City Of Wanneroo

Neerabup District Planning Study
Traffic and Transport Study

November 2021

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

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1. Introduction

The City of Wanneroo (the City) has engaged GHD to develop a revised planning and implementation framework for the Neerabup Industrial Area (NIA) to complement the City's concept plan for the area.

The project requires translating the concept planning undertaken to date through a revised structure plan and amendments to the City of Wanneroo District Planning Scheme 2 (DPS 2), as required. The revised planning framework for the NIA will be informed by several technical studies.

This report provides the traffic and transport input to the NIA Planning Study. The current NIA Agreed Structure Plan 17 (ASP 17) is shown in Figure 1.

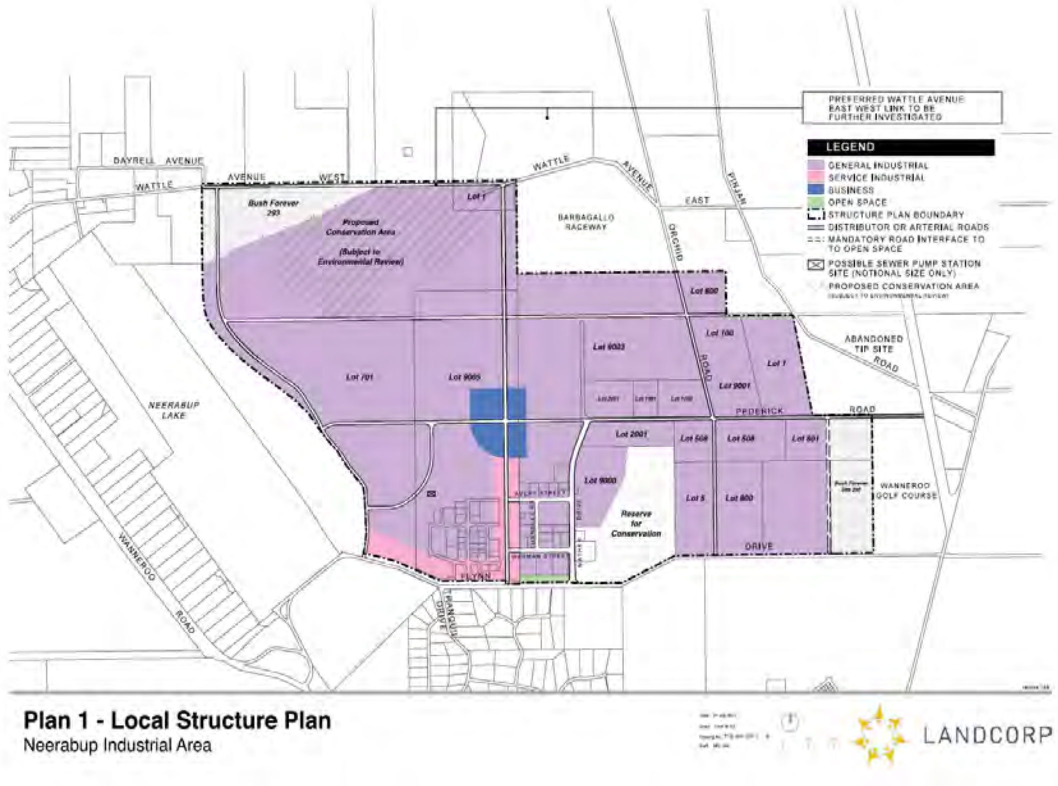

Figure 1-1 Neerabup Industrial Area Local Structure Plan

The City's concept plan is shown in Figure 1-2.

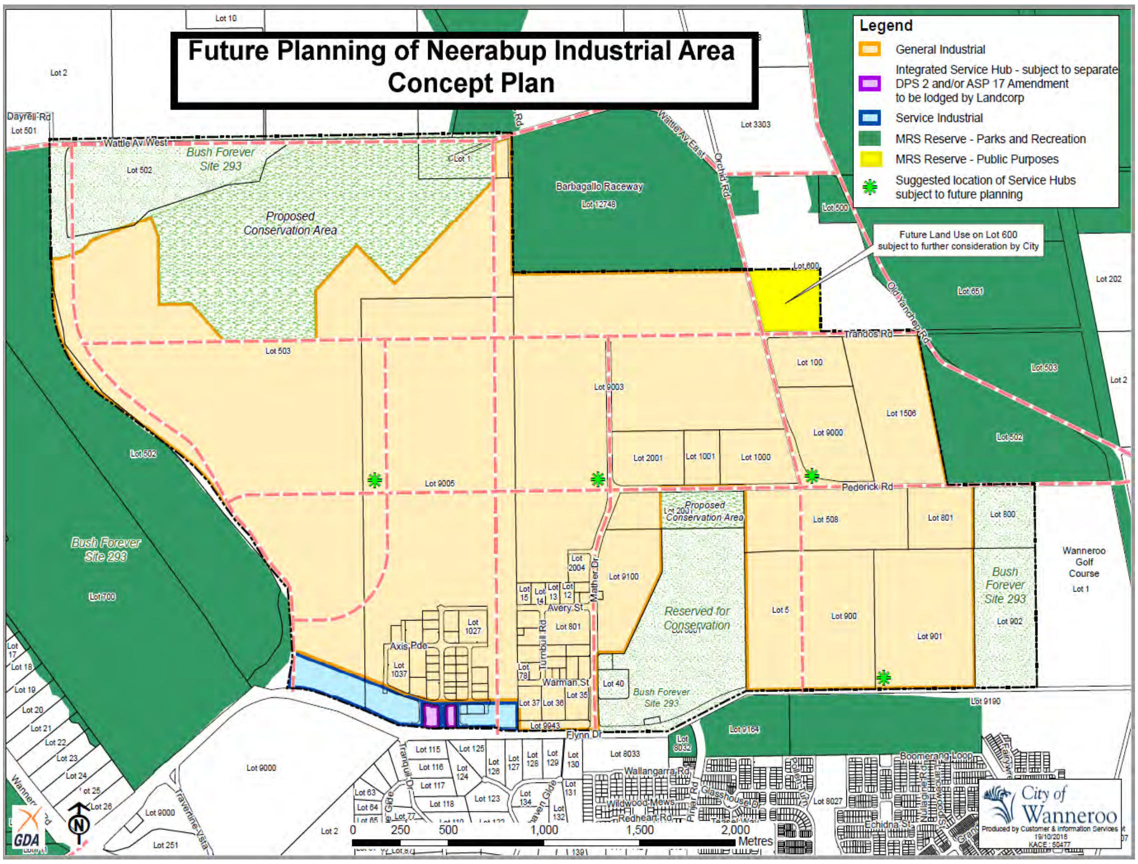

Figure 1-2 Future Planning of Neerabup Industrial Area Concept Design

1.1 Scope of Work

The following scope of work has been undertaken as part of the transport assessment for the NIA:

- A study of the existing traffic volumes on roads within the NIA, as well as major roads that adjoin the NIA (such as Flynn Drive, Pinjar Road and Old Yanchep Road).
- Develop an understanding of the range of traffic volumes that future subdivision and development in the NIA could generate – based on the potential zoning and land use permissibility in the NIA. Determine whether the estimate of anticipated daily vehicle movement numbers indicated for the major roads on Plan 3 of ASP 17 is accurate.
- Determine if the ‘major roads’ (dual carriageway roads as designated on Plan 3 of ASP 17) provide the most appropriate and efficient traffic movements to service existing and future subdivision and development in the NIA. If it is found that the major road configuration currently set out in ASP 17 is not efficient, traffic modelling and planning would be required to identify an alternative major road configuration through the NIA.
- A study and analysis of appropriate cross section design for each of the required major roads – as well an analysis of intersection treatments (traffic signals, roundabouts etc.) likely to be required where major roads intersect.
- Consider how traffic flow into/from the NIA could change in the future, following further extensions of the Mitchell Freeway, the delivery of the Yanchep/Whiteman Highway and a more direct road connection between the NIA and Neaves Road.

appropriate, analyse whether the existing minor road layout on Plan 3 of ASP 17 is appropriate.

- Investigate the need and delivery of high wide load (HWL) corridors servicing the NIA.
- An analysis of how private motor vehicles accessing the NIA can be deterred or discouraged in an efficient and cost-effective manner, particularly by:
  - The identification of potential bus routes to and through the NIA.
  - The provision of a passenger railway station in or near the NIA (should rail be provided in the future on an alignment similar to what is shown in the Department of Transport's *Perth and Peel @ 3.5 million – Transport Network Plan*).
  - The delivery of bus, cyclist, and pedestrian infrastructure throughout the NIA.

Several factors could influence the analysis listed above, and assumptions on certain matters may need to be made. Factors and assumptions that have been used in providing this analysis have been clearly identified and justified in the report.

1.2 Disclaimer

This report has been prepared by GHD for City Wanneroo and may only be used and relied on by City Wanneroo for the purpose agreed between GHD and the City Wanneroo as set out this report.

GHD otherwise disclaims responsibility to any person other than City Wanneroo arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

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2. Existing conditions

2.1 Existing traffic volumes

Recent traffic data was obtained from Main Roads WA Traffic Map and the City of Wanneroo for Mather Drive, Old Yanchep Road, Pederick Road, Wattle Avenue, Flynn Drive and Pinjar Road. GHD also undertook automatic traffic counts and video intersection movement counts at the following locations to supplement the available traffic data:

Automatic counts (one week, hourly/daily)

- Greenwich Parade, north of Flynn Drive
- Mather Drive, north of Flynn Drive
- Pinjar Road, south of Flynn Drive
- Flynn Drive between Pinjar Road and Golf Club
- Flynn Drive between Travertine Vista and Quarry site
- Old Yanchep Road between Trandos Road and Wattle Avenue
- Pederick Road 750m west of Old Yanchep Road

Video intersection survey (6:00 am – 6:00 pm on a weekday)

- Greenwich Parade /Flynn Drive intersection
- Mather Drive/Flynn Drive intersection
- Pederick Road/Old Yanchep Road intersection

The Main Roads WA road hierarchy indicating road types and criteria, as well as traffic volumes is shown in Table 1.

Table 1 Main Roads WA road hierarchy criteria

ROAD HIERARCHY FOR WESTERN AUSTRALIA
ROAD TYPES AND CRITERIA (see Note 1)

CRITERIA	PRIMARY DISTRIBUTOR (PD) (see Note 2)	DISTRICT DISTRIBUTOR A (DA)	DISTRICT DISTRIBUTOR B (DB)	REGIONAL DISTRIBUTOR (RD)	LOCAL DISTRIBUTOR (LD)	ACCESS ROAD (A)
Primary Criteria						
1. Location (see Note 3)	All of WA incl. BUA	Only Built Up Area.	Only Built Up Area.	Only Non Built Up Area. (see Note 4)	All of WA incl. BUA	All of WA incl. BUA
2. Responsibility	Main Roads Western Australia.	Local Government.	Local Government.	Local Government.	Local Government.	Local Government.
3. Degree of Connectivity	High. Connects to other Primary and Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	Medium. Minor Network Role Connects to Distributors and Access Roads.	Low. Provides mainly for property access.
4. Predominant Purpose	Movement of inter regional and/or cross town/city traffic, e.g. freeways, highways and main roads.	High capacity traffic movements between industrial, commercial and residential areas.	Reduced capacity but high traffic volumes travelling between industrial, commercial and residential areas.	Roads linking significant destinations and designed for efficient movement of people and goods between and within regions.	Movement of traffic within local areas and connect access roads to higher order Distributors.	Provision of vehicle access to abutting properties
Secondary Criteria						
5. Indicative Traffic Volume (AADT)	In accordance with Classification Assessment Guidelines.	Above 8 000 vpd	Above 6 000 vpd.	Greater than 100 vpd	Built Up Area - Maximum desirable volume 6 000 vpd. Non Built Up Area – up to 100 vpd.	Built Up Area - Maximum desirable volume 3 000 vpd. Non Built Up Area – up to 75 vpd.
6. Recommended Operating Speed	60 – 110 km/h (depending on design characteristics).	60 – 80 km/h.	60 – 70 km/h.	50 – 110 km/h (depending on design characteristics).	Built Up Area 50 - 60 km/h (desired speed) Non Built Up Area 60 – 110 km/h (depending on design characteristics).	Built Up Area 50 km/h (desired speed). Non Built Up Area 50 – 110 km/h (depending on design characteristics).
7. Heavy Vehicles permitted	Yes.	Yes.	Yes.	Yes.	Yes, but preferably only to service properties.	Only to service properties.
8. Intersection treatments	Controlled with appropriate measures e.g. high speed traffic management, signing, line marking, grade separation.	Controlled with appropriate measures e.g. traffic signals.	Controlled with appropriate Local Area Traffic Management.	Controlled with measures such as signing and line marking of intersections.	Controlled with minor Local Area Traffic Management or measures such as signing.	Self controlling with minor measures.
9. Frontage Access	None on Controlled Access Roads. On other routes, preferably none, but limited access is acceptable to service individual properties.	Prefer not to have residential access. Limited commercial access, generally via service roads.	Residential and commercial access due to its historic status Prefer to limit when and where possible.	Prefer not to have property access. Limited commercial access, generally via lesser roads.	Yes, for property and commercial access due to its historic status. Prefer to limit whenever possible. Side entry is preferred.	Yes.
10. Pedestrians	Preferably none. Crossing should be controlled where possible.	With positive measures for control and safety e.g. pedestrian signals.	With appropriate measures for control and safety e.g. median/islands refuges.	Measures for control and safety such as careful siteing of school bus stops and rest areas.	Yes, with minor safety measures where necessary.	Yes.
11. Buses	Yes.	Yes.	Yes.	Yes.	Yes.	If necessary (see Note 5)
12. On-Road Parking	No (emergency parking on shoulders only).	Generally no. Clearways where necessary.	Not preferred. Clearways where necessary.	No – emergency parking on shoulders – encourage parking in off road rest areas where possible.	Built Up Area – yes, where sufficient width and sight distance allow safe passing. Non Built Up Area – no. Emergency parking on shoulders.	Yes, where sufficient width and sight distance allow safe passing.
13. Signs & Linemarking	Centrelines, speed signs, guide and service signs to highway standard.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs and guide signs.	Speed and guide signs.	Urban areas – generally not applicable. Rural areas - Guide signs.
14. Rest Areas/Parking Bays	In accordance with Main Roads' *Roadside Stopping Places Policy*.	Not Applicable.	Not Applicable.	Parking Bays/Rest Areas. Desired at 60km spacing.	Not Applicable.	Not Applicable.

MAIN ROADS Western Australia
D10#10992

2.1.1 Intersection analysis

Sidra analysis has been undertaken of the three surveyed intersections. Existing intersection volumes can be found in Appendix A.

Greenwich Parade/Flynn Drive intersection

Greenwich Pde/Flynn Drive Existing AM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive East														
5	T1	369	13.0	388	13.0	0.225	0.3	LOS A	0.3	2.5	0.08	0.04	0.08	78.5
6	R2	22	5.0	23	5.0	0.225	9.8	LOS A	0.3	2.5	0.08	0.04	0.08	60.1
Approach		391	12.5	412	12.5	0.225	0.8	NA	0.3	2.5	0.08	0.04	0.08	77.2
North: Greenwich Pde														
7	L2	13	30.0	14	30.0	0.011	6.0	LOS A	0.0	0.4	0.44	0.52	0.44	47.3
9	R2	17	17.0	18	17.0	0.030	8.6	LOS A	0.1	0.7	0.56	0.73	0.56	48.2
Approach		30	22.6	32	22.6	0.030	7.5	LOS A	0.1	0.7	0.51	0.64	0.51	47.8
West: Flynn Drive West														
10	L2	36	5.0	38	5.0	0.019	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	63.7
11	T1	340	15.0	358	15.0	0.185	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		376	14.0	396	14.0	0.185	0.7	NA	0.0	0.0	0.00	0.06	0.00	78.0
All Vehicles		797	13.6	839	13.6	0.225	1.0	NA	0.3	2.5	0.06	0.07	0.06	75.8

Greenwich Pde/Flynn Drive Existing PM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive East														
5	T1	476	3.0	501	3.0	0.263	0.2	LOS A	0.3	2.1	0.06	0.02	0.06	79.1
6	R2	18	11.0	19	11.0	0.263	10.1	LOS B	0.3	2.1	0.06	0.02	0.06	60.3
Approach		494	3.3	520	3.3	0.263	0.6	NA	0.3	2.1	0.06	0.02	0.06	78.2
North: Greenwich Pde														
7	L2	32	12.0	34	12.0	0.024	5.7	LOS A	0.1	0.8	0.43	0.54	0.43	50.6
9	R2	50	4.0	53	4.0	0.088	8.9	LOS A	0.3	2.0	0.60	0.80	0.60	50.4
Approach		82	7.1	86	7.1	0.088	7.6	LOS A	0.3	2.0	0.53	0.70	0.53	50.5
West: Flynn Drive West														
10	L2	7	0.0	7	0.0	0.004	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
11	T1	366	6.0	385	6.0	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		373	5.9	393	5.9	0.189	0.2	NA	0.0	0.0	0.00	0.01	0.00	79.6
All Vehicles		949	4.6	999	4.6	0.263	1.0	NA	0.3	2.1	0.08	0.08	0.08	75.1

Analysis indicates a good level of service A/B with a low degree of saturation 0.225-0.263. Increasing all volumes by 95% indicates a poor level of service of E for the right turn from Greenwich Parade.

Mather Drive/Flynn Drive intersection

Mather Drive/Flynn Drive intersection Existing AM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	INPUT VOLUMES HV] %	DEMAND FLOWS [Total veh/h	DEMAND FLOWS HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	95% BACK OF QUEUE Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive East														
5	T1	384	11.0	404	11.0	0.245	0.5	LOS A	0.5	4.1	0.11	0.04	0.11	78.2
6	R2	26	34.0	27	34.0	0.245	11.2	LOS B	0.5	4.1	0.11	0.04	0.11	58.8
Approach		410	12.5	432	12.5	0.245	1.2	NA	0.5	4.1	0.11	0.04	0.11	76.6
North: Mather Drive														
7	L2	29	48.0	31	48.0	0.129	6.5	LOS A	0.4	4.3	0.52	0.71	0.52	42.7
9	R2	46	43.0	48	43.0	0.129	10.7	LOS B	0.4	4.3	0.52	0.71	0.52	43.6
Approach		75	44.9	79	44.9	0.129	9.1	LOS A	0.4	4.3	0.52	0.71	0.52	43.2
West: Flynn Drive West														
10	L2	69	16.0	73	16.0	0.040	7.2	LOS A	0.0	0.0	0.00	0.63	0.00	60.3
11	T1	314	13.0	331	13.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		383	13.5	403	13.5	0.169	1.3	NA	0.0	0.0	0.00	0.11	0.00	75.5
All Vehicles		868	15.7	914	15.7	0.245	1.9	NA	0.5	4.3	0.10	0.13	0.10	71.3

Mather Drive/Flynn Drive intersection Existing PM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	INPUT VOLUMES HV] %	DEMAND FLOWS [Total veh/h	DEMAND FLOWS HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	95% BACK OF QUEUE Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive East														
5	T1	422	3.0	444	3.0	0.266	0.5	LOS A	0.7	4.9	0.14	0.05	0.14	77.9
6	R2	38	23.0	40	23.0	0.266	10.4	LOS B	0.7	4.9	0.14	0.05	0.14	58.9
Approach		460	4.7	484	4.7	0.266	1.4	NA	0.7	4.9	0.14	0.05	0.14	75.9
North: Mather Drive														
7	L2	70	10.0	74	10.0	0.254	6.0	LOS A	1.0	7.3	0.53	0.74	0.56	49.5
9	R2	120	6.0	126	6.0	0.254	9.3	LOS A	1.0	7.3	0.53	0.74	0.56	50.5
Approach		190	7.5	200	7.5	0.254	8.0	LOS A	1.0	7.3	0.53	0.74	0.56	50.1
West: Flynn Drive West														
10	L2	29	17.0	31	17.0	0.017	7.3	LOS A	0.0	0.0	0.00	0.63	0.00	60.0
11	T1	337	7.0	355	7.0	0.175	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		366	7.8	385	7.8	0.175	0.6	NA	0.0	0.0	0.00	0.05	0.00	77.8
All Vehicles		1016	6.3	1069	6.3	0.266	2.3	NA	1.0	7.3	0.16	0.18	0.17	69.8

Analysis indicates a good level of service A/B with a low degree of saturation 0.245-0.266. Increasing all volumes by 70% indicates a poor level of service of E for the right turn from Mather Drive.

Pederick Road/Old Yanchep Road intersection

Pederick Road / Old Yanchep Road Existing AM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Old Yanchep Road S														
1	L2	10	40.0	11	40.0	0.006	8.7	LOS A	0.0	0.3	0.04	0.60	0.04	53.8
2	T1	83	10.0	87	10.0	0.044	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		93	13.2	98	13.2	0.044	0.9	LOS A	0.0	0.3	0.00	0.06	0.00	83.9
North: Pld Yanchep Road N														
8	T1	70	11.0	74	11.0	0.044	0.0	LOS A	0.0	0.3	0.03	0.05	0.03	88.2
9	R2	6	0.0	6	0.0	0.044	7.5	LOS A	0.0	0.3	0.03	0.05	0.03	73.1
Approach		76	10.1	80	10.1	0.044	0.6	NA	0.0	0.3	0.03	0.05	0.03	86.8
West: Pederick Road														
10	L2	5	0.0	5	0.0	0.003	6.5	LOS A	0.0	0.1	0.18	0.55	0.18	63.8
12	R2	5	80.0	5	80.0	0.005	8.0	LOS A	0.0	0.1	0.18	0.58	0.18	45.8
Approach		10	40.0	11	40.0	0.005	7.3	LOS A	0.0	0.1	0.18	0.56	0.18	53.3
All Vehicles		179	13.4	188	13.4	0.044	1.2	NA	0.0	0.3	0.03	0.09	0.03	82.4

Pederick Road / Old Yanchep Road Existing PM
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Old Yanchep Road S														
1	L2	5	40.0	5	40.0	0.003	8.7	LOS A	0.0	0.1	0.03	0.61	0.03	53.9
2	T1	72	1.0	76	1.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		77	3.5	81	3.5	0.036	0.6	LOS A	0.0	0.1	0.00	0.04	0.00	86.2
North: Pld Yanchep Road N														
8	T1	89	13.0	94	13.0	0.054	0.0	LOS A	0.0	0.2	0.01	0.02	0.01	89.3
9	R2	3	0.0	3	0.0	0.054	7.5	LOS A	0.0	0.2	0.01	0.02	0.01	73.8
Approach		92	12.6	97	12.6	0.054	0.3	NA	0.0	0.2	0.01	0.02	0.01	88.7
West: Pederick Road														
10	L2	7	28.0	7	28.0	0.004	7.0	LOS A	0.0	0.2	0.17	0.55	0.17	56.1
12	R2	7	14.0	7	14.0	0.006	6.8	LOS A	0.0	0.1	0.16	0.58	0.16	59.7
Approach		14	21.0	15	21.0	0.006	6.9	LOS A	0.0	0.2	0.16	0.56	0.16	57.9
All Vehicles		183	9.4	193	9.4	0.054	0.9	NA	0.0	0.2	0.02	0.07	0.02	84.2

Analysis indicates a good level of service A with a low degree of saturation 0.044-0.054. Considerable capacity is available at this intersection.

2.1.2 Road geometry and capacity

Table 2 describes the geometry of the existing road network within the NIA and existing daily traffic volumes in vehicles per day (vpd).

Table 2 Existing geometry and daily traffic volumes in the NIA

Road	Geometry	Capacity (vpd)[1]	Vehicles per day (heavy vehicle %)[2]	Road Classification
Flynn Drive	Single carriageway, approximately 7 metres (m) wide, unkerbed, no right turn lanes in Flynn Drive at intersections with NIA, left turn lanes in place at Greenwich Pde, Pinnacle Dr, Mather Dr. Some localised widening at intersections.	8,000	10,150 east of Wanneroo Road (21.1% trucks)	Regional distributor
Flynn Drive	Single carriageway, approximately 7 metres (m) wide, unkerbed, no right turn lanes in Flynn Drive at intersections with NIA, left turn lanes in place at Greenwich Pde, Pinnacle Dr, Mather Dr. Some localised widening at intersections.	8,000	2,460 east of Mather Drive (19.8%)	Regional distributor
Old Yanchep Road	Single carriageway, approximately 7 m wide, unkerbed, no right turn lanes in Old Yanchep Rd at intersections with NIA, left turn lanes in place (not with Flynn Drive). Sealed shoulders. Localised widening at intersection with Ziatas Rd intersection.	8,000	2,420 north of Flynn Dr (18.2%) 3,120 south of Flynn Dr (21.4%) 1,980 vpd Trandos Rd-Wattle Ave (22.6%)	Regional distributor
Mather Drive	Single carriageway, approximately 7.3 m wide, unkerbed. Unsealed shoulders.	6,000	2,700 (27.5%)	Industrial road
Pederick Road	Single carriageway, approximately 7.3 m wide, unkerbed. Unsealed shoulders.	6,000	325 (49.7%)	Industrial road
Greenwich Parade	Boulevard between Flynn Dr and Hemisphere St roundabout, 2 x single lane. North of Hemisphere St approximately 9.7 m wide, mountable kerb.	6,000	1,100 (20.7%)	Industrial road
Wattle Avenue west	Single carriageway, approximately six metres wide, unkerbed. Unsealed shoulders	6,000	210 (not available)	Access road
Wattle Avenue east	Single carriageway, approximately six metres wide, unkerbed. Unsealed shoulders	6,000	N/A	Access road
Pinjar Road	Single carriageway, one lane in each direction, channelization at intersections	>8,000	6,100 (11.4%)	Distributor A

A review of the existing daily traffic volumes on the roads within the NIA indicates that all roads are operating within their current anticipated capacity. Traffic count data is shown in Figure 2-1.

[1] Anticipated volumes, not physical capacity. A single carriageway road can carry in excess of 8-12,000 vpd (Austroads/Road Reserves Review joint study for the Department of Planning, and Urban Development, Department of Transport, Main Roads Department, and Transperth 1991).
[2] Time period of vehicle volumes ranges between 2012 – 2019, volumes rounded to the nearest ten.

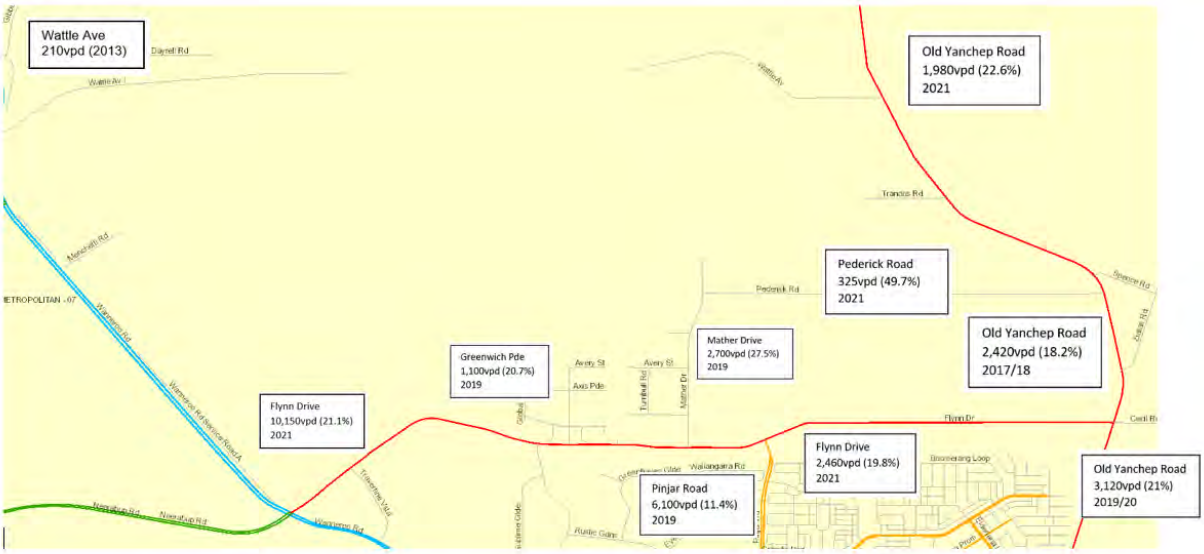


Figure 2-1 Traffic count data in Neerabup Industrial Area (Base map source: Main Roads WA Road Information Mapping)

2.2 Crash analysis

A crash analysis has been undertaken of the road network within the NIA for the five-year period of 2016-2020 to determine whether any existing safety issues exist. The assessment, shown in Table 3 , 4, 5 and 6 has been undertaken using the Main Roads WA Crash Analysis Reporting System (CARS). No significant safety issue has been identified at any of the intersections analysed.

Table 3 Intersection crash history

Location	Reported Crashes	Commentary
Flynn Drive/Greenwich Parade intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Flynn Drive/Pinnacle Drive intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Flynn Drive/Mather Drive intersection	One required medical treatment	No significant safety issue is identified at the intersection based on the crash history
Flynn Drive/Old Yanchep Road intersection	One - required hospital treatment	No significant safety issue is identified at the intersection based on the crash history
Flynn Drive/Pinjar Road intersection	Three, two property damage only (PDO) major, one PDO minor	No significant safety issue is identified at the intersection based on the crash history
Greenwich Parade/Hemisphere Street intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Greenwich Parade/Axis Parade intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Mather Drive/Pederick Road intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Old Yanchep Road/Ziatas Road intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Old Yanchep Road/Pederick Road intersection	Two – One hospital, one PDO major	No significant safety issue is identified at the intersection based on the crash history
Old Yanchep Road/Trandos Road intersection	One - PDO major	No significant safety issue is identified at the intersection based on the crash history
Old Yanchep Road/Wattle Avenue East intersection	Nil	No significant safety issue is identified at the intersection based on the crash history
Wattle Avenue/Wanneroo Road	Nil	No significant safety issue is identified at the intersection based on the crash history

Mid-block crash data for Flynn Drive (Travertine Vista to Old Yanchep Road) is considered in Table 4. The crash data indicates lighting may be an issue and run off road collisions may require immediate remedial geometric measures. The relative low traffic volume and high heavy vehicle numbers seem to confirm the above findings as the exposure is relatively low, yet crashes are still occurring.

