

Appendix B-2

The background of the page is a complex, abstract graphic. It features a blurred photograph of a highway interchange with multiple lanes and overpasses. This image is overlaid with numerous semi-transparent, overlapping geometric shapes, primarily triangles and parallelograms, in shades of blue, green, and orange. The shapes are arranged in a way that creates a sense of depth and movement, with some appearing to be layered on top of others. The overall effect is a modern, dynamic, and technical aesthetic.

20Connect Long List Assessment

Appendix B-2

20Connect Long List Assessment

Technical Note

To	NZ Transport Agency	From	20Connect Project Team
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Date	2020-05-08	Pages (including this page)	27
Subject	Strategic Interventions		

1 Introduction

As outlined in the options development approach within the **20Connect single-stage business case options assessment methodology and multi-criteria analysis framework** Technical Note, this Technical Note covers the development and assessment of Strategic Intervention options.

The key outcomes sought from this assessment are:

- Review of programme business case (PBC) recommended programme
- Development and assessment of strategic interventions by the project team
- Stakeholder input into the strategic interventions assessment
- Complete 'sieve' of the strategic interventions to inform the development of the long list options in conjunction with the investment partners.

2 Interventions defined

Through a comprehensive review of the programme business case (PBC) recommended programme, and consultation with investment and project partners, the following interventions were identified for assessment.

2.1 Base Case interventions

2.1.1 A1 Do nothing

- No new services or infrastructure beyond that which is currently committed
- This intervention has not been carried forward as an option due to increased future transport demands and a need to maintain an expected level of service.

2.1.2 A2 Do minimum

- No new services or infrastructure beyond that which is currently committed and delivered by other projects within the Southwest Gateway programme of works:
 - SH20B Short Term Improvements
 - Puhinui Station and Puhinui Road bus lanes
 - Airport to Botany Rapid Transit Network Long Term Improvements SSBC
 - AIAL Transport Improvements
 - City Centre to Māngere Light Rail Transit Project.
- This intervention has been carried forward as the Base Case for options analysis.

2.2 Non-infrastructure interventions

2.2.1 B1 Land use – Up-zoning

- Address growth pressure through the change of land use of proposed developments, altering dynamics
- Increase the expected 2046 Auckland Unitary Plan employment and residential densities of Future Urban Zone land and other light industry zone land located to the north-west and east of the Airport
- See Figure 1.

2.2.2 B2 Land use – Down-zoning

- Address growth pressure through the change of land use of proposed developments, altering dynamics
- Decrease the expected 2046 Auckland Unitary Plan employment and residential densities of Future Urban Zone land and other light industry zone land located to the north-west and east of the Airport
- See Figure 1.



Figure 1: B1 Land use (Up-zoning) and B2 Land use (Down-zoning)

2.2.3 B3 Land use – Up-zoning at transport nodes

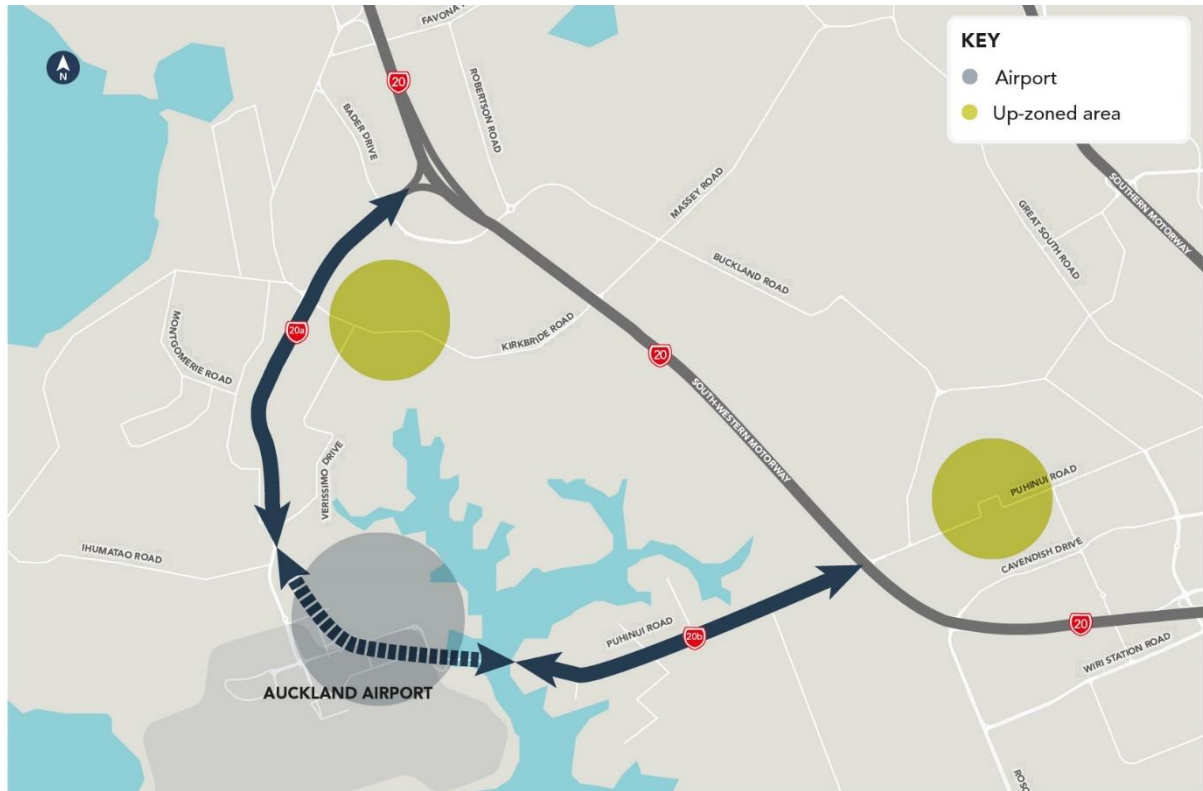


Figure 2: B3 Land use – Up-zoning at transport nodes (proposed transit-oriented development sites)

- Maximise utility of new infrastructure through multi-function zoning around transport nodes, altering travel dynamics and general use of the network
- Increase the expected 2046 Auckland Unitary Plan employment and residential densities, enabling mixed use developments around existing and proposed transport nodes located to the north-west and east of the Airport. For example, Puhinui Station and Mangere Bus Interchange.

2.2.4 B4 Pricing led – Congestion

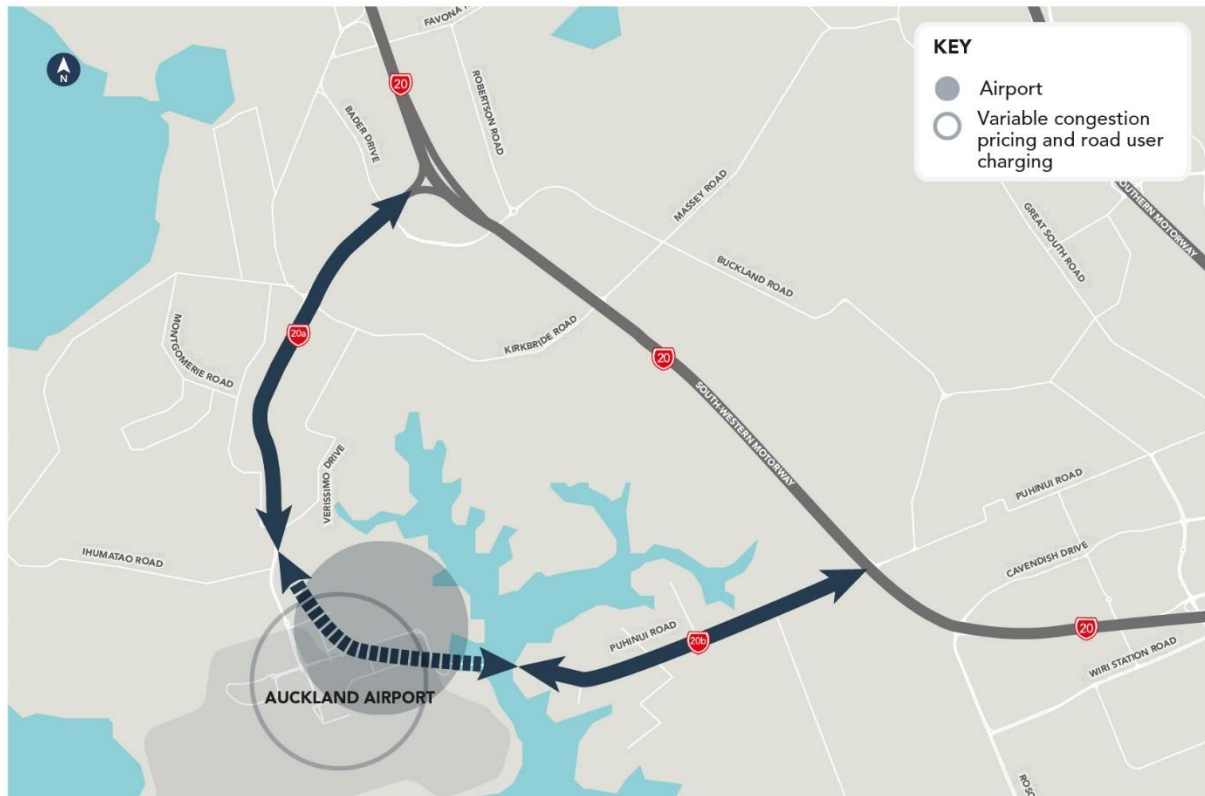


Figure 3: B4 Pricing led – Congestion (proposed congestion charging zone)

- Optimise existing assets, infrastructure and services through pricing to influence travel mode choice and timing
- Apply variable congestion pricing and road user charges in the Airport Precinct to reduce congestion and to encourage mode shift from private vehicles to public transport
- Congestion pricing would work much like a road toll but would charge road users subject to the time of day and congestion level. It is assumed that there are only two points of entry into and out of the congestion zone and that all road users including private vehicles, taxis and freight, would be charged to travel through the congestion zone. Exemptions include:
 - Bellyhold freight
 - Drivers with disability permits
 - Public transport
 - Park and ride shuttles from outside the congestion zone
 - Other shuttle bus services.

2.2.5 B5 Pricing led – Public transport

- Encourage behaviour change and influence travel mode choice and timing through public transport pricing, optimising existing assets and infrastructure
- Reduce public transport fares to encourage greater use and off-peak travel. Specifically, bus and rail fares for both ATHop card users and cash fares Auckland-wide.
- See Figure 4.

2.2.6 B6 Pricing led – Parking

- Encourage behaviour change and influence travel mode choice through parking pricing, optimising existing assets and infrastructure. Specifically, encourage mode shift from private vehicles to public transport and/or use of park & ride facilities away from airport terminals.
- Increase parking fees at all parking sites located within 500m of the airport terminals to discourage passengers, employees and 'meeters and greeters' from using private vehicles for travel to the Airport
- See Figure 4.

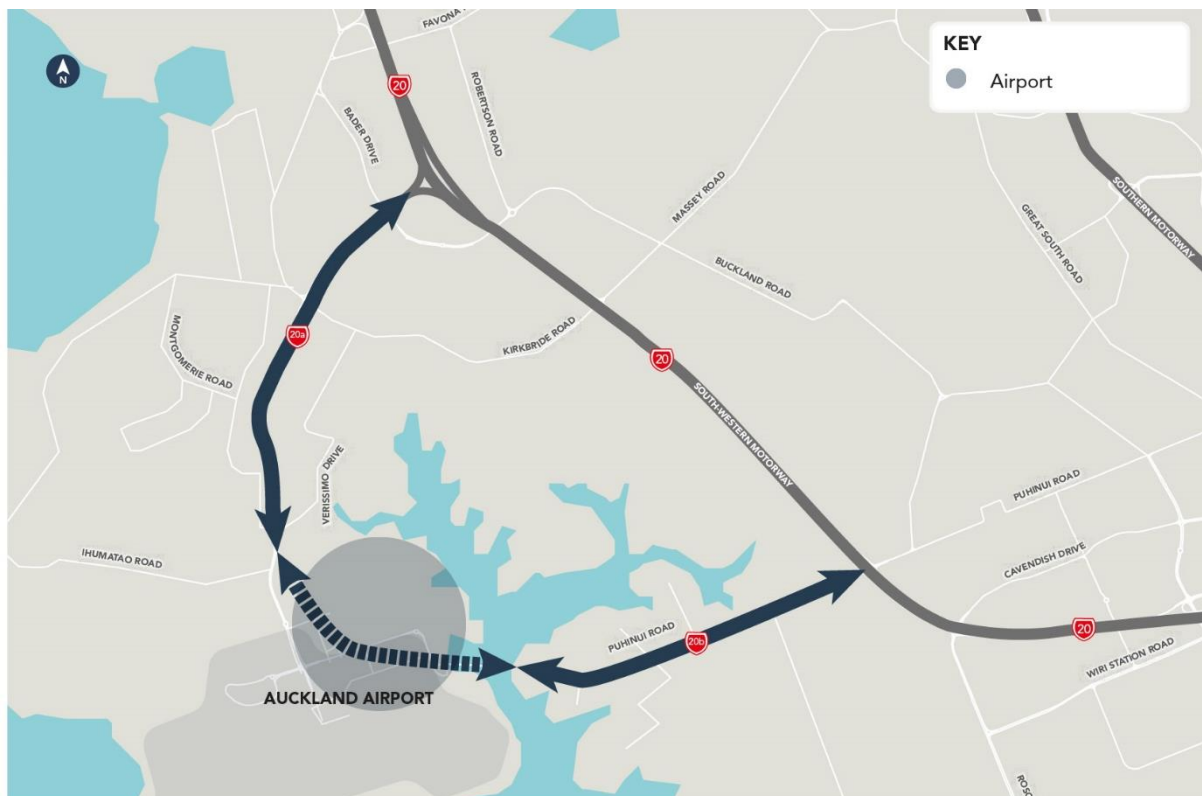


Figure 4: B5 Pricing led (Public transport) and B6 Pricing led (Parking)

