vehicles		2879	5.0	2879	5.0	0.277	0.5	NA	0.3	1.8	0.01	0.02	0.01	67.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: C101 [AM Peak 2033- South Street - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	331	3.0	331	3.0	0.183	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.1
2	T1	1079	5.0	1079	5.0	* 1.018	123.2	LOS F	23.5	173.7	1.00	1.24	1.59	12.5
3	R2	609	3.0	609	3.0	* 1.024	138.0	LOS F	21.9	158.4	1.00	1.15	1.65	11.4
Approach		2019	4.1	2019	4.1	1.024	108.6	LOS F	23.5	173.7	0.84	1.10	1.35	15.5
East: South Street														
4	L2	468	3.0	468	3.0	0.260	7.3	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1293	5.0	1293	5.0	0.982	102.4	LOS F	25.0	185.0	1.00	1.08	1.29	18.6
6	R2	266	3.0	266	3.0	* 1.025	136.5	LOS F	17.3	125.2	1.00	1.14	1.67	5.2
Approach		2027	4.3	2027	4.3	1.025	84.9	LOS F	25.0	185.0	0.77	0.97	1.04	19.7
North: North Lake Road														
7	L2	327	3.0	327	3.0	0.450	39.8	LOS D	9.3	67.2	0.75	0.90	0.75	15.1
8	T1	716	5.0	716	5.0	0.665	60.7	LOS E	10.0	73.8	0.98	0.82	0.98	26.5
9	R2	142	3.0	142	3.0	0.174	56.6	LOS E	2.6	18.5	0.84	0.75	0.84	26.8
Approach		1185	4.2	1185	4.2	0.665	54.4	LOS D	10.0	73.8	0.90	0.84	0.90	24.6
West: South Street														
10	L2	229	3.0	229	3.0	0.215	20.7	LOS C	4.7	33.7	0.49	0.70	0.49	39.6
11	T1	1158	5.0	1158	5.0	* 1.004	116.9	LOS F	26.6	196.6	1.00	1.24	1.54	13.3
12	R2	155	3.0	155	3.0	0.596	72.2	LOS E	6.6	47.8	0.99	0.81	0.99	29.1
Approach		1542	4.5	1542	4.5	1.004	98.1	LOS F	26.6	196.6	0.92	1.12	1.33	16.3
All Vehicles		6774	4.3	6774	4.3	1.025	89.6	LOS F	26.6	196.6	0.85	1.02	1.17	18.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47

West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [AM Peak 2033- Access 3 - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2038	5.0	2038	5.0	0.791	10.8	LOS B	9.5	70.0	0.64	0.60	0.64	20.4
6	R2	46	0.0	46	0.0	* 0.340	82.8	LOS F	2.1	14.9	1.00	0.75	1.00	5.1
Approach		2084	4.9	2084	4.9	0.791	12.4	LOS B	9.5	70.0	0.64	0.60	0.65	18.5
North: Access 3														
7	L2	67	0.0	67	0.0	0.473	68.7	LOS E	2.9	20.2	0.96	0.78	0.96	2.8
9	R2	45	0.0	45	0.0	* 0.602	90.6	LOS F	1.2	8.1	1.00	0.78	1.16	2.3
Approach		113	0.0	113	0.0	0.602	77.5	LOS E	2.9	20.2	0.97	0.78	1.04	2.5
West: South Street														
10	L2	109	0.0	109	0.0	0.077	10.9	LOS B	1.2	8.2	0.26	0.67	0.26	33.6
11	T1	2059	5.0	2059	5.0	* 0.914	39.3	LOS D	25.0	185.0	0.82	0.91	0.99	14.6
Approach		2168	4.7	2168	4.7	0.914	37.9	LOS D	25.0	185.0	0.80	0.90	0.95	15.1
All Vehicles		4365	4.7	4365	4.7	0.914	26.7	LOS C	25.0	185.0	0.73	0.75	0.81	15.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Main Street - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2029	5.0	2029	5.0	0.364	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		2029	5.0	2029	5.0	0.364	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.8
North: Main Street														
7	L2	48	0.0	48	0.0	0.136	7.7	LOS A	0.8	5.7	0.54	0.75	0.54	22.2
Approach		48	0.0	48	0.0	0.136	7.7	LOS A	0.8	5.7	0.54	0.75	0.54	22.2
West: South Street														
10	L2	55	0.0	55	0.0	0.029	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	1832	5.0	1832	5.0	0.329	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.8
Approach		1886	4.9	1886	4.9	0.329	0.2	NA	9.5	70.0	0.00	0.02	0.00	57.6
All Vehicles		3964	4.9	3964	4.9	0.364	0.2	NA	9.5	70.0	0.01	0.02	0.01	58.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: F101 [AM Peak 2033- South Street / Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	156	2.0	156	2.0	0.612	71.1	LOS E	6.7	47.9	0.99	0.81	0.99	17.2
2	T1	107	2.0	107	2.0	* 0.939	93.9	LOS F	9.8	70.1	1.00	1.12	1.46	14.1
3	R2	74	2.0	74	2.0	0.939	98.5	LOS F	9.8	70.1	1.00	1.12	1.46	22.8
Approach		337	2.0	337	2.0	0.939	84.3	LOS F	9.8	70.1	1.00	0.98	1.24	17.7
East: South Street														
4	L2	78	2.0	78	2.0	0.913	70.6	LOS E	30.1	221.9	1.00	1.02	1.17	28.5
5	T1	1649	5.0	1649	5.0	* 0.913	64.0	LOS E	30.2	223.4	0.98	1.02	1.16	20.5
6	R2	166	3.0	166	3.0	* 0.924	97.2	LOS F	8.7	63.0	1.00	0.97	1.42	15.1
Approach		1894	4.7	1894	4.7	0.924	67.2	LOS E	30.2	223.4	0.99	1.02	1.19	20.3
North: Gilbertson Road														
7	L2	152	3.0	152	3.0	0.480	42.5	LOS D	7.2	52.4	0.78	0.74	0.78	29.5
8	T1	71	3.0	71	3.0	0.480	37.9	LOS D	7.2	52.4	0.78	0.74	0.78	27.3
9	R2	223	3.0	223	3.0	* 0.700	45.7	LOS D	7.6	54.8	0.93	0.82	0.95	11.3
Approach		445	3.0	445	3.0	0.700	43.4	LOS D	7.6	54.8	0.86	0.78	0.87	21.6
West: South Street														
10	L2	124	3.0	124	3.0	0.902	68.7	LOS E	17.0	125.0	1.00	0.96	1.09	7.2
11	T1	1617	5.0	1617	5.0	0.902	69.1	LOS E	17.0	125.0	1.00	0.96	1.09	22.5
12	R2	91	2.0	91	2.0	0.498	77.3	LOS E	4.1	29.0	1.00	0.78	1.00	19.1
Approach		1832	4.7	1832	4.7	0.902	69.5	LOS E	17.0	125.0	1.00	0.95	1.08	21.6
All Vehicles		4507	4.3	4507	4.3	0.939	67.1	LOS E	30.2	223.4	0.98	0.96	1.12	20.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											
P3	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38

West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	85	2.0	85	2.0	0.212	4.6	LOS A	0.0	0.0	0.00	0.12	0.00	48.1
2	T1	313	3.0	313	3.0	0.212	0.0	LOS A	0.0	0.0	0.00	0.12	0.00	46.3
Approach		398	2.8	398	2.8	0.212	1.0	NA	0.0	0.0	0.00	0.12	0.00	47.2
North: Gilbertson Rd														
8	T1	409	3.0	409	3.0	0.237	0.2	LOS A	0.1	1.1	0.09	0.03	0.09	43.6
9	R2	25	2.0	25	2.0	0.237	5.3	LOS A	0.1	1.1	0.09	0.03	0.09	47.5
Approach		435	2.9	435	2.9	0.237	0.5	NA	0.1	1.1	0.09	0.03	0.09	45.2
West: Brophy St														
10	L2	27	5.0	27	5.0	0.164	5.8	LOS A	0.2	1.9	0.49	0.73	0.49	40.9
12	R2	84	5.0	84	5.0	0.164	9.0	LOS A	0.2	1.9	0.49	0.73	0.49	40.9
Approach		112	5.0	112	5.0	0.164	8.2	LOS A	0.2	1.9	0.49	0.73	0.49	40.9
All Vehicles		944	3.1	944	3.1	0.237	1.6	NA	0.2	1.9	0.10	0.15	0.10	44.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	327	3.0	327	3.0	0.183	0.1	LOS A	0.1	0.4	0.05	0.02	0.05	48.2
3	R2	13	1.0	13	1.0	0.183	5.0	LOS A	0.1	0.4	0.05	0.02	0.05	42.1
Approach		340	2.9	340	2.9	0.183	0.3	NA	0.1	0.4	0.05	0.02	0.05	47.8
East: Williamson Rd														
4	L2	36	1.0	36	1.0	0.042	5.9	LOS A	0.1	0.5	0.43	0.61	0.43	26.7
6	R2	6	1.0	6	1.0	0.042	8.3	LOS A	0.1	0.5	0.43	0.61	0.43	28.4
Approach		42	1.0	42	1.0	0.042	6.3	LOS A	0.1	0.5	0.43	0.61	0.43	27.0
North: Gilbertson Rd														
7	L2	2	1.0	2	1.0	0.202	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.5
8	T1	381	3.0	381	3.0	0.202	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
Approach		383	3.0	383	3.0	0.202	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.6
All Vehicles		765	2.9	765	2.9	0.202	0.5	NA	0.1	0.5	0.04	0.04	0.04	46.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: A101 [PM Peak 2033- Access 1 - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1258	5.0	1201	5.1	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
3	R2	32	0.0	30	0.0	0.423	65.1	LOS F	0.4	2.9	0.96	1.01	1.09	11.6
Approach		1289	4.9	1231 N1	5.0	0.423	1.6	NA	0.4	2.9	0.02	0.02	0.03	65.2
East: Access 1														
4	L2	36	0.0	36	0.0	0.097	6.7	LOS A	0.1	0.5	0.50	0.71	0.50	20.7
6	R2	54	0.0	54	0.0	1.825	888.6	LOS F	8.2	57.2	1.00	2.00	5.03	1.2
Approach		89	0.0	89	0.0	1.825	535.8	LOS F	8.2	57.2	0.80	1.48	3.22	1.3
North: North Lake Road														
7	L2	58	10.0	58	10.0	0.301	6.5	LOS A	0.5	4.0	0.00	0.06	0.00	38.2
8	T1	1672	5.0	1672	5.0	0.301	0.0	LOS A	5.5	40.9	0.00	0.02	0.00	68.8
Approach		1729	5.2	1729	5.2	0.301	0.3	NA	5.5	40.9	0.00	0.02	0.00	66.7
All Vehicles		3108	4.9	3050 N1	5.0	1.825	16.5	NA	8.2	57.2	0.03	0.07	0.11	34.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [PM Peak 2033- South Street - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	217	3.0	217	3.0	0.120	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.2
2	T1	747	5.0	747	5.0	1.006	119.2	LOS F	15.3	113.5	1.00	1.17	1.61	12.9
3	R2	663	3.0	663	3.0	* 1.404	444.7	LOS F	42.0	303.9	1.00	1.72	2.96	3.9
Approach		1627	3.9	1627	3.9	1.404	236.9	LOS F	42.0	303.9	0.87	1.32	1.94	7.8
East: South Street														
4	L2	719	3.0	676	3.0	0.376	7.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1458	5.0	1371	5.0	0.958	81.7	LOS F	25.0	185.0	0.99	1.09	1.28	21.8
6	R2	331	3.0	311	3.0	* 1.385	421.3	LOS F	25.6	185.0	1.00	1.68	2.89	1.7
Approach		2507	4.2	2358 N1	4.1	1.385	105.1	LOS F	25.6	185.0	0.71	1.02	1.13	16.6
North: North Lake Road														
7	L2	508	3.0	508	3.0	1.109	152.2	LOS F	26.2	190.0	1.00	1.19	1.90	3.6
8	T1	1012	5.0	1012	5.0	* 1.386	415.0	LOS F	25.7	190.0	1.00	1.89	2.88	5.5
9	R2	234	3.0	234	3.0	0.244	52.7	LOS D	4.1	29.5	0.83	0.77	0.83	28.0
Approach		1754	4.2	1754	4.2	1.386	290.5	LOS F	26.2	190.0	0.98	1.54	2.32	5.9
West: South Street														
10	L2	215	3.0	215	3.0	0.177	15.3	LOS B	3.4	24.7	0.39	0.67	0.39	44.6
11	T1	1378	5.0	1378	5.0	* 1.439	466.0	LOS F	71.9	531.9	1.00	2.17	3.03	3.8
12	R2	244	3.0	244	3.0	1.089	178.7	LOS F	18.3	132.6	1.00	1.23	1.91	15.4
Approach		1837	4.5	1837	4.5	1.439	375.1	LOS F	71.9	531.9	0.93	1.87	2.57	5.1
All Vehicles		7725	4.2	7575 N1	4.3	1.439	241.8	LOS F	71.9	531.9	0.86	1.41	1.93	7.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [PM Peak 2033- Access 3 - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2508	5.0	2363	5.0	* 1.091	157.1	LOS F	9.5	70.0	1.00	1.57	1.78	1.9
6	R2	120	0.0	113	0.0	0.830	89.0	LOS F	5.4	37.9	1.00	0.84	1.14	4.8
Approach		2628	4.8	2476 N1	4.8	1.091	154.0	LOS F	9.5	70.0	1.00	1.54	1.75	2.0
North: Access 3														
7	L2	187	0.0	187	0.0	* 1.081	179.4	LOS F	14.7	102.6	1.00	1.30	1.96	1.1
9	R2	124	0.0	124	0.0	0.912	101.7	LOS F	3.4	23.8	1.00	1.03	1.59	2.0
Approach		312	0.0	312	0.0	1.081	148.4	LOS F	14.7	102.6	1.00	1.19	1.82	1.3
West: South Street														
10	L2	280	0.0	250	0.0	0.184	12.0	LOS B	3.0	20.9	0.29	0.68	0.29	32.1
11	T1	2268	5.0	2028	5.0	1.034	115.5	LOS F	25.0	185.0	1.00	1.40	1.58	5.7
Approach		2548	4.5	2278 N1	4.5	1.034	104.1	LOS F	25.0	185.0	0.92	1.32	1.44	6.4
All Vehicles		5488	4.4	5066 N1	4.7	1.091	131.2	LOS F	25.0	185.0	0.97	1.42	1.62	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Main Street - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2278	5.0	2196	5.0	0.394	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		2278	5.0	2196 N1	5.0	0.394	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Main Street														
7	L2	135	0.0	135	0.0	0.413	10.4	LOS B	3.2	22.5	0.60	0.88	0.78	18.3
Approach		135	0.0	135	0.0	0.413	10.4	LOS B	3.2	22.5	0.60	0.88	0.78	18.3
West: South Street														
10	L2	144	0.0	131	0.0	0.071	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2252	5.0	2047	5.0	0.367	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.8
Approach		2396	4.7	2178 N1	4.7	0.367	0.3	NA	9.5	70.0	0.00	0.03	0.00	55.4
All Vehicles		4808	4.7	4509 N1	5.0	0.413	0.5	NA	9.5	70.0	0.02	0.04	0.02	55.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [PM Peak 2033- South Street / Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	92	2.0	92	2.0	0.540	76.7	LOS E	4.0	29.0	1.00	0.78	1.00	16.3
2	T1	89	2.0	89	2.0	* 0.976	108.9	LOS F	8.2	58.8	1.00	1.16	1.61	12.7
3	R2	53	2.0	53	2.0	0.976	113.4	LOS F	8.2	58.8	1.00	1.16	1.61	20.8
Approach		234	2.0	234	2.0	0.976	97.3	LOS F	8.2	58.8	1.00	1.01	1.37	16.1
East: South Street														
4	L2	132	2.0	132	2.0	1.039	131.1	LOS F	50.6	372.1	1.00	1.31	1.55	19.1
5	T1	1922	5.0	1922	5.0	* 1.039	126.2	LOS F	50.8	375.6	1.00	1.34	1.57	12.0
6	R2	233	3.0	233	3.0	1.021	134.1	LOS F	14.8	107.4	1.00	1.09	1.67	11.5
Approach		2286	4.6	2286	4.6	1.039	127.3	LOS F	50.8	375.6	1.00	1.32	1.58	12.4
North: Gilbertson Road														
7	L2	144	3.0	144	3.0	0.748	52.0	LOS D	10.1	73.0	0.87	0.80	0.91	26.7
8	T1	125	3.0	125	3.0	0.748	47.4	LOS D	10.1	73.0	0.87	0.80	0.91	24.9
9	R2	265	3.0	265	3.0	* 0.899	68.7	LOS E	11.7	85.1	0.97	0.98	1.26	8.2
Approach		535	3.0	535	3.0	0.899	59.2	LOS E	11.7	85.1	0.92	0.89	1.09	17.7
West: South Street														
10	L2	165	3.0	152	3.0	0.948	77.1	LOS E	17.0	125.0	1.00	1.05	1.21	6.4
11	T1	1862	5.0	1710	4.9	0.948	81.4	LOS F	17.0	125.0	1.00	1.06	1.21	20.1
12	R2	224	2.0	206	2.0	* 1.043	142.3	LOS F	13.4	96.0	1.00	1.09	1.69	12.2
Approach		2252	4.6	2067 N1	4.5	1.043	87.2	LOS F	17.0	125.0	1.00	1.06	1.26	18.2
All Vehicles		5306	4.3	5122 N1	4.5	1.043	102.6	LOS F	50.8	375.6	0.99	1.16	1.39	15.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2033 BG Layout (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	126	2.0	122	2.0	0.250	4.6	LOS A	0.0	0.0	0.00	0.14	0.00	47.9
2	T1	359	3.0	346	3.0	0.250	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	45.6
Approach		485	2.7	468 N1	2.7	0.250	1.2	NA	0.0	0.0	0.00	0.14	0.00	46.9
North: Gilbertson Rd														
8	T1	482	3.0	482	3.0	0.297	0.5	LOS A	0.3	2.3	0.15	0.05	0.15	39.2
9	R2	48	2.0	48	2.0	0.297	5.9	LOS A	0.3	2.3	0.15	0.05	0.15	47.0
Approach		531	2.9	531	2.9	0.297	1.0	NA	0.3	2.3	0.15	0.05	0.15	43.0
West: Brophy St														
10	L2	66	5.0	66	5.0	0.434	7.6	LOS A	0.9	6.9	0.60	0.87	0.85	38.2
12	R2	186	5.0	186	5.0	0.434	12.9	LOS B	0.9	6.9	0.60	0.87	0.85	38.2
Approach		253	5.0	253	5.0	0.434	11.5	LOS B	0.9	6.9	0.60	0.87	0.85	38.2
All Vehicles		1268	3.3	1251 N 1	3.3	0.434	3.2	NA	0.9	6.9	0.19	0.25	0.24	42.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	400	3.0	387	3.0	0.227	0.2	LOS A	0.1	0.9	0.09	0.03	0.09	46.5
3	R2	25	1.0	24	1.0	0.227	5.7	LOS A	0.1	0.9	0.09	0.03	0.09	41.1
Approach		425	2.9	412 N1	2.9	0.227	0.6	NA	0.1	0.9	0.09	0.03	0.09	46.0
East: Williamson Rd														
4	L2	14	1.0	14	1.0	0.020	6.3	LOS A	0.0	0.2	0.47	0.63	0.47	25.5
6	R2	3	1.0	3	1.0	0.020	9.6	LOS A	0.0	0.2	0.47	0.63	0.47	27.5
Approach		17	1.0	17	1.0	0.020	6.9	LOS A	0.0	0.2	0.47	0.63	0.47	26.0
North: Gilbertson Rd														
7	L2	4	1.0	4	1.0	0.247	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.5
8	T1	464	3.0	464	3.0	0.247	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.5
Approach		468	3.0	468	3.0	0.247	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.4
All Vehicles		911	2.9	897 N1	2.9	0.247	0.4	NA	0.1	0.9	0.05	0.03	0.05	46.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [AM Peak 2033- Access 1 - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1947	5.0	1471	5.2	0.262	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
3	R2	12	0.0	9	0.0	0.093	41.7	LOS E	0.1	0.6	0.92	0.97	0.92	16.3
Approach		1959	5.0	1479 N1	5.2	0.262	0.3	NA	0.1	0.6	0.01	0.01	0.01	69.1
East: Access 1														
4	L2	13	0.0	13	0.0	0.039	7.3	LOS A	0.0	0.2	0.53	0.71	0.53	19.6
6	R2	19	0.0	19	0.0	0.454	112.6	LOS F	0.5	3.7	0.97	1.03	1.14	8.6
Approach		32	0.0	32	0.0	0.454	70.5	LOS F	0.5	3.7	0.79	0.90	0.90	9.3
North: North Lake Road														
7	L2	22	10.0	22	10.0	0.323	6.5	LOS A	0.0	0.0	0.00	0.02	0.00	38.7
8	T1	1536	5.0	1536	5.0	0.323	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	69.3
Approach		1558	5.1	1558	5.1	0.323	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.4
All Vehicles		3548	5.0	3069 N1	5.7	0.454	0.9	NA	0.5	3.7	0.01	0.02	0.01	66.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [AM Peak 2033- South Street - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	407	3.0	407	3.0	0.225	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.1
2	T1	1334	5.0	1334	5.0	* 1.189	247.9	LOS F	42.3	313.2	1.00	1.68	2.22	6.7
3	R2	743	3.0	743	3.0	* 1.217	281.0	LOS F	42.4	306.6	1.00	1.45	2.35	5.9
Approach		2484	4.1	2484	4.1	1.217	218.2	LOS F	42.4	313.2	0.84	1.43	1.89	8.5
East: South Street														
4	L2	611	3.0	464	3.0	0.258	7.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1628	5.0	1237	5.0	0.900	77.8	LOS E	22.5	166.8	1.00	0.96	1.12	22.6
6	R2	348	3.0	265	3.0	* 1.180	245.1	LOS F	23.1	167.6	1.00	1.32	2.10	2.9
Approach		2587	4.3	1965 N1	4.3	1.180	83.7	LOS F	23.1	167.6	0.76	0.92	0.99	19.7
North: North Lake Road														
7	L2	483	3.0	483	3.0	0.822	54.4	LOS D	17.1	123.8	0.95	1.04	1.01	11.8
8	T1	893	5.0	893	5.0	0.805	64.9	LOS E	13.9	102.7	1.00	0.91	1.09	25.4
9	R2	189	3.0	189	3.0	0.239	58.3	LOS E	3.5	25.3	0.87	0.77	0.87	26.4
Approach		1565	4.1	1565	4.1	0.822	60.9	LOS E	17.1	123.8	0.97	0.93	1.04	22.5
West: South Street														
10	L2	281	3.0	281	3.0	0.261	21.1	LOS C	5.6	40.7	0.50	0.74	0.50	39.3
11	T1	1429	5.0	1429	5.0	* 1.203	260.8	LOS F	55.4	410.1	1.00	1.76	2.27	6.5
12	R2	192	3.0	192	3.0	0.854	85.1	LOS F	9.3	67.2	1.00	0.93	1.23	26.4
Approach		1902	4.5	1902	4.5	1.203	207.7	LOS F	55.4	410.1	0.93	1.52	1.90	8.6
All Vehicles		8539	4.2	7917 N1	4.6	1.217	151.2	LOS F	55.4	410.1	0.87	1.23	1.50	11.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [AM Peak 2033- Access 3 - South Street (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2587	5.0	2034	5.1	0.669	8.2	LOS A	9.5	70.0	0.49	0.45	0.49	24.5
6	R2	46	0.0	36	0.0	* 0.267	82.1	LOS F	1.7	11.6	1.00	0.74	1.00	5.2
Approach		2634	4.9	2070 N1	5.0	0.669	9.5	LOS A	9.5	70.0	0.49	0.46	0.49	22.3
North: Access 3														
7	L2	67	0.0	67	0.0	0.473	68.7	LOS E	2.9	20.2	0.96	0.78	0.96	2.8
9	R2	45	0.0	45	0.0	* 0.536	88.9	LOS F	1.2	8.7	1.00	0.75	1.08	2.3
Approach		113	0.0	113	0.0	0.536	76.8	LOS E	2.9	20.2	0.97	0.77	1.01	2.6
West: South Street														
10	L2	109	0.0	85	0.0	0.060	11.9	LOS B	1.2	8.4	0.34	0.68	0.34	32.3
11	T1	2547	5.0	1989	5.2	* 0.946	56.2	LOS E	25.0	185.0	0.89	1.05	1.15	10.9
Approach		2657	4.8	2074 N1	4.9	0.946	54.4	LOS D	25.0	185.0	0.87	1.03	1.12	11.3
All Vehicles		5403	4.8	4256 N1	6.0	0.946	33.2	LOS C	25.0	185.0	0.69	0.75	0.81	12.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Main Street - South Street (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2577	5.0	2015	5.1	0.362	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		2577	5.0	2015[N1]	5.1	0.362	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.8
North: Main Street														
7	L2	48	0.0	48	0.0	0.135	7.7	LOS A	1.8	12.8	0.53	0.74	0.53	22.3
Approach		48	0.0	48	0.0	0.135	7.7	LOS A	1.8	12.8	0.53	0.74	0.53	22.3
West: South Street														
10	L2	55	0.0	44	0.0	0.024	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2252	5.0	1807	5.1	0.325	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.8
Approach		2306	4.9	1851[N1]	5.0	0.325	0.1	NA	9.5	70.0	0.00	0.01	0.00	57.9
All Vehicles		4932	4.9	3915[N1]	6.2	0.362	0.2	NA	9.5	70.0	0.01	0.02	0.01	58.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [AM Peak 2033- South Street / Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	213	2.0	213	2.0	1.018	134.7	LOS F	13.9	99.4	1.00	1.16	1.70	10.7
2	T1	132	2.0	132	2.0	* 1.309	353.5	LOS F	29.0	207.6	1.00	1.96	2.69	4.6
3	R2	128	2.0	128	2.0	1.309	358.0	LOS F	29.0	207.6	1.00	1.96	2.69	8.4
Approach		473	2.0	473	2.0	1.309	256.3	LOS F	29.0	207.6	1.00	1.60	2.25	7.6
East: South Street														
4	L2	105	2.0	105	2.0	1.297	341.4	LOS F	82.9	611.0	1.00	2.06	2.55	8.9
5	T1	2034	5.0	2034	5.0	* 1.297	335.7	LOS F	83.2	615.6	1.00	2.08	2.55	5.0
6	R2	223	3.0	223	3.0	* 1.329	373.4	LOS F	25.1	181.4	1.00	1.49	2.75	4.5
Approach		2362	4.7	2362	4.7	1.329	339.5	LOS F	83.2	615.6	1.00	2.02	2.57	5.1
North: Gilbertson Road														
7	L2	266	3.0	266	3.0	0.713	39.3	LOS D	11.4	82.7	0.79	0.77	0.79	30.5
8	T1	85	3.0	85	3.0	0.713	34.7	LOS C	11.4	82.7	0.79	0.77	0.79	28.2
9	R2	329	3.0	329	3.0	* 1.149	207.7	LOS F	22.8	165.0	1.00	1.39	2.12	2.7
Approach		681	3.0	681	3.0	1.149	120.2	LOS F	22.8	165.0	0.89	1.07	1.43	9.8
West: South Street														
10	L2	166	3.0	139	3.0	1.060	141.3	LOS F	17.0	125.0	1.00	1.29	1.56	3.5
11	T1	1966	5.0	1640	5.1	1.060	144.6	LOS F	17.0	125.0	1.00	1.31	1.55	12.7
12	R2	119	2.0	99	2.0	0.585	79.0	LOS E	4.4	31.6	1.00	0.79	1.00	18.9
Approach		2252	4.7	1878 N1	4.7	1.060	140.9	LOS F	17.0	125.0	1.00	1.28	1.52	12.3
All Vehicles		5767	4.3	5393 N1	4.6	1.329	235.4	LOS F	83.2	615.6	0.99	1.61	2.03	7.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	98	2.0	76	2.0	0.215	4.6	LOS A	0.0	0.0	0.00	0.10	0.00	48.3
2	T1	423	3.0	328	3.0	0.215	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	46.7
Approach		521	2.8	404 N1	2.8	0.215	0.9	NA	0.0	0.0	0.00	0.10	0.00	47.4
North: Gilbertson Rd														
8	T1	597	3.0	597	3.0	0.338	0.2	LOS A	0.2	1.3	0.08	0.03	0.08	44.3
9	R2	28	2.0	28	2.0	0.338	5.6	LOS A	0.2	1.3	0.08	0.03	0.08	47.6
Approach		625	3.0	625	3.0	0.338	0.4	NA	0.2	1.3	0.08	0.03	0.08	45.4
West: Brophy St														
10	L2	37	5.0	37	5.0	0.598	10.1	LOS B	0.7	5.4	0.61	0.93	1.01	35.7
12	R2	134	5.0	134	5.0	0.598	16.2	LOS C	0.7	5.4	0.61	0.93	1.01	35.7
Approach		171	5.0	171	5.0	0.598	14.9	LOS B	0.7	5.4	0.61	0.93	1.01	35.7
All Vehicles		1317	3.2	1200 N1	3.5	0.598	2.6	NA	0.7	5.4	0.13	0.18	0.18	42.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2033- Gilbertson Rd/Williamson Rd (Site Folder: AM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	424	3.0	339	3.1	0.207	0.4	LOS A	0.1	1.0	0.12	0.05	0.12	45.2
3	R2	36	1.0	29	1.0	0.207	5.9	LOS A	0.1	1.0	0.12	0.05	0.12	40.4
Approach		460	2.8	368 N1	2.9	0.207	0.8	NA	0.1	1.0	0.12	0.05	0.12	44.7
East: Williamson Rd														
4	L2	102	1.0	102	1.0	0.142	6.7	LOS A	0.2	1.6	0.52	0.72	0.52	24.8
6	R2	19	1.0	19	1.0	0.142	10.3	LOS B	0.2	1.6	0.52	0.72	0.52	27.0
Approach		121	1.0	121	1.0	0.142	7.3	LOS A	0.2	1.6	0.52	0.72	0.52	25.3
North: Gilbertson Rd														
7	L2	6	1.0	6	1.0	0.269	4.1	LOS A	0.0	0.0	0.00	0.01	0.00	46.4
8	T1	502	3.0	502	3.0	0.269	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	49.3
Approach		508	3.0	508	3.0	0.269	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.2
All Vehicles		1089	2.7	997 N1	3.0	0.269	1.2	NA	0.2	1.6	0.11	0.11	0.11	41.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [PM Peak 2033- Access 1 - North Lake Road (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1258	5.0	1201	5.1	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
3	R2	32	0.0	30	0.0	0.423	65.1	LOS F	0.4	2.9	0.96	1.01	1.09	11.6
Approach		1289	4.9	1231 N1	5.0	0.423	1.6	NA	0.4	2.9	0.02	0.02	0.03	65.2
East: Access 1														
4	L2	36	0.0	36	0.0	0.097	6.7	LOS A	0.1	0.5	0.50	0.71	0.50	20.7
6	R2	54	0.0	54	0.0	1.825	888.6	LOS F	8.2	57.2	1.00	2.00	5.03	1.2
Approach		89	0.0	89	0.0	1.825	535.8	LOS F	8.2	57.2	0.80	1.48	3.22	1.3
North: North Lake Road														
7	L2	58	10.0	58	10.0	0.301	6.5	LOS A	0.5	4.0	0.00	0.06	0.00	38.2
8	T1	1672	5.0	1672	5.0	0.301	0.0	LOS A	5.5	40.9	0.00	0.02	0.00	68.8
Approach		1729	5.2	1729	5.2	0.301	0.3	NA	5.5	40.9	0.00	0.02	0.00	66.7
All Vehicles		3108	4.9	3050 N1	5.0	1.825	16.5	NA	8.2	57.2	0.03	0.07	0.11	34.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [PM Peak 2033- South Street - North Lake Road (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	217	3.0	217	3.0	0.120	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.2
2	T1	747	5.0	747	5.0	1.006	119.2	LOS F	15.3	113.5	1.00	1.17	1.61	12.9
3	R2	663	3.0	663	3.0	* 1.404	444.7	LOS F	42.0	303.9	1.00	1.72	2.96	3.9
Approach		1627	3.9	1627	3.9	1.404	236.9	LOS F	42.0	303.9	0.87	1.32	1.94	7.8
East: South Street														
4	L2	719	3.0	676	3.0	0.376	7.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1458	5.0	1371	5.0	0.958	81.7	LOS F	25.0	185.0	0.99	1.09	1.28	21.8
6	R2	331	3.0	311	3.0	* 1.385	421.3	LOS F	25.6	185.0	1.00	1.68	2.89	1.7
Approach		2507	4.2	2358 N1	4.1	1.385	105.1	LOS F	25.6	185.0	0.71	1.02	1.13	16.6
North: North Lake Road														
7	L2	508	3.0	508	3.0	1.109	152.2	LOS F	26.2	190.0	1.00	1.19	1.90	3.6
8	T1	1012	5.0	1012	5.0	* 1.386	415.0	LOS F	25.7	190.0	1.00	1.89	2.88	5.5
9	R2	234	3.0	234	3.0	0.244	52.7	LOS D	4.1	29.5	0.83	0.77	0.83	28.0
Approach		1754	4.2	1754	4.2	1.386	290.5	LOS F	26.2	190.0	0.98	1.54	2.32	5.9
West: South Street														
10	L2	215	3.0	215	3.0	0.177	15.3	LOS B	3.4	24.7	0.39	0.67	0.39	44.6
11	T1	1378	5.0	1378	5.0	* 1.439	466.0	LOS F	71.9	531.9	1.00	2.17	3.03	3.8
12	R2	244	3.0	244	3.0	1.089	178.7	LOS F	18.3	132.6	1.00	1.23	1.91	15.4
Approach		1837	4.5	1837	4.5	1.439	375.1	LOS F	71.9	531.9	0.93	1.87	2.57	5.1
All Vehicles		7725	4.2	7575 N1	4.3	1.439	241.8	LOS F	71.9	531.9	0.86	1.41	1.93	7.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [PM Peak 2033- Access 3 - South Street (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2508	5.0	2363	5.0	* 1.091	157.1	LOS F	9.5	70.0	1.00	1.57	1.78	1.9
6	R2	120	0.0	113	0.0	0.830	89.0	LOS F	5.4	37.9	1.00	0.84	1.14	4.8
Approach		2628	4.8	2476 N1	4.8	1.091	154.0	LOS F	9.5	70.0	1.00	1.54	1.75	2.0
North: Access 3														
7	L2	187	0.0	187	0.0	* 1.081	179.4	LOS F	14.7	102.6	1.00	1.30	1.96	1.1
9	R2	124	0.0	124	0.0	0.912	101.7	LOS F	3.4	23.8	1.00	1.03	1.59	2.0
Approach		312	0.0	312	0.0	1.081	148.4	LOS F	14.7	102.6	1.00	1.19	1.82	1.3
West: South Street														
10	L2	280	0.0	250	0.0	0.184	12.0	LOS B	3.0	20.9	0.29	0.68	0.29	32.1
11	T1	2268	5.0	2028	5.0	1.034	115.5	LOS F	25.0	185.0	1.00	1.40	1.58	5.7
Approach		2548	4.5	2278 N1	4.5	1.034	104.1	LOS F	25.0	185.0	0.92	1.32	1.44	6.4
All Vehicles		5488	4.4	5066 N1	4.7	1.091	131.2	LOS F	25.0	185.0	0.97	1.42	1.62	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Main Street - South Street (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2278	5.0	2196	5.0	0.394	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		2278	5.0	2196[N1]	5.0	0.394	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Main Street														
7	L2	135	0.0	135	0.0	0.413	10.4	LOS B	3.2	22.5	0.60	0.88	0.78	18.3
Approach		135	0.0	135	0.0	0.413	10.4	LOS B	3.2	22.5	0.60	0.88	0.78	18.3
West: South Street														
10	L2	144	0.0	131	0.0	0.071	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2252	5.0	2047	5.0	0.367	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.8
Approach		2396	4.7	2178[N1]	4.7	0.367	0.3	NA	9.5	70.0	0.00	0.03	0.00	55.4
All Vehicles		4808	4.7	4509[N1]	5.0	0.413	0.5	NA	9.5	70.0	0.02	0.04	0.02	55.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [PM Peak 2033- South Street / Gilbertson Rd (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	92	2.0	92	2.0	0.540	76.7	LOS E	4.0	29.0	1.00	0.78	1.00	16.3
2	T1	89	2.0	89	2.0	* 0.976	108.9	LOS F	8.2	58.8	1.00	1.16	1.61	12.7
3	R2	53	2.0	53	2.0	0.976	113.4	LOS F	8.2	58.8	1.00	1.16	1.61	20.8
Approach		234	2.0	234	2.0	0.976	97.3	LOS F	8.2	58.8	1.00	1.01	1.37	16.1
East: South Street														
4	L2	132	2.0	132	2.0	1.039	131.1	LOS F	50.6	372.1	1.00	1.31	1.55	19.1
5	T1	1922	5.0	1922	5.0	* 1.039	126.2	LOS F	50.8	375.6	1.00	1.34	1.57	12.0
6	R2	233	3.0	233	3.0	1.021	134.1	LOS F	14.8	107.4	1.00	1.09	1.67	11.5
Approach		2286	4.6	2286	4.6	1.039	127.3	LOS F	50.8	375.6	1.00	1.32	1.58	12.4
North: Gilbertson Road														
7	L2	144	3.0	144	3.0	0.748	52.0	LOS D	10.1	73.0	0.87	0.80	0.91	26.7
8	T1	125	3.0	125	3.0	0.748	47.4	LOS D	10.1	73.0	0.87	0.80	0.91	24.9
9	R2	265	3.0	265	3.0	* 0.899	68.7	LOS E	11.7	85.1	0.97	0.98	1.26	8.2
Approach		535	3.0	535	3.0	0.899	59.2	LOS E	11.7	85.1	0.92	0.89	1.09	17.7
West: South Street														
10	L2	165	3.0	152	3.0	0.948	77.1	LOS E	17.0	125.0	1.00	1.05	1.21	6.4
11	T1	1862	5.0	1710	4.9	0.948	81.4	LOS F	17.0	125.0	1.00	1.06	1.21	20.1
12	R2	224	2.0	206	2.0	* 1.043	142.3	LOS F	13.4	96.0	1.00	1.09	1.69	12.2
Approach		2252	4.6	2067 N1	4.5	1.043	87.2	LOS F	17.0	125.0	1.00	1.06	1.26	18.2
All Vehicles		5306	4.3	5122 N1	4.5	1.043	102.6	LOS F	50.8	375.6	0.99	1.16	1.39	15.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2033- Brophy St/Gilbertson Rd (Site Folder: PM)]