Table 4 Flynn Drive (Travertine Vista to Old Yanchep Road) mid-block crash data

SLK	Reported Crashes	Commentary
0.61	Medical Rear end collision. Daylight.	No comment
1.15	Fatal Departed left verge on curve eastbound, hit pole	The crash data indicates run off road collisions may require remedial geometric measures
1.27	PDO major. East to west swerving to avoid animal. Run off road. Daylight. Hit fence /tree.	No comment
1.37	PDO major Dawn, curve, swerving to avoid animal, hit tree	The crash data indicates lighting may be an issue and run off road collisions may require remedial geometric measures
1.43	PDO major Dark, off left verge, hit tree	The crash data indicates lighting may be an issue and run off road collisions may require remedial geometric measures
2.78	PDO major Dark, streetlights on. West to east rear end. Stopped to avoid animal.	No comment
3.45	PDO major Rear end, eastbound truck collides with eastbound truck	No details available
3.49	PDO minor Dark, wet, eastbound off left verge, runs into ditch	The crash data indicates lighting may be an issue and run off road collisions may require remedial geometric measures
3.51	PDO minor Rear end, south-west/south-west	Intersection
3.54	PDO major Departed left verge, collides with pole	The crash data indicates run off road collisions may require remedial geometric measures
3.74	PDO major Dark, curve, off right carriageway westbound collides with tree	The crash data indicates lighting may be an issue and run off road collisions may require remedial geometric measures
3.76	Hospital Wet, curve, off left verge westbound	The crash data indicates run off road collisions may require remedial geometric measures
3.78	Fatal West to east, motorcycle hit fence.	The crash data indicates run off road collisions may require remedial geometric measures
4.84	Medical Dawn, rear end, westbound vehicle collides with westbound vehicle	The crash data indicates lighting may be an issue
5.18	PDO major Rear end, eastbound vehicle collides with eastbound vehicle	No details available

Mid-block crash data for Old Yanchep Road (Flynn Drive to Wattle Avenue) is shown in Table 5 It shows that there have been two reported mid-block crashes in Old Yanchep Road (Flynn Drive to Wattle Avenue). No significant safety issues are identified based on crash numbers.

It is noted that Old Yanchep Road in the vicinity of the NIA now has edge lines and centre line marking, which is likely to improve conditions.

Table 5 Old Yanchep Road (Flynn Drive to Wattle Avenue) mid-block crash data

SLK	Reported crashes	Commentary
1.99	PDO major Dark, off left verge northbound, collides with tree	Crash data indicates run off road collisions may require remedial geometric measures.
3.99	PDO minor Dark, loss of control on left turn west to north	Driveway

Mid-block crash data for Wattle Avenue (Wanneroo Road to Old Yanchep Road) is presented in Table 6. No significant safety issue was identified based on reported number of crashes.

Table 6 Wattle Avenue (Wanneroo Road to Old Yanchep Road) mid-block crash data

SLK	Reported Crashes	Commentary
5.56	PDO minor	-

2.3 Restricted access vehicle network

A review of the Main Roads WA restricted access vehicle (RAV) mapping tool shows the roads in and around the NIA are part of the RAV Network 4 route and accommodate trucks up to 27.5 metres in length (Figure 2-2).

Flynn Drive (Wanneroo Road east to Neaves Road), Mather Drive (Flynn Drive to Pederick Road) and Pederick Road also support Tri Drive combinations up to 27.5 metres in length. It is noted however that in the future there is likely to be demand for RAV Network 7, trucks up to 36.5 m in length. Given PDNH/Tonkin Highway is approved for 36.5 m RAV combinations now it is fully opened, Main Roads WA expects the transport industry to request similar access to adjacent industrial estates. This will then be subject to suitability of the connecting roads to the industrial estates and the internal roads within it.

This network will need to be expanded as the NIA develops to ultimately accommodate RAV Network 7 vehicles. Potential RAV Network 7 routes are shown on Figure 2-2.

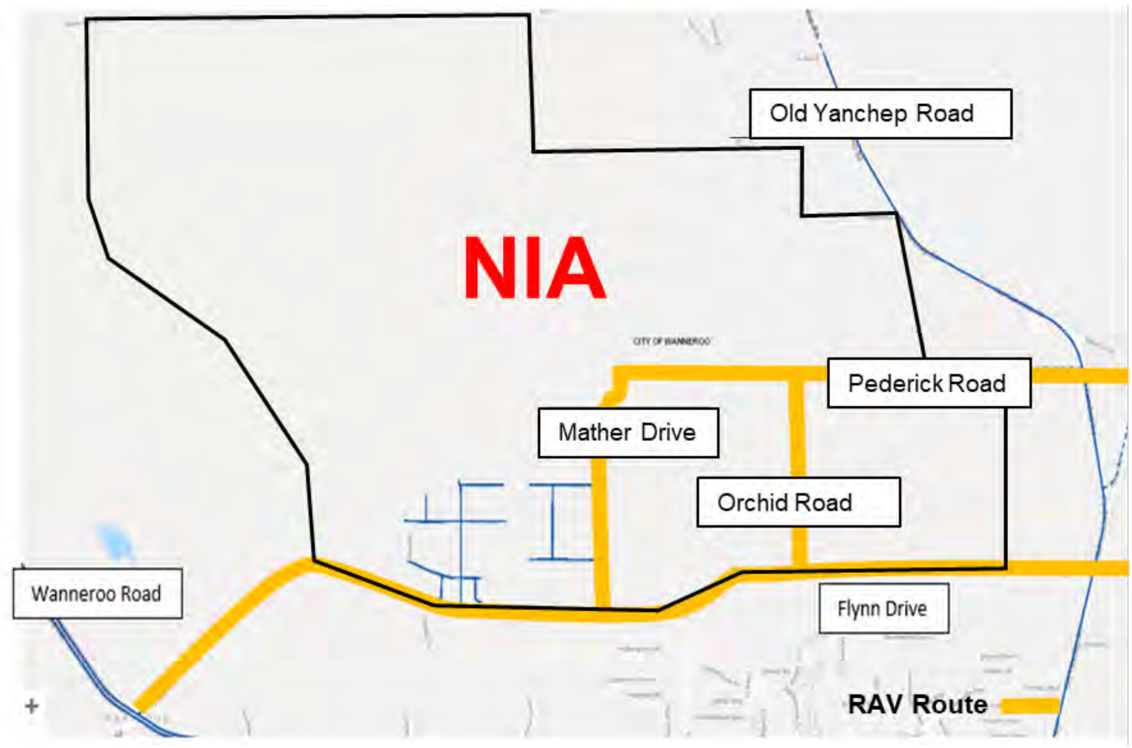


Figure 2-2: Potential RAV Network 7 surrounding the NIA (MRWA)

2.4 High wide load trunk routes

Figure 2-3 shows the current high wide load (HWL) corridor to the east of Neerabup utilizing Great Northern Highway (GNH). There is no direct HWL access to the NIA.

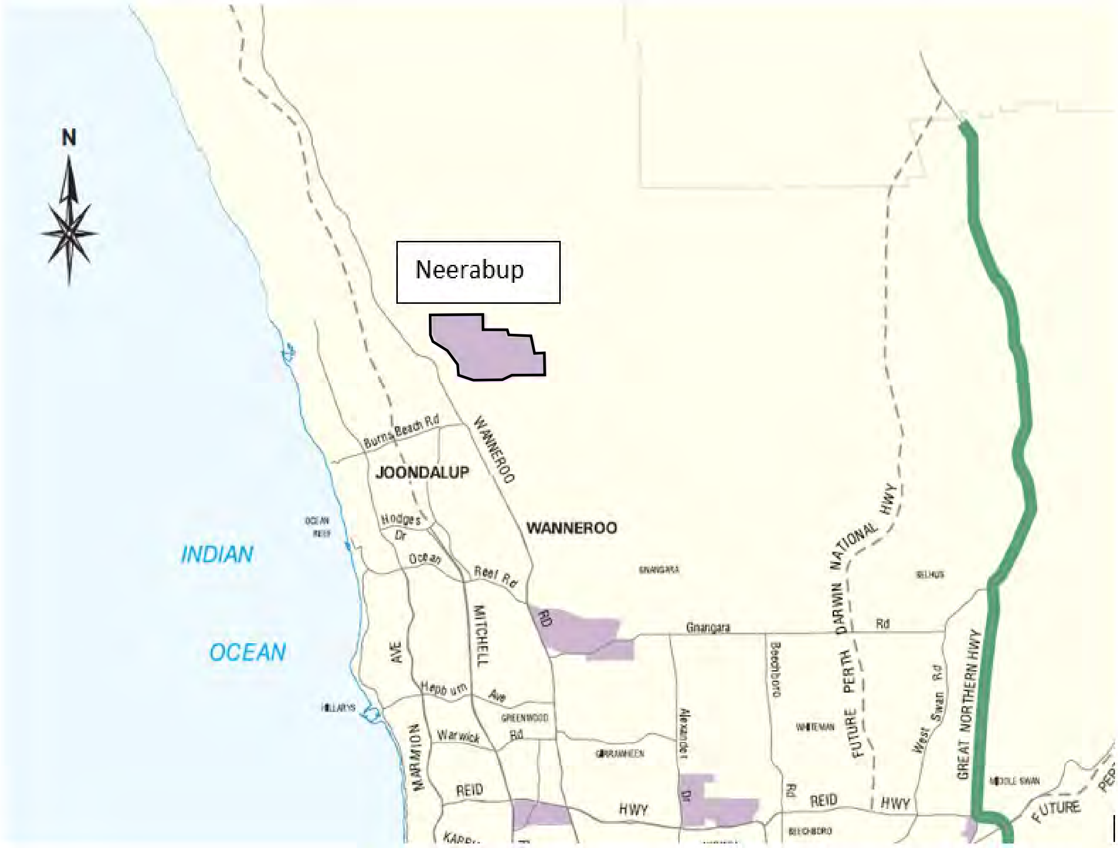


Figure 2-3 High wide load northern suburbs trunk route (MRWA)

2.5 Existing road hierarchy

The existing road hierarchy for roads surrounding and within the NIA is shown in Figure 2-4 (Main Roads WA) and Figure 2-5 (City of Wanneroo) respectively.

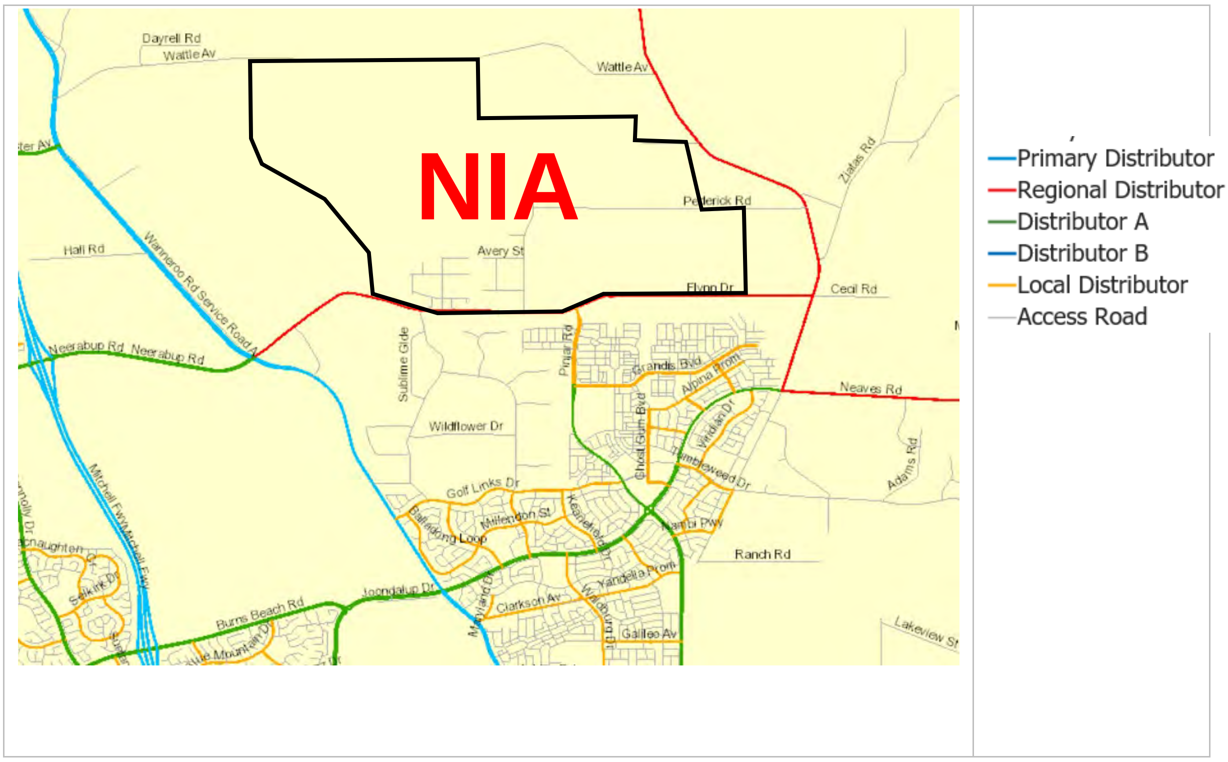


Figure 2-4 Road hierarchy (MRWA)

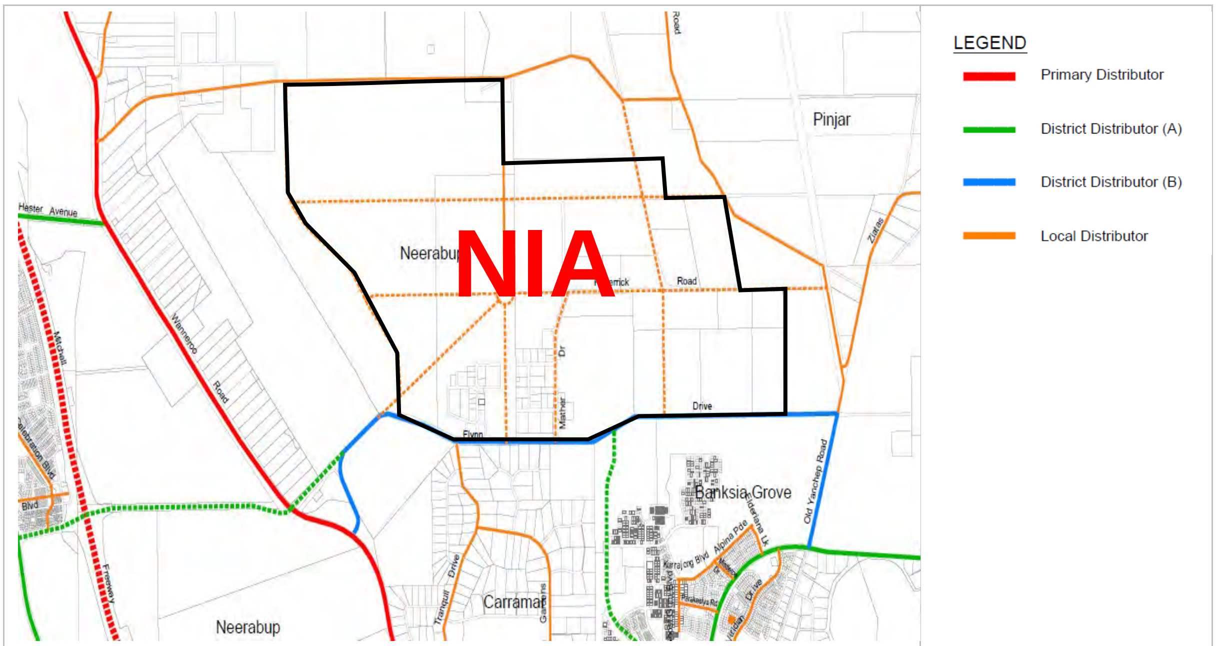


Figure 2-5: Road hierarchy (City of Wanneroo)

The City of Wanneroo's road hierarchy shows Old Yanchep Road north as a Local Distributor and Flynn Drive as a District Distributor B. Main Roads WA shows the internal roads as Access Roads and Old Yanchep Road north as a Regional Distributor.

3. Review of reference documents

Several reference documents have been reviewed to provide context and guidance to aid in planning of the transport network to, from and within the NIA.

3.1 Neerabup Industrial Area Structure Plan No 17

The Context Plan included within the *Neerabup Industrial Area Structure Plan No 17*, showing the location of the Structure Plan area is shown in Figure 3-1.

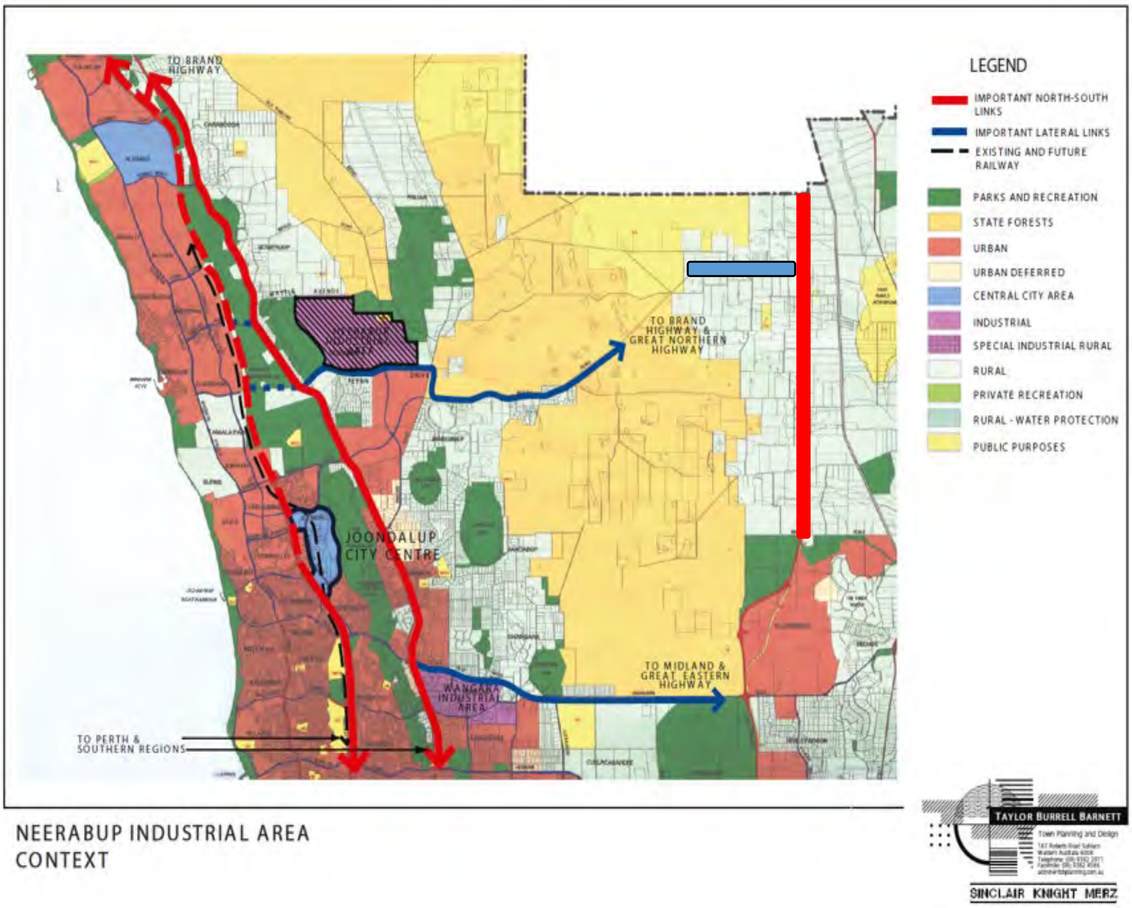


Figure 3-1: Neerabup Industrial Area context plan

3.1.1 Traffic volumes

Forecast daily traffic volumes on full development from the ASP 17 report are shown in Figure 3-2. Road connections are proposed to be developed along the western boundary, with a central east-west road linking with Old Yanchep Road and connecting Wattle Avenue East and West.

ASP 17 adopted 5.5 trips per 100 m^2 for general industrial and service industrial land and 9.7 trips per 100 m^2 for business land uses. Specific floor areas are not available, however the trip rates used would appear to be appropriate compared with industry trip rates, noting a trip rate for factory use of five trips per 100 m^2 is usually adopted.

Flynn Drive is forecast to carry up to 24,400 vpd adjacent to the NIA and 32,700 vpd east of Wanneroo Road. The forecast volumes indicate a two-lane dual carriageway will be required.

Road A (north-south) – Pinnacle Drive, is forecast to carry up to 15,300 vpd and indicates a two-lane dual carriageway will be required north of Pederick Road.

Road B (north-south) links Pederick Road with the western north-south road (Road C) is forecast to carry up to 23,500 vpd and indicates a two-lane dual carriageway will be required.

The western (north-south) road, Road C, is forecast to carry up to 34,400 vpd and indicates a two-lane dual carriageway will be required.

Road D (east-west) Trandos Road extension - links Road C with Old Yanchep Road. It is forecast to carry up to 22,500 vpd (west of Orchid Road) and indicates a two-lane dual carriageway will be required for this section. To the east of Orchid Road, forecast volumes are 7,500 vpd and a single carriageway with one lane in each direction is required.

Road E (east-west) – Pederick Road, links Road C with Old Yanchep Road. It is forecast to carry up to 36,800 vpd and indicates a two-lane dual carriageway will be required.

Road F (north-south) - Orchid Road is forecast to carry up to 20,100 vpd south of Road D and indicates a two-lane dual carriageway will be required. Volumes north of Road D are 7,600 vpd. A single carriageway with one lane in each direction would be adequate. The plan indicates a dual carriageway.

Mather Drive is forecast to carry up to 14,800 vpd and indicates two-lane dual carriageway will be required.

Wattle Avenue West is forecast to carry 8,500 vpd. A single carriageway is likely to accommodate the forecast volumes, a dual carriageway is shown on the plan.

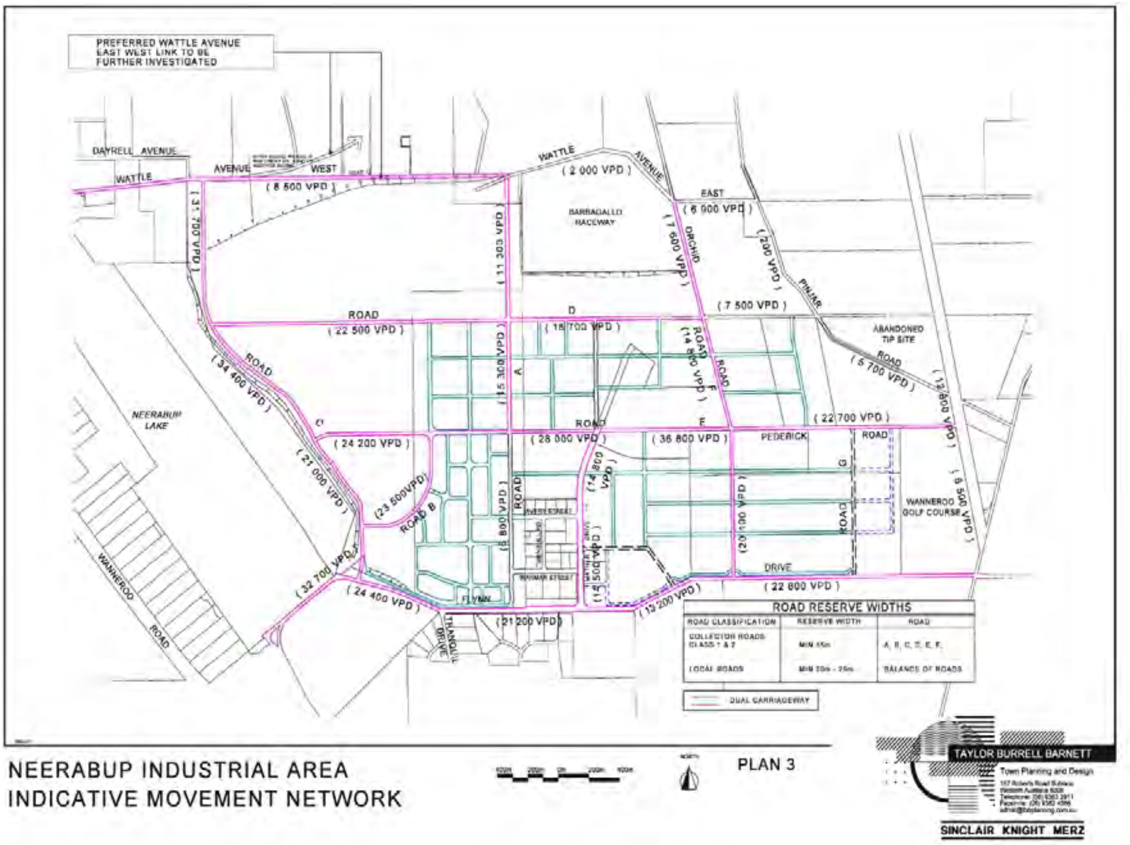


Figure 3-2 Indicative movement network and daily traffic volumes

A dual carriageway cross section is identified in Figure 3-3 for those roads with high forecast traffic volumes above 8,000 vpd.

3.1.2 Road reserves

Road reserve widths identified in ASP 17 are shown in Table 7.

Table 7 City of Wanneroo road width requirements

Road Class.	Reserve Width	Pavement Width	Verge Width
Collector Roads			
Class 1 and Class 2	Min 32-35m	13.4m	Min 5.1m
Local Roads	Min 20-25m	10.0m	Min 5.1m

The Western Australian Planning Commission's (WAPC) *Development Control Policy 4.1 – Industrial Subdivision* (DC 4.1) indicates a minimum road reserve width of 20 metres for local roads. For heavily trafficked/major through routes, a minimum road reserve width of 25 metres is required. Carriageway widths of ten metres are favoured for local minor roads.

Road cross sections from ASP 17 are shown in Figure 3-3. These cross sections will be considered to inform the proposed updated Structure Plan, being cognisant of truck requirements and other users.

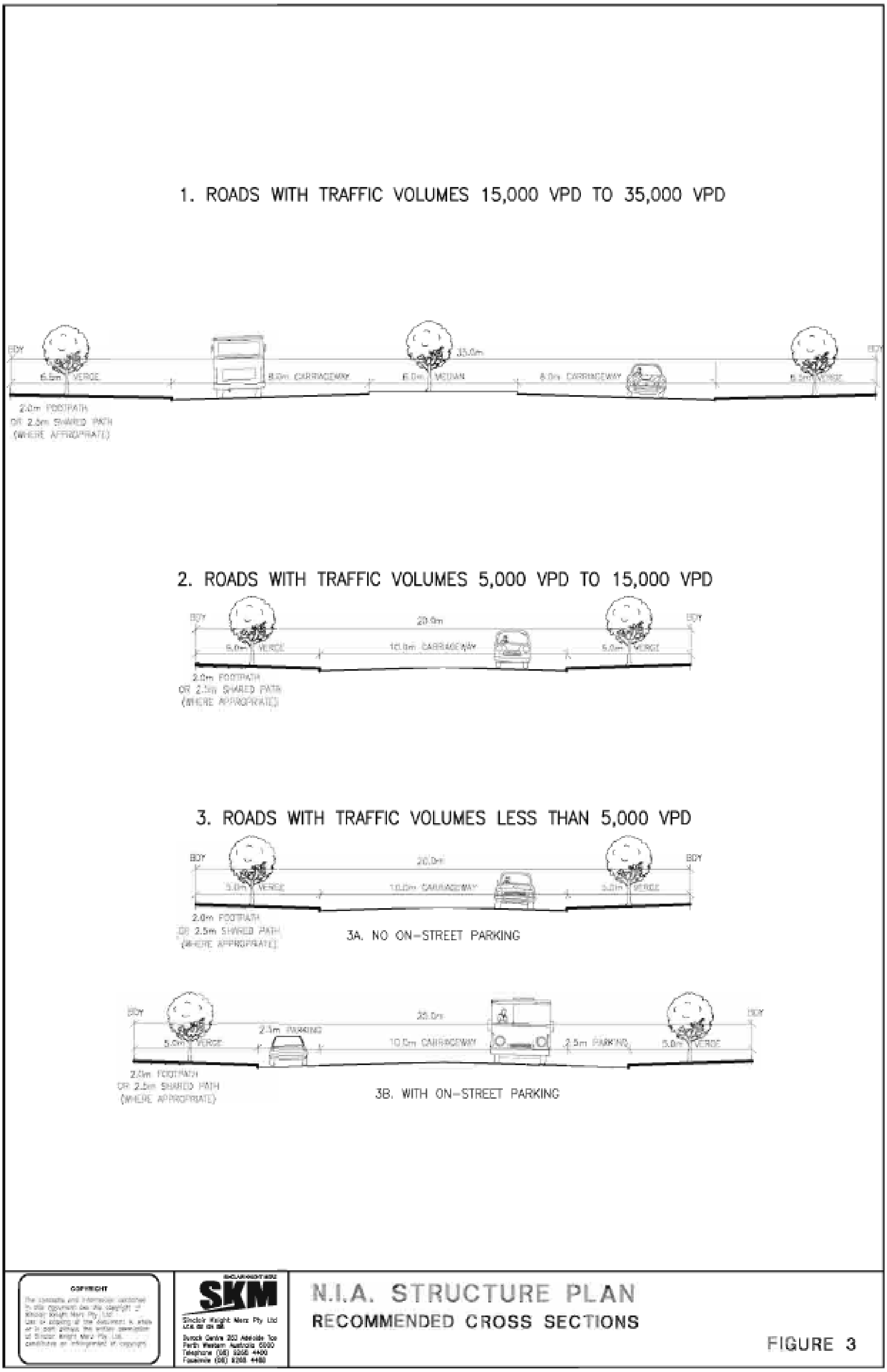


Figure 3-3 NIA road cross sections

3.1.3 Wanneroo/Barbagallo Raceway Access - Wattle Avenue East and West

ASP 17 indicates Wattle Avenue East and West provide access to the north of the raceway site from Old Yanchep Road and Wanneroo Road respectively. However, the two sections of Wattle Avenue do not connect to provide through access from Old Yanchep Road in the east to Wanneroo Road in the west. Whilst previously contemplated, the connection of Wattle Avenue East and West was not considered to be a requirement of the ASP 17 as Road A (shown in Figure 3-2) was indicated as providing better permanent access arrangements for Wanneroo Raceway.

ASP 17 noted the raceway had been experiencing traffic congestion problems during major events. At the time the Structure Plan was prepared, the only permanent public road access to the raceway was from Wattle Avenue East; however, the City permitted the raceway to construct a temporary access road from Mather Drive, which alleviated the aforementioned traffic problems. It is understood that whilst the City may have allowed this access to the raceway at the time ASP 17 was prepared (2004/5), this access will no longer be used as the City has recently (2020) granted development approval for extractive industry on Lot 9003 Mather Drive, which will remove this access.

There may be opportunity to develop a supplementary route in the short term via Trandos Road and an extension of Orchid Road, which could be further explored by the City. In the longer-term, access is likely to be via Wattle Avenue East and Flynn Drive/Orchid Road (if the Whiteman-Yanchep Highway is developed).

3.1.4 Public transport

ASP 17 identified a lack of planned public transport routes at the time it was prepared. However, ASP 17 outlined that the road reserve widths planned for the NIA were sufficient to cater for bus routes should they be introduced.

