



Airport - Manukau - Botany

Auckland Transport

LRT concept alignment investigation

IZ058400-RPT-001 | Final

8 May 2017

PO: 420004461



Airport - Manukau - Botany

Project No: IZ058400
Document Title: Airport Manukau Botany LRT concept alignment investigation
Document No.: IZ058400-RPT-001
Revision: FINAL
Date: 08 May 2017
Client Name: Auckland Transport
Client No: PO: 420004461
Project Manager: Jeremy Hosking
Author: Keith Hall / Scott Elaurant / Lauren Stuckey
File Name: J:\IE\Projects\02_New Zealand\IZ058400\02 Documents\Report\2 Airport Manukau Botany Report\airport manukau botany lrt concept_FINAL_20170508.docx

Jacobs New Zealand Limited

Carlaw Park
12-16 Nicholls Lane, Parnell
Auckland 1010
PO Box 9806, Newmarket
1149 Auckland
New Zealand
T +64 9 928 5500
F +64 9 928 5501
www.jacobs.com

© Copyright 2017 Jacobs New Zealand Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This report has been prepared on behalf of, and for the exclusive use of Jacobs' Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Document history and status

Revision	Date	Description	By	Review	Approved
Draft	17/10/2016	Draft issue to client for initial review and comment	KH / KK	SC / JH	JH
Draft	23/02/2017	Draft executive summary for client review	LS	JH	JH
Draft	01/05/2017	Updated draft issue to client for initial review and comment	LS	JH / SE	JH
FINAL	08/05/2017	FINAL for Auckland Transport issue	LS	JH	JH

Contents

Executive Summary	1
1. Introduction	5
1.1 Demographics and Commuting Patterns	5
1.2 Strategic Context	7
1.2.1 Auckland Transport Alignment Project	7
1.2.2 The Auckland Plan and the 'Southern Initiative'	9
1.2.3 South-western Multi-modal Airport Rapid Transit (SMART) Indicative Business Case – Rail to the Airport	11
1.2.4 Transform Manukau	11
1.3 Key Project Drivers	13
1.3.1 SH20B Indicative Business Case	13
2. Future Land Use	14
3. Light Rail Assumptions	17
3.1 Operating Speed	17
3.1.1 Extent of separation of LRT trackway	17
3.1.2 Spacing of stations	17
3.1.3 Frequency of service and length of journey	17
3.1.4 Time and quality of transfers between modes	18
3.1.5 Service reliability	18
3.2 System Integration	18
3.3 Land Use Integration	19
4. Option Development	20
4.1 Options from the Airport to Manukau City Centre	20
4.2 Options from the Botany Town Centre to Manukau City Centre	20
4.3 Options through Manukau City Centre	21
4.4 Option Combinations	21
4.4.1 Alignment Option 1	21
4.4.2 Alignment Option 1A	21
4.4.3 Alignment Option 1B	22
4.4.4 Alignment Option 2	24
4.4.5 Alignment Option 2A	24
4.4.6 Alignment Option 3	26
4.4.7 Alignment Option 4	28
4.4.8 Alignment Option 4A	28
5. Evaluation Framework	30
6. Option Evaluation	33
6.1 Sensitivity Analysis	35
7. Initial Option Conclusions	36
8. Further investigation	38
8.1 Airport to Puhinui	38

8.1.1	Auckland International Airport to SH20 interchange	38
8.1.2	SH20 / SH20B interchange	39
8.1.3	Puhinui Road	41
8.1.4	Puhinui Station.....	42
8.2	Botany to Manukau	45
8.2.1	Options	46
8.2.1.1	Preston Road.....	46
8.2.1.2	Chapel Road.....	48
8.2.1.3	Te Irirangi Drive	50
8.2.2	Option Comparison	52
8.2.2.1	Travel Time.....	52
8.2.2.2	Potential walk up catchment.....	54
8.2.3	Recommended Manukau to Botany alignment.....	56
8.3	Manukau City Centre.....	56
8.3.1	Option 1 – Manukau Station Road.....	57
8.3.2	Option 2 – Ronwood Avenue.....	58
8.3.3	Option 3 – Putney Way	60
8.3.4	PT interchange.....	63
8.3.5	Recommended Manukau City Centre alignment.....	63
8.3.6	SH1	64
9.	Recommended LRT concept alignment.....	68
10.	Further investigation.....	70
10.1.1	Land use changes.....	70
10.1.2	Integrated PT network.....	70
10.1.3	Pedestrian access.....	71
10.1.4	Cycle access.....	71
10.1.5	Staging	72

Appendix A. Workshop 1 - Project Kick-off minutes

Appendix B. Workshop 2 - LRT Concept Alignment minutes and materials

Appendix C. Workshop 3 – Minutes

Appendix D. Recommended concept alignment drawings

Executive Summary

This report documents the consideration of potential light rail transit (LRT) between Auckland International Airport and Botany Town Centre with service to Manukau City Centre and identifies a recommended LRT concept alignment.

A strategic public transport connection from the Airport to Botany (via Manukau) was identified by Auckland Transport Alignment Project (ATAP) as a key element of the overall future strategic public transport network. The connection was prioritised as a 'Decade 2' project (between 2028 – 2038), based on the extent to which it addresses the most significant transport challenges and may provide value for money in the next decade. Transform Manukau and the Auckland Plan and Southern Initiative identify growth in both housing and employment in this corridor, including significant intensification in Manukau Central with additional growth in Botany Town Centre and the Airport Business Centre. From a transport perspective, existing infrastructure and public transport services do not adequately meet existing or future mobility needs, especially among socially deprived populations. Therefore, there is a need for expanded public transport throughout this corridor. For the purposes of this investigation, it was assumed that the public transport connection between the Airport and Botany via Manukau will be served by light rail.

The recommended concept alignment for LRT has been developed with significant stakeholder engagement, involving meetings and workshops. Key stakeholder representatives included: Panuku Development Auckland (PDA), AT Metro and internal Auckland Transport stakeholders. The outcomes of this engagement refined the project objectives and informed the option development process.

The project approach investigated alignment concepts for each of three segments: alignments from Auckland International Airport to the west of Manukau City Centre, alignments from Botany Town Centre to the east of the Manukau City Centre, and alignments within Manukau City Centre. The locations of LRT stations were considered at a high level to align with existing and future public transport hubs and key trip generators along the study corridor. The spacing of the LRT stations was also considered to align with the transport function and characteristics of each of the potential corridors.

The process of identifying and evaluating alignment options for each of the three major segments, distinguished the key differentiators between the options and identified a preferred alignment from the Auckland International Airport to Puhinui. However, further consideration was required to understand the feasibility of complex sections of the route, and determine the general preferred alignment through Manukau City Centre and onwards to Botany. Rather than postponing the resolution of these issues to the Indicative Business Case (IBC) phase, they were further investigated in order to determine a preferred recommended alignment for LRT.

The investigation confirmed that as an RTN connection the primary objective of the Airport Manukau Botany link is to provide; an efficient Public Transport service, with a competitive travel time, that serves Manukau City Centre.

The additional investigation resulted in the following refined understandings and options regarding each section of the route:

- Auckland International Airport to the west of Manukau City Centre:
 - An alignment that connects north of the Manukau Rail Spur to Puhinui Train Station is preferred because interchanging at Puhinui captures both the Eastern and Southern heavy rail lines.
 - Along the southern side of SH20B (west of SH20) a 20 m corridor has been negotiated for an RTN link and state highway upgrades. Collaboration with NZTA through the subsequent IBC process to determine how to accommodate RTN and general vehicle capacity upgrades.
 - It is feasible to accommodate LRT at grade through the SH20 interchange subject to further investigation of traffic capacity implications, location of services and consideration of active modes through the interchange.
 - It is feasible for LRT to span the North Island Main Trunk (NIMT) at Puhinui Station. There are a variety of options available to incorporate an LRT stop which can support interchanging with heavy rail

and bus services. Heavy rail connections to the north and south and LRT connections to the east and west will result in a high level of Public Transport service at Puhinui Station, providing an ideal opportunity for Transport Orientated Development (TOD). Despite the planning restrictions surrounding Puhinui Station due to the Aircraft Noise Area, there may be potential for development on the northern side of Puhinui Road subject to further investigation in the IBC phase.

East of Manukau City Centre to Botany Town Centre:

- Assessment of the Preston Road, Chapel Road and Te Irirangi Drive corridors, has determined that Te Irirangi Drive is the preferred alignment for LRT between Manukau and Botany.
- Preston Road was not considered as a suitable option because: it does not serve Manukau City; is slow in travel time; has an industrial environment unsuitable for LRT walk up catchment; and, would have significant property impacts.
- Te Irirangi Drive was accepted as the preferred LRT alignment option because it can: serve Manukau City Centre; achieve a competitive travel time; have potential for supporting land use redevelopment; have the lowest property impacts; have minimal traffic impact; support active travel mode facilities; and, have potential for interchange with a local bus network.
- Chapel Road was similar to the Te Irirangi Drive corridor however the option was slower in travel time and would have more property impacts. The FTN is planned for Chapel Road and the Mill Road Corridor upgrade includes bus facilities along Hollyford Drive and Redoubt Road.

Through Manukau City Centre:

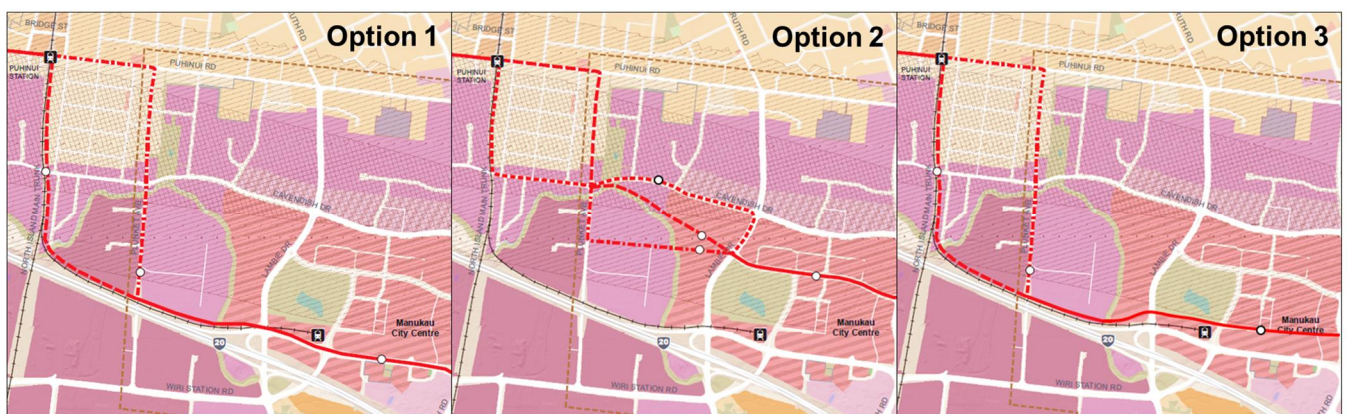
- It was agreed that the preferred alignment through Manukau City Centre should continue the corridor's predominately east-west orientation while maximising direct access between LRT and the primary destinations and redevelopment sites in the urban core. As the preferred alignment already has connection to the Eastern and Southern rail lines (at Puhinui), it was considered not necessary for the preferred option to connect with the Manukau Station.

- Three primary east-west route options were developed:

Option 1 – Manukau Station Road – via KiwiRail or Plunket Avenue

Option 2 – Ronwood Avenue via KiwiRail or Plunket Avenue through the AMP site

Option 3 – Manukau Station Road and Putney Way through the Westfield site



- Consultation with AT Metro confirmed that there are feasible solutions available for all of the options considered for to create a cohesive Public Transport Network with strong Bus and LRT interchange opportunities. It was also determined that it is not necessary for LRT to physically connect to the Manukau Bus Station.
- Consultation with PDA revealed that within the next 10 years, PDA is focusing on the redeveloping the land along Manukau Station Road and Putney Way. These areas do not necessarily need the support of LRT to encourage regeneration. Considering Ronwood Avenue, PDA long term aims (10+ years) are for the current low density retail to move and allowing for higher density commercial and residential development. The possible future timing of LRT (Decade 2) is more likely to align with the

programme for development of the Ronwood Avenue area and encourage developer investment resulting in organic redevelopment.

- The recommended preferred alignment for LRT through Manukau City Centre is along Ronwood Avenue due to east-west orientation; ability to serve centroid of activity for pedestrian movements, potential to serve and support part of Manukau City Centre requiring redevelopment; potential to integrate with the bus PT network; and, ability to still be competitive in travel time. The section of the alignment through the AMP SUPA CENTRA site is subject to consultation and negotiation.

Based on the considerations and investigation for a LRT concept alignment between Auckland International Airport and Botany Town Centre with service to Manukau City Centre the recommended option to be further investigated is as shown in Figure 1.1.



Figure 1.1 Recommended LRT concept alignment

Further investigation through the IBC processed is recommended in the following areas:

- Consultation with wider stakeholders including land owners, NZTA and KiwiRail. Negotiations with land owners regarding alignments through sites such as AMP SUPA CENTRA and Westfield. The utilisation of the designated space along SH20B corridor to accommodate LRT.
- Development of a strategy to consider how the Airport Manukau Botany LRT route would be implemented if the timing of the project occurred before SMART including location of the LRT depot site and potential to stage the LRT route.
- Value capture opportunities of the LRT route.
- Opportunities for Transport Orientated Development.
- Do Minimum scenario for option evaluation and comparison purposes.
- Identify consenting requirements and development of a progression pathway for the next project phases.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to **document the development of a concept alignment for LRT, from Auckland International Airport to Botany Town Centre via Manukau Metropolitan Centre** in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party

1. Introduction

1.1 Demographics and Commuting Patterns

South-east Auckland is currently one of the most populated areas in Auckland and significant population and employment growth is forecast for Auckland Airport and Manukau City Centre, as well as the wider area to the east of Manukau City Centre including Botany, Botany Town Centre, Flatbush and Ormiston.

This report presents options for improving access to the wider public transport network as this area grows, as well as meeting corridor-specific requirements associated with movements between Botany Town Centre, Manukau City Centre, and the Auckland International Airport. In particular, this report evaluates options for LRT in the corridor between Botany Town Centre and Auckland Airport via Manukau City Centre.

In general, South Auckland is an area characterised by its population diversity. Among the local boards serving the project area, Howick most closely reflects the demographic and employment characteristics of greater Auckland, as shown in Table 1.1. In contrast, Mangere-Otahuhu and Otara-Papatoetoe in the project area reflect a much higher diversity in population, as well as lower personal income levels. Nearby Papakura is similar to Howick and regional Auckland in demographics and income, while Manurewa also reflects lower income and higher diversity. Some corridor options pass through Manurewa, but the most striking feature of Manurewa is the low level of employment compared to other local board areas.

Table 1.1 Local Board demographics in and around the project corridor¹

	Population				Housing Units	Personal income	Employed in area
	Maori	European	Other	Total			
Study area							
Howick	5%	55%	40%	127,125	43,266	\$30,300	43,690
Mangere-Otahuhu	16%	20%	65%	70,959	18,339	\$19,700	38,510
Otara-Papatoetoe	16%	21%	64%	75,663	20,994	\$21,100	37,500
Nearby Areas							
Papakura	28%	61%	11%	45,636	15,942	\$28,000	14,220
Manurewa	25%	37%	38%	82,242	23,847	\$24,700	4,540
Region							
Auckland	11%	59%	30%	1,415,550	509,625	\$29,600	650,610

¹ 2013. Statistics New Zealand. 2013 Census data.

All of the local boards in and near the project corridor have higher rates of commuting in personal or company motor vehicles than the region as a whole, coupled with lower rates of public and active transport, as shown in Table 1.2. This pattern of commuting is consistent areas of lower population density and dispersed employment centres that lack well-connected street networks. In these areas, access to most jobs requires access to a motor vehicle, since commute distances are typically longer and public transport is less available.

A closer look at Table 1.2 reveals that economic characteristics may also affect commute patterns. Residents of Howick and Papakura have higher rates of commuting not just by personal car, but also by company car, and both areas have personal incomes near that of the region as a whole. Manurewa has similar commuting patterns, even with lower personal incomes. Although changing travel mode from personal car to public transport can offer economic savings to households, it is less likely that public transport will be an attractive option to commuters whose cars are provided by employers.

Conversely, residents of Mangere-Otahuhu and Otara-Papatoetoe have much lower incomes and less access to company vehicles, coupled with less access to quality public transport in environments that preclude walking and cycling as effective modes of transport. In both of these areas, residents are nearly twice as likely to be passengers (in carpools or being taken to work by family members or friends) than the region as a whole, and in most of the nearby areas. The core of the study area, including Mangere-Otahuhu and Otara-Papatoetoe local board areas, likely has the greatest unmet demand for public transport improvements, but a major improvement to public transport may also require investments that improve connectivity to provide walk and cycling access to public transport stops. Nonetheless, these areas represent the areas with the greatest opportunity for mode share change.

Table 1.2 Commuting patterns²

	Main means of transport to work					
	Private car	Company vehicle	Passenger	Bus/Train	Walk/cycle	Other
Study area						
Howick	60%	12%	3%	3%	2%	20%
Mangere-Otahuhu	56%	6%	8%	5%	3%	22%
Otara-Papatoetoe	57%	6%	7%	6%	4%	20%
Nearby Areas						
Papakura	56%	12%	4%	5%	3%	20%
Manurewa	59%	9%	6%	4%	2%	20%
Region						
Auckland	52%	10%	4%	7%	5%	22%

² 2013. Statistics New Zealand. 2013 Census data.

Without interventions in public and active transport over the longer term, the high degree of reliance on motor vehicle travel, whether as a driver or passenger, will continue. Any growth in population or employment that occurs in this area will likely result in increased traffic congestion, longer travel times for motorists and public transport users, and reduced access by residents to regional employment centres.

This finding is supported in the Auckland Transport Alignment Project – Foundation Report, which found that declining access, both by car and public transport, will continue in South Auckland through 2036. Congestion on the motorway network and selected key arterial routes will continue through 2046, while most gains in public transport mode share will occur in the city centre and at key nodes connected by the existing and future rapid transit network, including Auckland International Airport and Manukau City Centre. For much of South Auckland, public transport origin trips will improve modestly, with public transport destination trips showing only nominal increases outside of the major centres. Irrespective of changes in mode share, most commute trips will take longer in future years than they currently do.

1.2 Strategic Context

1.2.1 Auckland Transport Alignment Project

Auckland's rapid population growth is placing substantial pressure on Auckland's transport network and this will be exacerbated by projected population growth over the next 30 years. The main purpose of ATAP is to improve the alignment between the Government and the Council regarding the development of Auckland's transport network in such a way that addresses significant growth forecast challenges and provides value for money. A 'Recommended Strategic Approach'³ has recently been developed by ATAP to guide the prioritisation of transport investment projects in Auckland.

A strategic public transport connection from the Airport to Botany (via Manukau) was identified by ATAP as a key element of the overall future strategic public transport network as shown in Figure 1.1. The public transport connection proposes a major interchange with the existing North Island Main Trunk line (NIMT) at Puhinui and a connection to the existing heavy rail station in the Manukau Metropolitan Centre.

Potential new transport investments were assessed against ATAP's prioritisation framework to develop an Indicative Programme of major investments. The strategic public transport connection was prioritised as a 'Decade 2' project (between 2028 – 2038), based on the extent to which it addresses the most significant transport challenges and may provide value for money in the next decade.

For the purposes of this investigation, it was assumed that the public transport connection between the Airport and Botany via Manukau will be served by light rail. The alignment options developed for the purposes of this investigation have considered an interchange at Puhinui and Manukau and the considerations, opportunities and constraints are discussed in section 4. An interchange at a new Wiri station as an alternative to Puhinui was also considered.

³ September 2016. Auckland Transport Alignment Project. *Recommended Strategic Approach*.

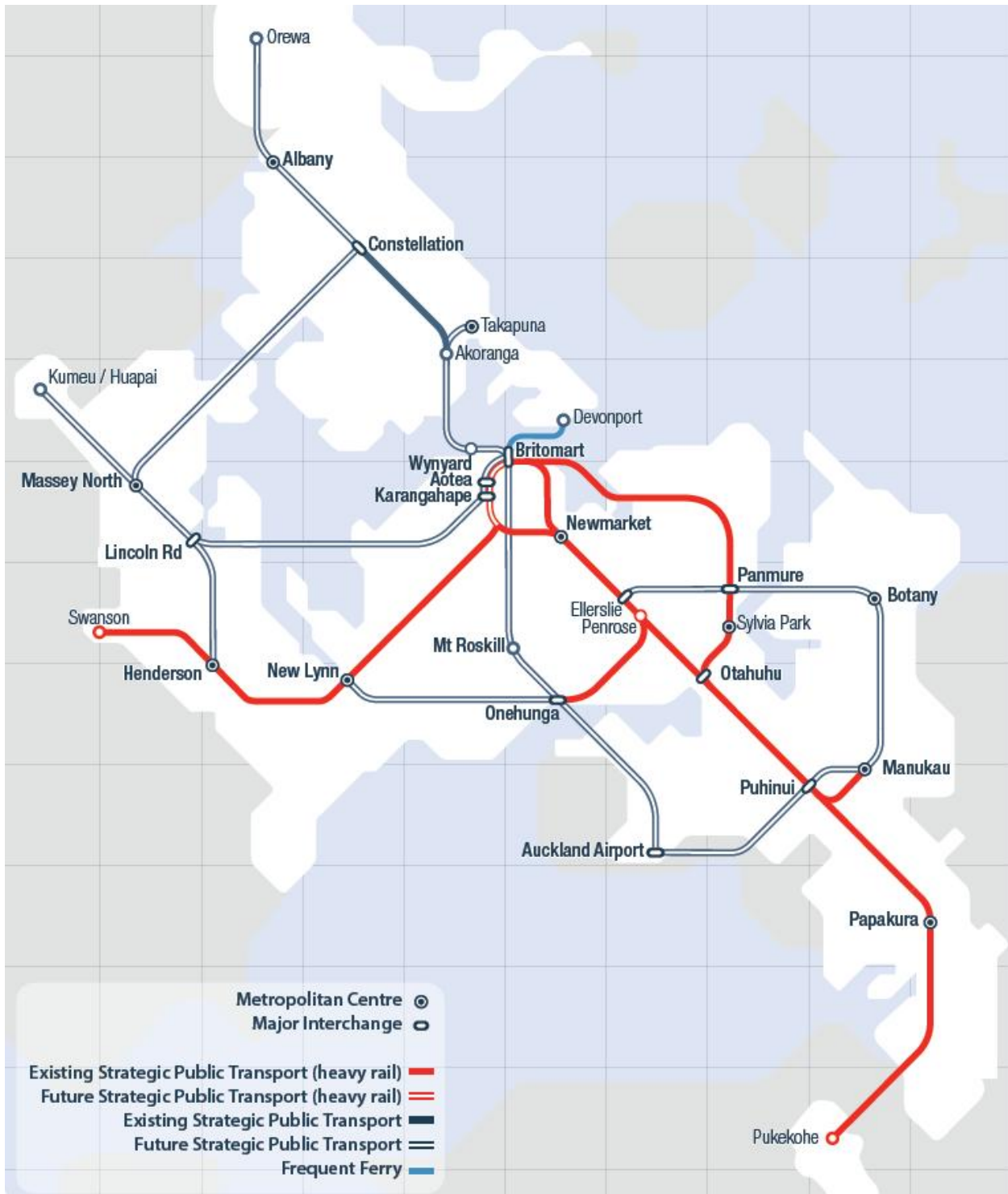


Figure 1.1 ATAP's proposed future strategic public transport network⁴

⁴ September 2016. Auckland Transport Alignment Project. *Recommended Strategic Approach*.

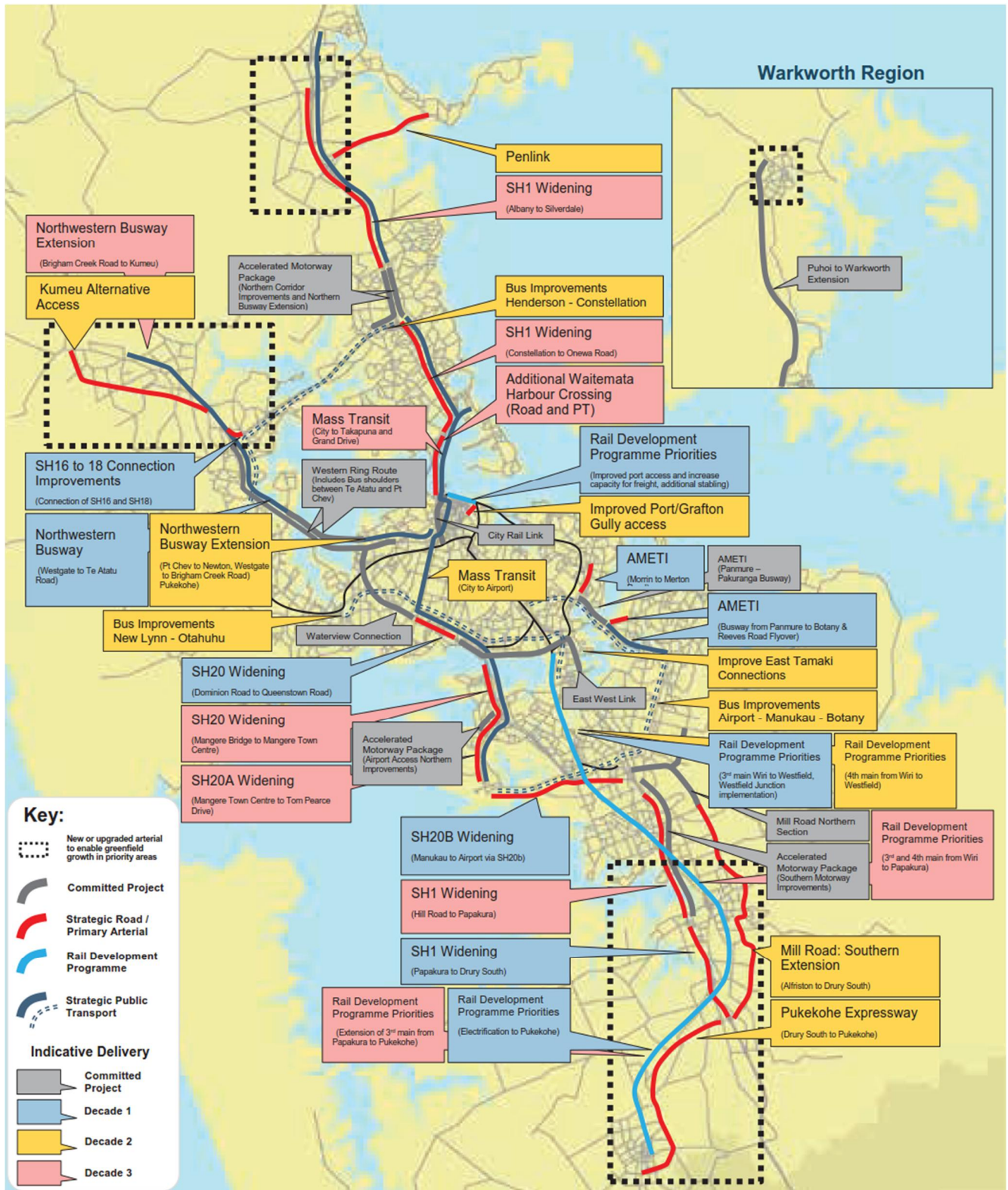


Figure 1.2 ATAP's indicative package of major transport intervention projects for the next three decades

1.2.2 The Auckland Plan and the 'Southern Initiative'

Manukau is the main centre of the southern Auckland area, including a mixture of commercial and retail activities. The large area of industrial and retail land use beyond the Manukau town centre supports Manukau's role as a key employment hub for Auckland.

As illustrated in Figure 1.3, Manukau is one of the most socioeconomically deprived areas in Auckland and is identified as an area with significant economic and development opportunities but high social need. Transforming Manukau has been identified as a key element of achieving the vision for Auckland to “create the world’s most liveable city”.

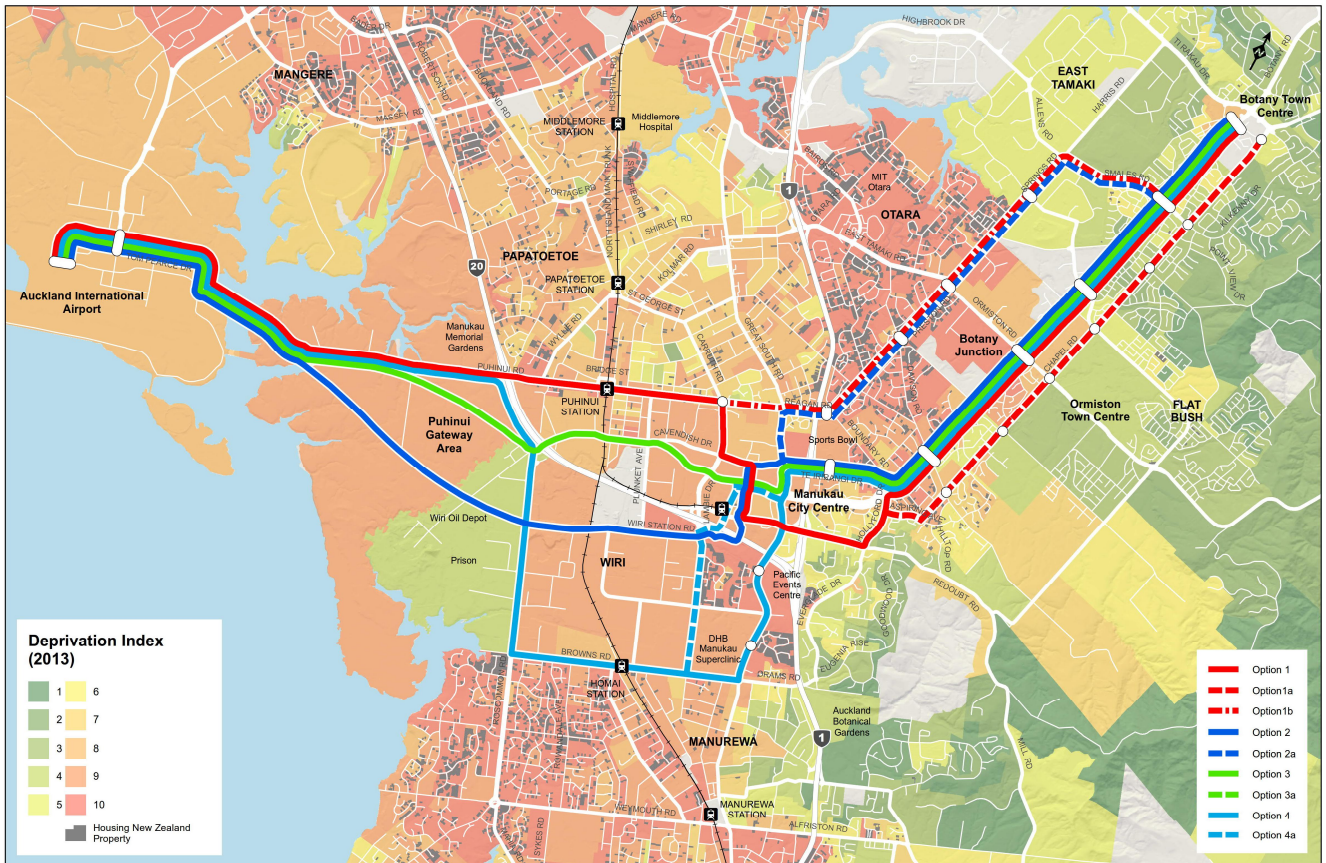


Figure 1.3 Socioeconomic deprivation index

The ‘Southern Initiative’ is one of two major place-based prioritisation projects to support the Auckland Plan and realise the vision for Auckland. The Initiative focuses on the social, economic and physical regeneration of the South Auckland area and recognises that sustained and coordinated efforts in the Southern Initiative area will make the greatest contribution toward Auckland and New Zealand’s future wellbeing.

The Auckland Plan also provides strategic direction on investment in transport infrastructure to better improve connections and accessibility within Auckland. Figure 1.4 demonstrates how the Airport, Manukau and Botany areas could be served by the rapid transit network in the future.

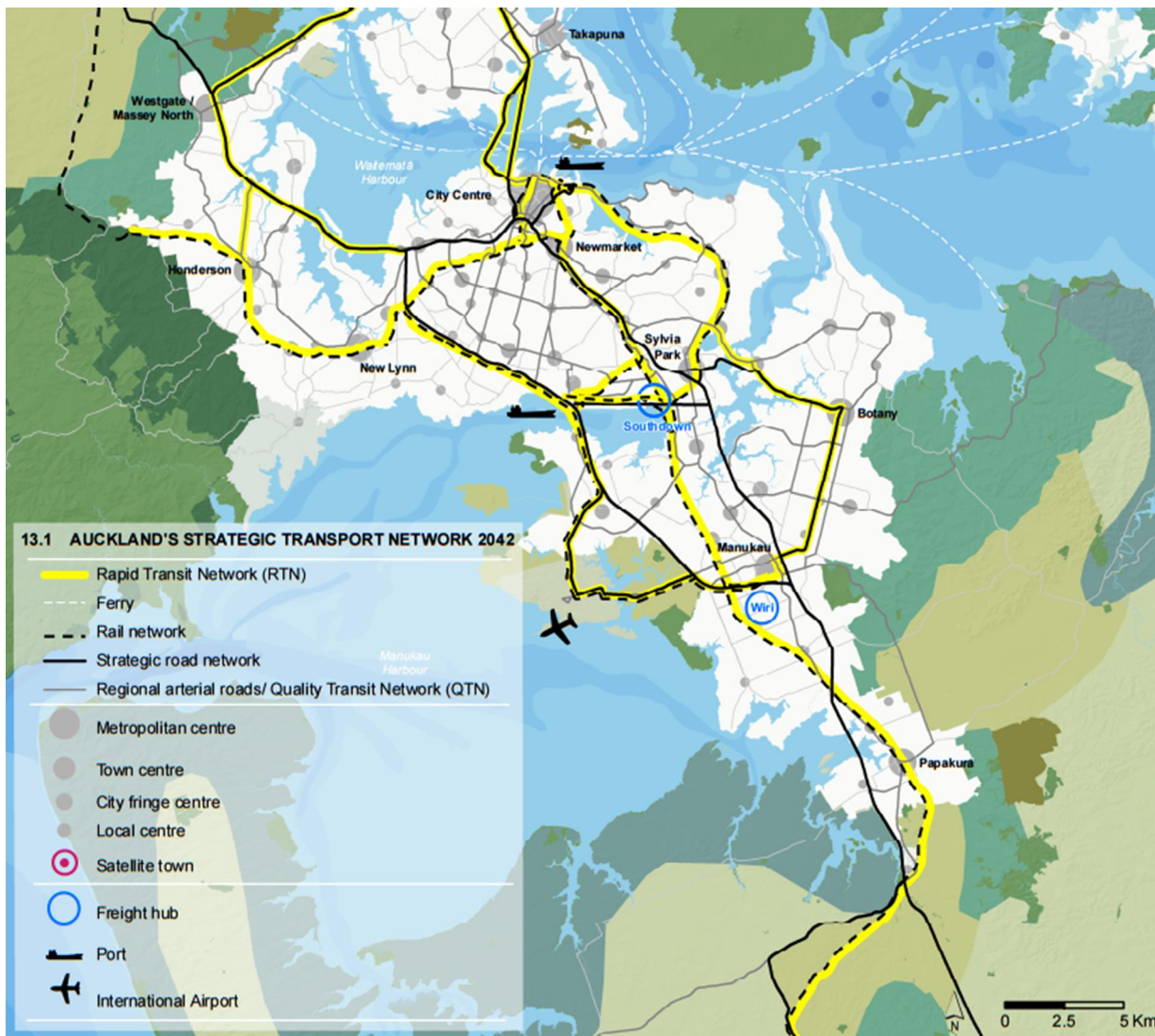


Figure 1.4 Auckland's future strategic transport network⁵

1.2.3 South-western Multi-modal Airport Rapid Transit (SMART) Indicative Business Case – Rail to the Airport

The South-western Multi-modal Airport Rapid Transit (SMART) IBC developed and assessed high-capacity, rapid transit solutions to provide a connection between the Auckland International Airport and the city centre. Heavy rail, light rail, bus rapid transit and hybrid options were investigated and key findings were that light rail and bus rapid transit options would best achieve the project objectives and provide the best value for money. Light rail would also deliver similar transport benefits to a heavy rail solution but at a significantly lower cost.

Providing light rail access to the Airport creates the potential for a wider light rail network in south Auckland and has the added benefit of enabling the extension of the rapid transit network from the Airport to the Botany Town Centre. This would not only improve access to East Auckland but would also improve transport options for commuters between Botany and Manukau.

1.2.4 Transform Manukau

The 'Transform Manukau' project is led by Panuku Development Auckland (PDA), which covers an area of 600ha, encompassing the Manukau Metropolitan Centre, the Manukau Sports Bowl and the Wiri suburban area

⁵ 2012. Auckland Council. *Auckland Plan Map 13.1 – Auckland's strategic transport network 2042*.

to the south (Figure 1.5). The underlying objective of the project is for Manukau Metropolitan Centre to become an attractive visitor destination, business centre and place to live, learn, work and play through urban renewal as outlined in the High Level Project Plan⁶. The investment programme will significantly increase the density of Manukau, especially from a residential perspective.