2.2.7 B7 Capacity management

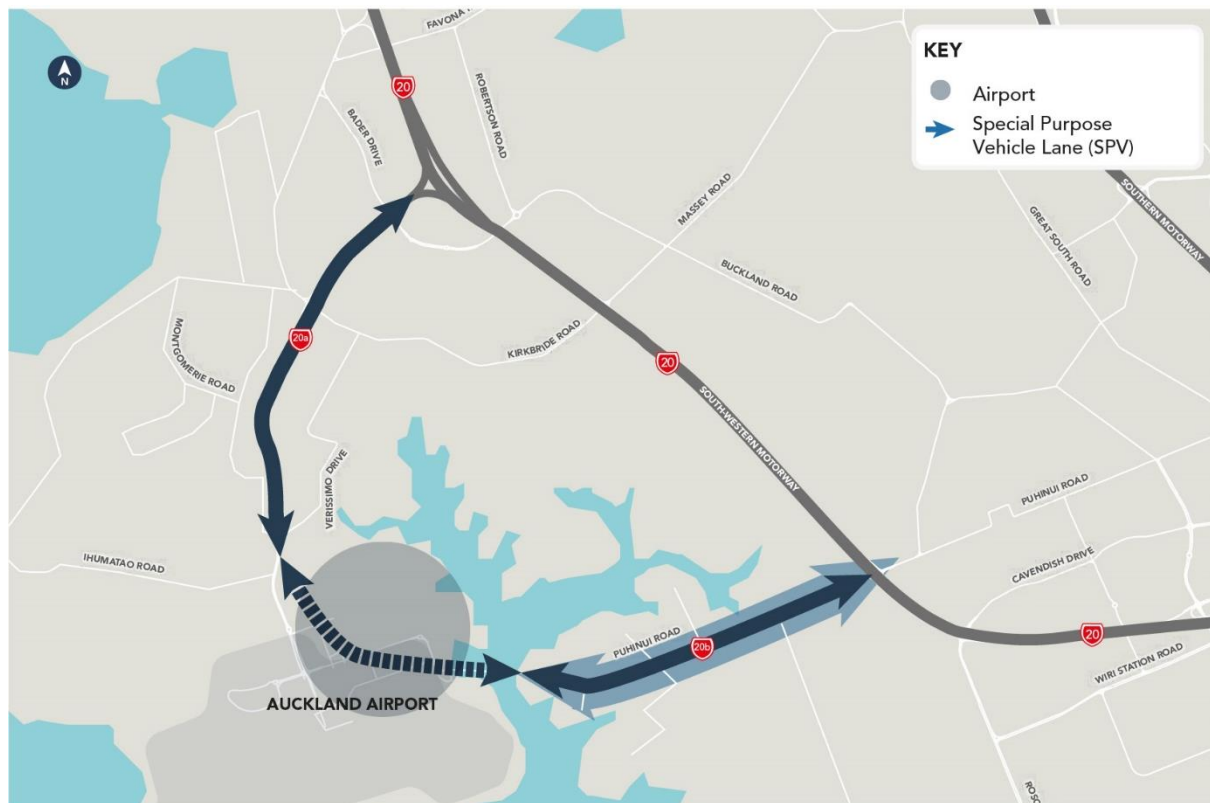


Figure 5: B7 Capacity management

- Optimise productivity of the corridor by reallocation to optimise total throughput
- Introduce special purpose vehicle (SPV) and tidal flow lanes on SH20B, specifically between SH20 interchange ramps and Pukaki Bridge, by utilising the existing road corridor to provide two lanes on the outside and a central lane. During peak hours, the outside lane will operate as an SPV lane for buses and potentially high occupancy vehicles such as T3, whilst the central lane provides a general traffic lane in the peak flow direction. During inter-peak times, it will act as a flush median lane.
- Note that no capacity interventions are assumed for SH20A.

2.3 Infrastructure interventions

2.3.1 C1 High investment – SH20A

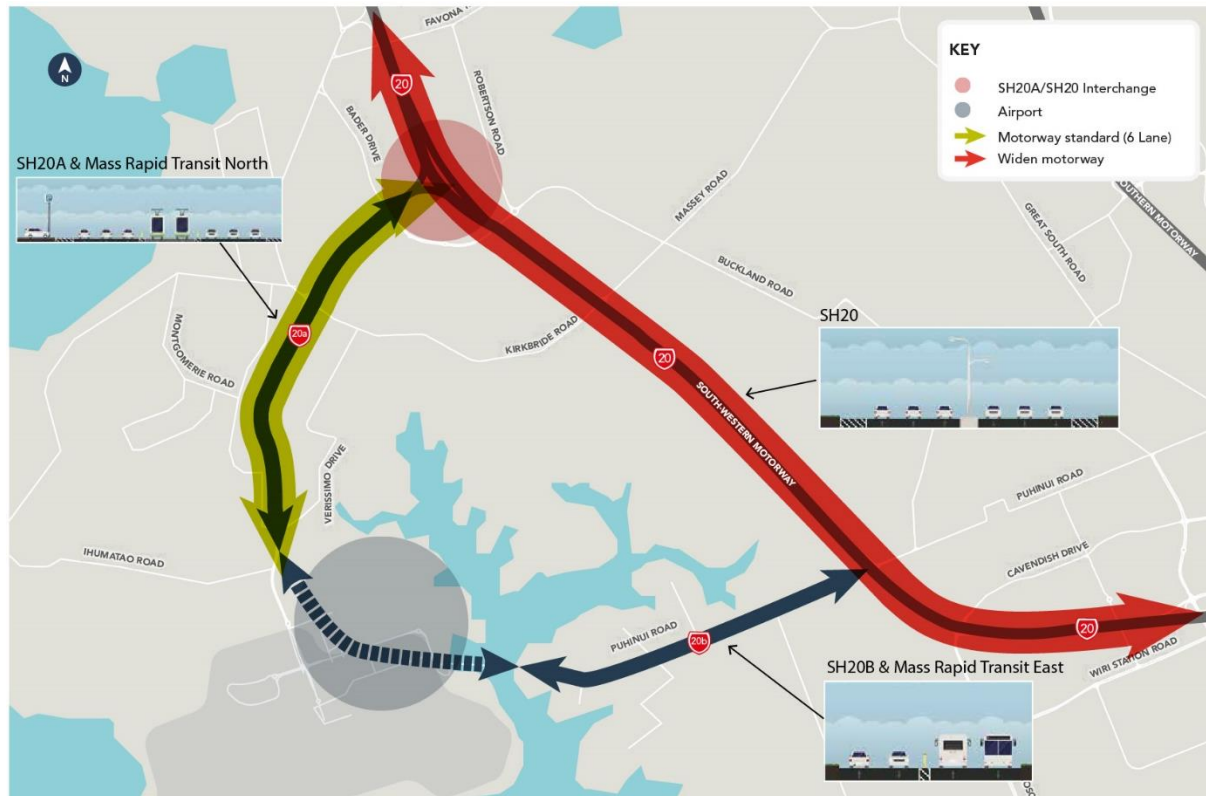


Figure 6: C1 High investment – SH20A

- Focus investment on the SH20A corridor for mass rapid transit (MRT) to optimise investment and minimise airport through-traffic to SH20B
- Increase local public transport, active modes, freight and SPV capacity
- Widen carriageway to three lanes in both directions (+1 lane in each direction) on SH20A
- Widen Kirkbride Road interchange underpass
- Introduction of a southbound motorway connection between Kirkbride Road and SH20 – alteration, relocation or removal of Bader Drive bridge and connecting off and on-ramps. This is due to the transition distance required to achieve the height required to go over the existing state highway, maintain safe sight distances and the on/off ramp connections at Kirkbride Road.
- SH20B to remain as existing.

2.3.2 C2 High investment – SH20B

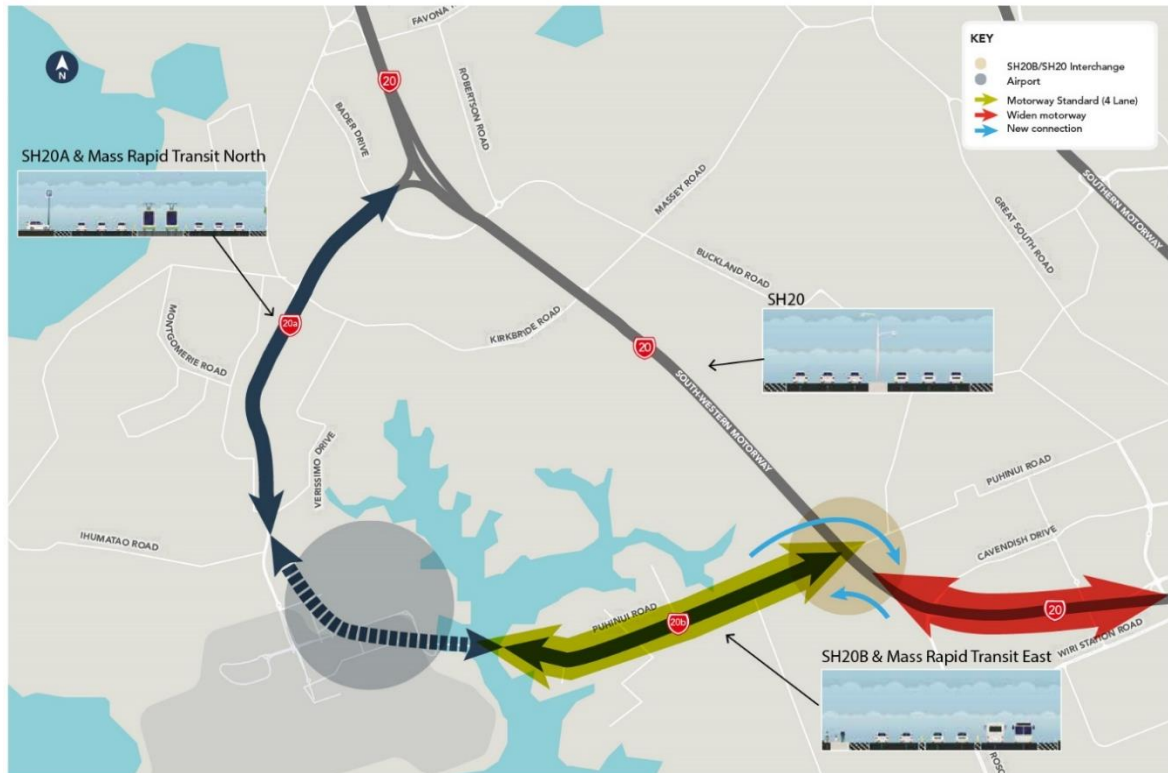


Figure 7: C2 High investment only – SH20B

- Focus investment on the SH20B corridor for MRT to optimise investment and minimise network disruption
- Widen carriageway to four lanes on SH20B with MRT – widening along the existing alignment is assumed to be on the south side due to current land use including Memorial Gardens (cemetery) on the north side. MRT also has several options including shoulder running, kerb side bus lanes and segregated MRT corridor.
- Widening of existing or new Pukaki Creek crossing
- New grade separated interchange to connect with local access – Price Road, Memorial Gardens, Campana Road, Orrs Road and the Scenic Lookout Airport Runway
- SH20B northbound connection with SH20 – the Memorial Gardens are situated in the northwest corner of this interchange. Introducing an additional connection may result in the need to acquire land or relocate the interchange.
- SH20B southbound connection with SH20 – the connected on/off ramps between Puhinui Road and Roscommon Road / Cavendish Drive may require alterations or a possible closure of one of these interchanges may be necessary, resulting with local network alterations to accommodate vehicle volume changes and approaches.
- Widening of SH20 to 6 lanes (3 lanes in both directions) to accommodate the increased north and southbound vehicle traffic
- Walking and cycling infrastructure to be introduced alongside the corridor with connections to the existing local network
- New local roads to connect existing local roads to the SH20B/SH20 interchange
- SH20A to remain as existing.