Network: N101 [AM Peak Ultimate (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	126	2.0	122	2.0	0.250	4.6	LOS A	0.0	0.0	0.00	0.14	0.00	47.9
2	T1	359	3.0	346	3.0	0.250	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	45.6
Approach		485	2.7	468 N1	2.7	0.250	1.2	NA	0.0	0.0	0.00	0.14	0.00	46.9
North: Gilbertson Rd														
8	T1	482	3.0	482	3.0	0.297	0.5	LOS A	0.3	2.3	0.15	0.05	0.15	39.2
9	R2	48	2.0	48	2.0	0.297	5.9	LOS A	0.3	2.3	0.15	0.05	0.15	47.0
Approach		531	2.9	531	2.9	0.297	1.0	NA	0.3	2.3	0.15	0.05	0.15	43.0
West: Brophy St														
10	L2	66	5.0	66	5.0	0.434	7.6	LOS A	0.9	6.9	0.60	0.87	0.85	38.2
12	R2	186	5.0	186	5.0	0.434	12.9	LOS B	0.9	6.9	0.60	0.87	0.85	38.2
Approach		253	5.0	253	5.0	0.434	11.5	LOS B	0.9	6.9	0.60	0.87	0.85	38.2
All Vehicles		1268	3.3	1251 N 1	3.3	0.434	3.2	NA	0.9	6.9	0.19	0.25	0.24	42.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2050- Gilbertson Rd/Williamson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	445	3.0	355	3.0	0.188	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
3	R2	1	1.0	1	1.0	0.188	6.0	LOS A	0.0	0.0	0.00	0.00	0.00	43.1
Approach		446	3.0	355 N1	3.0	0.188	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
East: Williamson Rd														
4	L2	1	1.0	1	1.0	0.003	6.6	LOS A	0.0	0.0	0.53	0.62	0.53	23.3
6	R2	1	1.0	1	1.0	0.003	9.6	LOS A	0.0	0.0	0.53	0.62	0.53	25.9
Approach		2	1.0	2	1.0	0.003	8.1	LOS A	0.0	0.0	0.53	0.62	0.53	24.8
North: Gilbertson Rd														
7	L2	1	1.0	1	1.0	0.281	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.6
8	T1	532	3.0	532	3.0	0.281	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach		533	3.0	533	3.0	0.281	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
All Vehicles		981	3.0	890 N1	3.3	0.281	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [AM Peak 2050- Access 1 - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1912	5.0	1631	5.1	0.290	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
3	R2	12	0.0	10	0.0	0.096	38.8	LOS E	0.1	0.6	0.91	0.96	0.91	17.1
Approach		1923	5.0	1641 N1	5.1	0.290	0.3	NA	0.1	0.6	0.01	0.01	0.01	69.1
East: Access 1														
4	L2	13	0.0	13	0.0	0.017	6.4	LOS A	0.0	0.2	0.48	0.63	0.48	21.2
6	R2	19	0.0	19	0.0	0.406	97.1	LOS F	0.5	3.3	0.97	1.02	1.12	9.8
Approach		32	0.0	32	0.0	0.406	60.8	LOS F	0.5	3.3	0.77	0.86	0.86	10.5
North: North Lake Road														
7	L2	22	10.0	22	10.0	0.272	6.5	LOS A	0.0	0.0	0.00	0.03	0.00	38.7
8	T1	1523	5.0	1523	5.0	0.272	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.4
Approach		1545	5.1	1545	5.1	0.272	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.5
All Vehicles		3500	5.0	3217 N1	5.4	0.406	0.8	NA	0.5	3.3	0.01	0.02	0.01	66.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [AM Peak 2050- South Street - North Lake Road (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	407	3.0	407	3.0	0.225	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.1
2	T1	1329	5.0	1329	5.0	* 1.491	505.6	LOS F	58.7	434.7	1.00	2.16	3.15	3.4
3	R2	725	3.0	725	3.0	* 1.490	518.4	LOS F	49.4	357.7	1.00	1.82	3.18	3.3
Approach		2462	4.1	2462	4.1	1.491	426.8	LOS F	58.7	434.7	0.83	1.80	2.64	4.6
East: South Street														
4	L2	559	3.0	514	3.0	0.286	7.3	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1557	5.0	1433	5.0	0.995	102.1	LOS F	25.0	185.0	1.00	1.17	1.40	18.6
6	R2	313	3.0	288	3.0	* 1.433	459.3	LOS F	25.6	185.0	1.00	1.72	2.98	1.6
Approach		2428	4.3	2235 N1	4.3	1.433	126.3	LOS F	25.6	185.0	0.77	1.11	1.28	14.4
North: North Lake Road														
7	L2	471	3.0	471	3.0	1.131	172.8	LOS F	26.2	190.0	1.00	1.22	2.01	3.3
8	T1	892	5.0	892	5.0	1.059	150.6	LOS F	22.2	164.0	1.00	1.30	1.77	13.5
9	R2	189	3.0	189	3.0	0.203	52.9	LOS D	3.3	23.8	0.82	0.76	0.82	27.9
Approach		1552	4.1	1552	4.1	1.131	145.4	LOS F	26.2	190.0	0.98	1.21	1.73	10.6
West: South Street														
10	L2	281	3.0	281	3.0	0.237	16.6	LOS B	4.8	34.8	0.43	0.69	0.43	43.3
11	T1	1396	5.0	1396	5.0	* 1.504	522.8	LOS F	69.3	513.1	1.00	2.25	3.20	3.4
12	R2	192	3.0	192	3.0	0.954	104.8	LOS F	10.5	76.3	1.00	1.03	1.48	23.1
Approach		1868	4.5	1868	4.5	1.504	403.8	LOS F	69.3	513.1	0.91	1.89	2.60	4.7
All Vehicles		8311	4.2	8117 N1	4.3	1.504	285.0	LOS F	69.3	513.1	0.86	1.52	2.08	6.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [AM Peak 2050- Access 3 - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2428	5.0	2197	5.0	* 1.036	111.7	LOS F	9.5	70.0	1.00	1.40	1.57	2.7
6	R2	46	0.0	42	0.0	* 0.308	82.5	LOS F	1.9	13.4	1.00	0.74	1.00	5.1
Approach		2475	4.9	2239 N1	4.9	1.036	111.2	LOS F	9.5	70.0	1.00	1.39	1.56	2.7
North: Access 3														
7	L2	67	0.0	67	0.0	0.473	68.7	LOS E	2.9	20.2	0.96	0.78	0.96	2.8
9	R2	45	0.0	45	0.0	* 0.609	90.8	LOS F	1.1	8.0	1.00	0.78	1.17	2.3
Approach		113	0.0	113	0.0	0.609	77.6	LOS E	2.9	20.2	0.97	0.78	1.04	2.5
West: South Street														
10	L2	109	0.0	94	0.0	0.066	10.3	LOS B	0.9	6.2	0.23	0.66	0.23	34.4
11	T1	2482	5.0	2133	5.1	0.982	74.7	LOS E	25.0	185.0	0.96	1.20	1.33	8.5
Approach		2592	4.8	2227 N1	4.9	0.982	72.0	LOS E	25.0	185.0	0.93	1.18	1.28	8.9
All Vehicles		5179	4.7	4579 N1	5.4	1.036	91.3	LOS F	25.0	185.0	0.97	1.27	1.41	5.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2050- Main Street - South Street (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2418	5.0	2137	5.0	0.384	0.0	LOS A	3.8	27.8	0.00	0.00	0.00	59.7
Approach		2418	5.0	2137[N1]	5.0	0.384	0.0	NA	3.8	27.8	0.00	0.00	0.00	59.7
North: Main Street														
7	L2	48	0.0	48	0.0	0.141	8.0	LOS A	0.7	4.9	0.55	0.76	0.55	21.7
Approach		48	0.0	48	0.0	0.141	8.0	LOS A	0.7	4.9	0.55	0.76	0.55	21.7
West: South Street														
10	L2	55	0.0	48	0.0	0.026	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2186	5.0	1926	5.0	0.346	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.8
Approach		2241	4.9	1974[N1]	4.9	0.346	0.1	NA	9.5	70.0	0.00	0.01	0.00	57.9
All Vehicles		4707	4.9	4160[N1]	5.5	0.384	0.2	NA	9.5	70.0	0.01	0.01	0.01	58.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [AM Peak 2050- South Street / Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	175	2.0	175	2.0	1.028	138.0	LOS F	11.3	80.9	1.00	1.17	1.75	10.5
2	T1	131	2.0	131	2.0	* 1.195	256.7	LOS F	18.1	129.6	1.00	1.63	2.33	6.1
3	R2	64	2.0	64	2.0	1.195	261.3	LOS F	18.1	129.6	1.00	1.63	2.33	11.0
Approach		369	2.0	369	2.0	1.195	201.3	LOS F	18.1	129.6	1.00	1.41	2.06	8.7
East: South Street														
4	L2	91	2.0	91	2.0	1.210	263.2	LOS F	94.2	695.2	1.00	1.85	2.22	11.1
5	T1	2020	5.0	2020	5.0	* 1.210	262.2	LOS F	94.2	695.2	1.00	1.85	2.26	6.3
6	R2	145	3.0	145	3.0	* 1.211	275.2	LOS F	13.8	99.6	1.00	1.33	2.41	5.9
Approach		2256	4.8	2256	4.8	1.211	263.1	LOS F	94.2	695.2	1.00	1.82	2.27	6.5
North: Gilbertson Road														
7	L2	108	3.0	108	3.0	0.515	45.8	LOS D	6.5	47.0	0.81	0.73	0.81	28.6
8	T1	84	3.0	84	3.0	0.515	41.2	LOS D	6.5	47.0	0.81	0.73	0.81	26.5
9	R2	223	3.0	223	3.0	* 1.094	171.8	LOS F	16.3	117.8	1.00	1.32	1.98	3.2
Approach		416	3.0	416	3.0	1.094	112.5	LOS F	16.3	117.8	0.91	1.05	1.43	9.8
West: South Street														
10	L2	120	3.0	110	3.0	0.839	54.2	LOS D	16.9	125.0	1.00	0.92	1.02	9.1
11	T1	1966	5.0	1808	5.0	0.839	54.2	LOS D	16.9	125.0	1.00	0.93	1.03	26.4
12	R2	101	2.0	93	2.0	0.766	86.3	LOS F	4.4	31.2	1.00	0.83	1.14	17.8
Approach		2187	4.8	2011 N1	4.8	0.839	55.7	LOS E	16.9	125.0	1.00	0.92	1.03	25.2
All Vehicles		5228	4.4	5052 N1	4.6	1.211	163.6	LOS F	94.2	695.2	0.99	1.37	1.69	10.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2050- Brophy St/Gilbertson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	38	2.0	35	2.0	0.192	4.6	LOS A	0.0	0.0	0.00	0.05	0.00	48.7
2	T1	358	3.0	327	3.0	0.192	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	48.2
Approach		396	2.9	362 N1	2.9	0.192	0.5	NA	0.0	0.0	0.00	0.05	0.00	48.4
North: Gilbertson Rd														
8	T1	416	3.0	416	3.0	0.232	0.1	LOS A	0.1	0.6	0.05	0.02	0.05	46.1
9	R2	16	2.0	16	2.0	0.232	5.0	LOS A	0.1	0.6	0.05	0.02	0.05	47.7
Approach		432	3.0	432	3.0	0.232	0.3	NA	0.1	0.6	0.05	0.02	0.05	46.6
West: Brophy St														
10	L2	56	5.0	56	5.0	0.355	6.7	LOS A	0.5	3.8	0.51	0.78	0.62	40.3
12	R2	134	5.0	134	5.0	0.355	9.9	LOS A	0.5	3.8	0.51	0.78	0.62	40.3
Approach		189	5.0	189	5.0	0.355	9.0	LOS A	0.5	3.8	0.51	0.78	0.62	40.3
All Vehicles		1017	3.3	983 N1	3.4	0.355	2.0	NA	0.5	3.8	0.12	0.18	0.14	44.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [AM Peak 2050- Gilbertson Rd/Williamson Rd (Site Folder: AM)]

Network: N101 [AM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
2	T1	378	3.0	352	3.1	0.187	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
3	R2	1	1.0	1	1.0	0.187	5.2	LOS A	0.0	0.0	0.00	0.00	0.00	43.1
Approach		379	3.0	353 N1	3.0	0.187	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
East: Williamson Rd														
4	L2	1	1.0	1	1.0	0.003	6.0	LOS A	0.0	0.0	0.47	0.58	0.47	24.8
6	R2	1	1.0	1	1.0	0.003	8.4	LOS A	0.0	0.0	0.47	0.58	0.47	27.0
Approach		2	1.0	2	1.0	0.003	7.2	LOS A	0.0	0.0	0.47	0.58	0.47	26.1
North: Gilbertson Rd														
7	L2	1	1.0	1	1.0	0.220	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	46.6
8	T1	416	3.0	416	3.0	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach		417	3.0	417	3.0	0.220	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.8
All Vehicles		798	3.0	772 N1	3.1	0.220	0.0	NA	0.0	0.0	0.00	0.00	0.00	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: A101 [PM Peak 2050- Access 1 - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
2	T1	1544	5.0	1385	5.2	0.248	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
3	R2	32	0.0	28	0.0	0.851	210.3	LOS F	0.9	6.5	1.00	1.09	1.46	4.1
Approach		1576	4.9	1413 N1	5.1	0.851	4.2	NA	0.9	6.5	0.02	0.02	0.03	59.0
East: Access 1														
4	L2	36	0.0	36	0.0	0.116	7.8	LOS A	0.9	6.6	0.55	0.78	0.55	18.9
6	R2	54	0.0	54	0.0	4.728	3526.5	LOS F	15.2	106.3	1.00	1.68	3.86	0.3
Approach		89	0.0	89	0.0	4.728	2119.0	LOS F	15.2	106.3	0.82	1.32	2.54	0.3
North: North Lake Road														
7	L2	58	10.0	58	10.0	0.360	6.5	LOS A	17.0	126.6	0.00	0.05	0.00	38.3
8	T1	2013	5.0	2013	5.0	0.360	0.1	LOS A	27.3	202.3	0.00	0.02	0.00	68.9
Approach		2071	5.1	2071	5.1	0.360	0.2	NA	27.3	202.3	0.00	0.02	0.00	67.2
All Vehicles		3736	4.9	3573 N1	5.1	4.728	54.9	NA	27.3	202.3	0.03	0.05	0.08	16.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: C101 [PM Peak 2050- South Street - North Lake Road (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: North Lake Road														
1	L2	267	3.0	267	3.0	0.148	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	60.2
2	T1	916	5.0	916	5.0	1.174	237.3	LOS F	27.3	202.0	1.00	1.53	2.20	6.9
3	R2	765	3.0	765	3.0	* 1.662	669.7	LOS F	58.5	423.5	1.00	1.99	3.57	2.6
Approach		1948	3.9	1948	3.9	1.662	375.5	LOS F	58.5	423.5	0.86	1.58	2.44	5.1
East: South Street														
4	L2	849	3.0	650	2.9	0.361	7.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
5	T1	1760	5.0	1347	4.9	0.896	61.2	LOS E	25.0	185.0	0.98	0.98	1.13	26.4
6	R2	400	3.0	306	2.9	* 1.620	624.2	LOS F	25.6	185.0	1.00	1.94	3.47	1.2
Approach		3009	4.2	2303 N1	4.1	1.620	120.9	LOS F	25.6	185.0	0.71	0.99	1.12	14.8
North: North Lake Road														
7	L2	573	3.0	573	3.0	1.459	457.7	LOS F	26.2	190.0	1.00	1.58	3.06	1.5
8	T1	1242	5.0	1242	5.0	* 1.637	632.6	LOS F	25.7	190.0	1.00	2.26	3.49	3.7
9	R2	279	3.0	279	3.0	0.298	54.3	LOS D	5.0	36.1	0.85	0.78	0.85	27.5
Approach		2094	4.2	2094	4.2	1.637	507.7	LOS F	26.2	190.0	0.98	1.88	3.02	3.7
West: South Street														
10	L2	260	3.0	260	3.0	0.211	14.8	LOS B	4.0	29.3	0.39	0.68	0.39	45.1
11	T1	1646	5.0	1646	5.0	* 1.686	683.6	LOS F	95.9	709.7	1.00	2.54	3.60	2.6
12	R2	302	3.0	302	3.0	1.599	606.3	LOS F	43.3	313.4	1.00	1.90	3.43	5.4
Approach		2208	4.5	2208	4.5	1.686	594.3	LOS F	95.9	709.7	0.93	2.23	3.20	3.3
All Vehicles		9260	4.2	8554 N1	4.5	1.686	395.8	LOS F	95.9	709.7	0.87	1.66	2.42	4.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: North Lake Road											
P1	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	109.1	51.9	0.48
East: South Street											
P2	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	104.6	46.0	0.44
North: North Lake Road											