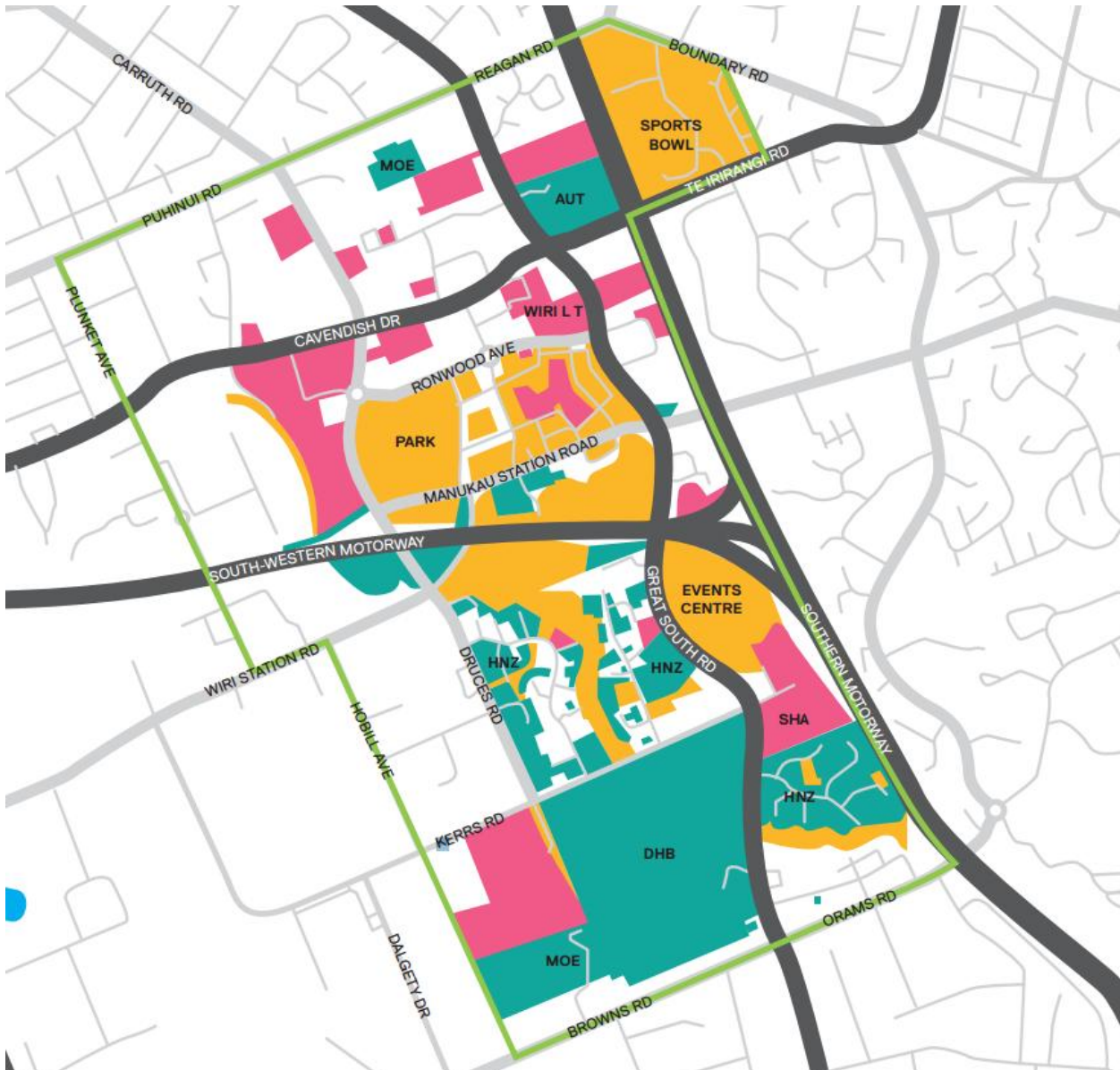


Figure 1.5 Transform Manukau focus area

Proximity to rapid public transport services to access employment and recreation opportunities is a key element of Manukau's transformation. Manukau is well-connected regionally with direct access to two main state highways (via four interchanges), but has a low level of local connectivity and access to key facilities and destinations. The residential catchment within walking distance of the Manukau Metropolitan Centre is also lacking, particularly since motorways represent key obstacles for accessing the various sectors of the Transform Manukau development area.

Providing a rapid transit connection from the Airport to the Manukau Metropolitan Centre without degrading the urban amenity of the area is fundamental to achieving the transformation vision for Manukau. A rapid transit corridor would reconnect key Manukau destinations and would help to create an intensive, people-focused

⁶ 2016. Panuku Development Auckland. *Transform Manukau: Renewal of Manukau Central – High Level Project Plan*.

transit-oriented development. It is recognised that the scale of bus movements to meet current and future demands in the centre could have an impact on liveable outcomes for the area.

The High Level Project Plan will be followed by more detailed Framework Planning, communications and engagement planning, detail site feasibility studies and subsequent business cases. This plan focuses on redevelopment of publicly-owned properties to support intensification of both commercial and residential uses. A significant portion of land in central Manukau is owned by Council or Crown entities, and redevelopment focuses on the area between Puhinui and Boundary Roads to the north, Plunket and Hobill Avenues to the west, Browns and Orams Roads to the South, and SH1 to Te Irirangi Drive on the east form the area of redevelopment in the plan. A key challenge for the integration of public transport with redevelopment in this area is its north-south orientation which contrasts with the east-west alignment proposed for LRT. Moreover, SH1 and SH 20 motorways represent significant barriers for through-movements in both east-west and north-south directions. While it is critical to connect Manukau Centre on any proposed alignment, the challenge will be to link major destinations without creating an inefficient and circuitous LRT route.

1.3 Key Project Drivers

Transform Manukau and the Auckland Plan and Southern Initiative identify growth in both housing and employment in this corridor, including significant intensification in Manukau Central with additional growth in Botany Town Centre and the Airport Business Centre. From a transport perspective, existing infrastructure and, in particular, public transport services do not adequately meet existing or future mobility needs, especially among socially deprived populations. Demographic and mobility indicators suggest an unmet need for expanded public transport throughout this corridor.

This preliminary evaluation considers the trade-offs between speed and access, as well as the need to connect socially deprived areas to employment opportunities, for a rapid transit network (RTN) corridor. In particular, the proposed corridor offers the opportunity to link areas of population growth and social deprivation to growing commercial centres and the wider public transport network.

A project kick-off workshop was attended by representatives from key stakeholder groups including Panuku Development Auckland (PDA), Auckland Transport and Jacobs, to discuss the key project drivers for the study. The minutes from this workshop are attached in Appendix A.

1.3.1 SH20B Indicative Business Case

Auckland Transport, with the NZ Transport Agency and Auckland Airport International Ltd (AIAL), is leading an IBC scheduled to begin in 2017 to inform future investment and investigate further capacity improvements for the SH20B corridor. SH20B plays an important role in overall state highway network and connects Auckland Airport (a hub for employment and freight), to the Manukau Metropolitan Centre and the wider south Auckland area. SH20B operates close to or at its theoretical capacity during peak times and strategic modelling indicates that the corridor and the road network surrounding the Manukau Metropolitan Centre will not provide adequate capacity to key employment areas in the long term. The Manukau Metropolitan Centre is of particular relevance to SH20B due to the residential development and additional employment opportunities proposed for the area.

The high level of existing congestion on SH20B compromises transport accessibility and the efficient operation of the corridor and surrounding road network. Additional traffic resulting from planned industrial, commercial and residential developments will only exacerbate existing issues. With population and employment growth forecast for the Airport – Manukau corridor, improved transport connections to key employment areas are required to realise the development potential of the south-east Auckland area. The development of an RTN route between the Airport, Manukau and Botany will be aligned with the NZ Transport Agency's business case development for SH20B.

2. Future Land Use

Future land use and road network connectivity are key drivers in creating a successful rapid transit project. Foundational principles of land use in public transport corridors include:

- Higher commercial development densities in urban centres, coupled with well-connected road networks, provide greater access to employment opportunities near public transport.
- Higher residential densities in urban centres, coupled with well-connected road networks, increase access for both active and public transport trips of all types, since housing is co-located with commercial in mixed-use areas.
- Higher development densities in residential areas along the corridor increase the “market” for public transport trips; more people living within close proximity of a rapid transit stop increases the number of people using the system, even without an increase in mode share.
- Well connected road networks in residential areas along the corridor also increases the “market” for public transport trips; more people can access the system in areas with well-connected road networks than in an area of comparable population without well-connected networks.
- Major activities along a public transport corridor must occur in a straight-line pattern. Rapid transit corridors that deviate from straight-line service to connect “scattered” destinations often become too slow to meet speed goals of rapid transit while failing to provide direct trips to all users.

Revised Auckland Unitary Plan land use maps for the entire study corridor and for the Manukau Metropolitan Centre are included in Figure 2.1 and Figure 2.2, respectively. The maps illustrate the potential opportunities and constraints relating to each of the potential alignment options.

Airport Manukau Botany LRT concept alignment investigation

JACOBS®

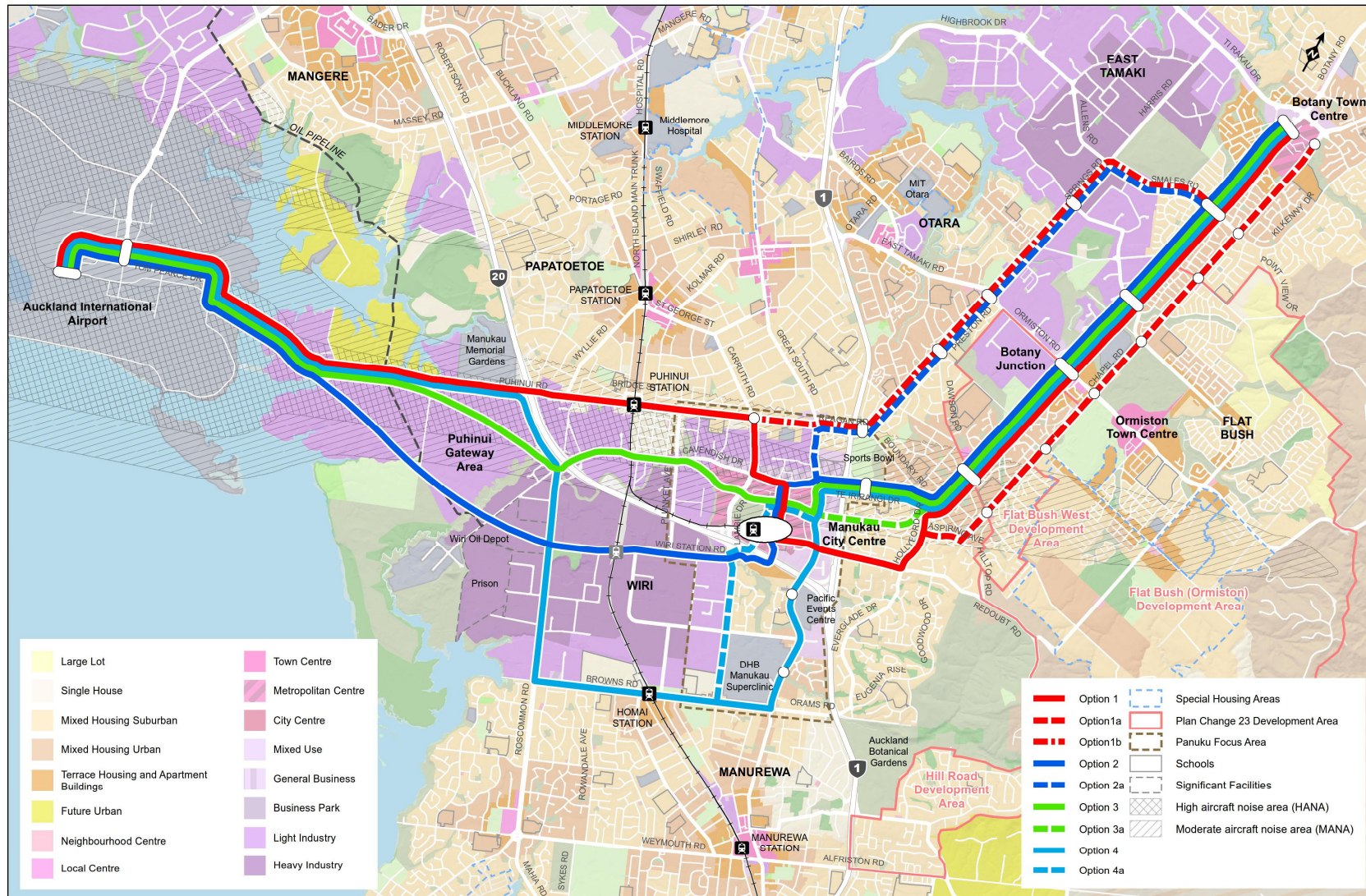


Figure 2.1 Revised Auckland Unitary Plan land use map

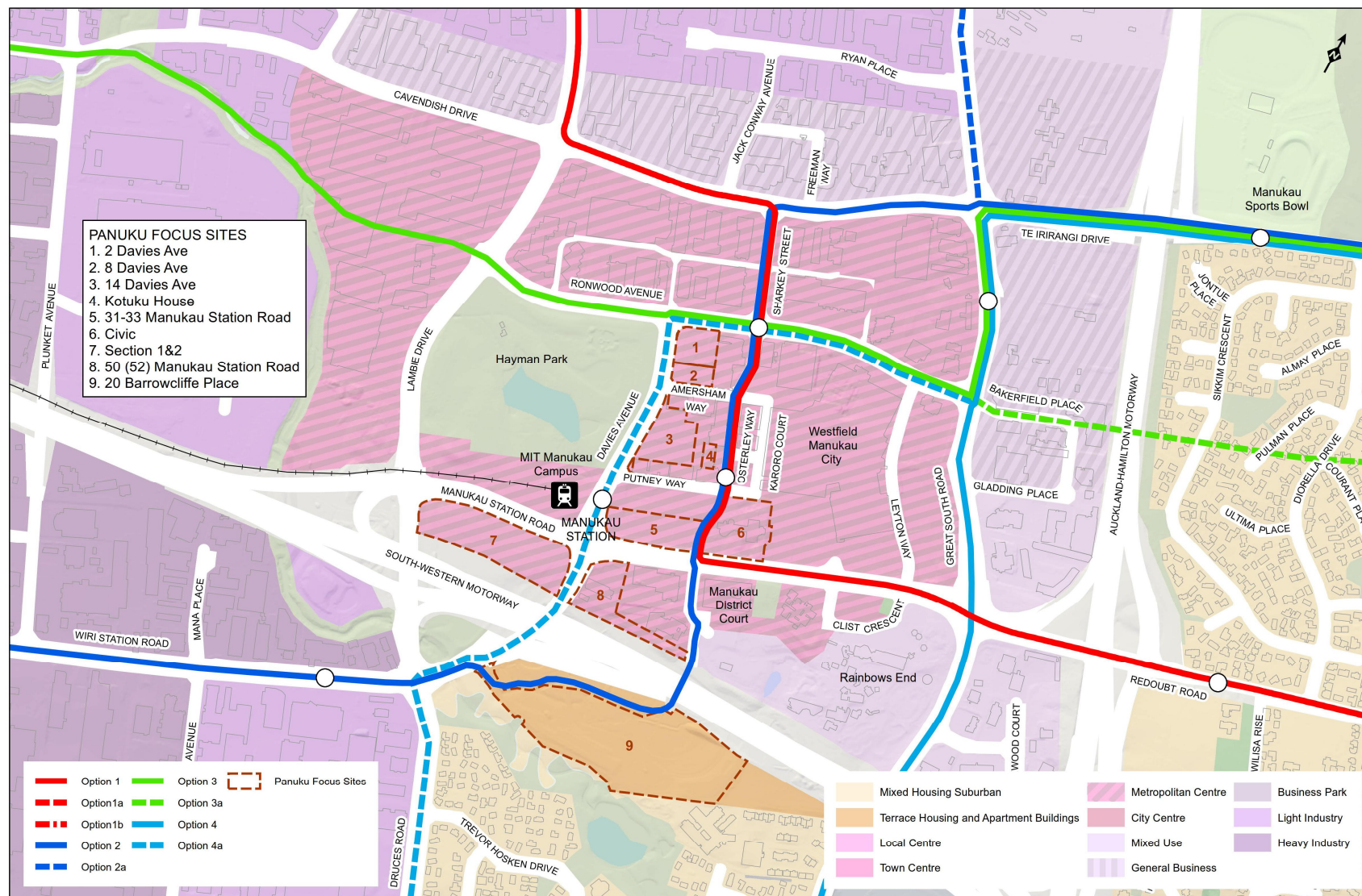


Figure 2.2 Revised Auckland Unitary Plan land use map – Manukau Metropolitan Centre

3. Light Rail Assumptions

Light rail transit (LRT) is highly adaptable into a variety of urban, suburban, and regional contexts ranging from fully grade-separated rapid transit systems to highly urban, mixed-traffic operations more similar to urban tram lines. This flexibility makes light rail a more attractive option than other rail-based rapid transit technologies, and this flexibility to design LRT corridors to suit localised characteristics results in a lower cost than other rail-based forms of rapid transit. In identifying corridor options for this initial evaluation, we have made the following assumptions:

3.1 Operating Speed

For light rail to be successful, it must achieve a balance between operating speed (shorter travel time) and user access to the system, including home or work, walking and cycling access, and transfers between other modes of public transport. Travel time does not reflect the time it takes for a train to operate from one end of the line to the other; travel time reflects the time it takes a passenger to make a journey. In addition to the actual speed (running time) of service, a number of factors impact the passenger journey time as discussed in the following sections.

3.1.1 Extent of separation of LRT trackway

Urban corridors operating on a dedicated trackway with minimum clearance from adjacent traffic lanes may operate up to the speed limit of the roadway, typically 50kph, while LRT corridors with buffers and access separations can easily exceed top speeds of 90kph. In urban centres where there is a great deal of interaction between pedestrians and other traffic, top speeds may be limited to less than 20kph. Greater separation of the LRT corridor from adjacent land uses and streets, however, reduces the opportunity to create integrated transit-orientated developments at stations.

Assumptions relating to the extent of separation of the LRT trackway include the following:

- In corridor segments where there is sufficient space to create a segregated right-of-way, it is assumed that maximum travel speed is more important than access. Stations are assumed to be at least 800m apart with an average operating speed between 32-36kph apart, except where fully independent sections with few stations could justify speeds of 52-66kph (including dwell time and acceleration/deceleration at stops).
- In corridor segments where there is limited right-of-way, an urban profile street is assumed with stations generally 800m apart, on average, and operating speeds of 22-32kph.
- Approaching and within the Manukau City Centre, stations could be located 500-800m apart, and urban operating speeds would likely be 22kph, except in areas with high pedestrian activity would reduce speeds to 12kph, on average.

3.1.2 Spacing of stations

Train speeds are affected by stations both in the time they are stopped at stations and in the acceleration and deceleration as they approach and depart stations. Stations that are closely spaced prevent trains from reaching the maximum allowable speed between stations. Too few stations, however, may also result in reduced ridership due to poor access to the system, in spite of achieving a high operating speed.

3.1.3 Frequency of service and length of journey

The longer the journey, the more important speed is to a passenger's journey. For shorter trips, however, frequency of the service becomes the more important factor in journey time. Frequency of service, or the ability to create timed transfers, is also important in designing PT connections. A 20 minute ride on a train connecting to a 10-minute LRT trip followed by a 5-minute bus ride involves 35 minutes using public transport. If all services run every 10 minutes in the peak period, the average wait time adds 15 minutes to the whole journey. But an

off-peak trip where trains run every 20 minutes, buses run every 30 minutes, and LRT operates every 15 minutes nearly doubles the total journey time. In short, investing in the capital infrastructure to build make sure the rapid transit system offers a fast trip can be undermined by a service that does not operate a sufficient frequency of service.

The frequency of service and length of journey will be identified in the IBC.

3.1.4 Time and quality of transfers between modes

In addition to the actual wait time when transferring between services, the effectiveness of transfers at major hubs can be undermined by the design of those hubs which require longer walks to make the transfers. A typical measure of this is the time it takes an average passenger to walk from the centre of the platform from one transfer to the centre of the platform of the next transfer. However, passenger's perception of time increases as quality of the wait diminishes (e.g. effect of weather, safety, and the urban environment).

Transfer penalties are evaluated only in terms of locating LRT stops near rail stations and bus exchanges; no assumptions about the quality of the transfers have been made.

3.1.5 Service reliability

Services that are routinely late, most typically bus services departing a rail station, create uncertainty of travel time for the passenger. If services are consistently unreliable, the passenger's perceived wait time increases. Passengers can perceive a lack of reliability even when buses arrive and depart as scheduled, but operate at a lesser frequency than rail service and schedules are not coordinated; conversely, bus services designed to meet train schedules can be perceived as more frequent and reliable by passengers.

LRT and heavy rail transfers are assumed to be superior at or near Puhinui Station and less desirable if separate transfers are made at Manukau and Homai or a future Wiri Station. The increased frequency of service at Puhinui will be perceived as more reliable by passengers.

A number of studies have evaluated the effect of various factors related to access, wait, and transfer times in public transport systems, and nearly have identified a heavier penalty associated with the time value in the transfer between modes than in the access time and wait associated with the initial access to the PT system. More significantly, perceived transfer penalties in most studies were lowest for metro systems, higher for other forms of rail, and significantly higher for bus transfers. In-vehicle trip time, level changes at stations, peak versus off-peak travel time, walk and wait times, and quality of pedestrian and station environments were all identified as variables in the various studies⁷.

3.2 System Integration

This evaluation assumes that the Airport-to-Botany will tie into future Queen-Dominion-Airport and AMETI LRT corridors. It is likely that both and nearly certain that at least one of those corridors would be developed first, but options are evaluated independently of other system improvements. This evaluation also does not consider the need for an operations, maintenance and storage facility for light rail vehicles, but it is assumed that vehicles, systems, and infrastructure design would be common across the LRT network. Assumptions include the following:

- It is assumed that the spatial arrangement of facilities at the airport will not allow continuous through service between the proposed SMART and Airport-to-Botany LRT corridors, since light rail vehicles would have to reverse directions at the Airport Terminal (this operation is possible but generally considered undesirable). Consequently, it is assumed that both LRT routes would share an alignment from a branch east of the airport with two common stops: the Airport Terminal and Airport Business Centre. Passengers could transfer between routes at these stops.

⁷ 2006. Hiroyuki, Taylor, and Miller. *The Effects of Out-of-Vehicle Time on Travel Behavior: Implications for Transit Transfers*.

- No assumptions have been made about the connection to the AMETI corridor, but it is assumed that continuous through service between the lines can be achieved.

3.3 Land Use Integration

Light rail transit is as much a tool to support redevelopment and intensification as it is a mode of transport. This corridor supports three major nodes that are existing destinations and are also planned for intensification. In addition to intensification at the Airport Business Centre, Manukau Metropolitan Centre, and Botany Town Centre, land use change must be supported throughout the LRT corridor to the extent feasible.

The assumptions relating to land use integration include the following:

- The combination of industrial zoning and impact of the flight path over much of the corridor limits the opportunity for residential zoning and, in part of the corridor, also places a significant limitation on building location and height. West of SH20, the corridor is assumed to have relatively few LRT stops under any future development scenario, but there may be an opportunity to integrate LRT with airport-related parking.
- Much of the Transform Manukau planning area, with its north-south orientation, cannot effectively be served by the LRT alignment. The LRT alignment should maximise access within the core Manukau Metropolitan Centre, while distribution of trips through the rest of the Transform Manukau planning area must rely on high-quality bus connections and a significant bridging of gaps in active transportation.
- Alignments to the east of Manukau City Centre may provide the greatest opportunities for transit-orientated development (TOD). Options on Te Irirangi Drive, a high speed, high volume arterial, will likely provide fewer nodes to support TOD but will offer a higher speed LRT service. Other alignment options may better support TOD, as well as access to more LRT stations, while sacrificing LRT speed. Lower speed options with more stops may produce higher ridership when land use planning provides for urban levels of density and development patterns.

4. Option Development

A number of potential options for the RTN corridor between the Airport and Botany were developed and the options considered both northern and southern alignments. In general, the alignments from two sets of options: alignments that served the segment between Manukau City Centre and the Airport and alignments that served Manukau City Centre to Botany Town Centre. Alignments within Manukau City Centre were developed to link the east and west segments.

A plan showing all alignment options as well as potential constraints and opportunities is attached in Appendix B. A more detailed plan of the alignment options through the Manukau Metropolitan Centre is also attached in Appendix B.

4.1 Options from the Airport to Manukau City Centre

Three general alignment options were identified from Auckland International Airport to SH20/Roscommon west of Manukau City Centre. All three alignments serve a station at the airport terminal and operate generally within the airport terminal and parking complex – an area proposed for redevelopment as the Airport Business Centre – to the SH20B crossing and Puhinui Road. A second stop within this segment serves the Airport Business Centre, but the scale and intensity of proposed development may warrant consideration of an additional stop. This segment also includes the alignment for the Airport-to-City LRT, and the alignment and stops would generally be shared between both routes. Moreover, the spatial arrangement of the airport terminal, Airport Business Centre, and the access route for both LRT lines generally precludes operation as a single LRT route through the airport. To the east of the Airport Business Centre, the three alignment options split to the west of the SH20B bridge. One option follows the south side of Puhinui Road, while the other two options operate at the centre and south and through an area zoned for industrial land uses.

None of these options are clearly superior to another; however, the northern alignment along Puhinui Road is likely to have the least impact on existing land uses, since it follows the existing roadway corridor and may be integrated with improvements associated with the SH20B project. The southern alignment may offer speed advantages but likely has the highest adverse land use impacts.

4.2 Options from the Botany Town Centre to Manukau City Centre

Three general alignment options were also identified from Botany Town Centre to Manukau City Centre. These follow Te Irirangi Drive as the central alignment, Chapel Road to the south, and Boundary, Tamaki, and Smales in the north. All options end at Botany Town Centre on Te Irirangi Drive or Chapel Road. These three alignments serve fundamentally different functions as part of a rapid transit corridor.

Te Irirangi Drive is a high speed traffic corridor and includes a wide median that would support a rapid transit alignment. However, Te Irirangi has relatively few access routes between major intersections, limiting access for passengers from adjacent areas. Te Irirangi was considered the best option where speed of LRT service was a priority factor.

Chapel Road is a narrow arterial that closely parallels Te Irirangi Drive. Although the corridor is in the early stages of development, both commercial and residential uses have close frontages to Chapel Road. The width of the corridor suggests that in the long term, it may be better suited for development as an urban LRT corridor with more frequent stops to provide better access to businesses and residents located closer to the corridor. Traffic will move more slowly, making this a better pedestrian environment than Te Irirangi Drive. Consequently, Chapel Road was considered the best option where access was a priority factor.

The northern alignment along Preston, Tamaki, and Smales serves two types of areas: an area of high social deprivation and an industrial area that may improve access to jobs. Although the corridor would require significant investment to accommodate LRT, Chapel was considered the best option where socio-economic deprivation and access to jobs were priority factors.

4.3 Options through Manukau City Centre

An ideal rapid transit corridor would operate through Manukau City Centre along the most direct east-west route possible. However, to realise the vision for South Auckland and to align with Auckland Transport's strategy for the rapid transit network (RTN), alignments were required to pass directly through the city centre to provide direct service to major destinations. Moreover, alignments were designed to be able to make a transfer to other bus and rail services.

To design routes that minimised circuitous routing, but provided service to the city centre and major PT interchanges, northern alignments to the east were generally paired with southern alignments to the south, and vice-versa. This allowed combinations of east and west segments that could easily be oriented in a north-south direction through Manukau City Centre in order to serve the largest number of major urban destinations and PT interchanges.

A direct east-west route (Option 1A) was retained for the evaluation, one that provided the fastest overall travel time but missed most of the key destinations and PT interchanges in Manukau City Centre. In addition, an alignment option designed to serve the largest number of potential destinations and redevelopment opportunities throughout the Panuku-defined Transform Manukau area was designed (Options 4 and 4A), but these provided the slowest travel times across the corridor. Most other options fell between these two extremes, both in terms of overall travel time and in terms of being more centrally located within the Panuku redevelopment area. Given the spatial distribution of key destinations and redevelopment areas, coupled with motorway barriers, all of the proposed options had both key strengths and weaknesses relative to each other. These are discussed in the following sections.

4.4 Option Combinations

4.4.1 Alignment Option 1

This option combines the northern Puhinui Road alignment to the east with an option on Te Irirangi Drive via Lambie, Cavendish, Osterley, Redoubt, and Hollyford (Figure 4.1).

Advantages:

This alignment serves key destinations within the Manukau City Centre, and provides closer access to socio-economically deprived areas to the north of Puhinui Road. This option also provides a high quality rail transfer at Puhinui, where all southern and Manukau line services operate, and a quality bus transfer to the east of the Manukau Central bus exchange. This location is further from the Manukau railway station; however, this was viewed as a less desirable transfer due to the split in services between Manukau and Southern lines. Finally, this alignment takes advantage of the median on Te Irirangi Drive to Botany Town Centre with the least disruption to existing land uses.

Disadvantages:

This alignment provides an indirect routing from the Airport to Botany Town Centre and passes through the congested intersections of Great South Road and SH1 motorway, which could have a negative impact on LRT operations. This alignment option also does not serve any of the areas to the south of Manukau City Centre and SH20 that are proposed for redevelopment and intensification.

4.4.2 Alignment Option 1A

This option combines the northern Puhinui Road alignment to the east with an option on Chapel Road via Lambie, Cavendish, Osterley, Redoubt, Hollyford and Aspiring (Figure 4.1).

Advantages:

This alignment serves key destinations within the Manukau City Centre, and provides closer access to socio-economically deprived areas to the north of Puhinui Road. This option also provides a high quality rail transfer

at Puhinui, where all southern and Manukau line services operate, and a quality bus transfer to the east of the Manukau Central bus exchange. This location is further from the Manukau railway station; however, this was viewed as a less desirable transfer due to the split in services between Manukau and Southern lines. Finally, this alignment takes advantage of potential intensification and mixed-use development on Chapel Road by providing an urban LRT design with more stops than would be desirable on the Te Irirangi Drive alignment.

Disadvantages:

This alignment provides an indirect routing from the Airport to Botany Town Centre and passes through the congested intersections of Great South Road and SH1 motorway, which could have a negative impact on LRT operations. This alignment option also does not serve any of the areas to the south of Manukau City Centre and SH20 that are proposed for redevelopment and intensification.

4.4.3 Alignment Option 1B

This option combines the northern Puhinui Road alignment to the east with the northern alignment to the west along Reagan, Preston, Tamaki, Springs, and Smales to Te Irirangi Drive at Botany Town Centre (Figure 4.1).

Advantages:

This alignment provides the most direct route, resulting in the shortest alignment and fastest travel time. This option also provides closer access to socio-economically deprived areas to the north of Puhinui Road and along Boundary Road. This option also provides a high quality rail transfer at Puhinui, where all southern and Manukau line services operate.

Disadvantages:

This alignment provides the least access to destinations within Manukau City Centre or any of the central Manukau redevelopment area. It also does not integrate LRT service with the bus exchange at Manukau Central.

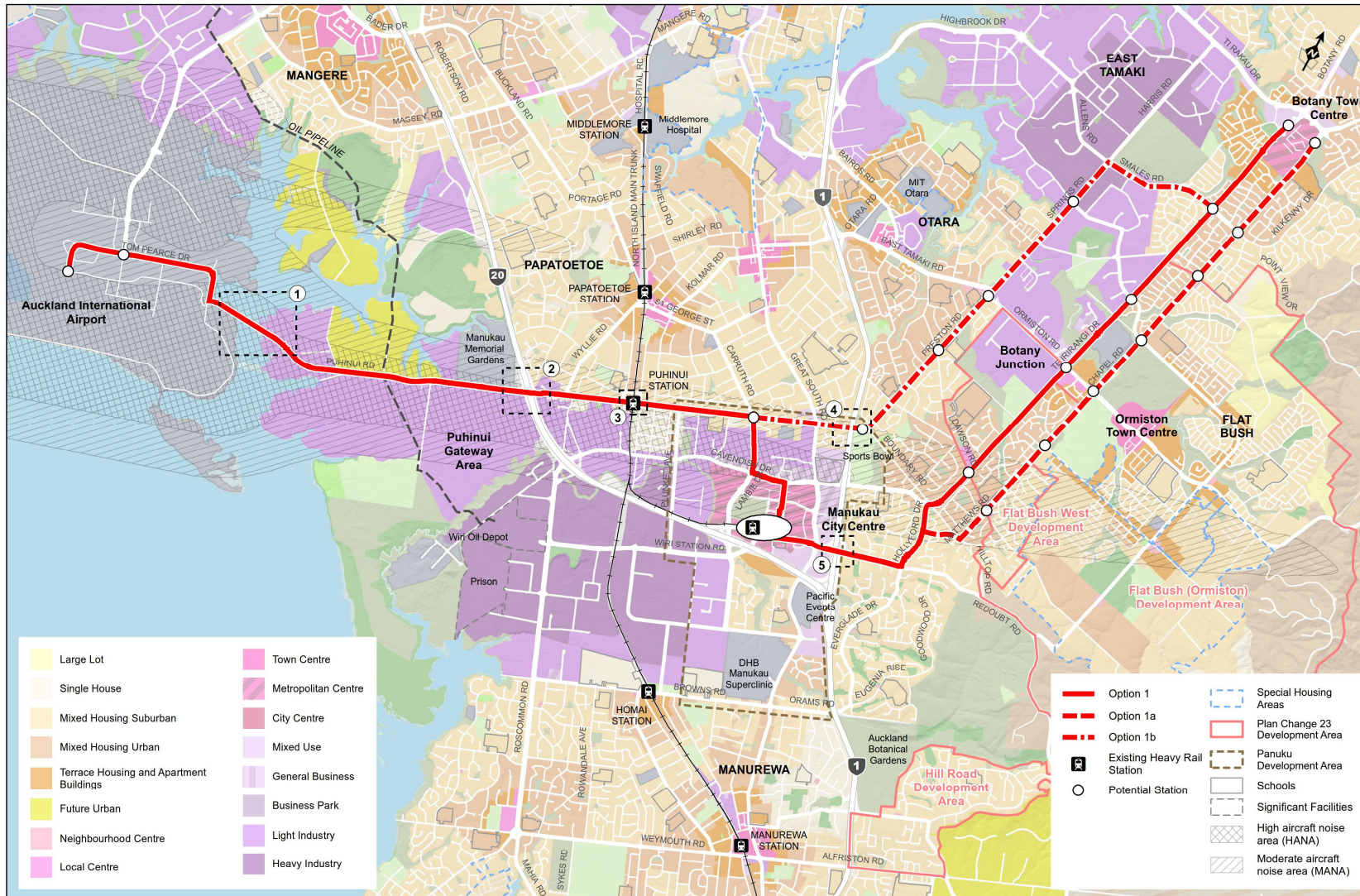


Figure 4.1 Alignment options 1, 1A and 1B

4.4.4 Alignment Option 2

This option combines the southern independent alignment to the east with an alignment to Botany Town Centre via Wiri Station Road, Osterley, Cavendish, and Te Irirangi Drive (Figure 4.2).

Advantages:

This alignment provides a direct and fast route from the airport, aligning to a north-south alignment within Manukau City Centre before continuing along the higher speed route option to Botany Town Centre. Although this is designed as a higher speed route option, the alignments through Manukau Central are designed to maximise access to major destinations in a central city surface LRT context. This alignment also provides connections to bus network east of the Manukau bus exchange and serves potential redevelopment opportunities to the south of Manukau City Centre and SH20.

Disadvantages:

This alignment provides the least connectivity to the heavy rail network. A connection at a future station at Wiri Station Road could be made, and the alignment could be modified to serve Manukau Station and the west side of the bus exchange. Even with these improvements, serving the heavy rail network from two separate stations south of the split in rail services is less desirable, from a passenger transfer perspective, than connecting at Puhinui where all services operate.

4.4.5 Alignment Option 2A

This option combines the southern independent alignment to the east with an alignment to Botany Town Centre via Wiri Station Road, Osterley, Cavendish, Great South Road, and the northern option to Botany Town Centre via Preston, Tamaki, Springs, Smales and Te Irirangi (Figure 4.2).

Advantages:

This alignment provides a less direct route from the airport, but provides better access to socio-economically deprived areas along Preston Road. This alignment maximises access to major destinations in a central city surface LRT context and provides connections to bus network east of the Manukau bus exchange and serves potential redevelopment opportunities to the south of Manukau City Centre and SH20.

Disadvantages:

This alignment provides the least connectivity to the heavy rail network. A connection at a future station at Wiri Station Road could be made, and the alignment could be modified to serve Manukau Station and the west side of the bus exchange. Even with these improvements, serving the heavy rail network from two separate stations south of the split in rail services is less desirable, from a passenger transfer perspective, than connecting at Puhinui where all services operate.

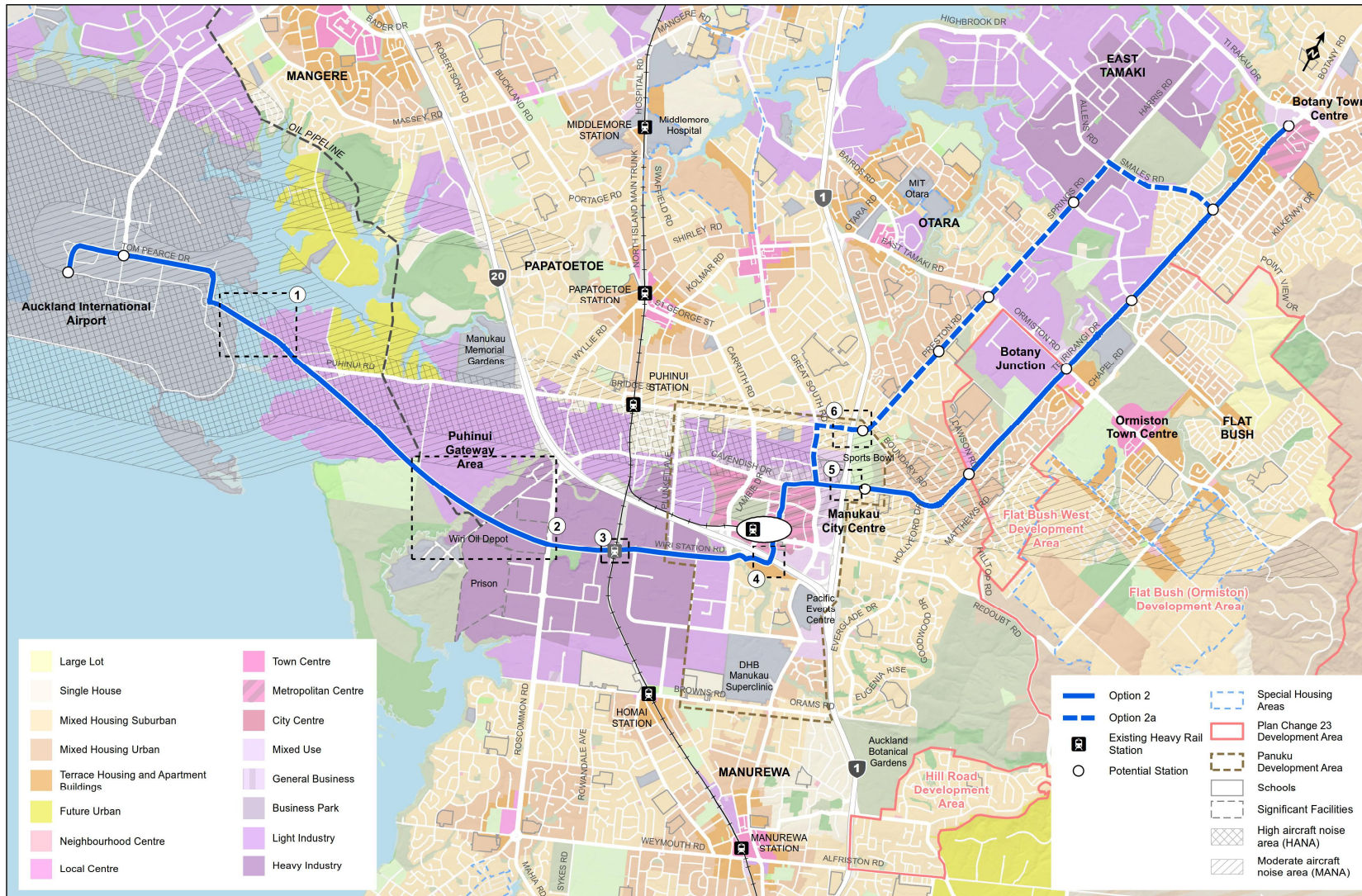


Figure 4.2 Alignment options 2 and 2A

4.4.6 Alignment Option 3

This option combines the central independent alignment to the east with the Te Irirangi alignment to Botany Town Centre via Cavendish, an independent alignment along Puhinui Stream, Ronwood, and Great South Road (Figure 4.3).