3.1.5 Relevance of traffic related information from ASP 17 for subsequent plan

Following a review of the previous ASP 17, the following observations were noted:

- The overall road network would appear suitable to meet the likely requirements of the NIA.
- The trip rates used would appear to be a little low compared with recent examination of more specific land use now proposed and relevant trip rates.
- Modelled traffic volumes would appear to be comparable in some areas compared with subsequent modelling. Noting a Business Park within the development is no longer.
- The conservation area has changed and there are also proposed access roads which will reduce the area modelled.
- Following discussion between the City, GHD and Development WA, the joining of Wattle Avenue East and West is unlikely, given the environmental constraints that exist.
- Some road reserves appear too narrow, and no account is taken of swales or local water management strategy (LWMS) requirements.
- No account for future RAV Network 7 movements.
- The Mitchell Freeway ended at Hodges Drive (an extension has since been undertaken).

- The Whiteman-Yanchep Highway was not proposed or even contemplated.
- Tonkin Highway was not built out to Bullsbrook, and therefore a connection via Neaves Road to Tonkin Highway could have not been contemplated.
- No Sidra analysis of major intersections with the adjacent road network or internally is included.

3.2 Various documents related to road geometry, function, characteristics, and spacing

To determine suitable characteristics and cross sections for roads within industrial areas, reference has been made to various documents, including:

- *Austroads Design Vehicles and Turning Path Guide*
- *Austroads Guide to Road Design Part 3*
- *Road Reserves Review* (DPLH)
- Institute of Highways and Transport, UK
- Main Roads WA's *Roundabouts and Traffic Signals Guidelines for the Selection of Intersection Control*
- *Standard Restricted Access Vehicle (RAV) Route Assessment Guidelines* (Main Roads WA)
- *Austroads Road Design for Heavy Vehicles*

3.2.1 Road function and characteristics

Table 8 indicates typical intersection turning radii included in *Austroads Design Vehicles and Turning Path Guide.*

Table 8 Guide to selection of the appropriate design and checking vehicle and the recommended turning radii (Austroads)

Intersecting road types	Design	Checking
Arterial/Arterial	Prime mover and semi-trailer (19 m) [(1)] Radius 15 m	Appropriate vehicle e.g. B-double (25 m) [(2)] **or** Prime mover and long semi-trailer (25 m) **or** Road train [(3)]
Arterial/Collector	Single unit truck/bus (12.5 m) Radius 12.5 m	Prime mover and semi-trailer (19 m) Radius 15 m
Arterial/Local (residential)	Service vehicle (8.8 m) Radius 12.5 m	Single unit truck/bus (12.5 m) Radius 12.5 m
Collector/Collector (industrial)	Prime mover and semi-trailer (19 m) [(1)] Radius 15 m	Prime mover and semi-trailer (19 m) [(1)] Radius 15 m
Collector/Collector (residential)	Single unit truck/bus (12.5 m) Radius 12.5 m	Prime mover and semi-trailer (19 m) [(1)] Radius 15 m
Collector/Local (residential)	Service vehicle (8.8 m) Radius 9 m	Single unit truck/bus (12.5 m) Radius 12.5 m
Local/Local (industrial) [(4)]	Prime mover and semi-trailer (19 m) [(1)] Radius 12.5 m [(5)]	Appropriate vehicle e.g. B-double (25 m) [(2)] **or** Prime mover and long semi-trailer (25 m) **or** Road train [(3)]
Local/Local (residential)	Service vehicle (8.8 m) Radius 9 m	Single unit truck/bus (12.5 m) Radius 12.5m

1 Select the appropriate vehicle for the design of sites that are frequently used by such vehicles.
2 B-double length may vary between jurisdictions.
3 Select appropriate road train from the *Guide to Road Design – Part 3: Geometric Design* (Austroads 2010b) or from relevant jurisdiction guide.
4 Also for intersections with industrial land use for collector/local intersections.
5 Simulations show that for this radius the maximum steering angle occurs at the exit of the turn and not applied at the crawl speed.

Source: Austroads (2009).

Table 9, from *Austroads Guide to Road Design Part 3*, indicates recommended lane widths.

Table 9 Lane widths (Austroads)

Element	Lane width (m)	Comments
General traffic lane	3.5	General traffic lane widths to be used for all roads
	3.0–3.4	For use on low speed roads with low truck volumes
Service road lane	3.4–5.5	Range of lane widths on service roads (refer to Section 4.12)
Wide kerbside lane	4.2	Locations where there are high truck volumes (additional width provided for trucks)
	4.2–4.5	Locations where motorists and cyclists use the same lane (refer Section 4.9.11 and Commentary 6)
HOV lane	3.5–4.5	Bus lane (refer Section 4.10.2)
	3.3	Tram/light rail vehicle lane (refer Section 4.10.3)
Minimum width between kerb and channel (to provide for passing of broken down vehicles)	5.0[(1)]–6.5[(2)]	Width of a single lane suitable for use in a left turn slip lane, or two lane, two way divided road with a raised median
	2 × 4.0 (8.0)	Width of two lanes that provide for two lines of traffic to (slowly) pass a broken down vehicle.

1 *Generally, a minimum width of 5.0 m should be provided. However, at the discretion of the road agency a lesser width may be considered on urban roads where the site is constrained and traffic using the facility is comprised of cars and small commercial vehicles, or where the length of treatment is short (e.g. channelised left-turn roadway).*
2 *Depending on the classification of the road, the design vehicle to be accommodated and space available at the site, the road agency may consider the provision of a width up to 6.5 m. However, where this width is likely to result in operational issues (e.g. two lines of cars in a left-turn roadway that is intended to operate as a single lane) measures should be undertaken to delineate the expected path for cars and other small vehicles.*

Road Reserves Review (DPLH) indicates the following road capacities (vehicles per day/vpd) to achieve a level of service C (free flowing traffic) (Table 10).

Table 10 Road capacity (DPLH)

Road	Capacity (vpd)
Urban Arterials	
4 lanes divided	38,000
District Roads	
2 lanes	12,000
4 lanes divided no parking	30,000
4 lanes divided (minimal frontage access)	38,000

The overall road reserve width will be influenced by path and clear zone requirements, services, street lighting, swale drains and LWMS requirements. Indicative road reserve widths are shown in this Transport report, however ultimate widths will need to consider all of the relevant requirements.

3.2.2 Intersection treatments

The UK Institute of Highways and Transport indicates traffic volume thresholds for various treatments. Figure 3-4 refers.

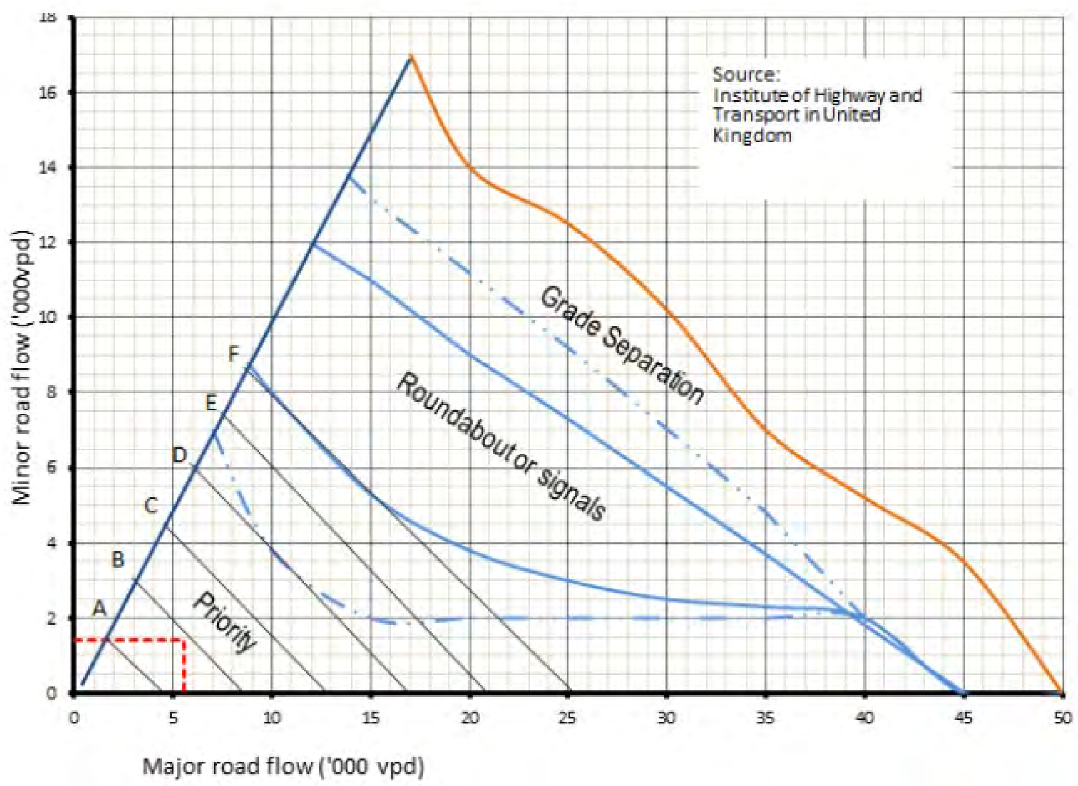


Figure 3-4 Intersection type volume thresholds (UK Institute of Highways & Transport)

Main Roads WA's *Roundabouts and Traffic Signals Guidelines for the Selection of Intersection Control* indicates intersection suitability (Table 11).

Table 11 Suitability of types of traffic control (MRWA)

	Primary Distributor (excluding Freeways)	Distributor A	Distributor B & Local Distributor	Access Road
Traffic Signals				
Primary Distributor (excluding Freeways)	O	O	O	X
Distributor A	O	O	O	X
Distributor B & Local Distributor	O	O	X	X
Access Road	X	X	X	X
Roundabouts				
Primary Distributor (excluding Freeways)	A	A	X	X
Distributor A	A	A	A	X
Distributor B & Local Distributor	X	A	A	O
Access Road	X	X	O	O
STOP signs or GIVE WAY signs				
Primary Distributor (excluding Freeways)	X / (O)	X / (O)	A	A
Distributor A	X / (O)	X / (O)	A	A
Distributor B & Local Distributor	A	A	A	A
Access Road	A	A	A	A
Legend: A = Most likely to be an appropriate treatment O = May be an appropriate treatment X = Usually an inappropriate treatment				

The document also indicates where large or special vehicles are expected to use a site where a roundabout is the preferred form of control it is important to:

- Provide appropriate space for the swept path of large vehicles.
- Provide truck stopping sight distance, understanding that at roundabouts it is difficult for drivers of multi-combinational vehicles to "pick a gap" – consequently it is important that if the design vehicle is an A-double, or larger, all three sight distance criteria given in the *Austroads Roundabout Guidelines* must be satisfied. If the design vehicle is a 19 m semi-trailer, then only criteria 1 & 2 must be satisfied.
- Consider vehicle stability for turning movements by providing radii appropriate for the turning speeds and providing a satisfactory crossfall and a uniform rate of change of crossfall. This is particularly important for multi-combinational vehicles where the prime mover and trailer(s) may be on different crossfalls at the same time.

Austroads Road Design for Heavy Vehicles indicates that large trucks should be able to enter and leave an intersection lane correct.

3.2.3 Street spacing

In view of the RAV network in future likely to accommodate 36.5 m trucks, appropriate intersection spacing will be required for right/left manoeuvres and left/right manoeuvres on the specific RAV routes. Figure 3-5 indicates the typical swept path requirement for a 36.5 m truck performing these manoeuvres and should be adopted for the RAV route. The drawing indicates approximately 110 m is required and appropriate intersection design to separate turning paths. Intersections on the same side of the road should also allow for RAV turning requirements and be adjusted to a minimum of 110 m. It is recommended that RAV 7 routes are restricted to the major roads and minor roads as required. Similar spacing should be applied to Network 4 routes (27.5 m trucks) to facilitate movement.

A review of the minor street spacing within the industrial areas of Wangara and Malaga that accommodate RAV Network 4 vehicles (27.5 m) indicates the following:

- Right/left stagger: 62 m – 175 m. Recommendation is for a minimum of 110 m in the NIA.
- Left/right stagger: 57 m – 85 m. Recommendation is for a minimum of 110 m in the NIA.
- Same side: 118 m – 200 m. Recommendation is for a minimum of 150 m in the NIA and 220 m if there is an intersection opposite.

For urban arterial roads or industrial distributor roads, the desirable minimum intersection spacing is 300 m.

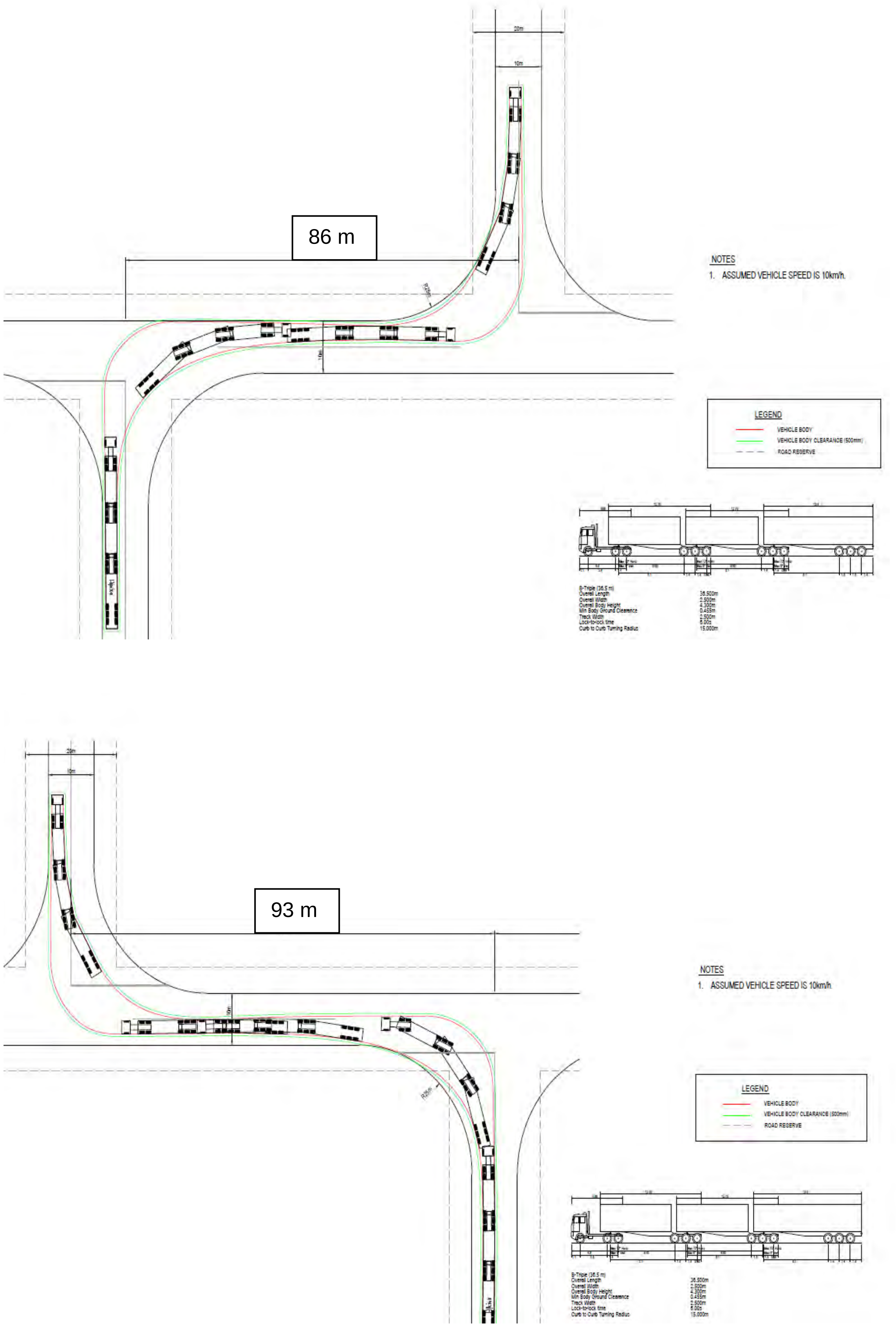


Figure 3-5 Indicative swept path requirements for left/right and right/left stagger for 36.5 m truck on RAV route

As indicated in Figure 2-2, Mather Drive, Orchid Road and Pederick Road are recommended as RAV Network 7 routes and other roads RAV Network 4. To safeguard future planning for RAV 7, all roads should adopt the recommended minimum spacing.

3.3 Perth and Peel @ 3.5 million Transport Network

3.3.1 Future road network

The *Perth and Peel @ 3.5 Million Transport Plan*[3] shows Whiteman-Yanchep Highway and Flynn Drive as Primary Distributors (Figure 3-6). The intersection of Flynn Drive/Whiteman-Yanchep Highway/Neaves Road is proposed to become a future interchange. Connectivity between the NIA, Tonkin Highway and the Bullsbrook industrial area will be significantly improved.

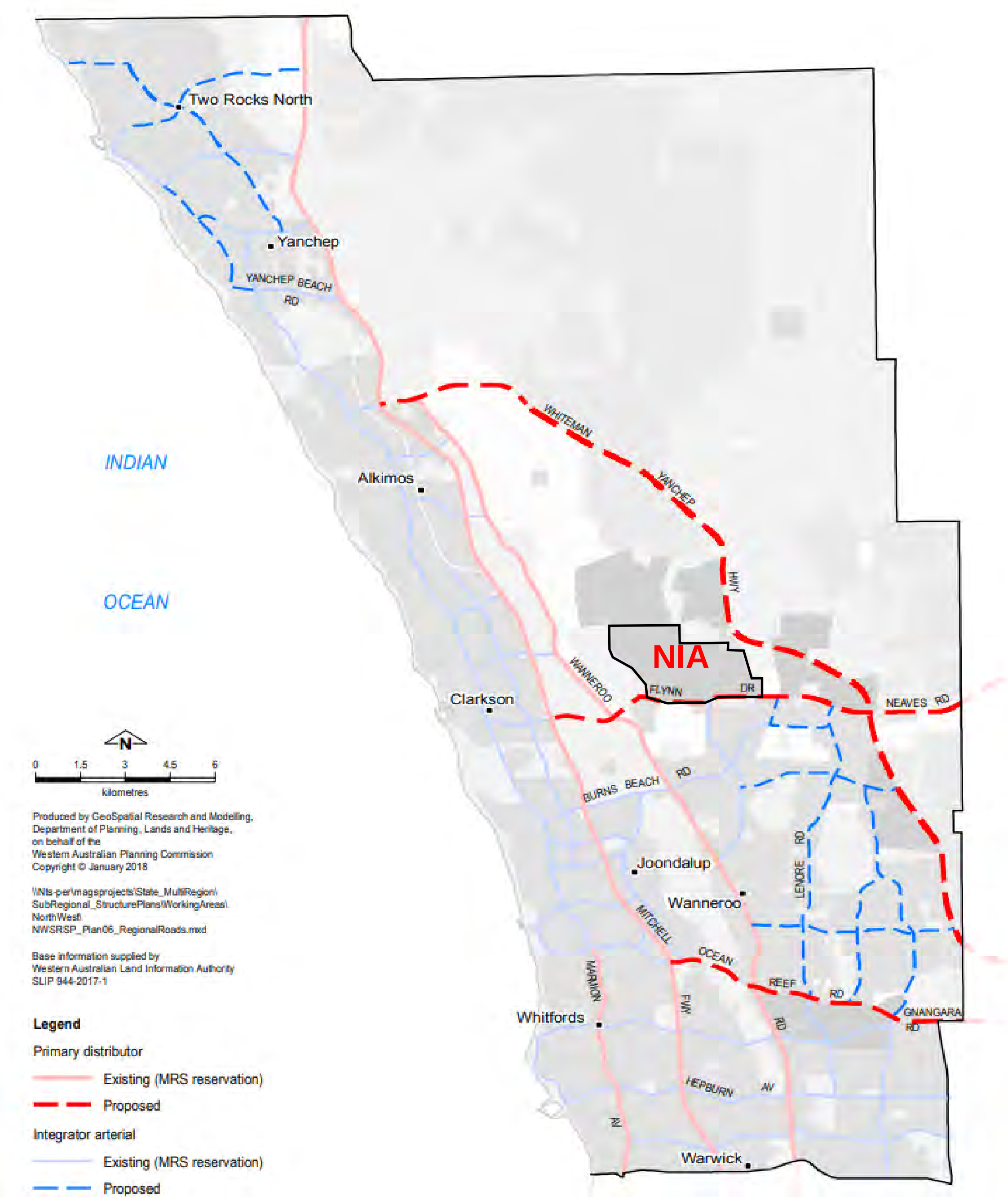


Figure 3-6 Future road network surrounding the NIA (*Perth and Peel @ 3.5 Million Transport Plan*)

[3] https://www.transport.wa.gov.au/mediaFiles/projects/PROJ_P_Perth_Peel_3.5million_TransportNetwork.pdf

3.3.2 Future rail link

The *Perth and Peel @ 3.5 Million Transport Plan* states that further investigation is required for the potential East Wanneroo Rail Link (or East-West Rail Link), to connect the Joondalup and Ellenbrook Lines in the long-term.

As advised by the Public Transport Authority in April 2021, the final alignment for this rail line, along with potential station locations, is still being investigated and as such is yet to be determined.

3.3.3 Freight transport 2050

The proposed future freight transport network through the North West sub-region, of which the NIA is a part, is shown in Figure 3-7.

The *Perth and Peel @ 3.5 Million Transport Plan* advises the following in relation to the freight network in the Neerabup area:

The North-West sub-region's economy is directly influenced by the efficiency of freight movements. The sub-region's freight network is reliant on the regional road network to connect activity and industrial centres within and outside of the sub-region. These roads include the Mitchell Freeway, Neaves Road–Flynn Drive, Gnangara Road– Ocean Reef Road and a portion of the proposed Whiteman-Yanchep Highway.

Neaves Road–Flynn Drive

This road will form part of the freight network and be upgraded to a primary distributor in order to improve its capacity and efficiency for freight and general traffic. It will provide an important east–west link to the North-East sub-region, particularly the potential Bullsbrook intermodal terminal.

Whiteman–Yanchep Highway

The Whiteman-Yanchep Highway is a new north-south primary distributor road that will connect the North-West sub-region to the North-East and Central sub-regions and broader regional road network.

The Neerabup regional road network, Wattle Avenue and a new north-south road are proposed to serve as integrator arterial roads that will connect the Neerabup and Nowergup industrial areas to the broader regional and freight road network.

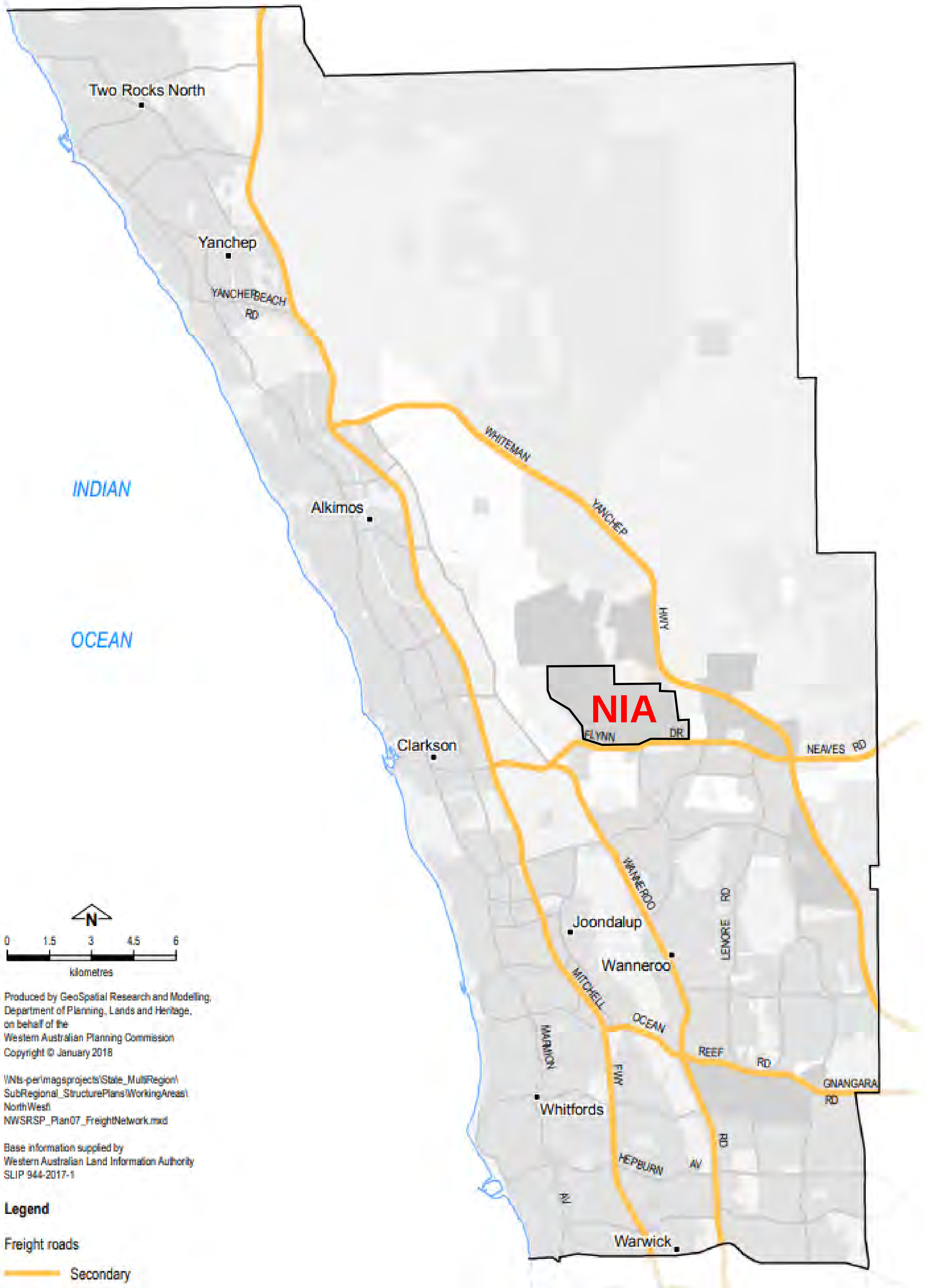


Figure 3-7 North west corridor freight transport routes 2050 (*Perth and Peel @ 3.5 Million*)

3.3.4 Walking access

The *Perth and Peel @ 3.5 million Transport Network* indicates that as the city grows, there will be more emphasis on providing high-quality, safe, and comfortable pedestrian and cycling infrastructure, especially around areas of greater activity. In addition, there will be more travel choices available to encourage increased use of public transport, walking and cycling.

3.4 Draft Perth Long Term Cycle Network

Cycling routes in and around the NIA that are currently included in the DoT *Draft Perth Long Term Cycle Network* are shown in Figure 3-8. Primary routes are shown in red, secondary routes in blue and local routes are in green. These are indications only and the final alignments and form of these routes are yet to be determined.

Figure 3-8 Proposed cycling routes (*Draft Perth Long Term Cycle Network*)

3.5 City of Wanneroo Long Term Cycle Plan

To facilitate a cycle friendly environment that is desirable, accessible, and attractive to a variety of users and provides a credible alternative to vehicle use for trips up to 10 km in length, the City has developed a Long Term Cycle Network Plan. The proposed network within and surrounding the NIA is shown in Figure 3-9. It shows a connected network for commuter cyclists that links regional and district facilities as well as providing internal connections within the NIA. These internal connections include cycle routes along Flynn Drive, Orchid Road, Pinnacle Drive, Wattle Avenue West, and Wattle Avenue East.

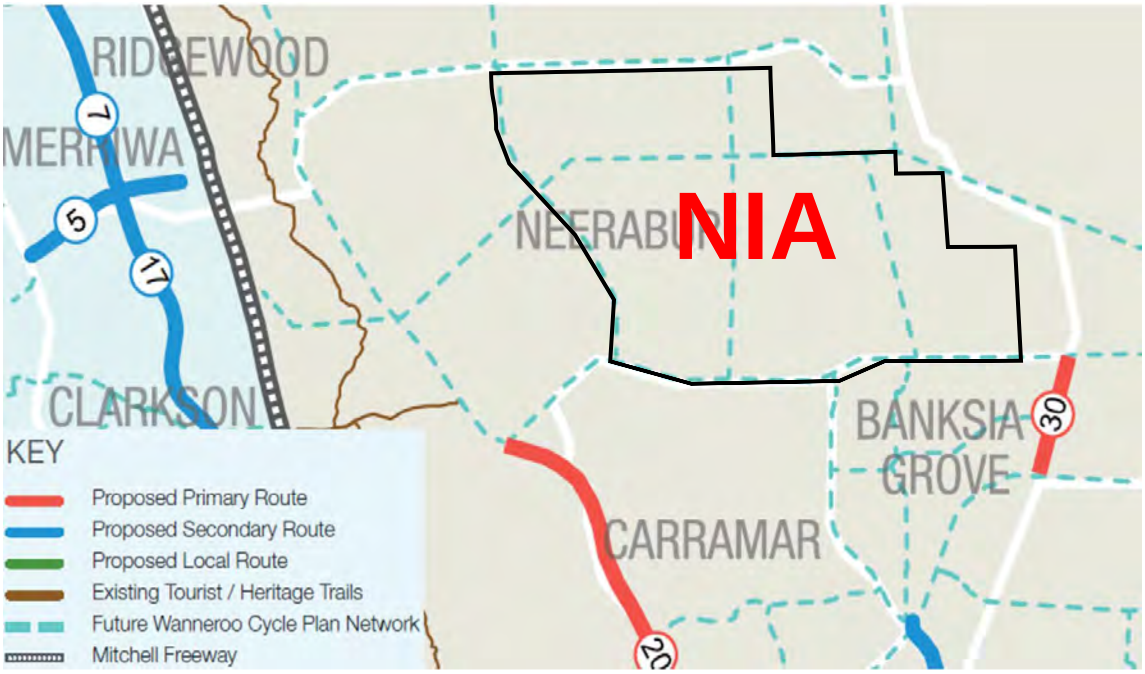


Figure 3-9: City of Wanneroo Long Term Cycle Network

3.6 City of Wanneroo Transport Strategy 2019/20

A review of the *City of Wanneroo Transport Strategy 2019/20* in relation to the NIA and major road network provides the following.

The City has a strong economic base that relies heavily on the regional road network for its freight transportation, particularly around industrial areas such as Neerabup and Wangara. The City's freight network underpins its capability to meet consumer demand, thereby making a substantial contribution to the prosperity and liveability of its community.

In the future, new freight routes will be provided in the City to allow for increased economic opportunities. These will include connections between Neerabup and Muchea and Neerabup and Fremantle. The new Whiteman–Yanchep Highway will connect the North-West sub-region to the North-East and Central subregions and broader regional road network. Neaves Road–Flynn Drive will be upgraded to a primary distributor to improve its capacity and efficiency for freight. It will provide an important east–west link to the North-East subregion.

The City's Transport Strategy will function concurrently with the City's Economic Development Strategy which outlines the need for strategic transport connections between homes and employment precincts. Redevelopment areas such as the Wanneroo Town Centre, Neerabup, and Wangara, are of high importance to achieve stronger connections. The City will undertake upgrades to non-motorised and public transport infrastructure to strengthen these links.