2.3.3 C3 High investment – SH20A & SH20B

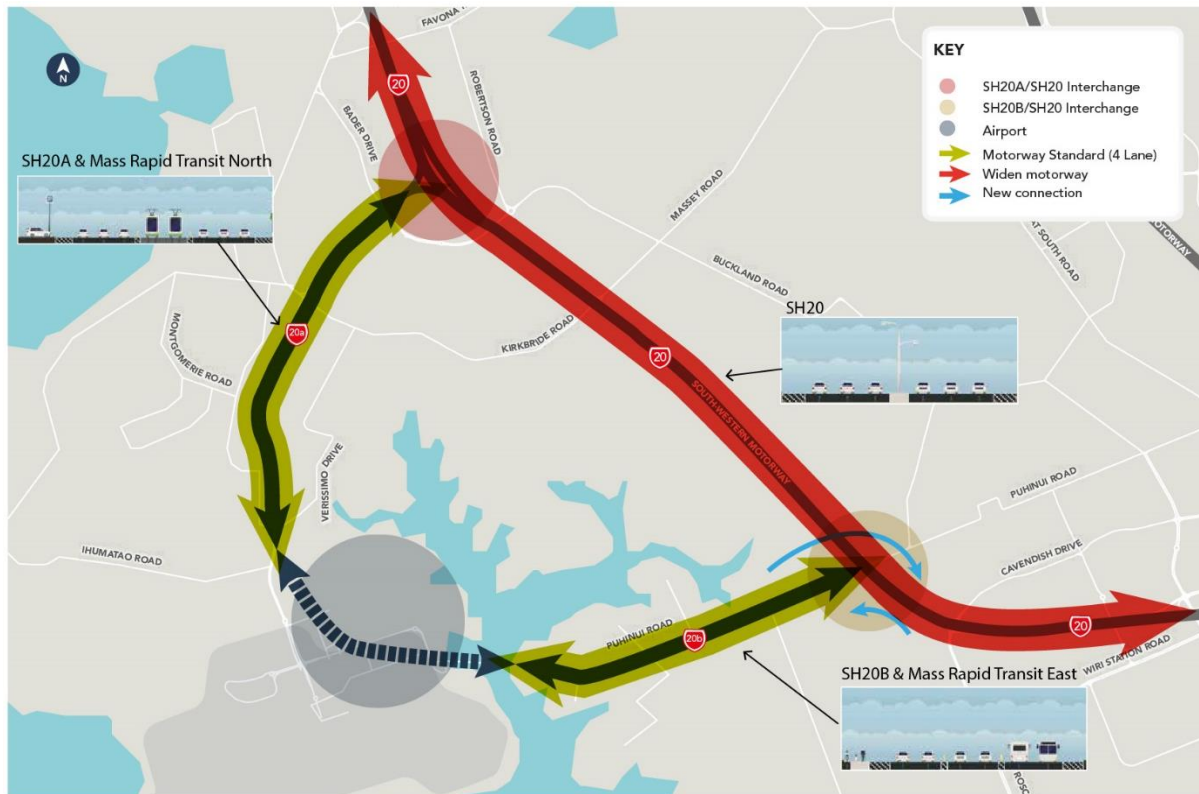


Figure 8: C3 High investment only – SH20A & SH20B

- Invest for long-term outcomes to maximise development potential and minimise disruption
- Invest in SH20A and SH20B corridors as per strategic interventions C1 and C2 (see Sections 2.3.1 and 2.3.2).

2.3.4 C4 Moderate investment – SH20A & SH20B

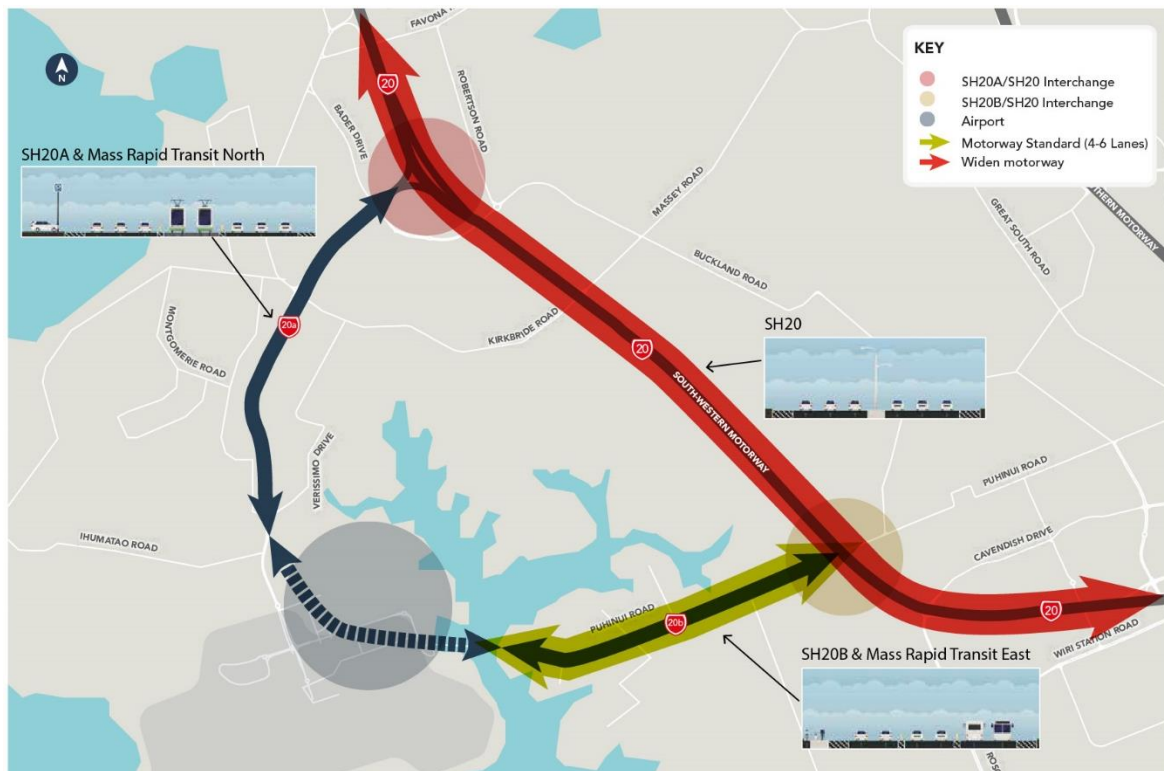


Figure 9: C4 Moderate investment – SH20A & SH20B

- Focus investment on the existing corridors and improve connections between corridors
- A reduced investment variation of strategic intervention C3 (see Section 2.3.3)
- Widening of existing or new Pukaki Creek crossing
- New at-grade signalised or roundabout interchange to connect with local access along SH20B – Price Road, Memorial Gardens, Campana Road, Orrs Road and the Scenic Lookout Airport Runway
- New service roads to connect to local roads near SH20B from the at-grade intersection
- SH20B southbound expressway connection with SH20 – introduction of a southbound expressway connection including Puhinui Road, Roscommon Road/Cavendish Drive which may require alterations or a possible closure of one of these interchanges resulting in local network alterations to accommodate vehicle volume changes and approaches.
- A possible northbound expressway connection from SH20B to SH20
- Possible introduction of a southbound expressway connection between Kirkbride Road and SH20 on SH20A
- Possible removal/relocation/alteration to Bader Drive bridge and off-ramp (emergency vehicle on-ramp) to accommodate SH20A to SH20 southbound connection
- Widening of SH20 to 6 lanes (3 in both directions) to accommodate the increased north and southbound vehicle traffic
- Walking and cycling infrastructure to be introduced alongside the corridor with connections to the existing local network.

3 Sieve process

In consultation with investment partners, analysis of the strategic interventions was undertaken through a sieve process whereby each intervention was evaluated against three high level measures as follows:

- **Criterion 1: Feasibility**
 - Technical, implementation and construction considerations.
- **Criterion 2: Risk, constraints and impacts**
 - Degree of social, environmental and economic impacts.
- **Criterion 3: Effectiveness**
 - Achievement of ILM benefits and objectives.

Reasonable qualitative approaches were applied to interventions where possible and demand and capacity analysis undertaken to assess these criteria.

3.1 Qualitative assessment of non-infrastructure interventions

3.1.1 B1 Land use – Up-zoning

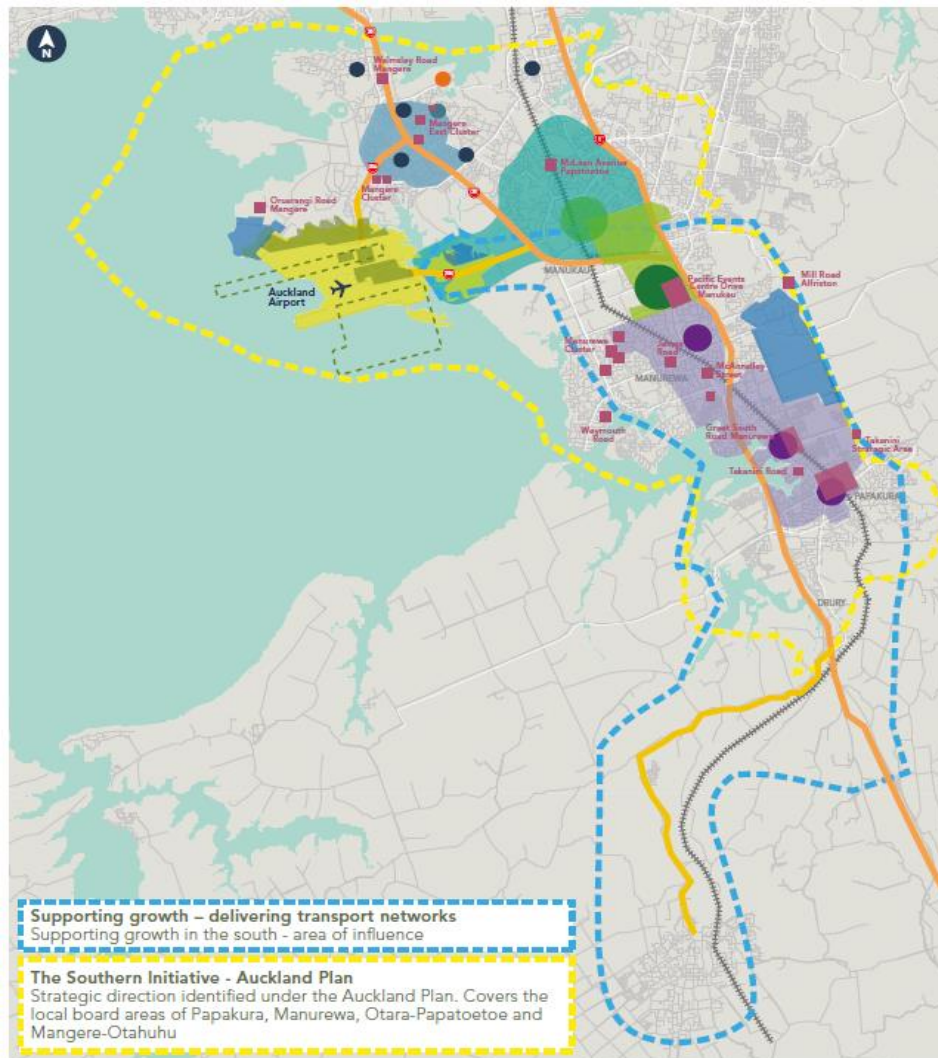
Feasibility

Zone	Description
Future Urban Zones (FUZ) under the Auckland Unitary Plan (AUP)	■ Three FUZ in the study area may be an opportunity to influence the final zone type and sub-sequentially, the type and density of development ■ These zones have not been officially zoned or developed yet under the AUP. FUZ are 'live zoned' via the preparation of a structure plan and a plan change to give effect to the zoning. ■ The ability to live zone land is often largely dependent on the availability of critical infrastructure to support development.
Residential and business zones	■ There is a mixture of different residential and business zones in the study area (see Figure 11) which may be intensified in some areas.
Auckland International Airport Limited (AIAL) land	■ Part of AIAL is zoned Business – Light industry to the east and does not appear to have developments planned in their notice of requirement application, which may be an opportunity to up zone surrounding areas or intensify the business zoning type ■ Agreement from AIAL is required, as is a structure plan to change the zoning.
Puhinui Reserve and associated Maori land within the Puhinui Precincts	■ Opportunities to intensify residential and business zoning within these precincts ■ Agreement from local iwi is required, as is a structure plan to change the zoning.