Advantages:

This alignment provides a more direct route across the overall alignment than most other options and maintains service into Manukau City Centre. This option may provide for further intensification and expansion of Manukau City Centre to the west.

Disadvantages:

This alignment requires a minor relocation of Puhinui Station to provide an effective transfer to the rail network, and it does not provide connectivity to the Manukau bus exchange. The alignment would not serve redevelopment areas to the south of SH20.

Airport Manukau Botany LRT concept alignment investigation

JACOBS

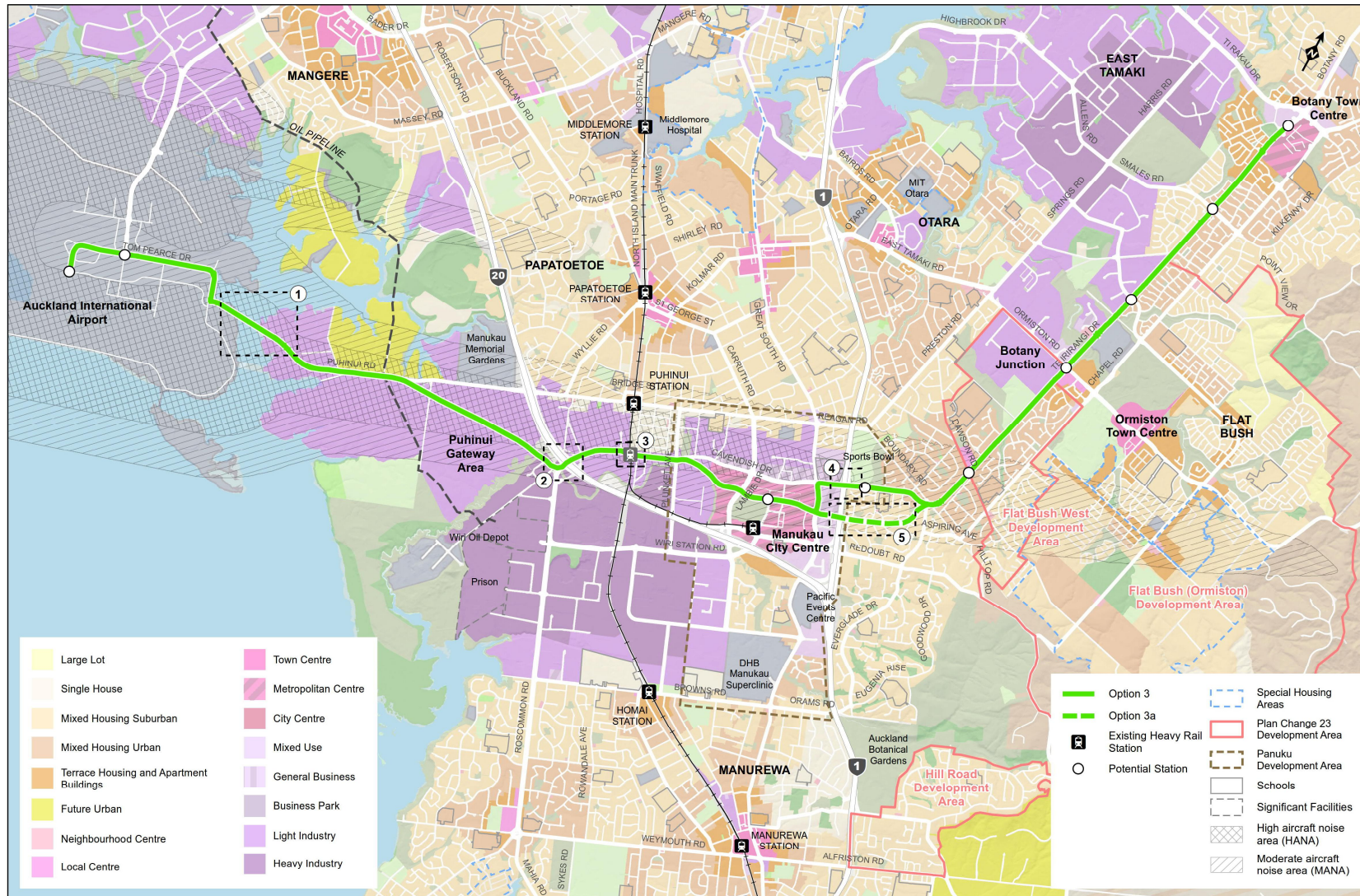


Figure 4.3 Alignment options 3 and 3A

4.4.7 Alignment Option 4

This option combines the north alignment along Puhinui Road to the east with the Te Irirangi alignment to Botany Town Centre via SH20, Roscommon, Browns, and Great South Road (Figure 4.4).

Advantages:

This alignment provides the greatest access to major destinations and redevelopment areas identified by Panuku.

Disadvantages:

This alignment is the least direct option between Botany Town Centre and the Airport, and it provides the least connectivity to the overall PT network. The only direct access to the heavy rail network is at Homai Station on the Southern Line; no link to the Eastern Line is provided, nor is a connection to the Manukau bus exchange. Given its length, this option has among the longest travel times and highest capital and operating cost. It also intersects with and operates on key strategic freight corridors.

4.4.8 Alignment Option 4A

This option combines the north alignment along Puhinui Road to the east with the Te Irirangi alignment to Botany Town Centre via SH20, Roscommon, Browns, Druces, Wiri Station, Davies, Ronwood and Great South Road (Figure 4.4).

Advantages:

This alignment provides the access to major destinations and redevelopment areas identified by Panuku, service to Manukau City Centre, and key bus and rail interchanges.

Disadvantages:

This alignment is the least direct option between Botany Town Centre and the Airport (roughly equal in indirectness to option 4 from which this option is derived). Although it improves connections to the PT network, the rail connections are located south of the rail split, providing a less desirable transfer between LRT and heavy rail. Given its length, this option has among the longest travel times and highest capital and operating cost. It also intersects with and operates on key strategic freight corridors.

Airport Manukau Botany LRT concept alignment investigation

JACOBS®

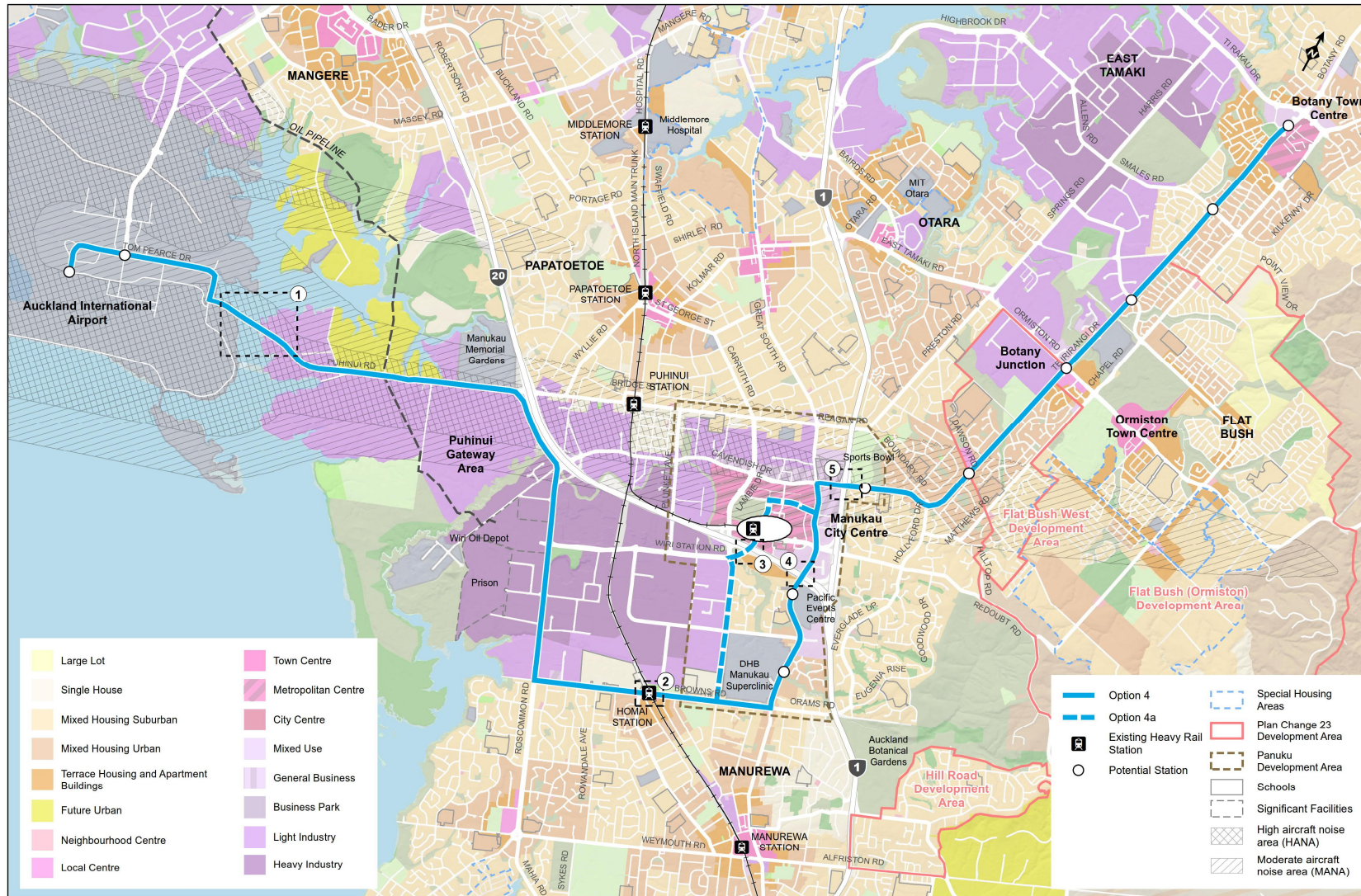


Figure 4.4 Alignment options 4 and 4A

5. Evaluation Framework

A multi-criteria analysis (MCA) framework was developed to assess the corridor alignment options and to identify technically feasible options to construct and operate as an LRT corridor. The options have been developed at a high level at this stage of analysis and the MCA framework provides an appropriate means for differentiating between the options. The assessment also provides an indication of options which can be progressed through the regulatory and consenting processes during later stages of the study.

An MCA framework was developed for the City Centre Future Access Study Stage 2 (CCFAS2)⁸ and for the South-western Multi-modal Airport Rapid Transit (SMART) IBC study. The MCA framework developed for the LRT Concept Alignment study was based on the CCFAS/SMART framework to ensure consistency between these relevant studies. The framework also strongly aligns with PDA's strategy for Manukau; particularly in terms of improving connections through integrated development.

The objectives used for the CCFAS2 and SMART studies were updated to align with the objectives of the LRT Concept Alignment and evaluation criteria were developed to assess the contribution of each option toward the objective.

The objectives used for the Airport to Botany evaluation framework include the following:

- **Mobility** - Improving the ability for travel within the Botany, Manukau and Auckland International Airport areas;
- **Access** - Increasing the level of access between the Auckland International Airport, Manukau and Botany;
- **Economic performance** - Improves the economic performance and supports productivity growth within the Southern and Eastern parts of Auckland;
- **Environment** - Provide a sustainable transport solution that minimises environmental impacts;
- **Built environment** - Facilitates development of proposed land uses in the Manukau, Botany and Flat Bush areas;
- **Implementation** - Optimises the constructability and implementation of the transport option; and
- **Cost** - CAPEX and OPEX of the option.

The following scoring method was adopted for the MCA:

-2	Negative impact
-1	Moderate negative impact
0	Neutral impact
1	Moderate positive impact
2	Positive impact

Assuming a reference year of 2046, each option was assessed against the MCA framework which included both quantitative and qualitative assessment criteria. During the early stages of the study, the assessment was largely qualitative and involved spatial analysis.

Table 5.1 Multi-criteria analysis framework

Project Objective	Objective Description	Evaluation Criteria	Measures
-------------------	-----------------------	---------------------	----------

⁸ City Centre Future Access Study Stage 2, Auckland Transport, 2012

Project Objective		Objective Description	Evaluation Criteria	Measures
1	Mobility	Improving the ability for travel within the corridor between the Botany, Manukau public transport hubs, a southern rail line station and Auckland International Airport.	<ul style="list-style-type: none"> Improvement of travel times on public transport routes Improvements to public transport reliability (reduction in the variability of public transport journey times) 	Qualitative assessment <ul style="list-style-type: none"> Length Speed Journey time variability
2	Accessibility	Increasing the level of public transport access to destinations in the Botany, Manukau and Auckland International Airport corridor.	<ul style="list-style-type: none"> Integration with the overall public transport network Integration with the overall transport network plan Extent to which the option connects key travel demand generators: <ul style="list-style-type: none"> Population Employment Destinations of significance Extent to which option provides greater accessibility for lower socio-economic areas 	Qualitative assessment <ul style="list-style-type: none"> Number of connections to key interchanges Potential future number and density of residents and employment near stations due to the RTN infrastructure
3	Economic performance	Improves the economic performance and supports productivity growth within the Southern and Eastern parts of Auckland.	<ul style="list-style-type: none"> Accessibility to existing and proposed employment areas Accessibility to identified employment growth areas Ability to deliver a more cost effective public transport network 	Qualitative mapping assessment
4	Environment	Provide a sustainable transport solution that minimises environmental impacts.	<ul style="list-style-type: none"> Extent to which the option impacts ecological, contaminated land, archaeological, open space, cultural and heritage values 	Qualitative mapping assessment
5	Built Environment	Facilitates development of proposed land uses in the Manukau, Botany and Flat Bush areas.	<ul style="list-style-type: none"> Alignment with future land use aspirations in the RAUP enabling development potential and creating additional land value Assessment for the potential for the land use to change near the stations to become more transit orientated Assessment of the walkability to the stations Urban amenity Land take required Proportion of significant buildings and properties 	Qualitative assessment

Project Objective		Objective Description	Evaluation Criteria	Measures
			impacted	
6	Implementation	Optimises the constructability and implementation of the transport option.	<ul style="list-style-type: none"> Construction complexity Difficulty of consenting the option 	Qualitative engineering assessment
7	Cost	CAPEX and OPEX of the option.	<ul style="list-style-type: none"> CAPEX OPEX 	High-level quantitative assessment (largely based on existing information)
8	Network operational impacts	Considers the effect of the RTN alignment on the operation of the rest of the network.	<p>Consideration of conflict points, trade-offs and pinch points in the network:</p> <ul style="list-style-type: none"> Strategic (motorway) traffic routes Regional through traffic (strategic road network) routes Freight routes Over-dimension routes Bus routes 	Qualitative assessment
9	Stage-ability	Ability for options to be incrementally implemented over time.		Qualitative assessment

6. Option Evaluation

Each of the alignment options were evaluated against the project objectives and evaluation criteria. The evaluation of the options against project objectives is summarised in Table 6.1 which takes into account the considerations, advantages and disadvantages of the options presented in section 4.

It was identified that some criteria did not differentiate between the options at this level of analysis ('non-differentiators') and are noted within Table 6.1 as strikethrough text.

Table 6.1 Preliminary MCA evaluation of LRT alignment options

Project Objective / Scoring	Bus (Do Minimum)	Option 1	Option 1A	Option 1B	Option 2	Option 2A	Option 3	Option 4	Option 4A
1 Mobility									
Reduced Travel Time on PT	0	1	1	2	2	2	2	1	1
<i>Travel time</i>	<i>92</i>	<i>44</i>	<i>46</i>	<i>37</i>	<i>39</i>	<i>39</i>	<i>34</i>	<i>43</i>	<i>46</i>
Reduced Variation in Travel Time on PT	0	2	2	2	2	2	2	2	2
Category Average	0.0	1.0	1.0	2.0	2.0	2.0	2.0	1.0	1.0
2 Accessibility									
PT Network Integration	0	1	2	-2	0	0	1	-1	1
Highest Population near PT	0	0	1	-1	0	0	0	0	0
Highest Employment near PT	0	1	2	-2	1	0	1	-1	1
Number of Generators served directly by PT	0	0	1	0	1	0	1	-1	1
Highest Access for Socially-Deprived Populations	0	1	0	2	0	2	0	1	1
Category Average	0.0	0.6	1.2	-0.6	0.4	0.4	0.6	-0.4	0.8
3 Economic performance									
Direct Service to Existing/Future Employment Centres	0	1	2	-2	1	0	1	0	1
Accessibility to identified employment growth areas	0	1	2	-2	1	-1	1	1	1
Ability to deliver a more cost effective public transport network	0	0	0	0	0	0	0	0	0
Category Average	0.0	0.7	1.3	-1.3	0.7	-0.3	0.7	0.3	0.7
4 Natural Environment									
Minimises impacts ecological, contaminated land, archaeological, open space, cultural, heritage values	0	-1	0	0	0	0	0	0	0
Category Average	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 Built Environment									
Aligned with RAUP to maximise housing and non-residential development in PT corridor	0	1	2	-2	1	-1	1	-1	1
Potential for the land use to change near the stations (intensification and connectivity)	0	1	2	-2	1	-1	1	-1	1

Project Objective / Scoring	Bus (Do Minimum)	Option 1	Option 1A	Option 1B	Option 2	Option 2A	Option 3	Option 4	Option 4A
Assessment of the walkability to the stations (connectivity and access)	0	0	1	-2	0	0	0	-1	0
Potential for improved urban amenity	0	1	2	0	1	1	1	0	1
Properties required for implementation	0	0	-1	-1	-1	-1	-1	0	0
Number of significant buildings and properties impacted	0	0	0	0	0	0	0	0	0
Category Average	0.0	0.5	1.0	-1.2	0.3	-0.3	0.3	-0.5	0.5
6 Implementation									
Construction complexity	0	0	-1	-1	0	-1	0	0	0
Difficulty of consenting the option	0	0	-1	-1	-2	-1	0	0	0
Category Average	0.0	0.0	-1.0	-1.0	-1.0	-1.0	0.0	0.0	0.0
7 Cost									
CAPEX	0	-1	-2	-1	-1	-2	-1	-2	-2
<i>Length</i>	0	18.6	18.6	16.6	18	18	17.3	22.2	22.2
<i>Number of grade separations</i>	0	4	4	4	5	4	4	5	5
<i>Generic cost</i>	0	1,130	1,130	1,030	1,150	1,100	1,065	1,360	1,360
OPEX	0	-1	-1	-1	-1	-2	-1	-2	-2
<i>LRT opex 10-minute headway 12h+ 15m 6h</i>	12,285	37,152	38,016	30,240	30,240	36,288	31,104	38,016	40,608
Category Average	0.0	-1.0	-1.5	-1.0	-1.0	-2.0	-1.0	-2.0	-2.0
8 Network Operational Impacts									
Effects on strategic (motorway) traffic routes	0	-2	-2	-1	0	1	-2	0	0
Effects on regional through traffic (strategic road network) routes	0	0	0	0	-1	-1	0	-2	-2
Effect on freight routes	0	0	0	0	-1	-1	0	0	0
Effects on O/D routes	0	0	0	0	-1	-1	0	-1	-1
Effects on existing bus routes and ability to enhance network connections with the future bus network	0	1	1	-1	-1	-1	1	-1	1
Category Average	0.0	-0.2	-0.2	-0.4	-0.8	-0.6	-0.2	-0.8	-0.4
9 Stage-ability									
Ability for options to be incrementally implemented over time	0	0	0	0	0	0	0	0	0
Category Average	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Summary Result of Qualitative Assessment									
Score	0.0	1.6	1.8	-3.5	0.6	-1.9	2.4	-2.4	0.6
Rank	6	3	2	9	4	7	1	8	5

6.1 Sensitivity Analysis

Equal weighting was initially ascribed to each of the project objectives included within the evaluation framework. Sensitivity testing was then carried out which involved trebling the weighting (or importance) of certain objectives within the framework. The purpose of the sensitivity testing was to determine the effect on the resulting ranking of options and to identify the consistently best-performing options.

It was identified that some criteria did not differentiate between the options at this level of analysis as described in the previous section. The weightings were not applied to the non-differentiators as to avoid the double counting of benefits or dis-benefits and the non-differentiators were therefore not reflected in the final evaluation.

The sensitivity testing considered the following weighting scenarios:

- Equal weighting by criteria, equal weighting by objective;
- Mobility and Network Operational Impacts objectives – 3x weighting;
- Land Use and Accessibility objectives – 3x weighting;
- Implementation and Cost objectives – 3x weighting; and
- Environment and Property Impacts objectives – 3x weighting.

The results of the sensitivity analysis are summarised in Table 6.2. It is noted that options 1A and 3 both perform consistently well against the equal weighting MCA evaluation and against the sensitivity testing scenarios.

Table 6.2 Sensitivity testing results

Weighting scenario	Alignment option ranking								
	Do Minimum	Option 1	Option 1A	Option 1B	Option 2	Option 2A	Option 3	Option 4	Option 4A
Mobility and Network Operational Impacts objectives – 3x weighting	9	5	2	7	3	6	1	8	4
Land Use and Accessibility objectives – 3x weighting	6	4	1	9	5	7	2	8	3
Implementation and Cost objectives – 3x weighting	2	3	4	8	5	9	1	7	6
Environment and Property Impacts objectives – 3x weighting	5	6	2	9	3	7	1	8	4

7. Initial Option Conclusions

Further investigation of additional options and considerations will be required to arrive at a preferred LRT alignment between the Airport and Botany.

Given the recent recommendations of ATAP, the likely next stage of this project is to identify the preferred light rail alignment option(s) and to further develop the alignment through the IBC. A gap analysis assessment was undertaken as part of Workshop 2 to identify further investigations required to inform the IBC process and the minutes from the workshop are attached in Appendix B.

Table 7.1 summarises the key actions resulting from workshop discussions for further assessment of a light rail alignment.

Table 7.1 Key investigations required to inform the IBC process

Item	Action
Modifications to evaluation framework and strategic outcomes	<ul style="list-style-type: none"> Further clarification is required regarding the critical success factors for the project and alignment options. Analysis of potential land use change as a result of implementing a strategic PT corridor. Further investigation of the strategic function of the corridors under consideration and the impact of traffic displacement on the surrounding road network.
Additional alignment options	<ul style="list-style-type: none"> Investigation and development of additional alignment options including: <ul style="list-style-type: none"> Through Hayman Park to the west of Manukau Metropolitan Centre. Through redevelopments to the east of the Manukau Metropolitan Centre including the Westfield Shopping Centre. Technical note detailing the consideration of replacing/extending the Manukau heavy rail branch line with light rail.
Do Minimum scenario	<ul style="list-style-type: none"> Identify and confirm an optimised bus-only Do Minimum scenario for option evaluation and comparison purposes.
Integration with heavy rail	<ul style="list-style-type: none"> Further investigation is required regarding the potential for moving Puhinui Station. A feasibility study is required to assess the impacts of station locations on network operations given existing infrastructure and prioritised rail investment programmes.
Integration with the Manukau Bus Station	<ul style="list-style-type: none"> Further optioneering is required for the interchange between light rail and the Manukau Bus Station. A feasibility study is required to assess the potential for relocating the existing bus station or adding a second bus interchange to:

	<ul style="list-style-type: none"> ○ Improve the interchange between light rail and bus services. ○ Improve access from the north and south to better serve Manukau Metropolitan Centre.
Consenting requirements	<ul style="list-style-type: none"> · Detailed assessment of property impacts. · Development of a progression pathway for the next project phases given that the corridor must be designated by 2023. · Further understanding of the potential issues and project risks surrounding the Pukaki Creek crossing and impacts to consenting processes.

8. Further investigation

During the MCA evaluation process for the preferred route from Auckland International Airport to Botany, several sections were identified as requiring further development. This was required to understand the feasibility of complex sections of the route, and determine the general preferred alignment through Manukau City Centre and onwards to Botany. Rather than postponing the resolution of these issues to the Indicative Business Case (IBC) phase, they were further investigated in order to determine a preferred recommended alignment for LRT.

Between the Airport and Puhinui, specific solutions were identified for the SH20 interchange and Puhinui Station.

Between Manukau and Botany further information helped to differentiate between the three corridors.

Through Manukau CDB options were developed that would support the strategic goals for Manukau.

A Workshop 3 was held on 8 February 2017 with AT stakeholders to discuss the results of this investigation and agree a final alignment selection.

This section documents the additional investigation to refine options regarding each section of the route.

8.1 Airport to Puhinui

8.1.1 Auckland International Airport to SH20 interchange

The agreed LRT alignment between the Auckland International Airport and the SH20 interchange follows the southern edge of SH20B Puhinui Road. A corridor along the southern side of SH20B, negotiated between landowners, Auckland Transport and NZTA for the RTN link, can accommodate the LRT. The typical cross section for SH20B Puhinui Road is shown in Figure 8.1. Approximately 10 m is required to accommodate LRT on a ballasted track, assuming a top speed in the range of 80-100 km/h. This allows sufficient width for maintenance access. Consultation with NZTA is required in the IBC phase to determine utilisation of the overall corridor space for both highway widening and RTN provision.

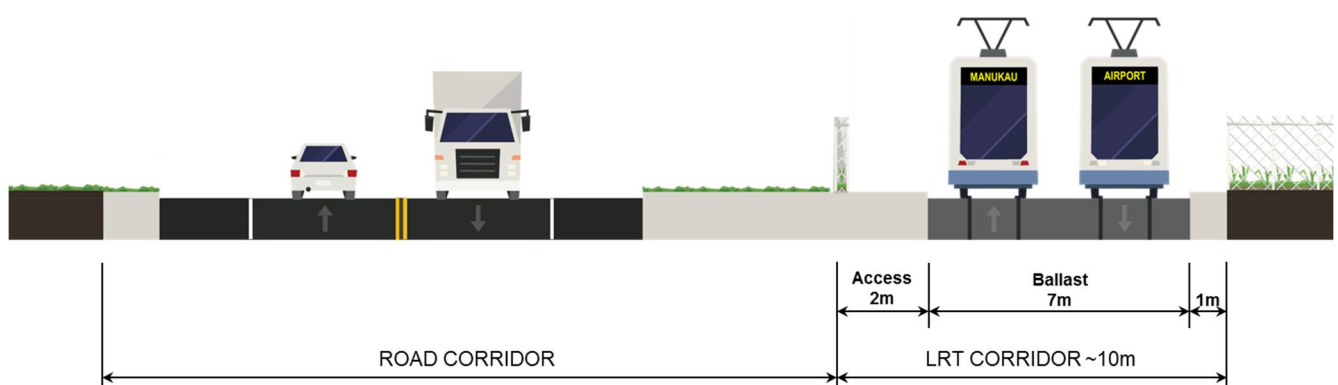


Figure 8.1 SH20B Puhinui Road: Airport to SH20B - typical cross section

Consultation with the following stakeholders will also be required during the IBC phase to manage the designations along the SH20B section of the route:

- New Zealand Transport Agency (State Highway 20B);
- Wiri Oil Services Ltd (Jet Fuel Pipeline - location not publically available within Airport designation);

- Watercare Services Ltd designations (Southwestern interceptor, Hunua No. 4 Watermain); and,
- New Zealand Refining Company Ltd (Petroleum Pipeline).

8.1.2 SH20 / SH20B interchange

The SH20 / SH20B interchange at Puhinui is a diamond interchange with each off-ramp intersection signalised, as shown in Figure 8.2.

Based on a preliminary assessment, LRT can be accommodated at grade through the interchange by replacing the southern spill through abutment (shown in Figure 8.3) with a vertical abutment, to achieve the cross section shown in Figure 8.3. Up to a 10 m envelope is available for LRT. The overhead LRT catenary can be fixed to the underside of the SH20 bridge. Figure 8.5 shows an example of retaining under an overpass to incorporate the T8 LRT in Paris. Further investigation is required to determine the location and extent of any services that may need moving to accommodate the LRT track slab.



Figure 8.2 Plan view of the existing SH20 / SH20B interchange⁹



Figure 8.3 SH20 interchange existing cross section (Google Street View, Oct 2015)

⁹ Auckland Council GeoMaps. (2017). *Geomapspublic.aucklandcouncil.govt.nz*. Retrieved 20 February 2017, from <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

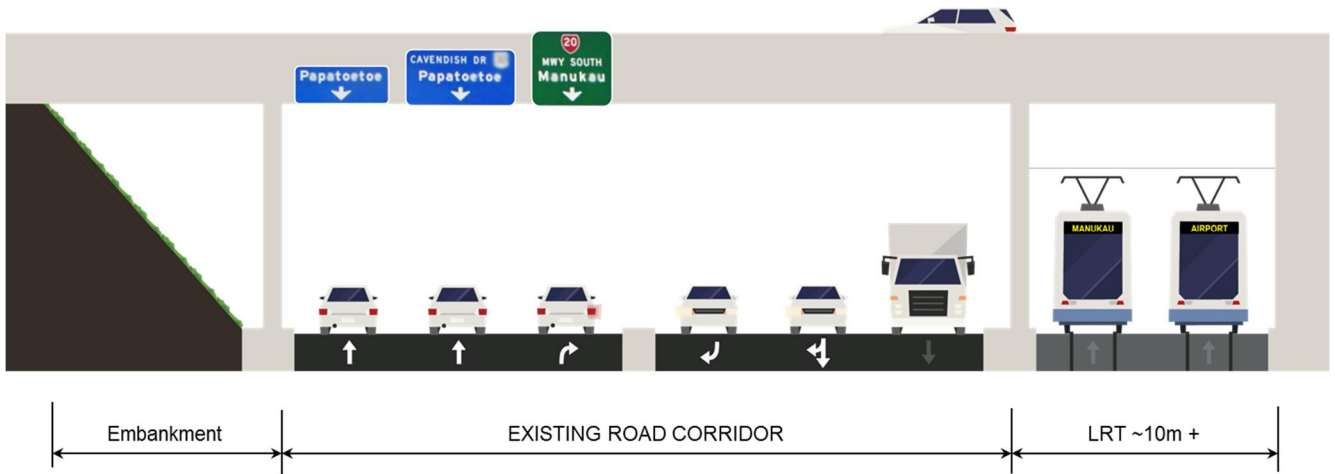


Figure 8.4 SH20 interchange cross section with LRT

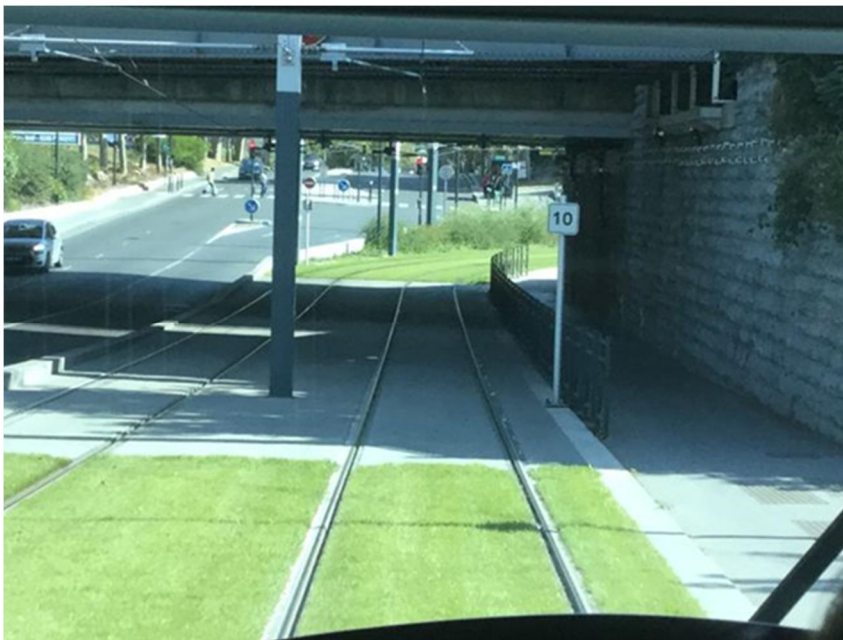


Figure 8.5 Example LRT line under overpass with vertical RE wall abutment (Paris T8)

The LRT alignment through the interchange would cross the southern ramps as shown in Figure 8.6. Having the Airport Manukau Botany LRT line cross the interchange at ground level, adjacent to SH20B, would require modification to of the signal phases for the ramp approaches that are crossed by the LRT line. All of the locations where the LRT crosses the southern ramps would need to be signal controlled for safety reasons. Any phasing required to accommodate LRT would be integrated into the overall interchange signal controls. Also, for safety reasons the LRT speed through the interchange and immediate approaches is likely to be reduced to 50-60 km/hr allowing LRVs to operate in “line of sight” through the interchange.

NZTA is currently addressing capacity issues at the interchange.¹⁰ Accommodating LRT will slightly reduce the traffic capacity of the interchange. Further assessment of traffic impacts should be undertaken and should include traffic modelling of the proposed arrangement. Potential changes to general traffic lane arrangements and widening should also be investigated as measures to minimise these potential traffic impacts.

¹⁰ Business case for implementation, SH20B Short Term Improvements, Detailed Business Case and Addendum following establishment of the Airport Task Force, Jacobs/NZTA, 28/02/2017

Ongoing consultation with NZTA regarding the interchange will be required to manage the following:

- Medium to long term upgrades proposed for the interchange do not preclude further development of the RTN corridor;
- Impacts of LRT on general traffic capacity are managed to achieve an acceptable level of performance; and,
- To provide for active transport modes through the interchange.

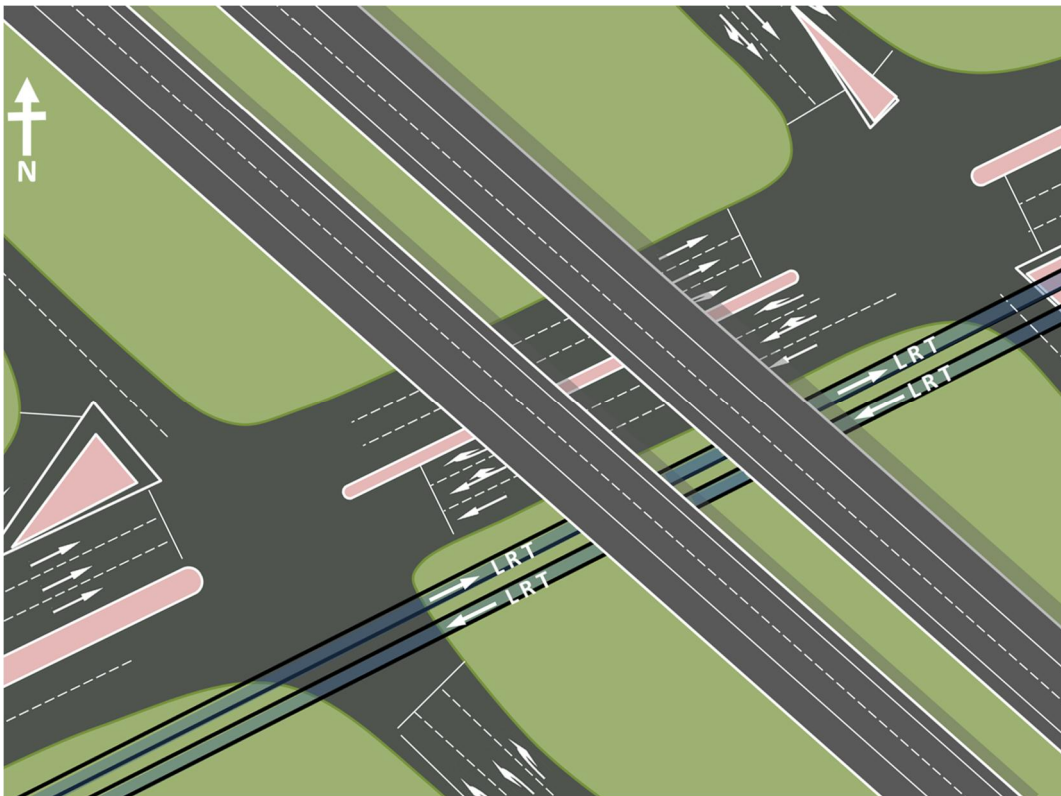


Figure 8.6 Plan view of SH20 interchange with LRT

8.1.3 Puhinui Road

From SH20 to Puhinui Station, the LRT alignment follows Puhinui Road with a typical cross section as shown in Figure 8.7. The cross section provides for a 7 m central street running LRT envelope. This cross section has been provided to reduce impacts on adjacent properties and is consistent with other LRT investigation in Auckland (i.e. Dominion Road). As this section of the alignment is street running the maximum speed of the LRT will be restricted to 50 km/h.

All unsignalised turns across the LRT tracks along Puhinui Road will be prohibited. Therefore, the following streets will become left in and left out: Vision Place, Milan Road and Raymond Road. The Noel Burnside Road / Puhinui Road intersection would need to be signalised. To prevent through movements across the tracks a barrier kerb parallel to the LRT tracks should be implemented.

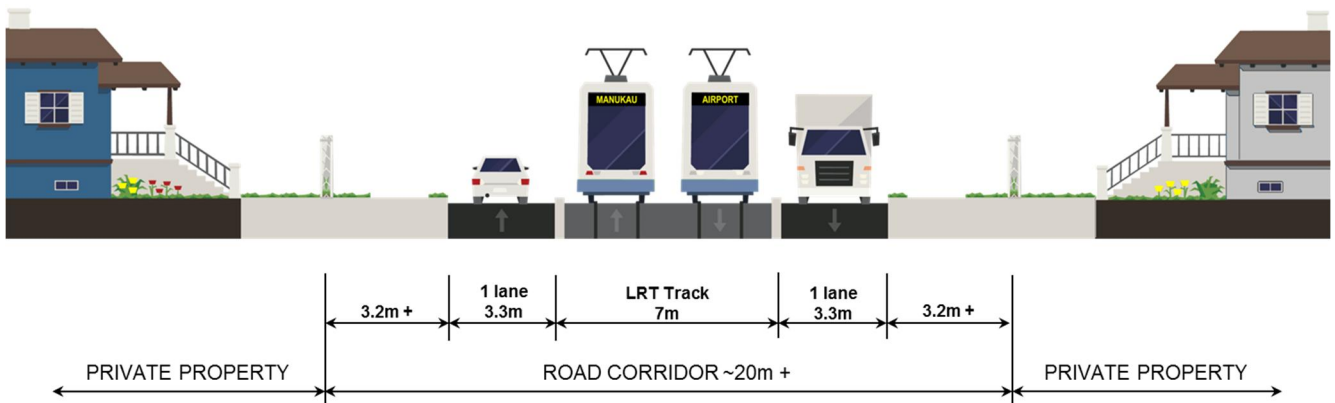


Figure 8.7 Puhinui Road cross section

8.1.4 Puhinui Station

It is proposed to grade separate the LRT track over the NMIT at Puhinui Station. A raised LRT stop platform would be constructed as part of the overpass. Stairs and lift from the LRT platform to the Puhinui heavy rail station will provide for interchange between modes. This section discusses the station site and physical constraints, and how these may impact on the development of a Puhinui LRT stop.