3.7 Future changes to the external major road network

3.7.1 ROM24 network

GHD requested the ROM24 network for 2041 from MRWA. A plot was received and is based on the Mitchell Freeway Extension project case network and land use assumptions (Figure 3-10). MRWA advised that as a strategic model, the broad input assumptions made at the metropolitan level can have a strong influence on the projected traffic in local areas; the provided projections are indicative only and should be adjusted using observed counts with a valid procedure. The Whiteman-Yanchep Highway is not identified as part of the network and will impact volumes on

Wanneroo Road and Flynn Drive as surrounding development increases. Developed land use in the NIA is not included in the ROM.

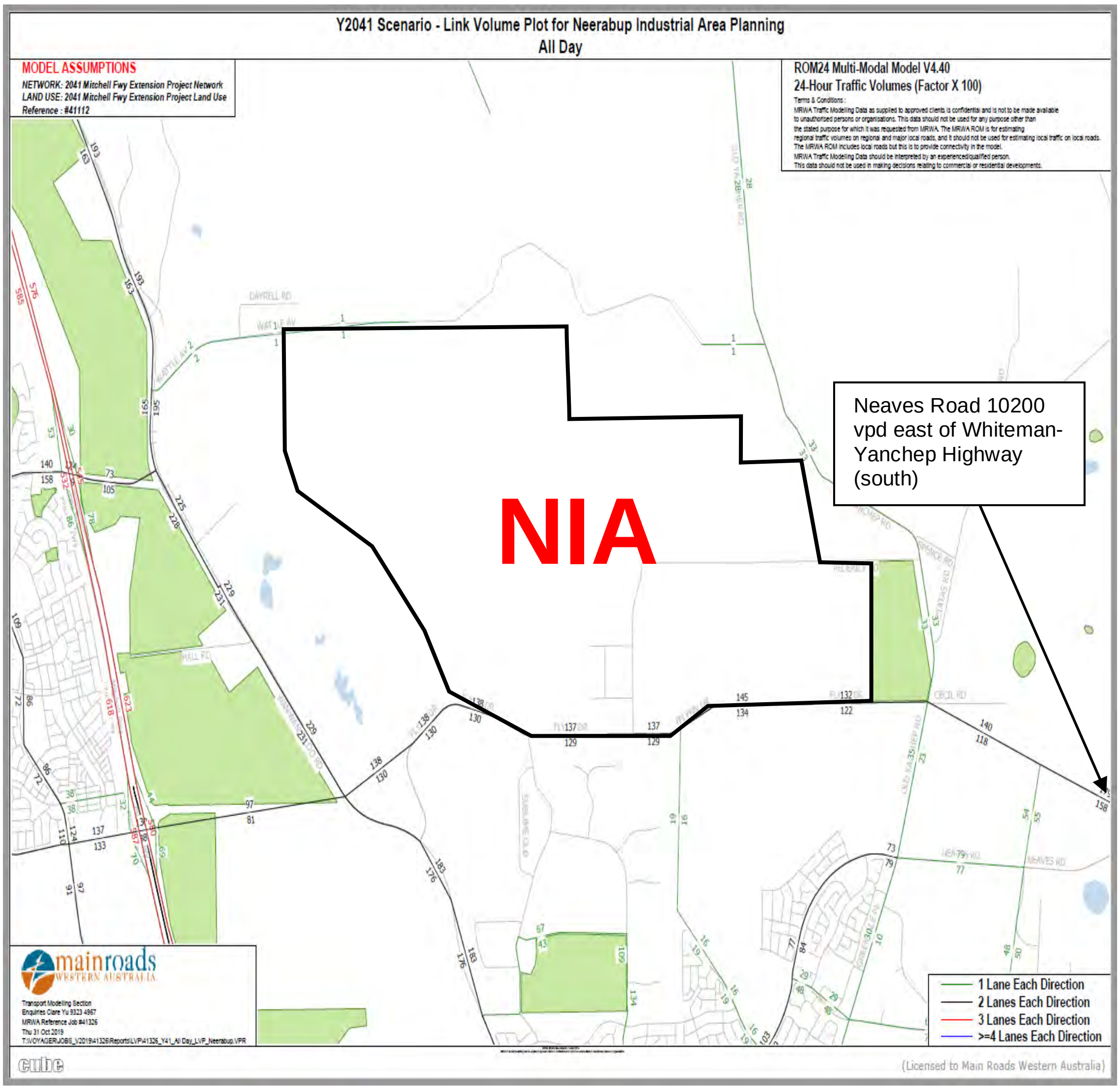


Figure 3-10 ROM24 Plot 2041

The validation plot for 2016 provided by Main Roads has no relevant data for Flynn Drive and therefore, no conclusions can be drawn on the accuracy of the forecast.

The following information is available from the plot for 2041 and includes uncalibrated indicative forecast traffic volumes (figures quoted are in both directions):

- Flynn Drive is two lanes in each direction and is forecast to carry approximately 28,000 vpd west of Old Yanchep Road (east of Pinjar Road) and 25,800 vpd just east of Old Yanchep Road linking to Neaves Road.
- Neerabup Road is forecast to carry around 18,000 vpd west of Wanneroo Road connecting to Mitchel Freeway to the west.
- Old Yanchep Road is one lane in each direction and is forecast to carry around 6,000-7,000 vpd.
- Wanneroo Road is two lanes in each direction and is forecast to carry around 46,000 vpd.

- Neaves Road is one lane in each direction and is forecast to carry 10,200 vpd east of Whiteman-Yanchep Highway (south).
- Whiteman-Yanchep Highway is forecast to carry 23,800 just south of Neaves Road.
- The road network within the NIA is not included in the ROM24 model.
- Mitchell Freeway is upgraded to three lanes in each direction.

Austroads and Road Reserves Review joint study for the Department of Planning and Urban Development, Department of Transport, Main Roads Department, and Transperth (1991) indicates the following road capacity based on a level of service of C:

- Urban arterials four lanes divided carriageway 38,000 vpd.
- District roads one lane in each direction 8,000-12,000 vpd.

The forecast traffic volumes are within the capacity of the road cross sections identified. Whilst no internal roads are included, it is clear from the Structure Plan forecasts (Figure 3-2) that major controlled intersections will be required with Flynn Drive to include traffic signals or roundabouts.

As indicated in Section 3.7.4, the Whiteman-Yanchep Highway (Gnangara Road to Neaves Road) is initially planned to connect Tonkin Highway and Neaves Road and this section is forecast to be required by 2031. It will eventually provide a strategic link to Mitchell Freeway in the Yanchep area when Perth's population reaches 3.5 million. The Whiteman-Yanchep Highway connection to the north will impact traffic volumes along Flynn Drive and Wanneroo Road as the area develops. Further ROM modelling by Main Roads WA including the Whiteman-Yanchep Highway was requested to quantify the impacts, however following discussion with Main Roads, it was advised that this has not been modelled and is not part of the ultimate modelled network at this stage. The Whiteman-Yanchep Highway is not yet within the Metropolitan Region Scheme (MRS).

As part of the major road network changes indicated in the *Perth and Peel @ 3.5 Million Transport Plan*, this link should be modelled. However, road networks within the 14 km section of Whiteman-Yanchep Highway, road connections and land use will be major considerations before this can be done.

In view of the relatively low traffic volumes on Old Yanchep Road to 2041 without the Whiteman-Yanchep Highway north connection, access to the NIA from this road is anticipated to remain adequate in the short term should the highway not be constructed, subject to intersection upgrade as development volumes from NIA warrant. To accommodate the longer-term volumes from the NIA should the northern connection of the highway not be constructed, Old Yanchep Road would need to be upgraded from a single carriageway to a dual carriageway with two lanes in each direction and intersection upgrade to include turn lanes.

Flynn Drive will require significant upgrade to a dual carriageway with two lanes in each direction to accommodate forecast traffic volumes with or without the NIA and with or without the Whiteman-Yanchep Highway extension.

3.7.2 Road Planning Study East Wanneroo District Structure Plan, 11 September 2019 – DPLH

The DPLH undertook a collaborative, multidisciplinary planning study to review and provide updated road concept plans for the network in East Wanneroo, in support of the proposed East Wanneroo District Structure Plan. The document includes forecast traffic volumes to 2051 using STEM (Figure 3-11). Flynn Drive is forecast to carry 32,000 vpd in 2051.

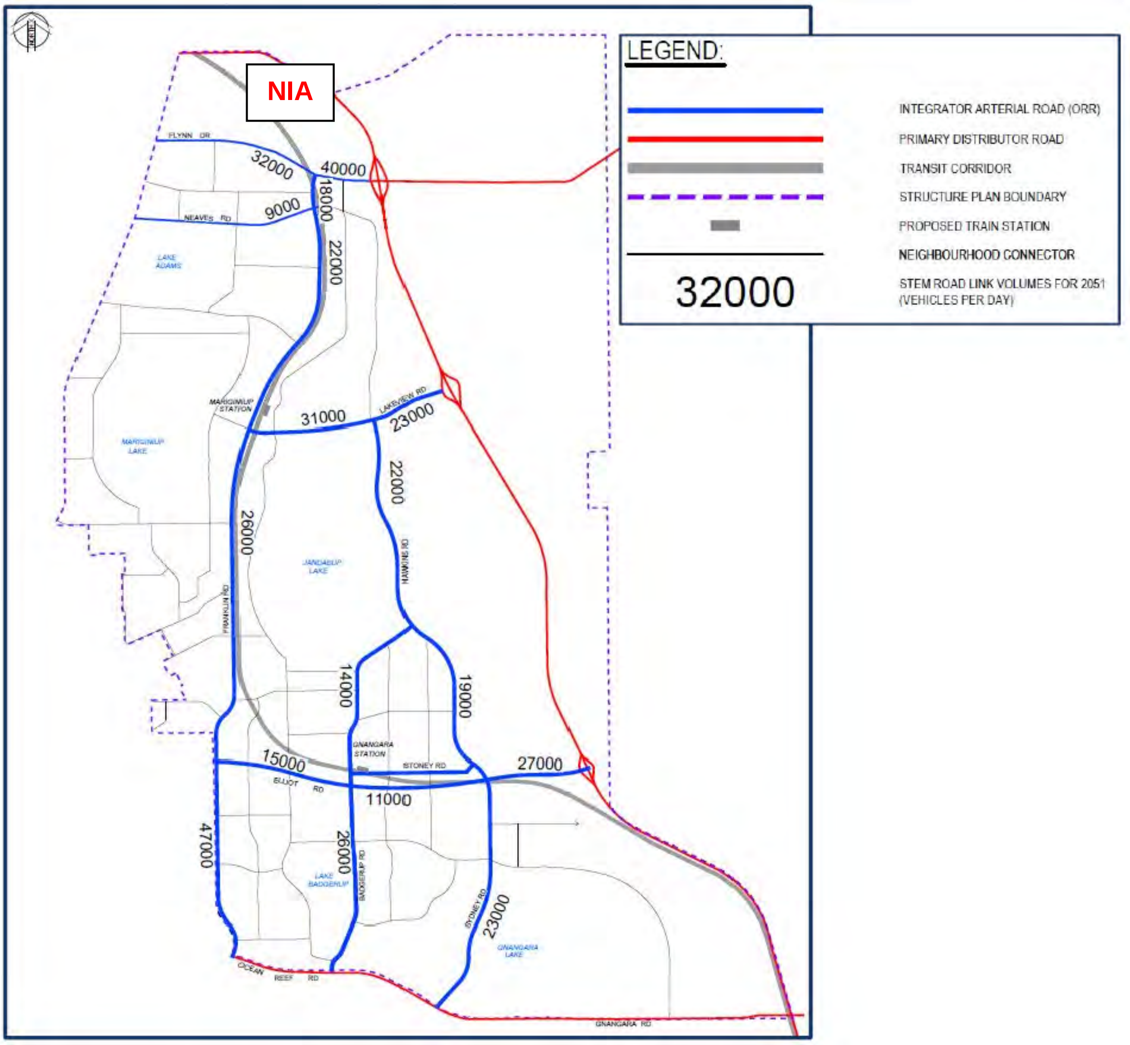


Figure 3-11 East Wanneroo STEM Link Volume Plots 2051 (DPLH)

3.7.3 Mitchell Freeway extension

Planning is underway for the extension of Mitchell Freeway from Hester Avenue to Romeo Road (Figure 3-12). Construction will align with the Yanchep Rail Extension and is planned to commence in March 2021. A reservation for the freeway extension is included in the MRS. Construction is anticipated to be completed by late 2023.

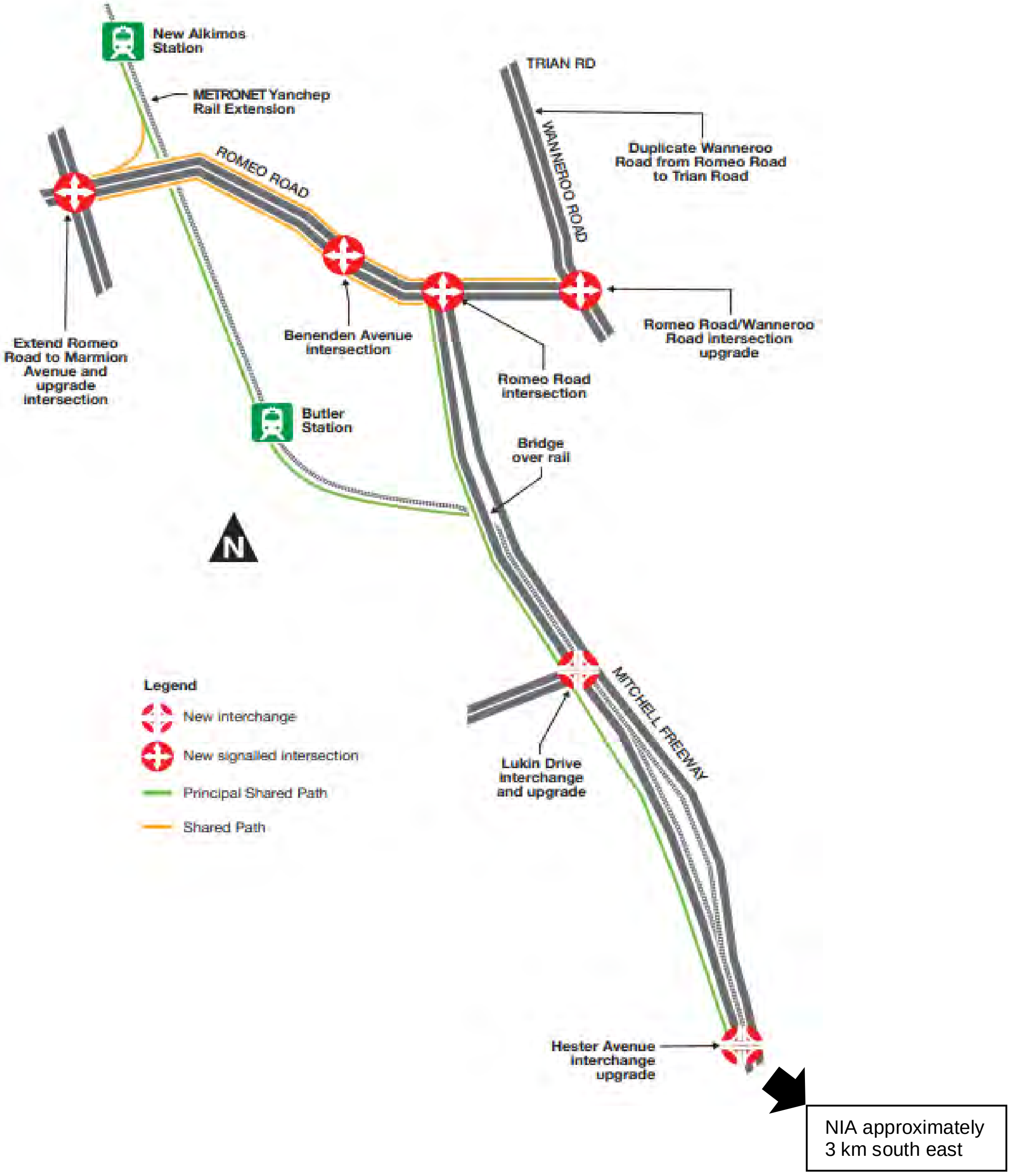


Figure 3-12 Planned Mitchell Freeway extension to Romeo Road (MRWA)

3.7.4 Whiteman Yanchep Highway (Gnangara Road to Neaves Road)

MRWA is undertaking an Alignment Definition Study to identify and protect the road reservation for a future Whiteman Yanchep Highway, between Gnangara and Neaves Roads. The Whiteman Yanchep Highway is a proposed new north-south route in the north west corridor of Perth. It is initially planned to connect Tonkin Highway and Neaves Road and this section is forecast to be required by 2031. It will eventually provide a strategic link to Mitchell Freeway in the Yanchep area when Perth's population reaches 3.5 million. Planning for the section between Tonkin Highway and Gnangara Road was undertaken as part of the NorthLink WA project.

The Alignment Definition Study has been conducted in close consultation with key stakeholders, including local government. It has included transport modelling and traffic analysis, preparation of a planning design concept, an environmental impact assessment and a noise impact assessment.

Benefits identified in the MRWA project update include:

- Improved connectivity between planned urban development and employment centres.
- Facilitated movement of regional freight and commuter traffic.
- Potential facilitation of future public transport development as it will include space for heavy rail within the median.

It is important to note this is a planning study only and no funding is currently available for construction. The initial stage is shown in Figure 3-13.

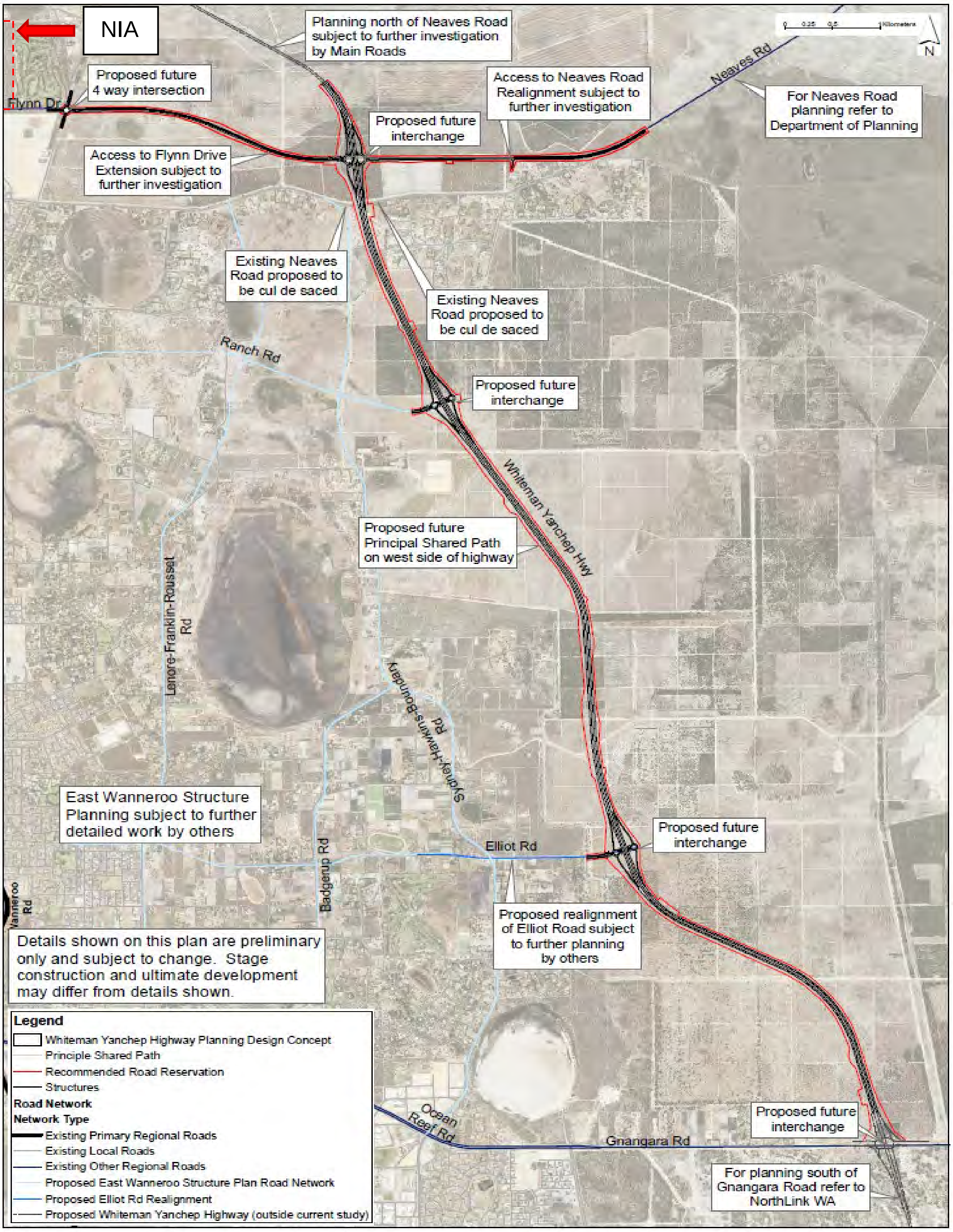


Figure 3-13 Whiteman-Yanchep Highway, Gnangara Road to Neaves Road (MRWA)

3.7.5 Neaves Road

The City of Swan directed GHD to the *City of Swan Transport Strategy* (September 2014) which identifies the possibility that Neaves Road west of Tonkin Highway/Perth Darwin National Highway (PDNH) may become a Primary Regional Road (PRR) in the future.

The *North-East Sub-Regional Planning Framework* (DPLH 2018) indicates Neaves Road is an important east-west link that connects the North-West sub region to the North-East sub-region. It provides access to PDNH, the Bullsbrook and Muchea employment nodes, and the planned Bullsbrook intermodal terminal (IMT). Neaves Road provides the freight connector to other routes to the west of Bullsbrook.

Previous discussion with MRWA indicates that GNH, PDNH and Stock Road (and possibly Neaves Road to the NIA) are being designed to accommodate RAV 7 vehicles. MRWA also advised that staging triggers for Neaves Road improvements have not been established, however they did confirm that it will be a PRR west of PDNH and an ORR east of PDNH.

Neaves Road provides a major east-west route linking Perth's north east and north west corridors and is forecast to carry approximately 9,000 vpd by 2031. In the *Transport @ 3.5 Million Plan*, Neaves Road (west of PDNH) is identified as a Secondary Freight Route. It is proposed to be connected to GNH via Rutland Road, including an overpass of the freight rail line and a connection to Railway Parade. This will provide a connection between Mitchell Freeway in the west to PDNH and GNH in the east. Freight between the Bullsbrook Industrial Area and the NIA is expected to almost entirely be via Neaves Road.

As shown in Figure 3-14, the Neaves Road/PDNH interchange provides for a flyover at Neaves Road with no opportunity for an east west HWL link at this stage, however opportunities could be further examined to incorporate a bypass route to access and exit PDNH. Feasibility of this would be required to determine whether the Rutland/Neaves Road route could be used to connect HWLs between GNH and the NIA.

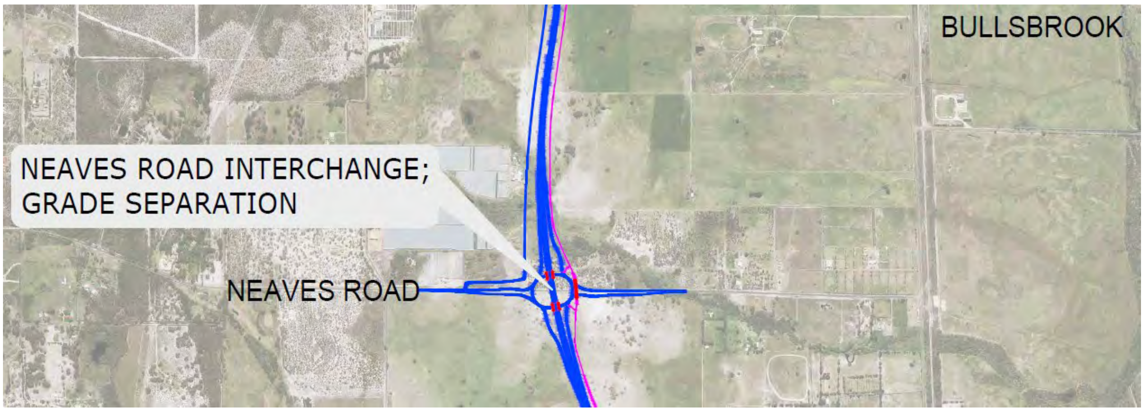


Figure 3-14 Neaves Road/PDNH (MRWA)

3.7.6 Great Northern Highway

GNH will remain as an important transport route, though most freight traffic will be reallocated to Tonkin Highway/PDNH. It is expected that truck traffic to and from the Eastern States would continue to use the more direct route via GNH, unless regulatory controls were instituted. The largest HWL and over size over mass (OSOM) vehicles will continue to use GNH as Tonkin Highway/PDNH has not been designed and built to accommodate the largest vehicles.

GNH already allows for RAV 7 and OSOM in a 10-metre-by-10-metre envelope and that is likely to remain the case, although the volumes of RAV 7 vehicles on GNH are expected to decrease now that Tonkin Highway/PDNH is open (April 2020).

3.7.7 Tonkin Highway/Perth Darwin National Highway

The design of Tonkin Highway/PDNH (south of the Brand Highway interchange) has been based on a 36.5 metre vehicle. As shown in Figure 3-15, the OSOM clearance along Tonkin Highway/PDNH is 8.5-metres wide by 6.5-metres high north of the Stock Road interchange, and 7-metres wide by 6.5 metres high to the south. The clearance under the bridge carrying Tonkin Highway/PDNH over Stock Road is 8.5-metres wide by 6.5-metres high (northbound).

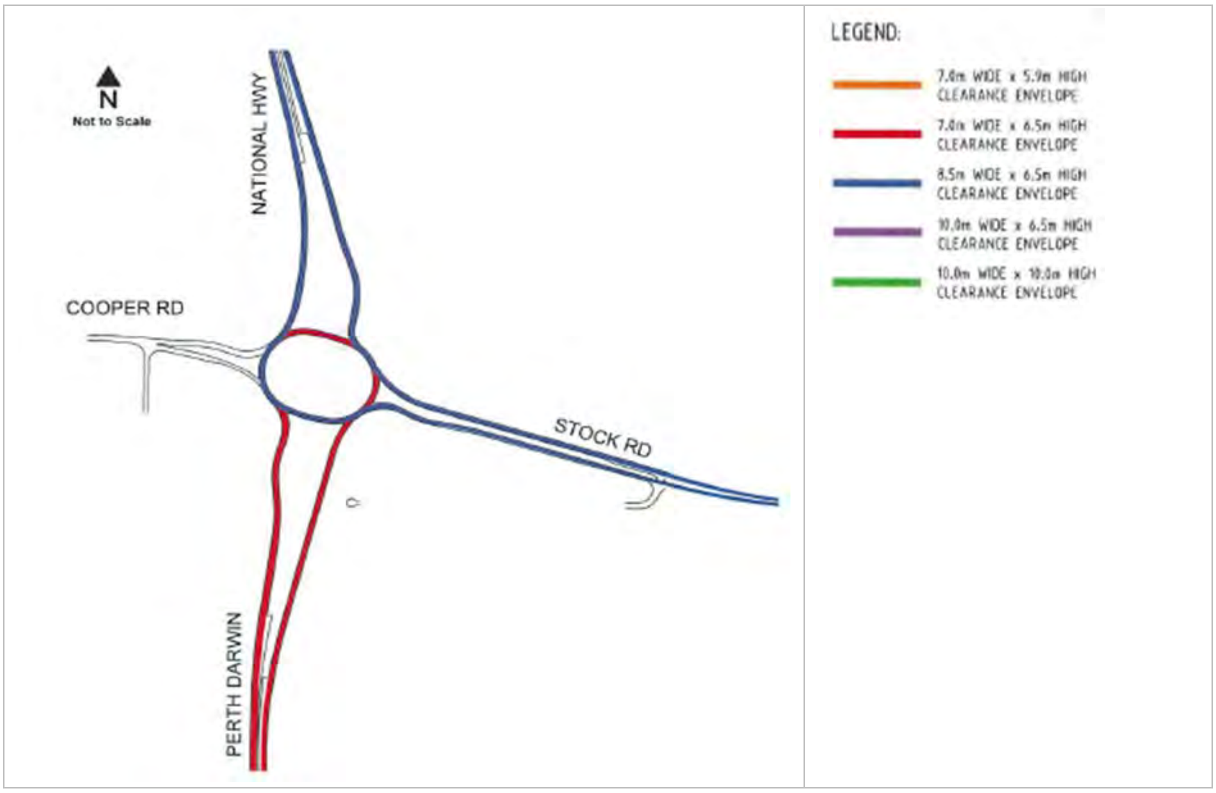


Figure 3-15 Stock Road and PDNH OSOM clearance envelopes (Main Roads WA)

As indicated in section 3.7.6, Tonkin Highway/PDNH, the northern section of NorthLink, opened in April 2020.

4. Updated Structure Plan

The following section is an analysis of the transport considerations identified as part of the review undertaken of ASP17 and consequential draft updated structure plan concept.

4.1 Traffic modelling

4.1.1 Modelling methodology

The NIA site area was divided into ten development zones and each road link numbered. GHD estimated the total site area available for development within each zone, with a 60% site area estimate used to inform the GFA developed within each lot / zone (as per the *Economic and Employment Strategy* for the NIA).

An adopted trip rate for each land use group was developed through collaboration with the City (see Table 12), and this was applied to the GFA to establish a daily trip volume for each zone.

Forecast traffic/trip distribution (as shown in Table 13) was then applied to external destinations. A route from each zone to each destination was determined and input into the model. The model then calculated the total daily trips on each link (Figure 4-1). These were then reviewed and finalised.

4.1.2 Average trip rates

ASP 17 was premised on the following average trip rates:

- 5.5 trips per 100 m^2 of gross floor area (GFA) adopted for the industrial area.
- 9.7 trips per 100 m^2 GFA adopted for business park land uses.
- 30% site coverage for industry use.
- 50% site coverage for business park use.

Table 12 lists the land use groupings to be contained within the proposed structure plan, along with the corresponding average trip rate per 100 m^2 of GFA that was identified and adopted for modelling purposes.

Table 12 Average trip rate by land use group

Land use group	Average trip rate/100 m^2 GFA Trip rate adopted for modelling purposes rate/100 m^2
Extractive/Mining/Basic Raw Materials	5
General Industry	5
Light/Commercial	12
Business Services	15

Considerable review and discussion was undertaken with the City of Wanneroo to arrive at suitable average trip rates and all modelling has been undertaken on this basis. Trip rates have been determined from a review of the following:

- NSW Transport Roads and Maritime Services (2013)
- WAPC Guidelines (commercial)
- RTA Guide to Traffic Generating Development (2002) (commercial)
- Cockburn Central East Structure Plan (Mixed business)
- GHD surveys of at 11 Business Parks in 2012
- GHD survey Manns Road industrial estate, NSW

4.1.3 Forecast traffic distribution

Forecast traffic distribution for the NIA is shown in Table 13. It is based on the distributions anticipated following completion of the major external road network.