P3 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	108.0	50.4	0.47
West: South Street										
P4 Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	103.8	45.0	0.43
All Pedestrians	126	69.2	LOS F	0.1	0.1	0.96	0.96	106.4	48.3	0.45

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: D101 [PM Peak 2050- Access 3 - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	3009	5.0	2281	5.0	* 0.936	46.7	LOS D	9.5	70.0	0.90	1.00	1.09	6.1
6	R2	120	0.0	91	0.0	0.668	85.7	LOS F	4.3	29.8	1.00	0.79	1.04	5.0
Approach		3129	4.8	2372 N1	4.8	0.936	48.2	LOS D	9.5	70.0	0.91	0.99	1.08	6.0
North: Access 3														
7	L2	187	0.0	187	0.0	* 0.938	100.4	LOS F	10.8	75.5	1.00	1.07	1.47	1.9
9	R2	124	0.0	124	0.0	0.717	82.9	LOS F	3.0	21.0	1.00	0.87	1.19	2.5
Approach		312	0.0	312	0.0	0.938	93.4	LOS F	10.8	75.5	1.00	0.99	1.36	2.1
West: South Street														
10	L2	280	0.0	221	0.0	0.167	13.7	LOS B	3.1	21.8	0.35	0.70	0.35	30.3
11	T1	2704	5.0	2131	5.0	0.884	28.3	LOS C	25.0	185.0	0.81	0.83	0.89	18.8
Approach		2984	4.5	2352 N1	4.6	0.884	26.9	LOS C	25.0	185.0	0.76	0.81	0.84	19.6
All Vehicles		6425	4.4	5035 N1	5.7	0.938	41.1	LOS D	25.0	185.0	0.85	0.91	0.99	10.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Access 3											
P3	Full	32	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street											
P41	Stage 1	53	69.3	LOS F	0.2	0.2	0.96	0.96	95.6	34.2	0.36
P42	Stage 2	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.0	30.9	0.33
All Pedestrians		137	69.3	LOS F	0.2	0.2	0.96	0.96	95.1	33.6	0.35

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2050- Main Street - South Street (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: South Street														
5	T1	2726	5.0	1963	5.1	0.353	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		2726	5.0	1963 N1	5.1	0.353	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.8
North: Main Street														
7	L2	135	0.0	135	0.0	0.426	11.0	LOS B	1.9	13.0	0.62	0.90	0.81	17.5
Approach		135	0.0	135	0.0	0.426	11.0	LOS B	1.9	13.0	0.62	0.90	0.81	17.5
West: South Street														
10	L2	144	0.0	117	0.0	0.063	4.8	LOS A	0.0	0.0	0.00	0.52	0.00	35.5
11	T1	2640	5.0	2149	5.0	0.386	0.0	LOS A	9.5	70.0	0.00	0.00	0.00	59.7
Approach		2784	4.7	2267 N1	4.7	0.386	0.3	NA	9.5	70.0	0.00	0.03	0.00	55.9
All Vehicles		5645	4.8	4364 N1	6.1	0.426	0.5	NA	9.5	70.0	0.02	0.04	0.03	55.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: F101 [PM Peak 2050- South Street / Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 150 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Road														
1	L2	103	2.0	103	2.0	0.608	77.4	LOS E	4.6	33.0	1.00	0.79	1.01	16.2
2	T1	105	2.0	105	2.0	* 1.081	168.6	LOS F	11.8	84.3	1.00	1.37	1.95	8.8
3	R2	55	2.0	55	2.0	1.081	173.2	LOS F	11.8	84.3	1.00	1.37	1.95	15.2
Approach		263	2.0	263	2.0	1.081	133.8	LOS F	11.8	84.3	1.00	1.14	1.58	12.4
East: South Street														
4	L2	149	2.0	149	2.0	1.129	195.7	LOS F	74.5	548.5	1.00	1.58	1.90	14.1
5	T1	2345	5.0	2345	5.0	* 1.129	190.4	LOS F	74.8	553.4	1.00	1.63	1.91	8.4
6	R2	213	3.0	213	3.0	1.108	193.0	LOS F	16.6	119.9	1.00	1.21	2.00	8.2
Approach		2707	4.7	2707	4.7	1.129	190.9	LOS F	74.8	553.4	1.00	1.59	1.92	8.7
North: Gilbertson Road														
7	L2	106	3.0	106	3.0	0.773	55.9	LOS E	9.9	71.5	0.88	0.82	0.96	25.8
8	T1	147	3.0	147	3.0	0.773	51.3	LOS D	9.9	71.5	0.88	0.82	0.96	24.1
9	R2	278	3.0	278	3.0	* 1.015	113.0	LOS F	16.4	119.1	1.00	1.16	1.64	4.6
Approach		532	3.0	532	3.0	1.015	84.5	LOS F	16.4	119.1	0.94	1.00	1.31	12.4
West: South Street														
10	L2	172	3.0	142	2.9	0.912	62.1	LOS E	17.0	125.0	1.00	0.99	1.11	8.0
11	T1	2217	5.0	1838	4.9	0.912	63.3	LOS E	17.0	125.0	1.00	1.00	1.12	23.9
12	R2	253	2.0	210	2.0	* 1.120	197.5	LOS F	16.4	117.5	1.00	1.19	1.97	9.3
Approach		2641	4.6	2189 N1	4.5	1.120	76.0	LOS E	17.0	125.0	1.00	1.02	1.20	20.1
All Vehicles		6143	4.4	5692 N1	4.7	1.129	134.1	LOS F	74.8	553.4	0.99	1.29	1.57	12.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Gilbertson Road											
P1	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	95.2	33.9	0.36
East: South Street											
P2	Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
North: Gilbertson Road											

P3 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	97.8	37.2	0.38
West: South Street										
P4 Full	16	69.2	LOS F	0.1	0.1	0.96	0.96	105.4	47.1	0.45
All Pedestrians	63	69.2	LOS F	0.1	0.1	0.96	0.96	101.0	41.3	0.41

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Peak 2050- Brophy St/Gilbertson Rd (Site Folder: PM)]

Network: N101 [PM Peak 2050 BG only (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Gilbertson Rd														
1	L2	99	2.0	76	2.0	0.200	4.6	LOS A	0.0	0.0	0.00	0.11	0.00	48.2
2	T1	389	3.0	299	3.0	0.200	0.0	LOS A	0.0	0.0	0.00	0.11	0.00	46.5
Approach		488	2.8	375 N1	2.8	0.200	0.9	NA	0.0	0.0	0.00	0.11	0.00	47.3
North: Gilbertson Rd														
8	T1	532	3.0	532	3.0	0.314	0.3	LOS A	0.2	1.8	0.11	0.04	0.11	42.1
9	R2	42	2.0	42	2.0	0.314	5.3	LOS A	0.2	1.8	0.11	0.04	0.11	47.3
Approach		574	2.9	574	2.9	0.314	0.6	NA	0.2	1.8	0.11	0.04	0.11	44.5
West: Brophy St														
10	L2	56	5.0	56	5.0	0.541	8.6	LOS A	0.7	5.2	0.53	0.85	0.82	37.5
12	R2	134	5.0	134	5.0	0.541	13.8	LOS B	0.7	5.2	0.53	0.85	0.82	37.5
Approach		189	5.0	189	5.0	0.541	12.3	LOS B	0.7	5.2	0.53	0.85	0.82	37.5
All Vehicles		1252	3.2	1138 N1	3.5	0.541	2.7	NA	0.7	5.2	0.14	0.20	0.19	42.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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Technical Memorandum

Subject	Kardinya ACP – Trip Distribution		
Client	Dato Holdings Pty Ltd	Project No.	PTG00870
Date	05/09/2024	Revision	A
Prepared by	Brian Sii	Discipline	Traffic and Transport
Reviewed by	Scott Lambie	Office	Perth

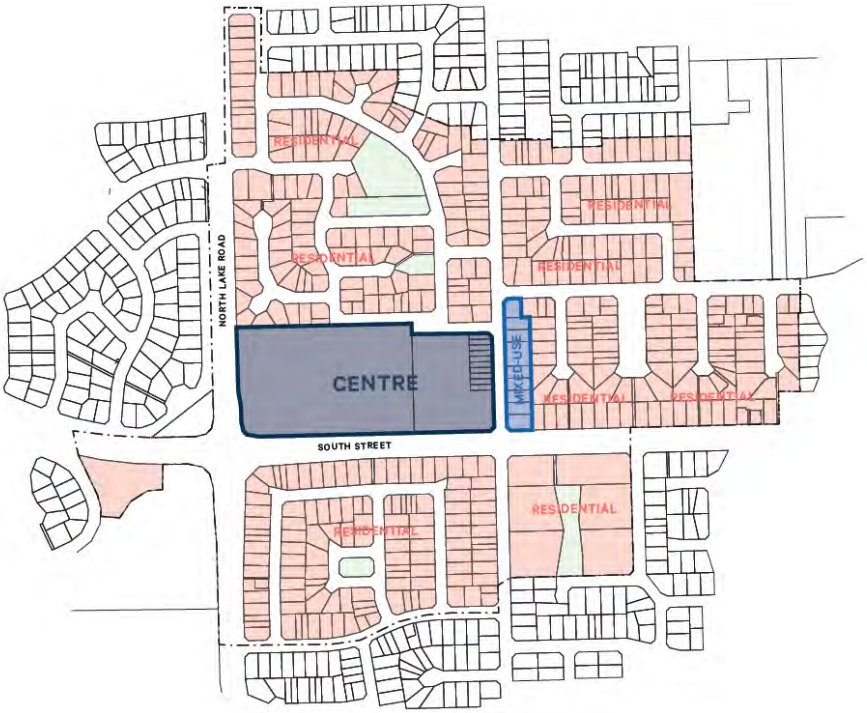
1 INTRODUCTION

Stantec previously prepared a TIA report for the Kardinya Activity Centre Structure Plan (ACSP) (Ref: CW1087800-TR-R001-B-Kardinya ACP_TIA_2021, dated 25/01/2022) The DPLH and MRWA have reviewed the TIA and have requested additional information to be provided to clarify the trip distribution methodology used in the assessment. This technical memorandum aims to provide additional information and clarification on the trip distribution methodology previously used in the TIA.

2 ACSP CONTEXT

The Kardinya ACSP is located within the City of Melville, 1.5km to the west of Murdoch University, 2km east of the O'Connor Industrial Area, 6.5km east of Fremantle and approximately 14km south of Perth CBD. The proposed Activity Centre Structure Plan includes the expanding Kardinya Shopping Centre, as well as parts of the surrounding area which currently comprises commercial development and residential neighbourhoods. The location and boundary of the Kardinya ACSP is shown in **Figure 1**.

Figure 1 Kardinya ACSP Precincts



3 TRIP GENERATION AND DISTRIBUTION

A desktop model of Kardinya Activity Centre was developed in order to determine the impact of the planned development on key intersection performances and road capacities. SCATs data from the signalised intersections was sourced from MRWA and supplementary traffic count data was used to determine the turning movements proportions at critical intersections in and around the Activity Centre.

3.1 Reference

Due regard was given to historical traffic data available publicly such as via Main Roads WA Traffic Map and other SCATs data. However, it is noted that the historical background traffic flow does not directly indicate the likely origin and destination trips likely generated by the ACSP.

ROM demand flows were also given due regard when considering the future traffic modelling. However, the detailed modelling consideration of the ROM model was not available and may not have considered the proposed ACSP fully.

3.2 Trip Generation

The trip generation of the proposed ACSP was previously calculated, taking into consideration the transport mode share and expected reciprocal demand. Employee journey to work presents the greatest opportunity for ode shift during the peak hours as it typically occurs regularly and at a consistent time of day. However, this would only make up to approximately 20% of the total daily destination trip. Conversely the travel behaviour of shoppers and education/school trips are generally more constrained by external factors, such as route choice, trip chaining requirements.

The long-term plan for the ACSP reflects the *Department of Transport's Public Transport for Perth in 2031,* anticipating a high-capacity public transport (BRT/LRT) route connecting Kardinya Centre with Murdoch Station. IT is expected that high frequency collector bus services would then connect users to this future express service, creating an efficient and attractive service for a wide range of trip purposes.

With the expected improvements in public transport infrastructure and the effects of densification and parking constraint on residential household behaviour, the private vehicle mode share is likely to decrease in the future, with increased public and active transport mode uses. The reduced traffic generation for each land use within the Activity Centre presented in the TIA has been extracted and shown in Figure 2.

Figure 2 Kardinya Activity Centre Proposed Development Traffic Generation

Land Use	AM Peak	PM Peak	Daily
Residential Traffic Generation			
Residential (1,460 Additional Dwellings)	534	534	5338
Impact of Journey to Work Mode Shift		*-6%*	
Modelled Residential Traffic Generation	**529**	**529**	**5,286**
Non-Residential Traffic Generation			
Kardinya Park Shopping Centre (Full Redevelopment) – included in background traffic	634	1,690	2,113
Other Commercial Developments	60	60	120
Internal Trip Proportion	*16%*	*31%*	*26%*
Modelled Commercial Traffic Generation	**583**	**1,208**	**1,652**

3.3 Trip Distribution and Assignment

The trip generation of the ACSP was divided into 4 zones of residential development (surrounding Kardinya Shopping Centre) and a "core" for residential development within the Kardinya Shopping Centre area, based on the estimated number of dwellings. This method considers the different travel patterns and potential routes expected of those living in each zone. The ACP zoning map is shown in Figure 3.

Figure 3 ACP Zoning Map

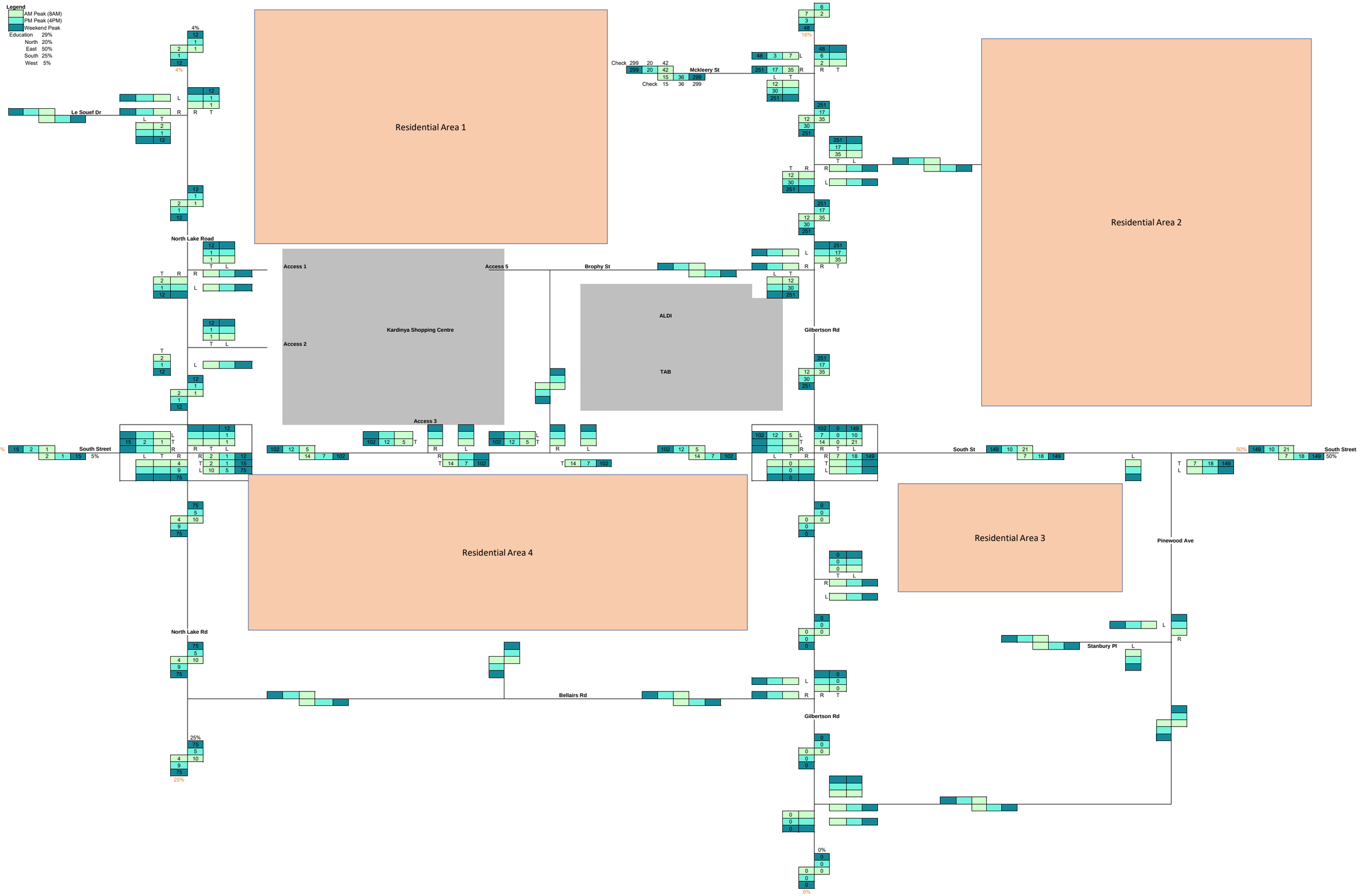
The trips generated by each zone were distributed considering the regional context in the vicinity of the ACSP. The majority of the external traffic (outside of ACSP) are likely to use North Lake Road and South Street as the major routes. The following was considered when estimating the directional distribution.

- East: A large proportion of the traffic is expected to travel east as it provides more connections to regional destinations, and major attractions such as Murdoch University, Hospital precinct and Freeway access).
- West – Traffic to the west is likely to use South Street with major regional destinations such as the O'Connor industrial area and Fremantle. These trips are likely to be recreational or work trips, with a small number of educational trips.
- North – Traffic to the north is likely to use Gilbertson Road and North Lake Road onto Leach Highway or Canning Highway. Major regional destinations include Myaree commercial area and other attractions along Leach Highway and Canning Highway.
- South – Traffic to the south is likely to predominantly use North Lake Road. However, this is likely to be of the minority, as a proportion of the southbound trips may also use Stock Road (west of ACP) or Kwinana Freeway (east of ACP) via South Street.

Based on the above assumptions, the following trip distribution % was estimated for the trip generated by the ACSP.

	1		2		3		4		Core	
	Edu	Work/Others	Edu	Work/Others	Edu	Work/Others	Edu	Work/Others	Edu	Work/Others
Trip Purpose	29%	71%	29%	71%	29%	71%	29%	71%	29%	71%
North	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
East	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
South	25%	10%	25%	10%	25%	10%	25%	10%	25%	10%
West	5%	20%	5%	20%	5%	20%	5%	20%	5%	20%

A snapshot of the traffic distribution for (Zone 1) is shown below:


Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak
Education 29%
North 20%
East 50%
South 25%
West 5%
Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Kardinya Shopping Centre
ALDI
TAB
Access 1
Access 2
Access 3
Access 5
Le Souef Dr
North Lake Road
Brophy St
Mckleery St
Gilbertson Rd
South Street
South St
Pinewood Ave
Bellairs Rd
Stanbury Pl
Check 299 20 42
Check 15 36 299
4%
16%
5%
25%
0%

Legend
AM Peak (8AM)
PM Peak (4PM)
Weekend Peak
Education 29%
North 20%
East 50%
South 25%
West 5%

Residential Area 1
Residential Area 2
Residential Area 3
Residential Area 4
Kardinya Shopping Centre
ALDI
TAB
Access 1
Access 2
Access 3
Access 5
Le Souef Dr
Mckleery St
Brophy St
Gilbertson Rd
North Lake Road
South Street
South St
Check
Bellairs Rd
Pinewood Ave
Stanbury Pl

4 FUTURE SCENARIOS

4.1 Background Traffic Growth

Previous discussion with Main Roads WA has suggested a traffic growth rate of 1.65% per annum, which should include future development in the vicinity of the Kardinya ACSP.

The TIA adopted the growth rate for South Street and North Lake Road and assumed a 1% per annum growth rate for the remaining roads in the vicinity of the ACSP.

4.2 Future Development Traffic

It is noted that the TIA assumed that the development traffic distribution is the same for opening and future year scenarios. Therefore, the reduced traffic generation of the ACSP due to transport mode use shift and expected public and active transportation improvements have been included even in the opening year scenario.

Appendix 3 - Pritchard Francis Servicing Report

Kardinya Park Shopping Centre
Kardinya
Engineering Services Report

Project No: 19320

pritchard francis
civil and structural engineering consultants

Table of Contents

Revision	Description	Author	Date
A	Issued For Review	Jamie De Palma	19 December 2019
B	Issued For Review	Jamie De Palma	6 January 2020
C	Stormwater Revised	Jamie De Palma	8 January 2020
D	Structure Plan Revised	Jamie De Palma	12 March 2020

1 General

At the request of Keith Somers on behalf of Dato Holdings Pty Ltd, Pritchard Francis has prepared this engineering servicing report to identify existing site conditions, existing services and potential upgrades required in order to facilitate the development of 1,856 dwellings within an approximate 500m radius of the existing Kardinya Park Shopping Centre.

The development area is located within the City of Melville and is centred about the existing Kardinya Park Shopping Centre which is boarded by South Street on the southern boundary, and North Lake Road on the western boundary. Figure 1 below depicts an aerial photograph of the area, whilst the proposed Local Structure Plan prepared by Element can be found within Appendix One.

Figure 1– 2019 Aerial photograph of the site

This report outlines the capacity of existing utility facilities to service the development. The services under assessment are:

- Water and Sewer Reticulation (Water Corporation WA)
- Drainage (City of Melville)
- Gas (Atco Gas Australia)
- Power (Western Power)
- Communications (Telstra and NBN Co)

In addition to utility service capacity assessment, the report also covers geology and preliminary earthworks advice for development.

2 Information Sources

The table below outlines the background and servicing information obtained by Pritchard Francis to facilitate this report.

Description of Data	Obtained From	Date
Dial Before You Dig	1100	7 November 2019
Site Survey	RM Surveys	8 November 2019
Aerial Imagery	Eagle View	8 November 2019
Groundwater Data	Department of Water	12 November 2019
Architectural Drawings	Hames Sharley	13 November 2019
Stormwater Drainage As Cons	Main Roads WA	14 November 2019
Water Corporation Data	Water Corporation	25 November 2019
Stormwater Drainage As Cons	City of Melville	26 November 2019
Structure Plan Proposal	Element	18 February 2020

3 Site Conditions

3.1 Geology

A geotechnical investigation of the site is yet to be completed and in lieu, Pritchard Francis have assessed the 1:50,000 Geological Map Series. The mapping indicates that the site is likely to consist of Sand comprising of pale yellowish brown, medium to course-grained sub-angular quartz, trace of feldspar, moderately sorted, of residual origin, which is typically suitable for urbanisation, excavation and of high permeability.

Based on our previous experience, we anticipate a site classification of class 'A' in accordance with AS 2870–2011 provided that normal site preparation is undertaken prior to construction.

An infiltration rate of 5m/day is anticipated as stormwater detention structures shall be located in the existing in-situ sand.

A detailed geotechnical investigation would need to be undertaken by a certified geotechnical engineer prior to construction to confirm site conditions and geological development constraints, if any at all. At completion of site work a final geotechnical inspection will be required and sign-off report produced in order for the local authority to provide clearances.

An extract of the Geological Map Series has been provided within Appendix Two.

3.2 Topography

In lieu of a site survey, Pritchard Francis have utilised the contours provided by the Water Corporation Esinet data. The development area includes some reasonable falls, with the levels being in the order of:

- RL 49m AHD at the western extent of the precinct (Callaway Court)
- RL 10m AHD at the northern extent of the precinct (Dalston Crescent)
- RL 23m AHD at the eastern extent of the precinct (South Street)
- RL 34m AHD at the southern extent of the precinct (Dixon Place)
- RL 22m AHD at the centre of the precinct (Kardinya Park Shopping Centre)

The site generally falls from the south-west to the north, with the north-western precinct comprising the steepest of the falls.

Minor earthworks and retaining walls to each individual development site would be likely to accommodate any change of level whilst mitigating any level difference between properties.

A detailed feature survey of the site will be required prior to any detailed documentation works being undertaken.

3.3 Acid Sulphate Conditions

Acid Sulphate Soils (ASS) are naturally occurring soils that contain iron sulphide minerals and are benign in undisturbed state below water table. When the soils get excavated or exposed to air, the sulphides react with oxygen to form sulphuric acid. Care and treatment must be undertaken when carrying out construction in areas with ASS.