Zone	Description
Local board, structure, area and private plans (see Figure 11)	■ Encourages the various development of sites, including: – Market Cove (private)– residential developments in Favona – Area plans (Auckland Council) – Including Māngere-Ōtāhuhu Area Plan, Ōtara-Papatoetoe Area Plan and the Integrated Area Plan for Manurewa, Takanini and Papakura. ■ Requires any proposed up-zoning to be in line with their objectives and plans.
Wider government-led development and transportation initiatives (see Figure 11)	Encourages the appropriate development of sites to suit transportation services including: ■ Supporting Growth – delivering transport networks (formerly Transport for Future Urban Growth (TFUG)) southern growth areas (including Pukekohe, Drury, Paerata and Takanini) ■ The Southern Initiative (Panuku Development Auckland). Opportunity to assist in promoting Auckland Council through land use changes by supporting the ability to zone for higher density development in South Auckland, by improving accessibility, access to jobs and economic growth. ■ Old Papatoetoe Town Centre Renewal (Panuku Development Auckland) ■ Puhinui Precinct and Southern Gateway programme ■ Housing developments (which were formerly Special Housing Areas (SHAs)) currently under construction. There are thirteen development sites that have already been 'live zoned' under the AUP. ■ Requires any proposed up-zoning to be in line with their objectives and plans.



Figure 10: Environmental features overview



GROWTH AND DEVELOPMENT AT AUCKLAND AIRPORT AND THE SURROUNDING AREA

LEGEND

Auckland Airport

The Quad, the Landing and Cargo

Notice of requirement to alter the existing designation for the extension of Auckland Airport's proposed second runway

Market Cove

Private residential and commercial development

AUCKLAND COUNCIL

Integrated area plan for Manurewa, Takanini, Papakura

Revitalisation of Manurewa, Takanini and Papakura centres

Māngere-Otahuhu Area Plan

Revitalisation of Mangere Bridge, Favona, Mangere East, Mangere and Otahuhu centres

Boggust Park Concept Plan

Redevelopment of HNZ houses in Mangere

Otara-Papatoetoe Area Plan

Revitalisation of Manurewa, Takanini and Papakura centres

Auckland Unitary Plan operative in part

Future urban zones are required to undergo structure planning and plan change processes to become 'live zoned' under the AUP

Panuku Development Auckland

Manukau Framework Plan

Wiri healthy neighbourhood

Old Papatoetoe Town Centre

Renewal

Live Zoned Areas

Development sites "live zoned" under the AUP (formally known as Special Housing Areas)

Motorway

Major Road

Railway

Figure 11: Locations of growth and development at Auckland Airport and the surrounding area

Risks and constraints

Item	Risk	Description
Puhinui Reserve	High	- The location of Auckland Airport and the surrounding area, including the Puhinui Peninsula, holds significant cultural and heritage value to Te Ākitai Waiohū and potentially other Mana Whenua groups in the wider region - Pukaki and Waokauri Creeks are held in Māori reservation titles, which affords them special status. They cannot be required/designated or acquired by the Crown for public works. The existing SH20B bridge was agreed to by the Māori trustee owners under the Eastern Access Agreement (1991). The DBC sets out an expectation that any further development of the bridge and SH20B corridor is restricted in perpetuity.
AIAL	Medium to High	- AIAL is the sole property owner of a large area of land within the study area and has existing relationships with the surrounding business associations. These considerations also provide an opportunity to better integrate the project with future AIAL projects. - Development is limited by restrictions under airports and airfields zone, Auckland Airport sub-precinct Coastal and Auckland Airport sub-precinct Core, and protection of aeronautical functions - obstacle limitation surfaces rules.
Reputation	Medium	- Further disruptions to the state highway network may damage reputations due to the current Southern Corridor Improvements (introduce improvements all at once to minimise customer disruption). - Local community unrest (SOUL) generating negative media attention and public interest.
Up-zoning in undeveloped areas	Low	- Any increase in development will incur an increase in travel demand to the area, therefore the assumption is that appropriate additional public access and transport services will reach the area. This assumption is a constraint to any proposed up-zoning in the study area (which may also be used as a justification tool for transport projects) and potentially poses reputational risks. - The ability to live zone (and up-zone) FUZ land is often largely dependent on the availability of critical infrastructure to support development. - Local communities may appeal any changes proposed and potentially take the case to the Environment Court (for example Save Our Unique Landscape (SOUL) whom have protested against the proposed SHA to the west of the airport, resulting in a hold on development until a resolution is reached).

Effectiveness

This intervention will be effective in enhancing the potential benefits gained from any further investment in the transport network.

In isolation, up-zoning will significantly exacerbate the existing congestion issues and therefore will not be effective at addressing the airport area's access problems. However, this intervention may be considered in conjunction with mass rapid transport projects.

Conclusion

Applications to re-zone land is controlled by the Auckland Council and the landowners themselves, therefore effecting the outcomes of this intervention lie outside of the control of the Transport Agency. This intervention will be effective if implemented in conjunction with mass rapid transit projects.

3.1.2 B2 Land use – Down-zoning

Feasibility

This intervention would require agreement from a number of stakeholders including iwi, local boards and AIAL both of which have a commercial interest in the development occurring and therefore are unlikely to agree.

Risks and constraints

Constraints on the growth in the area could affect the viability of existing infrastructure projects through reduced benefits from fewer employees or residents in the study area.

This intervention does not allow for the future airport growth in passenger trips, commercial development and neighbouring business requirements.

Effectiveness

Although this intervention may reduce future demand for travel in the study area, it does not address the existing capacity constraints and network congestion, nor does it allow for future growth in airline passengers or Auckland's population

Conclusion

As with the up-zoning of land intervention, the re-zoning of land is at the discretion of the property owners and Auckland Council and therefore outside the Transport Agency's control. This intervention is not considered effective in addressing the problem statements for this business case and will not be considered further.

3.1.3 B3 Land use – Up-zoning at transport nodes

Feasibility

This intervention would require changes to the Auckland Unitary Plan through a plan change process which would be open to public submissions.

Risks and constraints

This intervention will likely exacerbate future demands on the transport network at these hubs.

Potential for any plan changes to be taken to the environment court

Effectiveness

Although this intervention does not address the existing capacity constraints and network congestion, nor allow for future growth in airline passengers and neighbouring business requirements, it provides for enhanced benefits overall as a result of higher density residential and employment within walking distance of transport stations.

Conclusion

As with the previous interventions, re-zoning of land is at the discretion of the property owners and Auckland Council and therefore outside the Transport Agency's control.

This intervention will be effective if implemented in conjunction with mass rapid transit projects and increased public transport frequency and capacity.

3.1.4 B4 Pricing led – Congestion

Feasibility

- Legislative changes will be required with potential changes to the Road User Charges Act 2012, Airport Authorities Act 1966, Auckland Airport Act 1987.
- Support from AIAL required which may not result due to the potential effect charging may have on their parking sites within the zone.

An integrated management system will be required to retrieve plate information, manage driver charging and alert on charge evasion. It may be implemented as part of NZTA's current toll management system or else would require a new platform. A system to enforce payment and follow up unpaid charges would be needed and would incur significant ongoing costs.

Risks and constraints

- High political risk – given New Zealanders appetite to accept congestion charging as a solution to road congestion, falls below 50%, politically it is unlikely to be supported. Although public support of such a scheme increased significantly when participants were advised that revenue from the scheme would fund other transport projects¹, in this case it is unlikely that the airport as the road controlling authority would support this use of the revenue.
- Congestion pricing failed in Lyon in 1997² due to public backlash. This draws attention to the need to consult and engage with the general public. High reputational risk for the Transport Agency and AIAL.
- High risk that the congestion charging will overload other parts of the network such as SH20a north of Landing Drive and Puhinui Road SH20 interchange, which both experience heavy congestion from local trips. This congestion will disadvantage time sensitive trips.
- This intervention would require a link for southbound freight from the airport industrial area onto SH20
- Without additional investment in public transport services, overcrowding on public transport will likely occur
- Political resistance or public outcry could lead to underutilisation of the system which would affect revenue for the owner and may have serious commercial implications for the airport. In the worst-case scenario, pushback could lead to the removal of the system causing a loss of investment.

The system may be vulnerable to equipment failure (e.g. ANPR camera) which would result in missed revenue (a key selling point of the system) and incorrect charging.

¹ <http://www.transport.govt.nz/assets/Import/Documents/arpes-summary-document.pdf>

² Stephane Hess & Maria Börjesson (2017): Understanding attitudes towards congestion pricing: a latent variable investigation with data from four cities, Transportation Letters, DOI: 10.1080/19427867.2016.1271762

Infrastructure requirements

ANPR Cameras, to be mounted on existing posts (such as street lights) or on existing or new gantries. With only two points of entry/exit in the congestion area limited infrastructure is required.

Effectiveness

- Congestion pricing is generally considered by traffic economists to be the most effective method of congestion reduction³. Schemes such as those in Singapore, Stockholm and London^{4 5} have been shown to be successful; assuming similar results, the scheme is expected to achieve:
 - A decrease in traffic volumes of between 13 – 20% within the congestion zone
 - An increase of up to 15% in PT patronage for trips to and from the airport

This intervention will not be effective in isolation but rather would need to be combined with other travel demand, capacity and infrastructure investment interventions to provide effective outcomes.

Conclusion

A congestion charging scheme requires political support to enact law change and agreement across investment partners and affected landowners. Due to the high risks associated with congestion charging this intervention will not be progressed further as a part of this project. However, the project team are aware of a piece of work being undertaken by The Congestion Question to assess the potential effectiveness of congestion pricing in Auckland. Sensitivity testing, incorporating congestion pricing schemes, will be undertaken as part of the regional modelling run for this project to build in

3.1.5 B5 Pricing led – Public transport

Feasibility

This intervention is feasible as Auckland Transport undertake yearly fare reviews and adjustments. In order to decrease the fare which users pay, a significant increase in patronage would be needed or an increase in the fare subsidy currently paid by the government for each ride would be needed to ensure operators remain viable.

Public consultation will be required for any change to fare pricing.

Risks and constraints

- The anticipated growth in patronage as a result of the fare reduction and an increasing Auckland population may result in insufficient capacity on the existing services to accommodate demand. Additional services will likely be required.
- Without additional interventions to improve journey reliability and comfort, users may continue to choose alternative modes of travel.
- A decrease in fares could lead to a significant decrease in revenue if a matching increase in public transport patronage does not occur
- Reputational risks associated with overloaded public transport could have a negative impact on the reputation of Auckland as a tourist destination.

³ Gila Albert & David Mahalel (2006): Congestion tolls and parking fees: A comparison of the potential effect on travel behaviour, Transport Policy, Vol. 13, No. 6, 496-502

⁴ <https://www.nzta.govt.nz/assets/userfiles/transport-data/Road%20Pricing.pdf>

⁵ <https://www.econstor.eu/bitstream/10419/166849/1/ifo-dice-report-v03-y2005-i3-p17-21.pdf>

Effectiveness

- The existing fares on public transport services operated by Auckland Transport are already considered low however many passengers and residents of Auckland are unaware that there is an affordable solution available.
- A change in PT fare may have some effect on patronage, however studies have shown that elasticities are lower with a decrease in public transport fares than with an equivalent increase in price. i.e. reducing the fare price is less effective at encouraging a patronage change⁶.

Studies show that travellers who were less concerned about the convenience of storing and retrieving luggage are more inclined to use public buses to access the airport⁷. To capture those passengers with luggage who are more concerned with security and convenience of private vehicles, changes in fares could be complemented by the provision of convenient luggage delivery service.

Conclusion

Due to the low elasticity associated with reducing the fare price, it is recommended that this intervention is not developed further for this project. However, it is recommended that a communications plan is developed to better educate people of the existing solutions, fares and the viability of a luggage delivery service is investigated.

3.1.6 B6 Pricing led – Parking

Feasibility

In terms of complexity, this intervention would be simple to implement but without the support of AIAL it would not be feasible, as the parking facilities closest to the airport terminals are owned by AIAL.

Risks and constraints

- An increase in parking fees could have the opposite effect in that it invites more traffic into the airport terminal forecourt, due to an increased number of pick-up and drop-off passengers.
- An increase in parking fees may have negative repercussions for employees if they do not have access to alternative modes of transport or park and ride facilities. As many employees at the airport work shifts, PT may not be a reasonable alternative. This could mean that the airport becomes less attractive/viable for current and potential employees.
- Increasing parking fees may act to make the airport less accessible and attractive to travellers, damaging airport reputation and/or losing travellers to other airports.

The current parking system functions in effect as a monopoly, with other parking providers having to follow pricing from the airport. Any further increases in parking fees could result in reputational damage.

Effectiveness

- Evidence suggests that restricting the supply of parking may lead to an increased number of pick-up and drop-off trips, not an increase in PT usage. The same study found that an increase in parking fees had little impact on employees' mode choice⁸.

⁶ <https://www.vtpi.org/tranelas.pdf>

⁷ Jou, R.-C., Hensher, D. A., & Hsu, T.-L. (2011). Airport ground access mode choice behaviour after the introduction of a new mode: A case study of Taoyuan International Airport in Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, Vol. 47, No. 3, 371-381.

⁸ Humphreys, I., & Ison, S. (2005). Changing airport employee travel behaviour: the role of airport surface access strategies. *Transport Policy*, Vol. 12, No. 1, 1-9.

- There also has been some recent pushback from customers on the cost of parking⁹

An airport in Taiwan found that parking fares had a statistically significant impact on travellers and did correlate parking fees with a mode choice change, though they did not specify which mode shift¹⁰.