Table 13 Forecast traffic distribution

A North via Wanneroo Rd	B South via Wanneroo Road	C West via Neerabup Road	D South via Pinjar Road	E North via New Highway	F South via New Highway	G East via Neaves Road	H South via Mitchell Freeway	J North via Mitchell Freeway
10%	10%	12.5%	5%	7.5%	15%	15%	12.5%	12.5%

Applying the average trip rates to the GFA proposed for each land use group within the NIA results in a traffic generation of around 260,000 vpd. Forecast traffic volumes for each link after applying the distributions listed above are shown in Figure 4-1.

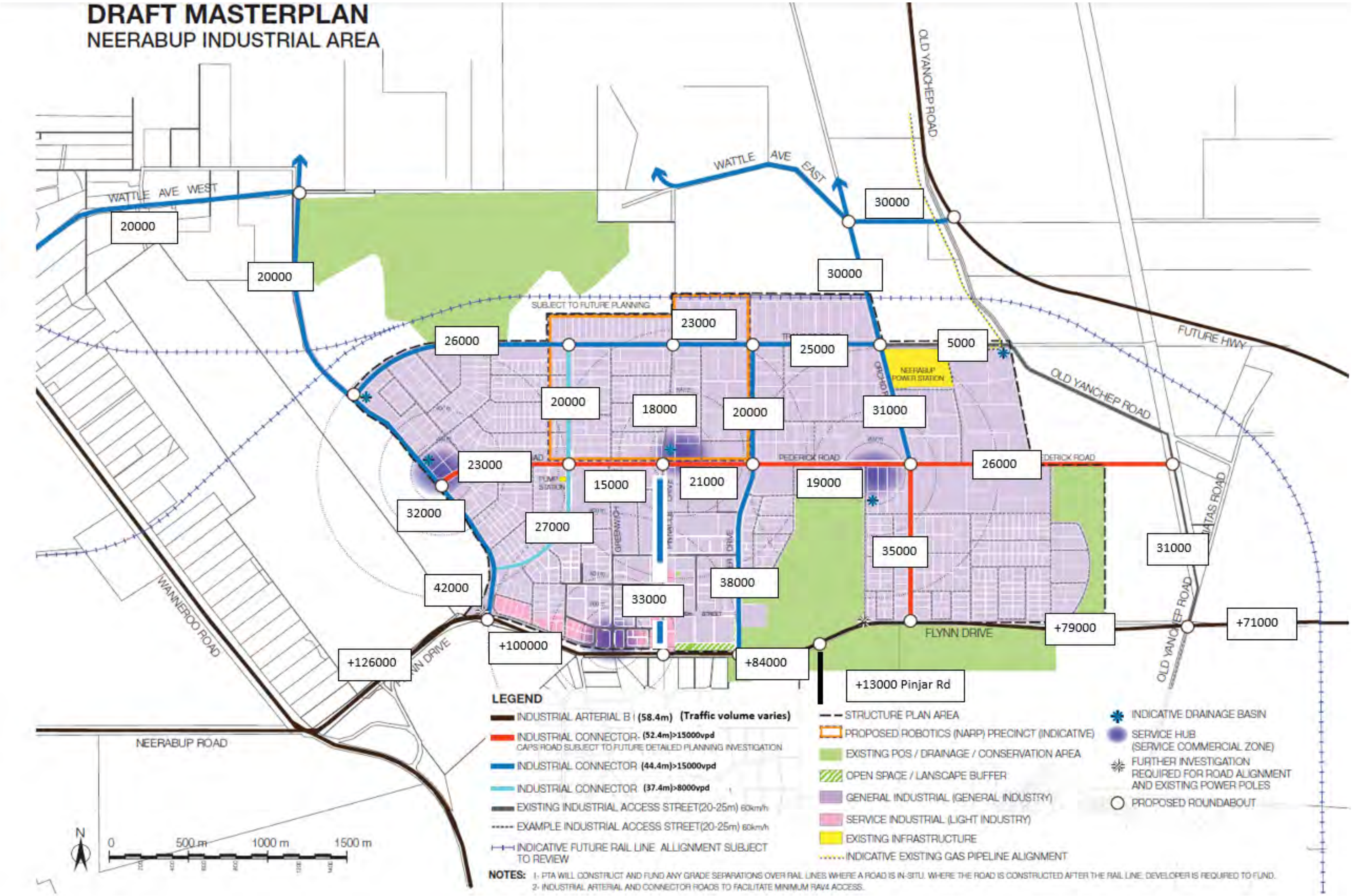


Figure 4-1 Proposed NIA Masterplan and forecast daily traffic volumes on full development

4.1.4 Key observation – Flynn Drive

Traffic modelling undertaken for the NIA indicates significant additional volumes on Flynn Drive upon full development as proposed (up to 126,000 vpd (two way) at the western end approaching Wanneroo Road). This is due to the high mode share of private vehicle travel to/from the NIA and the mix of land uses proposed within the NIA which includes a significant amount of higher trip generating development. Flynn Drive will be the main distributor for a large proportion (57.5%) of traffic to/from the NIA, as many vehicles seek to access Flynn Drive to travel south via Wanneroo Road or the Mitchell Freeway, west towards the coastal suburbs and north via the Freeway. The ultimate land use mix may therefore need to be further reviewed to reduce overall traffic generation.

Main Roads WA provided ROM forecasts for Flynn Drive; however, at the time of writing, the ROM did not include land use for the NIA at full development as proposed, nor did it include future major road connections (such as the northern section of Whiteman-Yanchep Highway). As a result, current available ROM forecasts are lower than indicated in this report. Liaison with Main Roads WA during the period of the study indicated they did not have a timeline when the ROM would be updated. Overtime as the NIA is developed, there could be an opportunity to revisit the proposed land uses to reduce the higher trip generating development.

4.2 Internal major road network

4.2.1 Road cross sections

The forecast traffic volumes upon full development of the NIA, as shown in Figure 4-1, will require dual carriageway construction and intersection control consisting of a combination of roundabouts and traffic signals.

Table 14 lists the proposed road cross section widths to be contained within the updated structure plan.

It is understood Pinnacle Drive has subdivision approval to have a 35 m-wide road reserve width, including 2 x 8.5 m carriageways, 6 m median, 2 x 6 m verges. Forecast traffic volumes are 33,000 vpd which would place it as an industrial connector – major.

Table 14 Recommended NIA road cross sections

Road Type (NIA road)	Max speed limit (km/h)	Forecast traffic volumes (vpd)	Recommended road reserve	Recommended cross section
Industrial access road (local roads)	50	Not modelled	20 m (1 x 10 m carriageway, 2 x 5 m verges)	Figure 4-2
Industrial connector – minor	50	Not modelled	25 m (1 x 10 m carriageway, 2 x 7.5 m verges)	Figure 4-3
Industrial connector – major on Figure 4-1	60	To 27,000 vpd (LoS C capacity 38,000 vpd)	37.4 m (2 x 9.2 m carriageways, 7 m median, 2 x 6 m verge minimum)	Figure 4-4
Industrial connector - major on Figure 4-1	60	To 42,000 vpd (LoS C capacity 38,000 vpd)	44.4 m (2 x 12.7 m carriageways, 7 m median, 2 x 6 m verge)	Figure 4-5
Industrial connector CAPS[4] Road on Figure 4-1	60	To 26,000 vpd (LoS C capacity 38,000 vpd)	52.4 m (2 x 5 m verges, 2 x 6 m access road, 2 x 3 m verge, 2 x 9.2 m carriageway, 6 m median)	Figure 4-6 Subject to future detailed planning
Industrial arterial (Flynn Drive)	70	>15,000 vpd	52.4-58.4 m (2 x 13.2 m carriageways, 15 m median, 2 x 5.5-8.5 m verges minimum)	Figure 4-7

Note: CAPS most likely to be used at Pederick Road.

Figure 4-2 to Figure 4-7 show potential cross sections for streets within the NIA[5]. Construction of the major internal roads should be staged, starting with a single carriageway until ultimate volumes warrant a dual carriageway.

It is understood Pinnacle Drive has subdivision approval to have a 35 m-wide road reserve width, including 2 x 8.5 m carriageways, 6 m median, 2 x 6 m verges. Forecast traffic volumes are 33,000 vpd which would place it as an industrial connector – major.

The ultimate road reserves accommodate swale drains, services, LWMS, and street lighting requirements.

[4] CAPS = Controlled Access Places

[5] The cross sections shown are for illustrative/example purposes only. Streets can be arranged subject to requirements (e.g., bicycle paths can be placed in the verge rather than in the carriageway, etc.). If Flynn Drive becomes a Primary Distributor, MRWA will determine road cross section and reserve.

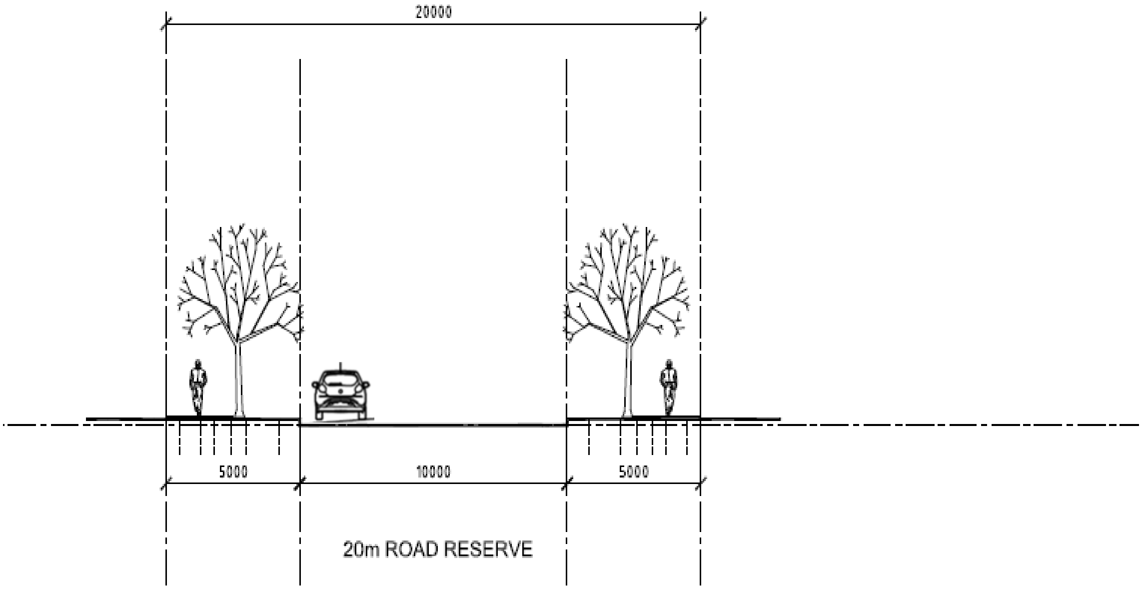


Figure 4-2 Industrial Access Street

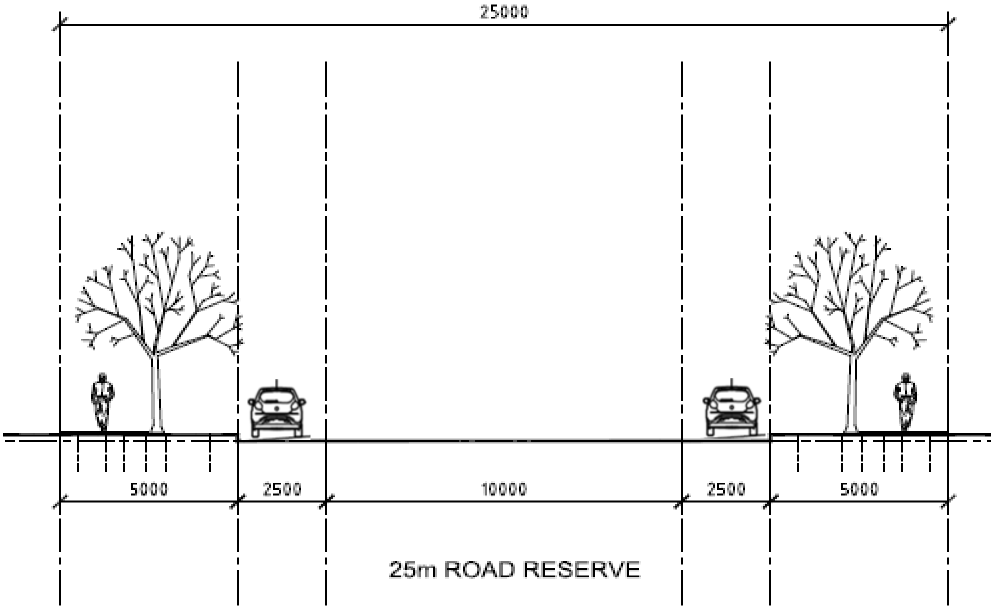


Figure 4-3 Industrial Connector Minor (embayed parking)

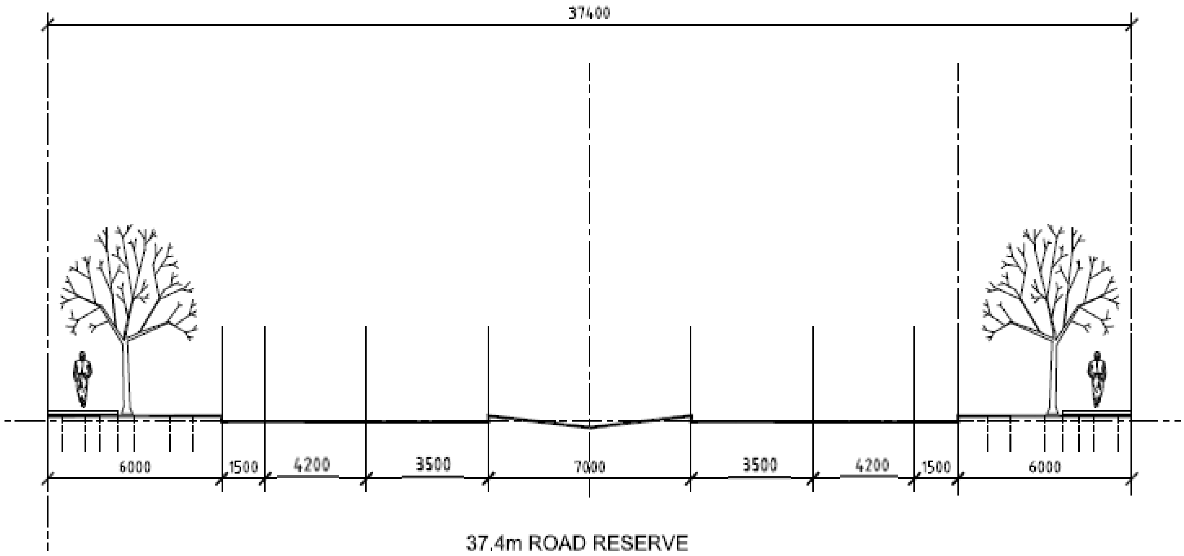


Figure 4-4 Industrial Connector (Major B)

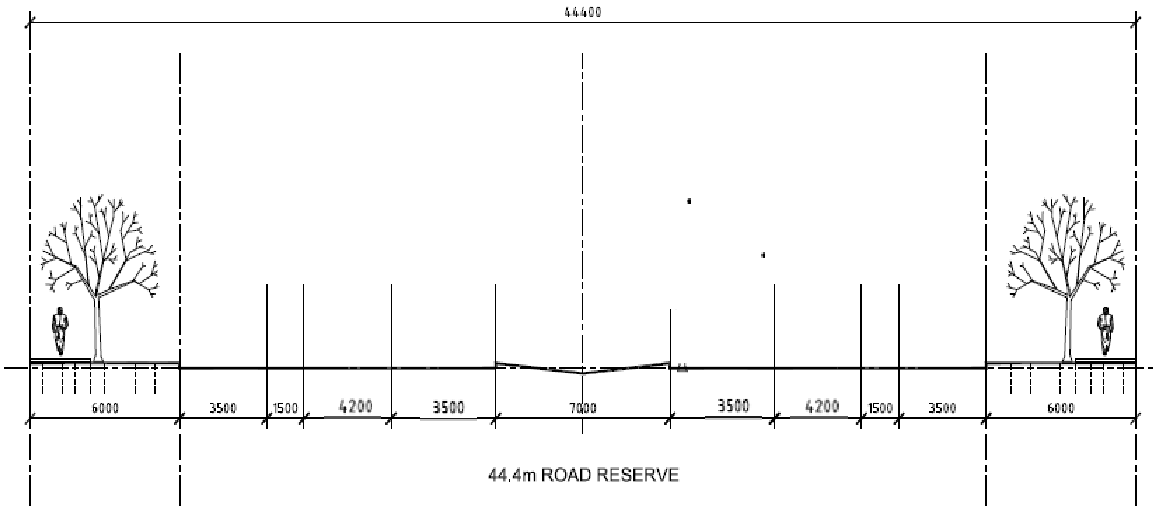


Figure 4-5 Industrial Connector with turn lane (Major A)

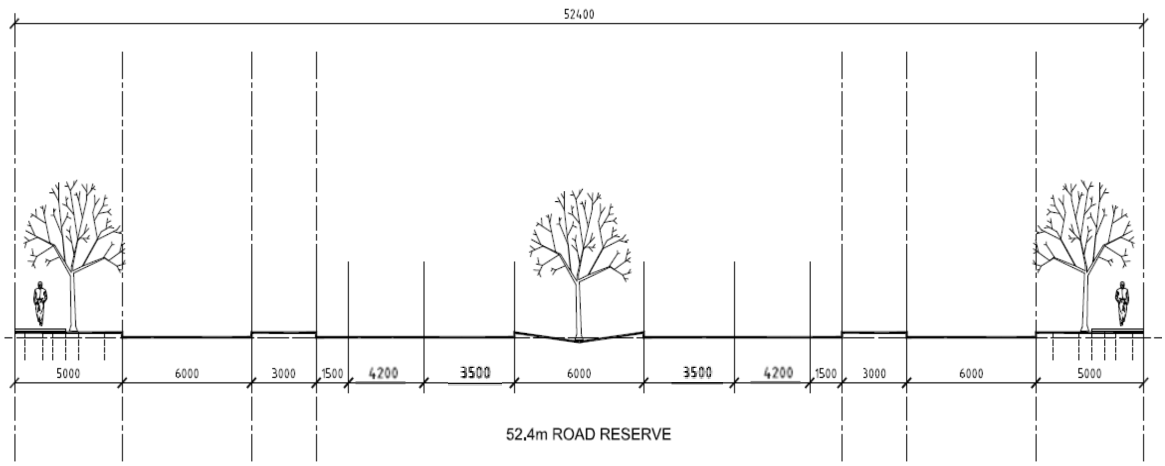


Figure 4-6 Industrial Connector (major) CAPS

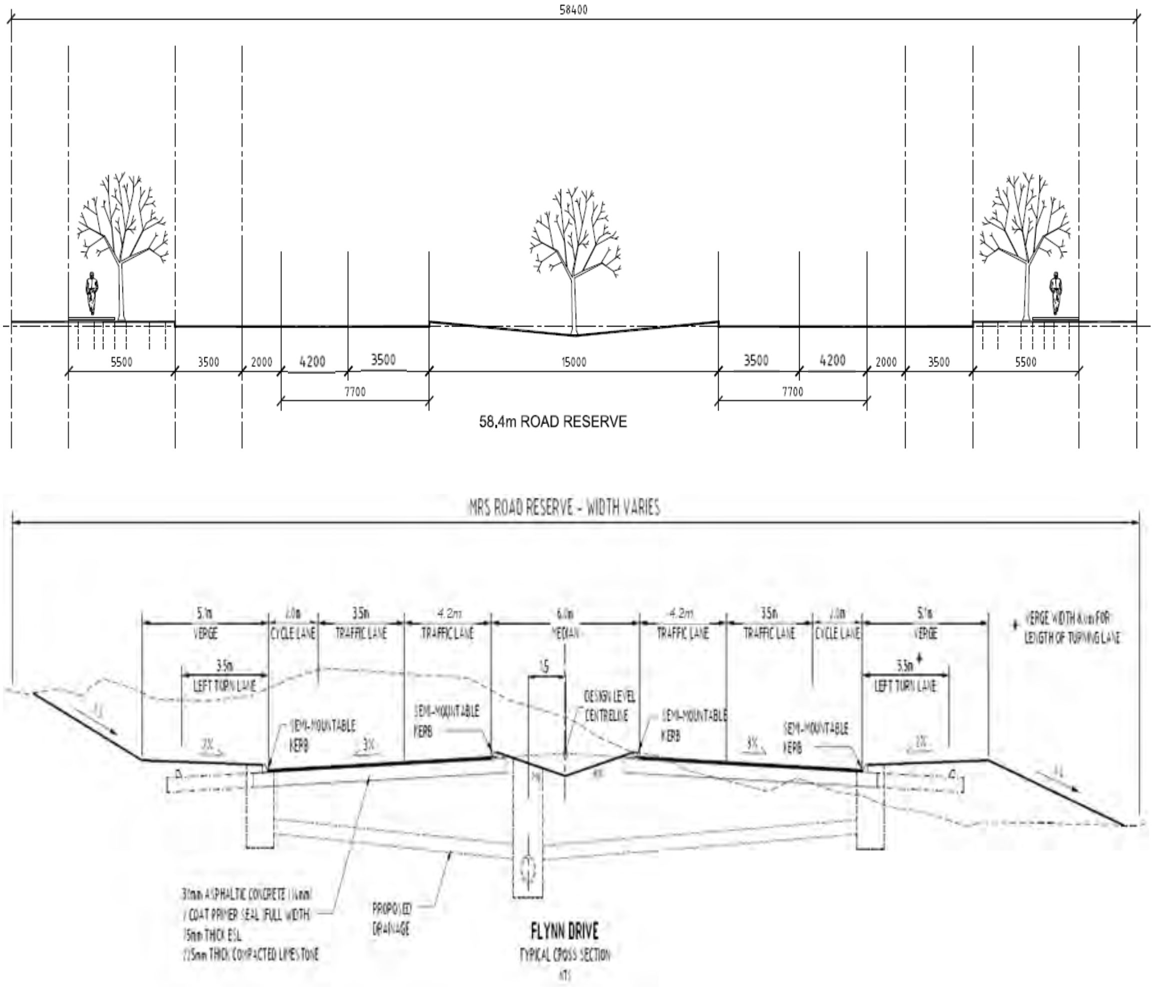


Figure 4-7 Industrial Arterial B Future Primary Distributor (Flynn Drive) – two arrangements

4.2.2 On street parking

The associated *Neerabup Structure Plan Car Parking Strategy* indicates formalised on street parking, whether it be paid or free, that is appropriately designed and located should be considered on streets that feature lot sizes under 5,000 m^2, where there is limited further subdivision potential and/or adjacent “service hub” precincts which would benefit from having some provision of on street parking.

In principle, for locations with lot sizes between 5,000 m^2 and 10,000 m^2, each land use should accommodate car parking on-site, however on-street parking provision could be permitted dependent upon land use typology, traffic volumes and road function. On-street parking may be in the form of embayed parking or verge side, depending on the context. Subdivision or development applications which propose one or the other should be accompanied by a traffic assessment in this regard. Where traffic volumes exceed 6,000 vehicles per day, any on-street provision needs to be carefully considered and located accordingly.

Land uses that occupy larger lots greater than 10,000 m^2 (e.g., large warehouses, etc), are not likely to require, or benefit from, on street parking. Furthermore, these lots will primarily be located on higher category roads, which would not be conducive to on street parking.

Local roads with a 20-25 m road reserve, a 10 m carriageway and low traffic volumes would support on street parking, either in the carriageway or via embayments. However, the provision/ location and form of any on-street parking should be further assessed at subdivision stage.

4.2.3 Controlled Access Places (CAPS)

Reference is made to *DC Policy 1.7 General Road Planning*. The document describes CAPS as follows:

This option is a modified service road concept which provides a combined driveway and parking facility as well as a cycling surface. It has the following features:

- *increased road reserve width which improves noise abatement.*
- *improved safety for ingress and egress points along the local distributor.*
- *short lengths between entry and exit points, usually 200 metres or 10 lots maximum.*

The location of these is to be determined, however adjacent to service hubs within the NIA on Pederick Road would be appropriate. If a designated 'CAPS' road is later proposed to not occur, then this road would then become an Industrial Connector – Major (dark blue) and accommodate turn lanes.

4.2.4 Major road intersections

The recommended major road intersection treatments for the NIA have been formulated with guidance from documents identified in section 3.2 and are shown in Table 15.

Table 15 Recommended NIA intersection treatments

NIA road type and major intersection	Signals	Roundabout	Stop/Give-way
Local roads (three-way intersection)	No	Yes, but very limited	Yes
Local roads (four-way intersection)	No	Yes, but limited	Yes
Industrial connector – on Figure 4-9 intersecting with Industrial Connector	Yes, but limited	Yes	Yes
Industrial connector – on Figure 4-8 intersecting with local road	No	Yes, but limited	Yes
Industrial connector – major on Figure 4-8 intersecting with Industrial connector	Yes, but limited	Yes	Yes, but limited
Industrial connector – major on Figure 4-8 intersecting with local road	No	No	Yes
Industrial connector – major on Figure 4-8 intersecting with Industrial Connector	Yes, but limited	Yes	Yes
Industrial connector – major on Figure 4-8 intersecting with local road	No	No	Yes
Industrial arterial - no service road (Flynn Drive)/major intersections	Yes	Yes, where safe and efficient pedestrian crossing facilities are present	No

As shown in Figure 4-8, there are 20 major road intersections in the NIA. These major road intersections are recommended to feature signalised or roundabout treatments.

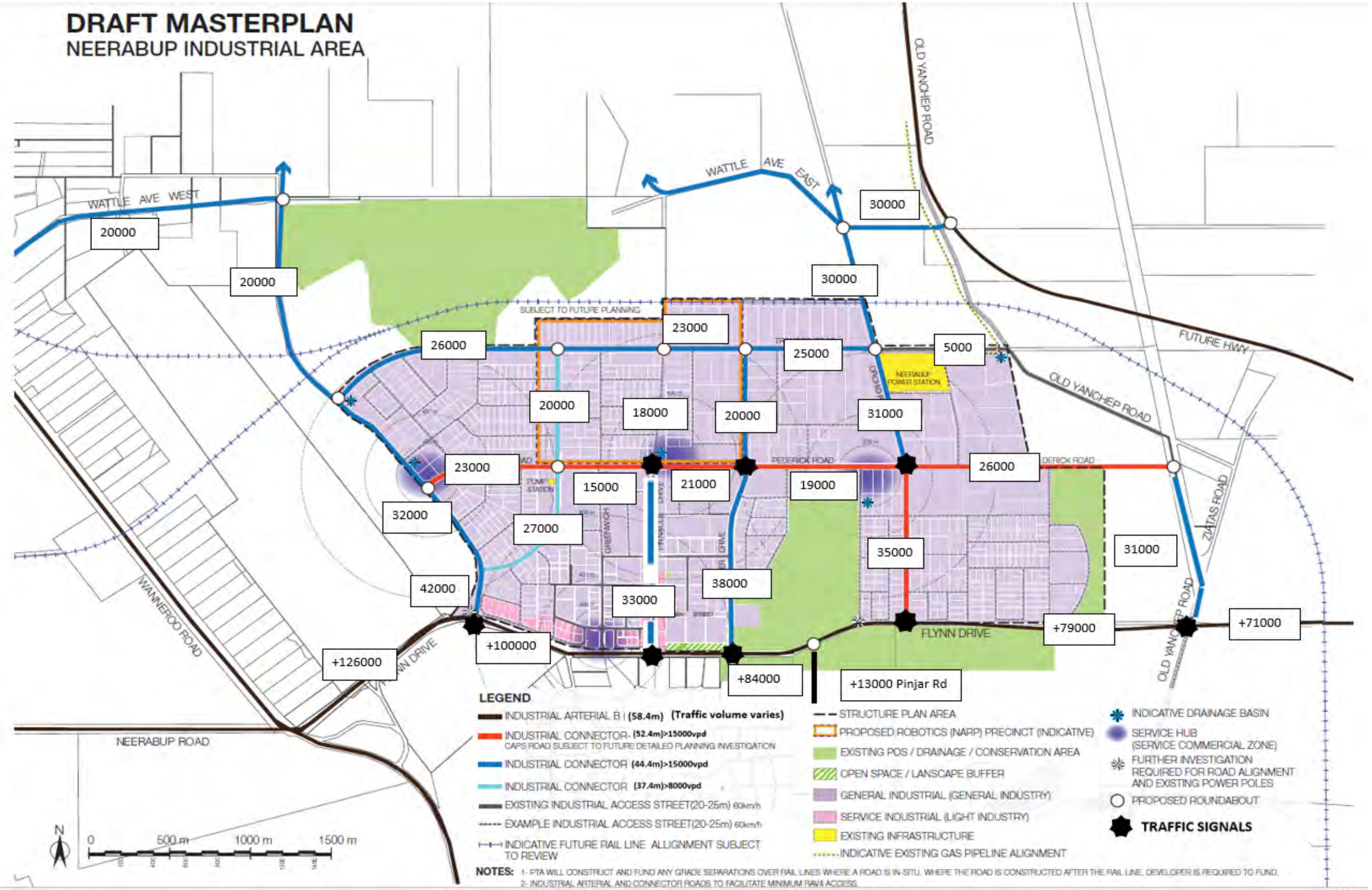


Figure 4-8 Recommended major road intersection treatments in the NIA

Signalised treatments are recommended to be implemented at major road intersections in the central area of the NIA (✸ refers on Figure 4-8), this is because of the high traffic volumes. Further, as central areas will be more likely to feature denser land use and subsequently, higher pedestrian volumes and movements than outer areas of the NIA signalised intersections offer greater pedestrian safety and access than roundabout treatments.

Roundabout treatments are recommended for major road intersections on outer/peripheral areas of the NIA in the earlier stages of development. These areas are likely to feature lower density land use, and as a result, lower pedestrian volumes and movements. Roundabout treatments typically provide better traffic flow than signalised intersection applications but offer reduced pedestrian safety and access.

Major intersections with Flynn Drive will require signalisation when future traffic volumes warrant. Flynn Drive will become a Primary Regional Road reserve under the MRS in the long term. Roundabouts are likely to operate in the short term however analysis for full development indicates they will be over capacity (Section 4.3 refers).

4.3 Road hierarchy

Based on a review of the forecast traffic volumes on the network, the road function, and Main Roads WA Road Types and Criteria, the road hierarchy shown in Figure 4-9 is recommended. Road cross sections in Table 14 apply.