In lieu of a geotechnical investigation, Pritchard Francis has assessed the Planning Bulletin to determine the Acid Sulphate Soil risk of the site. The mapping series indicates that the site has a low to no risk of Acid Sulphate Soils.

An extract of the Acid Sulphate Soils Risk Map is provided within Appendix Three.

3.4 Groundwater

The Department of Water indicate that the groundwater is likely to be encountered at RL 9.0m AHD in the eastern precinct of the development zone, reducing to RL 6.0m AHD in the western precinct.

Most of the development area is in excess of 10m from the groundwater and is therefore unlikely that the groundwater will impact the structural design, nor the stormwater detention solution for the development site.

However, the northern precinct where the natural surface falls to RL 10m AHD, may only have 2-3m of clearance to the groundwater. Groundwater in this precinct may impact the construction of basements and stormwater detention solutions.

An extract of the Groundwater Map is provided within Appendix Four.

3.5 Contamination

The Department of Water and Environmental Regulation contaminated site database indicates that no sites within the development area are registered as contaminated site. The publicly available database only lists sites classified as 'Remediated for restricted use', 'Contaminated – remediation required' and 'Contaminated – restricted use'.

3.6 Geomorphic Wetlands

The Department of Biodiversity, Conservation and Attractions Geomorphic Wetlands DBCA-019 database indicates that no sites within the development area are classified as geomorphic wetlands.

3.7 Bushfire Risk

The Department of Fire and Emergency Services (DFES) bushfire risk mapping indicates that no sites within the development area are in a bushfire prone area.

3.8 Heritage Considerations

The Department of Planning, Lands and Heritage (DPLH) aboriginal heritage mapping indicates that no sites within the development area are impacted by Heritage considerations.

4 Infrastructure

4.1 Sewerage Reticulation

The Water Corporation Esinet data obtained on 25 November 2019 indicates that the development area is located adjacent to the following sewer reticulation mains:

- All road reserves are currently serviced by Ø150mm and Ø225mm reticulation mains.
- Ø450mm sewer distribution main operates within the north-western precinct, discharging south-east.
- Ø600mm sewer distribution main operates within the central precinct, discharging south-east.
- Ø760mm sewer distribution main operated within the south-eastern, discharging south-east.
- All sewer reticulation mains north of South Street grade to the Le Souef Drive Pump Station. The pump station is charged via a 200mm rising main along North Lake Road, discharging into the Ø600mm sewer distribution main at South Street.
- All sewer reticulation mains south of South Street grade to the sewer distribution main.

The Water Corporation provided advice with respect to the sewer servicing on 18 December 2019, being:

- The reticulation infrastructure in the catchment the subject area is within can cater for the increase in predicted flows.
- The Le Suoef Dr pump station that serves the catchment and some downstream headworks (major infrastructure) will need to upgraded in the future.
- In regards to developers requirements, as per above there should be no upgrading of reticulation infrastructure but developers may be required to fund new, relocation and/or protection of works depending on the development proposal taking place.
- The upgrading of the headworks infrastructure will be funded by the Water Corporation.

This advice was subsequently confirmed with respect to the updated structure plan, provided on 9 March 2020:

- The update does not change the comments we made previously as informed below.
- The reticulation infrastructure in the catchment the subject area is within can cater for the increase in predicted flows.
- The Le Suoef Dr pump station that serves the catchment and some downstream headworks (major infrastructure) will need to upgraded in the future.
- In regards to developers requirements, as per above there should be no upgrading of reticulation infrastructure but developers may be required to fund new, relocation and/or protection of works depending on the development proposal taking place.
- The upgrading of the headworks infrastructure will be funded by the Water Corporation.

The advice from the Water Corporation confirms that the proposed structure plan amendment can be supported by the existing sewer reticulation infrastructure.

Refer to Appendix Five which contains a plan of the existing sewer infrastructure and Water Corporation correspondence.

4.2 Water Reticulation

The Water Corporation Esinet data obtained on 25 November 2019 indicates that the development area is surrounded by the following water reticulation mains:

- All road reserves are currently serviced by Ø100mm, Ø150mm and Ø200mm reticulation mains.
- Ø375mm water distribution main operates within the north-western precinct, continuing to the east.
- Ø375mm water distribution main operates within the northern precinct, continuing to the east.
- Ø305mm water distribution main operates within the Gilbertson Road.
- Ø760mm water distribution main operates within the south-eastern precinct, within both South Street and Gilbertson Road.

The Water Corporation provided advice with respect to the water servicing on 2 December 2019, being:

- By the way some good news, water does not seem to be a problem.

The advice from the Water Corporation confirms that the proposed structure plan amendment can be supported by the existing water reticulation infrastructure.

A hydraulic consultant will be required to assess each individual development site in order to:

- Size the water and fire connections to the development site.
- Review the water pressure and flow within the existing water mains to verify whether pumps and tanks are necessary to support a proposed development.

Refer to Appendix Six which contains a plan of the existing water infrastructure.

4.3 Stormwater Drainage Strategy

4.3.1 City of Melville Drainage Infrastructure

The City of Melville stormwater data obtained on 26 November 2019 indicates that the development area is surrounded by the following stormwater assets:

- Stormwater assets within the northern precinct typically grade to the Laurie Withers Reserve and Jack Martin Reserve.
- Stormwater assets within the eastern precinct appear to grade towards Morris Buzacott Reserve.
- Stormwater assets within the southern precinct typically grade to Gilbertson Road, and south towards Red Gum Park.
- Stormwater assets within South Street are controlled by Main Roads WA, which ultimately discharge into the Gilbertson Road drainage system.

Pritchard Francis anticipate that an upgrade to the existing road reserve drainage networks would not be required, and all stormwater networks would be appropriately sized to cater for the existing land uses and road reserve widths. An increase to the residential zoning will not impose additional load on the existing stormwater networks as per Section 4.3.2 below.

Refer to Appendix Seven which contains a plan of the existing stormwater infrastructure.

4.3.2 City of Melville Drainage Requirements

The City of Melville website defines that all developments shall contain stormwater on site in accordance with the City of Melville detention requirements. The detention requirements differ subject to the development type.

Residential Development

- All stormwater shall be retained and discharged on site.
- All soak-wells installed in paved or concrete areas shall be provided with trafficable lids and made accessible for maintenance purposes.
- Soak-wells to be no closer than 1.0m to a footing or boundary.
- All soak-wells used shall be from an accredited supplier.
- All soak-wells installed within flexible pavement areas (bitumen or brick paving) shall be provided with an appropriate base to prevent any subsidence of the well liners.
- It is the owner's responsibility to regularly clean and maintain on-site drainage systems to ensure its on-going functionality.
- Residential sites located below road level shall have drainage systems designed to cater for a 1:100 ARI 24hr storm event.
- Residential sites located above road level shall have drainage systems designed to cater for a 1:20 ARI 1hr storm event.

Industrial and Mixed Use

- All drainage systems designed for the proposed developments shall be certified by a Registered Professional Engineer.
- The design of the systems, shall conform to the requirements of the Building Code of Australia (BCA) and the Australian Standard (AS 3500).
- It shall be the Engineer's responsibility to demonstrate that a 1:100 ARI 24hr storm event is fully contained within the property boundary.

A copy of the stormwater detention requirements is provided within Appendix Eight.

4.4 Gas Supply

A Dial Before You Dig investigation indicates that there is existing gas infrastructure within the vicinity of the proposed structure plan amendment. All road reserves are fed with medium-low to medium pressure pipelines.

Atco Gas provided advice with respect to the gas servicing on 12 March 2020, being:

- Currently, part of the distribution network in Kardinya is reticulated in Medium Low Pressure (MAOP 7kPa) and this will be rationalised to Medium Pressure (MAOP 70kPa) in 2020.
- The gas distribution network in this area of interest in the suburb of Kardinya is currently going through a program to rationalise the gas pressure. Once completed (total completion by 2021) the gas network in this area will be able to supply a total of approximately 1900 dwellings.

The advice from Atco Gas confirms that the proposed structure plan amendment can be supported by the existing and planned upgrades of the gas infrastructure.

Refer to Appendix Nine which contains a plan of the existing gas infrastructure and Atco Gas correspondence.

4.5 Electrical Supply

A Dial Before You Dig investigation indicates that there is existing Western Power infrastructure within the vicinity of the proposed structure plan amendment. The following Western Power assets are located around the development area:

- Existing 66kVa overhead transmission line within the eastern verge of North Lake Road.
- High Voltage overhead cables within the southern verge of South Street, western verge of Gilbertson Road and western verge of North Lake Road.
- Typical High Voltage feeders within the residential streets.

Pritchard Francis engaged with 3E Electrical to seek further electrical advice, with the following comments received:

Background

The proposed development of the Kardinya Shopping Centre precinct, resulting in the increase in dwelling density by an additional 1521 dwellings. Based on the assumption that we have 75%/25% group housing/multi-story dwelling and green title development works. The additional load that will be added to the network will be approximately 6.5MVA of design load. Network feeders are designed to cater for 10MVA of actual load, and some provision for growth.

Existing and Proposed Power Infrastructure

The area is fed by the O'Connor zone substation located at the Garling St and Bowen St intersection, with HV distribution feeders all throughout this area. A mixture of aerial and underground HV feeder cables are available to connect/extend as the area develops. The spare capacity in the zone substation is between 25 – 30MVA, which is more than enough to cater for any expansion works in the surrounding suburbs. As the development area is within a couple of kms of the zone substation, tweaks to the existing network to shift load would be the first option for Western Power during the initial phases of the area upgrade.

In the past when additional load is added to the network at a slower rate, approximately 1.5MVA per year this has been considered load growth and thus any major network reinforcement works that maybe required to provide the capacity in the area is covered by Western Power.

Based on the overall load profile and probably staged development of the area, large network costs would not likely be incurred.

The Dial Before You Dig data has been provided within Appendix Ten.

4.6 Communications

A Dial Before You Dig investigation indicates that there is existing communications infrastructure within the vicinity of the proposed structure plan amendment. The following assets are located around the development area:

- Telstra Cables within all road reserves,
- Optus fibre optic within the northern verge of South Street, western and eastern verge of North Lake Road,
- Nextgen within the northern verge of South Street,
- NBN within all road reserves.

Pritchard Francis engaged with 3E Electrical to seek further communication advice, with the following comments received:

3E Communications Advice

The proposed redevelopment is located within a suburb that has already been converted to NBN Co broadband under the Brownfields Rollout. Therefore, NBN Co would be regarded as the infrastructure provider of last resort (IPoLR) and could be engaged, if the Developer/s so wanted, for the provision of broadband and voice infrastructure. If not, either of the niche Service Providers could be engaged. Under the Definitive Agreements with NBN Co, Telstra is not permitted provide broadband or voice infrastructure on its copper network for a period of 20 years, from the time of the agreement.

Developers have two obligations in relation to telecommunications:

- Firstly, to provide fibre ready pit and pipe, a requirement under the Telecommunications Act 1997
- Secondly, to provide telecommunications infrastructure, as is provided for other utilities, a requirement of the Federal Government's Telecommunications in New Developments Policy.

Although the fibre ready requirement applies strictly to Developers who are statutory corporations, we recommend that all Developers comply.

Although the existing NBN Co technology within Kardinya is Fibre to the Node (FTTN), given the increase in yield, NBN Co would most likely deliver fibre to the Premises (FTTP) technology, if the redevelopment were not to take place over an extended period of time. If the development were to be undertaken by a single Developer then NBN Co would most likely lean towards an FTTP solution. However, if multiple Developers were involved, ie primarily individual home owners, then it would be more difficult to obtain an FTTP solution. Assuming a mix of development by multiple home owners and land Developers, the probability of FTTP being delivered would be increased. A consortium of Developers could approach NBN Co under the Technology Choice Programme seeking the provision of FTTP or an approach could be made to NBN Co seeking their funding of the network upgrade, given the expected increase in yield and the consequential inadequacy of the FTTN network. NBN Co would take such as decision on commercial basis.

Major roads within the proposed redevelopment area, such as South St, North Lake Rd, Gilbertson Rd, are well serviced with large conduit routes but most other streets would not be regarded as fibre ready, since many are only serviced with P20 or P35 pipe, neither of which could support a substantial increase in cable infrastructure – see Telstra DBYD attached. Such streets would need to be upgraded to fibre ready standards. It should be noted that some existing conduit routes are constructed of asbestos composite material and that telecommunications carriers works and costs could reflect the precautions needed to be taken when upgrading networks through those routes.

Assuming road reserves are unchanged, we would not foresee telecommunications relocation works arising from the redevelopment but if alterations were made to road reserves, then a number of telecommunications carriers could be affected, ie Optus, Nextgen, Pipe Networks, NBN Co and Telstra. If road reserves we to be altered we recommend that such changes be implemented without compromising the standard alignments designated within the Utility Providers Code of Practice.

Apart from the costs associated with the upgrade works above, we would not see any obstacle to the provision of the additional services to the development.

The communications Dial Before You Dig data has been provided within Appendix Eleven.

5 Conclusion

This report outlines the existing geotechnical conditions and existing road reserve services servicing the proposed structure plan amendment of Kardinya Park. Pritchard Francis confirm that the site is accessible and can be served with roads, electrical, water, sewer, gas, stormwater drainage and communications infrastructure.

Appendices

Appendix One:	Local Structure Plan
Appendix Two:	Geology
Appendix Three:	Acid Sulphate Soils Risk Map
Appendix Four:	Groundwater Mapping
Appendix Five:	Sewer Reticulation Infrastructure
Appendix Six:	Water Reticulation Infrastructure
Appendix Seven	Stormwater Infrastructure
Appendix Eight:	Stormwater Detention
Appendix Nine:	Gas Infrastructure
Appendix Ten:	Electrical Infrastructure
Appendix Eleven:	Communication Infrastructure

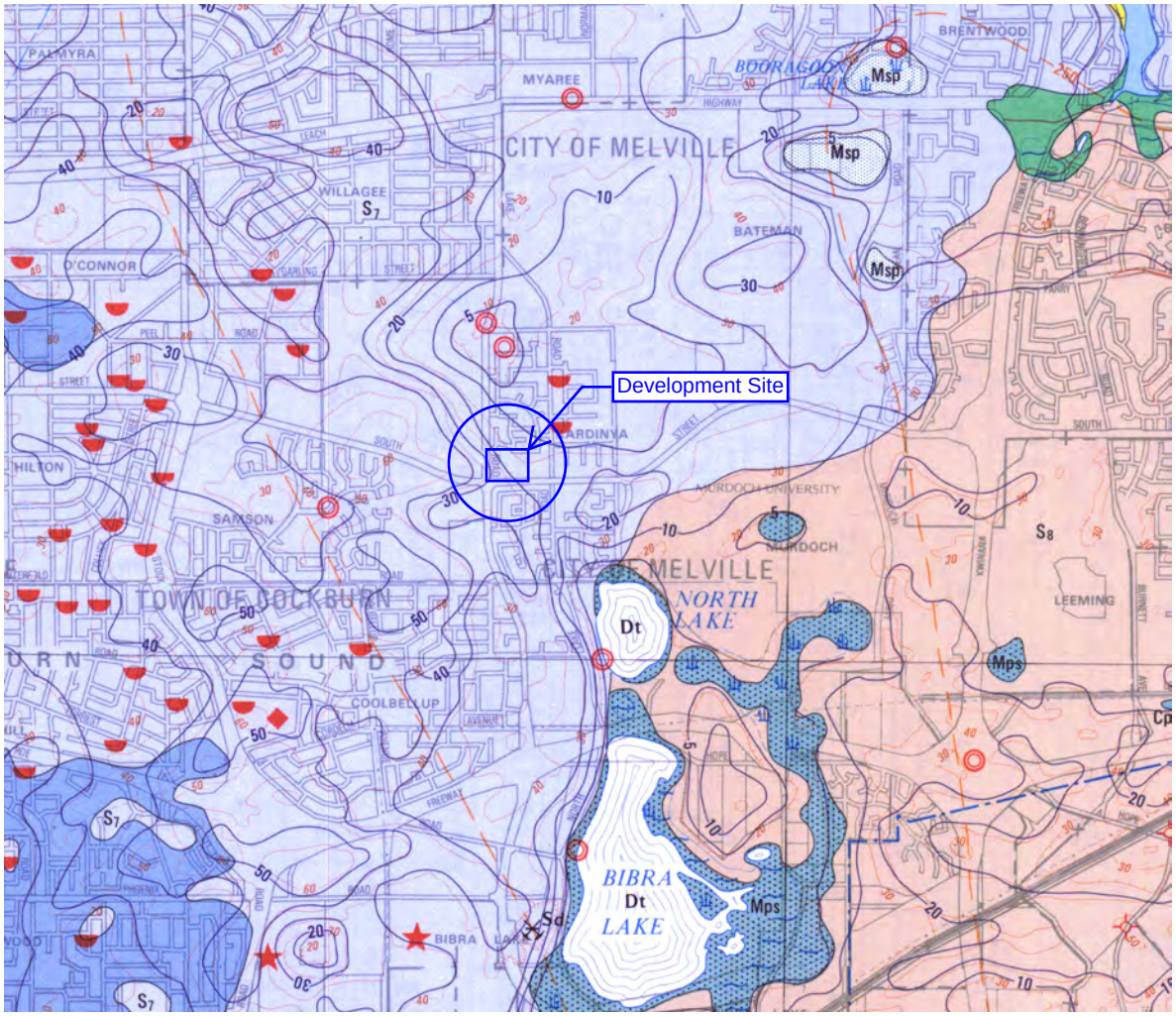
Appendix One: Local Structure Plan


R40
22,810m²
31
R60
11,320m²
60
R40
8,535m²
27
R40
3,890m²
12
R40
6,135m²
19
R60
2,330m²
12
R60
10,017m²
42
23,310m²
186
6,135m²
19
R40
R60
6,895m²
29
R80
R80/R160
9,020m²
96
R80/R160
R80
26,162m²
139
R80
2,890m²
15
R160
8,780m²
116
R80/R160
6,830m²
54
R160
4,800m²
51
66,779m²
200
11,320m²
110
18,000m²
95
R100
R80
7,495m²
39
R80
37,205m²
197
R80
32,140m²
170
R80
R60
R60
11,800m²
50
21,170m²
89
2,430m²
7
2,550m²
8
1,562m²
4
5,810m²
18
R40
R40
R40
R40

Appendix Two: Geology

PERTH

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA



SHEET 2034 II AND PART OF 2034 III AND 2134 III

Map Unit: Unconsolidated Material	Map Unit: Rock	Description	Equivalent Unit on geological maps	Relief; Slope	Rock-Mineral Resources	Physical Properties: Permeability	Corrosion potential	Slope stability	Ease of excavation	Shrink swell potential	Bearing capacity	SMEC	Current Processes	Suitability for specified land uses: waste disposal	Septic tanks	Roads	Urban environment	Excavation	Notes
		PEATY CLAY – dark grey and black[2] with variable sand content of lacustrine origin	Swamp deposits (Qhw)	20–60 m;F	Peat, diatomite	L	M–H	L	H	M–H	L	OH-CH	Flooding	×	×	×	⊗	×	High water table, prone to flooding, organic and clayey soils of low bearing capacity
		SILT – grey mottled yellowish brown, blocky, firm, variable clay content		20 m;F	Plastic clay for brick, pipe and tile manufacture	L	L–M	L–M	H	L–M	M–H	ML MH	Flooding	×	×	×	◆	○	High water table, prone to flooding, variable bearing capacity, differential settlement of foundations may occur
		PEAT – black, clayey in part, saturated fibrous organic soil		15 m;F	Peat	H	H	L	H	H	L	Pt	Flooding	×	×	×	×	×	High water table, prone to flooding, low bearing capacity, differential settlement will occur, high compressibility
		PEATY SAND – greyish brown, medium-grained quartz, moderately well sorted, variable organic content, of lacustrine origin		20–25 m;F	Sand, diatomite	M–H	L–M	L	H	L	L	SP–SW	Flooding	×	×	×	⊗	×	High water table, prone to flooding, variable under foundations
		PEATY SAND – dark grey and black quartz sands with variable organic content and common peat lenses, variable clay content		10–15 m;F	Peat	H	M–H	L	H	L–M	L–M	SC, Pt		×	×	×	○	×	High water table, may be prone to flooding, variable bearing capacity, differential settlement of foundations could occur
	S_1	CALCAREOUS SAND – white, fine to medium-grained, sub-rounded quartz and shell debris, of aolian origin	Safety Bay Sand (Qhs)	0–20 m;M	Limesand	H	L–M	L	H	N/A	L	SP–SW	Wind transportation	×	●	◆	×	×	Active blowouts, and sand sheets, unvegetated, high lime content gives it considerable potential for fixing certain kinds of waste, and neutralising acids, low bearing capacity, settlement can be uneven
	S_2	CALCAREOUS SAND – as S_1		0–60 m;M–S	Limesand	H	L–M	L	H	N/A	L	SP–SW	Wind transportation	◆	●	◆	⊗	×	Prone to remobilisation where the sparse vegetation is removed, high lime content gives it potential for fixing certain kinds of waste, and neutralising acids, low bearing capacity, settlement can be uneven
	LS_{Es}	LIMESTONE – pale yellowish brown, weakly cemented, friable, medium-grained, sub-rounded quartz and shell debris, of aolian origin		40–55 m;M–S	Limesand	H	L–M	M	H	N/A	L–M	SP–SW	Wind transportation	×	●	◆	⊗	×	Generally linear features with moderate to steep slopes, susceptible to remobilisation, low bearing capacity
	C	CLAY – mid to dark grey, soft, saturated, prominent 0.2 m thick oyster shell bed near surface of alluvial origin	Alluvium (Qha)	0–4 m;F		L	M–H	L–M	H	L	L	CL	Flooding, stream flow, sediment transport	×	×	×	○	×	Confined to Swan River floodplain, prone to flooding, differential settlement of foundations may occur, high water table
	Cm_2	CLAY – dark strong brown, hard when dry, soft when moist, variable silt content, no sand, of alluvial origin		2–10 m;F	Clays for brick pipe and tile manufacture	L	L	M	H	L	L–M	CL	Flooding, stream flow, sediment transport	●	×	×	◆	×	Confined to Helena River floodplain and Jane Brook, high water table, prone to flooding, bearing capacity dependent on clay mineralogy
	Mr_1	CLAYEY SILT – yellow brown to strong brown, blocky, mottled, soft, with variable clay content, dispersive in part, of alluvial origin		2–10 m;F	Clays for brick pipe and tile manufacture	L	L	L–M	H	L	L–M	ML	Flooding, stream flow, sediment transport	×	×	×	◆	×	Confined to Swan River floodplain and some tributaries, prone to flooding, high water table, some settlement under load can be expected
	Ms_1	SANDY SILT – light yellow brown, blocky, mottled, some fine to medium-grained sand, soft when moist, variable clay content		1–5 m;F	Silts and clays for brick pipe and tile manufacture	L	L	M	H	L	M	ML	Flooding	○	×	×	◆	×	Confined to Swan River floodplain, high water table, prone to flooding, some settlement of foundations may occur
	S_{1d}	SAND – pale grey to white, medium-grained sub-angular, quartz and feldspar, well sorted, abundant whole and broken bivalves and gastropod shells, of alluvial origin		0–5 m;F		H	L	L–M	H	N/A	L–M	SP	Potential for flooding	×	×	×	◆	○	Confined to Swan River estuary high water table, prone to flooding, some settlement of foundations may occur, bearing capacity is dependent on degree of consolidation of the material
	Sm_1	SILTY SAND – strong brown, leached at surface, fine to medium-grained, quartz, variable silt content		5–10 m;F		M	L	L–M	H	L	M	SF silty		●	×	●	◆	◆	Confined to Swan River floodplain, high water table, variable thickness, bearing capacity is dependent on the amount of silt in the material
	M_2	SILT – strong brown, tough, hard, variable fine-grained quartz sand in matrix	Alluvium (Qa)	200–290 m;G		L	L	M	H	L	M	ML	Some solifluction, occasional, stream flow	○	×	●	◆	○	Confined to valleys on the Darling Scarp, variable thickness, may become saturated during periods of water flow
	Mgr_2	GRAVELLY SILT – strong brown, tough with common pebbles of fine to coarse-grained, sub-rounded granite, some dolerite and rare sandstone (SS) variable sand content	Colluvium (Qc)	40–100 m;G	Gravel, possibility of silts and clays for brick pipe and tile manufacture	L–M	L	M–H	H	L	M–H	ML	Some solifluction, some stream flow	◆	×	×	◆	○	Variable value as a foundation; permanent cuts are unstable
	Ms_2	SANDY SILT – strong brown, firm, friable, occasional pebbly horizons with little matrix containing quartzite, quartz, granite, laterite, of colluvial origin		20–50 m;G	Used in brick manufacture to impart body	L	L	M–H	H	L–M	M	ML–M	Stream flow, some mass movement	◆	×	×	◆	○	Variable value as a foundation, permanent cuts are unstable, dispersive in part
	Mr_2	SANDY SILT – yellowish brown, tough, with variable sand content of fine to medium-grained quartz sand, some gravel in places.		20–75 m;G	Potential for gravel in part	L–M	L	L–M	H	L	M	ML	Stream flow, some mass movement	◆	×	×	◆	○	Variable value as a foundation, permanent cuts are unstable
	Smg	SILTY SAND – dark yellowish brown, tough silty, medium to coarse quartz sand, in places is abundant medium to coarse-grained plastitic laterite (G_p) pebbles.		30 m;F	Gravel	M–H	L	L	H	L	L–M	SF silty		◆	×	◯	◆	◆	Restricted occurrence
	S_3	SAND – pale and olive yellow, medium to coarse-grained, sub-angular to sub-rounded quartz, trace of feldspar, moderately sorted, of residual origin.	Sand derived from Tamala Limestone (Qts)	0–100 m;G	Specification sand	M	L	L–M	H	N/A	L–M	SP–SW	Groundwater recharge	●	×	●	◆	◆	Few limitations, some settlement under foundations can be expected, some ability to attenuate pollutants due to small clay content, usually considerable depth to water table due to topography
LS_3		LIMESTONE – light, yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface karstic, of aolian origin.	Tamala Limestone (Qtl)	0–65 m;F–G	Dimension stone, metallurgical, agricultural and construction grade limestone	H	L	M–H	M–H	N/A	V		Groundwater recharge	×	×	●	◆	◆	Variable bearing capacity dependent on degree of cementation, solution cavities and fissures could lead to settlement under load and offer an easy path for pollutants down to the water table
LS_{3r}		LIMESTONE – as LS_3, abundant karstic phenomena including caves, swallows, dolines		30–40 m;G	As LS_3	H	L	M–H	M–H	N/A	V_1		Groundwater recharge	×	◆	●	⊗	⊗	As LS_3, high water table in places, extensive cave systems and other large scale karstic phenomena known
S_9		SAND – very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of aolian origin	Bassendean Sand (Qpb)	15–80 m;F–G	Construction and glass sand	H	L	L	H	N/A	M–H	SP–SW	Groundwater recharge, some wind transportation	●	×	●	◆	◆	Well drained, when dry and vegetation free it could be remobilised, drainage disposal is only a problem in areas of high water table
S_{10}		SAND – as S_9	Thin Bassendean Sand over Guildford formation (Qpb/Qpa)	10–55 m;F	Construction and glass sand	H	L	L	H	N/A	M–H	SP–SW	Groundwater recharge, some wind transportation	×	×	×	◆	◆	Of variable thickness, the sands physical properties are modified by the underlying material generally high water table.
Mgr_1		PEBBLY SILT – strong brown silt with common, fine to occasionally coarse-grained, sub-rounded laterite quartz, heavily weathered granite pebble, some fine to medium-grained quartz sand, of alluvial origin	Guildford Formation (Qpa)	5–30 m;F	Plastic clays for brick, pipe and tile manufacture	L	L	M–H	H	L	M–H	ML	Stream flow, flooding	×	◆	×	◆	○	Near surface water table, prone to flooding, differential settlement of foundations may occur unless built on columns or concrete rafts above 1 m of compacted sand, dispersive in places
Ms_3		SANDY SILT – strong brown to mid grey, mottled, blocky, disseminated fine sand, hard when dry, variable clay content of alluvial origin.		2–5 m;F	Clays for brick, pipe and tile manufacture	L	L	M–L	H	L	M–H	ML	Flooding	×	⊗	×	◆	○	Confined to Swan River floodplain, susceptible to flooding, some settlement of foundations may occur, dispersive in places
St_1		SAND – light grey, medium-grained, sub-angular to rounded quartz and feldspar, moderately sorted of alluvial origin		5–15 m;F		H	L	L–M	H	N/A	L	SW	Stream flow, sediment transport	×	×	×	×	×	Restricted to fluvial channel with seasonal flow
St_{12}		SAND – yellow, fine to medium-grained, sub-angular to rounded quartz, with some feldspar, well sorted, variable silt content, of colluvial origin	Yoganup Formation (Qpc)	25–75 m;F–G	Construction sand	M–H	L	L–M	H	N/A	L–M	SW		◆	×	◆	◆	◆	Settlement could occur under load, requires protection against erosion when exposed
	SS	SANDSTONE – light grey, hard, compact, moderately weathered, fine-grained silty sandstone, lateritisation has affected the rock in places	Ridge Hill Sandstone (Qph)	75–100 m;G		M	L	M–H	L–M	L	L–M			×	×	○	◆	◆	Areally restricted, variable foundations
	LA_1	LATERITE – massive and cemented, occasionally vesicular, up to c. 4 m in thickness, overlies a zone of mottled and/or pallid clays and saprolite	Laterite (Ql)	235–335 m;F–G		L	L	M–H	L	L	H		Stream flow, sediment transport	×	×	○	◆	◆	Can only be excavated by blasting, variable foundations and sub-surface drainage is a problem
G_2		GRAVEL–strong brown, coarse, sub-rounded to rounded lateritised granite pebbles in clay-silt mixture, moderately sorted, of colluvial origin		220–335 m;G	Gravel	H	L	L	H	L	L	GW	Stream flow, sediment transport	×	×	×	◆	◆	Very loose, though occasionally weakly consolidated, needs protection against water erosion and fluctuations in moisture content, when compacted can withstand heavy loads
	DO	DOLERITE – quartz rich, fine-grained, melanocratic, 2 to 20 m wide dykes	Dolerite (d)	25–250 m;G–M	Crushed rock aggregate when fresh, soils may contain plastic clays	L		M	L	L	H			×	×	×	◆	◆	Can be a good foundation when fresh but soils developed on dolerite (plastic clays) give poor foundations unless moisture content kept constant
M_3		SILT – yellowish brown mottled, overlying kaolisitic horizon, firm and tough when dry, soft when wet, very variable sand content	Even-grained Granite (Aa and Aea)	30–270 m;G		L	L	L–M	H	L–M	ML–M		Solifluction, stream flow	×	×	×	○	◆	Foundation conditions variable and can be good providing requisite preparation conditions are carried out, tendency to be unstable on steep slopes, seepage is common
	GR	GRANITE – mesocratic, fine to coarse-grained, ranges in composition from granodiorite to granite, adamellite being commonest variety		20–270 m;G–S	Crushed rock aggregate, dimension stone	L	L	H	L	L	H		Stream flow	●	×	×	◆	◆	Foundation conditions generally good, even when weathered providing requisite preparation conditions are carried out
	GN_1–GN_{10}	GRANITES and GNEISSES – intimate association of coarse-grained granites (GR) and gneisses and fine-grained dolerites (DO)	Migmatite (Am)	20–180 m;M–S		L	L	M–H	L	L	M–H		Stream flow	●	×	×	◆	◆	Heterogeneous material, adequate foundations providing requisite preparations are followed for clayey soils, where present; unstable on steep slopes, shear zones are common