Conclusion

This intervention may be effective with AIAL support and an alternative revenue stream can be sought to offset the potential lost revenue. This intervention will be much less effective in isolation and should be considered alongside travel demand, capacity and infrastructure investment interventions to provide an effective outcome.

3.1.7 B7 Capacity management

Feasibility

- This intervention is considered feasible as there is at least 10m of existing pavement along the corridors to reallocate road space with only minor widening required.
- The minor carriageway widening required falls within the existing designation.

Tidal flow lanes are only operable within New Zealand Legislation under the guise of a system trial. Therefore, this scheme would also need to operate as a temporary trial or alternatively legislature changes would be required.

Risks and constraints

- Potential for wasted investment as bottlenecks at either end provide the main constraint and improving the midblock capacity may not improve the traffic throughput.
- An SPV lane may not be utilised optimally as a result of the existing traffic mix and occupancy. High occupancy rates of vehicles on airport trips would provide too high demand for a T2 lane
- Risk that the benefits will not warrant the expenditure as a result of the risk noted above.
- As there is no physical moveable barrier dictating the flush median or tidal flow lane, therefore drivers who are new to the country or city may not understand the rules and not adhere to the displayed restrictions. Vehicles that disobey the signs and run up the flush median to avoid queueing, compromising safety, increasing congestion and road user satisfaction.
- With the lack of a physical barrier, it is probable that the posted speed limit would have to decrease from 'open road' to 50kmph which will increase vehicle travel times along SH20b.
- Significant safety risk
- Part of SH20B is located within AIAL's property boundary therefore requiring their agreement to install tidal flow up to the Pukaki Bridge and additional signage on the Western side of the bridge alerting drivers. If agreement cannot be reached the length of the tidal flow section will have to be reduced.
- Side accesses pose a risk to tidal flow lanes and therefore the number of side access roads would need to be restricted.

⁹ <http://www.scarlatti.co.nz/2-general/76-articles-fcarparkingprices>

¹⁰ Jou, R.-C., Hensher, D. A., & Hsu, T.-L. (2011). Airport ground access mode choice behaviour after the introduction of a new mode: A case study of Taoyuan International Airport in Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, Vol. 47, No. 3, 371-381.

Infrastructure requirements

Minor widening of the existing shoulders may be required to accommodate buses and freight along SH20B. Tidal flow will require installation of overhead gantries, in road LED lights as well as beginning and end signage to alert drivers to the traffic feature, along with cameras for operational and safety monitoring.

Effectiveness

- The effectiveness of this intervention is dependent on the vehicles considered to be SPVs and hence able to use the SPV lanes.
- This intervention will be effective in providing improved journey times for buses, as they will be able to bypass queued traffic. However, buses will still have to merge back into the general traffic streams at the bottlenecks and as a result, there will be increased delay for general traffic.
- This intervention may increase the attractiveness of public transport as general traffic vehicles will observe buses and shuttles being able to bypass queues, potentially encouraging a mode shift.
- A recent trial by Auckland Transport of dynamic lane controls along Whangaparaoa has seen a positive impact on the traffic during the times that the dynamic lane is used. Travel times and queuing on nearby roads have reported improvement as well¹¹.
- Although these treatments will provide an additional capacity for approximately 1000SPV's on SH20B, this increased capacity is still not adequate to support the 2046 ARTi11 demands. In addition, the constraints on the network are caused by bottlenecks at the junctions, particularly Puhinui Interchange and Pukaki Creek Bridge.
- Implementation of the moveable physical barrier is very effective in reducing fatalities and improving road safety. In a 1992 report¹² on the implementation of the moveable barrier along the harbour bridge in 1990, it was found that head-on fatal accidents had been eliminated and found the moveable barrier to be "most effective".

Conclusion

This may be effective with AIAL support and if capacity is provided for SPVs on the neighbouring network. This intervention will be considered alongside infrastructure upgrades to Puhinui Interchange and the airport road network.

3.2 Qualitative assessment of infrastructure interventions

3.2.1 C1 High Investment – SH20A

Infrastructure requirements for this intervention include:

- Minor widening of the existing shoulders will be required to accommodate buses and freight along SH20A.
- Widen Kirkbride Road interchange underpass.
- Introduce a southbound motorway connection between Kirkbride Road and SH20 – alteration, relocation or removal of Bader Drive bridge and connecting off and on-ramps.

¹¹ <https://at.govt.nz/about-us/news-events/initial-dynamic-lane-control-trial-results-positive/>

¹² THE MOVEABLE LANE BARRIER ON AUCKLAND'S HARBOUR BRIDGE: PROBLEMS, SOLUTIONS AND FEATURES (1992) - <http://arbknowledge.com>

Feasibility

- The SH20 widening is considered relatively complex but requires nothing unusual, while the SH20A widening and SH20A/SH20 connection are considered to have moderately complex feasibility considerations with some elements having greater complexity that are still manageable. Overall, this option is considered feasible as while the infrastructure requirements are relatively complex, they require nothing unusual,

Risks and constraints

- Commercial property impacts and high associated costs related to widening the SH20A corridor.
- Risk that the benefits will not warrant the expenditure because of the risk noted above.
- Negative impacts on places of heritage and on Maori communities and wellbeing.

Effectiveness

- The effectiveness of this intervention is dependent on the vehicles considered to be SPVs and hence able to use the SPV lanes.
- This option will be effective in providing improved journey times for buses along SH20A and SH20, as buses will be able to bypass queued traffic.
- This option may increase the attractiveness of public transport as general traffic vehicles will observe buses and shuttles being able to bypass the queue, potentially encouraging a mode shift.

Conclusion

This may be effective in improving journey times for buses, freight and SPV along SH20A and SH20. However, it does not directly support A2B as SH20B remains as existing (no provision for MRT). There are also significant risks, constraints and impacts involved with building new infrastructure that would need to be mitigated.

3.2.2 C2 High Investment – SH20B

The infrastructure requirements for this intervention include:

- Widening carriageway along SH20B to four lanes with MRT – widening along existing alignment is assumed to be on the south side due to current land use including Memorial Gardens on the north side.
- Widening of existing or new Pukaki Bridge
- Introduce a motorway connection between SH20B and SH20.

Feasibility

- The SH20 widening is considered relatively complex but requires nothing unusual, while the SH20B widening (motorway) is considered to have moderately complex feasibility considerations with some elements having greater complexity that are still manageable. Overall, this option is considered feasible as while the infrastructure requirements are relatively complex, they require nothing unusual,

Risks and constraints

- Commercial property impacts and high associated costs related to widening the SH20B corridor.
- Risk that the benefits will not warrant the expenditure because of the risk noted above.

- Negative impacts on places of heritage and on Maori communities and wellbeing.
 - The significance of the area is formally recognised in the Eastern Access Agreement (1991), which acknowledged that the construction of the proposed eastern access approach road and bridge to the Airport (Pukaki Bridge) would impact the ancestral land and waters, and cultural traditions of the people of Te Waiohū Pukaki. Further development of this road corridor is constrained by this agreement.
- Introducing a new SH20B/SH20 connection may result in the need to acquire land or relocate the interchange. The connected on and off ramps may require alterations or possible closure of one of these interchanges may be necessary.

Effectiveness

- The effectiveness of this intervention is dependent on the vehicles considered to be SPVs and hence able to use the SPV lanes.
- This option will be effective in providing improved journey times for buses along SH20B and SH20, as buses will be able to bypass queued traffic.
- This option may increase the attractiveness of public transport as general traffic vehicles will observe buses and shuttles being able to bypass the queue, potentially encouraging a mode shift.

Conclusion

This may be effective in improving journey times for buses, freight and SPV along SH20B and SH20. It also directly supports A2B by providing for MRT along SH20B. However, there are also significant risks, constraints and impacts involved with building new infrastructure that would need to be mitigated.

3.2.3 C3 High Investment – SH20A & SH20B

Infrastructure requirements for this intervention include:

- Minor widening of the existing shoulders will be required to accommodate buses and freight along SH20A.
- Widen Kirkbride Road interchange underpass.
- Introduce a southbound motorway connection between Kirkbride Road and SH20 – alteration, relocation or removal of Bader Drive bridge and connecting off and on-ramps.
- Widening carriageway along SH20B to four lanes with MRT – widening along existing alignment is assumed to be on the south side due to current land use including Memorial Gardens on the north side.
- Widening of SH20 to six lanes.
- Widening of existing or new Pukaki Bridge.
- Introduce a motorway connection between SH20B and SH20.

Feasibility

- The SH20 widening is considered relatively complex but requires nothing unusual, while the SH20B widening (motorway) is considered to have moderately complex feasibility considerations with some elements having greater complexity that are still manageable. Overall, this option is considered feasible as while the infrastructure requirements are relatively complex, they require nothing unusual,

Risks and constraints

- Commercial property impacts and high associated costs related to widening the SH20A and SH20B corridors.
- Risk that the benefits will not warrant the expenditure because of the risk noted above.
- Negative impacts on places of heritage and on Maori communities and wellbeing.
 - The significance of the area is formally recognised in the Eastern Access Agreement (1991), which acknowledged that the construction of the proposed eastern access approach road and bridge to the Airport (Pukaki Bridge) would impact the ancestral land and waters, and cultural traditions of the people of Te Waiohūa Pukaki. Further development of this road corridor is constrained by this agreement.
- Introducing a new SH20B/SH20 connection may result in the need to acquire land or relocate the interchange. The connected on and off ramps may require alterations or possible closure of one of these interchanges may be necessary.

Effectiveness

- The effectiveness of this intervention is dependent on the vehicles considered to be SPVs and hence able to use the SPV lanes.
- This option will be effective in providing improved journey times for buses along SH20A, SH20B and SH20, as buses will be able to bypass queued traffic.
- This option may increase the attractiveness of public transport as general traffic vehicles will observe buses and shuttles being able to bypass the queue, potentially encouraging a mode shift.

Conclusion

This may be effective in improving journey times for buses, freight and SPV along SH20A, SH20B and SH20. It also directly supports A2B by providing for MRT along SH20B. However, there are also significant risks, constraints and impacts involved with building new infrastructure that would need to be mitigated.

3.2.4 C4 Moderate investment – SH20A & SH20B

Infrastructure requirements for this intervention include:

- Introduce a southbound expressway connection between Kirkbride Road and SH20 – alteration, relocation or removal of Bader Drive bridge and connecting off and on-ramps.
- Widening carriageway along SH20B to four lanes with MRT – widening along existing alignment is assumed to be on the south side due to current land use including Memorial Gardens on the north side.
- Widening of SH20 to six lanes.
- Widening of existing or new Pukaki Bridge.
- Introduce a motorway connection between SH20B and SH20.

Feasibility

- The SH20 widening and SH20B (expressway) are considered relatively complex but require nothing unusual. Overall, this option is considered feasible as while the infrastructure requirements are relatively complex, they require nothing unusual,

Risks and constraints

- Commercial property impacts and high associated costs related to widening the SH20B corridor.
- Risk that the benefits will not warrant the expenditure because of the risk noted above.
- Negative impacts on places of heritage and on Maori communities and wellbeing.
 - The significance of the area is formally recognised in the Eastern Access Agreement (1991), which acknowledged that the construction of the proposed eastern access approach road and bridge to the Airport (Pukaki Bridge) would impact the ancestral land and waters, and cultural traditions of the people of Te Waiohū Pukaki. Further development of this road corridor is constrained by this agreement.
- Introducing a new SH20B/SH20 connection may result in the need to acquire land or relocate the interchange. The connected on and off ramps may require alterations or possible closure of one of these interchanges may be necessary.

Effectiveness

- The effectiveness of this intervention is dependent on the vehicles considered to be SPVs and hence able to use the SPV lanes.
- This option will be effective in providing improved journey times for buses along SH20A, SH20B and SH20, as buses will be able to bypass queued traffic.
- This option may increase the attractiveness of public transport as general traffic vehicles will observe buses and shuttles being able to bypass the queue, potentially encouraging a mode shift.

Conclusion

This may be effective in improving journey times for buses, freight and SPV along SH20A, SH20B and SH20. It also directly supports A2B by providing for MRT along SH20B. However, there are also significant risks, constraints and impacts involved with building new infrastructure that would need to be mitigated.