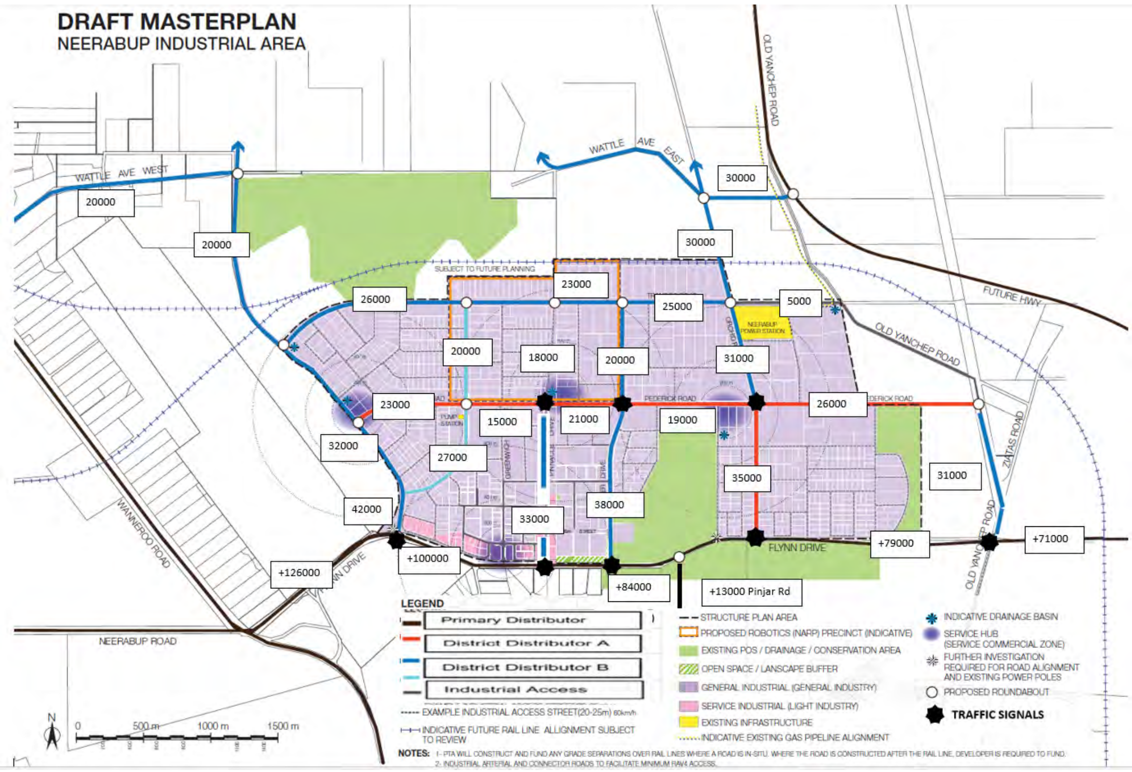


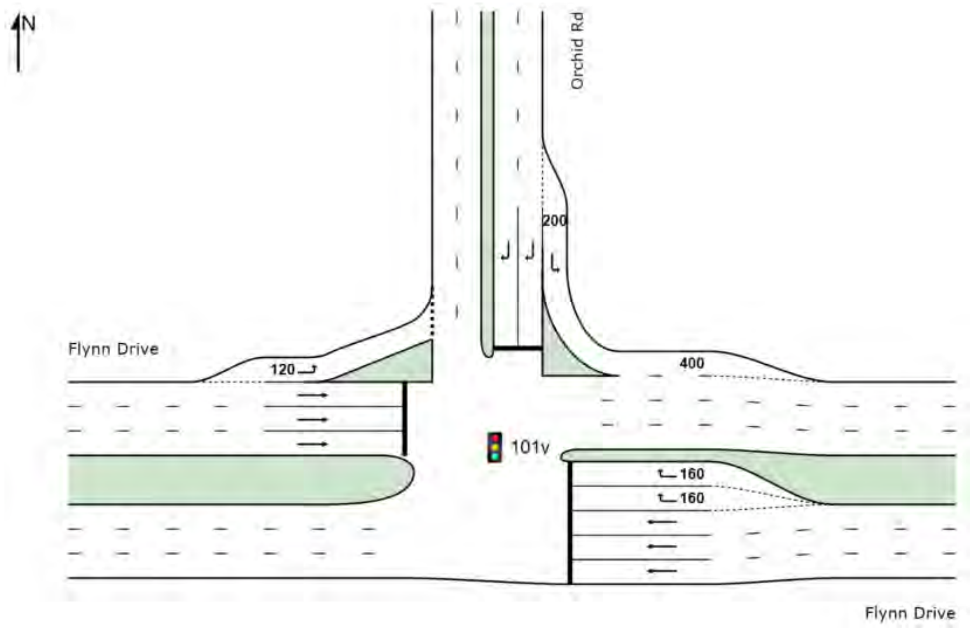
Figure 4-9 Recommended road hierarchy

4.4 Intersection analysis

SIDRA analysis has been undertaken for some key intersections on full development. Based on turning volumes undertaken by GHD, turning proportions have been applied to forecast intersection volumes shown in Figure 4-8. ROM volumes (2041) for Flynn Drive have been adopted.

4.4.1 Orchid Rd/Flynn Drive – full development

The following signalised geometry has been analysed. A PM analysis is shown.



Orchid Rd/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 119 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive														
5	T1	1479	10.0	1479	10.0	* 0.997	112.7	LOS F	46.9	356.7	1.00	1.37	1.80	23.2
6	R2	515	10.0	515	10.0	* 1.003	129.3	LOS F	24.3	184.6	1.00	1.24	2.03	20.2
Approach		1994	10.0	1994	10.0	1.003	117.0	LOS F	46.9	356.7	1.00	1.34	1.86	22.3
North: Orchid Rd														
7	L2	949	10.0	949	10.0	0.528	9.8	LOS A	0.0	0.0	0.00	0.56	0.00	58.0
9	R2	1628	10.0	1628	10.0	* 1.019	136.6	LOS F	89.2	678.1	1.00	1.28	1.86	19.2
Approach		2577	10.0	2577	10.0	1.019	89.9	LOS F	89.2	678.1	0.63	1.02	1.18	25.5
West: Flynn Drive														
10	L2	393	10.0	393	10.0	0.324	10.9	LOS B	5.9	45.1	0.35	0.71	0.35	56.8
11	T1	1181	10.0	1181	10.0	0.796	47.7	LOS D	22.6	171.5	1.00	0.91	1.08	39.3
Approach		1574	10.0	1574	10.0	0.796	38.5	LOS D	22.6	171.5	0.83	0.86	0.90	42.6
All Vehicles		6145	10.0	6145	10.0	1.019	85.5	LOS F	89.2	678.1	0.80	1.08	1.33	27.1

Should the ultimate forecast volumes eventuate, it is clear that significant upgrade will be required to Flynn Drive, including the Flynn Drive/Orchid Road intersection.

Analysis of the geometry shown indicates a poor level of service on full development.

A sensitivity analysis has been undertaken to determine when the intersection starts to perform poorly and the following analysis for 80% of all volumes indicates one movement with a LoS E.

Orchid Rd/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 83 seconds (Site Optimum Cycle Time - Minimum Delay)
Flow Scale Analysis: Constant Scale Factor = 80.0 %

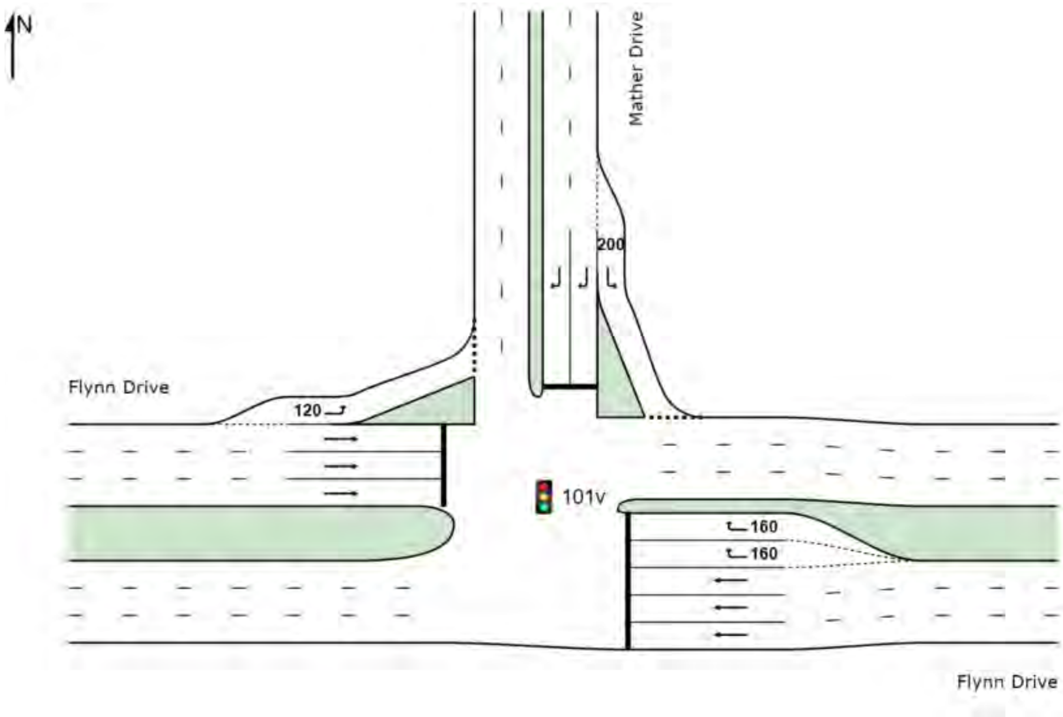
Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Flynn Drive														
5	T1	1479	10.0	1183	10.0	* 0.863	41.6	LOS D	18.1	137.6	1.00	1.01	1.29	42.0
6	R2	515	10.0	412	10.0	* 0.865	55.2	LOS E	9.7	73.5	1.00	0.99	1.45	34.0
Approach		1994	10.0	1595	10.0	0.865	45.1	LOS D	18.1	137.6	1.00	1.01	1.33	39.6
North: Orchid Rd														
7	L2	949	10.0	759	10.0	0.423	8.3	LOS A	0.0	0.0	0.00	0.56	0.00	58.1
9	R2	1628	10.0	1302	10.0	* 0.885	43.5	LOS D	30.7	233.0	1.00	1.00	1.25	37.6
Approach		2577	10.0	2062	10.0	0.885	30.5	LOS C	30.7	233.0	0.63	0.84	0.79	43.2
West: Flynn Drive														
10	L2	393	10.0	314	10.0	0.263	9.6	LOS A	2.9	22.2	0.34	0.70	0.34	57.9
11	T1	1181	10.0	945	10.0	0.689	32.3	LOS C	12.1	91.8	0.97	0.84	1.00	47.0
Approach		1574	10.0	1259	10.0	0.689	26.6	LOS C	12.1	91.8	0.81	0.80	0.84	49.3
All Vehicles		6145	10.0	4916	10.0	0.885	34.3	LOS C	30.7	233.0	0.80	0.88	0.98	43.3

A further analysis has been undertaken for a roundabout at the intersection on full development, however the results indicate a very poor level of service and that it will not function. This suggests that if roundabouts are installed on Flynn Drive initially, they will ultimately need to be signalised.

4.4.2 Mather Road/Flynn Drive – Full Development

The following signalised geometry has been analysed. A PM analysis is shown.



Mather Dr/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 118 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Flynn Drive														
5	T1	1479	10.0	1479	10.0	* 1.057	188.2	LOS F	61.9	470.3	1.00	1.70	2.38	15.6
6	R2	561	10.0	561	10.0	* 1.084	238.1	LOS F	38.7	294.2	1.00	1.51	2.78	12.5
Approach		2040	10.0	2040	10.0	1.084	201.9	LOS F	61.9	470.3	1.00	1.65	2.49	14.6
North: Mather Drive														
7	L2	1034	10.0	1034	10.0	0.890	31.1	LOS C	38.0	289.0	0.90	0.99	0.98	42.9
9	R2	1772	10.0	1772	10.0	* 1.084	230.8	LOS F	130.2	989.3	1.00	1.58	2.55	12.8
Approach		2806	10.0	2806	10.0	1.084	157.2	LOS F	130.2	989.3	0.96	1.36	1.97	17.3
West: Flynn Drive														
10	L2	427	10.0	427	10.0	0.354	11.0	LOS B	6.7	50.6	0.36	0.71	0.36	56.6
11	T1	1181	10.0	1181	10.0	0.844	52.6	LOS D	23.9	181.3	1.00	0.96	1.16	37.3
Approach		1608	10.0	1608	10.0	0.844	41.6	LOS D	23.9	181.3	0.83	0.90	0.95	41.1
All Vehicles		6454	10.0	6454	10.0	1.084	142.5	LOS F	130.2	989.3	0.94	1.34	1.88	18.9

Should the ultimate forecast volumes eventuate, it is clear that significant upgrade will be required to Flynn Drive, including the Flynn Drive/Mather Road intersection.

Analysis of the geometry shown indicates a poor level of service on full development.

A sensitivity analysis has been undertaken to determine when the intersection starts to perform poorly and the following analysis for 75% of all volumes indicates one movement with a LoS E.

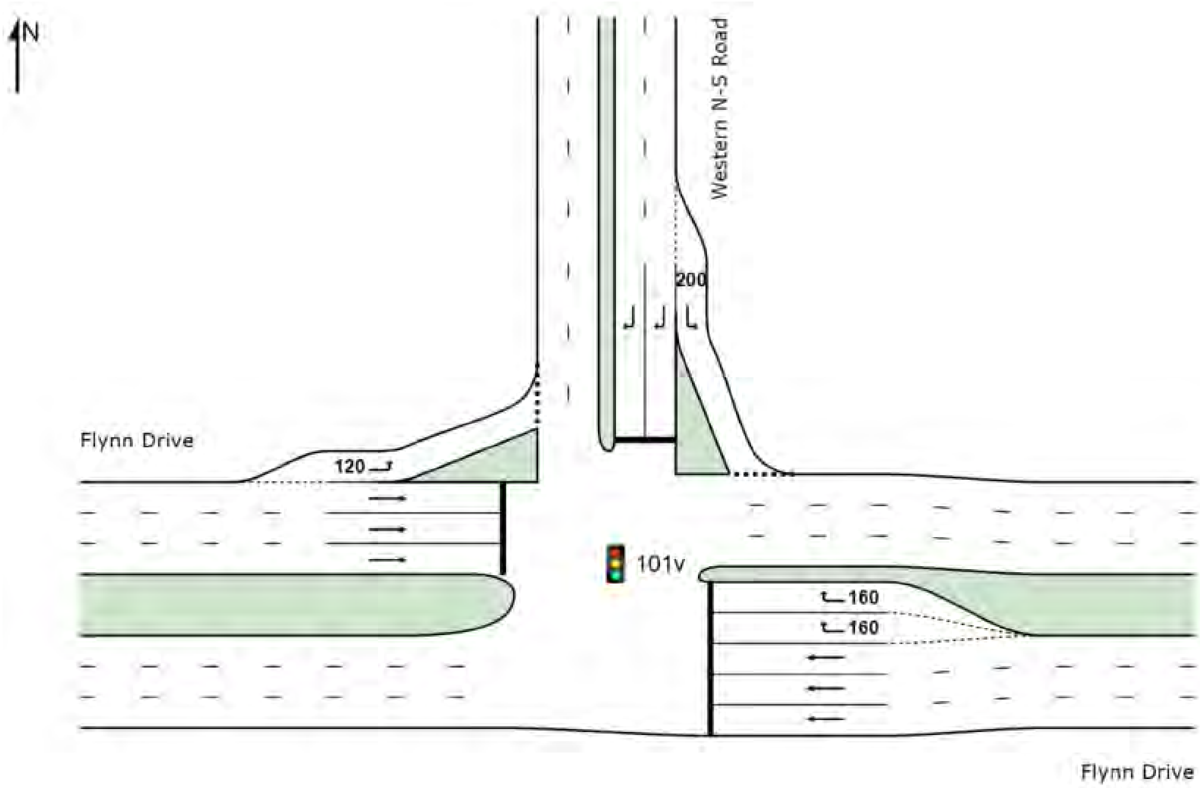
Mather Dr/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 83 seconds (Site Optimum Cycle Time - Minimum Delay)
Flow Scale Analysis: Constant Scale Factor = 75.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Flynn Drive														
5	T1	1479	10.0	1109	10.0	0.851 *	41.0	LOS D	16.7	127.0	1.00	0.99	1.27	42.3
6	R2	561	10.0	421	10.0	0.884 *	57.0	LOS E	10.1	76.9	1.00	1.02	1.52	33.3
Approach		2040	10.0	1530	10.0	0.884	45.4	LOS D	16.7	127.0	1.00	1.00	1.34	39.4
North: Mather Drive														
7	L2	1034	10.0	775	10.0	0.667	11.7	LOS B	15.9	120.6	0.66	0.79	0.66	55.2
9	R2	1772	10.0	1329	10.0	0.877 *	41.4	LOS D	30.5	231.7	0.99	0.99	1.22	38.4
Approach		2806	10.0	2105	10.0	0.877	30.5	LOS C	30.5	231.7	0.87	0.92	1.01	43.2
West: Flynn Drive														
10	L2	427	10.0	320	10.0	0.270	9.6	LOS A	3.0	22.8	0.34	0.70	0.34	57.9
11	T1	1181	10.0	886	10.0	0.680	32.9	LOS C	11.4	86.4	0.97	0.83	1.00	46.7
Approach		1608	10.0	1206	10.0	0.680	26.7	LOS C	11.4	86.4	0.80	0.80	0.83	49.2
All Vehicles		6454	10.0	4841	10.0	0.884	34.3	LOS C	30.5	231.7	0.89	0.91	1.07	43.2

4.4.3 Western N-S Road/Flynn Drive - full development

The following signalised geometry has been analysed. A PM analysis is shown.



Western N-S Road/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 122 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Flynn Drive														
5	T1	1479	10.0	1479	10.0	* 1.132	309.8	LOS F	84.3	640.4	1.00	2.11	3.10	10.2
6	R2	621	10.0	621	10.0	* 1.171	385.4	LOS F	59.4	451.7	1.00	1.82	3.56	8.2
Approach		2100	10.0	2100	10.0	1.171	332.2	LOS F	84.3	640.4	1.00	2.03	3.24	9.5
North: Western N-S Road														
7	L2	1140	10.0	1140	10.0	0.962	63.0	LOS E	73.5	558.4	1.00	1.13	1.29	31.3
9	R2	1960	10.0	1960	10.0	* 1.172	378.0	LOS F	198.7	1510.4	1.00	1.95	3.41	8.4
Approach		3100	10.0	3100	10.0	1.172	262.2	LOS F	198.7	1510.4	1.00	1.65	2.63	11.5
West: Flynn Drive														
10	L2	470	10.0	470	10.0	0.392	11.4	LOS B	8.0	60.6	0.38	0.72	0.38	56.4
11	T1	1181	10.0	1181	10.0	0.904	64.6	LOS E	27.3	207.5	1.00	1.05	1.31	33.3
Approach		1651	10.0	1651	10.0	0.904	49.5	LOS D	27.3	207.5	0.82	0.95	1.05	37.7
All Vehicles		6851	10.0	6851	10.0	1.172	232.4	LOS F	198.7	1510.4	0.96	1.60	2.43	12.8

Should the ultimate forecast volumes eventuate, it is clear that significant upgrade will be required to Flynn Drive, including the Flynn Drive/Western North-South Road intersection.

Analysis of the geometry shown indicates a poor level of service on full development.

A sensitivity analysis has been undertaken to determine when the intersection starts to perform poorly and the following analysis for 75% of all volumes indicates one movement with a LoS E.

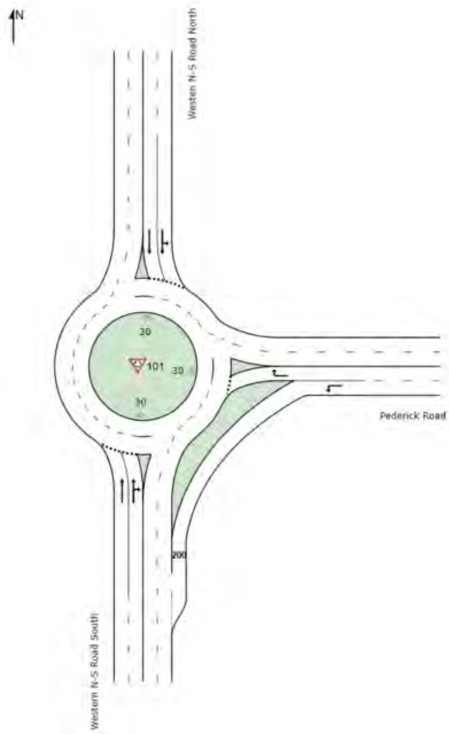
Western N-S Road/Flynn Drive PM Full Development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 87 seconds (Site Optimum Cycle Time - Minimum Delay)
Flow Scale Analysis: Constant Scale Factor = 70.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Flynn Drive														
5	T1	1479	10.0	1035	10.0	* 0.833	41.6	LOS D	15.9	120.8	1.00	0.97	1.23	42.0
6	R2	621	10.0	435	10.0	* 0.877	58.0	LOS E	10.8	82.1	1.00	1.00	1.47	33.0
Approach		2100	10.0	1470	10.0	0.877	46.5	LOS D	15.9	120.8	1.00	0.98	1.30	38.9
North: Western N-S Road														
7	L2	1140	10.0	798	10.0	0.669	11.6	LOS B	16.6	126.4	0.64	0.79	0.64	55.3
9	R2	1960	10.0	1372	10.0	* 0.874	41.1	LOS D	32.2	245.0	0.98	0.98	1.18	38.5
Approach		3100	10.0	2170	10.0	0.874	30.3	LOS C	32.2	245.0	0.86	0.91	0.98	43.4
West: Flynn Drive														
10	L2	470	10.0	329	10.0	0.278	9.8	LOS A	3.3	25.1	0.34	0.70	0.34	57.7
11	T1	1181	10.0	827	10.0	0.665	34.7	LOS C	11.1	84.1	0.97	0.82	0.99	45.6
Approach		1651	10.0	1156	10.0	0.665	27.6	LOS C	11.1	84.1	0.79	0.79	0.81	48.5
All Vehicles		6851	10.0	4796	10.0	0.877	34.6	LOS C	32.2	245.0	0.88	0.90	1.04	42.9

4.4.4 Pederick Road/Western N-S Road – full development

The following geometry has been analysed. A PM analysis is shown.



Pederick/Western N-S Road Full Development PM
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Western N-S Road South														
2	T1	508	10.0	508	10.0	0.458	6.5	LOS A	3.3	24.8	0.73	0.66	0.74	54.0
3	R2	324	10.0	324	10.0	0.458	12.8	LOS B	3.2	24.1	0.73	0.83	0.77	51.9
Approach		832	10.0	832	10.0	0.458	9.0	LOS A	3.3	24.8	0.73	0.73	0.75	53.2
East: Pederick Road														
4	L2	1186	10.0	1186	10.0	0.660	6.8	LOS A	0.0	0.0	0.00	0.39	0.00	56.3
6	R2	508	10.0	508	10.0	0.497	11.9	LOS B	3.0	22.9	0.66	0.86	0.72	51.7
Approach		1694	10.0	1694	10.0	0.660	8.3	LOS A	3.0	22.9	0.20	0.53	0.22	54.8
North: Western N-S Road North														
7	L2	72	10.0	72	10.0	0.316	5.2	LOS A	1.9	14.8	0.54	0.51	0.54	53.6
8	T1	600	10.0	600	10.0	0.316	5.2	LOS A	1.9	14.8	0.54	0.51	0.54	55.4
Approach		672	10.0	672	10.0	0.316	5.2	LOS A	1.9	14.8	0.54	0.51	0.54	55.2
All Vehicles		3198	10.0	3198	10.0	0.660	7.8	LOS A	3.3	24.8	0.41	0.58	0.42	54.4

Analysis for full development indicates a good level of service for all movements, indicating an intersection level of service of A.

4.4.5 Trandos Road/Western N-S Road – full development

The following geometry has been analysed. A PM analysis is shown.

Trandos Road/Western N-S Road Full Development PM
Site Category: (None)
Roundabout

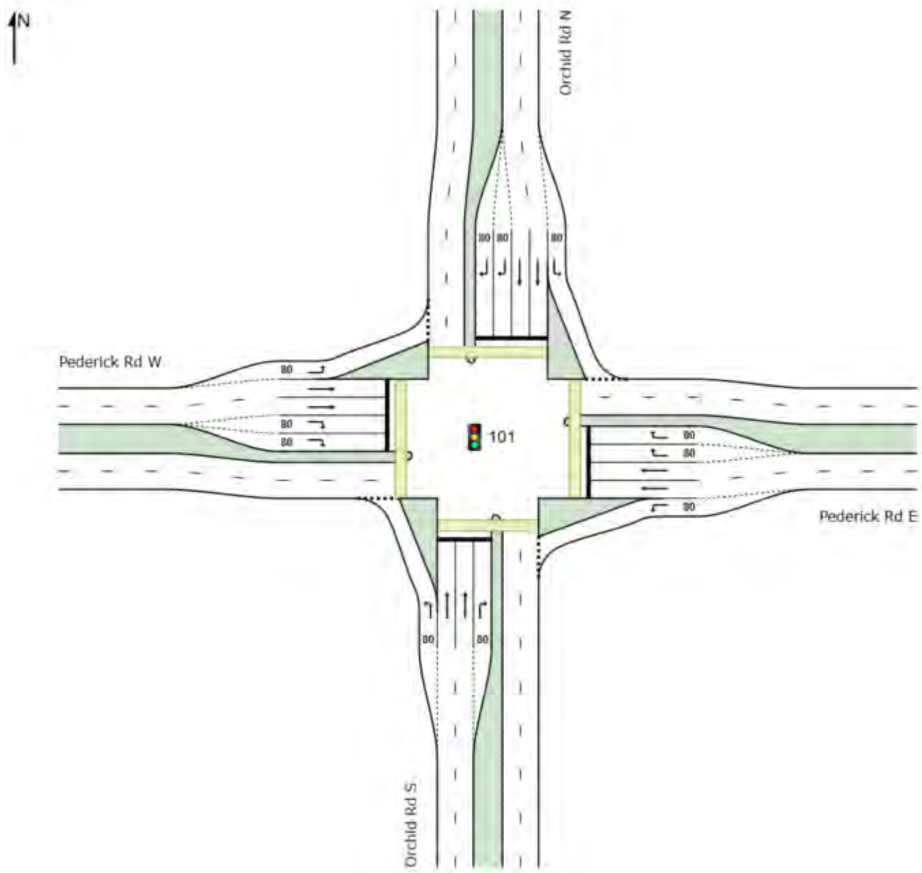
Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Western N-S Road South														
2	T1	520	10.0	520	10.0	0.627	16.9	LOS B	7.7	58.4	1.00	1.09	1.31	48.0
3	R2	425	10.0	425	10.0	0.627	24.4	LOS C	6.3	48.0	1.00	1.13	1.33	45.0
Approach		945	10.0	945	10.0	0.627	20.2	LOS C	7.7	58.4	1.00	1.11	1.32	46.6
East: Trandos Road														
4	L2	958	10.0	958	10.0	0.533	3.9	LOS A	0.0	0.0	0.00	0.40	0.00	56.6
6	R2	958	10.0	958	10.0	0.920	22.0	LOS C	18.4	139.6	1.00	1.35	1.88	45.8
Approach		1916	10.0	1916	10.0	0.920	13.0	LOS B	18.4	139.6	0.50	0.87	0.94	50.5
North: Western N-S Road North														
7	L2	317	10.0	317	10.0	0.426	5.3	LOS A	2.6	19.7	0.63	0.60	0.63	53.6
8	T1	519	10.0	519	10.0	0.426	5.5	LOS A	2.6	19.7	0.63	0.55	0.63	55.0
Approach		836	10.0	836	10.0	0.426	5.4	LOS A	2.6	19.7	0.63	0.57	0.63	54.4
All Vehicles		3697	10.0	3697	10.0	0.920	13.1	LOS B	18.4	139.6	0.66	0.86	0.97	50.2

Analysis for full development indicates a good level of service for all movements, indicating an intersection level of service of B.

4.4.6 Pederick Road/Orchid Road – full development

The following signalised geometry has been analysed. A PM analysis is shown.



Pederick/Orchid Rd Full Development PM
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Orchid Rd S														
1	L2	337	10.0	337	10.0	0.285	10.9	LOS B	6.2	47.2	0.40	0.67	0.40	50.0
2	T1	444	10.0	444	10.0	0.297	24.4	LOS C	8.3	63.1	0.72	0.60	0.72	43.0
3	R2	333	10.0	333	10.0	* 1.007	129.6	LOS F	32.0	243.4	1.00	1.34	2.03	19.2
Approach		1114	10.0	1114	10.0	1.007	51.7	LOS D	32.0	243.4	0.71	0.84	1.01	32.3
East: Pederick Rd E														
4	L2	234	10.0	234	10.0	0.321	28.2	LOS C	8.5	64.5	0.71	0.76	0.71	40.5
5	T1	312	10.0	312	10.0	0.816	61.3	LOS E	9.5	72.0	1.00	0.94	1.27	30.1
6	R2	234	10.0	234	10.0	0.776	67.2	LOS E	7.1	53.6	1.00	0.90	1.23	28.4
Approach		780	10.0	780	10.0	0.816	53.1	LOS D	9.5	72.0	0.91	0.88	1.09	32.0
North: Orchid Rd N														
7	L2	434	10.0	434	10.0	0.423	19.8	LOS B	11.0	83.4	0.58	0.81	0.58	44.7
8	T1	1300	10.0	1300	10.0	* 1.029	148.4	LOS F	75.4	572.8	1.00	1.75	2.07	17.5
9	R2	434	10.0	434	10.0	0.654	53.2	LOS D	11.5	87.7	0.98	0.83	0.99	31.9
Approach		2168	10.0	2168	10.0	1.029	103.6	LOS F	75.4	572.8	0.91	1.38	1.56	22.2
West: Pederick Rd W														
10	L2	285	10.0	285	10.0	0.233	8.7	LOS A	3.8	28.6	0.32	0.65	0.32	51.6
11	T1	380	10.0	380	10.0	* 0.994	109.5	LOS F	16.3	124.1	1.00	1.36	2.07	21.6
12	R2	285	10.0	285	10.0	* 0.945	86.4	LOS F	10.2	77.4	1.00	1.16	1.79	24.7
Approach		950	10.0	950	10.0	0.994	72.3	LOS E	16.3	124.1	0.80	1.09	1.46	27.4
All Vehicles		5012	10.0	5012	10.0	1.029	78.3	LOS E	75.4	572.8	0.84	1.13	1.35	26.2

Analysis for full development indicates a poor level of service for some movements (LoS F).