Puhinui Station is located on the southern side of Puhinui Road, as shown in Figure 8.8. Puhinui Road is not formed over the NMIT. Traffic is routed a block to the north to Bridge Street to cross the heavy rail line at an overpass. Auckland Transport has noted that in the past there has been investigation into constructing the missing segment of Puhinui Road. However, it was decided to maintain the detour around Bridge Street due to the space requirements of the ramps and the preference to maintain Cavendish as the main east-west corridor.

Also of relevance to the Puhinui Station is that ATAP indicates that to provide an integrated and resilient rail network, between Wiri and Westfield, requires a third main in 'Decade 1' and a fourth main in 'Decade 2'. Any spanning of the NMIT will need to be wide enough to accommodate four mains in the future. The Bridge Street bridge, to the north of Puhinui road, will require works to be able to include 4 mains.



Figure 8.8 Plan view of the existing Puhinui Station¹¹

An option has been developed for the Puhinui LRT stop to be constructed on a grade separated overpass carrying the LRT track over the heavy rail track. The features of this would be:

- Grade separate LRT over heavy rail
- LRT platforms elevated over heavy rail for optimal heavy rail/LRT interchange
- Laneways beside ramp sections of LRT track for local property access from east and west.
- LRT platform also acts as improved pedestrian access to heavy rail station platform
- LRT platform also acts as pedestrian link across heavy rail

An example of an LRT stop on a LRT overpass is shown in Figure 8.9. While this Adelaide example is over traffic lanes a similar design could be applied over heavy rail. Some initial LRT geometric design investigation has been undertaken to determine if any there are any design limitations or considerations that would affect the viability (or cost) of the LRT overpass at Puhinui Station.

¹¹ Auckland Council GeoMaps. (2017). [Geomapspublic.aucklandcouncil.govt.nz](https://geomapspublic.aucklandcouncil.govt.nz). Retrieved 20 February 2017, from <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>



Figure 8.9 Adelaide example of LRT overpass & elevated station (centre platform)

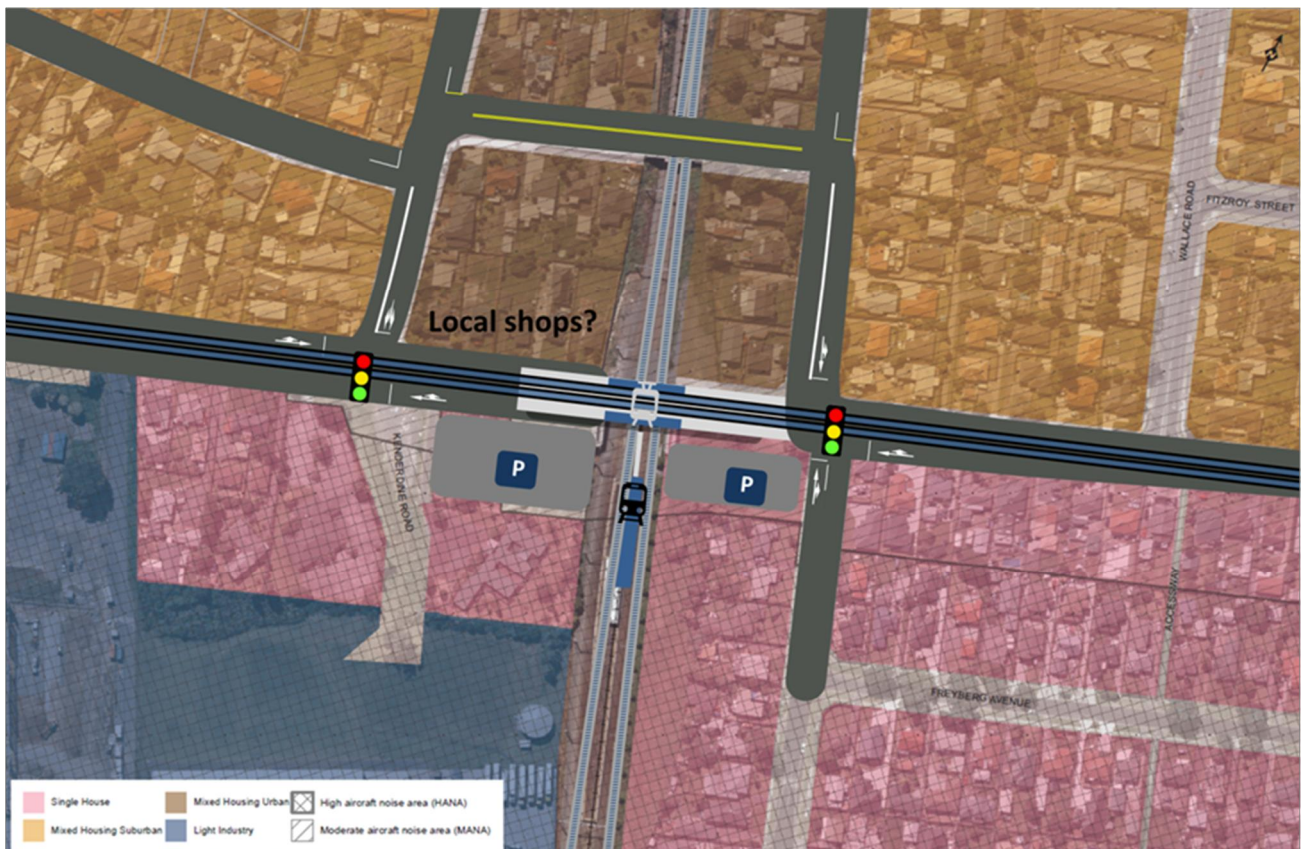


Figure 8.10 Plan view of Puhinui Station

As shown in Figure 8.11, there is limited length (~190 m) available between Kenderdine Road and Cambridge Terrace to grade separate LRT. The overpass will need to span four NMIT lines with sufficient vertical clearance to meet design standards. Initial assessments show that if a design speed approaching the LRT stop of 40 km/h is adopted, stop length (66 m) and minimum standards are accepted then an overpass structure is achievable, with minimal property impacts either side on Puhinui Road.

There are a variety of specific design options of how the NMIT could be spanned while accommodating the LRT interchange at Puhinui Station, the details of which will need to be investigated during the IBC phase.

The connectivity of the PT network at Puhinui Station with Heavy rail, LRT and bus will result in a high level of Public Transport service. From Puhinui Station, Heavy Rail connects passengers to the north and south, LRT would connect passengers to the east and west and buses would connect passengers to the local area. The PT connectivity at Puhinui Station creates an ideal opportunity for Transport Orientated Development (TOD) at Puhinui Station. Supporting development around this key interchange can also support the utilisation of the PT network.

The Puhinui Station area is subject to the Aircraft Noise Area designation shown in Figure 8.11. Much of the southern side of Puhinui Road is subject to the High Aircraft Noise Area (HANA) zoning however the area immediately to the north of Puhinui Station, including Puhinui Road, is subject to the Moderate Aircraft Noise Area (MANA) zoning. In the Auckland Unitary Plan there are a number of Permitted and Restricted discretionary activities outlined for the MANA and HANA zones. There are more opportunities for new activities within the MANA zoning. There is a need to consider the implications of the HANA and MANA zoning in more detail. In order to take advantage of the development potential and opportunities around Puhinui Station, Auckland Transport will need to work with key stakeholders during the IBC phase for their mutual interest.



Figure 8.11 Plan view of land use around Puhinui Station

8.2 Botany to Manukau

Section 4 identified the following three potential corridors for LRT from Manukau to Botany:

- Preston Road;
- Chapel Road; and,
- Te Irirangi Drive.

This section compares the details of each of these options in order to determine the preferred LRT corridor.

8.2.1 Options

8.2.1.1 Preston Road

In this option the alignment from Puhinui Road follows Preston Road, East Tamaki Road, Springs Road and Smales Road before joining Te Irirangi Drive, as shown in Figure 8.12.

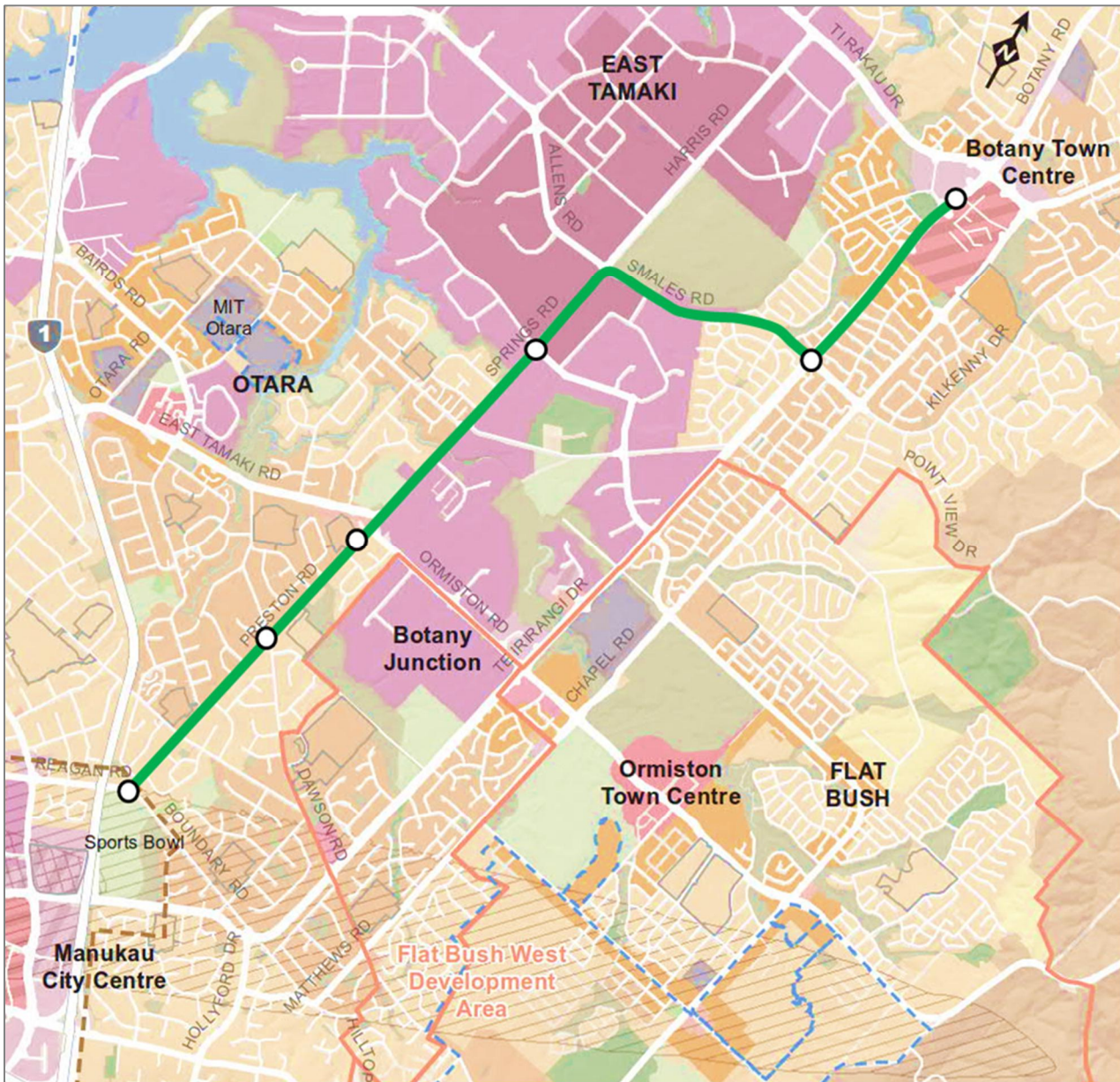


Figure 8.12 Preston Road option alignment

Preston Road is in a residential area. The existing road reserve cross section is approximately 20 m wide including two traffic lanes, a flush median and parking on both sides. Along Preston Road the LRT alignment would have a narrow cross section as shown in Figure 8.13. The cross section provides for a 7 m central street running LRT envelope. Removing parking and the flush median to include LRT will likely minimise adjacent property impacts. As this section of the alignment is street running the maximum speed of the LRT will be restricted to 50 km/h.

All unsignalised turns across the LRT tracks along Preston Road will be prohibited. Most local streets off Preston Road would be left unsignalised and become left in, left out only. Roads where movements across LRT need to be maintained could be signalised. To prevent through movements across the tracks a barrier kerb parallel to the LRT tracks should be implemented.

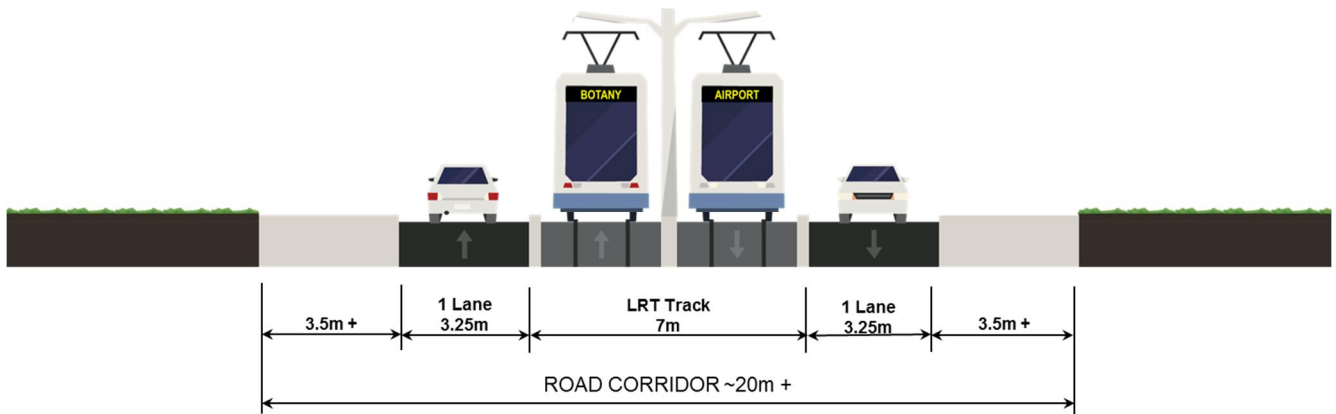


Figure 8.13 Preston Road - typical cross section

East Tamaki Road, Springs Road and Smales Road are similar in existing cross section. The existing cross section of East Tamaki Road is typically 25 m wide including four traffic lanes and a median. The existing cross section of Springs Road is typically 25-30 m wide including four traffic lanes and a median. To include LRT and maintain four traffic lanes as shown in Figure 8.14 widening of the corridor would be required, resulting in property impacts. Additional land would also be required at key signalised intersections to accommodate right turning bays.

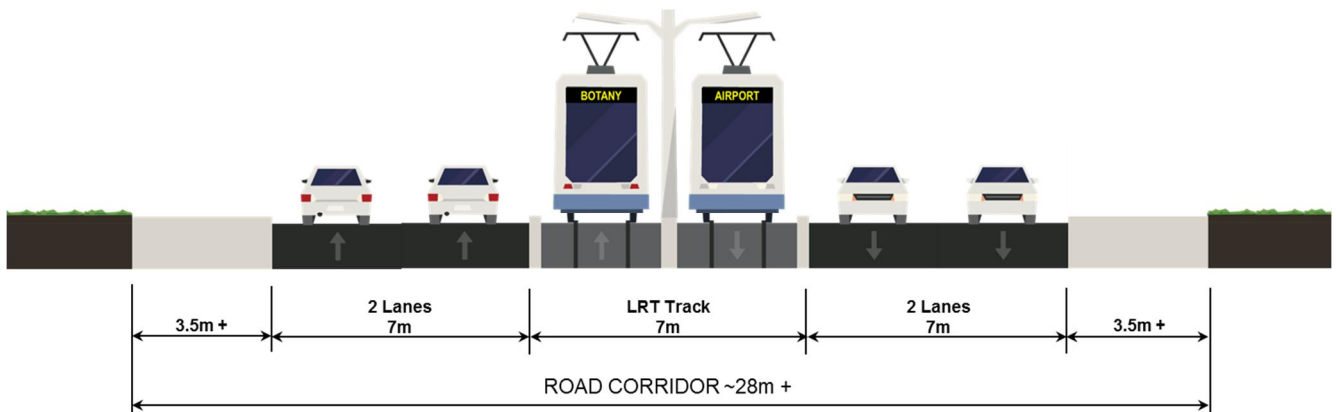


Figure 8.14 East Tamaki Road / Springs Road - typical cross section

East Tamaki Road and Springs Road are in an industrial area and strategically important for heavy vehicles in the area. Both East Tamaki Road and Springs Road are classified as primary arterials and are over dimension vehicle routes. The industrial nature of the area and high proportion of heavy vehicles also creates an environment that is not supportive for active modes that would connect to the LRT which could negatively influence the potential catchment. Using the central median and existing road width for LRT is likely to have a negative impact on the capacity of the corridor for freight / industry related activities.

To achieve a direct route and competitive travel time from the Airport to Botany a Preston Road alignment would likely bi-pass Manukau CBD. Puhinui road is greater than 1.25 km from Putney Way, the future centre of the Manukau City Centre. Therefore, to connect to Manukau City Centre from this option alignment, passengers

would need to transfer to a bus service. This option does not adequately serve Manukau City Centre and would not contribute to the goals for redevelopment of the area.

8.2.1.2 Chapel Road

In this option from Manukau to Botany, the LRT alignment follows Chapel Road as shown in Figure 8.15. Chapel Road is an over dimension vehicle route and is planned to be a bus corridor as part of the FTN (Future Transport Network).¹²

The cross section shown in Figure 8.16, provides for a 7 m central street running LRT envelope. Removing on-street parking to include LRT will reduce adjacent property impacts. There will be localised property requirements at intersections, LRT stops and where there are no service lanes. As this section of the alignment is street running the maximum speed of the LRT will be restricted to 50 km/h.

¹² Regional Public Transport Plan (RPTP), Auckland Transport, July 2015



Figure 8.15 Chapel Road option alignment

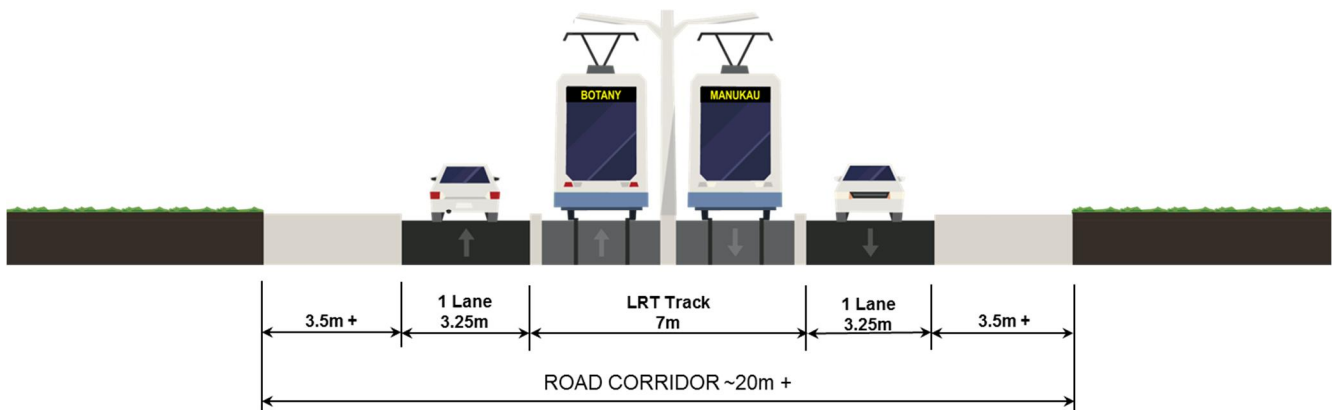


Figure 8.16 Chapel Road - typical cross section

All unsignalised turns across the LRT corridor along Chapel Road will be prohibited. The unsignalised streets intersecting with Chapel Road will become left in and left out. A number of intersections will need to be signalised to accommodate traffic movements across the tracks to maintain connectivity through the road network particularly to access the residential areas. To prevent through movements across the tracks mid-block, a barrier kerb parallel to the LRT tracks should be implemented.

8.2.1.3 Te Irirangi Drive

In this option from Manukau to Botany, the LRT alignment follows Te Irirangi Drive as shown in Figure 8.17.



Figure 8.17 Te Irirangi option alignment

Along the majority of the length of Te Irirangi Drive there is dedicated corridor available in the central raised median. From Whetstone Road to Botany Town Centre, the corridor is at least 35 m wide, the typical cross sections can provide for LRT, LRT stops and active mode facilities within the road reserve as shown in Figure 8.18. The cross section provides for a 7 m central LRT envelope within the central median, separated from traffic lanes by planting. As this section of the alignment is separated the maximum speed of the LRT will be able to achieve is 70-80 km/h. Due to the width of the corridor it is likely that four lanes of traffic will be maintained.

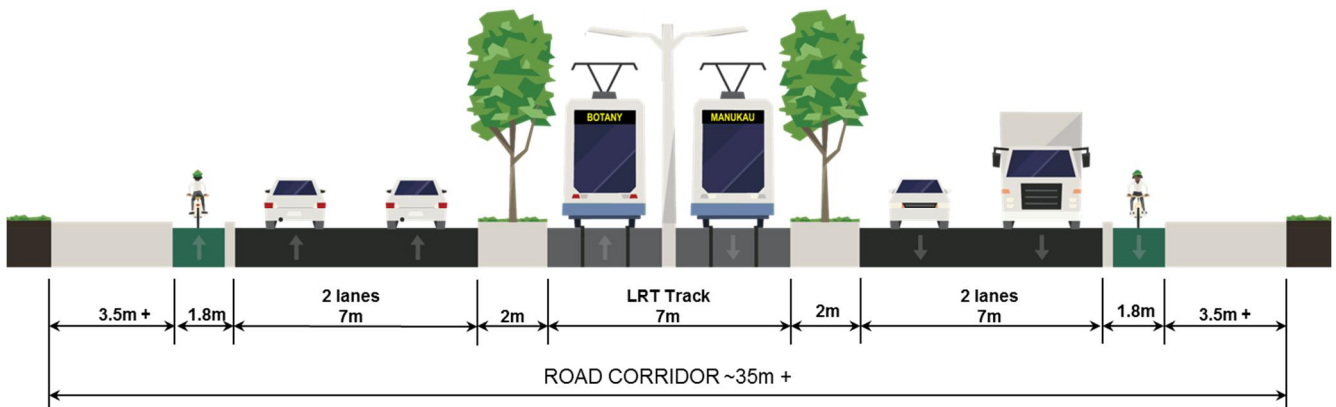


Figure 8.18 Te Irirangi Drive - typical cross section north of Whetstone Road

South of Whetstone Road the Te Irirangi Drive corridor reduces to approximately 30 m wide. The typical cross section accommodating LRT is shown in Figure 8.19. As this section of the alignment is street running the maximum speed of the LRT will be restricted to 50 km/h. Localised property impacts are likely along this section to include one LRT stop (near Dawson Road) and maintain traffic capacity at the Hollyford Avenue / Boundary Road and Dawson Road intersections.

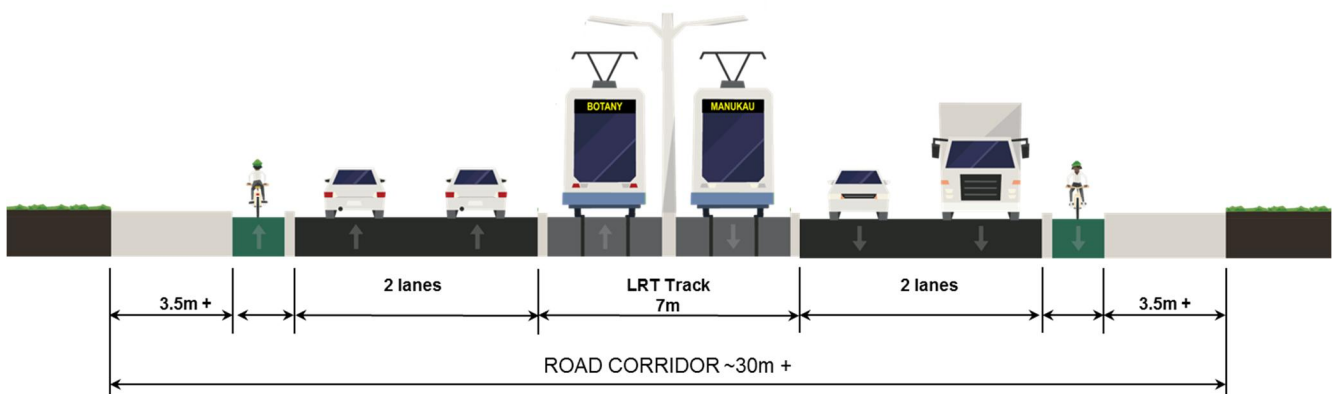


Figure 8.19 Te Irirangi Drive - typical cross section south of Whetstone Road

All unsignalled turns across the LRT tracks along Te Irirangi Drive will be prohibited. From the Boundary Road / Hollyford Drive intersection to Botany Town Centre, the existing central median restricts movements across Te Irirangi Drive only to signalised intersections and a single U-turn provision (between Belinda Avenue and Penion Drive). The U-turn provision will need to be removed or signalised. Planting and a barrier kerb along each side of the LRT tracks will prevent through movements across the tracks, restricting crossing traffic movements to the signalised intersections.

8.2.2 Option Comparison

8.2.2.1 Travel Time

Currently, between the Airport and Botany general vehicle travel times are highly variable, generally in the range of 22-60 minutes. Using the existing public transport usually results in a travel time of 57-80 minutes.¹³

As a RTN link the LRT needs to be able to provide an effective public transport service and therefore it is important that it provide a competitive in travel time between the Airport and Botany. Providing a competitive travel time on the Manukau to Botany section of the alignment also may provide opportunity to serve more

¹³ Based on Google Maps and Auckland Transport schedules

locations in Manukau City Centre without compromising the travel time. LRT is also able to provide a consistent travel time being separate for general traffic and not influenced by peak travel times.

Figure 8.20 compares the approximate travel times that were estimated between the Airport and Botany via each of the three Manukau to Botany corridor options. The estimated travel times are based on the average speeds of LRT (including stops) for typical cross sections shown in Table 8.1, time penalties were also added for turns that would require the LRT to slow. The travels times via Preston Road and Te Irirangi Drive are similar however the Preston Road alignment does not serve Manukau City Centre. The Manukau City Centre is approximately 1.25 km from Puhinui Road and would require an interchange with a bus service for passengers to get to the City Centre. For LRT to serve the Manukau City Centre using the Preston Road alignment would likely increase the travel time by more than 9 minutes and result in an indirect route to Botany. Thus Preston Road alignment option fails to meet the key objectives of the project.

The estimated LRT travel time for the Chapel Road alignment is approximately double that of the Te Irirangi Drive alignment. The Te Irirangi Drive alignment both can serve Manukau City Centre and provide the more competitive travel time.



		Preston	Te Irirangi	Chapel
■	Airport to Puhinui	14	14	14
■	Through Manukau	0 ¹⁴	14	14
■	To Botany	24	9	18
	Total	39	38	47

Figure 8.20 Comparison of estimated travel times

Table 8.1 Average LRT speed

Operational Speed (km/hr)	LRT Operations	Average Speed (km/hr) ¹⁵
30	Priority in street	12
50	Priority in street	22
50	Separate	30
70	Separate	40
80	Separate	45

¹⁴ Preston Road alignment would not serve Manukau CBD.

¹⁵ Average speeds are based on Dominion Road modelling for LRT reference design and include stops.

8.2.2.2 Potential walk up catchment

The 2046 population and employment for each corridor based on 800m pedestrian walking catchment are shown in Figure 8.21. The Chapel Road corridor is expected to have the highest population and employment.

Figure 8.22 shows the currently planned land use for each corridor around the indicative stop locations for each corridor. Along all three corridors there are areas with land use that based on current future planning are not likely to generate significant patronage demand. However, there is potential to improve the demand through Transport Orientation Development (TOD) around key stop locations.

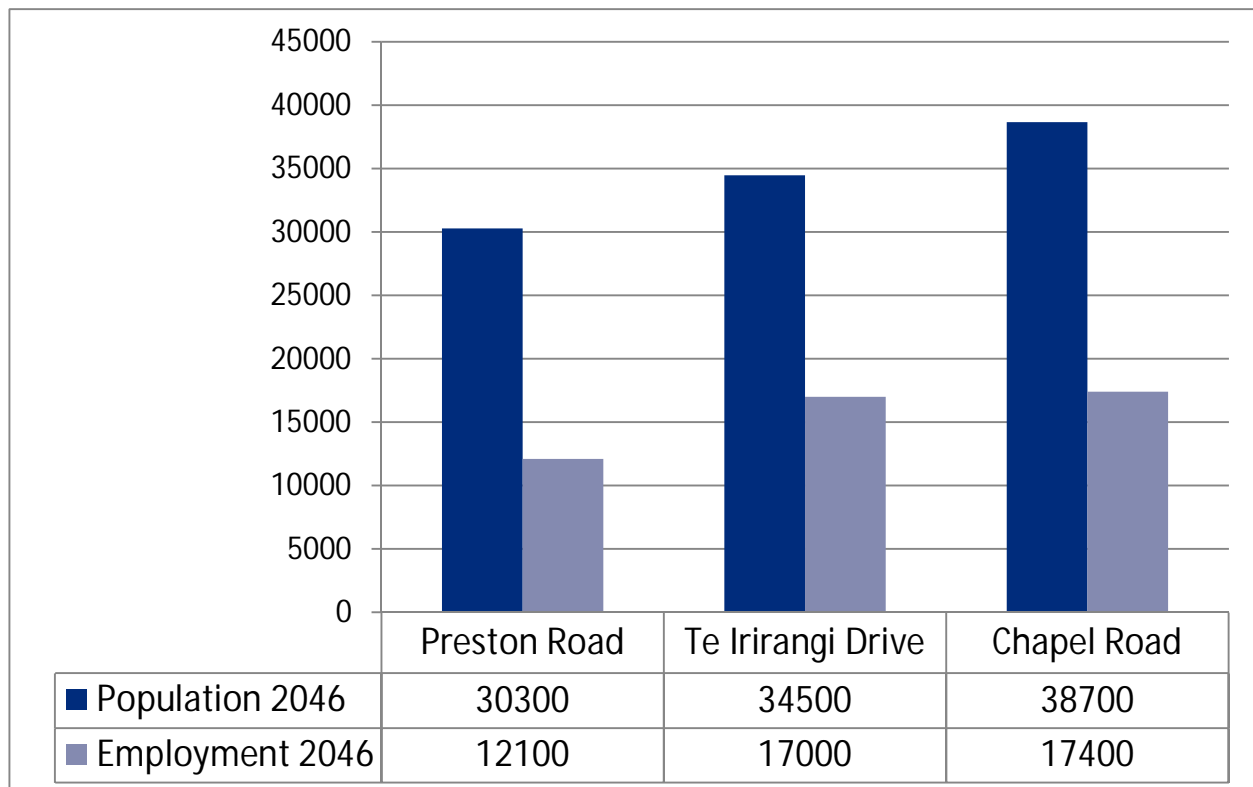


Figure 8.21 800m catchment comparison 2046 (Auckland Unitary Plan, 2016)

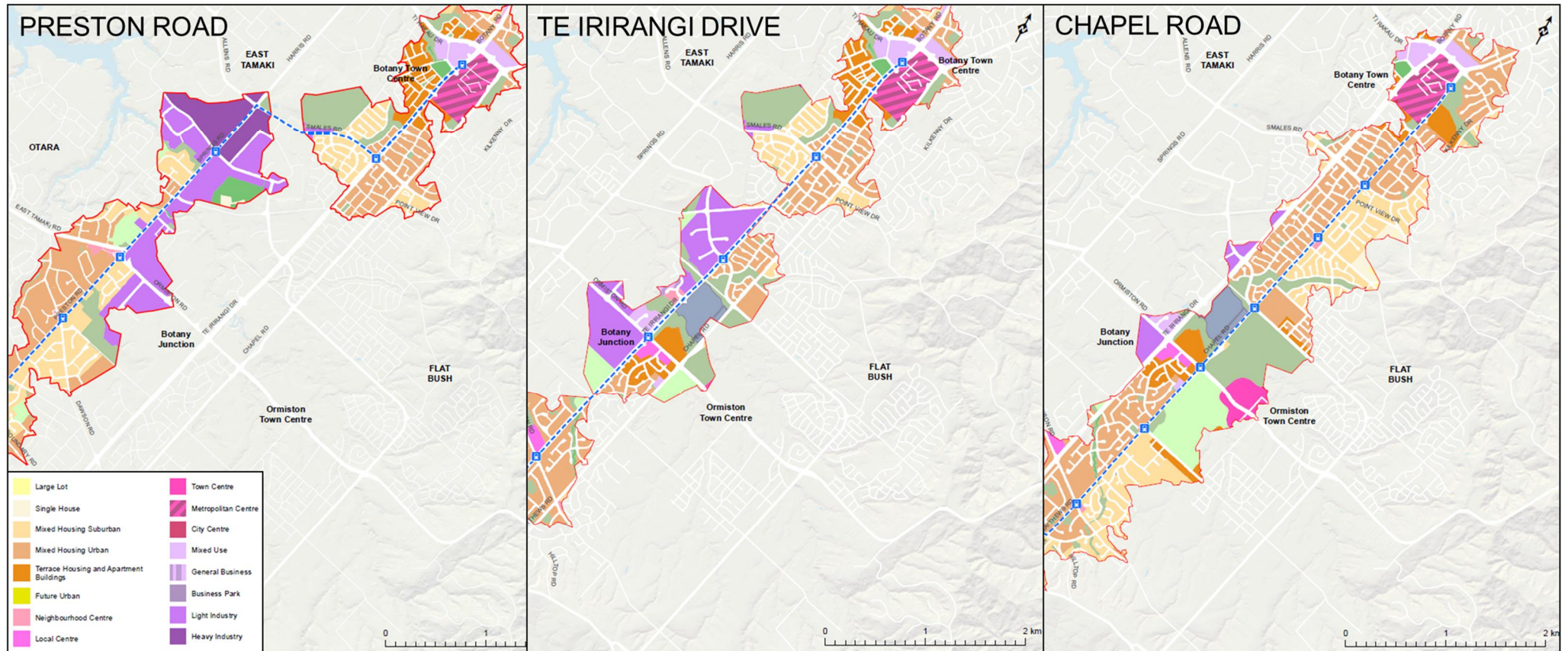


Figure 8.22 Walking catchment (800m) around indicative LRT stop locations

8.2.3 Recommended Manukau to Botany alignment

Based on the assessment and comparison of the Manukau to Botany corridors the recommended LRT concept alignment for further development is the Te Irirangi Drive corridor.

Between Puhinui Station and Te Irirangi Drive there are a number of option alignments that would allow LRT to service Manukau City Centre without compromising the travel time of the whole LRT route.

At Workshop 3 there was agreement that Te Irirangi Drive is preferred for LRT over the other alignment options because:

- It allows LRT to serve the Manukau City Centre;
- It can achieve a competitive travel time;
- There is potential for land use redevelopment around stations;
- The width of the corridor means it will have the lowest property impacts;
- The width of the corridor and limited movements across Te Irirangi Drive means that it will have minimal traffic impact;
- There is the highest potential for active transport facilities in corridor due to width; and,
- Potential for interchange with local feeder buses on crossing roads creating an integrated and connected PT network.

8.3 Manukau City Centre

As part of Workshop 3 the following three primary east-west route options (shown in Figure 8.23) were developed:

- Option 1 – Manukau Station Road – via KiwiRail or Plunket Avenue
- Option 2 – Ronwood Avenue via KiwiRail or Plunket Avenue through the AMP site
- Option 3 – Putney Way through the Westfield site

It was agreed at workshop 3 that alignments should avoid Cavendish Drive due to its east-west strategic function.

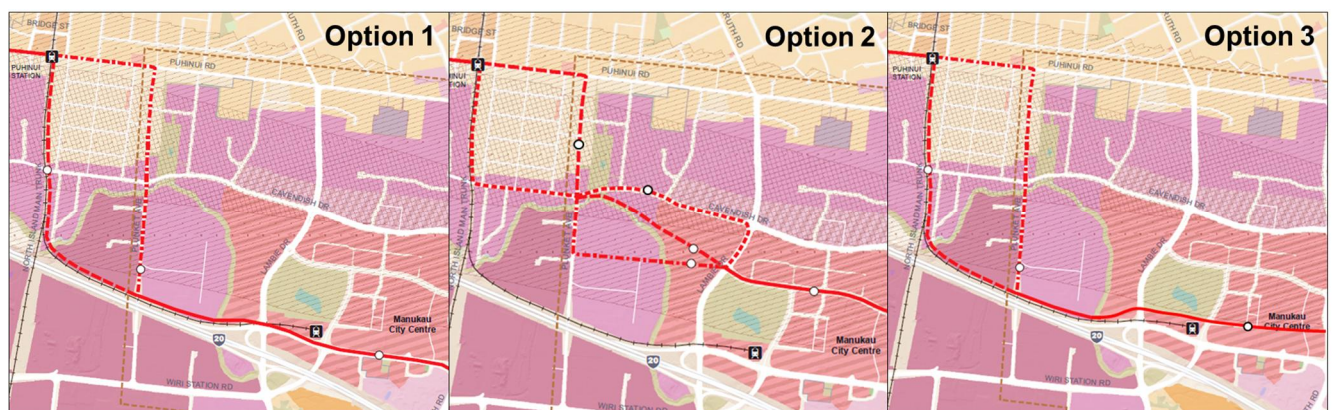


Figure 8.23 Manukau City Centre options

This section compares the details of each of these options in order to determine the preferred LRT corridor through Manukau.

8.3.1 Option 1 – Manukau Station Road

This option may run along the KiwiRail corridor or Plunket Avenue, then along Manukau Station Road as shown in Figure 8.24. The Manukau City Centre LRT stop would be located on Manukau Station Road and be within walking distance of the Manukau station and bus interchange.