3.3

3.3 Comparative results

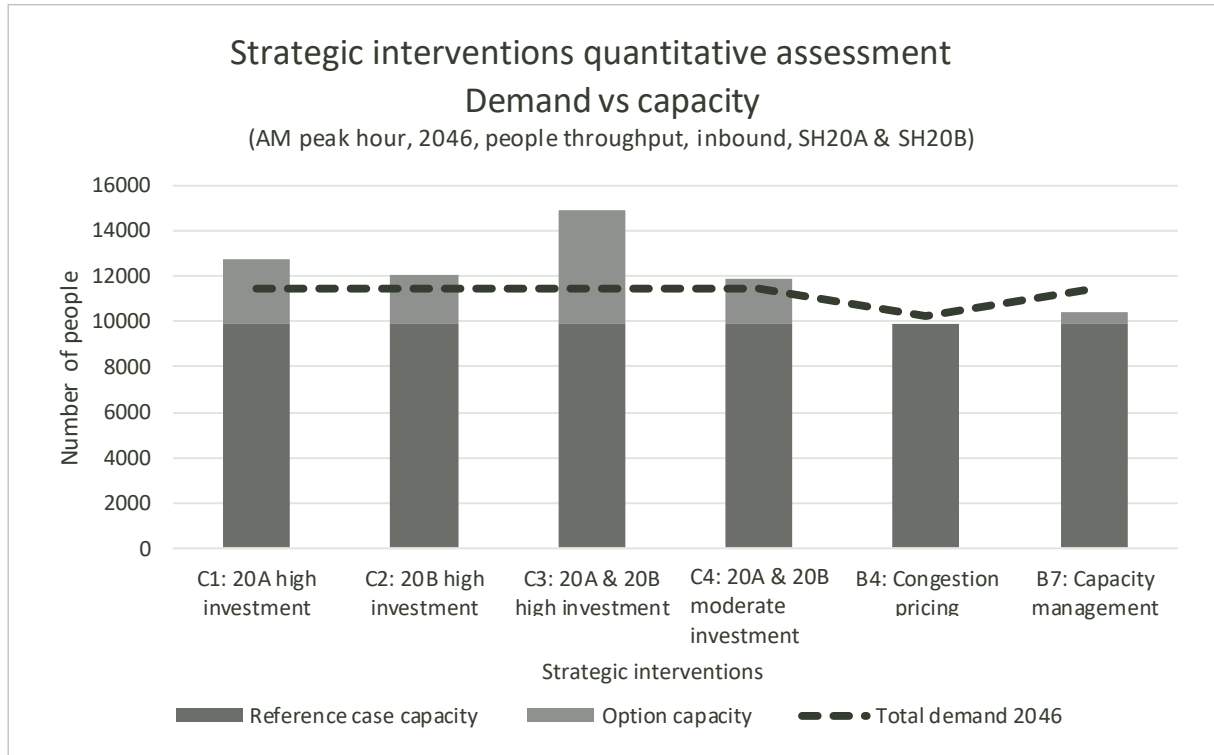


Figure 12: Comparative demand vs. capacity

- C3 noticeably performs better than all other assessed interventions
- B4 and B7 do not sufficiently provide for future demand
- C1, C2 and C4 have similar performances overall.

4 Summary of results

The results of the sieve process were used to better understand the differences between the interventions in relation to feasibility, risks and effectiveness. One non-infrastructure intervention (B2) was discarded following the sieve process, while all four infrastructure interventions (C1, C2, C3 and C4) were retained as the foundation of the long list assessment options. It is acknowledged that the options that performed best were those that invested in both corridors approaching the Airport.

The remaining non-infrastructure interventions (B1, B3, B4, B5, B6 and B7) were retained for further consideration, however in isolation, they were deemed unable to fulfil the investment objectives of the project as they do not provide the infrastructure requirements needed to meet future demand. A number of these non-infrastructure interventions will be incorporated into the preferred option and are discussed in more detail within the business case.

Due to the interdependent public transport and local road opportunity focus of the projects, the 20Connect infrastructure interventions have primarily considered additional state highway connections and capacity, as well as multi-modal infrastructure to directly enable MRT between the Airport and Botany and the Airport and CBD. It is intended that the 20Connect interventions will complement public transport and walking and cycling facilities with an appropriate level of roading investment to achieve behaviour change, ensuring the effectiveness of the MRT interventions and optimisation of infrastructure investment.

The infrastructure interventions are all deemed to be feasible and align with the investment objectives by providing additional capacity along state highway corridors to meet future demand, improve journey reliability and support active modes. They also facilitate the operation of interdependent projects such as MRT between the Airport and Botany/CBD. However, there are significant risks, constraints and impacts involved with building new infrastructure that will need to be mitigated.

Approvals:

	Name	Title	Signature	Date
Authored by:		Consultant, Infrastructure Advisory		2020-05-20
		Consultant, Infrastructure Advisory		
Reviewed by:		Associate		2020-05-20

Technical Note

To	NZ Transport Agency	From	20Connect Project Team
Copy		Reference No:	501094-4401-TEC-KK-0010
Date	2020-05-08	Pages (including this page)	20
Subject	Transport Planning Longlist Assessment		

Transport planning methodology

This report details the transport planning approach to long list option assessment.

The options were assessed according to their performance in year 2046, which aligns with a 30-year assessment period as per the Transport Agency's requirements. The Auckland Macro Strategic Model (MSM) was utilised to estimate future transport demand for year 2046.

The MSM is a multi-modal strategic transportation model commonly used to assess transport system investment in the Auckland region. The model is implemented in the EMME3 modelling suite and is developed and maintained by the Auckland Forecasting Centre (AFC), an internal Auckland Transport modelling team. For the purpose of this projects long list assessment, four different scenarios were developed for modelling.

The MSM produced traffic volume outputs for each scenario. These were then used for a road network assessment with the SATURN model suite, which enables modelling of road sections at a mesoscopic level.

Figure 1 illustrates the extent and relationship between the MSM and SATURN model areas, the purple is the road network of MSM and the SATURN as the insert boxed section.

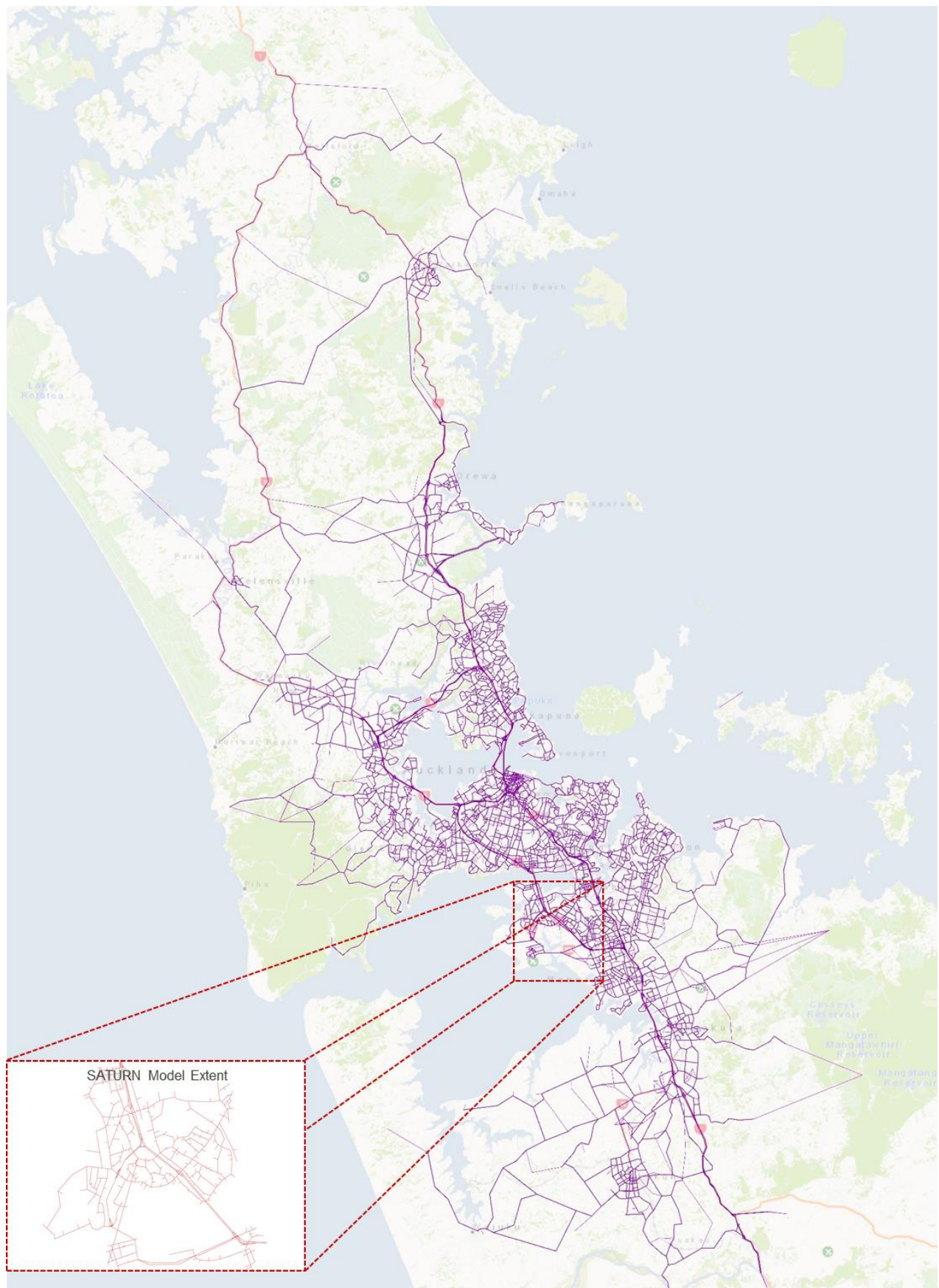


Figure 1: MSM and SATURN extent and relationship

1.1 Macro Strategic Model (MSM) Options

The following higher tier model scenarios were tested in the MSM:

- **Scenario 1:** MSM 2046 baseline network and demand
- **Scenario 2:** High public transport (PT) investments
- **Scenario 3:** High road investment
- **Scenario 4:** High public transport (PT) and road investment

These modelled scenarios were based on the 2046 network and demand model developed for the Auckland Transport Alignment Project (ATAP). Scenarios were approved in consultation with the project partners.

The modelling of these scenarios demonstrates the impact of investment on one travel mode (e.g. PT or Road) compared to a mixed approach on the transport network.

The origin, destination and travel demand of trips was kept constant for all scenarios. However, the demand assigned to each travel mode fluctuates between the scenarios due to different infrastructure and operational parameters assumed with each scenario. For example, high PT, such as implementing a rapid transit PT service, will result in more people in buses and trains than a high road investment scenario only.

The transport treatment included in each scenario is provided in Table 1.

Table 1: Strategic model scenario summary

Infrastructure elements	Scenario 1 2046 baseline	Scenario 2 High PT	Scenario 3 High road	Scenario 4 High PT & road
SH20 widening (Mangere Bridge to Mangere Town Centre)	✗	✗	✓	✓
SH20A widening (Mangere Town Centre to Tom Pearce)	✗	✗	✓	✓
SH20B widening (Manukau to Airport via SH20B)	✗	✗	✓	✓
Mass Rapid Transit (CBD to Airport)	✗	✓	✗	✓
Bus improvements (Airport to Manukau to Botany)	✗	✓	✗	✓
SH20A to SH20B connection	✗	✗	✓	✓

1.1.1 MSM Modelling results

The MSM provided insights into the following transport data:

- Airport precinct traffic volumes (general traffic and public transport)
- Airport precinct mode share rates
- Accessibility
 - Population
 - Jobs
 - Tertiary education facilities and hospitals

These are discussed below.

Traffic volumes and mode share

One objective of the project is to increase accessibility to the airport, including its precincts, whilst enabling a more balanced mode share.

Figure 2, Figure 3 and Figure 4 compare scenario traffic volumes (person trips) within the MSM study area for the AM, inter (IP) and PM peak (2 hour) periods respectively. They show the impact of focusing on one travel mode compared to an investment approach which includes both PT and road.