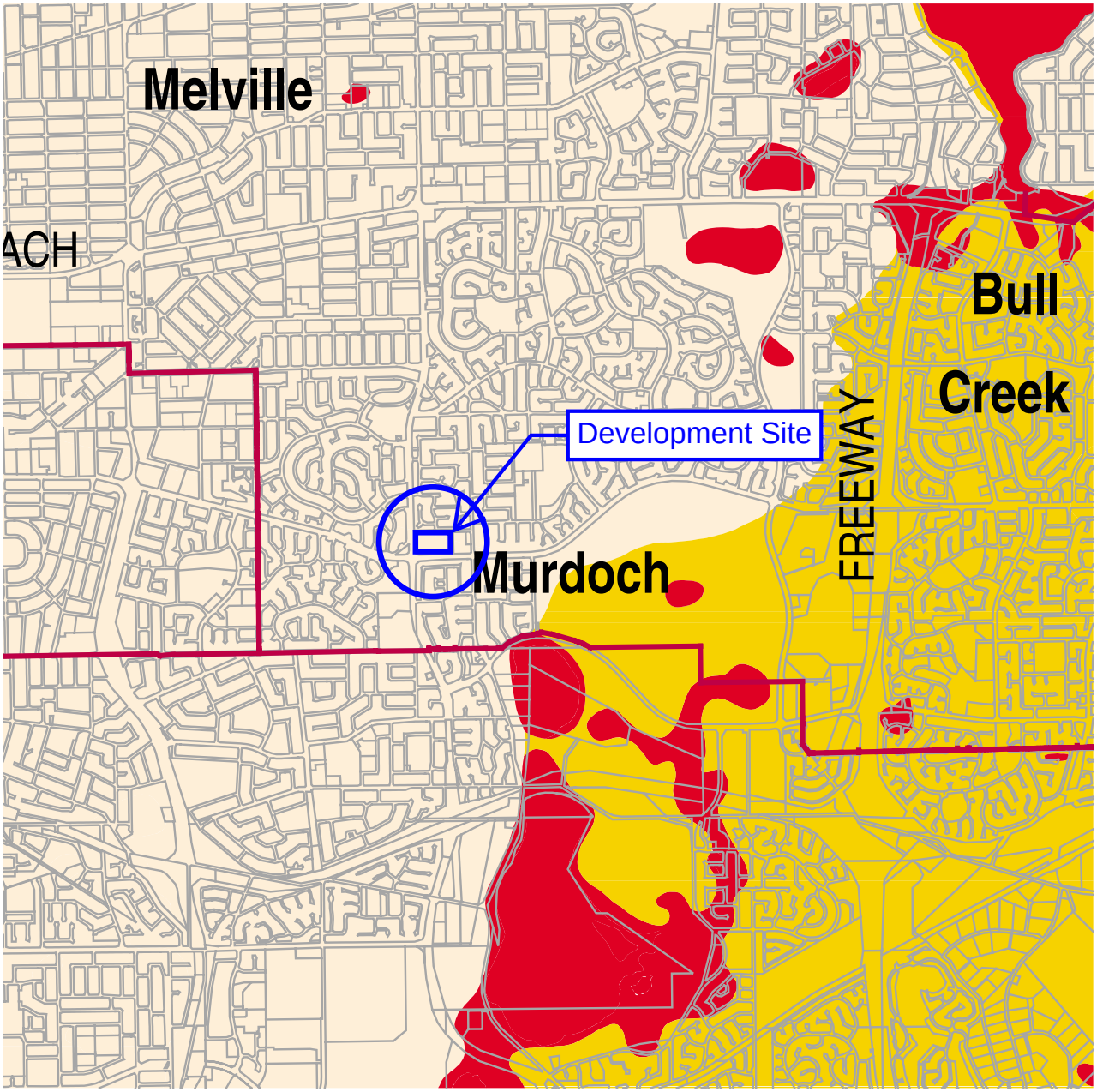
REFERENCES

1. See Lithological Classification
2. The terms unconsolidated material and rocks are used in the sense of the engineering terms "soil" and "rock".
3. Colours were derived from Standard Soil Colour Charts, notation omitted.
4. Maximum and minimum elevation of the unit with respect to Australian Height Datum.
5. Slopes expressed qualitatively in four terms, F–flat, G–gentle, M–moderate, S–steep; which correspond to < 3°, 3°–10°, 10°–20°, > 20°. The dominant slope of each unit is given.
6. H ..... high; M ..... moderate; L ..... low; V ..... variable; N/A ..... not applicable. Properties vary with degree of weathering
7. Low over sinkholes and collapse features
8. Snowy Mountains Engineering Corporation Soil Classification which describes soils in terms of grain size, grading characteristics and compressibility. For rocks the symbols refer to the weathered products.
9. × activity undesirable for the environment; ▼▼ environment unsuitable or hazardous for the activity; ● possible problems for the environment; ○ possible problems for the activity; ◆ activity compatible with unit

The data contained on this sheet are provided for preliminary studies and are not intended as a substitute for detailed on-site investigation

Appendix Three: Acid Sulphate Soils Risk Map

Figure 3: Central Metropolitan Region Scheme Acid Sulfate Soils

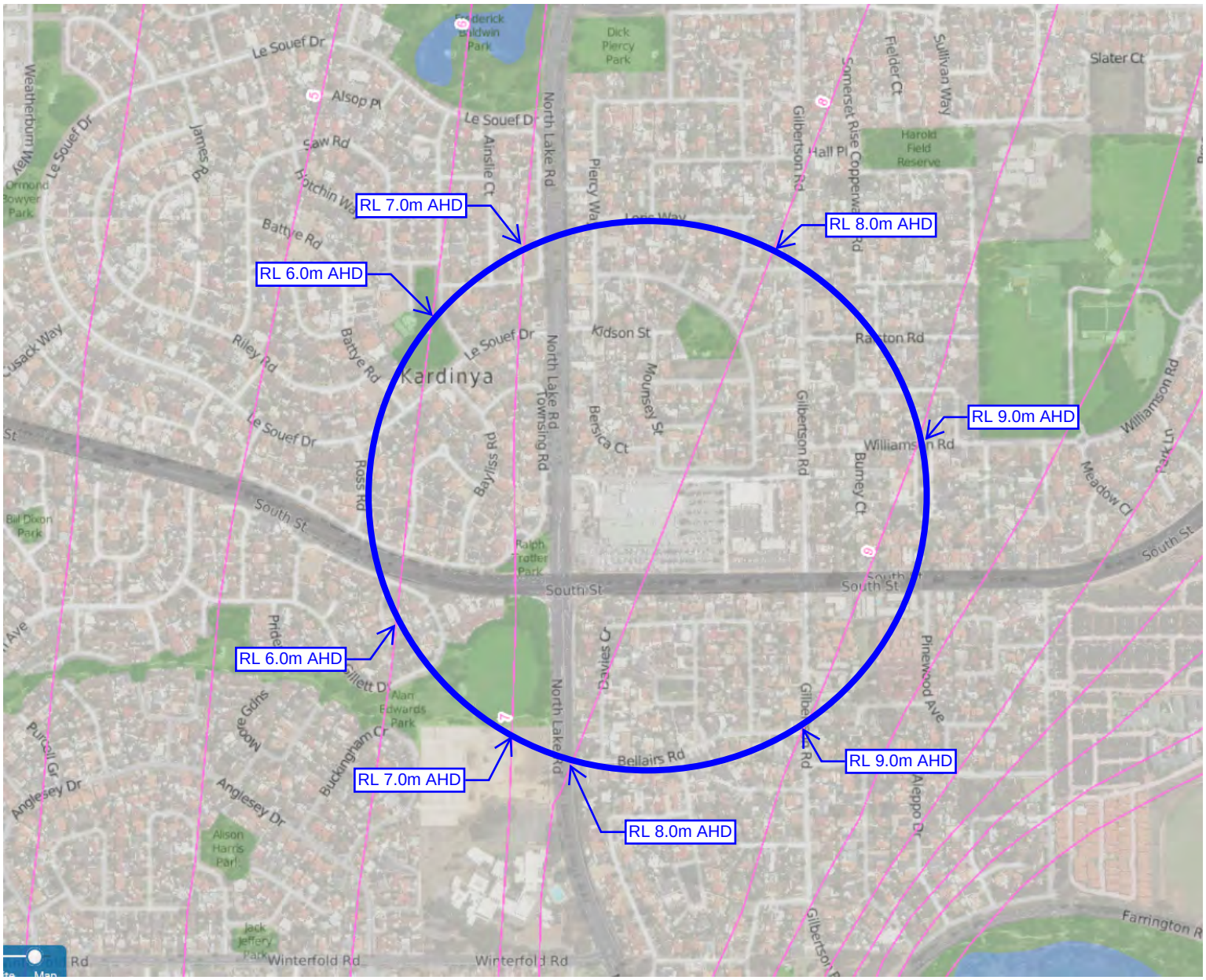


LEGEND

- High risk of actual acid sulfate soil (AASS) & potential acid sulfate soil (PASS) <3m from surface
- Moderate to low risk of AASS and PASS occuring generally at depths of >3m
- Low to no risk of AASS and PASS occuring generally at depths of >3m
- Local Government Boundary

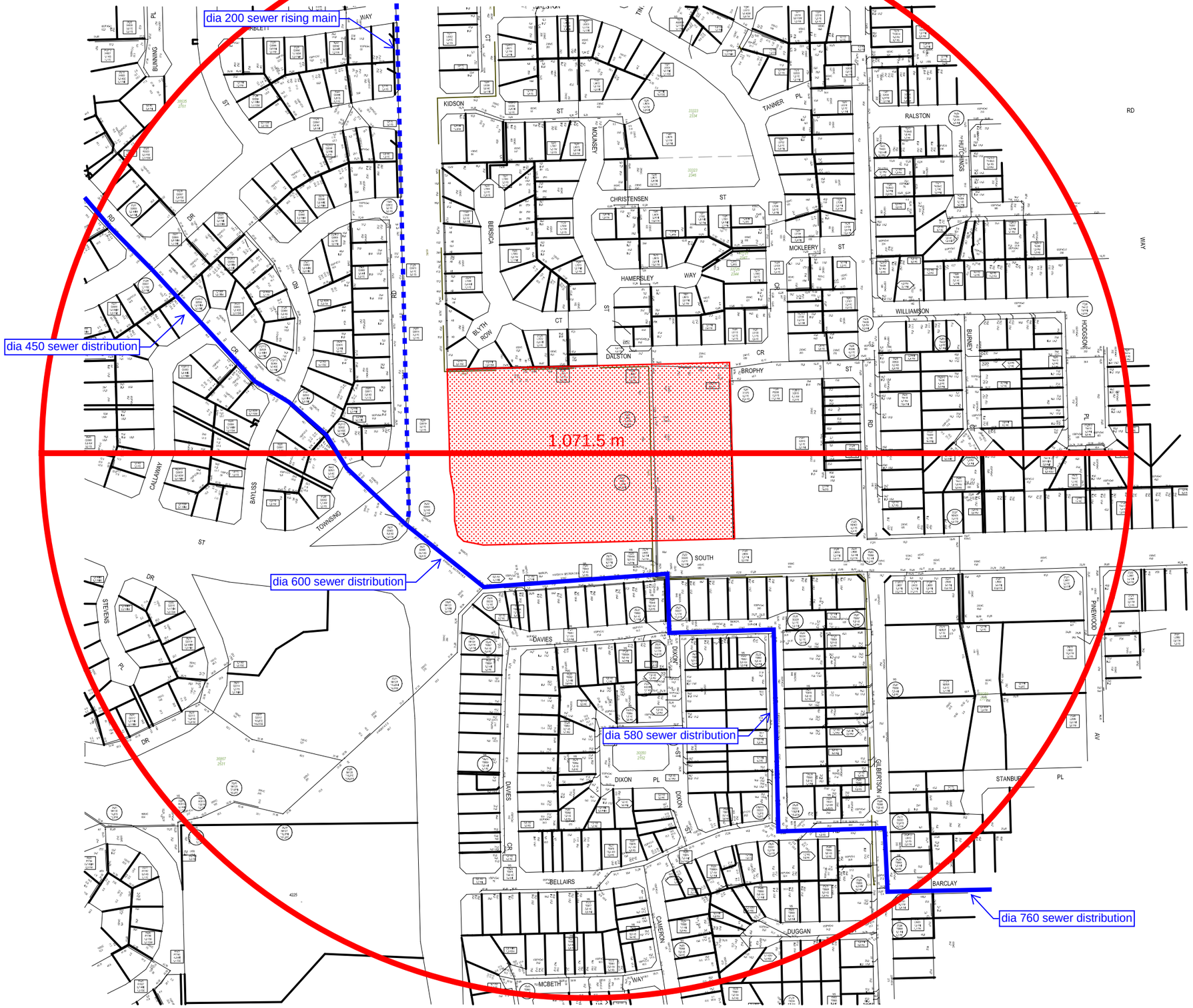
Appendix Four: Groundwater Mapping

DEPARTMENT OF WATER
GROUNDWATER



Appendix Five: Sewer Reticulation Infrastructure

WATER CORPORATION
SEWER RETICULATION



Jamie De Palma

From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Monday, 9 March 2020 8:17 AM
To: Jamie De Palma
Subject: RE: South St Kardinya

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Kardinya

Hi Jamie

Thanks for the update with the expected yield. The update does not change the comments we made previously as informed below.

- The reticulation infrastructure in the catchment the subject area is within can cater for the increase in predicted flows.
- The Le Suoef Dr pump station that serves the catchment and some downstream headworks (major infrastructure) will need to upgraded in the future.

In regards to developers requirements, as per above there should be no upgrading of reticulation infrastructure but developers may be required to fund new, relocation and/or protection of works depending on the development proposal taking place.

The upgrading of the headworks infrastructure will be funded by the Water Corporation.

If you have any queries please ask.

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

From: Jamie De Palma [mailto:jamie.d@pfeng.com.au]
Sent: Wednesday, 19 February 2020 8:54 AM
To: Kevin Purcher
Subject: RE: South St Kardinya

Morning Kevin,

The planning consultant for the Kardinya Structure Plan has received feedback from the WAPC and City of Melville, and the development area has slightly expanded with an expected yield of 1,856 dwellings in lieu of 1,521. An increase of 335 dwellings.

Will the additional dwellings impact your previous assessment regarding water and sewer servicing?

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Wednesday, 18 December 2019 8:38 AM
To: Jamie De Palma <jamie.d@pfeng.com.au>
Subject: RE: South St Kardinya

Hi Jamie

Your email is perfectly timed. I just got a response from Planning last night. Please note the following.

- The reticulation infrastructure in the catchment the subject area is within can cater for the increase in predicted flows.
- The Le Suoef Dr pump station that serves the catchment and some downstream headworks (major infrastructure) will need to upgraded in the future.

In regards to developers requirements, as per above there should be no upgrading of reticulation infrastructure but developers may be required to fund new, relocation and/or protection of works depending on the development proposal taking place.

The upgrading of the headworks infrastructure will be funded by the Water Corporation.

If you have any queries please ask.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

From: Jamie De Palma [mailto:jamie.d@pfeng.com.au]
Sent: Wednesday, 18 December 2019 7:46 AM
To: Kevin Purcher
Subject: RE: South St Kardinya

Hi Kevin,

Hope things are going well.

Just touching base to see how the planning review of the sewer reticulation is progressing? If you have any queries please call me.

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Tuesday, 3 December 2019 11:49 AM
To: Jamie De Palma <jamie.d@pfeng.com.au>
Subject: RE: South St Kardinya

Hi Jamie

Just to keep you updated the review of our scheme should be completed around the end of the December. I'll be on leave around then so if it comes before I go on leave that will be good but if not I will be getting back to you early January.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

From: Kevin Purcher
Sent: Monday, 2 December 2019 2:44 PM
To: Jamie De Palma
Subject: RE: South St Kardinya

Thanks Jamie

Just what I needed. I'll arrange for a review of the Wastewater Planning.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

From: Jamie De Palma [mailto:jamie.d@pfeng.com.au]
Sent: Monday, 2 December 2019 2:25 PM
To: Kevin Purcher
Subject: RE: South St Kardinya

Hi Kevin,

Comments in blue below.

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Monday, 2 December 2019 2:12 PM
To: Jamie De Palma <jamie.d@pfeng.com.au>
Subject: South St Kardinya

Hi Jamie

In regards to your query you sent us recently could you help with a bit more information.

Are the 1521 dwellings additional to the existing dwellings in the area or the total dwellings after development has occurred? The 1521 dwellings are the total amount of dwellings after development has occurred. There are about 300 dwellings within the structure plan already, so we are looking at 1221 additional dwellings.

Do you have an idea of the timing of the development (over how many years)? The increase in density is coming off the back of the $100M Kardinya Park Shopping Centre redevelopment. With the shopping centre to be completed in about 3 years, it would be fair to say that most of the dwelling increase will be 5-10 years away.

I will have to put this up to our Networks team to do a full review for the area because a quick desktop review looks like the Le Souef Dr WWPS would be under pressure and some connecting sewers may also be.

Could you also let me know what the drivers are for the query as the review of the planning has not been scheduled and it may take some time. Kardinya Park Shopping Centre was recently commissioned and a Development Application to the City of Melville will be submitted this month (December 2019). As a result of the shopping centre redevelopment, the client and City are keen to redevelop the surrounding precinct and create a hub.

BTW some good news, water does not seem to be a problem. Excellent. Thanks for confirming.

If you have a query please ask.

Regards

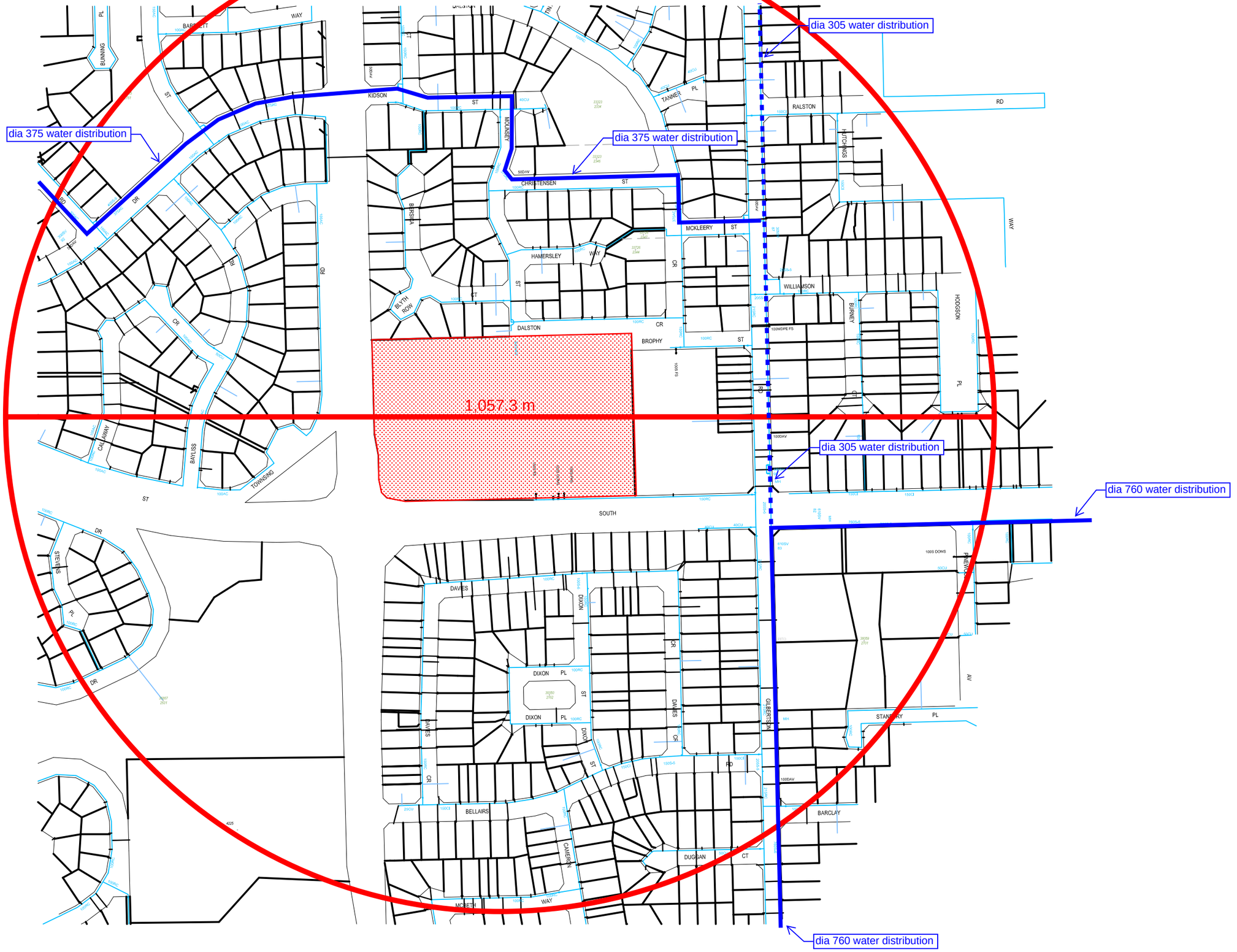
Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

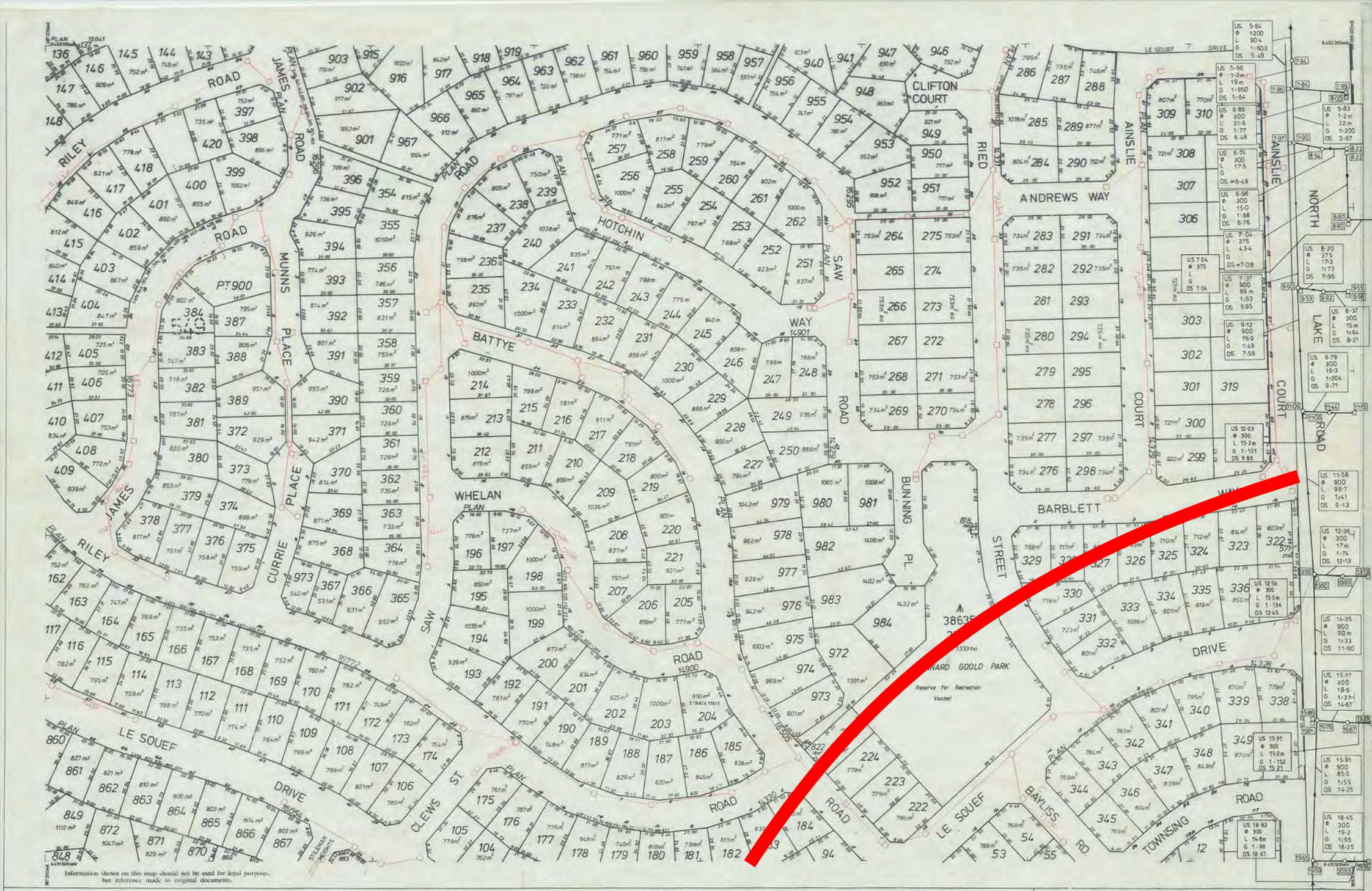
watercorporation.com.au

Appendix Six: Water Reticulation Infrastructure

WATER CORPORATION
WATER RETICULATION



Appendix Seven Stormwater Infrastructure



Information shown on this map should not be used for legal purposes, but reference made to original documents.