Alignments along the KiwiRail corridor will need to allow for four tracking of heavy rail and therefore will likely require land acquisition. Faster travel times may be achieved along the rail as LRT is separate from traffic. Consultation during the IBC phase is required with KiwiRail for options following the KiwiRail corridor.

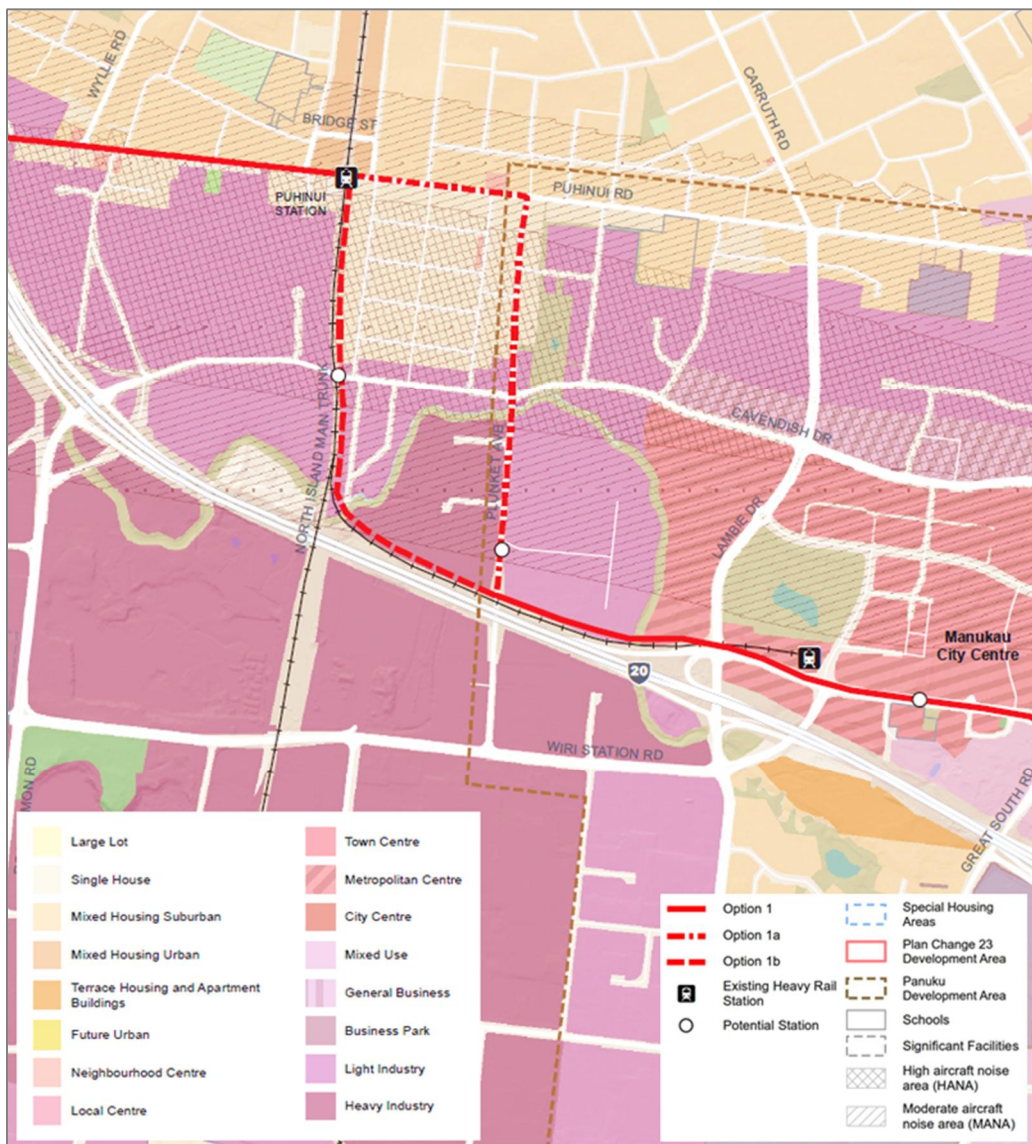


Figure 8.24 Option 1 - Manukau Station Road

PDA plans for Manukau Station Road to become a tree-lined avenue in Manukau City Centre, with high PT and active mode amenity as illustrated in Figure 8.25. Consultation with PDA revealed that within the next 10 years, PDA is focusing on the redeveloping the land adjacent to Manukau Station Road. This area does not necessarily need the support of LRT to encourage regeneration. The area is well served by the FTN and is within walking distance of the Manukau Bus Station.

In Workshop 3 there was general agreement that due to the proposed timing of LRT, as defined in ATAP, LRT would better serve Manukau City Centre by supporting land use redevelopment in another area of Manukau.



Figure 8.25 PDA plans for Manukau Station Road¹⁶

8.3.2 Option 2 – Ronwood Avenue

As shown in Figure 8.26, the alignment to Ronwood Avenue could follow either the KiwiRail or Plunket Road corridors to Cavendish Drive where the alignment could either pass through the current AMP SUPA CENTRE site or follow Cavendish Drive to Lambie Drive. A Ronwood Avenue LRT alignment would allow PT to serve and penetrate an area of Manukau City that would not be served by the Manukau Station and Bus Interchange.

The existing cross section of Ronwood Avenue is approximately 32 m wide with two traffic lanes, a planted median and parking. This width would allow for a centre running LRT separated by planting, while maintaining two traffic lanes and including pedestrian and cycle facilities. An indicative cross-section is shown in Figure 8.27.

In order to accommodate LRT, U-turn provisions will need to be removed and the following unsignalised intersections may need to be signalised to provide controlled crossing points across LRT tracks: Lambie Drive, Osterley Way and Leyton Way. Movements across the tracks at all other locations along Ronwood Avenue will be prevented by planting.

¹⁶ Draft Manukau Framework Plan, Panuku Development Auckland, November 2016



Figure 8.26 Option 2 – Ronwood Avenue

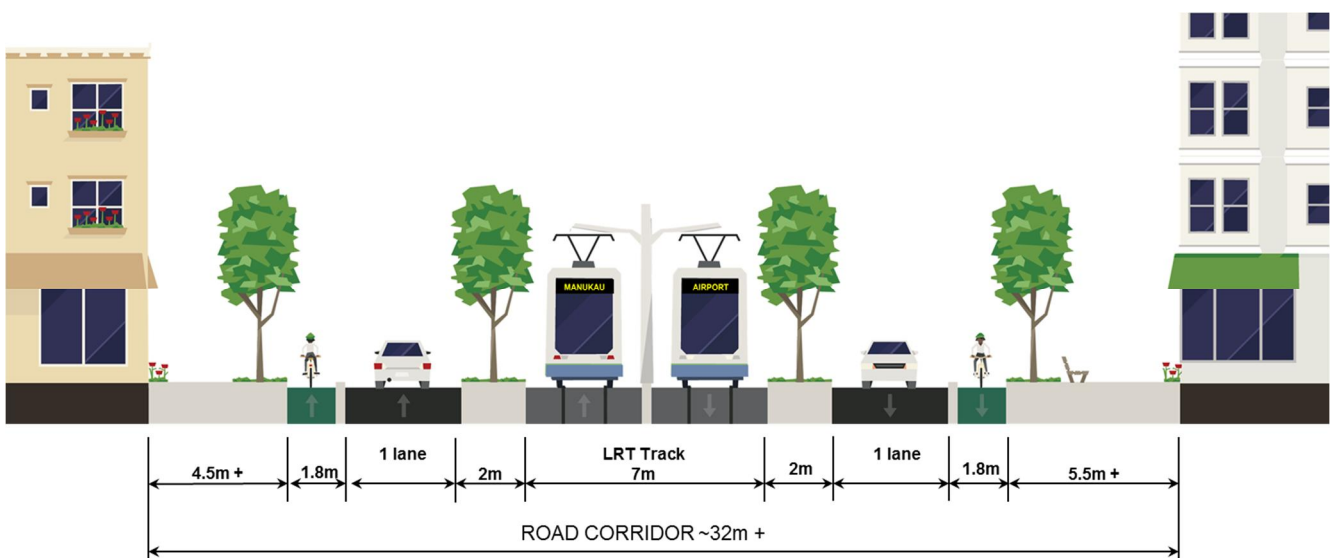


Figure 8.27 Ronwood Avenue cross section

The land adjacent to Ronwood Avenue is a mix of privately owned and PDA controlled lots. PDA does not have the same level of interest in adjacent land as the Manukau Station Road corridor. PDA has less control over the area adjacent to Ronwood Avenue. The Ronwood Avenue area is expected to develop over time. Consent applications for development adjacent to Ronwood Avenue have already been submitted and the long term aim (10 + years) of PDA is to move the current low density retail and allow for higher density commercial and residential development. The possible future timing of LRT (Decade 2) is likely to align with the programme for development of the Ronwood Avenue area and encourage developer investment resulting in organic redevelopment thus supporting PDA's goals for the area without PDA solely responsible for driving the redevelopment.

For LRT to be a success on Ronwood Avenue it is important that the adjacent land use frontage is activated to support pedestrians and enable walk up access. Car parking between LRT and Manukau City Centre destinations creates a barrier for pedestrians and will limit the accessibility of the RTN.

The section of the alignment through the AMP SUPA CENTRA site is subject to consultation and negotiation with the current land owner and would need to be further investigated in the IBC phase.

8.3.3 Option 3 – Putney Way

This option may run along the KiwiRail corridor or Plunket Avenue, then along Putney Way and through the southern side of Westfield (Countdown supermarket area) as shown in Figure 8.28. This alignment may reinforce the future centre of Manukau. The Manukau City Centre LRT stop would be located on Putney Way and be within walking distance of the Manukau station and bus interchange.



Figure 8.28 Option 3 – Putney Way

PDA plans for Putney Way to become the main street and heart of Manukau City Centre, with high pedestrian amenity as illustrated in Figure 8.29. Development along the Putney Way corridor is part of the initial focus area for Manukau redevelopment expected within the next 10 years. As PDA has control over much of the land in the area the redevelopment can happen with or without the support of LRT. The area is well served by the FTN and is within walking distance of the Manukau Bus Station.

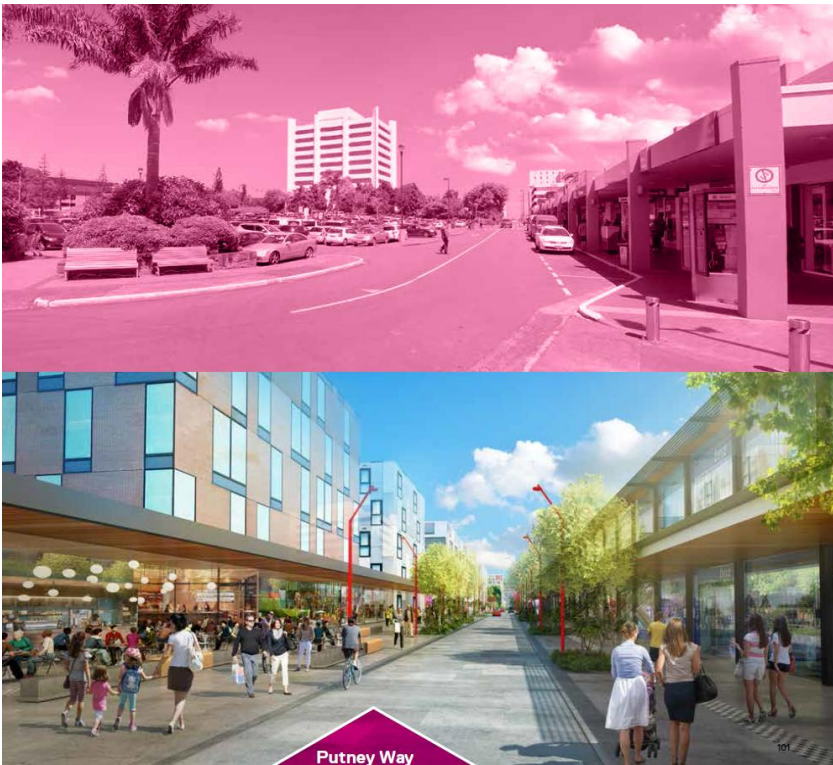


Figure 8.29 PDA plans for Putney Way¹⁷

In line with the PDA plans for Putney Way, the LRT cross section would be shared running as shown in Figure 8.29. Through pedestrianised spaces the maximum LRT speed would be limited to 30 km/h however in practise the actual LRT speed is usually around 12 km/h.

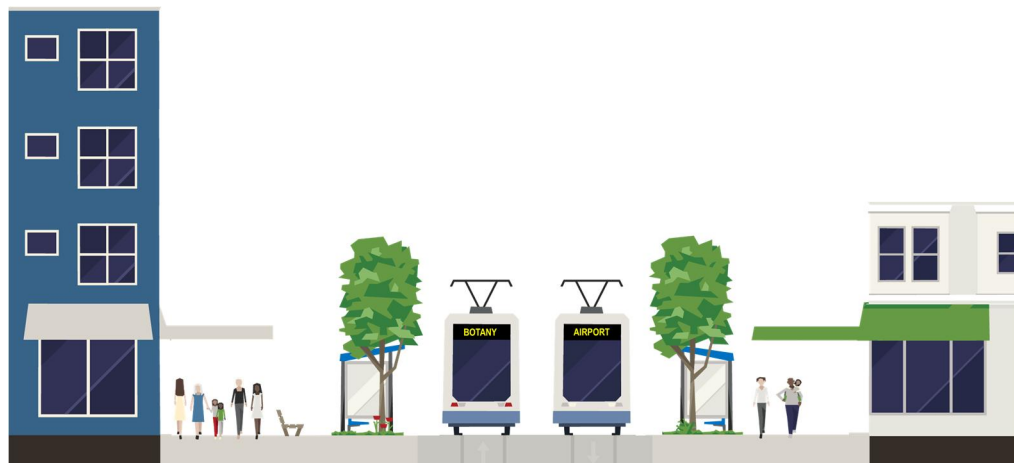


Figure 8.30 Putney Way cross section

Further investigation into how the LRT would access Putney Way from Lambie Drive is required, when more information is available regarding the proposed Te Papa site. The Putney Way option (illustrated in Figure 8.28) could be attractive if the corridor could be secured across the Westfield Site. Consultation with KiwiRail, Westfield and Te Papa will be required to achieve this alignment.

¹⁷ Draft Manukau Framework Plan, Panuku Development Auckland, November 2016

8.3.4 PT interchange

As noted in Section 8.1.4, the LRT interchanges with heavy rail at the Puhinui Station allowing transfers to both Eastern and Southern lines. By providing this connection means that it is not considered critical for LRT to physically connect to the Manukau Station.

It is important to create interchange opportunities between Bus and LRT at Manukau. Bus and LRT stops should be designed within line of sight and walking distance of each other. There are two main options for creating these interchanges:

- Locate the LRT stop within sight/walking distance of the Manukau Bus Interchange; or
- Route buses to the LRT corridor and LRT stops.

Where bus services route to the LRT corridor, interchange between LRT and bus can be at intersection, along platform or across platform as shown in Figure 8.31. This results in minimal walking required to transfer between LRT and Bus services.



Figure 8.31 Examples of existing shared Bus / LRT stops in Saarbrücken (left) and in Orleans (right)

Consultation with AT Metro has confirmed that these are feasible solutions that would create a cohesive Public Transport Network with strong Bus and LRT interchange opportunities in Manukau City Centre.

While there are feasible options for bus and LRT interchange that does not connect to the Manukau Bus Interchange, messaging around the proposed PT network would need to be carefully managed by Auckland Transport, AT Metro and PDA to address public perception.

8.3.5 Recommended Manukau City Centre alignment

Based on the assessment and comparison of the Manukau City Centre options the recommended LRT concept alignment for further development is Ronwood Avenue.

Ronwood Avenue is recommended for LRT over the other alignment options because:

- Due to the timing of LRT and plans for future adjacent land use, Ronwood Avenue has the highest potential to support intensification, redevelopment, and expansion of Manukau City Centre;
- It has an east-west orientation;
- The alignment serves the Manukau City Centre centroid of activity for pedestrian movements;

- There is potential to integrate with the bus PT network;
- The alignment serves areas of Manukau City Centre not already served by PT; and,
- It can be competitive in travel time relative to the other options.

8.3.6 SH1

Two main options were considered from the Manukau City Centre across SH1 to Te Irirangi Drive. These were:

- Redoubt Road and Hollyford Drive
- Great South Road and Te Irirangi Drive

The Redoubt Road and Hollyford Drive alignment, as shown in Figure 8.32, would be centre street running, with a top speed of approximately 50 km/h. These road corridors are residential. Diorella Drive and Aspiring Ave intersections would need to become signalised and all other residential access onto Redoubt Road and Hollyford Drive would become left in left out only.

The existing cross section of Redoubt Road is approximately 22 m wide and Hollyford Drive is 30 m in width. The Mill Road corridor project includes the widening of Redoubt Road and Hollyford Drive to include additional lanes and bus facilities for the FTN. Further property impacts would be required along Hollyford Drive and Redoubt Road to include LRT without reducing the planned future traffic capacity.

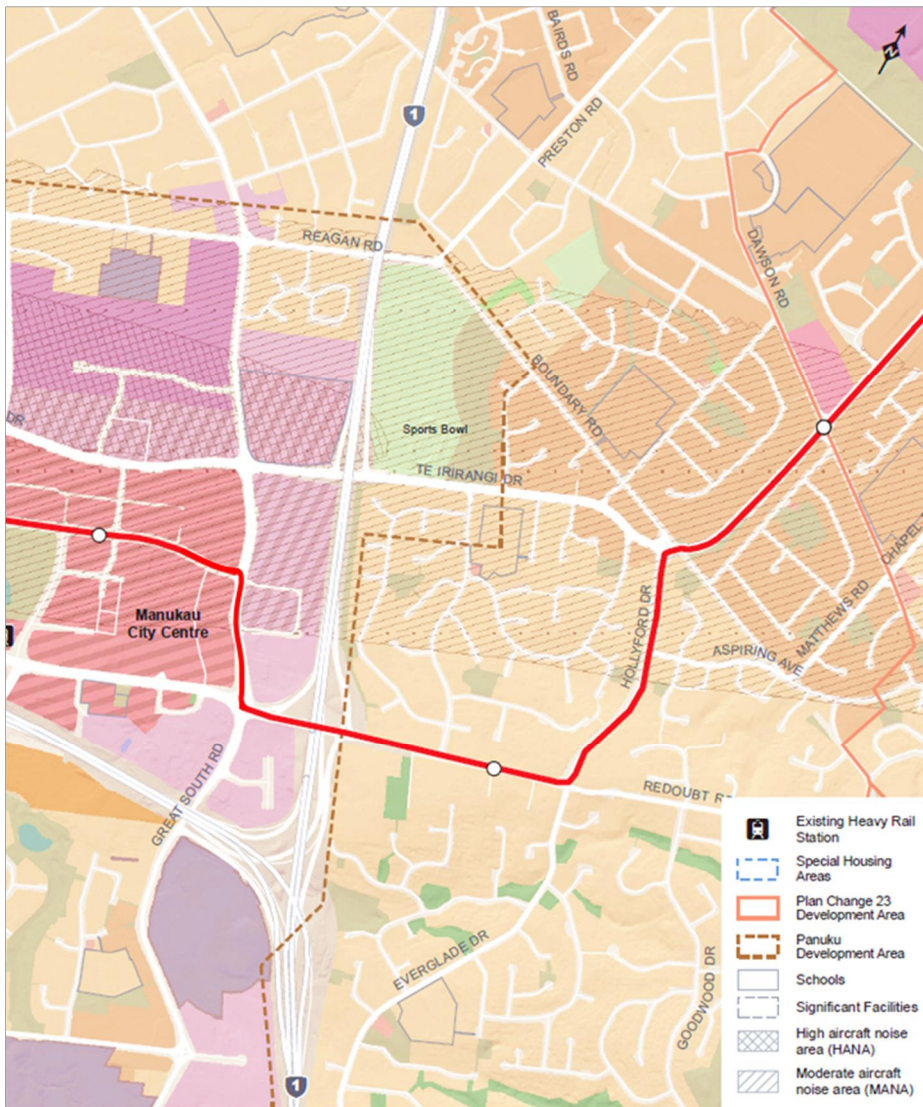


Figure 8.32 Redoubt Road and Hollyford Drive option

The Great South Road and Te Irirangi Drive alignment, as shown in Figure 8.33, would mainly be centre street running, with a top speed of approximately 50 km/h. The alignment would allow PT to penetrate the north-eastern section of the controlled Panuku Development. Strategically placed LRT stops would provide access to the AUT site and the redeveloped Sports Bowl site.

The existing Great South Road corridor is approximately 34 m wide and includes 6 traffic lanes. In order to maintain the traffic capacity along Great South Road there would be property impacts.

The Te Irirangi Drive corridor is approximately 30m wide. The typical cross section accommodating LRT is shown in Figure 8.19. Localised property impacts may be required along this section to include two LRT stops (between Great South Road and Boundary Road) and maintain traffic capacity at the SH1 interchange, Hollyford Avenue / Boundary Road and Diorella Drive intersections.

All unsignalled turns across the LRT tracks along Te Irirangi Drive and Great South Road will be prohibited. The following streets on Te Irirangi Drive will become left in and left out: Leila Place and Sharlimar Place. The planting and barrier kerb along each side of the LRT tracks will prevent through movements across the tracks, restricting crossing traffic movements to the signalled intersections.

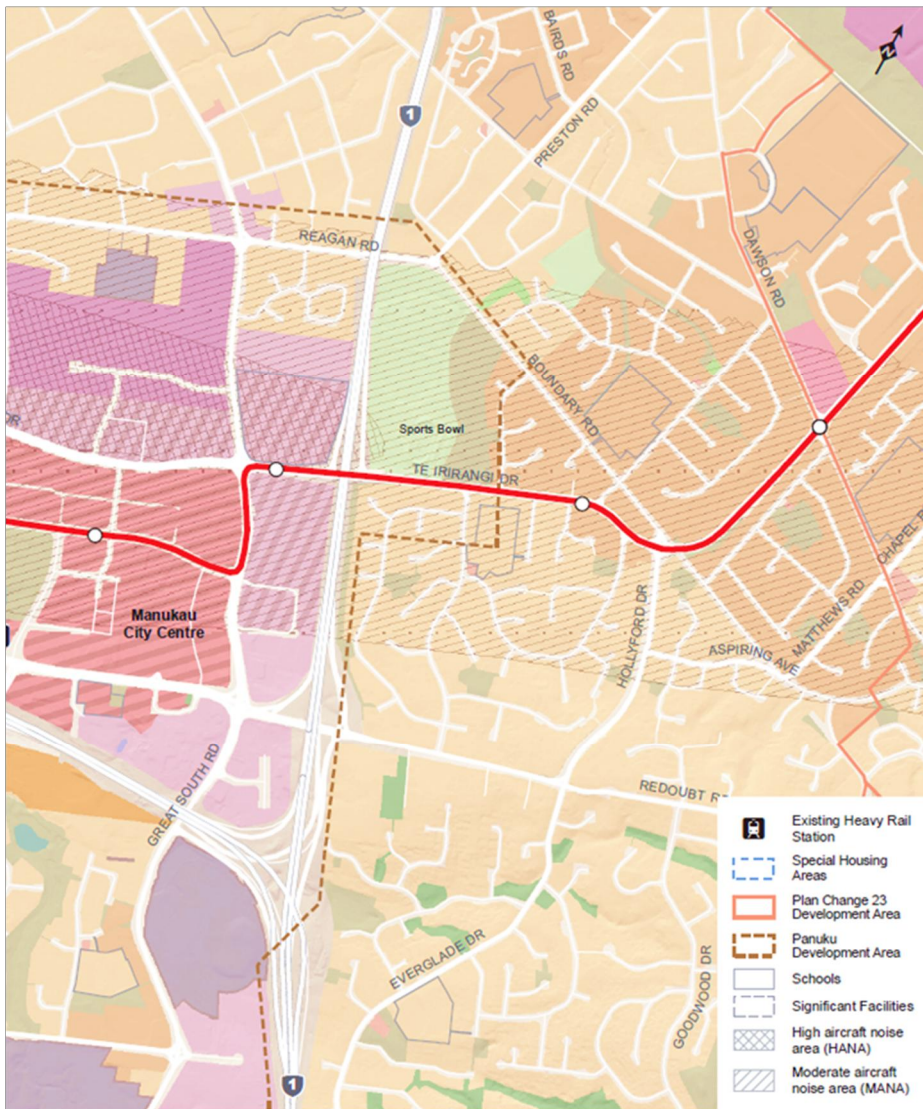


Figure 8.33 Great South Road and Te Irirangi Drive option

It was agreed amongst the study key stakeholders, that the Great South Road and Te Irirangi Drive option was preferred over the Redoubt Road and Hollyford Drive for the following reasons:

- As part of the FTN Redoubt Road and Hollyford Drive will be the primary bus corridor;
- The Te Irirangi alignment can serve strategically important areas in the northern PDA area such as AUT and the sports bowl;
- From Ronwood Avenue it is shorter in length for the LRT alignment travel north toward Botany.

A design constraint of the alignment option via Great South Road and Te Irirangi Drive is crossing SH1. The existing SH1 interchange at Te Irirangi Drive is a half diamond interchange, with north facing ramps as shown in Figure 8.34. One option to minimise the impact of the LRT on the interchange is to have the alignment along the southern side of the interchange with the LRT alignment crossing back to centre running at another signalised intersection. It would also be possible to have LRT centre running along Te Irirangi Drive over SH1. Centre running LRT could be coordinated with the traffic signals to minimise the impact on traffic. However, modelling is required to understand the potential impact to traffic and capacity at the Te Irirangi Drive / SH1 interchange. Both options would require additional space across SH1 to accommodate LRT without having impacts on the

traffic capacity of the interchange by either widening the existing bridge or building an LRT specific crossing. The alignment through the SH1 / Te Irirangi Drive interchange will need to be confirmed during the IBC phase.



Figure 8.34 Plan view of the existing SH1 interchange¹⁸

¹⁸ Auckland Council GeoMaps. (2017). [Geomapspublic.aucklandcouncil.govt.nz](https://geomapspublic.aucklandcouncil.govt.nz). Retrieved 20 February 2017, from <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

9. Recommended LRT concept alignment

The recommended concept LRT alignment from Auckland International Airport to Botany Town centre via Manukau City Centre is as shown in Figure 9.1 and the alignment drawings are attached in Appendix D.

This recommended concept LRT alignment for the RTN connection achieves the primary objective of the Airport Manukau Botany link to provide; an efficient Public Transport service, with a competitive travel time, that serves Manukau City Centre. Therefore, this alignment is recommended to be taken forward as an input into further assessments via the subsequent IBC.

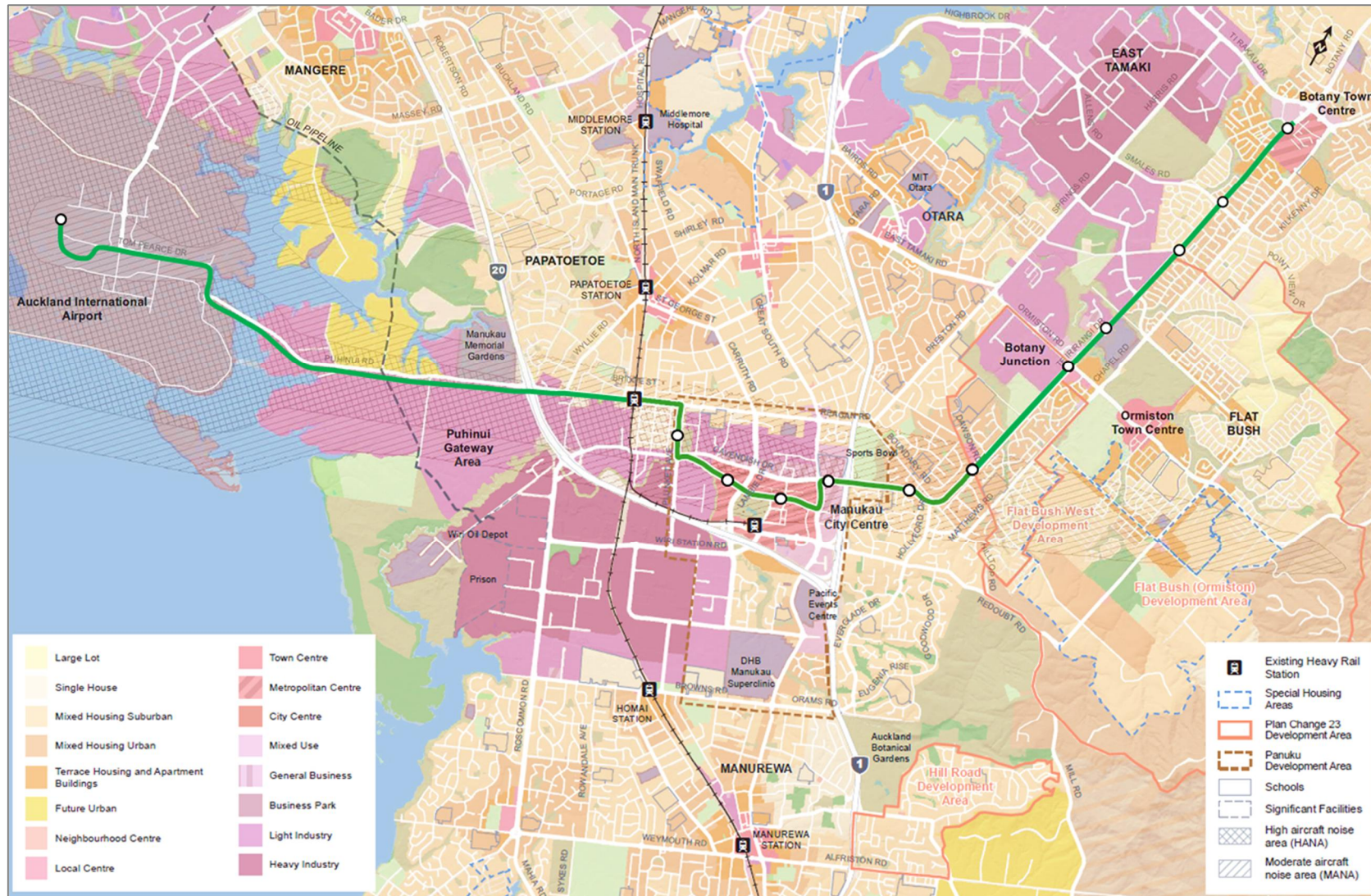


Figure 9.1 Recommended LRT concept alignment

10. Further investigation

This section outlines recommended strategies recommended for further investigation in the IBC phase. A number of the recommendations are suggestions to maximise patronage along the LRT route and capture value.

10.1.1 Land use changes

Along the alignment there are areas with land use that based on current future planning are not likely to generate significant patronage demand. In order to maximise the potential demand it is recommend that changes in land use to allow gradual redevelopment of some land to uses more amenable to public transport – residential, educational, office or retail. While the route may not be economic to build initially, but will become more so as the area develops. Current open space may create opportunity for redevelopment that will be encouraged by LRT.

At specific locations near LRT stops there are opportunities for concentrated Transport Orientated Development (TOD). This sort of development might be informed by Auckland Transport and guided by Council Organisations to achieve an appropriate outcome. As highlighted in Section 8.1.4, the area surrounding Puhinui Station has high potential for guided development. The stop locations along Te Irirangi Drive also have high propensity for TOD.

10.1.2 Integrated PT network

As the RTN link the LRT alignment will create the primary spine for PT in the area with a supporting bus network linking local areas to the RTN. To create a robust, integrated PT network strong bus linkages across LRT servicing local connection to LRT are required as illustrated in Figure 10.1. This may require reorganising adjacent local bus routes to interchange/shuttle to LRT stations i.e. east/west buses link to north-south LRT.

It is important to develop quality bus interchanges. Interchanging between the bus and LRT will need to be as seamless as possible for Public Transport passengers. Interchange can be at intersection, along platform or across platform, as shown in the examples in Figure 8.31.

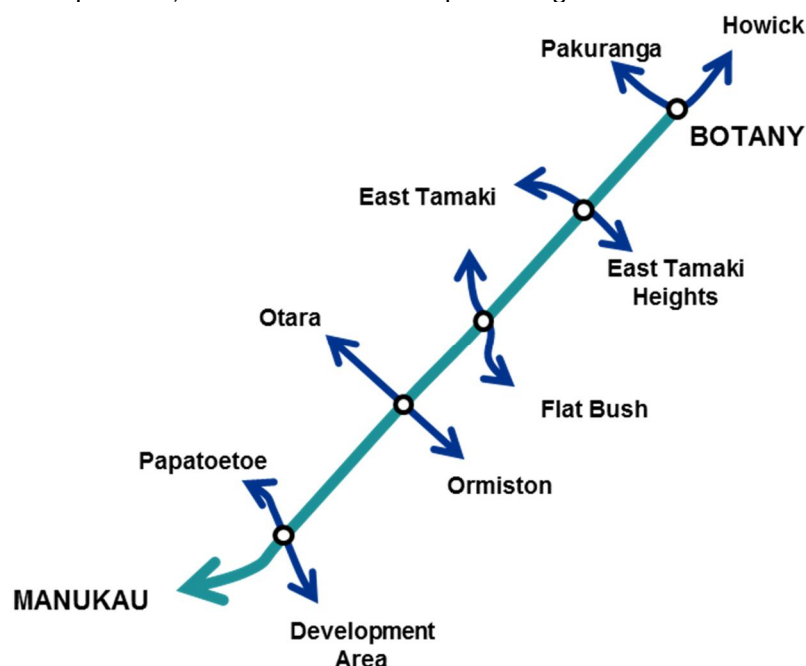


Figure 10.1 Bus connections to local areas from LRT

10.1.3 Pedestrian access

The majority of demand for LRT is generated by local catchments that can be walked to from LRT stops. Therefore, it is important to maximise pedestrian access to LRT. This can be done by locating LRT stops on key cross streets with good connectivity to residential areas.

Walking can also be encouraged through improving local pedestrian environment by:

- Activating the frontage of adjacent land use;
- Removing car parking forming a barrier for pedestrians;
- Installing pedestrian refuges at key crossing points on nearby arterial and sub arterial roads;
- Improving quality of footpaths on roads connecting to LRT stops; and,
- Creating pedestrian laneways where street system is very circuitous to reach LRT stop.



10.1.4 Cycle access

The LRT project provides an opportunity to improve cycle access. Maximising cycle access can also have a positive effect on the demand for LRT as it increases the catchment at each stop.

Cycle access to LRT can be maximised by:

- Including cycle lockers or racks at each stop;
- Permit cycles on LRVs in along the LRT route; and,
- Construct protected cycle lanes in streets that have cross section altered to add LRT.



10.1.5 Staging

The staging and timing of an LRT RTN needs to be further considered. Specifically:

- Potential benefits or disadvantages of building the LRT RTN in sections;
- Options for using other modes for sections of the route in the interim; and
- Depot requirements if the AMB LRT line is implemented prior to the SMART LRT project.