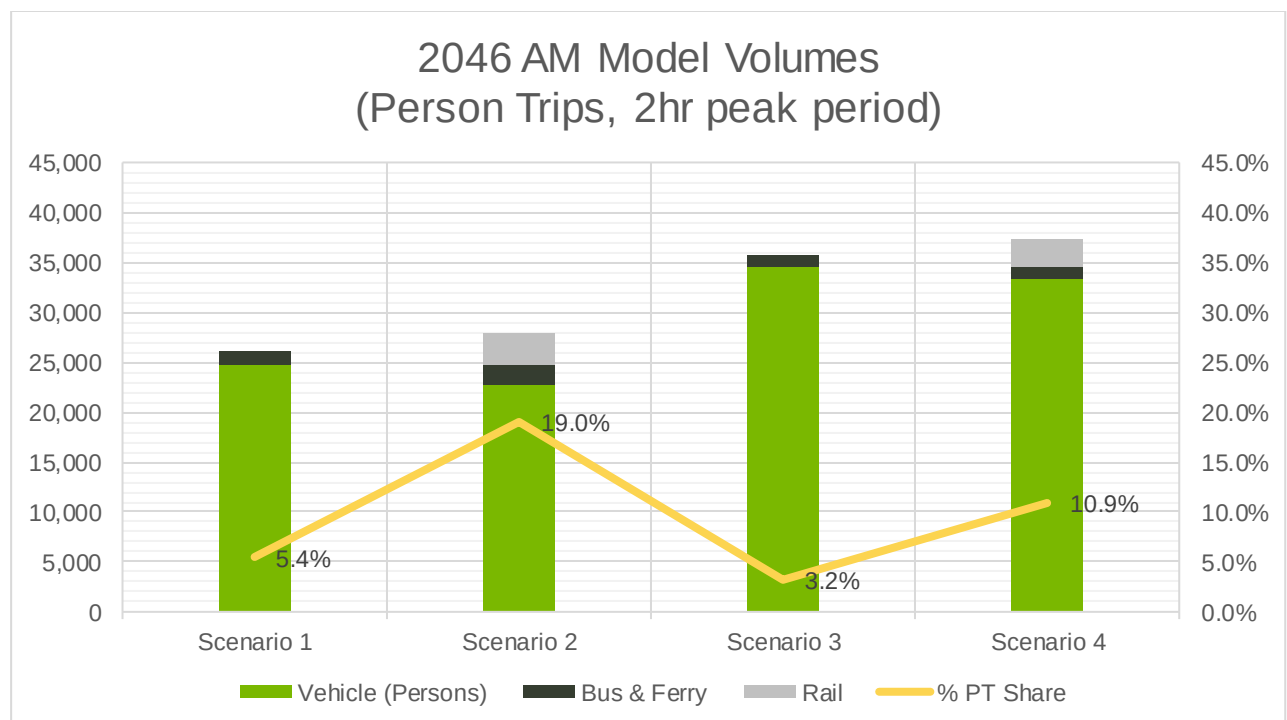


Figure 2: Airport precinct traffic demand (person trips) – AM peak

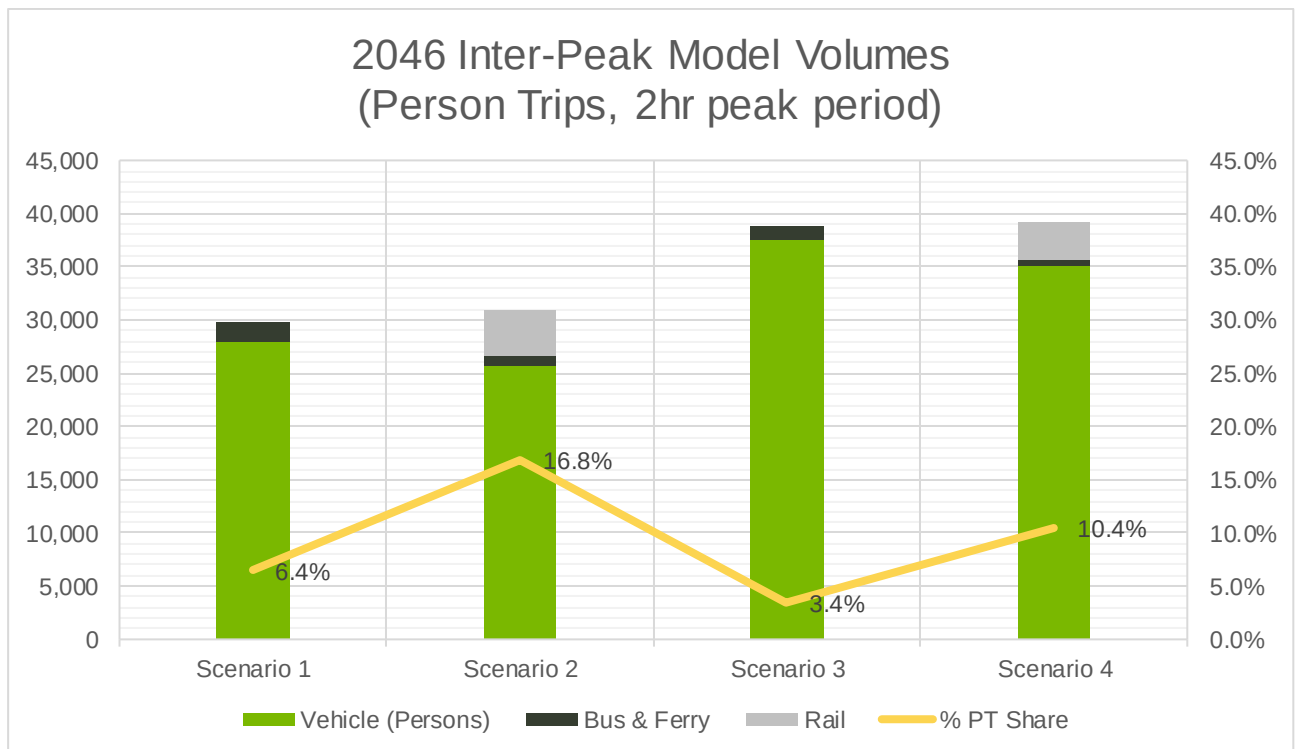


Figure 3: Airport precinct traffic demand (person trips) - Inter-peak

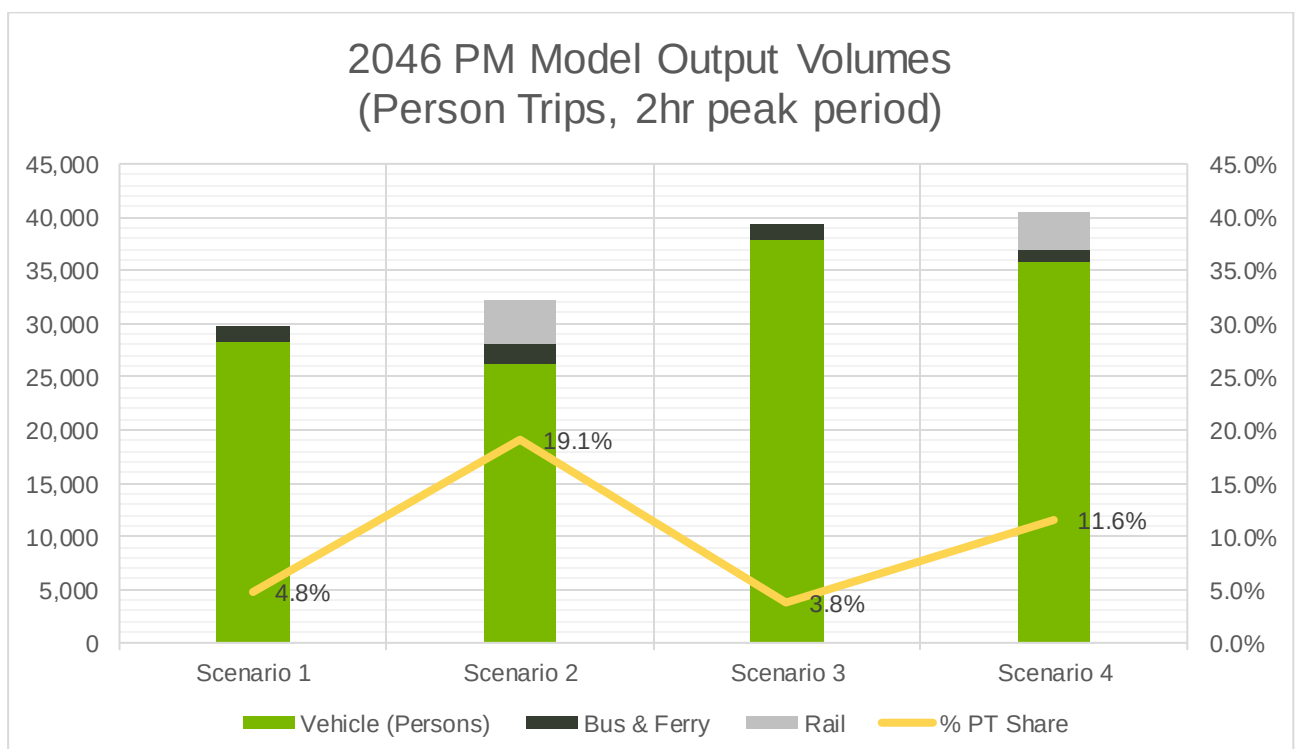


Figure 4: Airport precinct traffic demand (person trips) - PM peak

The model results indicate that any transport system investment will improve accessibility, illustrated by the significant increase in trip volumes compared to the baseline (Scenario 1).

The results demonstrate that high public transport investment can improve PT mode share from approximately 5% in the baseline to just under 20% during the AM and PM peak periods. Road investment increases the amount of people able to access the airport precinct. In contrast, Scenario 2 indicates that public transport investment can potentially reduce vehicle demand while still increasing access.

Scenario 3 indicates that road improvements can reduce public transport mode share.

Scenario 4 shows that, when combined, high public transport and road investments result in the highest number of people trips within the airport precinct

Accessibility

The accessibility assessments were carried out using ArcGIS Network Analyst extension (service area analysis module), using the MSM model output shapefiles as the basis for the GIS network dataset.

For each of the scenarios, the following outputs for 2046 in both the AM and PM peak periods were estimated:

- 30-minute driving catchment areas from the Airport
- Population within this catchment
- Employment opportunities in the catchment

Each 30-minute catchment output is contained within the MSM model road network.

The catchments were generated as follows:

- Creating a 'network dataset' in ArcGIS by adopting vehicle travel times from the MSM outputs
- For each scenario:
 - Creating a 30-minute driving catchment from the Airport outwards
 - Relating each catchment with GIS information regarding population and job estimates
 - Estimating the population and number of jobs accessible, assuming a uniform distribution of population and jobs within each catchment, by multiplying the population and number of jobs by the percentage of catchment land area covered.

The catchment of the PM peak hours was found to be significantly smaller than the AM peak catchment, indicating high congestion in the evening peak period. The PM catchment is regarded as a critical scenario for accessibility assessment, since it has the smallest catchment area from the airport precinct.

The 30-minute catchment for each scenario during PM peak hours is summarised below in Figure 5. Comparing the size of the catchments provides insight into which areas will be deprived of this timely half-hour area of access to the airport, and its surrounding jobs, in 2046.

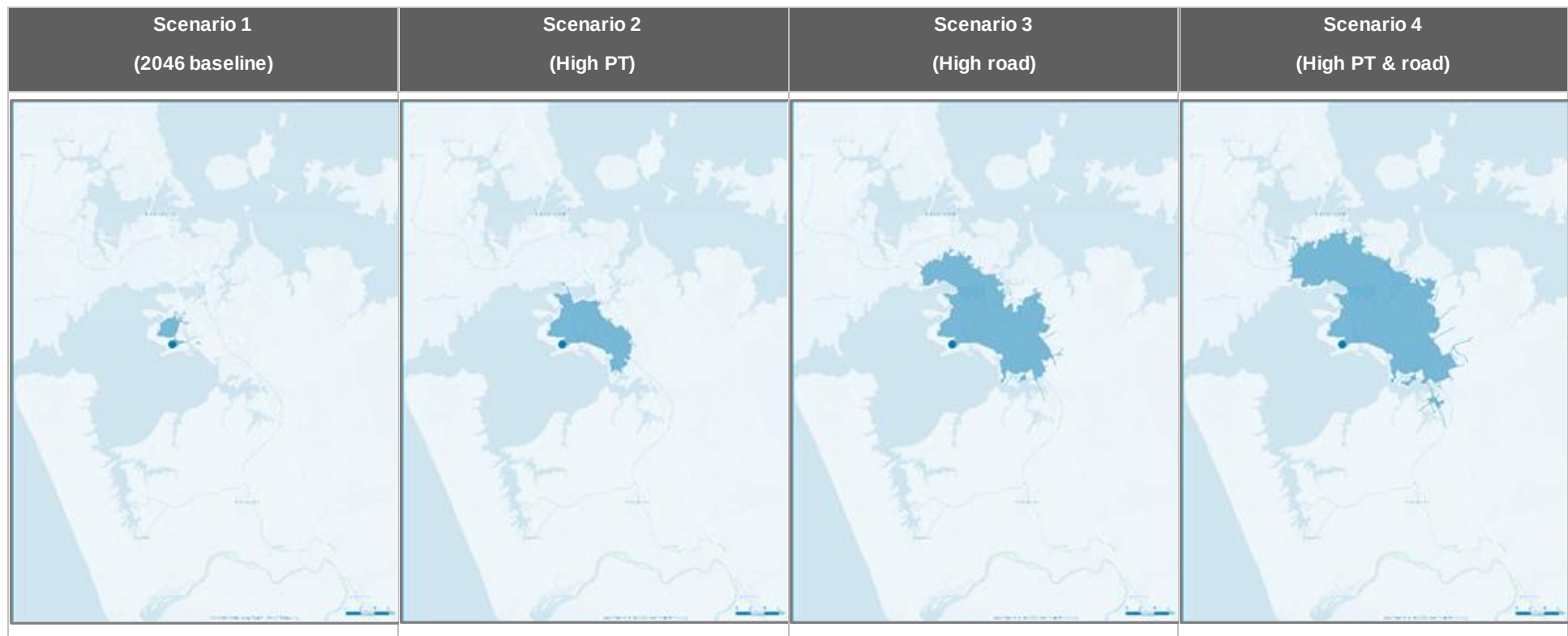


Figure 5: 30-minute driving catchments for each scenario (PM peak)

Figure 6 shows the population that live within a 30-minute PM peak drive from the airport for each scenario.

Figure 7 shows the amount of job opportunities within a 30-minute PM peak drive from the airport for each scenario.