PRODUCED AS PART OF THE STATE LARGE SCALE SERIES OF CADASTRAL AND TOPOGRAPHICAL MAPS AT SCALES OF 1:500, 1:1000, 1:2000, 1:5000 AND BASED UPON THE AUSTRALIAN MAP GRID TO A STANDARD RECTANGULAR SHEET SYSTEM OF 800mm X 800mm

UNIVERSAL TRANSVERSE MERCATOR PROJECTION ZONE NO.50
HORIZONTAL DATUM - AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM - A.H.D.

COMPILED - BY THE DEPT OF LANDS & SURVEYS

BY THE AUTHORITY OF THE SURVEYOR GENERAL

GENERAL NOTES

Surveyed Boundary
Disarranged Boundary
Superseded Boundary
Subdivided Green Lot or Location Boundary
Townsite Boundary (Under Land Act)
Townsite Boundary (Under Local Govt. Act)
Agricultural Area or Lease Boundary
Land District Boundary
State Forest Boundary
Catchment Area Boundary

Locations, Town or Suburban Lots 3517
Subdivided Locations, Town or Suburban Lots 6892
Agricultural Area, Estate & L.T.O. Lots 207
Geodetic Station
Traverse Station
Bench Mark BM 72

All distances shown are in
All heights shown are on

ADJOINING SHEETS

19	25	20	25	21	25
19	24	20	24	21	24
19	23	20	23	21	23

SCALE 1:1000

or 1 inch = 1.25 chains = 83.33 feet = 25.4 metres
or 1 centimetre = 0.197 chains = 32.81 feet = 10 metres

USEFUL METRIC CONVERSIONS

1 Metre = approx. 39.3701 inches	1 Yard = 0.9144 Metres
1 Centimetre = approx. 0.3937 Inches	1 Inch = 2.54 Centimetres
1 Kilometre = approx. 3/5 Miles	1 Chain = approx. 20 Metres
1 Hectare = approx. 2½ Acres	1 Acre = approx. 0.4047 Hectares

DEPARTMENT OF LAND ADMINISTRATION
WESTERN AUSTRALIA

LAND DISTRICT	COCKBURN SOUND
LOCAL AUTHORITY	CITY OF MELVILLE
LOCALITY	WILLAGEE

STATE LARGE SCALE SERIES
SHEET No.
PERTH 1000
20 24

Information shown on this map should not be used for legal purposes, but reference made to original documents.

Updated 7-8-93

PRODUCED AS PART OF THE STATE LARGE SCALE SERIES OF CADASTRAL AND TOPOGRAPHICAL MAPS AT SCALES OF 1:1000, 1:2000, 1:2500, 1:5000 AND BASED UPON THE AUSTRALIAN MAP GRID TO A STANDARD RECTANGULAR SHEET SYSTEM OF 800MM X 500MM

UNIVERSAL TRANSVERSE MERCATOR PROJECTION ZONE NO. 50
HORIZONTAL DATUM – AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM – A.H.D.

COMPILED – BY THE DEPT. OF LANDS AND SURVEYS

BY THE AUTHORITY OF THE SURVEYOR GENERAL
CROWN COPYRIGHT RESERVED MARCH 1972

GENERAL NOTES

VALUER GENERAL'S OFFICE	VALUER
UNIMPROVED VALUES	
EFFECTIVE FROM / /	VALUER GENERAL

Surveyed Boundary
Unsurveyed Boundary
Superseded Boundary
Subdivided Crown Lot or Location Boundary
Townsite Boundary (Under Land Act)
Townsite Boundary (Under Local Govt. Act)
Agricultural Area or Estate Boundary
Land District Boundary
State Forest Boundary
Catchment Area Boundary
Local Authority Boundary

Locations, Town or Suburban Lots
Subdivided Locations, Town or Suburban Lots
Agricultural Area, Estate & L.T.O. Lots
Geodetic Station
Traverse Station
Bench Mark
All distances shown are in
All heights shown are in

ADJOINING SHEETS

19.24	20.24	21.24
19.23	20.23	21.23
19.22	20.22	21.22

SCALE 1:1000

or 1 inch = 1.25 chains = 83.33 feet = 25.4 metres
or 1 centimetre = 0.497 chains = 32.81 feet 10 metres

USEFUL METRIC CONVERSIONS

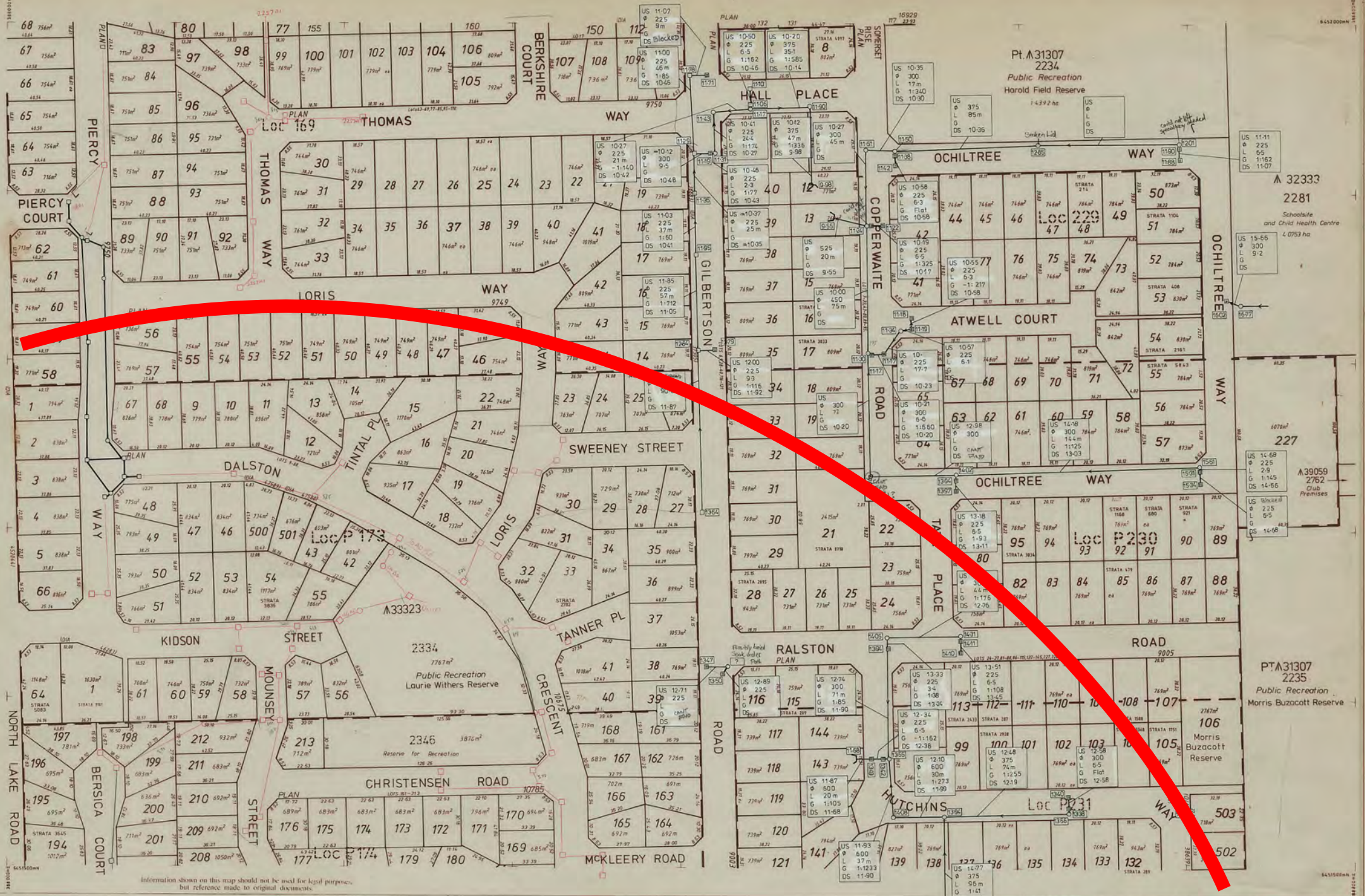
1 Metre = approx. 39.3701 inches
1 Centimetre = approx. 0.3937 inches
1 Hectare = approx. 2.4 Acres
1 Kilometre = approx. 0.62 Miles
1 Inch = 0.0254 Metres
1 Foot = approx. 30 Centimetres
1 Chain = approx. 20 Metres
1 Link = approx. 20 Centimetres

VALUER GENERAL'S OFFICE, PERTH.
WESTERN AUSTRALIA

LAND DISTRICT	COCKBURN SOUND
LOCAL AUTHORITY	CITY OF MELVILLE
LOCALITY	HILTON & WILLAGEE

STATE LARGE SCALE SERIES
SHEET No.
PERTH 1000
20.23

PREV. K 13-10-14



Information shown on this map should not be used for legal purposes, but reference made to original documents.

SCALE 1:1000

20-25	21-25	22-25
20-24	21-24	22-24
20-23	21-23	22-23

VALUER GENERAL'S OFFICE	VALUER
UNIMPROVED VALUES	
EFFECTIVE FROM / /	VALUER GENERAL

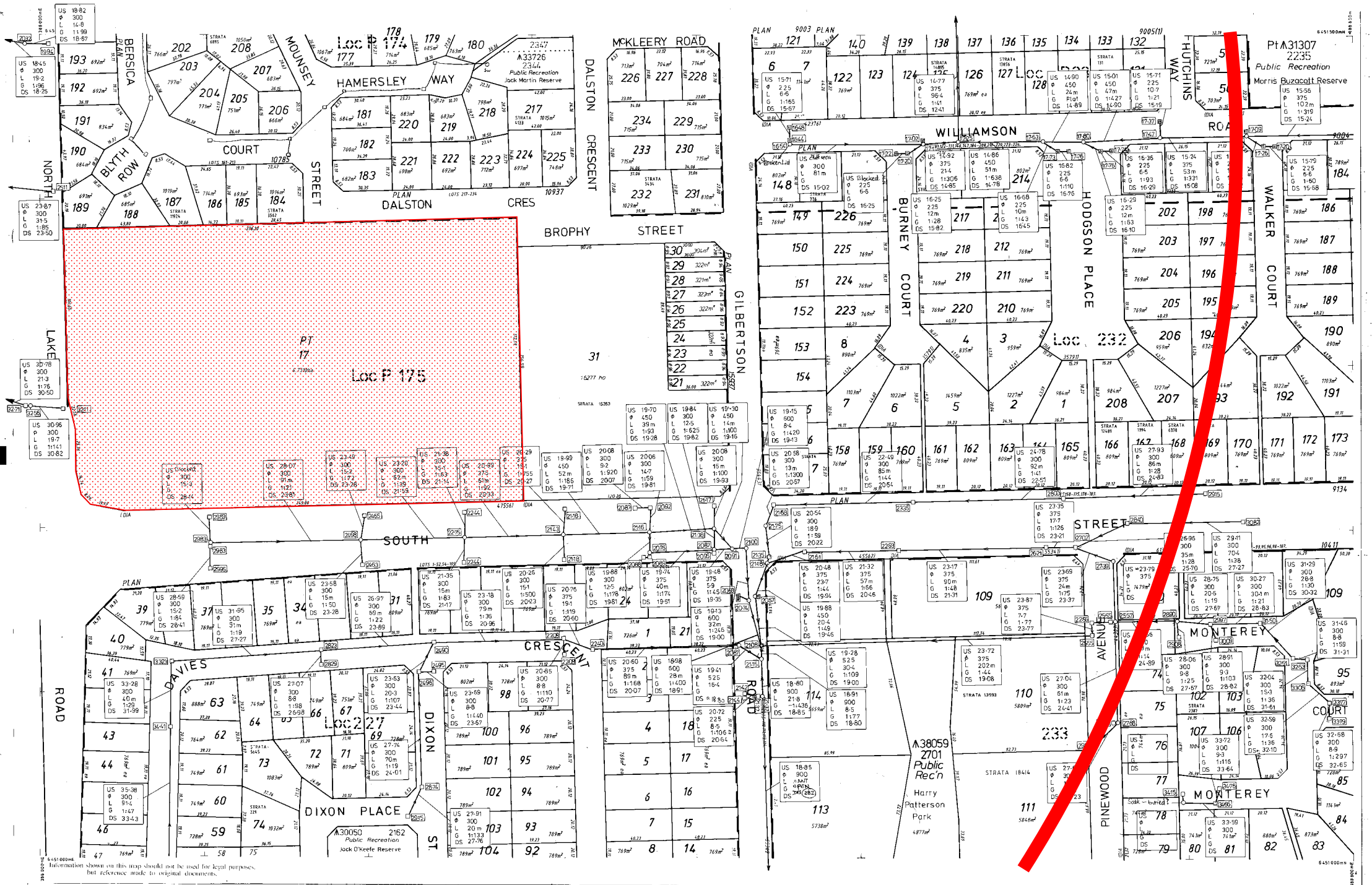
UNIVERSAL TRANSVERSE MERCATOR PROJECTION ZONE NO 50
HORIZONTAL DATUM : AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM : A H D
COMPILED BY THE DEPARTMENT OF LANDS & SURVEYS

VALUER GENERAL'S OFFICE. PERTH.

WESTERN AUSTRALIA

LAND DISTRICT	COCKBURN SOUND
LOCAL AUTHORITY	CITY OF MELVILLE
LOCALITY	KARDINYA

STATE LARGE SCALE SERIES
SHEET No.
PERTH 1000
21-24



Information shown on this map should not be used for legal purposes, but reference made to original documents.

SCALE 1:1000

20-24	21-24	22-24
20-23	21-23	22-23
20-22	21-22	22-22

Prev K13-10,11,14 & K13-15

UNIVERSAL TRANSVERSE MECATOR PROJECTION ZONE 50
HORIZONTAL DATUM, AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM, A.H.D.
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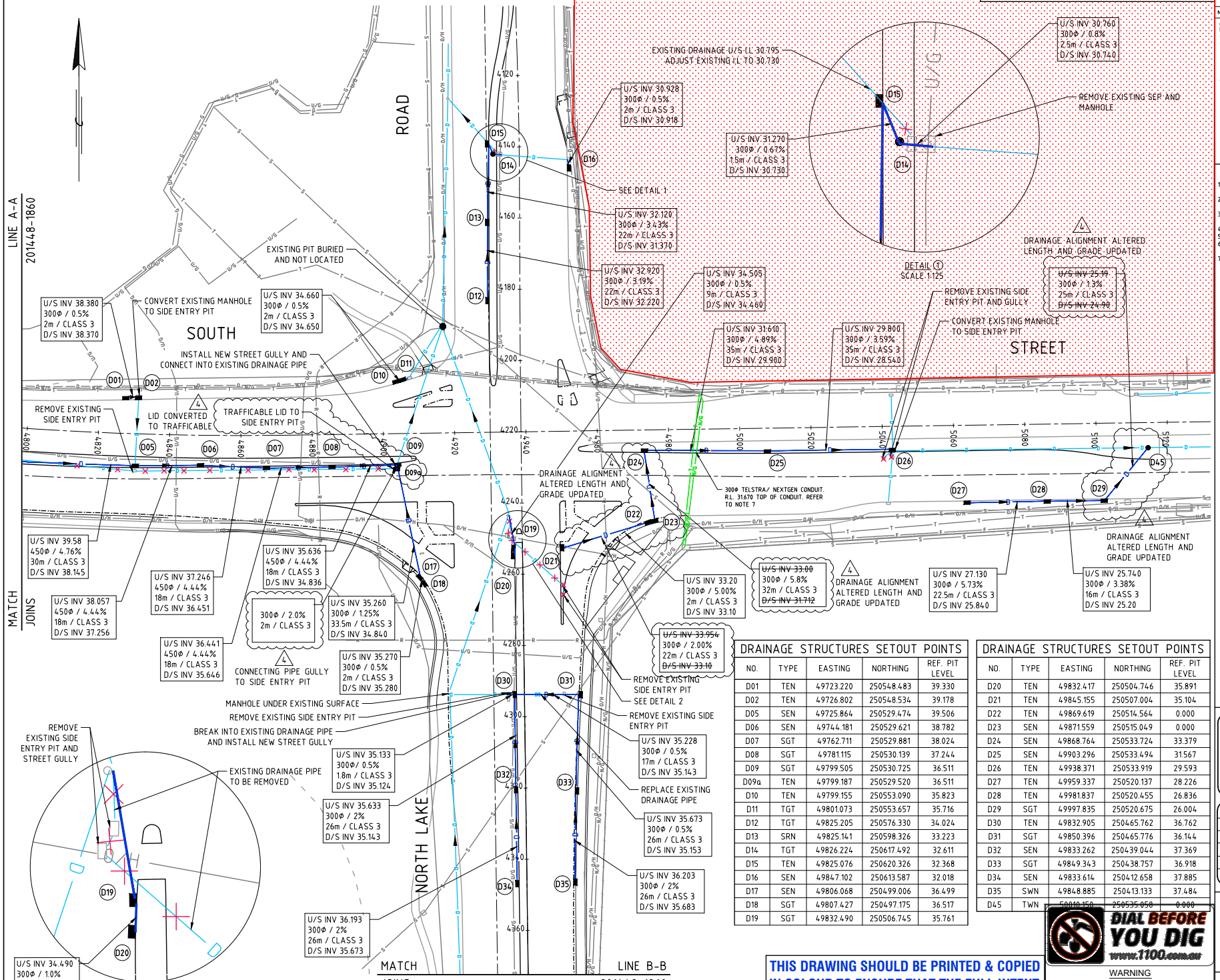
VALUER GENERAL'S OFFICE
GROUND AND VALUES
GENERAL VALUATION
AT 1 JULY 1970
VALUER
VALUER GENERAL

VALUER GENERAL'S OFFICE. PERTH.
WESTERN AUSTRALIA

LAND DISTRICT	COCKBURN SOUND
LOCAL AUTHORITY	CITY OF MELVILLE
LOCALITY	KARDINYA. ELLIS

STATE LARGE SCALE SERIES
SHEET No.
PERTH 1000
21-23



DRAINAGE STRUCTURES SETOUT POINTS

NO.	TYPE	EASTING	NORTHING	REF. PIT LEVEL
D01	TEN	49723.220	250548.483	39.330
D02	TEN	49726.802	250548.534	39.178
D05	SEN	49725.864	250529.474	39.506
D06	SEN	49744.181	250529.621	38.782
D07	SGT	49762.711	250529.881	38.024
D08	SGT	49781.115	250530.139	37.244
D09	SGT	49799.505	250530.725	36.511
D09a	TEN	49799.187	250529.520	36.511
D10	TEN	49799.155	250553.090	35.823
D11	TGT	49801.073	250553.657	35.716
D12	TGT	49825.205	250576.330	34.024
D13	SRN	49825.141	250598.326	33.223
D14	TGT	49826.224	250617.492	32.611
D15	TEN	49825.076	250620.326	32.368
D16	SEN	49847.102	250613.587	32.018
D17	SEN	49806.068	250499.006	36.499
D18	SGT	49807.427	250497.175	36.517
D19	SGT	49832.490	250506.745	35.761

DRAINAGE STRUCTURES SETOUT POINTS

NO.	TYPE	EASTING	NORTHING	REF. PIT LEVEL
D20	TEN	49832.417	250504.746	35.891
D21	TEN	49845.155	250507.004	35.104
D22	TEN	49869.619	250514.564	0.000
D23	SEN	49871.559	250515.049	0.000
D24	SEN	49868.764	250533.724	33.379
D25	SEN	49903.296	250533.494	31.567
D26	TEN	49938.371	250533.919	29.593
D27	TEN	49959.337	250520.137	28.226
D28	TEN	49981.837	250520.455	26.836
D29	SGT	49997.835	250520.675	26.004
D30	TEN	49832.905	250465.762	36.762
D31	SGT	49850.396	250465.776	36.144
D32	SEN	49833.262	250439.044	37.369
D33	SGT	49849.343	250438.757	36.918
D34	SEN	49833.614	250412.658	37.885
D35	SWN	49848.885	250413.133	37.484
D45	TWN	50019.150	250535.058	0.000

THIS DRAWING SHOULD BE PRINTED & COPIED IN COLOUR TO ENSURE THAT THE FULL INTENT OF THE DRAWING IS CONVEYED.

AMENDMENTS

No.	DATE	DESCRIPTION	APPROVED
A	19.09.2014	ISSUED FOR 85% DESIGN REVIEW	DN
B	03.10.2014	RE-ISSUED FOR 85% DESIGN REVIEW	DN
C	10.11.2014	ISSUED FOR 100% DESIGN REVIEW	DN
0	04.03.2015	ISSUED FOR CONSTRUCTION	DN
1	16.09.2015	PIPE SLOPES & INVERT LEVELS AMENDED TO REDUCE PIT DEPTH	SA
2	20.11.2015	D22 - D24 NETWORK UPDATED	SA
3	10.12.2015	D29 & D45 DRAINAGE DESIGN AMENDED	SA
4	11.07.2016	AS CONSTRUCTED	DN

NOTES

1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE MRWA SPECIFICATIONS.
2. EASTING/NORTHING SPECIFIED FOR SIDE ENTRY PITS DENOTE THE FACE OF KERB.
3. REMOVE ANY REDUNDANT DRAINAGE STRUCTURES AND CONNECTING PIPES AND BACKFILL WITH SUITABLE MATERIAL.
4. ALL NEW PIPES TO BE CLASS 3.
5. ALL PIPE JOINTS SHALL BE RUBBER RING JOINTED.
6. DRAINAGE STRUCTURES "D07" TO "D09" ARE TO BE STREET GULLIES DUE TO STREET LIGHTING IN CENTRAL MEDIAN.
7. CONTRACTOR TO ENSURE SAFE INSTALLATION OF DRAINAGE PIPE BETWEEN D24 AND D25 TO AVOID CLASHING WITH TELSTRA/ NEXTGEN CONDUIT.

LEGEND

- EXISTING SIDE ENTRY PIT
- EXISTING MANHOLE
- EXISTING DRAINAGE PIPE NETWORK
- REMOVE EXISTING DRAINAGE PIPE
- PROPOSED SIDE ENTRY PIT
- PROPOSED STREET GULLY
- D02 PROPOSED MANHOLE
- PROPOSED DRAINAGE PIPE

UPSTREAM INVERT
DIAMETER / SLOPE
LENGTH / CLASS
DOWNSTREAM INVERT

SERVICES

- EXISTING GAS MAIN ATCO
- EXISTING NEXTGEN
- EXISTING OPTUS
- EXISTING OVERHEAD POWER
- EXISTING UNDERGROUND POWER
- EXISTING SEWER GRAVITY MAIN
- EXISTING TELSTRA DISTRIBUTION
- EXISTING OPTIC FIBRE
- EXISTING RETICULATION
- EXISTING WATER MAIN
- 300Φ TELSTRA/NEXTGEN CONDUIT TO BE AVOIDED

AS CONSTRUCTED DRAWING

Government of Western Australia
mainroads WESTERN AUSTRALIA
METROPOLITAN REGION
WATERLOO CRESCENT East Perth 6004
Telephone (08) 9323 4111 Fax (08) 9323 4430

		DATE
SURVEYED	SURVEY RESULTS	11.08.2014
DESIGNER	T. SILVA / D. NGUYEN	27.10.2014
DRAWN	K. WILLIAMS	27.10.2014
CHECKED	D. NGUYEN	10.11.2014
AUTHORISED	T. NGUYEN	04.03.2015
RECOMMENDED	S. ALKINS	04.03.2015

SCALE 1:500
MICROFILM DATE
A1

SOUTH STREET (H032)
NORTH LAKE ROAD (3)

DRAINAGE MODIFICATIONS
SHEET 1 OF 2

LOCAL AUTHORITY (119) CITY OF MELVILLE
COMMISSIONED
DRAWING NUMBER 201448-1859 -4 REV.