Appendix A. Workshop 1 - Project Kick-off minutes

Carlaw Park
12-16 Nicholls Lane, Parnell
Auckland 1010
PO Box 9806, Newmarket
1149 Auckland
New Zealand
T +64 9 928 5500

Subject	Kickoff Workshop		
Project	A to B Pre Scoping	Project No.	IZ058400
Prepared by	Sam Corbett	Phone No.	9285752
Location	AMP Building, Level 18	Date/Time	30 March 2016
Participants	Daniel Newcombe, Manager City Centre & RTN Initiatives - Auckland Transport Theunis Van Schalkwyk, Project Director Key Strategic Initiatives - Auckland Transport Renata Smit, Principal Transport Planner - Auckland Transport Steve Wrenn, Senior Planner (Network & Land Use Integration) - Auckland Transport Anthony Cross, Network Manager - Auckland Transport Evan Keating, Senior Transport Planning - Auckland Transport Liam Winter, Transport Planner - Auckland Transport Nick Renton, Assistant Transport Planner - Auckland Transport Dan Richter, Rail Engineer - Jacobs Stephanie Kane, Planner - Jacobs Sam Corbett, Principal Transport Planner – Jacobs		
Apologies	Don Munro, Manager Strategic Policy Integration - Auckland Transport Christina Robertson, Transport Land Use Integration Plans Leader – Auckland Transport Jeremy Hosking, Project Manager - Jacobs Karyn Sinclair, Principal Planner - Jacobs		

Notes		Action
1	Scope of work is to do some pre-scoping of the Airport to Botany (A to B) RTN corridor. This will result in the following key deliverables: <ul style="list-style-type: none"> • Drawings illustrating potential alignment of the LRT A to B line • Brief memo summarising the assessment, assumptions and standards used to develop the drawings 	
2	There are three main drivers for completing this project: <ul style="list-style-type: none"> • SH20B IBC – this will be led by NZTA and is scheduled to kick-off in April/May – AT will use this piece of work to inform their requirements for the 20B IBC • Transform Manukau – led by Panuku, this investment will significantly increase the density of Manukau especially from a residential perspective • Botany development plans – also important but probably less pressing as compared to the two 	

Notes	Action
<p>other drivers</p>	
<p>3 Key issues emerging from workshop are as follows:</p> <ul style="list-style-type: none"> • Puhinui Gateway Plan Change 35 is on hold as the entire area will be live zoned as industrial through the Unitary Plan process • Designation exists along Puhinui Rd (southside) and it was suggested that all designations be shown on future maps • Depot will be needed for LRT and the Puhinui Gateway Area could be a good location for the depot • Residential development east of the airport is limited by the noise contours from the Auckland Airport which extend as far east as SH1 • Airport to Manukau segment was noted as most import segment of the A to B RTN and would likely be staged before the Manukau to Botany segment 	<p>Jacobs to add designations to maps</p>
<p>4 LRT alignment discussions resulted in the following outcomes:</p> <ul style="list-style-type: none"> • LRT to follow SH20B/Puhinui Rd between the airport and SH20 on south side of road • LRT connection to Puhinui Station is a 'must have' to provide LRT-heavy rail transfer opportunities (future Wiri Station could be an alternative to Puhinui Station) • Should explore potential alignment opportunity along SH20 although this would miss Puhinui Station and would require a station connection at future Wiri Station • Manukau bus station – this is also considered a critical connection and LRT alignment should go as close as possible to the bus station • A number of alignment options were discussed in Manukau city centre and it was suggested that the alignment be resolved once more information is known on Panuku's plans • Te Irirangi Dr is considered the preferred alignment for LRT between Botany and Boundary Rd • East Tamaki Dr/Ormiston Rd will have frequent bus service so a station should be provided near Te Irirangi Dr and Ormiston Rd • Two separate alignments should be explored south of Boundary Rd – one following Hollywood Dr and Redoubt Rd and the other following Te Irirangi Dr to SH20 • A third potential alignment was also discussed 	<p>Jacobs to investigate</p> <p>LW to share additional information on Panuku's development plans for Manukau</p>

Notes	Action
<p>of going through the residential area bounded by Te Irirangi Dr, SH20, Redoubt Rd and Hollywood Dr. This would require acquisition of many houses, but it was thought that there is a high percentage of Housing NZ houses in this area</p> <ul style="list-style-type: none">• Centre running was noted as preferred alignment option for LRT as it's less disruptive on general traffic and on adjacent property/side roads/etc. Compelling case must exist to operate LRT on either side of road.	Jacobs assess % of Housing NZ stock in this neighbourhood

Appendix B. Workshop 2 - LRT Concept Alignment minutes and materials

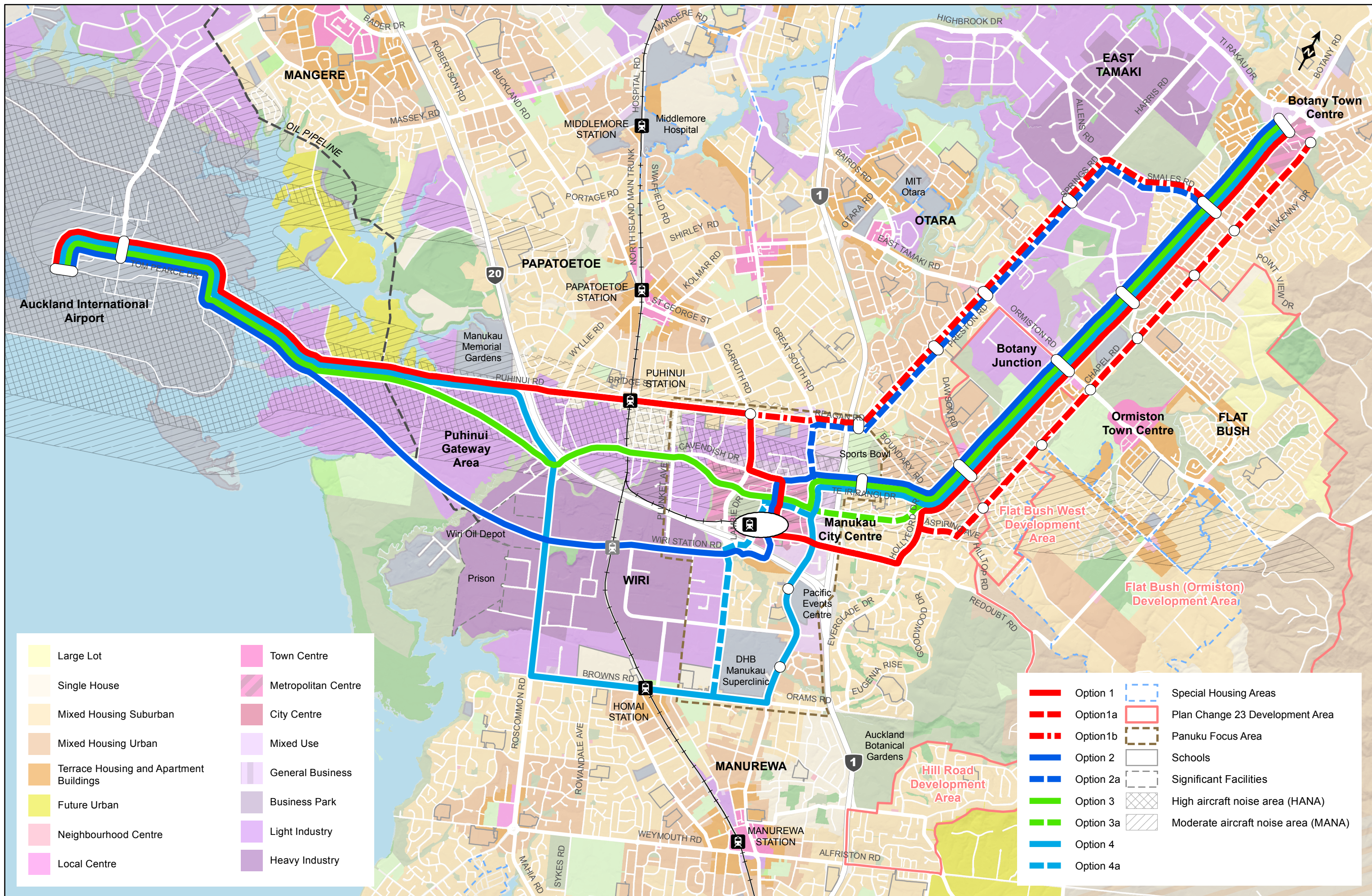
Carlaw Park
12-16 Nicholls Lane, Parnell
Auckland 1010
PO Box 9806, Newmarket
Auckland 1149
New Zealand
T +64 9 928 5500

Subject	Airport to Botany LRT concept alignment: MCA workshop		
Project	Airport to Botany LRT Concept Alignment	Project No.	IZ058400
Location	AMP Building, 29 Customs St West	Date/Time	10:30 am – 12:30pm 05 September 2016
Participants	<p>Theunis Van Schalkwyk, Project Director Key Strategic Initiatives - Auckland Transport</p> <p>Renata Smit, Principal Transport Planner - Auckland Transport</p> <p>Nick Renton, Assistant Transport Planner - Auckland Transport</p> <p>Jeremy Hosking, Project Manager - Jacobs</p> <p>Keith Hall, Principal Transport Planner - Jacobs</p> <p>Kerry King, Transport Engineer - Jacobs</p> <p>Richard Davison, Senior Project Planning Leader - Panuku Development Auckland</p> <p>Nik Vorster, Transport Economist - Auckland Transport</p> <p>Don Munro, Manager Strategic Policy Integration - Auckland Transport</p> <p>Richard Donaldson, Principal Rail Operations Advisor - Auckland Transport</p> <p>Gyles Bendall, Programme Leader Public Realm - Panuku Development Auckland</p> <p>Steve Wrenn, Senior Planner (Network & Land Use Integration) - Auckland Transport</p> <p>Anthony Cross, Network Manager - Auckland Transport</p> <p>Evan Keating, Senior Transport Planning - Auckland Transport</p>		
Apologies	<p>Daniel Newcombe, Manager City Centre & RTN Initiatives - Auckland Transport</p> <p>Liam Winter, Transport Planner - Auckland Transport</p> <p>Damian Flynn, Network Integration Manager - Auckland Transport</p>		

Notes	Action
<p>1 Proposed Unitary Plan zoning and land use – Airport to Puhinui Gateway zone</p> <ul style="list-style-type: none"> Potential issues regarding the Pukaki Creek Crossing (common to all alignments). 40m strip along SH20B is protected for a light rail/bus rapid transit alignment and widening of the corridor but must be designated by 2023. Live zoning areas may be more difficult than the protected corridor to gain consent. Airport is considering an off-site Park & Ride facility for staff/visitors (not for PT services), and providing a shuttle service to the Airport. 	<p>To be considered in the future Indicative Business Case.</p> <p>Needs to be understood further on in the process (IBC stage).</p>
<p>2 Road network</p> <ul style="list-style-type: none"> Consideration of whether LRT will drive land use change and to what degree. 	<p>Further analysis of change in land use potential and desired strategic function of main</p>

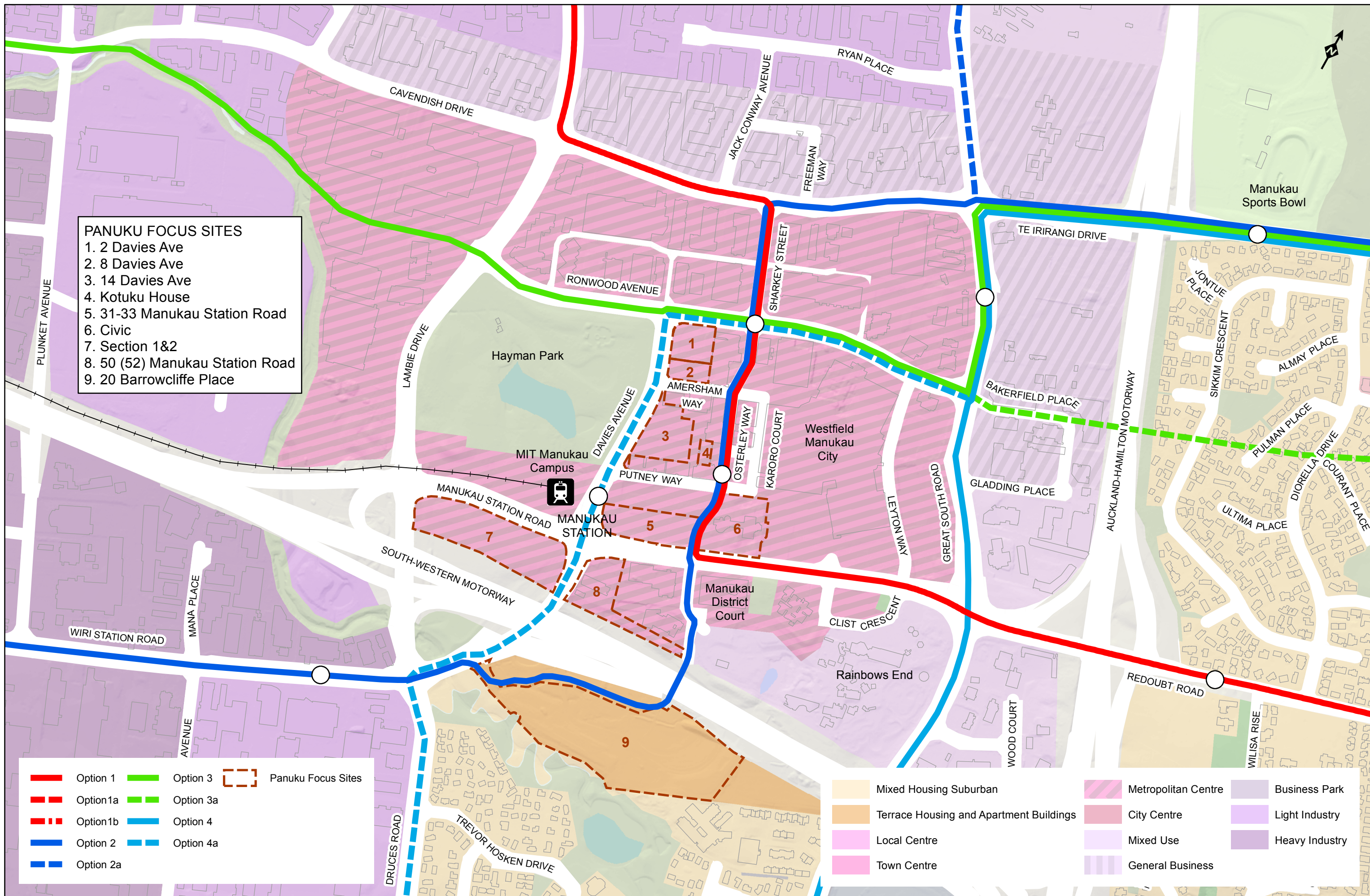
<ul style="list-style-type: none"> • Need to consider the trade-offs of running an LRT alignment along Te Irirangi Drive, Chapel Road or Preston and the impact LRT may have on road/street function. <ul style="list-style-type: none"> ○ Te Irirangi Drive – will it remain as an urban strategic corridor despite being future proofed for rapid transit? ○ With the implementation of LRT, which corridor will become the next strategic through route and will other corridors be able to accommodate this shift? ○ Chapel Road may be more responsive to land use change but would require more land take than Te Irirangi Drive and does not connect to Ormiston Town Centre. 	<p>corridors between Manukau and Botany Town Centre.</p>
<p>3 Light rail concept alignment options</p> <ul style="list-style-type: none"> • An optimised bus-based option needs to be developed as the 'Do Minimum' option for comparison purposes. • Agreed that the Airport to Botany alignment can be divided into 3 sections which serve different functions. The different sections can then be combined to form a 'hybrid' option: <ul style="list-style-type: none"> ○ Airport-Manukau; ○ Manukau City Centre (which will drive the section to Botany Town Centre); and ○ Manukau-Botany Town Centre. • Discussed the possibility of running alignments through Hayman Park - PDA was supportive of this. • Considered the possibility of replacing the Manukau heavy rail branch by a light rail alignment - issue of columns underneath the MIT building which limit the possibility for extending the alignment past Manukau Station. Light rail could run parallel to the existing heavy rail line but it was recommended not to replace a single-seat journey between Manukau and Britomart with a journey requiring passengers to interchange. • Manukau City Westfield shopping centre is planning to redevelop – land is leased from the Council and may be up for renegotiation. There are also further land use opportunities to the north of Ronwood Ave (owned by Wiri Licensing Trust). 	<p>Further analysis required for IBC stage.</p> <p>Re-evaluate hybrid options based on the function of the section in the IBC phase.</p> <p>Develop further alignment options.</p> <p>Technical note for MIT building and Manukau Station.</p> <p>Develop further alignment options through Manukau Metropolitan Centre.</p>
<p>4 Integration with heavy rail</p> <ul style="list-style-type: none"> • Connection with a northern station was generally preferred, provided that it was balanced with access for movements from the south. • Discussed the potential for moving the station or access to Puhinui combined with the removal of a southern station. Adding another station to the line is 	<p>Develop critical success factors to determine benefits of a northern/southern connection.</p> <p>Further feasibility study is required for technical details of network operations and stop</p>

	not desirable from an operations perspective.	locations given current turnouts.
	<ul style="list-style-type: none"> Potential development of the heavy rail line involves a 4-track railway line (side by side) alignment from Westfield to the Manukau branch to avoid crossings. There is no intention to grade separate. 	
5	Integration with the Manukau bus station	
	<ul style="list-style-type: none"> Consideration of moving the Manukau bus station or adding another bus station – possibility of having two bus interchanges (one for north access and one for south), and forming a bus ‘transit mall’. Effective integration between the two is critical. 20-30 year timeframe for this project - bus station capacity should not be an issue. 	Further optioneering required around the bus interchange and integration with LRT and heavy rail.
6	Freight	
	<ul style="list-style-type: none"> Current evaluation framework may place more emphasis on PT and not enough on freight – does not reflect ATAP’s views on the importance of freight movements. Assume that the Inland Port on Wiri Station Road will remain where it is for the next 30 years, but will move if the main Port moves. <ul style="list-style-type: none"> Do not preclude the strategic assumptions of moving the Inland Port. 	



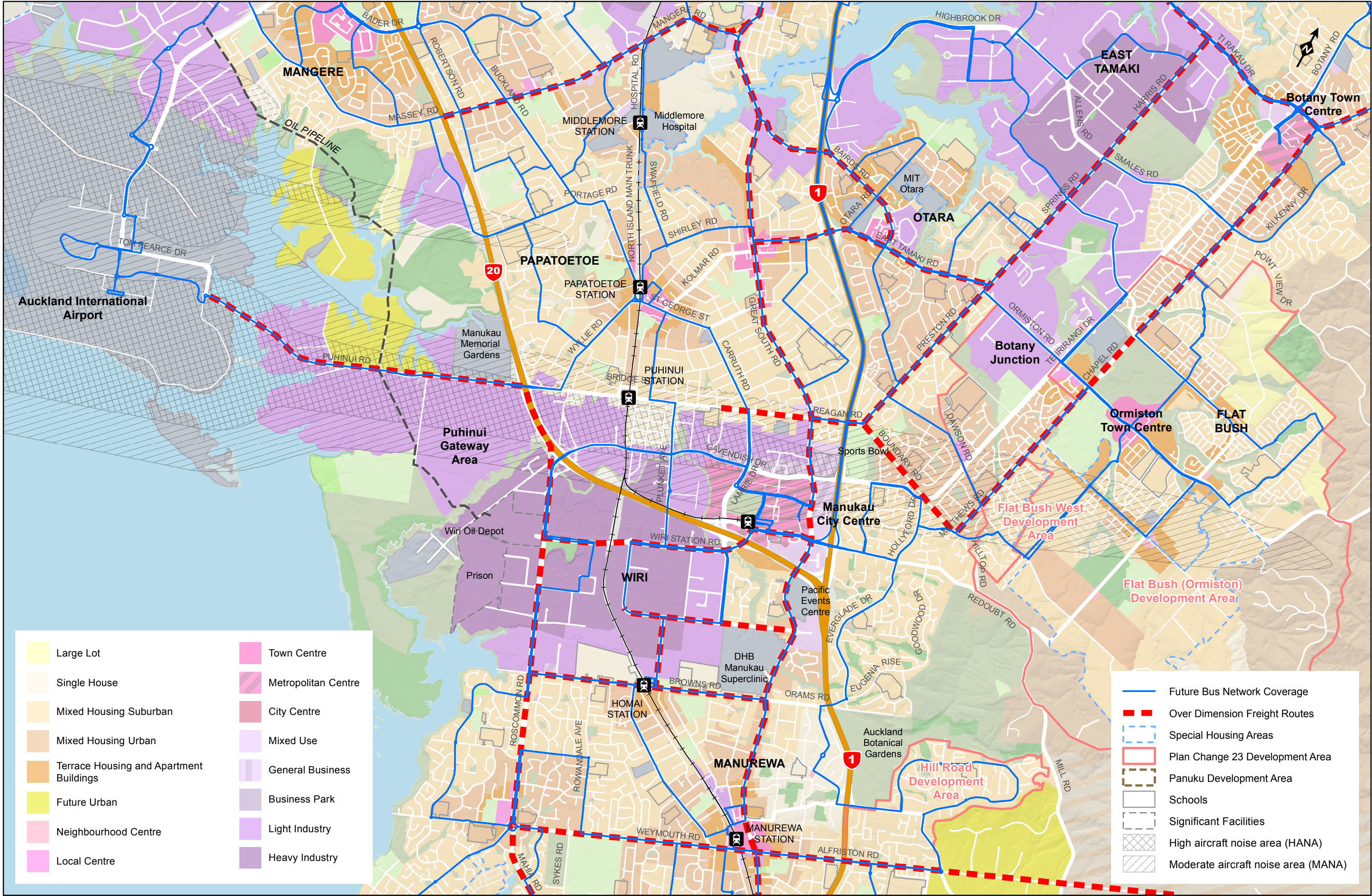
LANDUSE MAP - ALL OPTIONS

DRAFT FOR CONSIDERATION



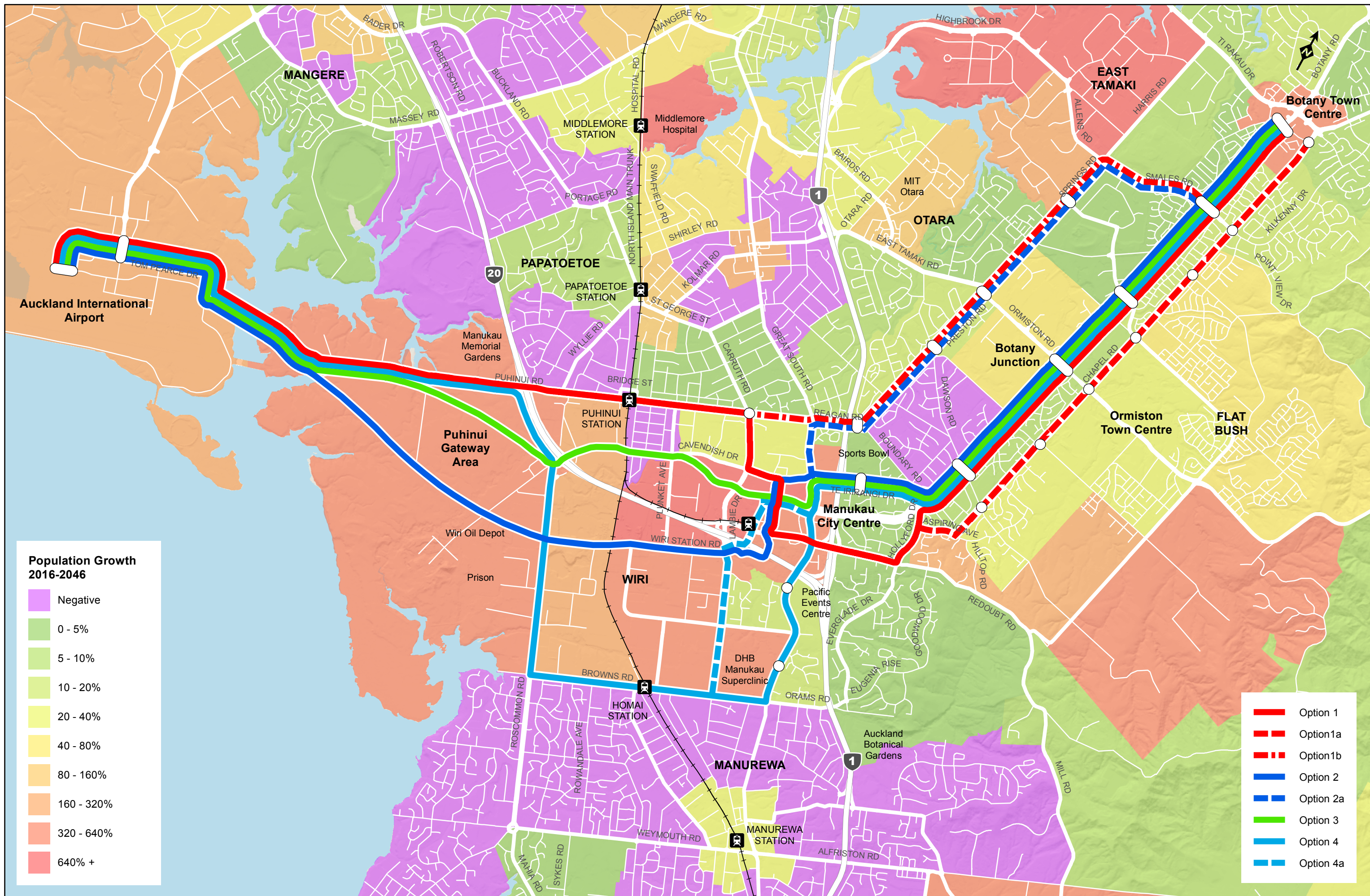
LANDUSE MAP - ALL OPTIONS (MANUKAU CITY CENTRE)

DRAFT FOR CONSIDERATION



TRANSPORT OVERVIEW

DRAFT FOR CONSIDERATION



Population Growth 2016 - 2046

DRAFT FOR CONSIDERATION

Appendix C. Workshop 3 – Minutes

Carlaw Park
12-16 Nicholls Lane, Parnell
Auckland 1010
PO Box 9806, Newmarket
Auckland 1149
New Zealand
T +64 9 928 5500

Subject	Airport to Botany LRT Concept Alignment: Workshop 3		
Project	Airport to Botany LRT Concept Alignment	Project No.	IZ058400
Location	AMP Building, 29 Customs St West	Date/Time	09:30 am – 12:30pm 08 February 2017
Participants	Renata Smit, Principal Transport Planner - Auckland Transport Jeremy Hosking, Project Manager - Jacobs Scott Elaurant, Principal Transport Planner - Jacobs Lauren Stuckey, Transport Engineer - Jacobs Richard Donaldson, Principal Rail Operations Advisor - Auckland Transport Gyles Bendall, Programme Leader Public Realm - Panuku Development Auckland Steve Wrenn, Senior Planner (Network & Land Use Integration) - Auckland Transport Liam Winter, Transport Planner - Auckland Transport Daniel Newcombe, Manager City Centre & RTN Initiatives - Auckland Transport Don Munro, Manager Strategic Policy Integration - Auckland Transport		
Apologies	Theunis Van Schalkwyk, Project Director Key Strategic Initiatives - Auckland Transport Nick Renton, Assistant Transport Planner - Auckland Transport Jennifer Estong, Transport Planner – Auckland Transport Richard Davison, Senior Project Planning Leader - Panuku Development Auckland Anthony Cross, Network Manager - Auckland Transport Evan Keating, Senior Transport Planning - Auckland Transport Nik Vorster, Transport Economist - Auckland Transport Damian Flynn, Network Integration Manager - Auckland Transport Ida Dowling, Senior Transport Consultant – Commute Transportation		

Notes	Action
1 Value capture - request from AT to consider value capture and potential to capture property uplift to finance project as part of option evaluation, not just potential for redevelopment of each option	Specific value capture considerations to be addressed in the IBC phase.
2 Airport to Puhinui <ul style="list-style-type: none"> Western alignment from AIAL to Puhinui agreed Consultation with NZTA on the use of the SH20B designation along Puhinui Road. NZTA talking about 4 laning. SH20 interchange <ul style="list-style-type: none"> Consultation required with NZTA to ensure that RTN corridor is coordinated with any upgrades. 	Set back agreed with land owner along SH20B corridor. IBC to determine how space is utilised through subsequent IBC process.

<ul style="list-style-type: none"> upgrades. - Consider the implications on traffic capacity. - Important to consider how active modes (walking/cycling) will be considered through the interchange. - Further investigation should include services that may need moving to accommodate n LRT track slab. - Between SH20 and Puhinui there are environmentally and historically significant sites (protected buildings and trees). - Interchanging at the Puhinui Train Station captures both the eastern (including Manukau) and southern heavy rail lines - Heavy Rail 4 tracking requires work at the Bridge Street bridge, so there could be potential have a combined LRT traffic solution over heavy rail to however due to the nature of Puhinui Road AT would like to maintain the dog-leg to avoid heavy traffic on Puhinui Road. Cavendish is the preferred East-West HCV route. - Puhinui Station <ul style="list-style-type: none"> - Concept agreed - Opportunity for development - HANA/MANA – detailed conditions regarding land use will need to be investigated/reviewed - Value capture potential here - Intent for 4 lane track HR here. Considered that ALRT can adequately span planned 4 tracking of HR. (End 1st decade, early 2nd decade ATAP) - Extent of works to be reviewed - Park 'n' Ride – short to medium term 	
<p>3 Botany to Manukau</p> <ul style="list-style-type: none"> - Further work comparing BRT and LRT. Need to consider staging and depot site <ul style="list-style-type: none"> - Noted whether BRT or LRT, not a differentiator for corridor section. - Strategy consideration if A-M-B implemented before SMART, would require a depot site. - Consider the traffic speed along the corridor. The speed does not affect the cost of the LRT if Te Irirangi is chosen. - Accepted Te Irirangi alignment as preferred because <ul style="list-style-type: none"> - Can serve Manukau City - Fastest travel time - Land use redevelopment potential around stations 	

<ul style="list-style-type: none"> - Lowest property impacts - Minimal traffic impact - Best potential for active transport facilities in corridor due to width - Potential for interchange with local feeder buses on crossing roads - Agreement that Preston is not a suitable option <ul style="list-style-type: none"> - rejected on width, unsuitable environment (industrial), misses Manukau City and slow travel time. - Recommended strong bus linkages across LRT servicing local connection to LRT. Project team to show schematically the network of N/S connections to improve patronage for E/W LRT. Show how Bus/LRT interchange layout could be configured schematically. 	
<p>4 Manukau City alignment</p> <p>LRT location</p> <ul style="list-style-type: none"> - The LRT stops need to be located close to the centroid of activity for pedestrian movements in the city centre. - Land use is the catalyst to regenerate Manukau. Need to coordinate LRT and land use. - In any scenario, between Lambie and Great South Road there is likely to only be one LRT stop. This stop location needs to be within line of sight of activity centre and interchanges with bus. <p>Bus Station</p> <ul style="list-style-type: none"> - Public perception if LRT does not connect with Bus+HR. AT, AT Metro and Panuku need to work together on PR if LRT does not physically connect to Manukau Bus Station <p>KiwiRail Corridor</p> <ul style="list-style-type: none"> - Alignments along the KiwiRail corridor will need to allow for 4 tracking of heavy rail and therefore will likely require land acquisition. Faster travel times may be achieved along the rail as LRT is separate from traffic. - Alignment along KiwiRail corridor could allow for a North-South LRT stop at Puhinui Train Station. - KiwiRail consultation required. - Alignments close to Frucor site could be difficult due to equipment sensitive to vibration. <p>Land Use</p> <ul style="list-style-type: none"> - AMP SUPA CENTA site – AMP also owns Botany so may see the potential/advantages of a Manukau – Botany LRT connection. Currently in the master 	

planning stages for the site. Opportunity to look into LRT opportunities and likelihood of a stop within this site.

- Westfield – key is active frontage. Need to land on alignment to guide discussion. Auckland Council ownership of the site provides leverage for discussion as Westfield would like to purchase the site. Still do not want to discount an option where LRT runs through the Westfield site.
- Currently (within the next 10years) Panuku is focusing on the redeveloping the land that they control the most which is the sites that the “Council Family” owns along Manukau Station Road and Putney Way. These areas do not necessarily need the support of LRT to encourage regeneration.
- The Ronwood Avenue area will change over time. Consent applications for development have already been submitted and Panuku is aiming to move the current low density retail and allow for higher density commercial and residential development. LRT along Ronwood is likely in the longer term to help support development along Ronwood in an area that Panuku has less control over and will better serve the whole of the Manukau Centre. The programme for development of Ronwood is more likely to align with the possible future timing of LRT.

Several feasible route options

- Option 1 – Manukau Station Road – via KiwiRail or Plunket Avenue
- Option 2 – Ronwood Avenue via AMP site and KiwiRail or Plunket Avenue then Great South Road/Te Irirangi Drive
- Option 3 – Manukau Station Road and Putney Street then new alignment through Westfield site
 - This option may run along the KiwiRail corridor along Putney Way and through the southern side of Westfield (Countdown supermarket area). Would need to think about how the LRT would get to Putney as proposed Te Papa site is in between.

Conclusions on routes:

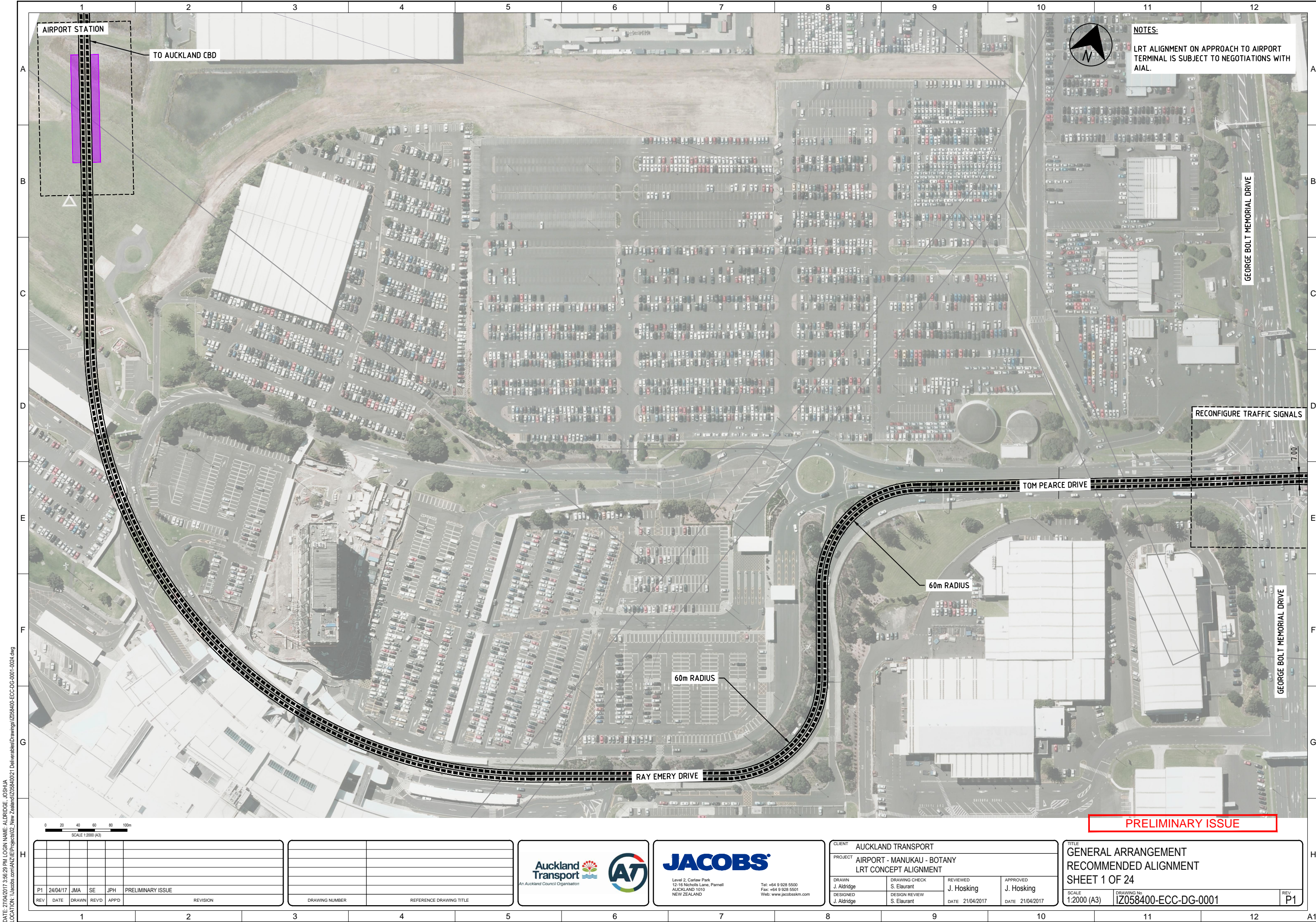
- No obvious advantage to options using Plunket Avenue alignment in preference to KiwiRail corridor
- Note some land cost likely with KiwiRail corridor as 4 tracks planned and LRT is likely to require extra land.
- Option 1 (Manukau Station Road) best option in short term (0-10 years) due to development potential with Panuku owned land adjacent
- Option 2 (Ronwood Avenue) best option in long term

(10+ years) due to greater area for redevelopment

- Option 3 could be attractive if corridor could be secured across Westfield Ste – they may redevelop

No obvious fatal flaws/engineering constraints to preclude any of three options

Appendix D. Recommended concept alignment drawings



AIRPORT STATION

TO AUCKLAND CBD

NOTES:
LRT ALIGNMENT ON APPROACH TO AIRPORT
TERMINAL IS SUBJECT TO NEGOTIATIONS WITH
AIAL.

GEORGE BOLT MEMORIAL DRIVE

RECONFIGURE TRAFFIC SIGNALS

TOM PEARCE DRIVE

60m RADIUS

60m RADIUS

RAY EMERY DRIVE

GEORGE BOLT MEMORIAL DRIVE

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE

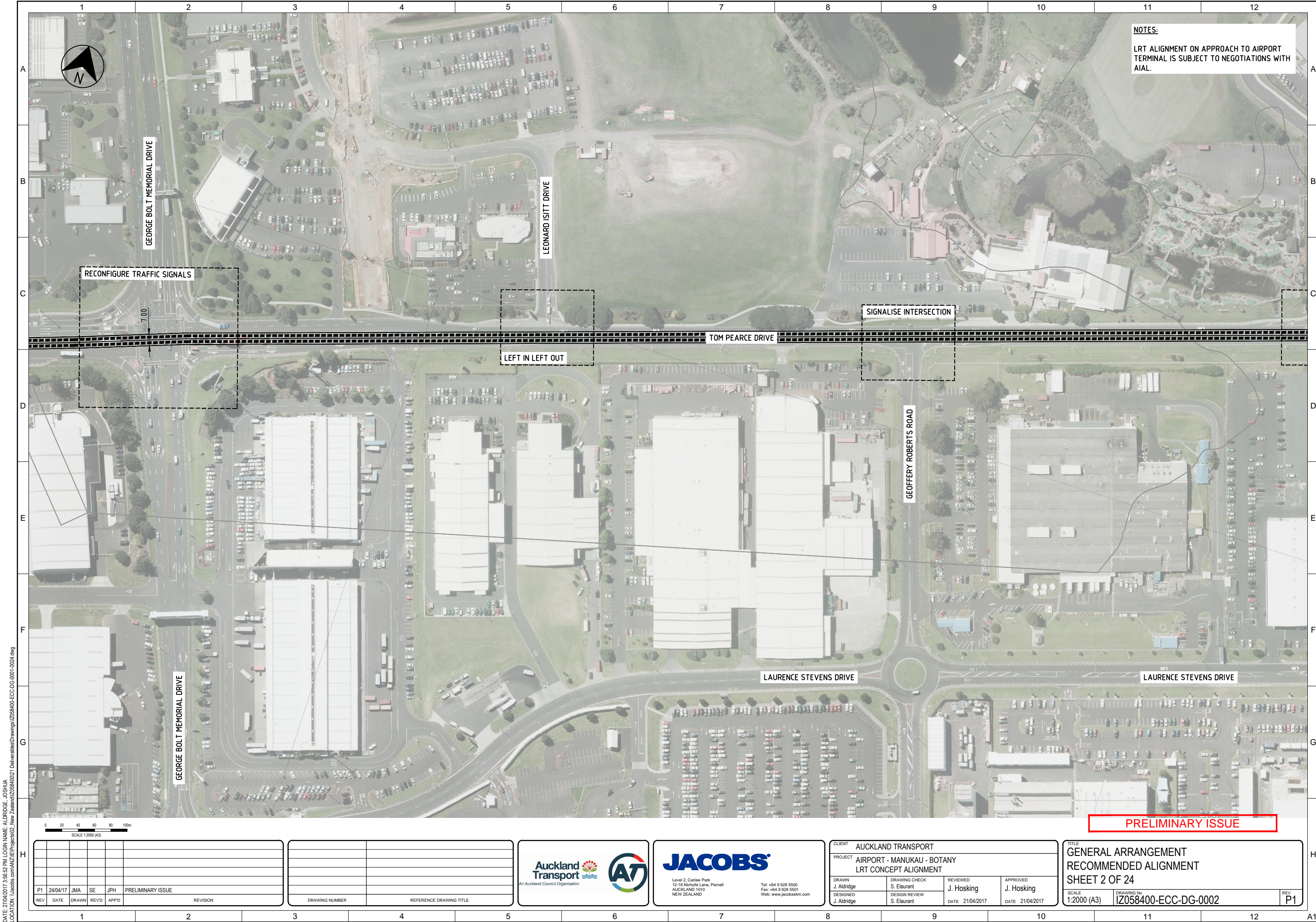
DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 1 OF 24	
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0001
REV P1	

DATE: 27/04/2017 3:56:29 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobss.com\ANZ\IE\Projects\02_NZ\Auckland\IZ058400-ECC-DG-0001-0024.dwg



NOTES:
LRT ALIGNMENT ON APPROACH TO AIRPORT
TERMINAL IS SUBJECT TO NEGOTIATIONS WITH
AIAL.