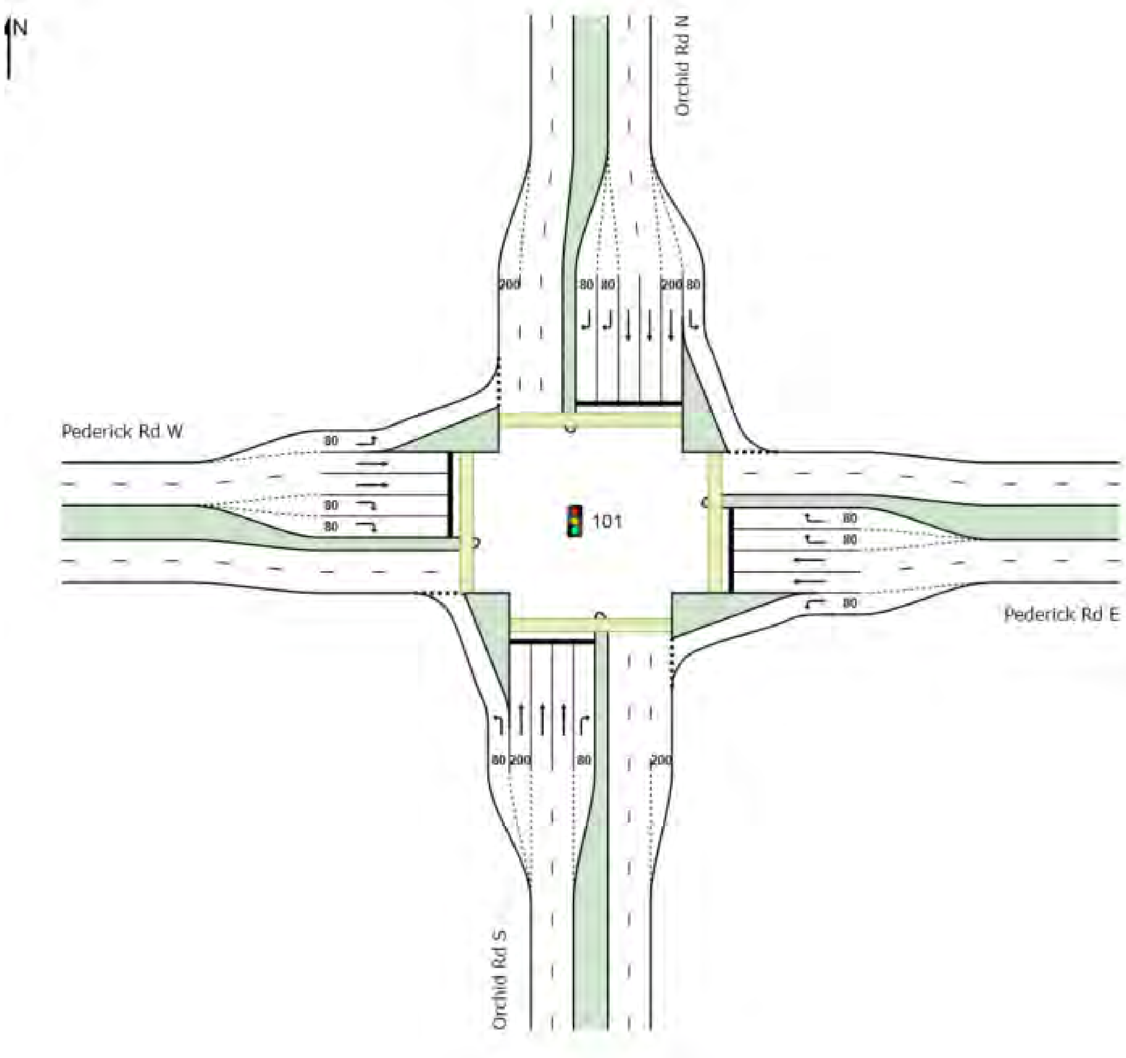
Further analysis, as shown below, using 80% of all volumes indicates an acceptable level of service. The analysis indicates future upgrade is likely.

Pederick/Orchid Rd Full Development PM
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)
Flow Scale Analysis: Constant Scale Factor = 80.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Orchid Rd S														
1	L2	337	10.0	270	10.0	0.228	8.7	LOS A	3.0	22.6	0.38	0.66	0.38	51.5
2	T1	444	10.0	355	10.0	0.287	21.1	LOS C	5.1	39.0	0.78	0.64	0.78	44.7
3	R2	333	10.0	266	10.0	* 0.820	45.8	LOS D	11.4	86.8	1.00	0.96	1.27	34.0
Approach		1114	10.0	891	10.0	0.820	24.8	LOS C	11.4	86.8	0.72	0.74	0.80	42.4
East: Pederick Rd E														
4	L2	234	10.0	187	10.0	0.203	14.0	LOS B	3.4	25.9	0.56	0.70	0.56	48.0
5	T1	312	10.0	250	10.0	0.682	41.0	LOS D	5.1	39.0	1.00	0.85	1.14	36.0
6	R2	234	10.0	187	10.0	0.720	49.7	LOS D	4.0	30.4	1.00	0.86	1.24	32.8
Approach		780	10.0	624	10.0	0.720	35.5	LOS D	5.1	39.0	0.87	0.81	0.99	37.7
North: Orchid Rd N														
7	L2	434	10.0	347	10.0	0.356	14.6	LOS B	6.6	50.1	0.58	0.74	0.58	47.7
8	T1	1300	10.0	1040	10.0	* 0.858	35.3	LOS D	23.0	174.6	0.99	1.04	1.23	38.1
9	R2	434	10.0	347	10.0	0.534	38.5	LOS D	6.4	48.3	0.95	0.80	0.95	36.5
Approach		2168	10.0	1734	10.0	0.858	31.8	LOS C	23.0	174.6	0.90	0.93	1.04	39.4
West: Pederick Rd W														
10	L2	285	10.0	228	10.0	0.187	7.8	LOS A	2.0	15.0	0.32	0.64	0.32	52.2
11	T1	380	10.0	304	10.0	* 0.830	45.3	LOS D	6.7	51.0	1.00	0.97	1.41	34.6
12	R2	285	10.0	228	10.0	* 0.877	55.6	LOS E	5.3	40.2	1.00	1.03	1.67	31.1
Approach		950	10.0	760	10.0	0.877	37.1	LOS D	6.7	51.0	0.80	0.89	1.16	37.1
All Vehicles		5012	10.0	4010	10.0	0.877	31.8	LOS C	23.0	174.6	0.84	0.86	1.00	39.3

The intersection layout has been tested to determine a layout to achieve an acceptable performance for full development and the following geometry and analysis refer.


N
Orchid Rd N
Pederick Rd W
Pederick Rd E
Orchid Rd S
101
80
200

Pederick/Orchid Rd Full Development PM
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Orchid Rd S														
1	L2	337	10.0	337	10.0	0.303	10.1	LOS B	4.9	36.9	0.45	0.68	0.45	50.5
2	T1	444	10.0	444	10.0	0.286	26.1	LOS C	4.8	36.9	0.82	0.67	0.82	42.2
3	R2	333	10.0	333	10.0	* 0.859	49.4	LOS D	15.7	119.7	1.00	1.01	1.32	33.0
Approach		1114	10.0	1114	10.0	0.859	28.2	LOS C	15.7	119.7	0.76	0.77	0.86	40.8
East: Pederick Rd E														
4	L2	234	10.0	234	10.0	0.243	16.4	LOS B	4.4	33.2	0.54	0.70	0.54	48.3
5	T1	312	10.0	312	10.0	0.724	42.8	LOS D	6.8	51.7	1.00	0.88	1.16	35.5
6	R2	234	10.0	234	10.0	0.717	50.5	LOS D	5.2	39.5	1.00	0.87	1.19	32.8
Approach		780	10.0	780	10.0	0.724	37.2	LOS D	6.8	51.7	0.86	0.82	0.98	37.5
North: Orchid Rd N														
7	L2	434	10.0	434	10.0	0.485	19.5	LOS B	9.7	73.8	0.69	0.84	0.69	44.8
8	T1	1300	10.0	1300	10.0	* 0.838	38.9	LOS D	19.4	147.5	1.00	1.01	1.21	37.1
9	R2	434	10.0	434	10.0	0.560	38.2	LOS D	8.2	62.5	0.94	0.81	0.94	36.7
Approach		2168	10.0	2168	10.0	0.838	34.9	LOS C	19.4	147.5	0.93	0.94	1.05	38.4
West: Pederick Rd W														
10	L2	285	10.0	285	10.0	0.238	8.7	LOS A	2.8	21.4	0.34	0.65	0.34	52.0
11	T1	380	10.0	380	10.0	* 0.882	50.8	LOS D	9.3	70.6	1.00	1.06	1.53	33.0
12	R2	285	10.0	285	10.0	* 0.873	57.1	LOS E	6.9	52.7	1.00	1.03	1.57	30.8
Approach		950	10.0	950	10.0	0.882	40.0	LOS D	9.3	70.6	0.80	0.93	1.18	36.2
All Vehicles		5012	10.0	5012	10.0	0.882	34.7	LOS C	19.4	147.5	0.86	0.88	1.02	38.3

Analysis for full development indicates a good level of service generally for all movements, indicating an intersection level of service of C. As part of detailed design, turn pocket lengths will need to be confirmed.

It is clear from the analysis that should ultimate forecast volumes eventuate, key internal intersections on major roads will need to be signalised with appropriate lane and turn lane configuration. As development stages occur, traffic volumes will need to be carefully monitored and road cross sections and intersection geometry analysed to determine when dual carriageway cross section and intersection upgrade are required. Noting a single carriageway can accommodate 8-12000 vpd at a good level of service.

4.5 Internal minor road network

For cross sections of the minor internal roads, DC 4.1 indicates a minimum road reserve width of 20 m. For heavily trafficked/major through routes, a minimum road reserve width of 25 m is required. Carriageway widths of ten metres are favoured.

In considering whether the location of future minor roads is appropriate, or whether the location of minor roads would be more appropriately considered at subdivisional stage, reference should be made to the WAPC's endorsed Structure Plan Framework. The Structure Plan Framework constitutes the manner and form in which a structure plan is to be prepared pursuant to Section

2, Part 4, clause 16 of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

In this respect, clause 4.1 of the Structure Plan Framework notes that structure plans are to provide information relevant to the site and commensurate with the scale of planning being undertaken. To this extent, a structure plan should identify the layout necessary to guide subdivision, including neighbourhood connector roads, but should not pre-determine individual lot layouts. Noting this, and the need to provide flexibility in lot sizes which will be dependent on use and are likely to change over time, it would be premature to fix the minor road network at this stage. Notwithstanding, broad principles should be identified in relation to road cross sections and intersection spacing. As discussed in Section 3, adequate intersection spacing is required on the RAV 7 routes to accommodate left/right and right/left manoeuvres and intersections on the same side, approximately 110 m.

The minor roads should include a 20-25 m road reserve and ten metre carriageway and should comply with spacing shown in Table 16.

Table 16 Proposed NIA street spacing

Through route	Terminating route	Min spacing on same side of route – unsignalised (based on left turn lane length on through route)	Min left / right staggers (based on non-overlapping right turn lanes on through route)	Right / left stagger (based on left turn lane length on through route)
Local roads	Local road	150 m (if no intersection opposite between intersections)	110 m (no turn lane)	110 m (no turn lane)
Industrial connector – major (Roads A & B)	Local road	150 m (if no intersection opposite between intersections)	175 m	110 m
Industrial connector – with turn lane (Wattle Ave, Orchid Ave, Mather Drive, Roads C, D & E)	Local road	150 m (if no intersection opposite between intersections)	175 m	110 m
Industrial arterial (Flynn Drive)	Local road	300 m	300 m	200 m

4.6 Comparison of forecast traffic volumes

Figure 4-10 compares the ASP 17 forecast traffic volumes with current modelling. There are some significant differences in forecast traffic volumes due to the land use modelled, i.e., the earlier ASP 17 included a Business Park, and it is unclear if earlier modelling included external through traffic. The external future network has also changed. The current proposed Structure Plan includes a changed conservation area, reducing traffic generation. In addition, internal access roads have been excluded from the modelled area. However, the major internal network cross sections remain similar indicating ultimate dual carriageways. These should be staged over time.

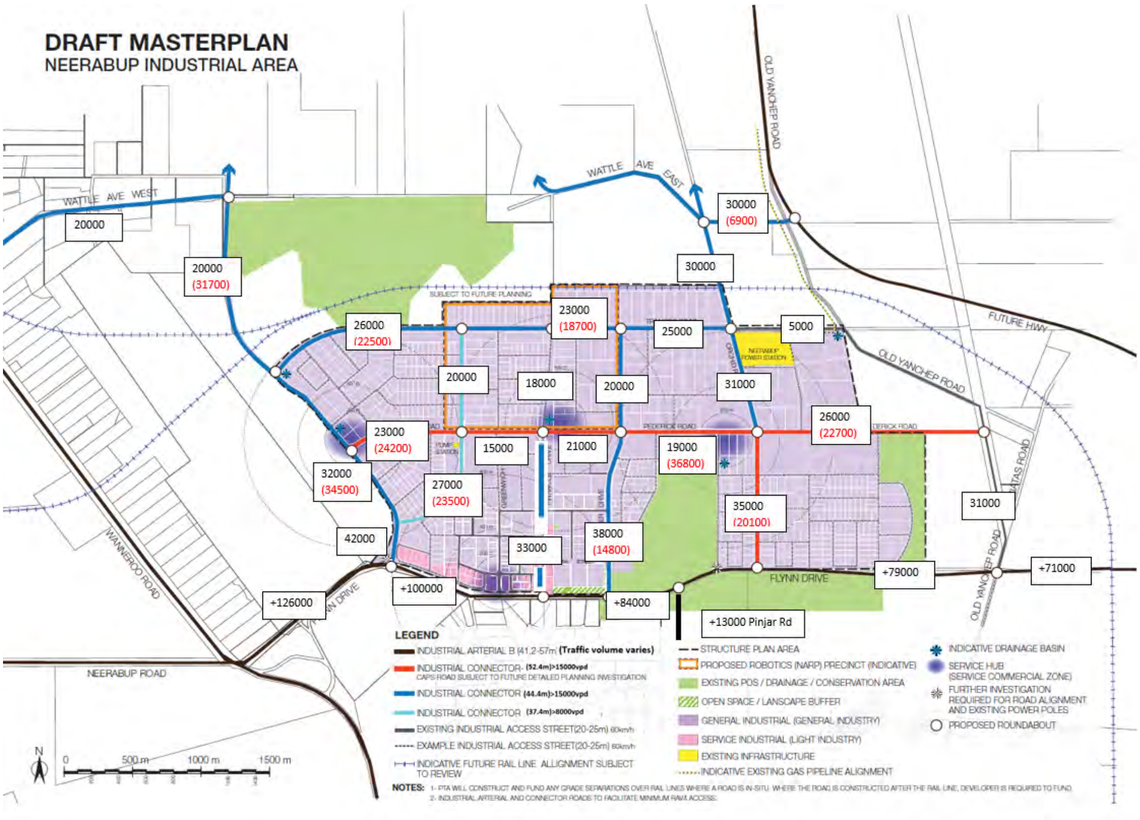


Figure 4-10 Comparison of traffic volumes (ASP forecasts in red)

As discussed in Section 3.7.1, Flynn Drive will become two lanes in each direction, and ROM forecast daily traffic volumes to 2041 are approximately 28,000 vpd west of Old Yanchep Road and 25,800 vpd just east of Old Yanchep Road linking to Neaves Road. The ROM land use does not include full development of the NIA resulting in an underestimation of daily volumes. When Main Roads WA completes its planning for the northern section of the Whiteman-Yanchep Highway and subsequent modelling, the ROM modelling will more accurately reflect volumes on Flynn Drive.

STEM modelling in Section 3.7.2 as part of *Road Planning Study East Wanneroo District Structure Plan*[6], indicates 32,000 vpd on Flynn Drive by 2051, however the extent of land use within the NIA is not known.

A review of daily traffic volumes in the vicinity of other established industrial areas has been undertaken as a comparison and the results are as follows:

- Hartman Drive - Wangara Industrial area: 21,800 vpd
- Gnangara Road - Wangara Industrial area: 11,300 vpd
- Victoria Road - Malaga Industrial area: 7,500 vpd
- Bannister Road – Canning Vale Industrial area: 12,400 vpd
- Clayton Street - Bellevue industrial area: 20,500 vpd

The current volumes at other industrial areas suggest the forecast volumes for NIA are likely to be at the upper level.

[6] DPLH, 11 September 2019

4.7 HWL route

Prior to considering potential HWL connections for the NIA, a qualitative analysis of potential HWL options to/from Perth was undertaken. For this, DevelopmentWA, Main Roads WA Heavy Vehicle Services and Main Roads WA Road Planning Branch were approached for comment. Their responses are summarised in Table 17.

Table 17 Queries and responses from DevelopmentWA and Main Roads WA

Query	Main Roads WA Heavy Vehicle Services	Main Roads WA Road Planning Branch	DevelopmentWA
Are you aware of a need for HWL access to the NIA?	Table 17 shows single trip oversize permit statistics for the NIA area for the two-year period of 2018 and 2019. There are more than 8,500 Class 1 Oversize Period Permits issued to transport operators in WA that allows state-wide access for HWL's up to 5.5 m in width, 5.5 m in height and 30 m in length. It is most likely some of these oversize loads would be accessing the NIA.	There is no need for HWL access to the NIA. However, there is a need for Oversize Over-mass (OSOM) access. Structure clearance requirements (road level to bridge soffit) for the main access routes are as follows (preliminary): • Flynn Drive / Neaves Road - 6.5 m • Wanneroo Road from the south - 6.5 m • Wanneroo Road from the north - 5.8 m	Yes, the connection to PDNH is considered important to the NIA. Several businesses within Meridian Park service the mining industry with connections to the Pilbara and Midwest (Trackspares, Enerflow, Klen International).
What is your view on upgrading Neaves Road to accommodate an east to west HWL link between the NIA and Bullsbrook Industrial Area?	It would seem logical given the direct link it would provide to the NIA.	Neaves Road, including the link between PDNH and GNH (currently Rutland Road) should provide 6.5 m clearance to accommodate OSOM vehicles.	A HWL route should follow the most direct route from the NIA to GNH as the designated north-south HWL route, i.e., Neaves Road.
Which link should be the primary road access to the NIA?	Flynn Road is currently approved for RAV Network 3 & 4 access (27.5 m combinations), as the major road providing access to the NIA at the moment from both Wanneroo Road and Old Yanchep Road. Furthermore, in looking at the Whiteman Yanchep Project, the preliminary map (Figure 4-8) indicates access to this estate will continue to be via Flynn Road.	Wanneroo Road from the south and Neaves Road / Flynn Drive from the east, via PDNH.	Neaves Road.

Query	Main Roads WA Heavy Vehicle Services	Main Roads WA Road Planning Branch	DevelopmentWA
What is your view on a connection to and from the NIA via GNH?	Given PDNH will be approved for 36.5 m RAV combinations once fully opened, we would expect the transport industry to request similar access to adjacent industrial estates. This will then be subject to suitability of the connecting roads to the industrial estates and the internal roads within it.	Neaves Road provides this connection.	Neaves Road.
What are your thoughts on HWLs accessing PDNH via Stock Road and connecting to the NIA via Neaves Road?	Stock Road will be a major connection point to PDNH for HWLs once complete. Refer to comment about Neaves Road above.	There is no need for HWL access to the NIA, only OSOM.	This does not align with MRWA's vison of retaining PDNH for fast moving 'light and commercial traffic' and using GNH for HWLs. Logically, the NIA would cater for all east-west traffic with light traffic accessing PDNH and HWL traffic continuing to GNH to travel predominantly north. The HWL connection from Stock to Neaves Roads should follow GNH, the MRWA designated HWL route.

Table 18 shows the number of single trip oversize permits issued for Flynn Drive and Wanneroo Road over the two years of 2018 and 2019.

Table 18 MRWA (HVS) single trip oversize permit statistics 2018 and 2019

Road Name	Total Single Trip Permits Issued	Maximum Width	Maximum Height	Maximum Length
Flynn Drive	60	5.5 metres	5.8 metres	35.0 metres
Wanneroo Road	160	6.4 metres	5.8 metres	40.0 metres

There is no existing HWL route serving the NIA and Main Roads WA's Road Planning Branch is not in favour of one being developed. In view of the OSOM planning for Stock Road in Bullsbrook, it is suggested that an OSOM route to the NIA be developed, with provision for 8.5 metres wide x 6.5 metres high clearance to access Tonkin Highway/PDNH via Stock Road then via Neaves Road to the NIA (Figure 4-11).

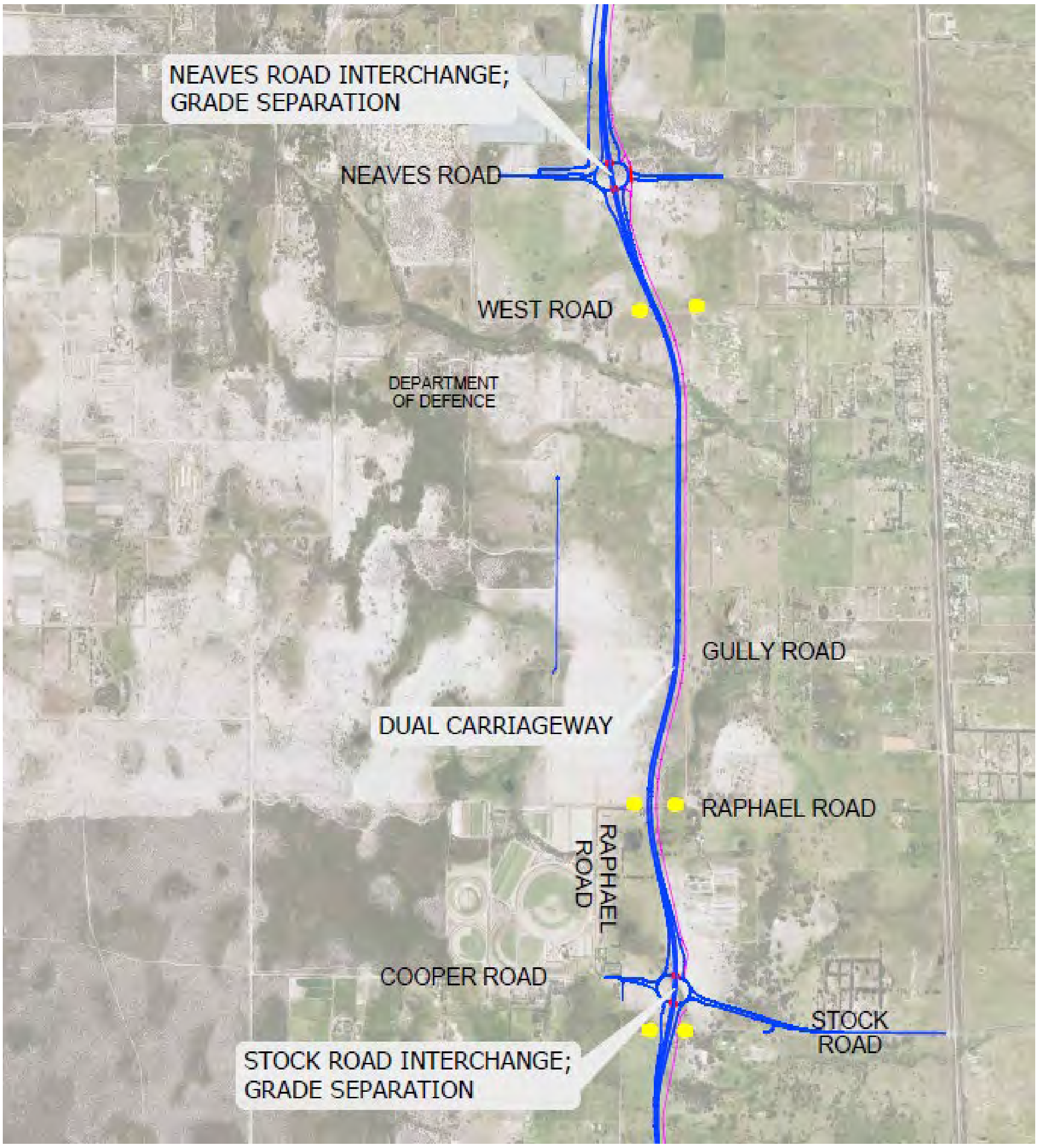


Figure 4-11 PDNH/Tonkin Highway - Stock Road to Neaves Road (MRWA)

It is also suggested that Flynn Drive be extended eastward to connect with the future Whiteman Yanchep Highway and a realigned Neaves Road (as shown in Figure 4-13). This aligns with comments provided by DevelopmentWA as it would improve easterly OSOM access, as well as a south eastern connection (via Whiteman Yanchep Highway) to Kewdale rail, Perth Airport air freight and ultimately Fremantle Port.

The NIA is very much reliant on road transport access by heavy vehicles, including RAVs, and this will continue to be the case for the foreseeable future. It is therefore suggested that Flynn Drive (from just east of Wanneroo Road to Mather Drive) is upgraded as an immediate priority. DevelopmentWA advised that the current state of Flynn Drive is a deterrent to some proponents considering locating within the NIA.

As indicated in Table 18, 60 oversize permits have been issued (2018/19) by Main Roads to access Flynn Drive indicating a significant demand and access is already achieved to this area.

Based on discussion with the aforementioned stakeholders, RAV access for 36.5 m vehicles is proposed to include Flynn Drive, Pederick Road, Mather Drive and Orchid Road as shown in Figure 4-12.

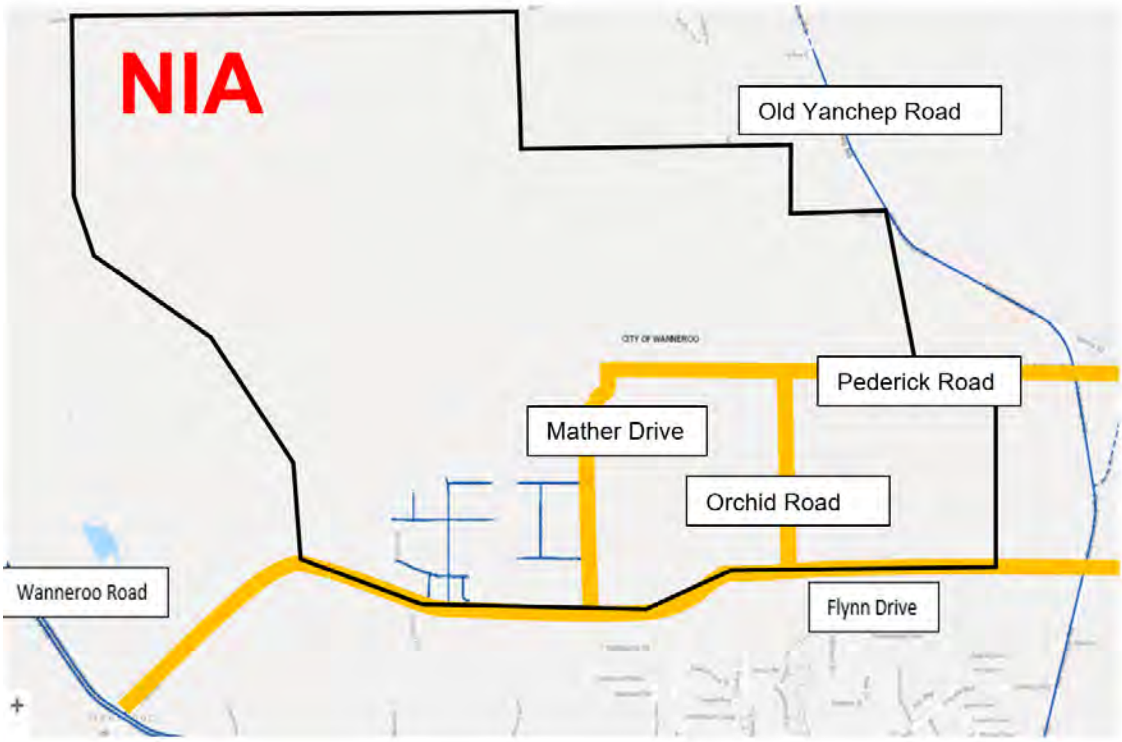


Figure 4-12 RAV 36.5 m network

Furthermore, from information provided by stakeholders regarding OSOM access to the NIA, likely routes are shown in Figure 4-13.

Figure 4-13 Likely NIA OSOM access routes to the NIA

4.8 Car trip reduction

Being an industrial area, access to/from the NIA will be very car dominated. However, there are several measures that can be implemented in the NIA that would help to encourage access by transport modes other than private motor vehicles, including:

- The introduction of bus routes to and through the NIA.
- The provision of a passenger railway station in or near the NIA, should a rail line be provided in the future on an alignment similar to what is shown in the Department of Transport's *Perth and Peel @ 3.5 million – Transport Network*.
- The delivery of cyclist and pedestrian infrastructure throughout the NIA.

These initiatives are discussed in the following sections.

4.8.1 Bus routes

There are no bus routes that serve the existing NIA, however there are three routes that operate near the NIA and these are shown in Figure 4-14. Services include the 391 (Joondalup Station), 390 (Joondalup Station) and 467 (Whitfords Station to Joondalup Station).

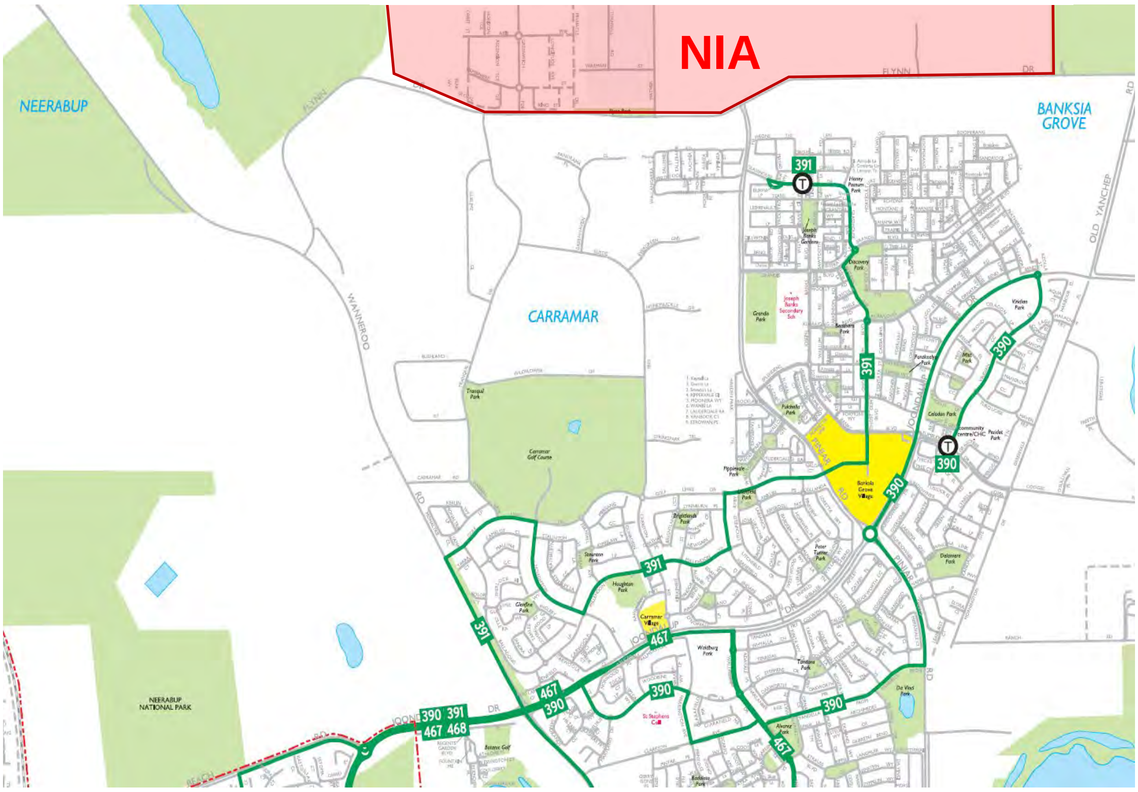


Figure 4-14 Existing bus routes near the NIA (Transperth)

Discussions were held with officers from Transperth regarding future bus services potentially serving the NIA, who advised as follows:

- Transperth has long term plans to extend Route 391 (existing Joondalup Station – Banksia Grove North) via Pinjar Road / Flynn Drive / Neerabup Road to operate to Clarkson Station. The route would not deviate through the NIA, but it would still provide a connection to the south west corner of the NIA via stops on Flynn Drive. This service would provide a connection between Banksia Grove and Neerabup (convenient if people work locally) as well as connecting the Neerabup area to rail at Clarkson. Transperth advised that they will determine stop locations as part of route planning once funding is secured and land uses were better known.