DIAL BEFORE YOU DIG www.1100.com.au

WARNING
BEWARE OF UNDERGROUND SERVICES
The location of underground cables are approximate only and their exact position should be checked on site. No guarantee is given that all existing cables and services are shown. Locate all underground cables and services before commencement of work. Refer to Worksafe Regulation 3.21.

Appendix Eight: Stormwater Detention

Stormwater Drainage

Please find below general guidelines and conditions for on-site stormwater drainage.

Submitting Plans - Drainage Details Required

All building related plans submitted to the City of Melville, must include a site plan indicating the following drainage details:

- Existing ground levels or contours.
- Proposed levels of paved or concrete areas.
- Details of proposed roof and pavement drainage disposal systems.
- Size (depth & diameter) and locations of all soak-wells.

Factors such as soil conditions, water table depth and capacity for storm events need to be taken into account by the appointed professional engineer.

Conditions Applicable for all General Residential Developments

- All stormwater shall be retained and discharged on site.
- All soak-wells installed in paved or concrete areas shall be provided with trafficable lids and made accessible for maintenance purposes.
- Soak-wells to be no closer than 1.0m to a footing or boundary.
- All soak-wells used shall be from an accredited supplier.
- All soak-wells installed within flexible pavement areas (bitumen or brick paving) shall be provided with an appropriate base to prevent any subsidence of the well liners.
- It is the owner's responsibility to regularly clean and maintain on-site drainage systems to ensure its on-going functionality.
-

Residential sites located below road level shall have drainage systems designed to cater for a 1:100 ARI 24hr storm event.

- Residential sites located above road level shall have drainage systems designed to cater for a 1:20 ARI 1hr storm event.

Design Conditions Applicable to Industrial and Mixed Use developments

- All drainage systems designed for the proposed developments shall be certified by a Registered Professional Engineer.
- The design of the systems, shall conform to the requirements of the Building Code of Australia (BCA) and the Australian Standard (AS 3500).
- It shall be the Engineer's responsibility to demonstrate that a 1:100 ARI 24hr storm event is fully contained within the property boundary.

For further information, please contact the City of Melville Senior Design Engineer on 9364 0681.

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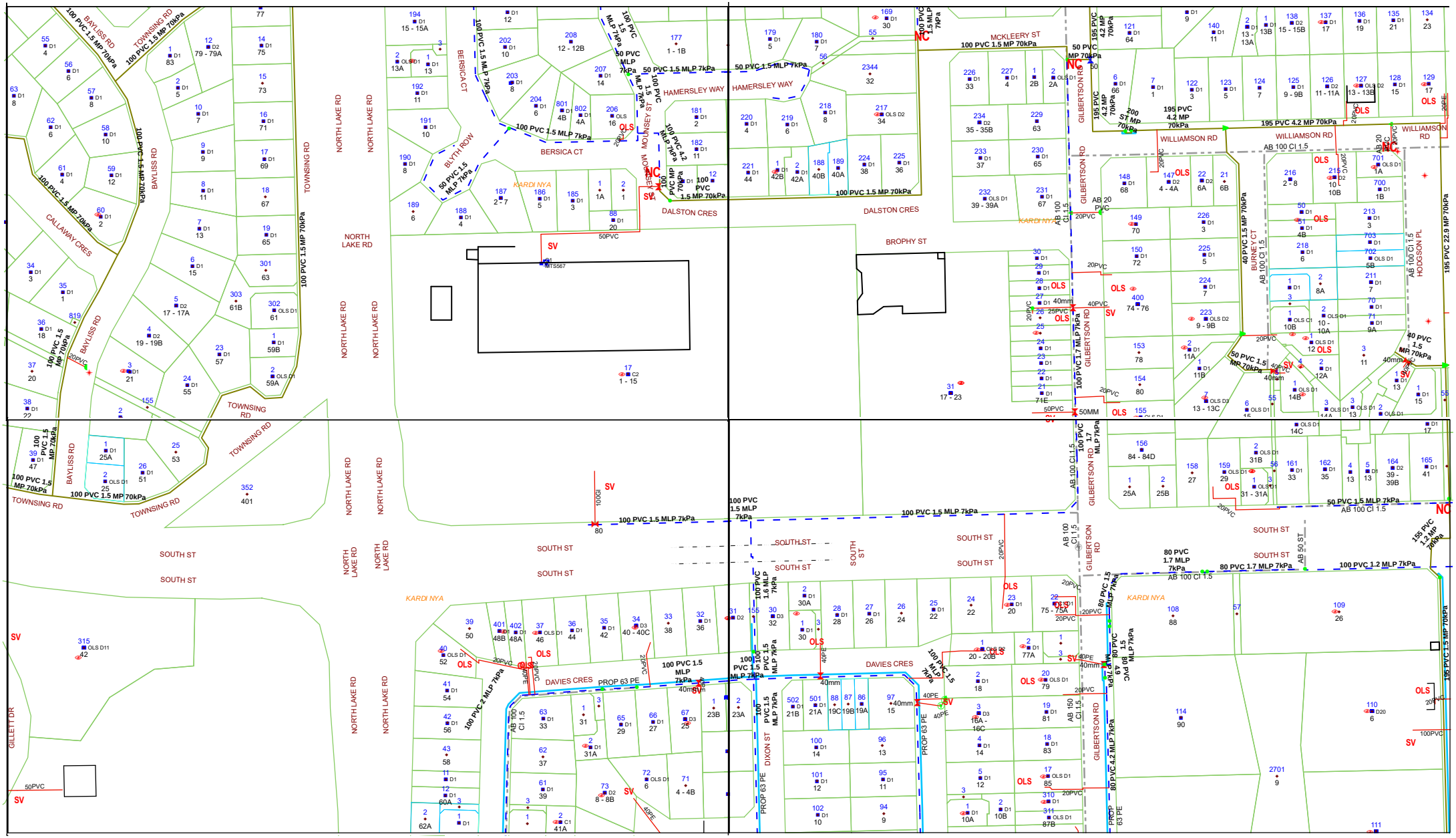
Appendix Nine: Gas Infrastructure


TOWNSING RD
BAYLISS RD
NORTH LAKE RD
BERSICA CT
HAMERSLEY WAY
BLYTH ROW
MOONSEY ST
KARDI NYA
DALSTON CRES
BROPHY ST
MCKLEERY ST
GILBERTSON RD
WILLIAMSON RD
CALLAWAY CRES
SOUTH ST
DAVIES CRES
DIXON ST
GILLETT DR
PROP 63 PE
AB 100 CI 1.5
AB 50 ST
100 PVC 1.5 MP 70kPa
50 PVC 1.5 MLP 7kPa
100 PVC 1.5 MLP 7kPa
195 PVC 4.2 MP 70kPa
80 PVC 1.7 MLP 7kPa
100 PVC 1.2 MLP 7kPa
OLS
SV
NC

Jamie De Palma

From: Asset Services <Asset.Services@atco.com>
Sent: Thursday, 12 March 2020 10:27 AM
To: Jamie De Palma; ATCO Gas AU – Land Development
Subject: RE: Kardinya - Corner South Street and North Lake Road - update to original feedback required thanks

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Kardinya

Hi Jamie,

Apologies for the late reply.

The gas distribution network in this area of interest in the suburb of Kardinya is currently going through a program to rationalise the gas pressure. Once completed (total completion by 2021) the gas network in this area will be able to supply a total of approximately 1900 dwellings.

Please do let me know if you have further questions.

Regards,

Mabel See
Asset Planning Engineer
Gas, Australia

E. mabel.see@atco.com
T. +61 8 6163 5042
A. 81 Prinsep Road, Jandakot WA 6164
W. atcogas.com.au

From: Jamie De Palma <jamie.d@pfeng.com.au>
Sent: Monday, 9 March 2020 11:01 AM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Cc: Asset Services <Asset.Services@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road - update to original feedback required thanks

Morning Asset Services,

Are you able to advise if the increase in dwelling count will impact the previous advice provided in December 2019?

Jamie De Palma
Associate - Civil

From: ATCO Gas AU – Land Development <Land.Development@atco.com>
Sent: Wednesday, 19 February 2020 10:17 AM
To: Jamie De Palma <jamie.d@pfeng.com.au>; ATCO Gas AU – Land Development <Land.Development@atco.com>
Cc: Asset Services <Asset.Services@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road - update to original feedback required thanks

Hi Asset services please can you assist client with his query thanks in advance

Regards

Lewis Searle
GIS Analyst
Gas, Australia

E. lewis.searle@atco.com
T. +61 8 6163 5160

From: Jamie De Palma <jamie.d@pfeng.com.au>
Sent: Wednesday, 19 February 2020 10:15 AM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Cc: Asset Services <Asset.Services@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road

Morning Lewis,

The planning consultant for the Kardinya Structure Plan has received feedback from the WAPC and City of Melville, and the development area has slightly expanded with an expected yield of 1,856 dwellings in lieu of 1,521. An increase of 335 dwellings.

Will the additional dwellings impact your previous assessment for gas servicing?

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: ATCO Gas AU – Land Development <Land.Development@atco.com>
Sent: Thursday, 2 January 2020 9:45 AM
To: Jamie De Palma <jamie.d@pfeng.com.au>
Cc: ATCO Gas AU – Land Development <Land.Development@atco.com>; Asset Services <Asset.Services@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road

Hi Jamie please find below ATCOs comments regarding your query

Thanks

Regards

Lewis Searle
GIS Analyst
Gas, Australia

E. lewis.searle@atco.com
T. +61 8 6163 5160

From: Asset Services <Asset.Services@atco.com>
Sent: Tuesday, 24 December 2019 11:41 AM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road

Hi Lewis,

Sorry for the late reply.

Currently, part of the distribution network in Kardinya is reticulated in MLP (MAOP 7kPa) pressure and this will be rationalised to MP (MAOP 70kPa) in 2020.
For 1521 domestic dwellings in the rezoned area around Kardinya Shopping Centre, the future MP network will be able to support this growth in medium pressure.

Please do let me know if you have any questions.

Regards,

Mabel See
Asset Planning Engineer
Gas, Australia

E. mabel.see@atco.com
T. +61 8 6163 5042
A. 81 Prinsep Road, Jandakot WA 6164
W. atcogas.com.au

From: ATCO Gas AU – Land Development <Land.Development@atco.com>
Sent: Thursday, 19 December 2019 12:32 PM
To: See, Mabel <Mabel.See@atco.com>; Asset Services <Asset.Services@atco.com>
Cc: ATCO Gas AU – Land Development <Land.Development@atco.com>
Subject: FW: Kardinya - Corner South Street and North Lake Road
Importance: High

Hi Mabel did you get a chance to have a look at this? client is chasing up…please can you let him know either way

Thanks very much

Regards

Lewis Searle
GIS Analyst
Gas, Australia

E. lewis.searle@atco.com
T. +61 8 6163 5160

From: Jamie De Palma <jamie.d@pfeng.com.au>
Sent: Wednesday, 18 December 2019 9:48 AM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road

Morning Lewis,

Hope things are going well at your end. Are you able to advise if the Kardinya structure plan amendment has been reviewed?

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: Jamie De Palma
Sent: Wednesday, 27 November 2019 7:18 AM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Subject: RE: Kardinya - Corner South Street and North Lake Road

Good morning Lewis,

Please find attached the proposed structure plan amendment depicting R-codes to achieve the desired 1,521 dwellings.

Jamie De Palma
Associate - Civil
Pritchard Francis | T (08) 9382 5111

From: Jamie De Palma
Sent: Tuesday, 26 November 2019 3:12 PM
To: ATCO Gas AU – Land Development <Land.Development@atco.com>
Subject: Kardinya - Corner South Street and North Lake Road

Good afternoon Lewis,

Pritchard Francis have been engaged to prepare an engineering services report for a potential structure plan rezoning of radius 400m around the existing Kardinya Park Shopping Centre.

A proposed structure plan with intended R-codes and number of dwellings is yet to be confirmed, although the client has suggested increasing the dwelling count by up to 1,500 within this 400m radius.

Can ATCO Gas please advise if any major upgrades to existing gas networks would be necessary to facilitate 1,500 additional dwellings?

I have also undertaken a dial before you dig search which has provided some data, but if ATCO Gas have a screen shot or similar which depicts this area in one image that would be super.

This is not a formal application for gas design, but rather a general request for network capacity.

If you have any queries, please call me.

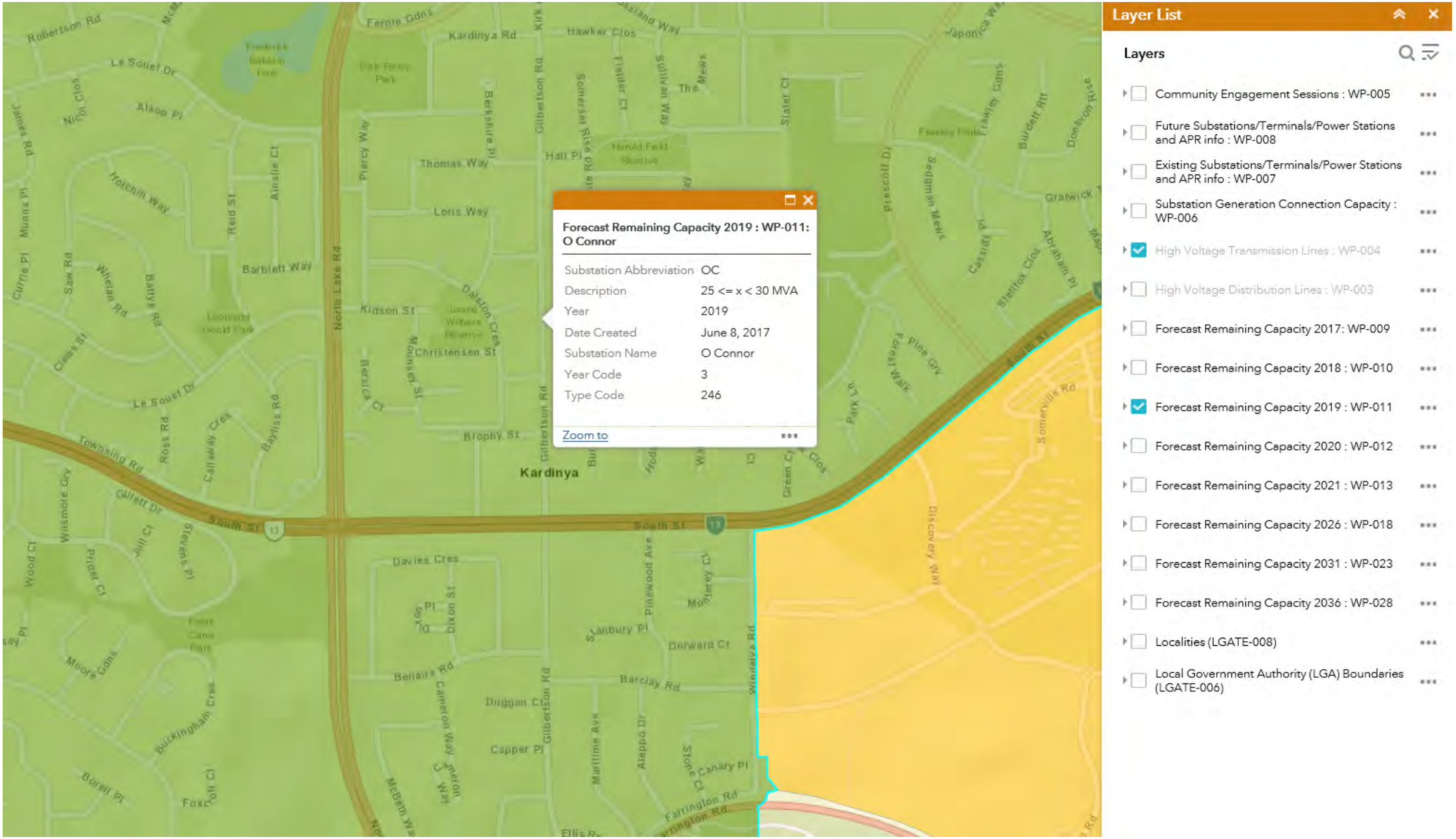
Jamie De Palma
Associate - Civil
BE (Hons) MIEAust CPEng NER

pritchard francis

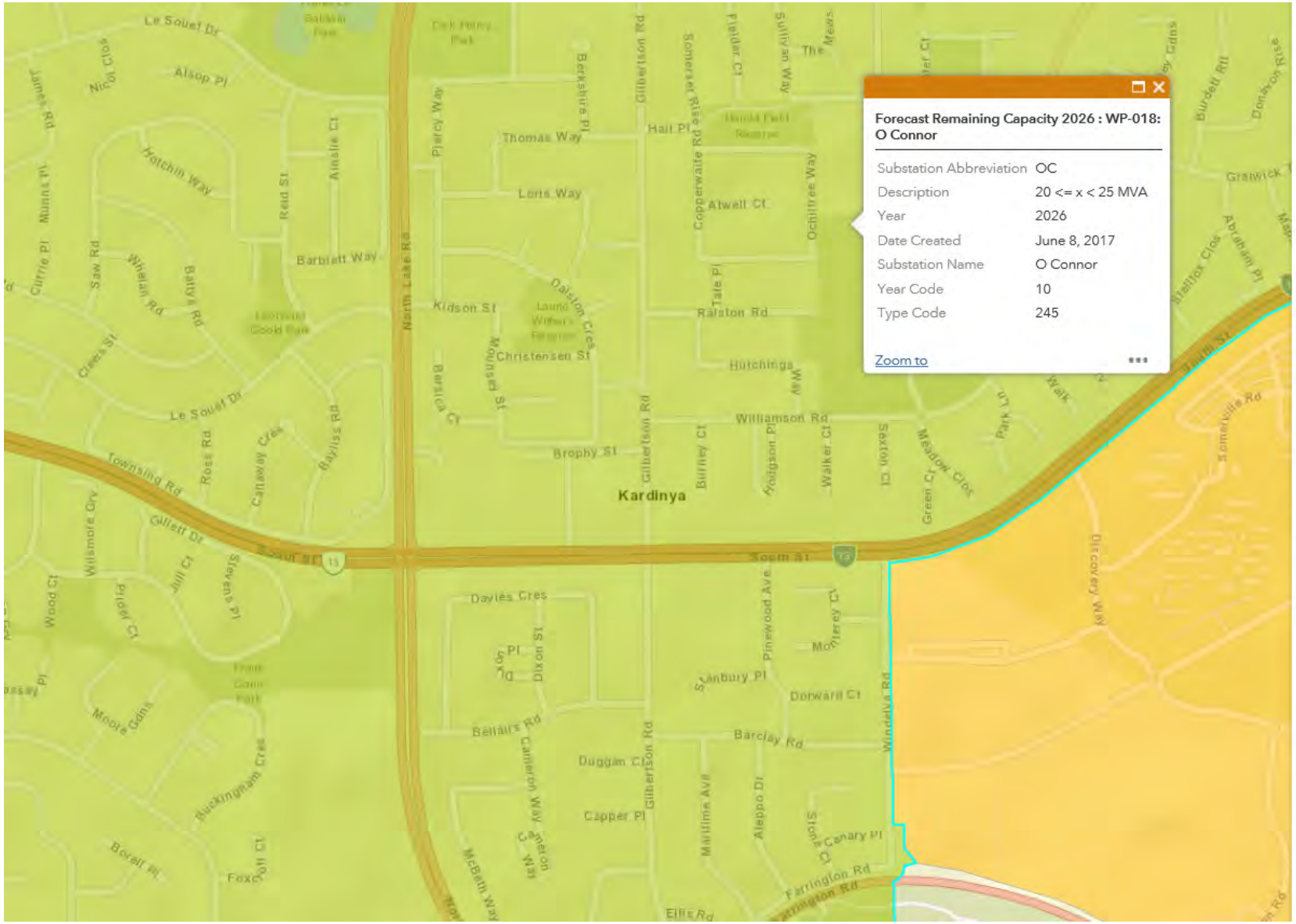
T (08) 9382 5111
E jamie.d@pfeng.com.au | **W** www.pfeng.com.au
430 Roberts Road, Subiaco WA 6008 | PO Box 2150 Subiaco WA 6904