DATE: 27/04/2017 3:56:52 PM LOGIN NAME: ALDRIDGE, JOSHUA
LOCATION: \\jacobs.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-0001-0024.dwg

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE

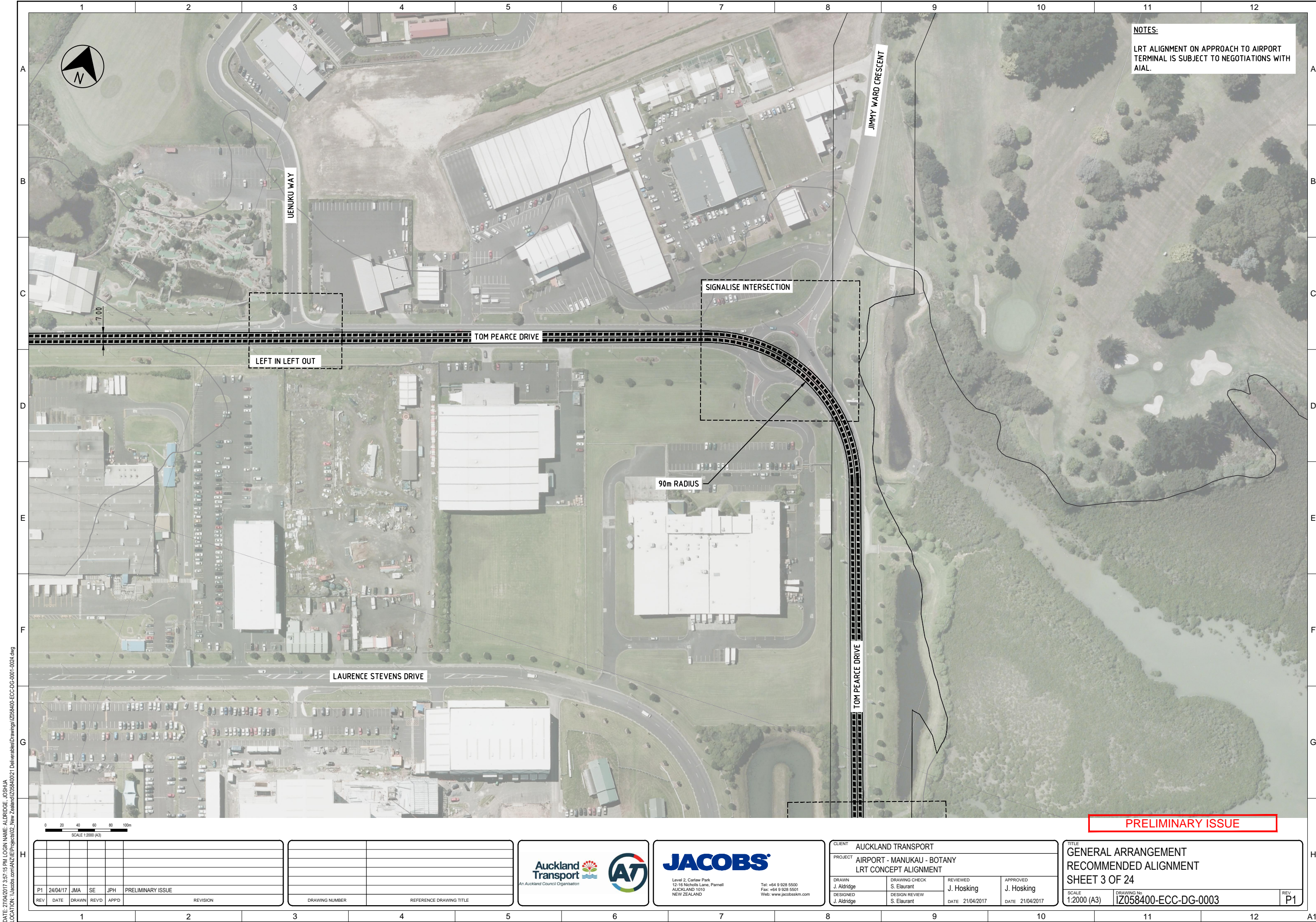


JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsnz.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 2 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0002	REV P1



NOTES:
LRT ALIGNMENT ON APPROACH TO AIRPORT
TERMINAL IS SUBJECT TO NEGOTIATIONS WITH
AIAL.

DATE: 27/04/2017 3:57:15 PM LOGIN NAME: ALDRIDGE, JOSHUA
LOCATION: \\aucts.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-001-0024.dwg

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE

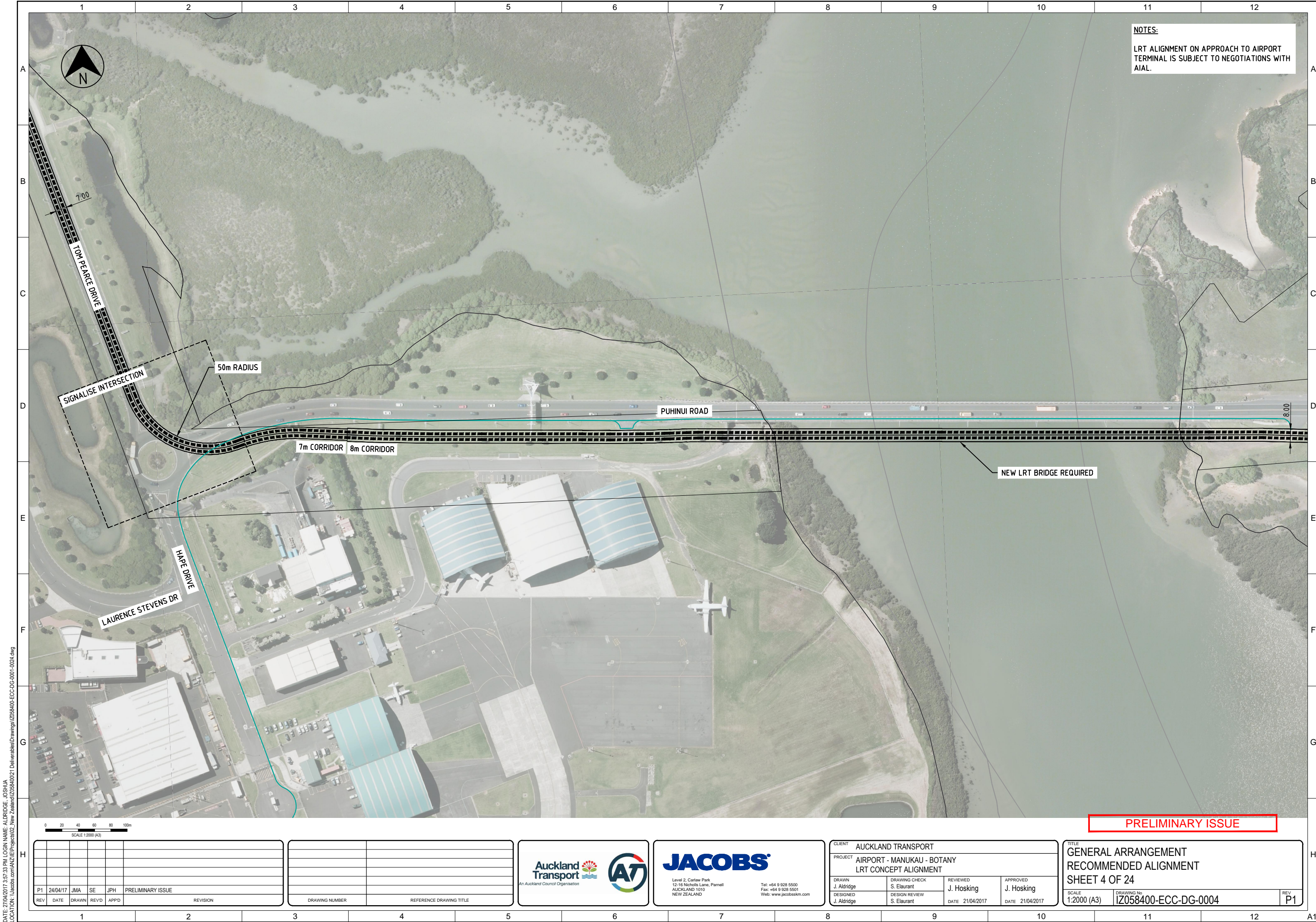


JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsgroup.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 3 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0003	REV P1

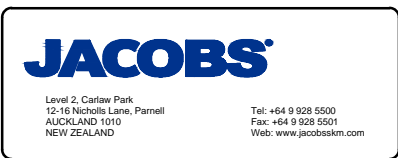


NOTES:
LRT ALIGNMENT ON APPROACH TO AIRPORT
TERMINAL IS SUBJECT TO NEGOTIATIONS WITH
AIAL.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

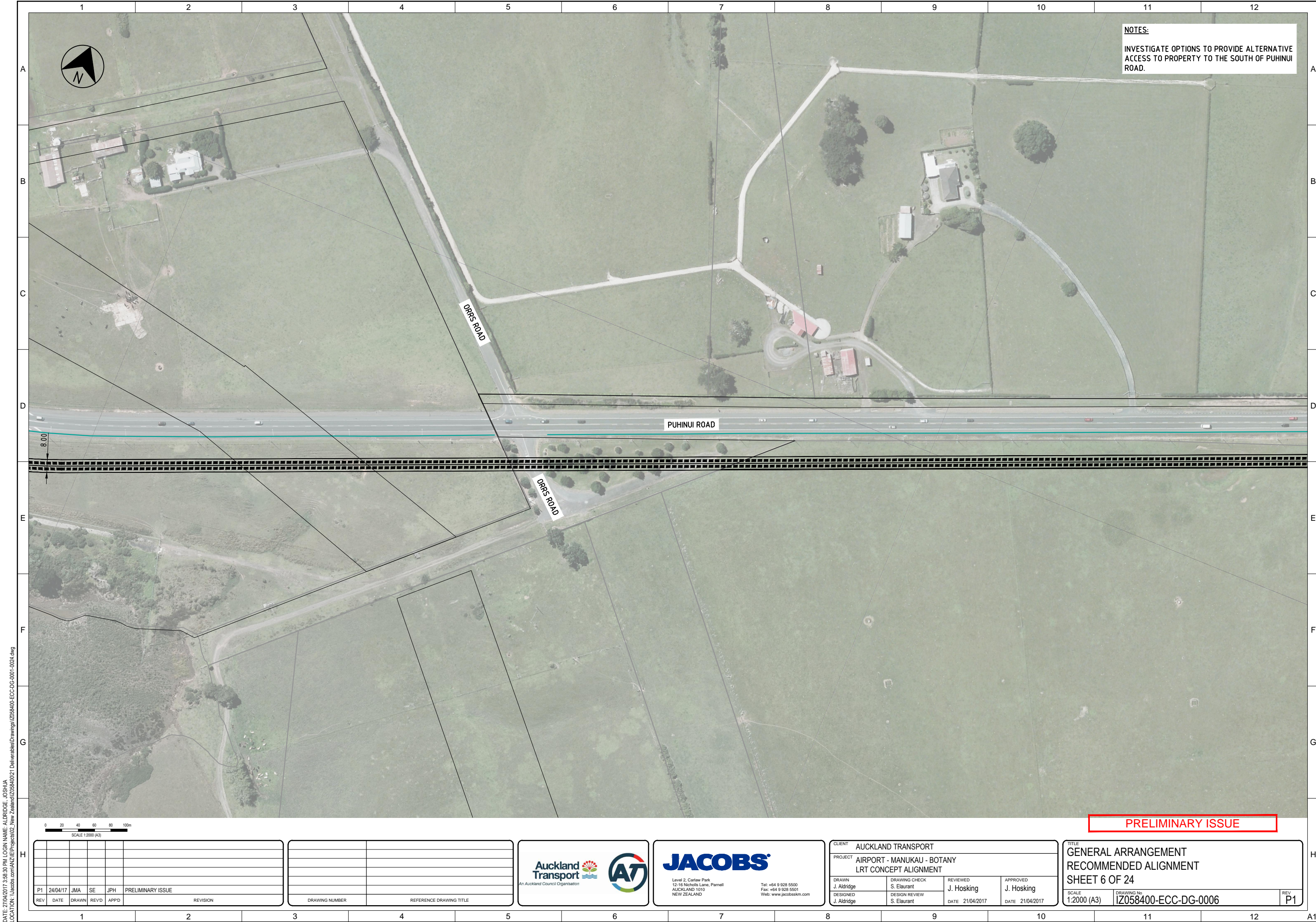
DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 4 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0004	REV P1

DATE: 27/04/2017 3:57:33 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\auctrans\projects\02 - New Zealand\IZ058400-ECC-DG-0004.dwg



PRELIMINARY ISSUE

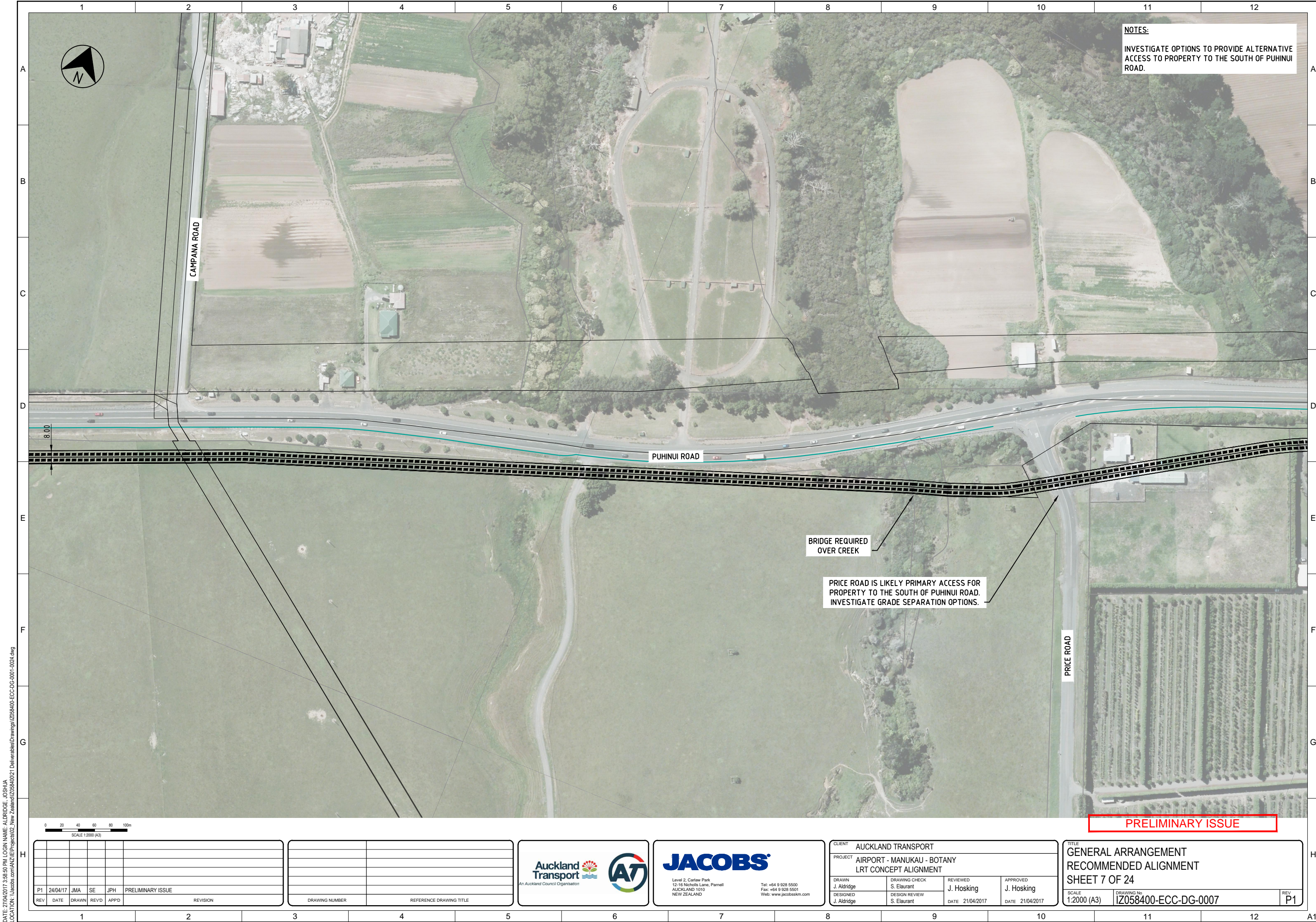
P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 6 OF 24			
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0006	REV P1	



NOTES:
INVESTIGATE OPTIONS TO PROVIDE ALTERNATIVE ACCESS TO PROPERTY TO THE SOUTH OF PUHINUI ROAD.

BRIDGE REQUIRED OVER CREEK

PRICE ROAD IS LIKELY PRIMARY ACCESS FOR PROPERTY TO THE SOUTH OF PUHINUI ROAD. INVESTIGATE GRADE SEPARATION OPTIONS.

PRICE ROAD

PRELIMINARY ISSUE

0 20 40 60 80 100m
SCALE 1:2000 (A3)

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

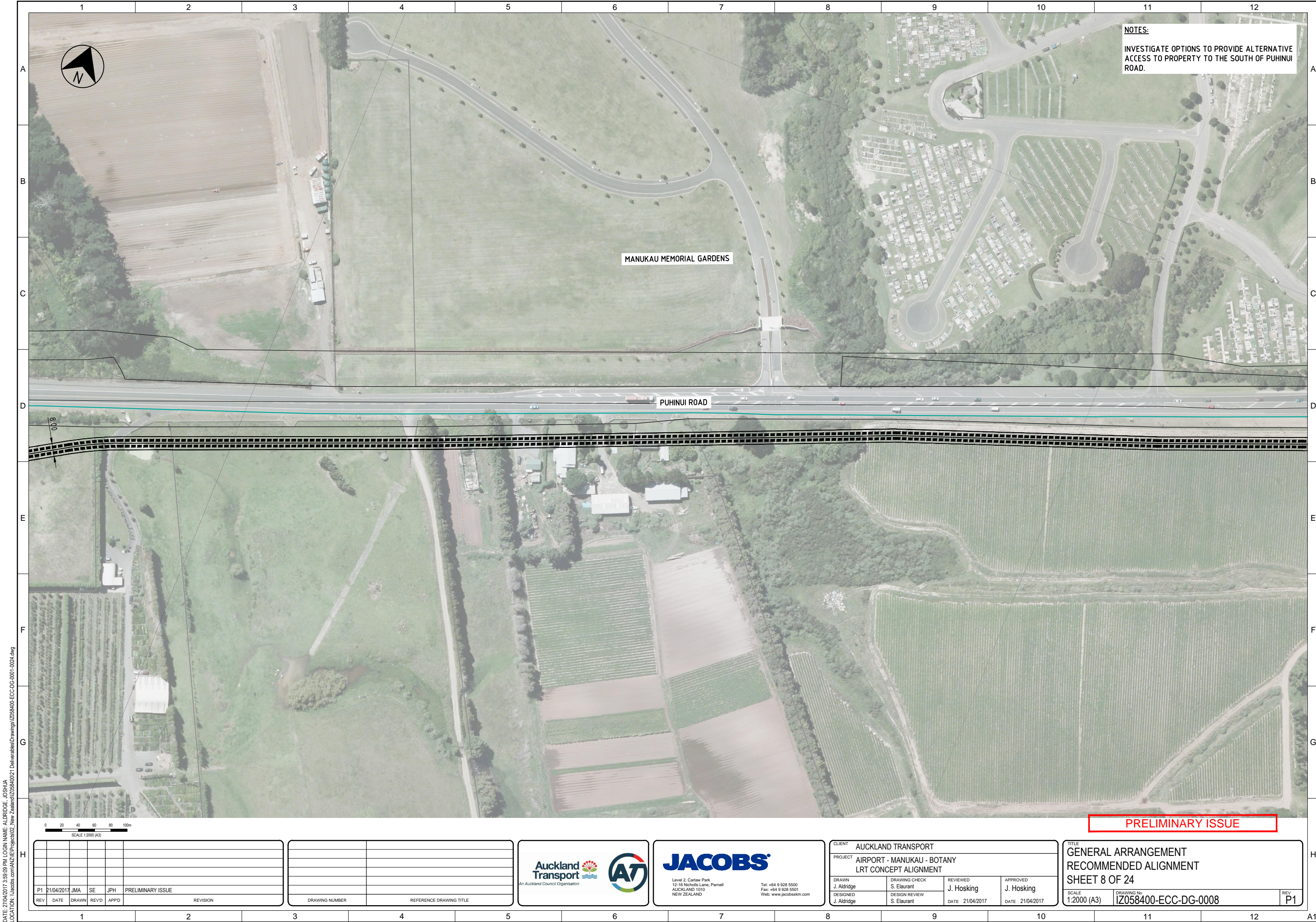
DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 7 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0007	REV P1

DATE: 27/04/2017 3:58:50 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobss.com\ANZ\IE\Projects\02_NZ\Auckland\058400\02_Deliverables\Drawings\IZ058400-ECC-DG-0001-0024.dwg



NOTES:
INVESTIGATE OPTIONS TO PROVIDE ALTERNATIVE
ACCESS TO PROPERTY TO THE SOUTH OF PUHINUI
ROAD.

MANUKAU MEMORIAL GARDENS

PUHINUI ROAD

PRELIMINARY ISSUE

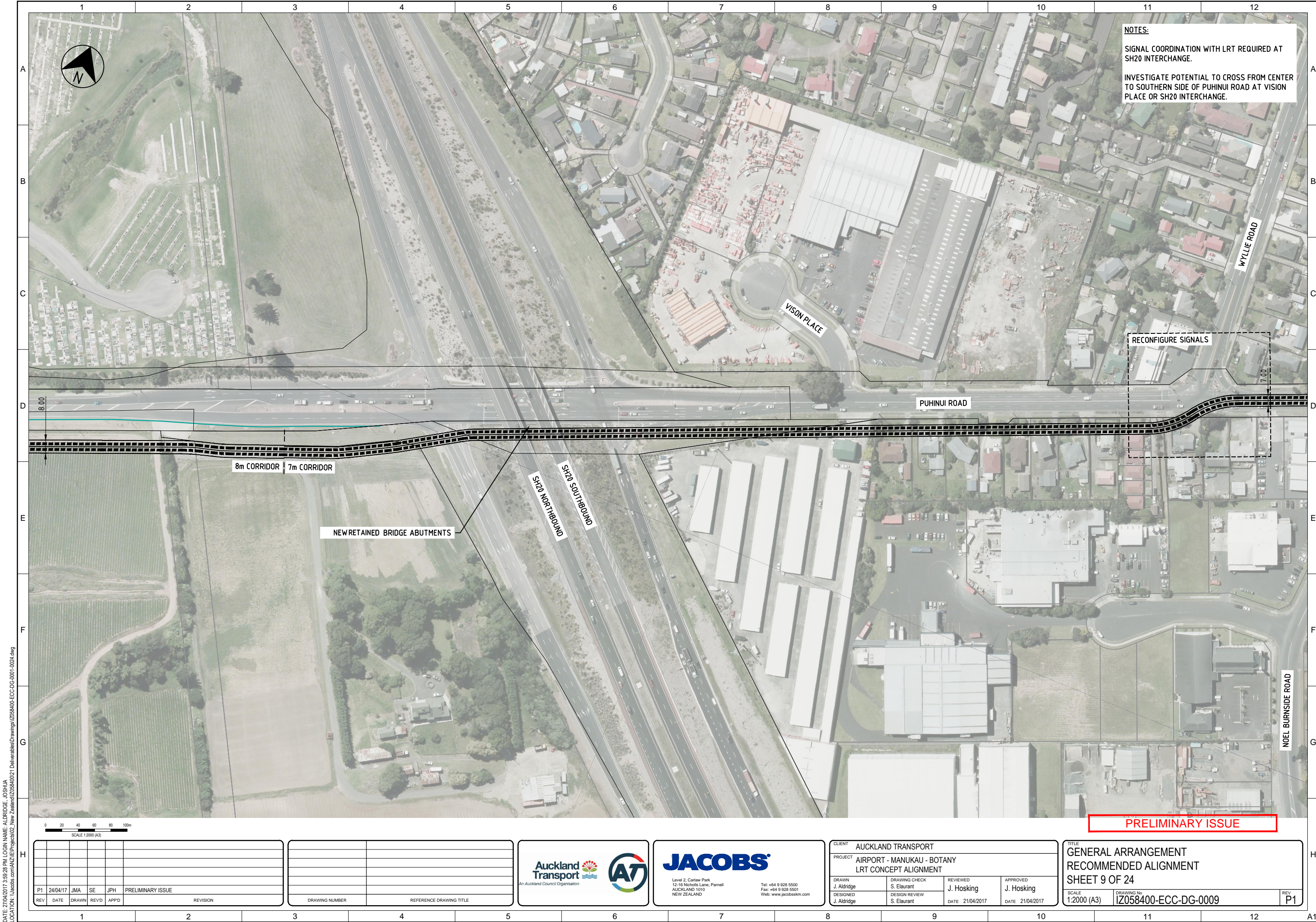
P1	21/04/2017	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REVD	APPD	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 8 OF 24			REV P1
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0008		



NOTES:

SIGNAL COORDINATION WITH LRT REQUIRED AT SH20 INTERCHANGE.

INVESTIGATE POTENTIAL TO CROSS FROM CENTER TO SOUTHERN SIDE OF PUHINUI ROAD AT VISION PLACE OR SH20 INTERCHANGE.

RECONFIGURE SIGNALS

8m CORRIDOR 7m CORRIDOR

NEW RETAINED BRIDGE ABUTMENTS

SH20 NORTHBOUND
SH20 SOUTHBOUND

PUHINUI ROAD

WYLLIE ROAD

NOEL BURNSIDE ROAD

PRELIMINARY ISSUE

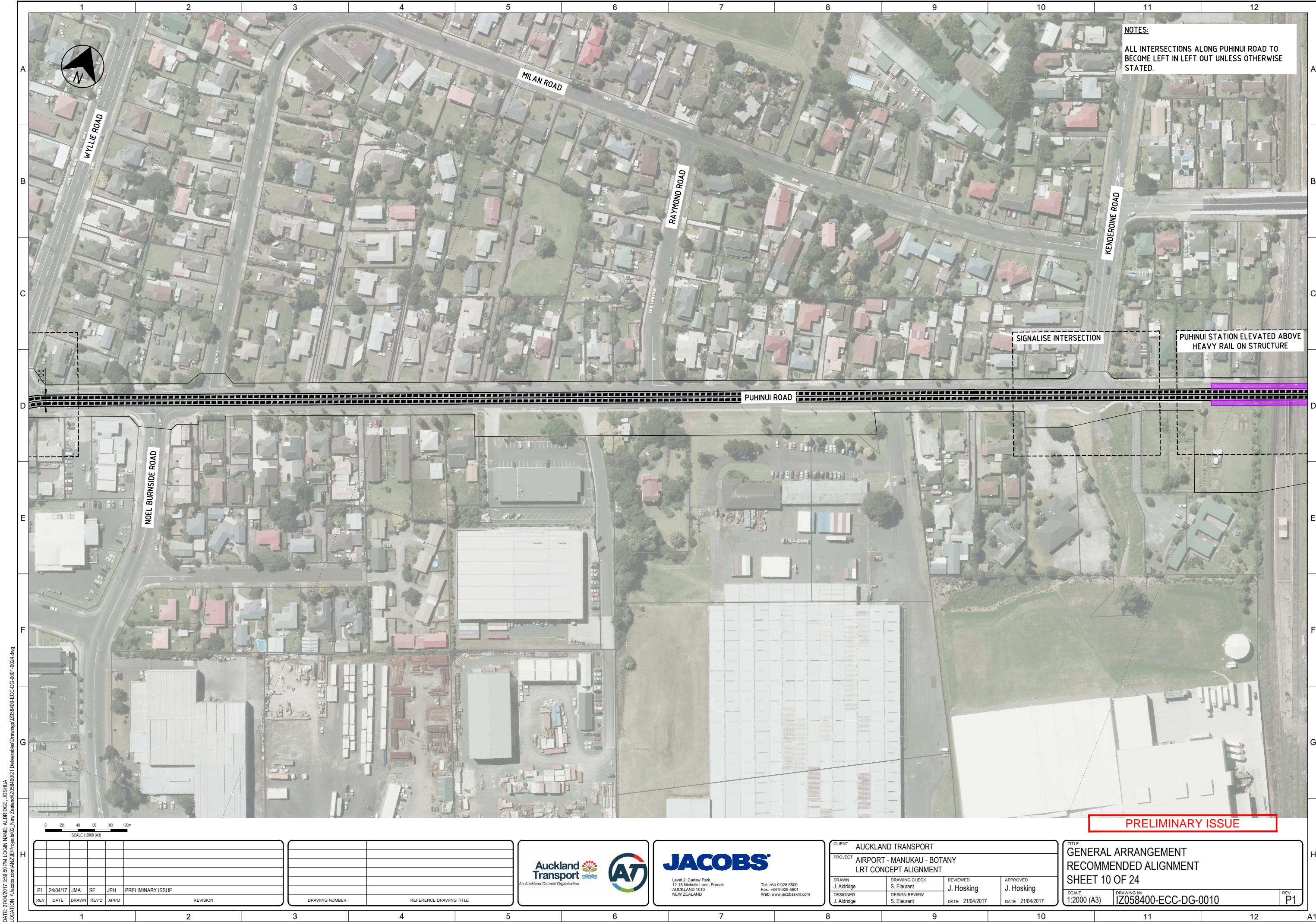
P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 9 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0009	REV P1



NOTES:
ALL INTERSECTIONS ALONG PUHINUI ROAD TO
BECOME LEFT IN LEFT OUT UNLESS OTHERWISE
STATED.

SIGNALISE INTERSECTION

PUHINUI STATION ELEVATED ABOVE
HEAVY RAIL ON STRUCTURE

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



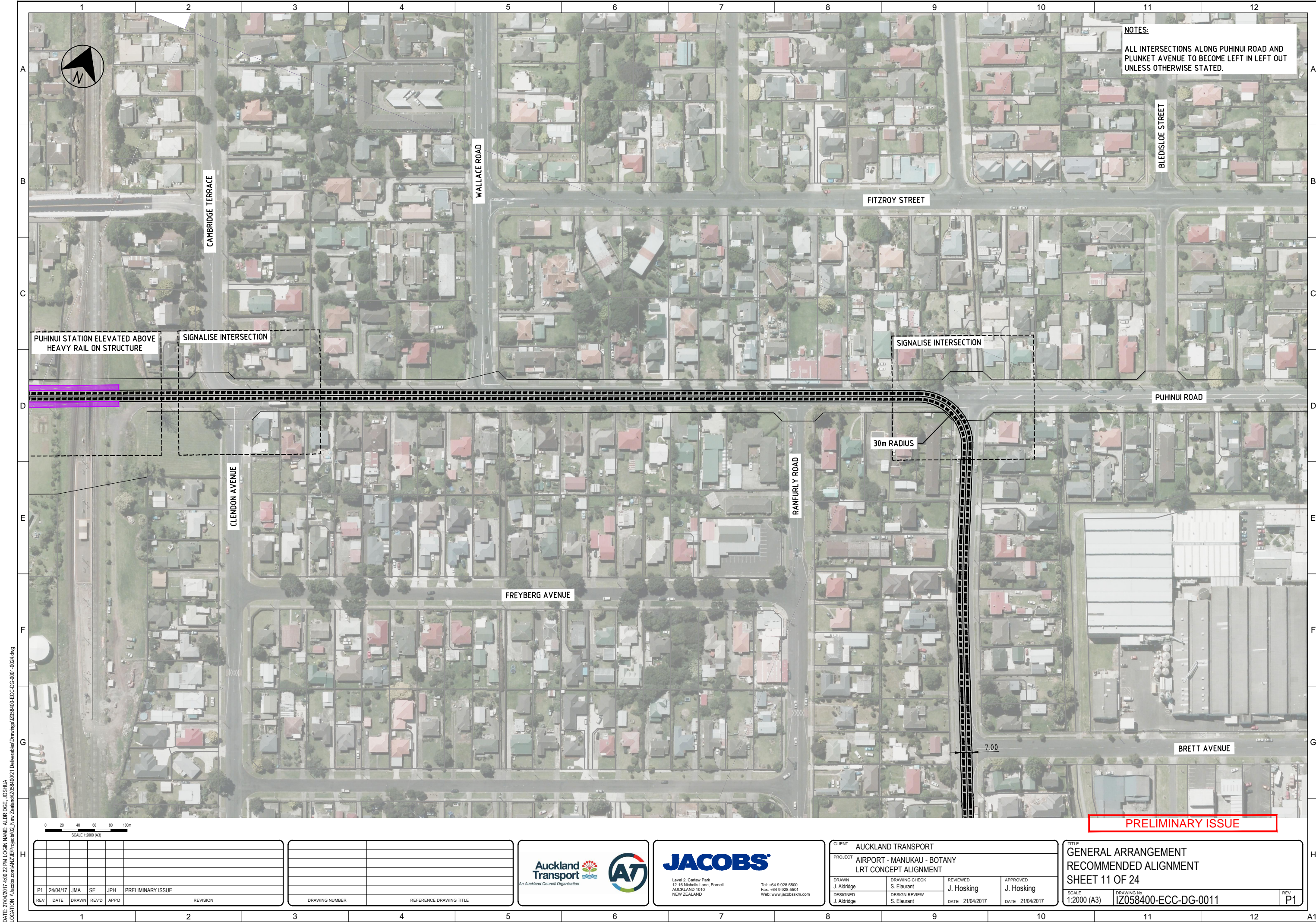
JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsgroup.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 10 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0010	REV P1

DATE: 27/04/2017 3:59:50 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobsgroup.com\ANZ\IE\Projects\102 New Zealand\IZ058400-ECC-DG-001-0024.dwg



NOTES:
ALL INTERSECTIONS ALONG PUHINUI ROAD AND
PLUNKET AVENUE TO BECOME LEFT IN LEFT OUT
UNLESS OTHERWISE STATED.