- Long term plans exist (unfunded) to introduce future Route 478 as a feeder from Clarkson Station via Neerabup Road/Flynn Drive to serve any development north of Flynn Drive (development which would be outside the walkable catchment of Route 391 and significant enough to justify another route). This route would only be introduced if the Route 391 above was serving reasonable numbers along Flynn Drive past the industrial section of the route. Route determination would be undertaken by Transperth once finding is secured and land use better known.
- Both the extensions of Route 391 and new Route 478 are low priority projects for Transperth, and they currently join around 200 other projects awaiting funding. It is hard to prioritise these improvements when bus patronage through existing industrial areas performs so poorly.

Prior to the potential introduction of Route 478, an interim measure that could be discussed with Transperth would be to deviate the 391 extension through the NIA (from Pinjar Road) to serve the service hubs, as shown in Figure 4-15, rather than operating solely along Flynn Drive. This would provide improved connectivity to and through this part of the NIA and therefore an increased incentive for patrons to use the service. Transperth's reluctance to deviate the service is however acknowledged and is suggested for future consideration. This route could be clockwise or anti-clockwise.

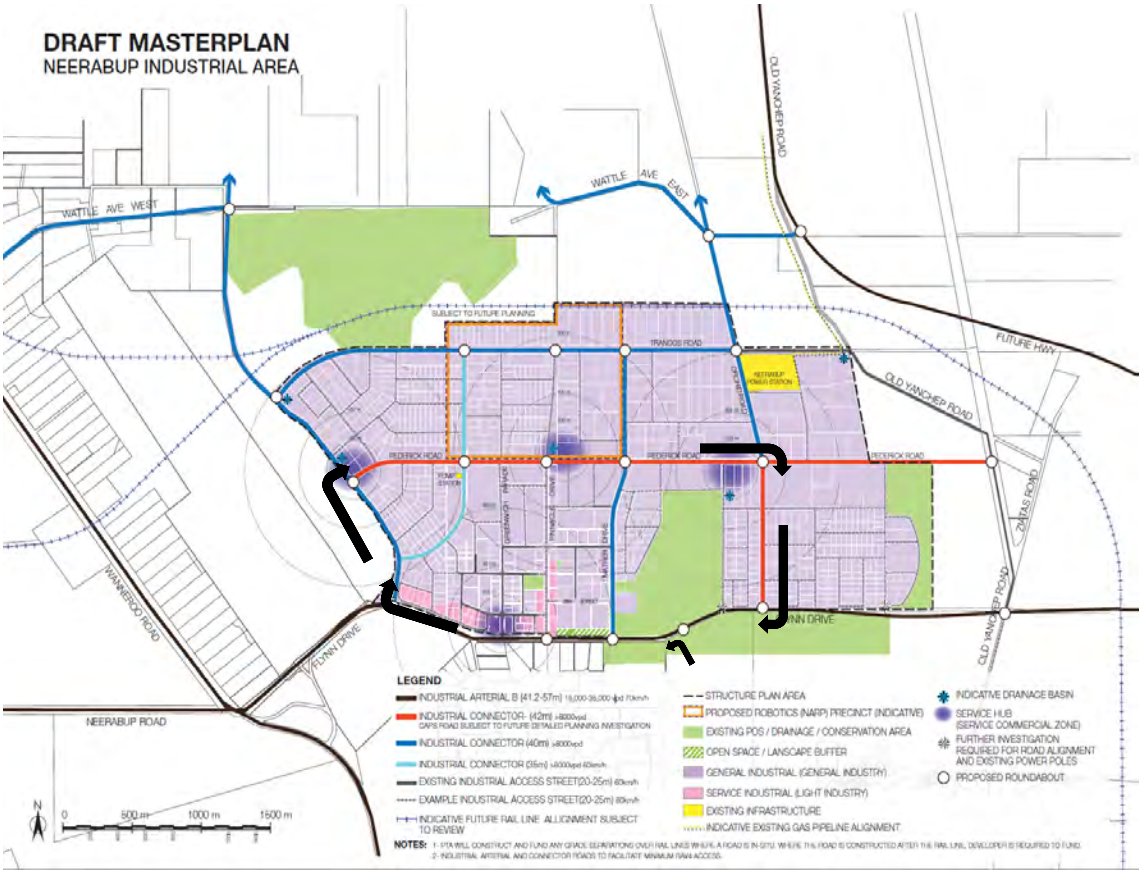


Figure 4-15 Potential Route 391 deviation (black arrows) through the south west NIA

The implementation of bus priority lanes through the NIA is not considered to be necessary and as such, is not recommended. Furthermore, the implementation of bus priority through the NIA would not be supported by Transperth.

4.8.2 Passenger railway and station in or near the NIA

The *Perth and Peel @ 3.5 million Transport Network* document states planned passenger rail infrastructure for the subregion includes the Yanchep Rail Extension as part of METRONET Stage One. The Yanchep Rail Extension will extend the existing Joondalup Line 13.8 kilometres (km) north to provide stations at Yanchep, Alkimos, and Eglinton. Further investigation is required for the potential East Wanneroo Rail Link (or East-West Rail Link) to connect the Joondalup and Ellenbrook Lines in the long-term. A final alignment for this rail line will be determined by the Public Transport Authority (PTA) following further assessment of alignment options.

Discussion with the PTA regarding the East Wanneroo Rail Link revealed that:

- The working planning title is now the "'North Western Line".
- Further planning to safeguard the alignment is in progress.
- It is likely to be delivered beyond 2040.
- Responsible parties for funding rail line cross points for new and existing roads are yet to be agreed.
- It is unlikely that a station within the NIA would be considered by the PTA. However, if one was to be considered, strict criteria would need to be met. This is further discussed below.

The potential development of a station within or adjacent to the NIA area would only be considered by the PTA if it coincided with the development of higher intensity commercial/office land uses that have a higher staff to floor space ratio. This form of use would provide a source of patronage for the station given office land uses not only have higher volumes of staff, office-based staff are also more inclined to use transit to access the workplace than workshop-based staff. In addition, a station in this location would have to show higher potential patronage than other potential nearby locations and would also have to roughly align with appropriate station spacing along the line to support line-wide operations.

The proposed locations of grade separated crossings and their use over at-grade crossings was discussed with the City during the preparation of the concept master planning. It was agreed that planning be undertaken noting two grade separated crossings – on the western road and Orchid Road. These locations are subject to further investigation as to their need and feasibility at a later stage of planning.

4.8.3 Pedestrian facilities and infrastructure in the NIA

In addition to meeting the requirements of the City of Wanneroo's Pathways Policy, as a minimum, every street within the NIA should be equipped with a standard three-metre-wide concrete footpath on at least one side of the street to facilitate walking, and a footpath or shared path on both sides of integrator arterials and local access streets where pedestrian and cyclist activity is high to negate the need for pedestrians to cross a street with higher traffic volumes. Routes that are likely to attract higher volumes of pedestrians are those that contain land uses that are more likely to attract or generate pedestrian access, such as service hubs and lunch bars. However, it should be noted that the low-density nature of industrial area land use does not lend itself to high levels of walk trips.

As a priority, service hubs should feature good pedestrian and cycle access, including pram ramps and crossing facilities within any planned traffic signals and in proximity to the Service Hub. Appropriate crossing facilities should also be considered at appropriate locations away from traffic signals where demand and/or traffic conditions warrant. Paths should be provided adjacent to, and connect with, crossing facilities. End of trip facilities, including inverted U bars for bicycle parking, should be provided at appropriate locations within the Service Hub.

Vehicular access to the premises should be no closer than 25 m from the adjacent intersection, in line with Main Roads WA's driveway policy. Predominant vehicular access should be via a secondary road. A daily vehicle trip rate of 10-15/100 m^2 GFA is assumed[7] and indicates around 150-225 vehicles per day based on 1,500 m^2 GFA. This will vary depending on the actual land use and should be confirmed when planned development is known.

Two lane roads should typically feature a standard three-metre-wide concrete footpath installed on both sides of the road if forecast peak hour traffic volumes exceed 1,100 vehicles per hour (vph) or 11,000 vehicles per day (vpd). Where forecast peak hour volumes are less than 1,100 vph or 11,000 vpd, a path on one side of a two-lane road is sufficient.

The DPLH's *Transport Impact Assessment Guidelines Volume 2* indicates where pedestrian crossing movement will be impacted based on traffic volumes and facilities will need to be considered (Table 19).

Table 19 Traffic volumes (vph) affecting pedestrian crossing amenity (DPLH)

Road cross-section	**Traffic volume affecting ability of pedestrians to cross *** (vehicles per hour – two-way)
2 lane undivided	1,100 vph
2 lane divided (or with pedestrian refuge islands)	2,800 vph
4 lane undivided (without pedestrian refuge islands)	700 vph
4 lane divided (or with pedestrian refuge islands)	1,600 vph

Assuming the peak hour traffic represents approximately 10% of daily traffic, several major internal roads are likely to require consideration of pedestrian crossing facilities as the industrial area develops. Table 20, from the DPLH's *Transport Impact Assessment Guidelines Volume 2*, indicates desirable spacing of pedestrian crossings. These values are a guide and any requirements for zebra or signalised crossings would need to be approved by Main Roads. The location of a crossing is based on its merits by Main Roads rather than numerical criteria. Signalised crossings within an industrial area are unlikely to be required in view of the low pedestrian activity. Pram ramps and refuge islands are more likely to be implemented in the short term particularly in the proximity of service hubs.

[7] Based on *RTA Guide to Traffic Generating Developments*

Table 20 Maximum desirable spacing for safe pedestrian crossings (DPLH)

Road type	Maximum spacing of safe pedestrian crossing facilities*
Arterial – minimal frontage activity	400 metres
Arterial – significant frontage activity	200 metres
Local distributor/Neighbourhood connector	100 metres

Safe crossing facilities include:

- pedestrian refuge islands (up to the volumes shown in Table 19)
- zebra crossings
- signalised pedestrian crossings (mid-block) - (unlikely in an Industrial area due to low pedestrian volumes)
- crossing facilities at signalised intersections
- overpasses/underpasses (where appropriate, although unlikely in an industrial area due to low pedestrian volumes)

4.8.4 Cycling facilities and infrastructure in the NIA

As discussed in Section 3.4, DoT's draft *Perth Long Term Cycle Network* indicates primary, secondary, and local routes in and around the NIA, with the specific form of the routes to be determined at future detailed planning stages. These routes are in close alignment with the City of Wanneroo Long Term Cycle Network that was approved by Council in June 2020 (Figure 4-16).

The network will provide good accessibility to surrounding residential areas, along with links to external networks and activity centres located outside the NIA. Connections to the long-distance major cycle routes along the Mitchell Freeway, to Banksia Grove, and to the future cycle route along the Whiteman-Yanchep Highway will also be provided (see Figure 3-8). Provision is also available for on-road cycle lanes.

Figure 4-16 City of Wanneroo Long Term Cycle Network

In view of the industrial nature of the traffic and ultimate high traffic volumes, off road cycling facilities through the precinct are desirable to encourage their use and to minimise potential conflict. The provision of suitable crossing locations is also important. Whilst the specific form of each cycle route is to be determined at a later design stage, it is recommended that paths be constructed of asphalt (i.e., be seamless) and be a minimum of three metres wide.

The paths shown in Figure 4-16 will be complemented by a path network throughout the NIA. The local route proposed on Pederick Road will provide access to the service hub.

To improve permeability through the NIA, some additional cycle routes, over and above those included in the City of Wanneroo network, are shown in Figure 4-17. This improved network will feature a street (Pederick Road) with paths on both sides to allow for increased access along this key central route. Additionally, a path system adjacent to the service hubs should be developed.

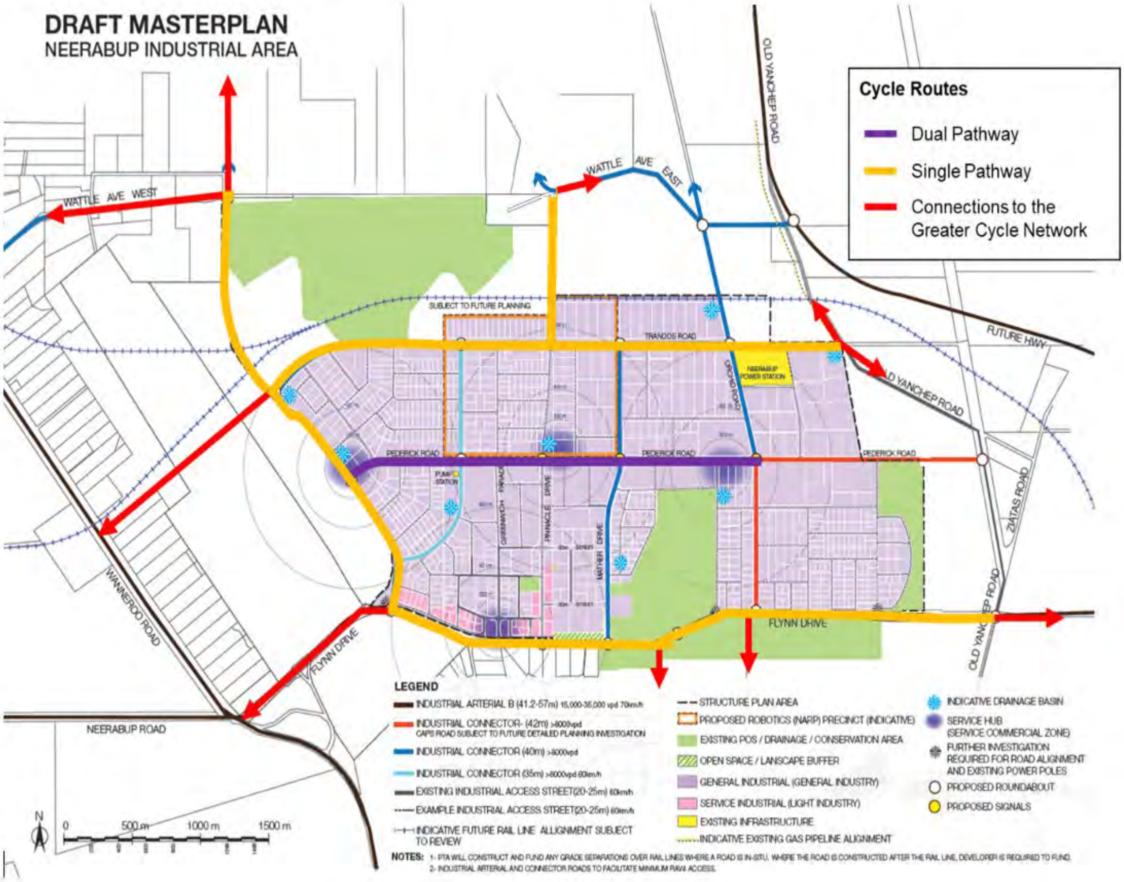


Figure 4-17 Suggested additional cycle routes through the NIA

Measures to facilitate cycling access to the NIA should include:

- Appropriate/sufficient end of trip facility provision at workplaces, including covered and secured bicycle parking facilities, with changerooms featuring such amenities as showers and lockers. A suggested rate of provision is two bicycle bays for the first 10 employees and one per ten employees thereafter. Lockers to be provided at rate of 1.2 lockers per bicycle bay. Showers at two per sex (male and female) for the first ten bicycle bays and one per sex for every ten bicycle bays thereafter.
- Sufficient at workplaces and provision of bicycle U-rails at service hubs.
- Wayfinding signage.
- Islands wide enough to accommodate a waiting bike.
- Suitable grades.
- Good connectivity to the overall network, both internal and external.

Accessibility to the service hubs on Pederick Road should be readily achieved and will be enhanced by the proposed traffic signals incorporating crossing facilities and adjacent paths.

Roundabouts are proposed at several major intersections and their implementation and design will need to be cognisant of options for cyclists to bypass the roundabout.

Signals are recommended where higher volumes of pedestrian/cyclist crossing is more likely.

5. Recommendations

Following an assessment of the information gained from stakeholder consultation, surveys of other local authorities, and a review of relevant literature, the recommendations made in relation to the planning of the NIA transport network as summarised into various sub sections as follows:

5.1 Road network

- The road network within the NIA should be designed to accommodate RAV Network 7 trucks up to 36.5 m in length (as discussed in Section 2.3, the surrounding road network only accommodates RAV Network 4 vehicles currently however is likely to be upgraded for RAV Network 7 trucks up to 36.5 metres). Intersections should allow for turning trucks to be accommodated lane correct. Similar intersection spacing should be applied to Network 4 routes (27.5 m trucks) to facilitate movement. Accesses to premises should be designed to allow trucks to enter when another vehicle is waiting to exit. The RAV network will need to be expanded as the Structure Plan develops.
- In the short term, safety issues on Flynn Drive and Old Yanchep Drive should be addressed to include shoulder widening, delineation and lighting.
- An OSOM route to be developed between Great Northern Highway and the NIA. In view of the OSOM planning for Stock Road, the most logical route to the NIA is likely to be for 8.5-metre-wide x 6.5-metre-high loads to access Tonkin Highway/PDNH via Stock Road and develop an exit to Neaves Road to the NIA.

The recommended road reserve widths for the NIA are shown in

- Table 14. Dual carriageways should be staged until significant development occurs. Traffic volumes and forecasts will need to be monitored as development occurs and reanalysed as required.
- The major intersections within the NIA, of which there are 20, should feature the treatments listed in Table 15.
- The upgrade of Flynn Drive to a dual carriageway will ultimately be required and will form an important connection to eastern and western destinations. Its upgrade is required to accommodate access to the NIA as development occurs, both within the industrial area and surrounding areas. As an immediate priority, the section of Flynn Drive from just east of Wanneroo Road to Mather Drive should be upgraded. Ultimate carriageway requirements for Flynn Drive must be determined by Regional modelling (ROM/STEM) by Main Roads WA/DoT) when their longer-term planning is completed.
- Upon development of Whiteman-Yanchep Highway, Flynn Drive should be extended eastward to connect with the future Whiteman Yanchep Highway and a realigned Neaves Road (as shown in Figure 3-13).
- The upgrade of Neaves Road could be supported to accommodate future transport demand linking the NIA and the Bullsbrook Industrial Area to the east, which will also include a proposed intermodal facility. It also provides an important link to Tonkin Highway/PDNH.
- Key intersections with Flynn Drive will ultimately require traffic signals to accommodate turning movements. High volumes are forecast on Flynn Drive and major road connections to NIA, roundabouts will not accommodate ultimate volumes based on analysis.
- Key major intersections within the NIA on major roads particularly in proximity to the service hubs will require traffic signals to accommodate forecast traffic volumes and pedestrian crossing activity.
- The operation of key intersections with the external road network should be upgraded as development occurs and traffic volumes warrant. Intersections with Flynn Drive will be a priority. The upgrade of major intersections with Flynn Drive will need to be staged, i.e., channelisation in the short term, then signalised, upgraded geometry, and turn lanes.
- The recommended road hierarchy is shown in Figure 4-9.

5.2 Public transportation

- The provision of bus routes within the NIA should be discussed with the PTA as development occurs. Any bus stops provided must have adequate path connections and constructed facilities, e.g., hardstand, bench seat, etc.
- The City of Wanneroo should liaise with the PTA about the alignment for the “North Western Line” proposed in the Neerabup area to connect the Joondalup and Ellenbrook Lines.

5.3 Active transportation

- The pedestrian and cycle path network must be developed within and through the NIA to include paths adjacent to all roads, connections to bus stops and suitable crossing facilities (see sections 4.8.3 and 4.8.4).
- Path and crossing connections to the surrounding residential areas should also be developed.

- Good cycling connectivity to Clarkson Station located to the west of the NIA is recommended.
- End of trip facilities should be provided with all development, i.e., showers, covered and secure bicycle parking, lockers.
- Appropriate quantum of U-rails provided at service hubs.
- Pathways be constructed to a minimum of three metres in width.

6. Reference documents

Austroads Design Vehicles and Turning Path Guide

Austroads Guide to Road Design Part 3

Austroads Road Design for Heavy Vehicles

City of Swan Transport Strategy, September 2014

City of Wanneroo Long Term Cycle Network, June 2020

City of Wanneroo Neerabup Industrial Area Structure Plan No 17, September 2017

City of Wanneroo Transport Strategy 2019/20

DC Policy 1.4 Industrial Subdivision

DC Policy 1.7 General Road Planning

Department of Planning Lands and Heritage Road Planning Study East Wanneroo District Structure Plan, 11 September 2019

Department of Planning Lands and Heritage/WA Planning Commission Perth and Peel @ 3.5 Million Transport Plan, March 2018.

Department of Planning Lands and Heritage/WA Planning Commission. North-East Sub Regional Planning Framework, March 2018

Department of Transport Draft Perth Long Term Cycle Network

Institute of Highways and Transport (UK)

Main Roads Supplement to Austroads Guide to Road Design

Main Roads WA Crash Analysis Reporting Tool

Main Roads WA High Wide Load Corridor Mapping

Main Roads WA North Link (https://northlinkwamap.mainroads.wa.gov.au)

Main Roads WA Planning and designing for pedestrians: guidelines 2011

Main Roads WA RAV Mapping Tool

Main Roads WA Road Hierarchy for Western Australia Road Types and Criteria

Main Roads WA Road Information Mapping System

Main Roads WA ROM24

Main Roads WA Roundabouts and Traffic Signals Guidelines for the Selection of Intersection Control

Main Roads WA Standard Restricted Access Vehicle (RAV) Route Assessment Guidelines

Main Roads WA Traffic Map

Metropolitan Region Scheme, June 2014

Road Reserves Review joint study for the Department of Planning, and Urban Development, Department of Transport, Main Roads Department, and Transperth (1991)

Transperth Bus Route Mapping

Western Australian Planning Commission Transport Impact Assessment Guidelines Volume 2

Appendices

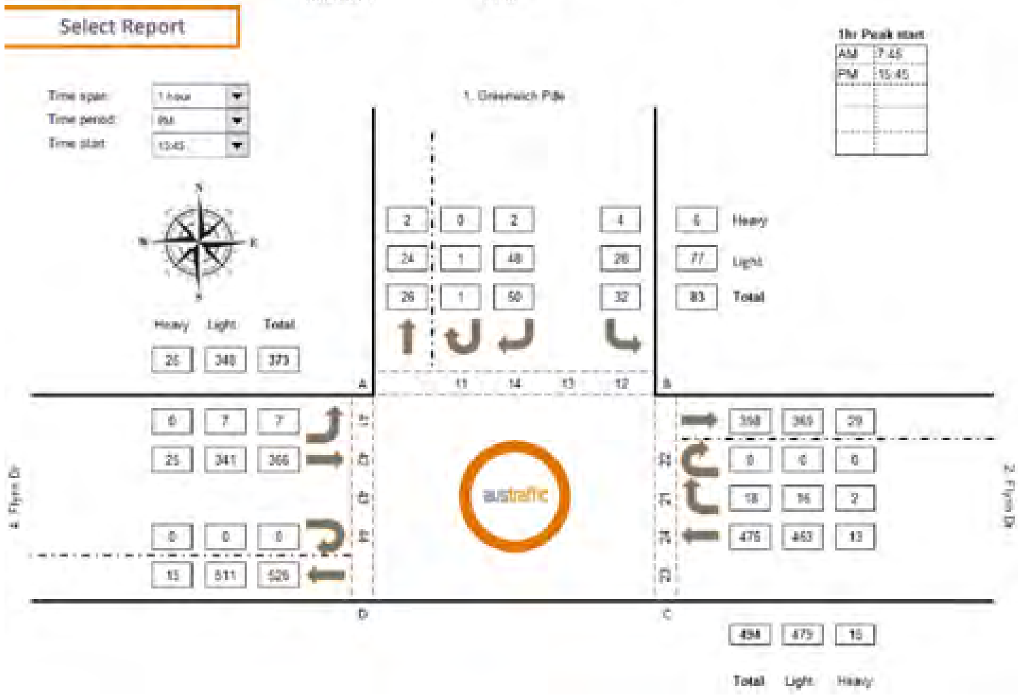
Appendix A - (Neerabup Industrial Area Existing Intersection Volumes)

austraffic

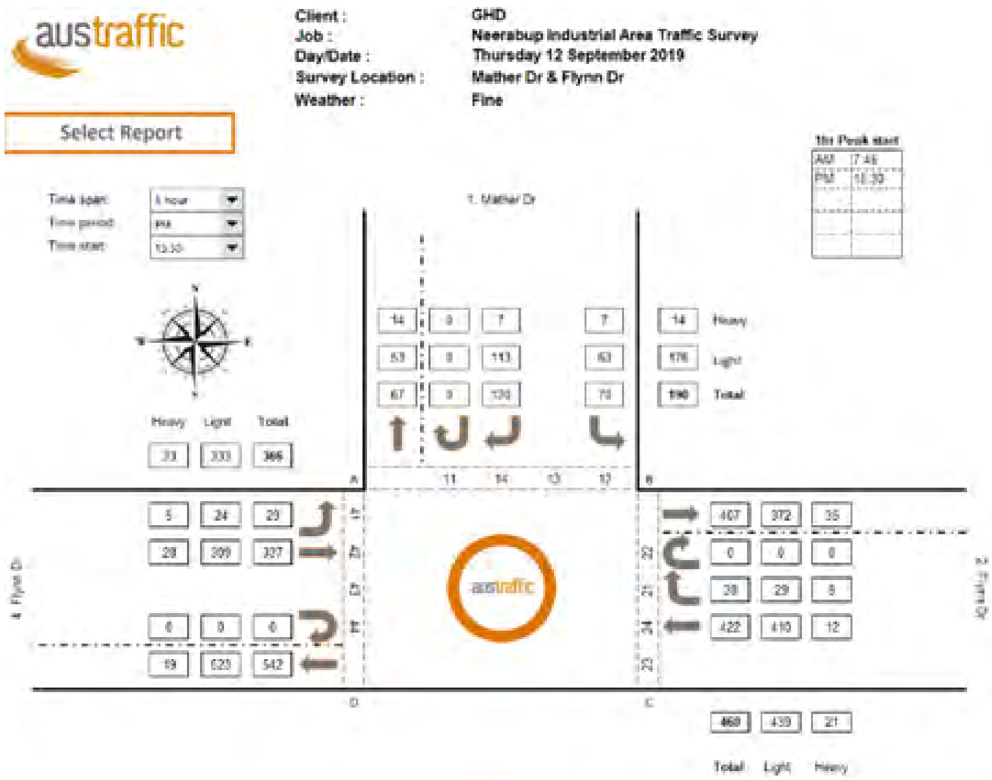
Client :	GHD
Job :	Neerabup Industrial Area Traffic Survey
Day/Date :	Thursday 12 September 2019
Survey Location :	Greenwich Pde & Flynn Dr
Weather :	Fine

austraffic

Client :	GHD
Job :	Neerabup Industrial Area Traffic Survey
Day/Date :	Thursday 12 September 2019
Survey Location :	Greenwich Pde & Flynn Dr
Weather :	Fine




austraffic
Client :
Job :
Day/Date :
Survey Location :
Weather :
GHD
Neerabup Industrial Area Traffic Survey
Thursday 12 September 2019
Mather Dr & Flynn Dr
Fine
Select Report
1hr Peak start
AM 7:45
PM 15:30
Time span
Time period
Time start
1. Mather Dr
2. Flynn Dr
4. Flynn Dr
Heavy
Light
Total


austraffic
Client :
Job :
Day/Date :
Survey Location :
Weather :
GHD
Neerabup Industrial Area Traffic Survey
Thursday 12 September 2019
Mather Dr & Flynn Dr
Fine
Select Report
1hr Peak start
AM 7:45
PM 15:30
Time span
Time period
Time start
1. Mather Dr
2. Flynn Dr
4. Flynn Dr
Heavy
Light
Total


austraffic
Client : GHD
Job : Neerabup Industrial Area Traffic Survey
Day/Date : Thursday 12 September 2019
Survey Location : Pederick Rd & Old Yanchep Rd
Weather : Fine
Select Report
1hr Peak start
AM 6:15
PM 15:15
Time span: 1hour
Time period: AM
Time start: 6:15
1. Old Yanchep Rd
3. Old Yanchep Rd
4. Pederick Rd
Heavy
Light
Total
8 0 0 8
80 0 6 62
88 0 6 70
8 Heavy
68 Light
76 Total
Heavy Light Total
4 6 10
11 14 13 12
A B C D
0 5 5
4 1 5
0 0 0
4 12 16
41 42 43 44
34 31 32 33
Total 93
Light 81
Heavy 12
10 83 0 75
6 75 0 63
4 8 0 12


austraffic
Client : GHD
Job : Neerabup Industrial Area Traffic Survey
Day/Date : Thursday 12 September 2019
Survey Location : Pederick Rd & Old Yanchep Rd
Weather : Fine
Select Report
1hr Peak start
AM 6:15
PM 15:15
Time span: 1hour
Time period: PM
Time start: 15:15
1. Old Yanchep Rd
3. Old Yanchep Rd
4. Pederick Rd
3 0 0 12
76 0 3 77
79 0 3 89
12 Heavy
80 Light
92 Total
Heavy Light Total
3 11 14
11 14 13 12
A B C D
2 5 7
1 6 7
0 0 0
2 6 8
41 42 43 44
34 31 32 33
Total 77
Light 74
Heavy 3
5 72 0 96
3 71 0 83
2 1 0 13

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12515608-60175-284/https://projectsportal.ghd.com/sites/pp18_01/neerabupdistrictplan/ProjectDocs/Transport/12515608-Rev-2-Neerabup Structure Plan Traffic and Transport Study Current Structure Plan.docx

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