Appendix Ten: Electrical Infrastructure

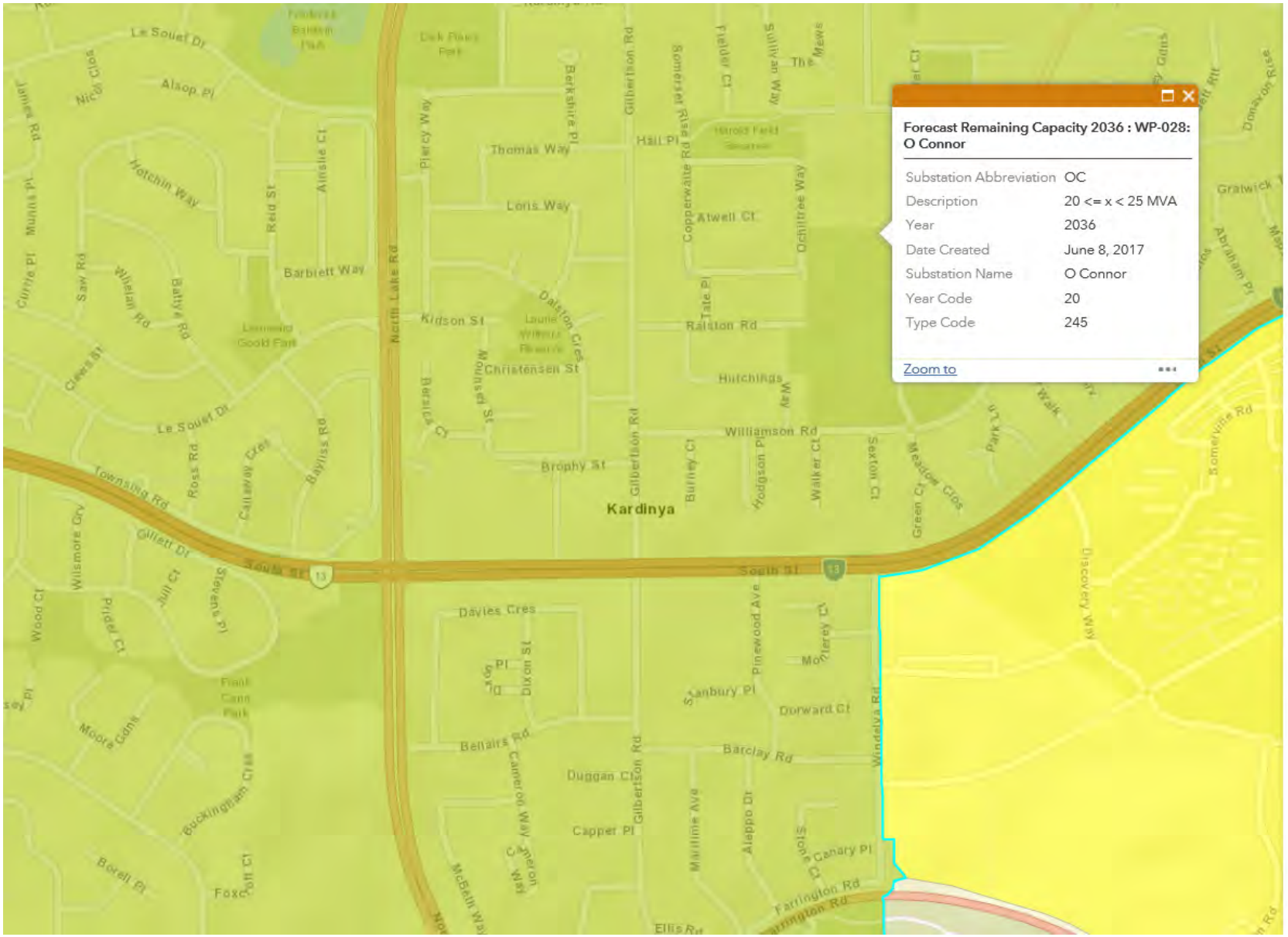
WESTERN POWER CAPACITY MAPPING 2019



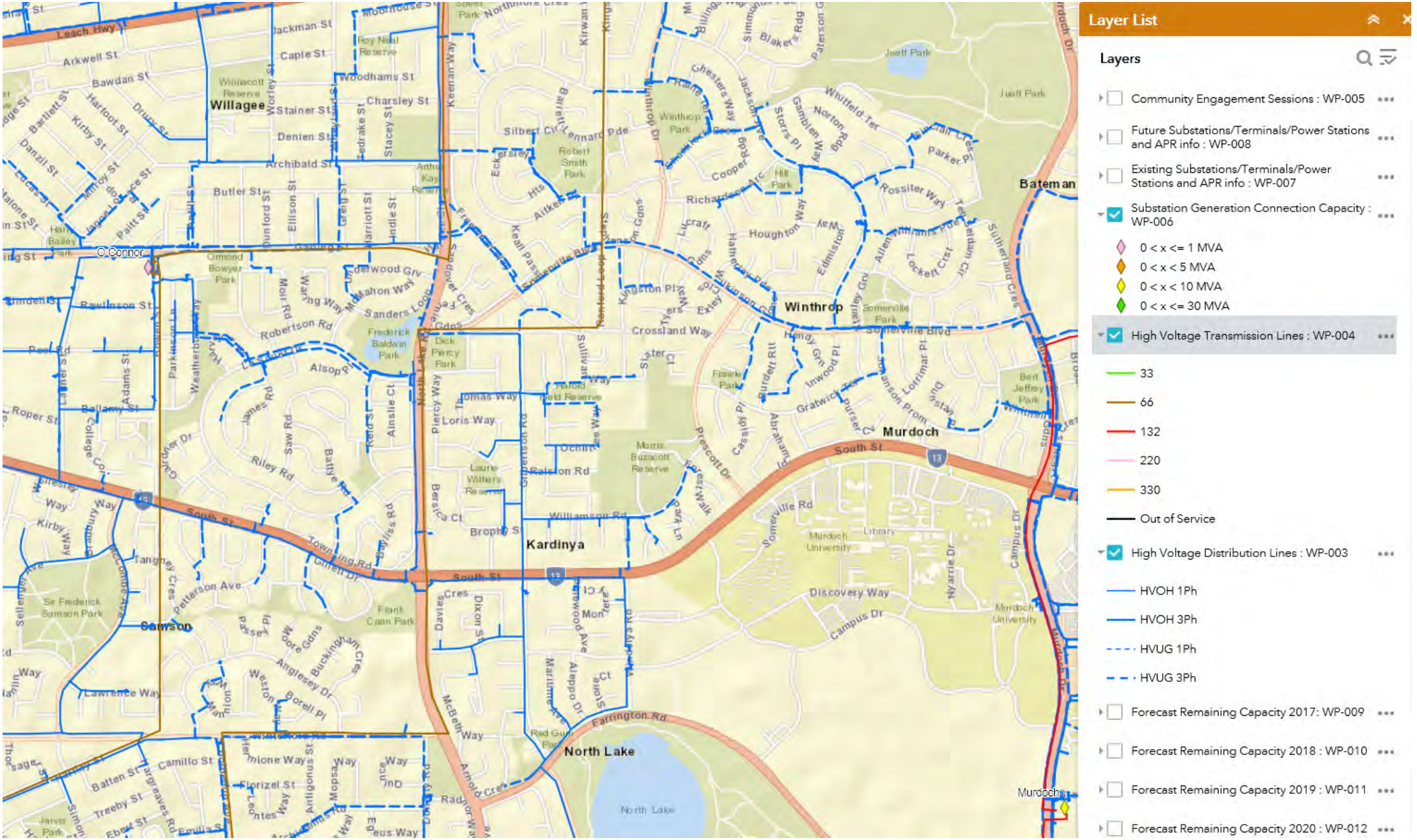
WESTERN POWER CAPACITY MAPPING 2026

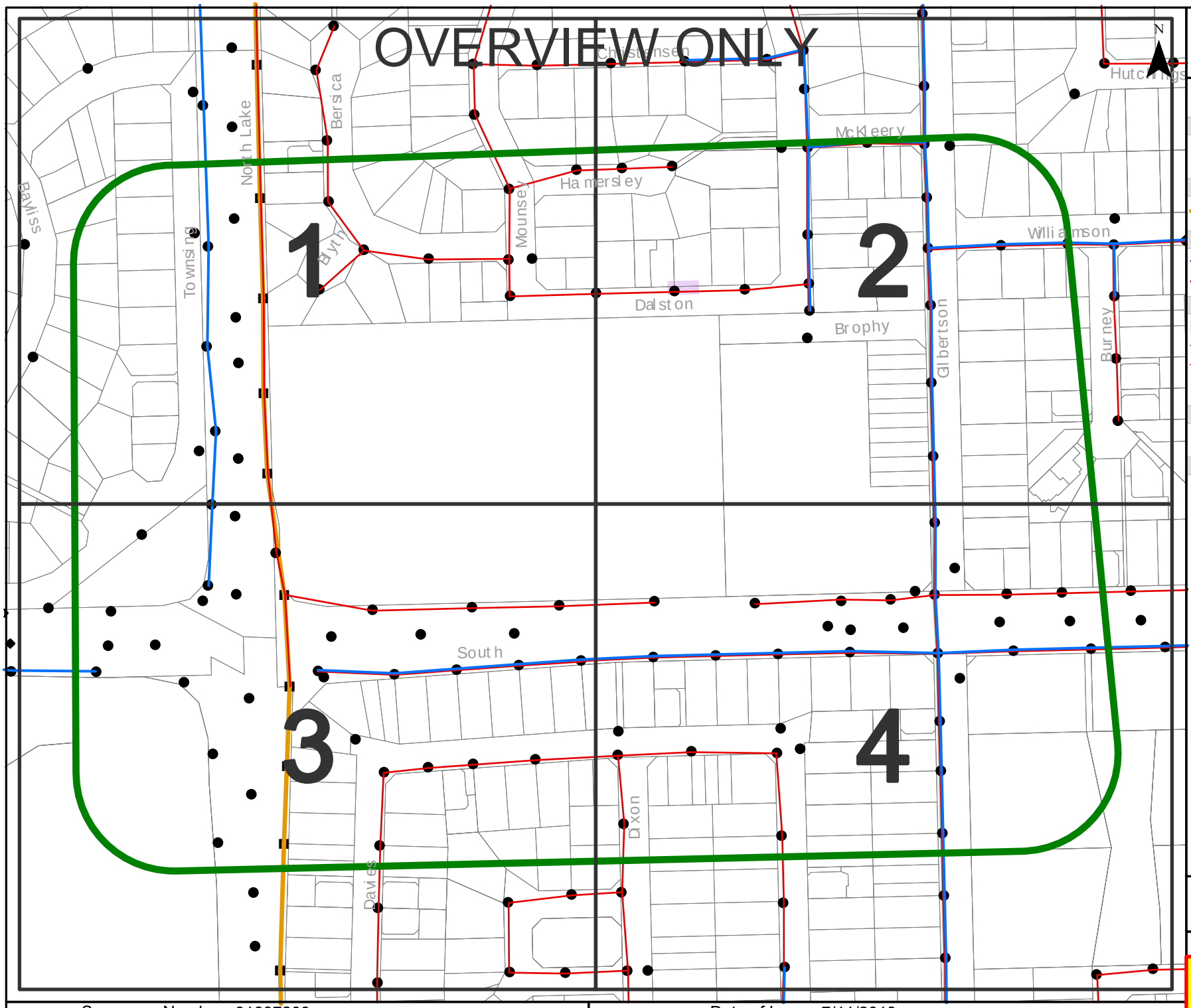


WESTERN POWER CAPACITY MAPPING 2036



WESTERN POWER CAPACITY MAPPING
TRANSMISSION LINES





OVERHEAD LEGEND

Structures

- Power Pole
- Transmission Poles

Transmission Overhead Powerline

- Transmission (33kV - 330kV)

Distribution Overhead Powerline

- High Voltage (1kV - 33kV)
- Low Voltage (< 1kV)

Proposed Construction Assets

- Design Area *
- High Voltage Overhead Powerline
- Low Voltage Overhead Powerline
- Power Pole

Communications Assets

- Overhead Pilot Cable

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Check that you have enough clearance from the DANGER ZONES near overhead powerlines.

Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

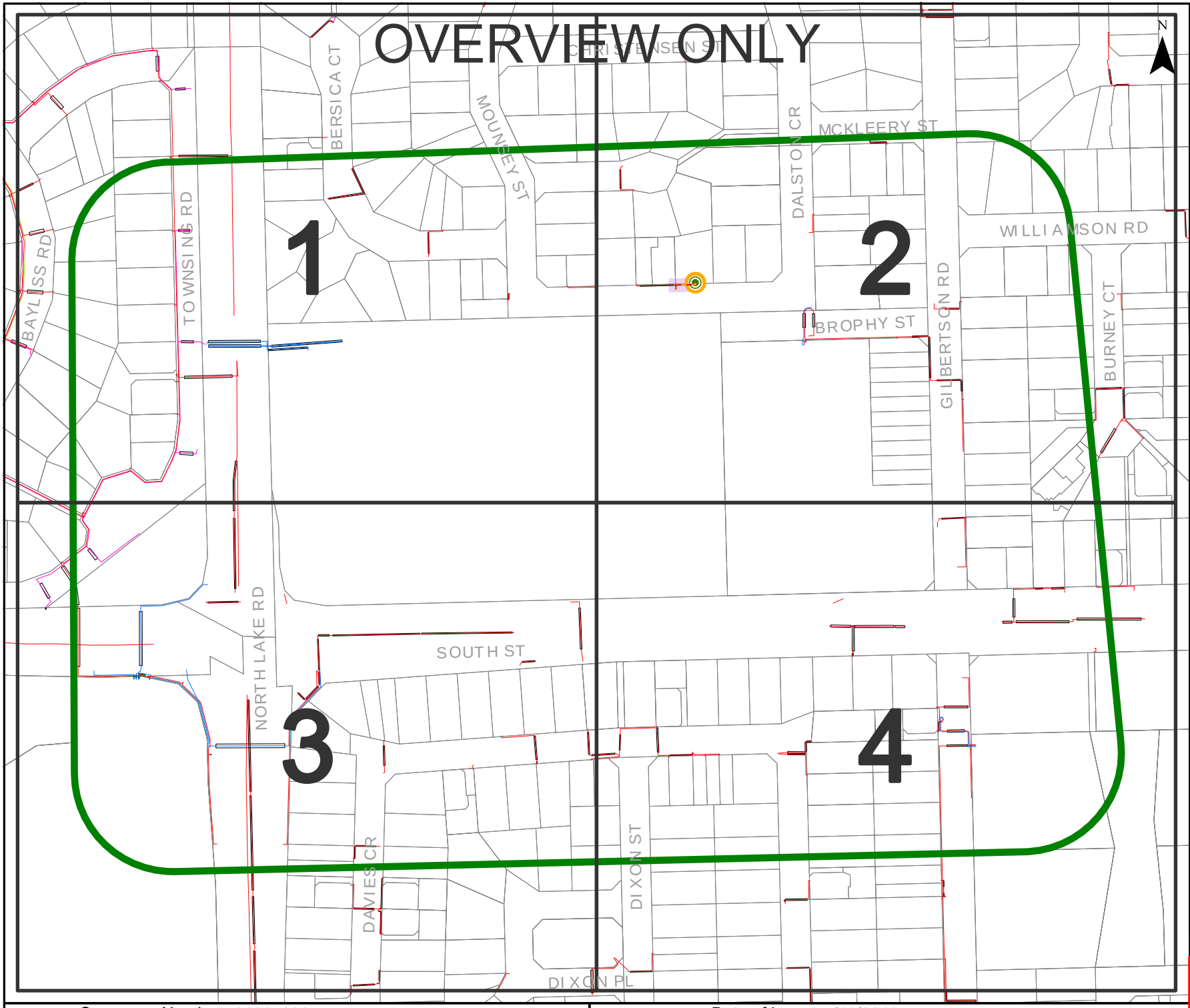
Information valid for 30 days from date of issue

A4	Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 91897203

Date of Issue: 7/11/2019



westernpower

UNDERGROUND LEGEND

Structures

- Pillar
- Metal Pole
- Transformer Site
- UG Crossing *
- Ring Main Unit
- LV Distribution Frame

Distribution Cables

- High Voltage Cable (1kV - 33kV)
- Low Voltage Cable (< 1kV)
- Street Light Circuit (< 1kV)
- Street Light Pilot (< 1kV)
- Earth Wire

Cable Pole Terminations

- HV Termination
- LV Termination

Proposed Construction Assets

- Design Area *
- High Voltage Underground Cable
- Low Voltage Underground Cable
- Metal Pole
- Pillar
- Transformer site
- HV Termination
- LV Termination

State Underground Power Project

- CURRENT Work Area *
- COMPLETED Area *

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.

Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

Information valid for 30 days from date of issue

A4	Scale : 1:3075

WARNING! Look out for overhead power lines

Sequence Number: 91897203

Date of Issue: 7/11/2019

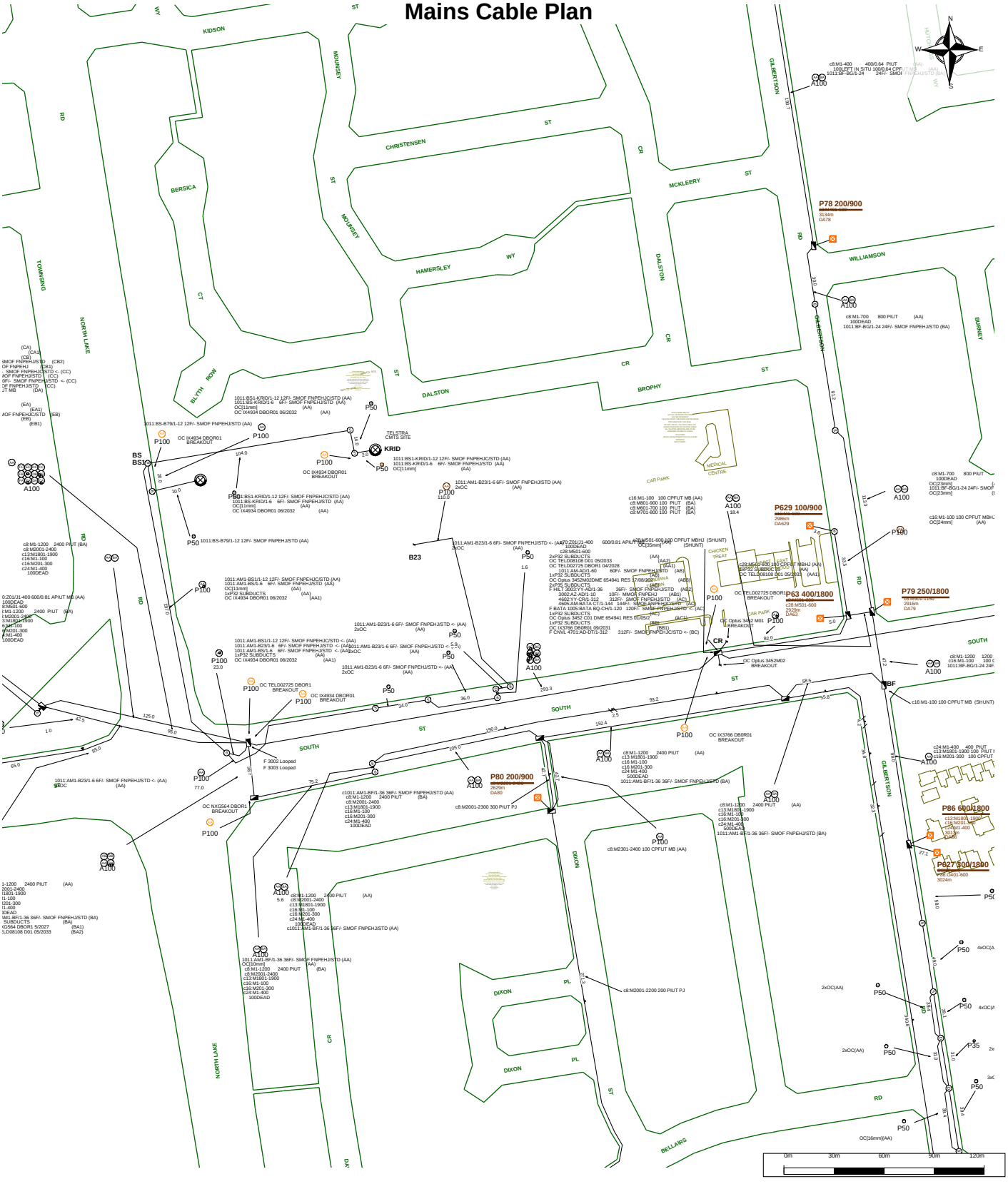
Appendix Eleven: Communication Infrastructure

Cable Plan

Telstra	For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	
Generated On 07/11/2019 15:10:39	Sequence Number: 91897204
	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

Mains Cable Plan



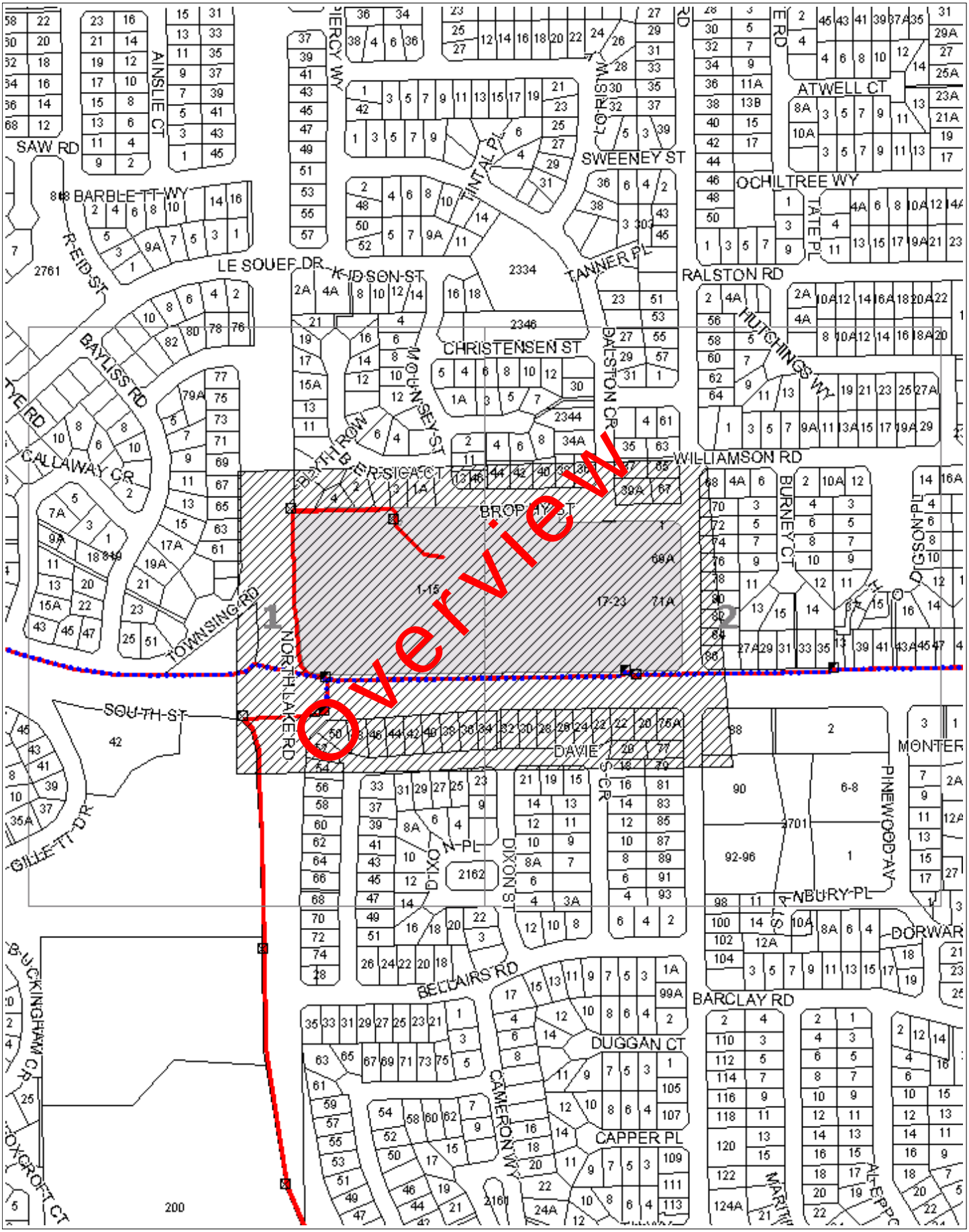
For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

Generated On 07/11/2019 15:10:42

Sequence Number: 91897204

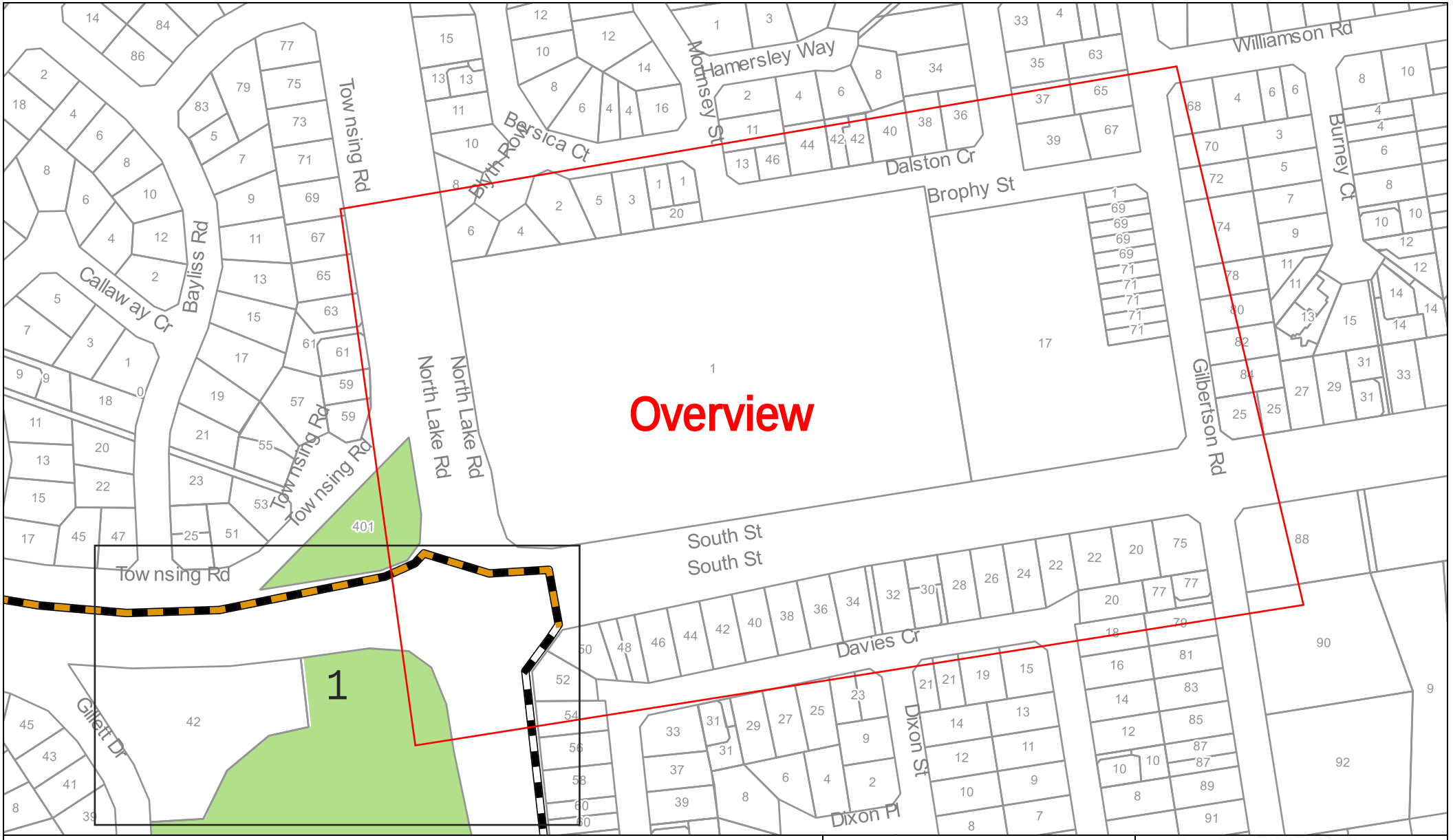
CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.



Sequence Number: 91897205

Date Generated: 07/11/2019

For all Optus DBYD plan enquiries –
Email: Fibre.Locations@optus.net.au
For urgent onsite assistance contact 1800 505 777
Optus Limited ACN 052 833 208



Sequence Number: 91897209

Date: 07/11/2019

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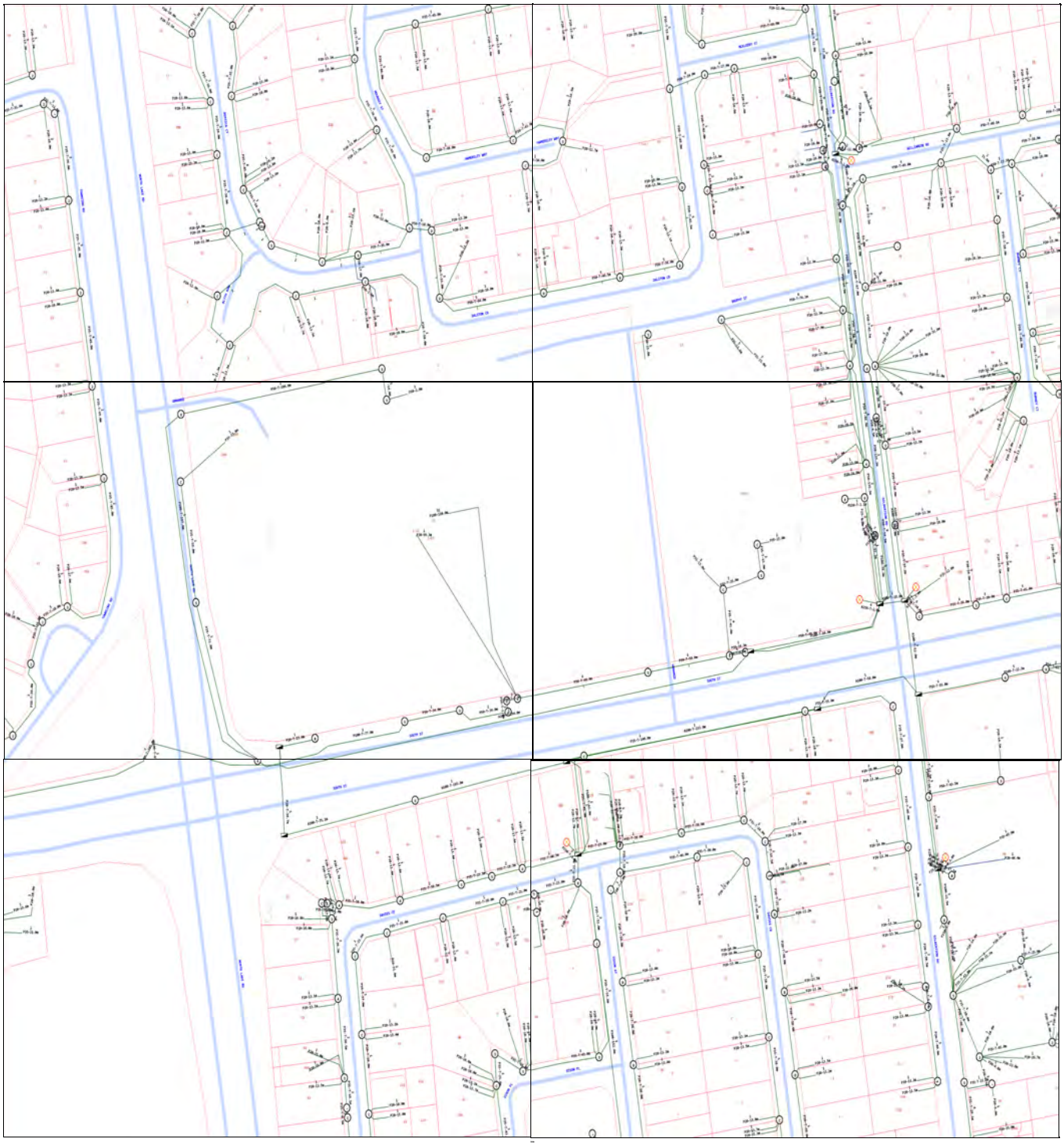
LEGEND

Digsite	Assets
Area	Cable
	3rd Party Duct
	Marker Post



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T. (08) 9289 8300 – E. hello@elementwa.com.au

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