PUHINUI STATION ELEVATED ABOVE
HEAVY RAIL ON STRUCTURE

SIGNALISE INTERSECTION

SIGNALISE INTERSECTION

FITZROY STREET

PUHINUI ROAD

30m RADIUS

CLENDON AVENUE

RANFURLY ROAD

FREYBERG AVENUE

BRETT AVENUE

7.00

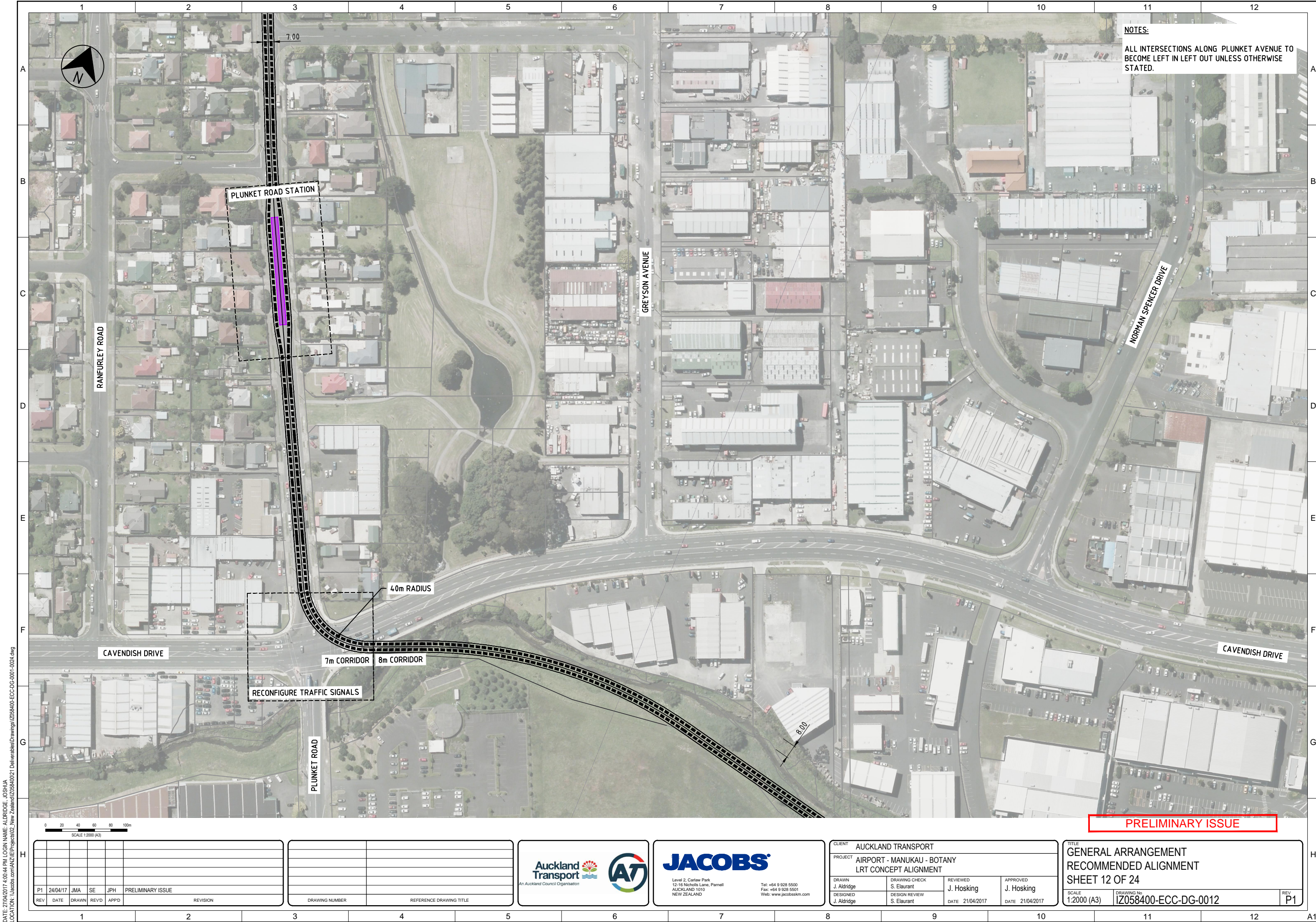
PRELIMINARY ISSUE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 11 OF 24			
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0011	REV P1	

DATE: 27/04/2017 4:00:22 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\aucts.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-001-0024.dwg



NOTES:
ALL INTERSECTIONS ALONG PLUNKET AVENUE TO
BECOME LEFT IN LEFT OUT UNLESS OTHERWISE
STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



JACOBS

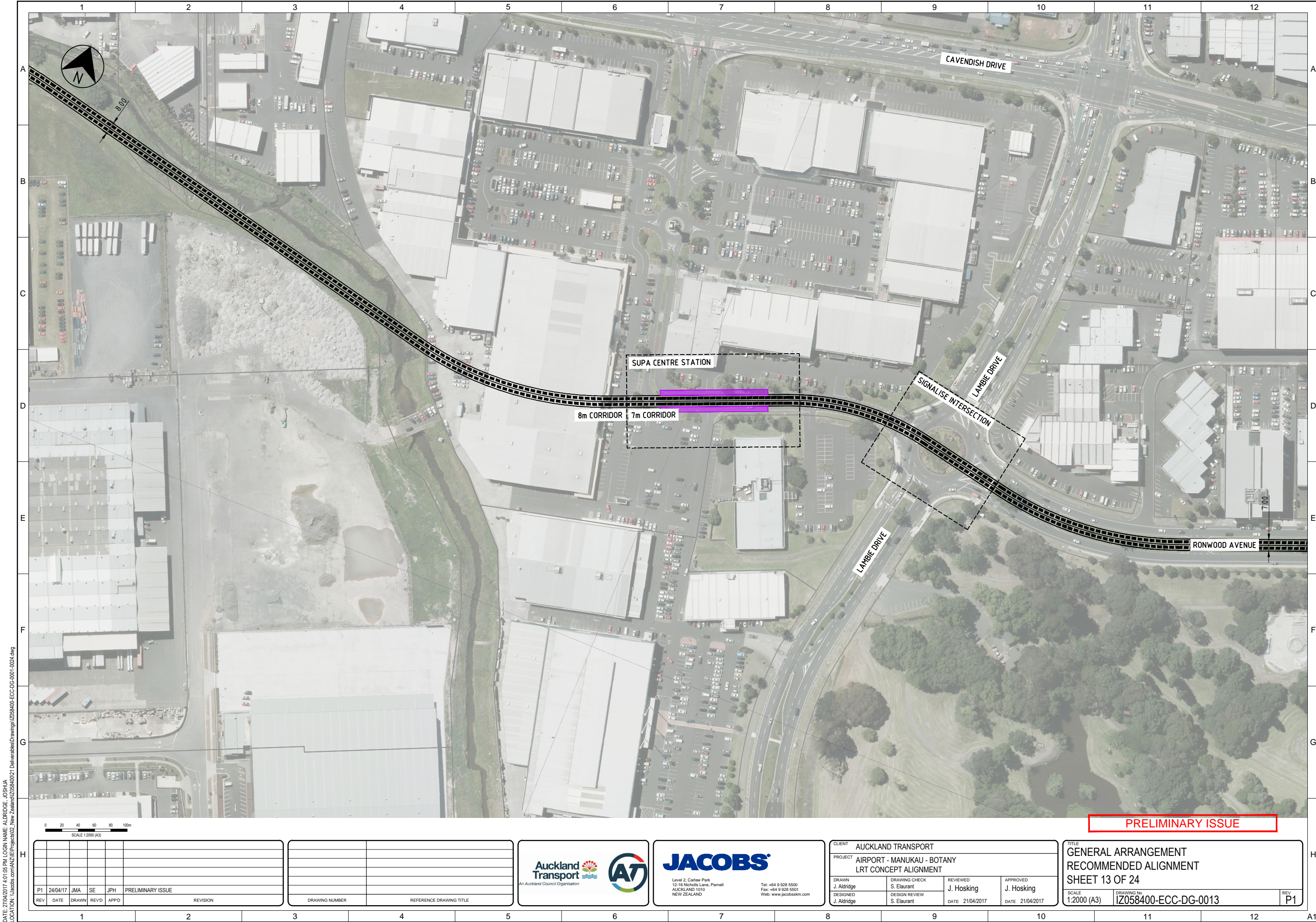
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsnz.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 12 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0012	REV P1

DATE: 27/04/2017 4:00:44 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobs.com\ANZ\IE\Projects\02_NZ\Auckland\IZ058400-ECC-DG-001-0024.dwg



PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE

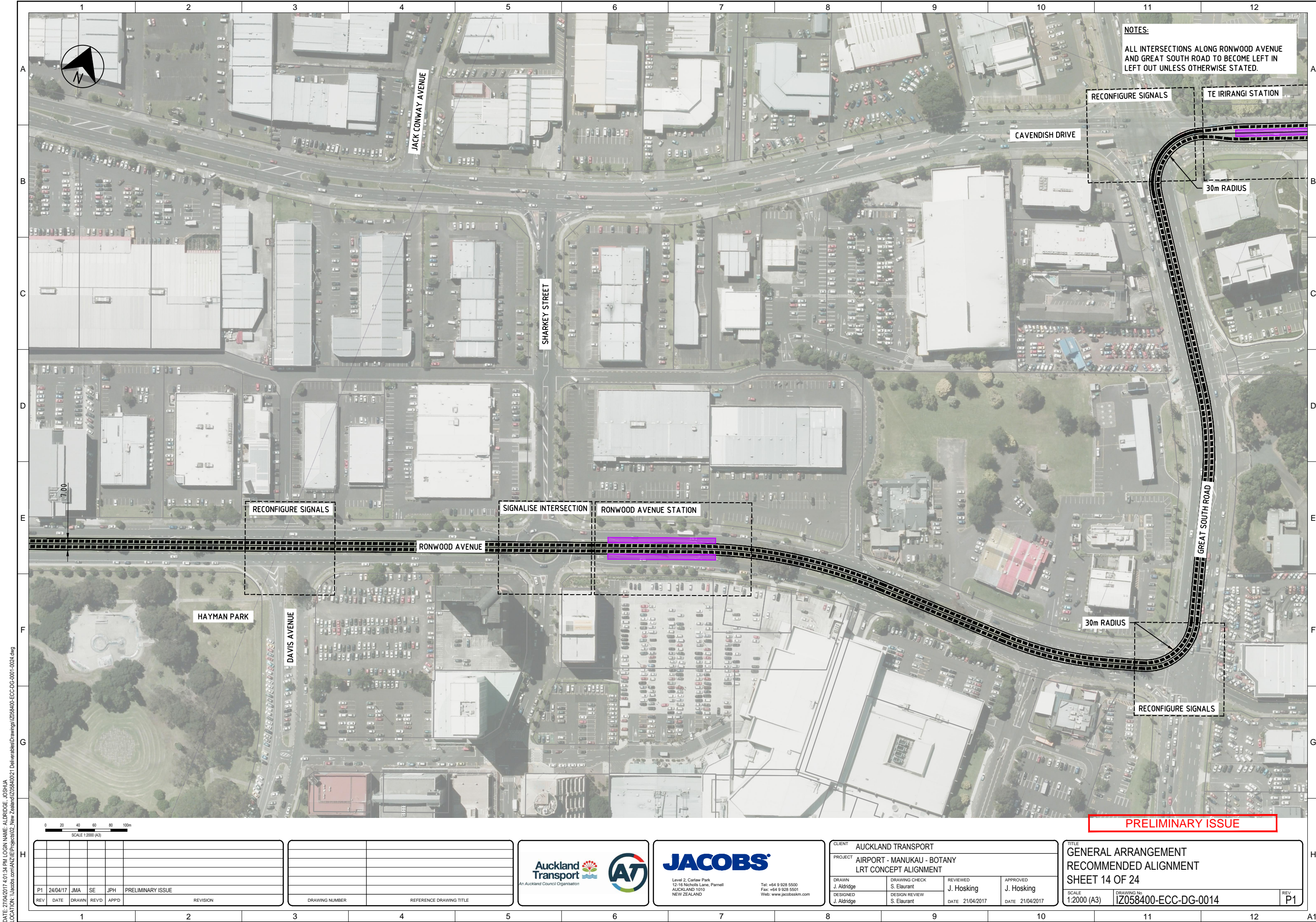


JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsgroup.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 13 OF 24			REV P1
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0013		



NOTES:
ALL INTERSECTIONS ALONG RONWOOD AVENUE
AND GREAT SOUTH ROAD TO BECOME LEFT IN
LEFT OUT UNLESS OTHERWISE STATED.

RECONFIGURE SIGNALS

TE IRIRANGI STATION

CAVENDISH DRIVE

30m RADIUS

SHARKEY STREET

RECONFIGURE SIGNALS

SIGNALISE INTERSECTION

RONWOOD AVENUE STATION

RONWOOD AVENUE

HAYMAN PARK

DAVIS AVENUE

30m RADIUS

RECONFIGURE SIGNALS

GREAT SOUTH ROAD

PRELIMINARY ISSUE

DATE: 27/04/2017 4:01:34 PM LOGIN NAME: ALDRIDGE, JOSHUA
LOCATION: \\jacobs.com\ANZ\IE\Projects\102\New Zealand\1058400-ECC-DG-001-0024.dwg



P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE

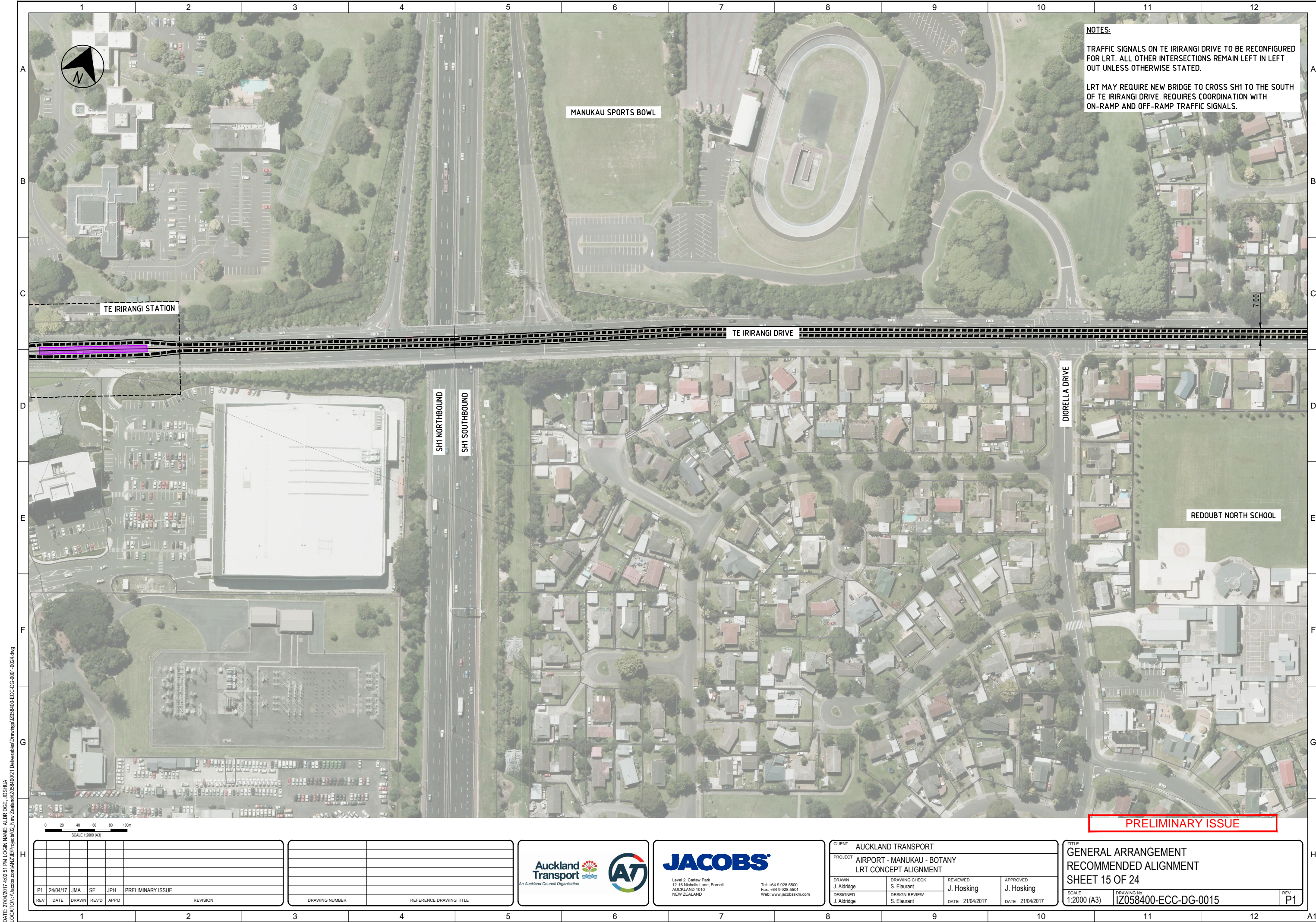


JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsnz.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 14 OF 24		
SCALE 1:2000 (A3)	DRAWING No I2058400-ECC-DG-0014	REV P1



NOTES:

TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

LRT MAY REQUIRE NEW BRIDGE TO CROSS SH1 TO THE SOUTH OF TE IRIRANGI DRIVE. REQUIRES COORDINATION WITH ON-RAMP AND OFF-RAMP TRAFFIC SIGNALS.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



JACOBS

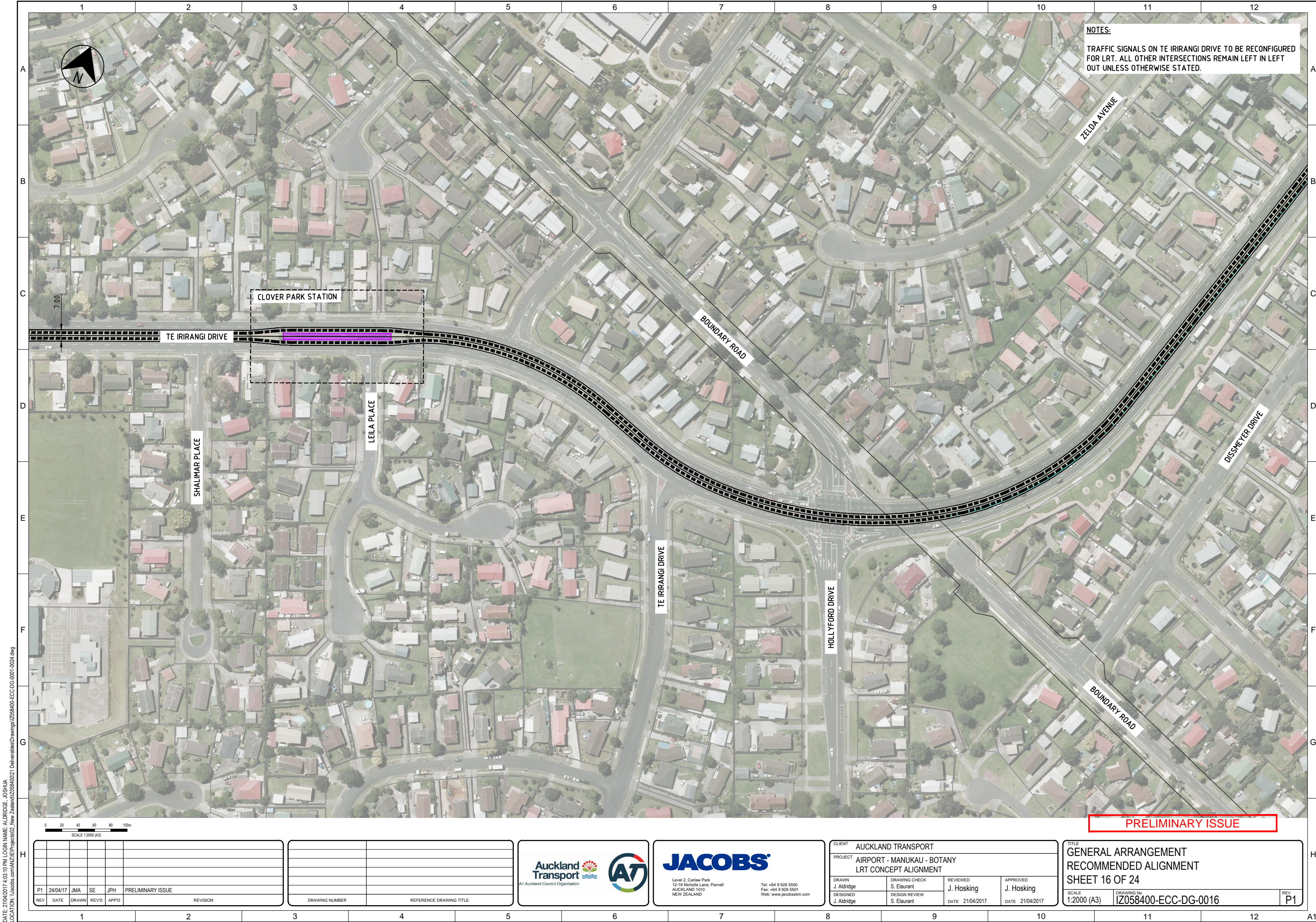
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobson.co.nz

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 15 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0015	REV P1

DATE: 27/04/2017 4:02:51 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobson.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-001-0024.dwg



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



JACOBS

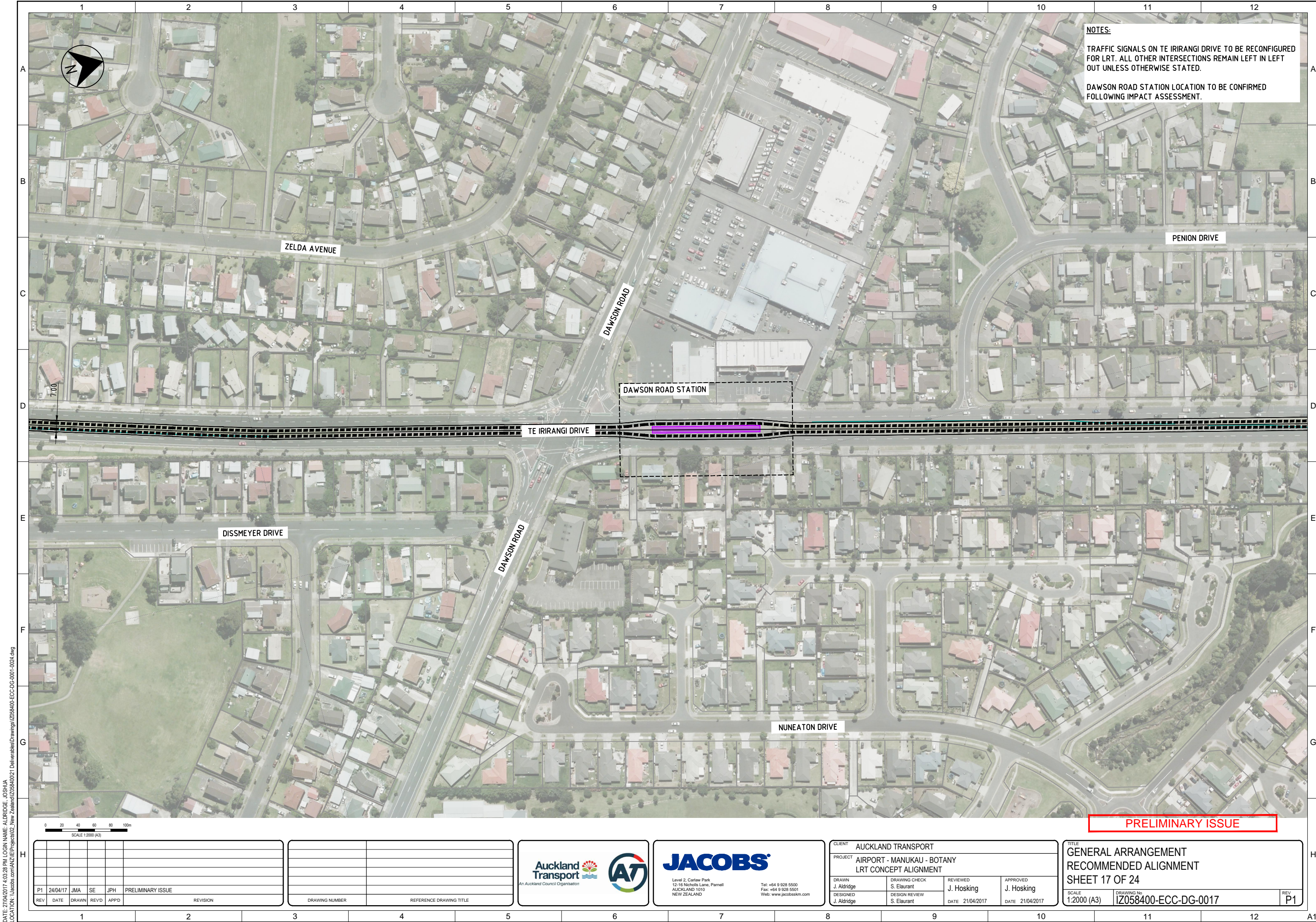
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobson.co.nz

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 16 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0016	REV P1

DATE: 27/04/2017 4:03:10 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: I:\projects\12058400\12058400-001-0024.dwg



NOTES:

TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

DAWSON ROAD STATION LOCATION TO BE CONFIRMED FOLLOWING IMPACT ASSESSMENT.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 17 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0017	REV P1

DATE: 27/04/2017 4:03:28 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\aotbs.com\ANZ\IE\Projects\02 - New Zealand\IZ058400-ECC-DG-001-0024.dwg



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



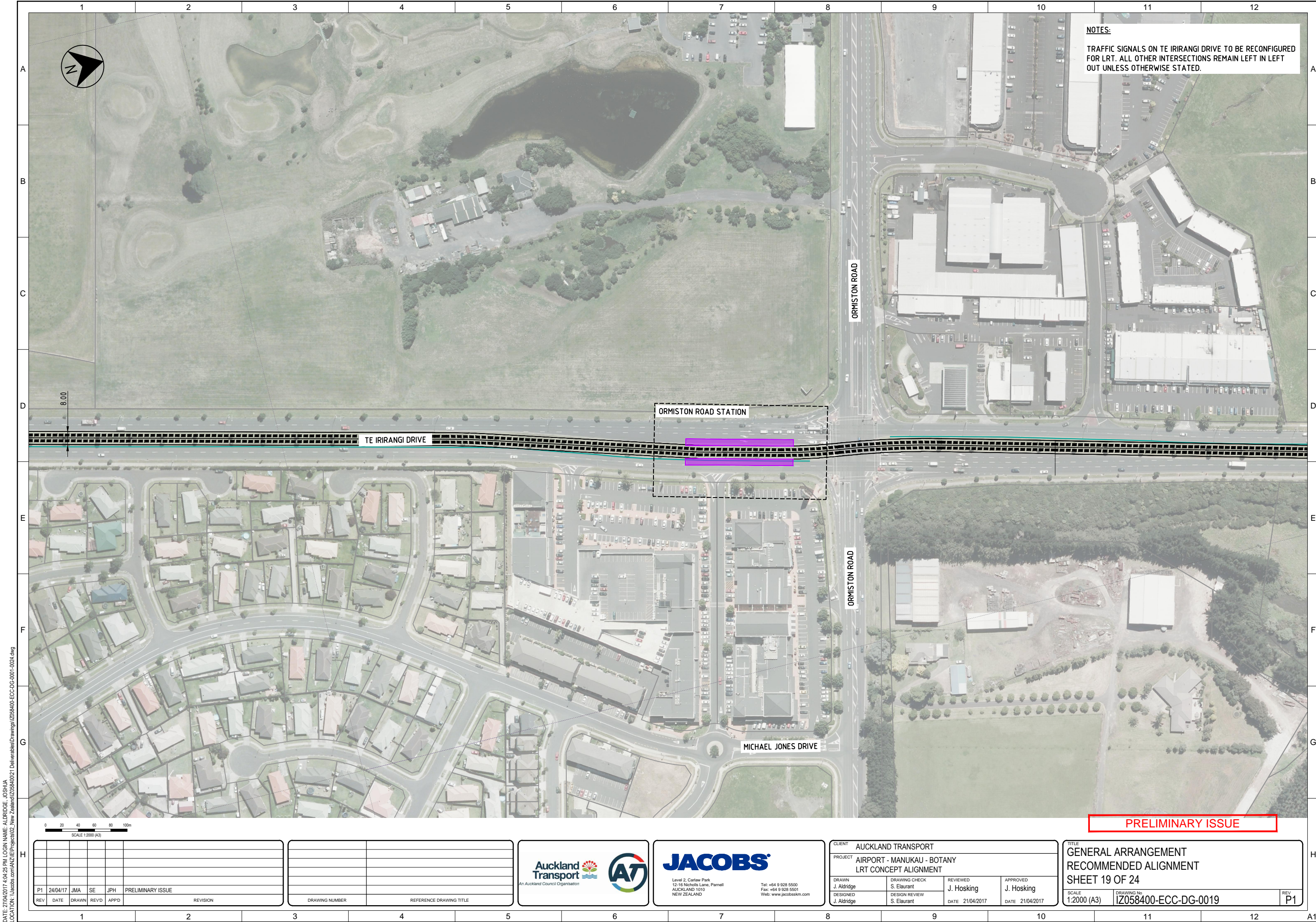
JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsgroup.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 18 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0018	REV P1

DATE: 27/04/2017 4:04:02 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\aucts.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-001-0024.dwg



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 19 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0019	REV P1

DATE: 27/04/2017 4:04:25 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobs.com\ANZ\IE\Projects\02_NZ\Auckland\058400-ECC-DG-001-0024.dwg



NOTES:

TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

BISHOP DUNN PLACE

POTENTIAL SCHOOL STATION

TE IRIRANGI DRIVE

TRENEARY LANE

SANCTA MARIA COLLEGE

PRELIMINARY ISSUE

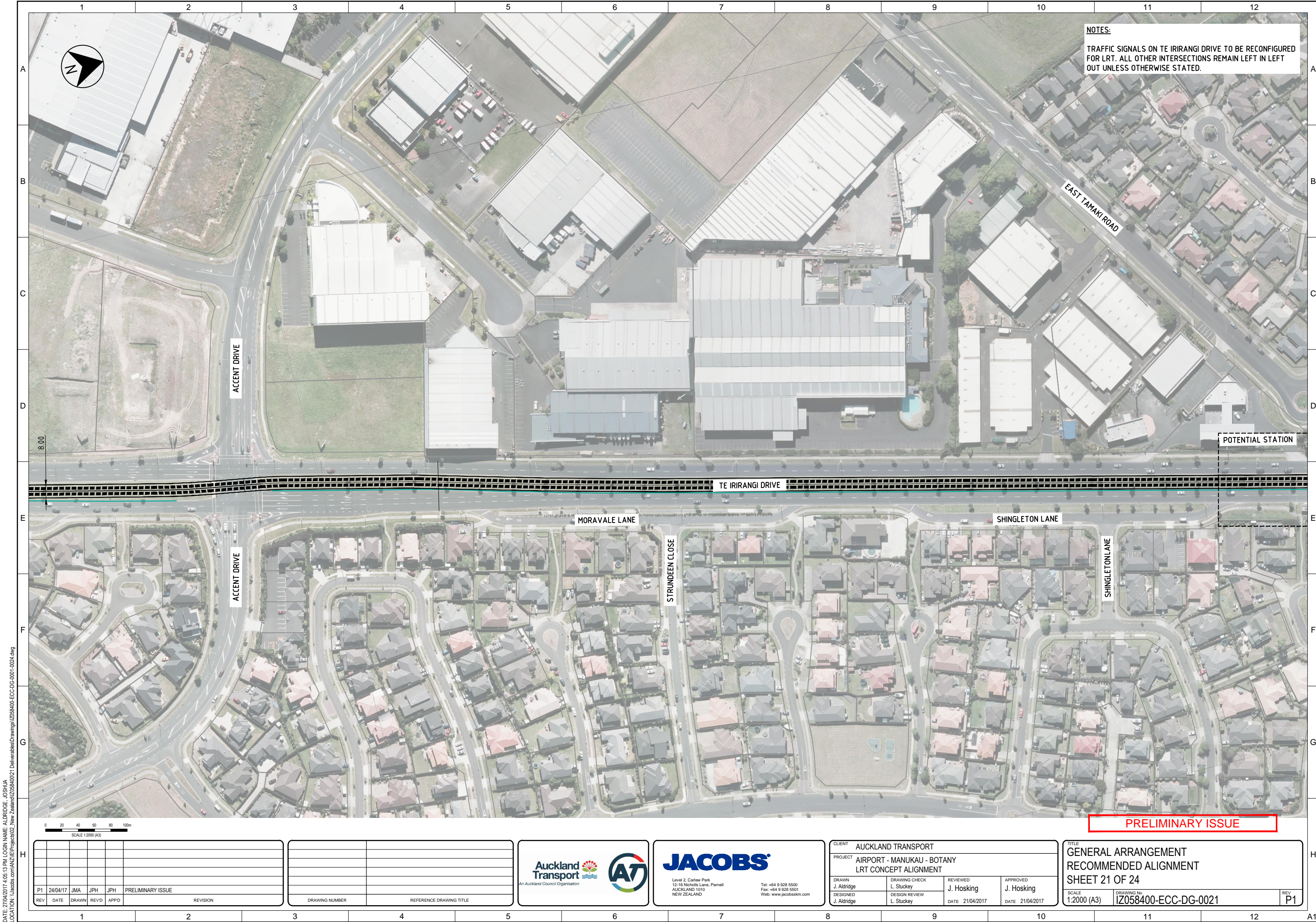
P1	24/04/17	JMA	JPH	JPH	PRELIMINARY ISSUE	
REV	DATE	DRAWN	REVD	APPD	REVISION	

DRAWING NUMBER	REFERENCE DRAWING TITLE



CLIENT		AUCKLAND TRANSPORT	
PROJECT		AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT	
DRAWN J. Aldridge	DRAWING CHECK L. Stuckey	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW L. Stuckey	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 20 OF 24		
SCALE 1:2000 (A3)	DRAWING No. IZ058400-ECC-DG-0020	REV P1



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	JPH	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



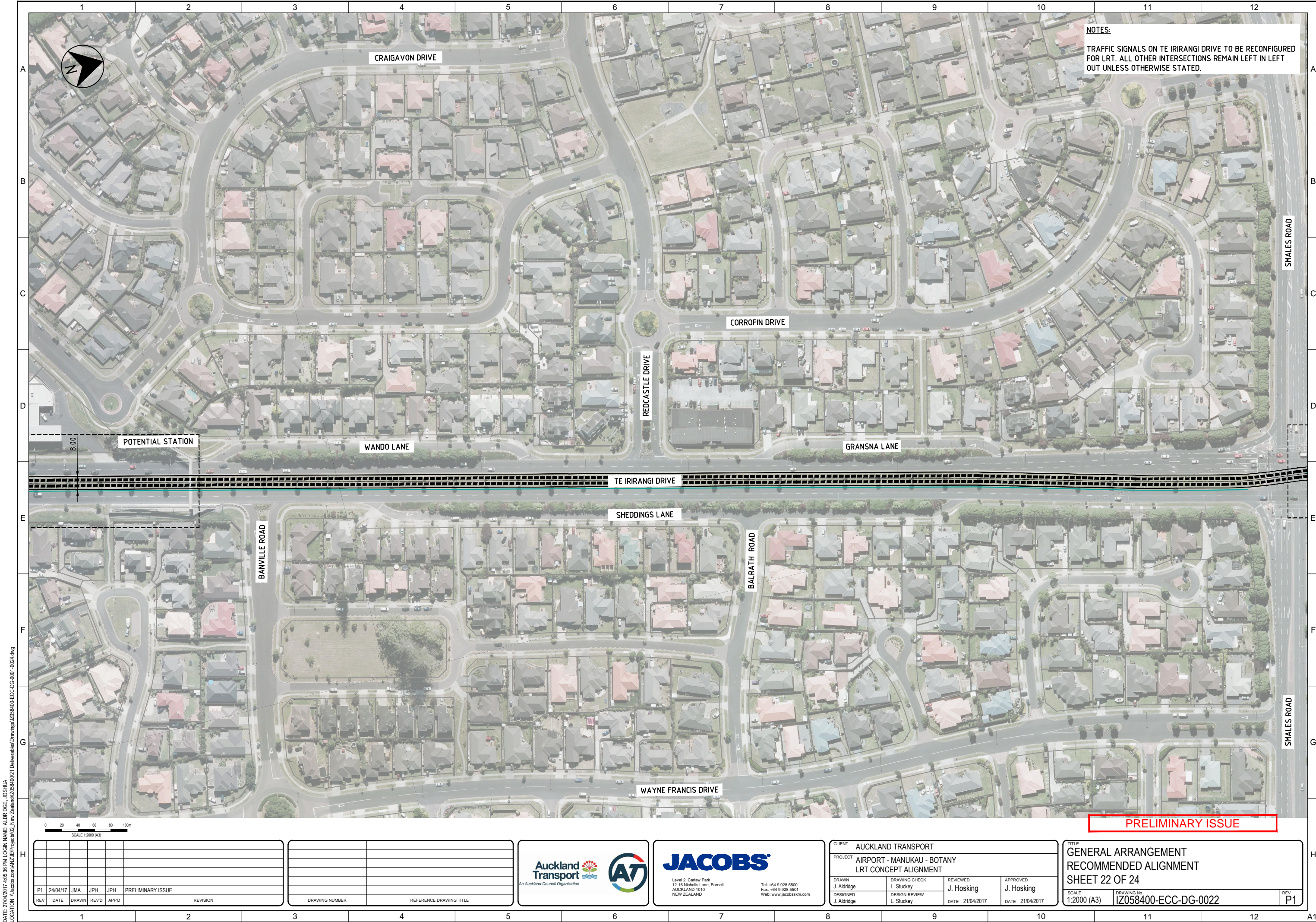
JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsnz.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK L. Stuckey	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW L. Stuckey	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 21 OF 24		REV P1
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0021	

DATE: 27/04/2017 4:05:13 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobs.com\ANZ\IE\Projects\02_NZ\Auckland\IZ058400-ECC-DG-001-0024.dwg



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

DATE: 27/04/2017 4:05:36 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\aucts.com\ANZ\IE\Projects\02_NZ\0540021_Deliverables\Drawings\0205400-ECC-DG-001-0024.dwg

P1	24/04/17	JMA	JPH	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE

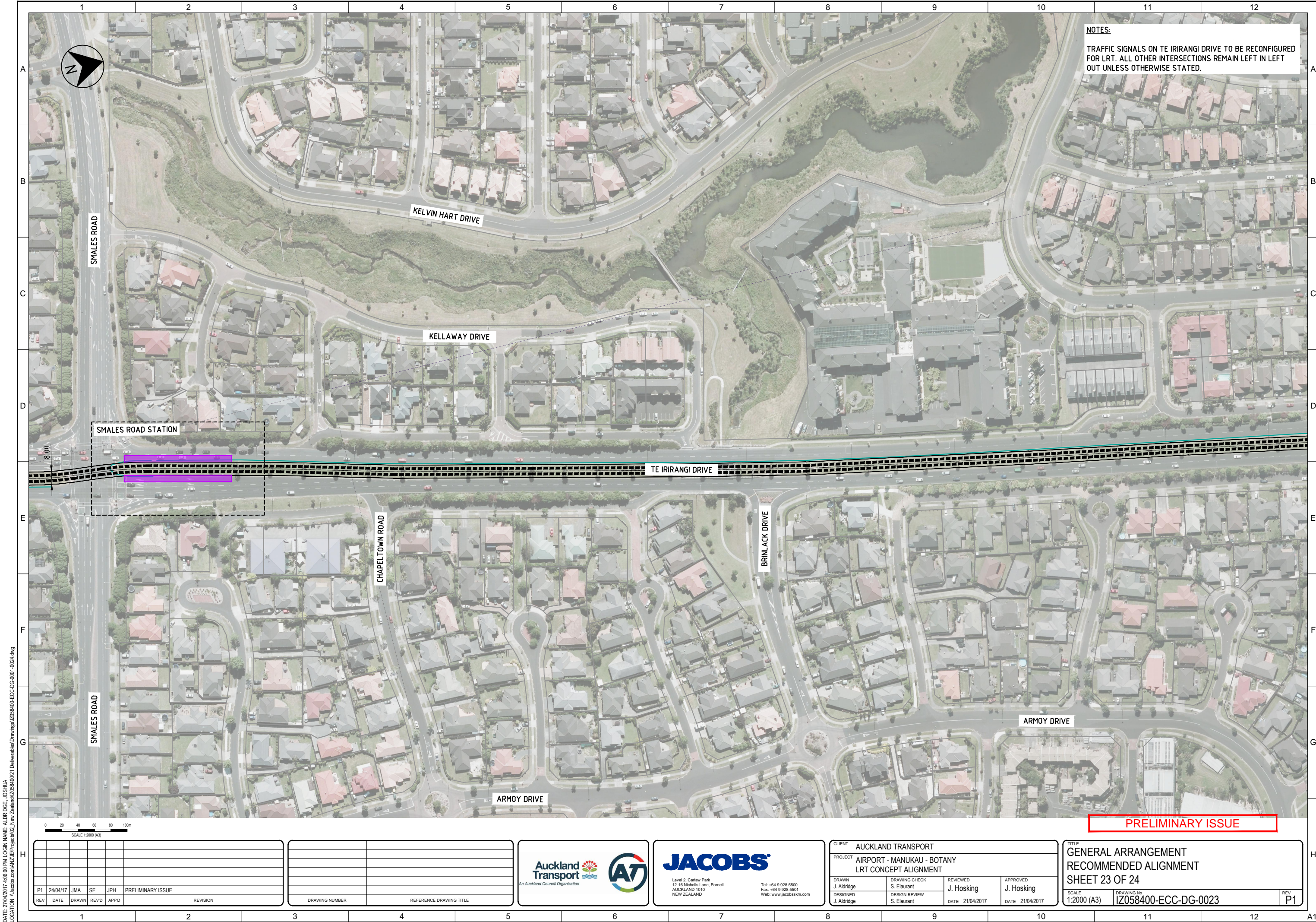


JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobson.co.nz

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK L. Stuckey	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW L. Stuckey	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 22 OF 24		REV P1
SCALE 1:2000 (A3)	DRAWING No I2058400-ECC-DG-0022	



NOTES:
TRAFFIC SIGNALS ON TE IRIRANGI DRIVE TO BE RECONFIGURED FOR LRT. ALL OTHER INTERSECTIONS REMAIN LEFT IN LEFT OUT UNLESS OTHERWISE STATED.

PRELIMINARY ISSUE

P1	24/04/17	JMA	SE	JPH	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	APP'D	REVISION

DRAWING NUMBER	REFERENCE DRAWING TITLE



JACOBS
Level 2, Carlaw Park
12-16 Nicholls Lane, Parnell
AUCKLAND 1010
NEW ZEALAND

Tel: +64 9 928 5500
Fax: +64 9 928 5501
Web: www.jacobsnz.com

CLIENT AUCKLAND TRANSPORT			
PROJECT AIRPORT - MANUKAU - BOTANY LRT CONCEPT ALIGNMENT			
DRAWN J. Aldridge	DRAWING CHECK S. Elaurant	REVIEWED J. Hosking	APPROVED J. Hosking
DESIGNED J. Aldridge	DESIGN REVIEW S. Elaurant	DATE 21/04/2017	DATE 21/04/2017

TITLE GENERAL ARRANGEMENT RECOMMENDED ALIGNMENT SHEET 23 OF 24		
SCALE 1:2000 (A3)	DRAWING No IZ058400-ECC-DG-0023	REV P1

DATE: 27/04/2017 4:06:00 PM LOGIN NAME: ALDRIDGE, JOSHUA LOCATION: \\jacobs.com\ANZ\IE\Projects\02_NZ\Auckland\05840021_Deliverables\Drawings\02058400-ECC-DG-001-0024.dwg