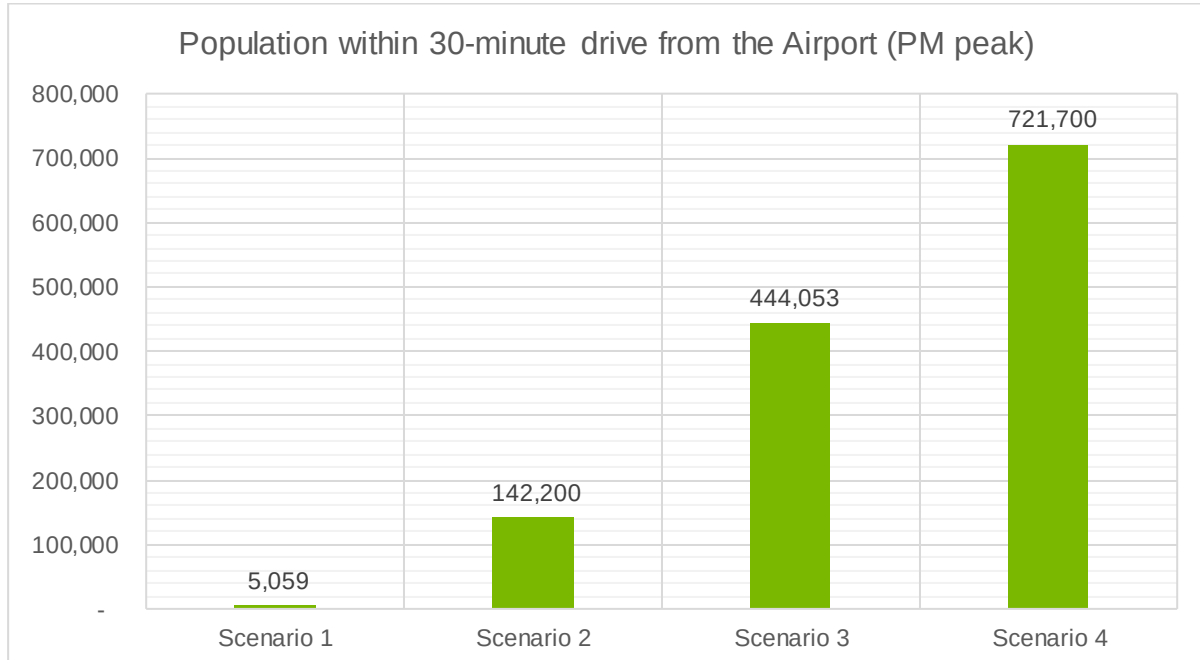


Figure 6: Population within 30-minute catchment of the Airport for each scenario (PM peak)

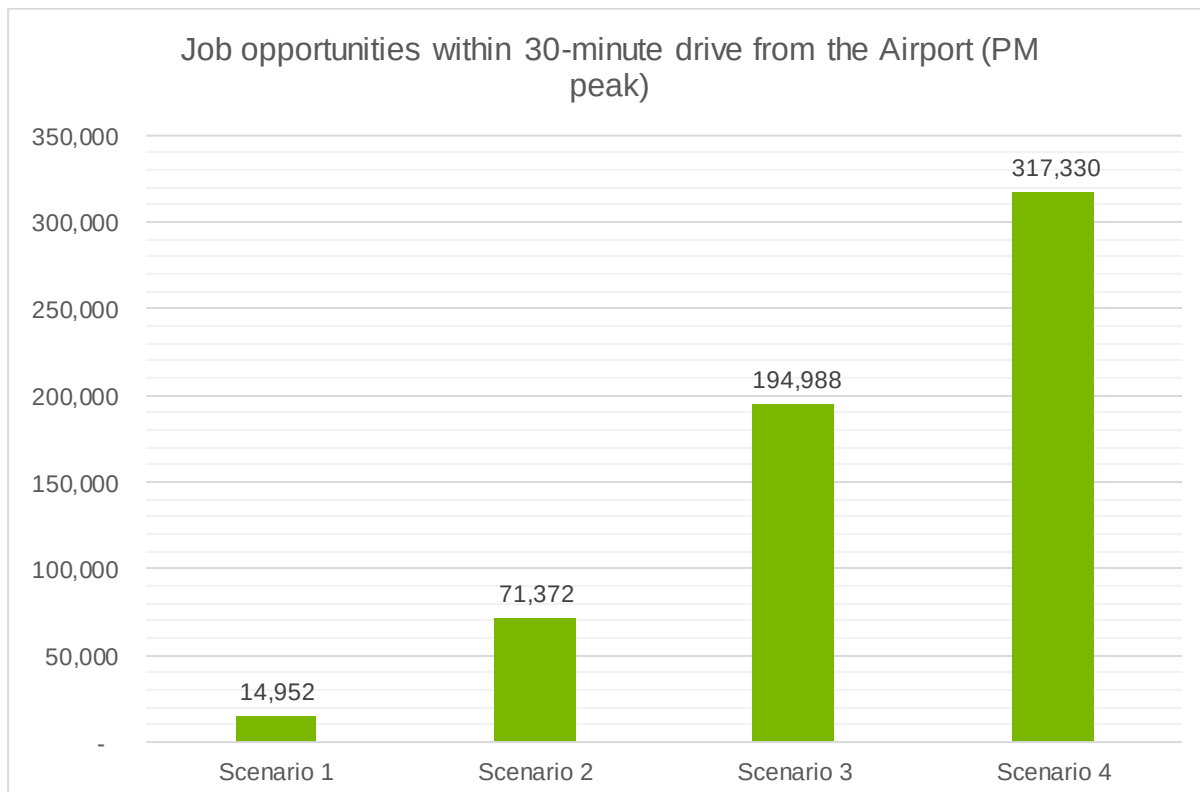


Figure 7: Job opportunities within 30-minute catchment of the Airport for each scenario (PM peak)

The catchment analysis indicates that the airport will be significantly more accessible to a larger part of Auckland with Scenario 4, following investment in both public transport and roads (general traffic and freight capacity).

As Scenario 4 generates the highest traffic volumes. These volumes were used in the SATURN model as the base demand for more refined option assessment as described in the following section of this technical note.

1.2 SATURN modelling option assessment

Utilising the traffic volumes generated within the MSM strategic model for Scenario 4, State Highway and local road network modelling was carried out in the SATURN modelling suite. SATURN is a mesoscopic highway assignment modelling suite and is capable of strategic highway modelling; including simulation of intersection operations, bus lanes, and also modelling queue backup at intersections in congested networks. SATURN was therefore best suited for the assessment of each long list options' impact on the road network.

Through consultation with project partners the following options were assessed in the SATURN model:

- Base Case – Do minimum
- Option C1 – High investment in SH20A
- Option C1b – High investment in SH20A and SH20B converted to rapid transit corridor. Note that this variation of Option C1 was the worst performing of all options so was not carried forward as a long list option.
- Option C2a – High investment in SH20B with south facing ramps only
- Option C2b – High investment in SH20B with all ramps
- Option C3 – High investment in SH20A and SH20B
- Option C4 – Moderate investment in SH20A and SH20B

The specific infrastructure treatments that were assessed in the local area traffic model for each of the long list options described above are summarised below in Table 2.

Table 2: Local area (SATURN) modelling scenarios

Corridor	Treatment	Option C1*	Option C2a	Option C2b	Option C3	Option C4
SH20A	SH20A widen to 6 lanes	✓	✗	✗	✓	✗
	SH20A to SH20 south connection - over	✓	✗	✗	✓	✓
SH20B	SH20B 4 lane (online at-grade)	✗	✗	✗	✗	✓
	SH20B 4 lane (offline grade separated)	✗	✓	✓	✓	✗
	SH20 to SH20B (south-facing ramps only)	✗	✓	✗	✓	✗
	SH20 to SH20B (all ramps)	✗	✗	✓	✗	✗
SH20	SH20 widening (SH20A to SH20B)	✓	✓	✓	✓	✓

Corridor	Treatment	Option C1*	Option C2a	Option C2b	Option C3	Option C4
	SH20 widening (SH20B to the south)	✗	✓	✓	✓	✓
	SH20 widening (SH20A to the north)	✓	✓	✓	✓	✓

*Option C1b includes the same treatments with the addition of SH20B conversion to a rapid transit corridor

Transport planning – Long List Options Key Performance Indicator assessment

The Key Performance Indicators (KPIs) used for the long list assessment were developed in workshops in cooperation with the client and based on the project's investment objectives.

Transport model outputs from the SATURN model provide appropriate performance metrics to assess each KPI by either directly taking outputs from the SATURN model or as a qualitative assessment of the model outputs.

This section explains which model outputs have been used to assess each KPI.

Table 3 shows the rating system the KPIs were scored against.

Table 3: KPI scoring

Rating	Description
	Significantly positive
	Moderately positive
	Minor positive
	Neutral
	Minor adverse
	Moderately adverse
	Significantly adverse

2.1 KPI 1: Capacity in the system vs forecast demand

Table 4: KPI 1 framework

Discipline	Problem	Benefit	Investment Objectives	KPI 1	KPI measures
Transport Planning	Inadequate transport system capacity, connections, and management to/from within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	To improve the reliability and resilience of the transport system	Capacity vs forecast demand	Degree of saturation of key links and intersections

The degree of saturation is the most applicable measure to assess each option's ability to cater for future demand.

The degree of saturation is defined as the arrival flow volume on a road section divided by the capacity of the road section, this is also known as "volume over capacity" (V/C) ratio. Road sections with a degree of saturation greater than 85% (of the road section capacity) were considered, and the number of highly saturated road sections under each option is shown in the figures below for the AM, inter-peak and PM peaks respectively. At degrees of saturation above 85% the road network is at high risk of becoming grid locked for road users.

Figure 8 and Figure 9 show the degree of saturation for each option and the Base Case during AM and PM peak hours respectively.

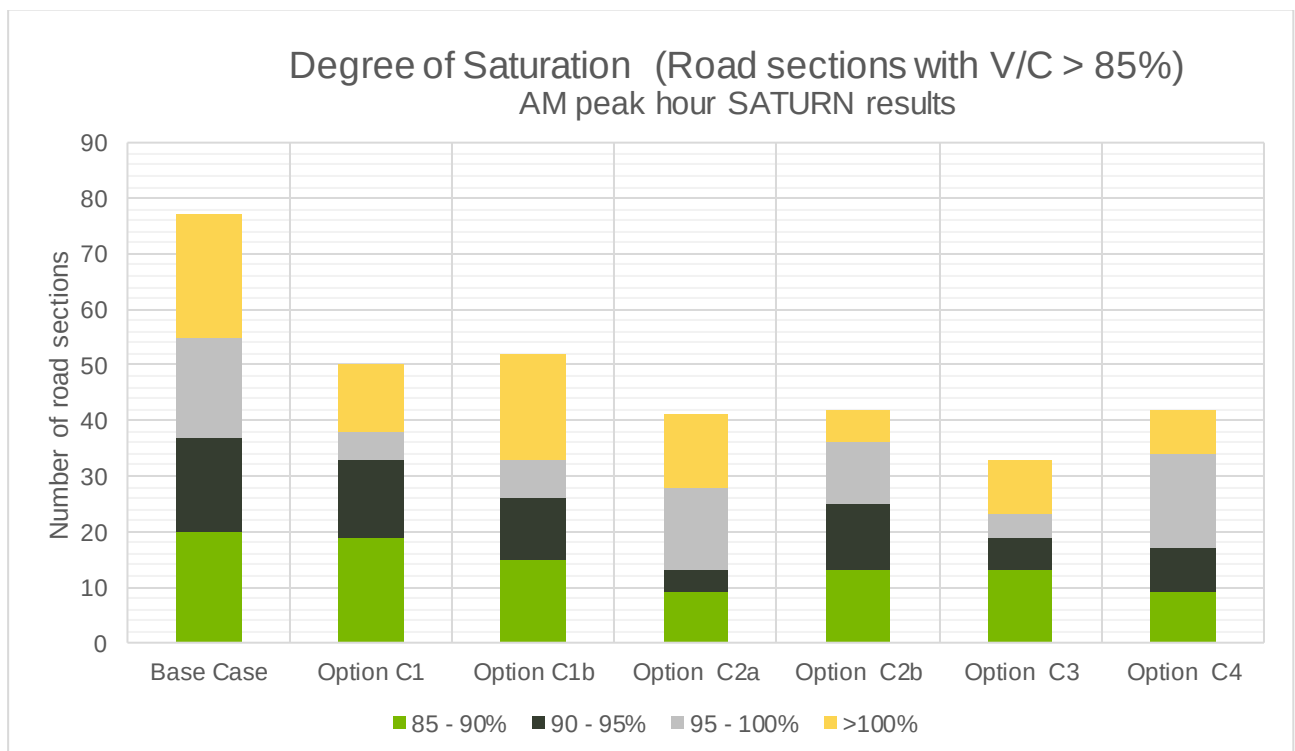


Figure 8: Degree of saturation assessment (AM peak)

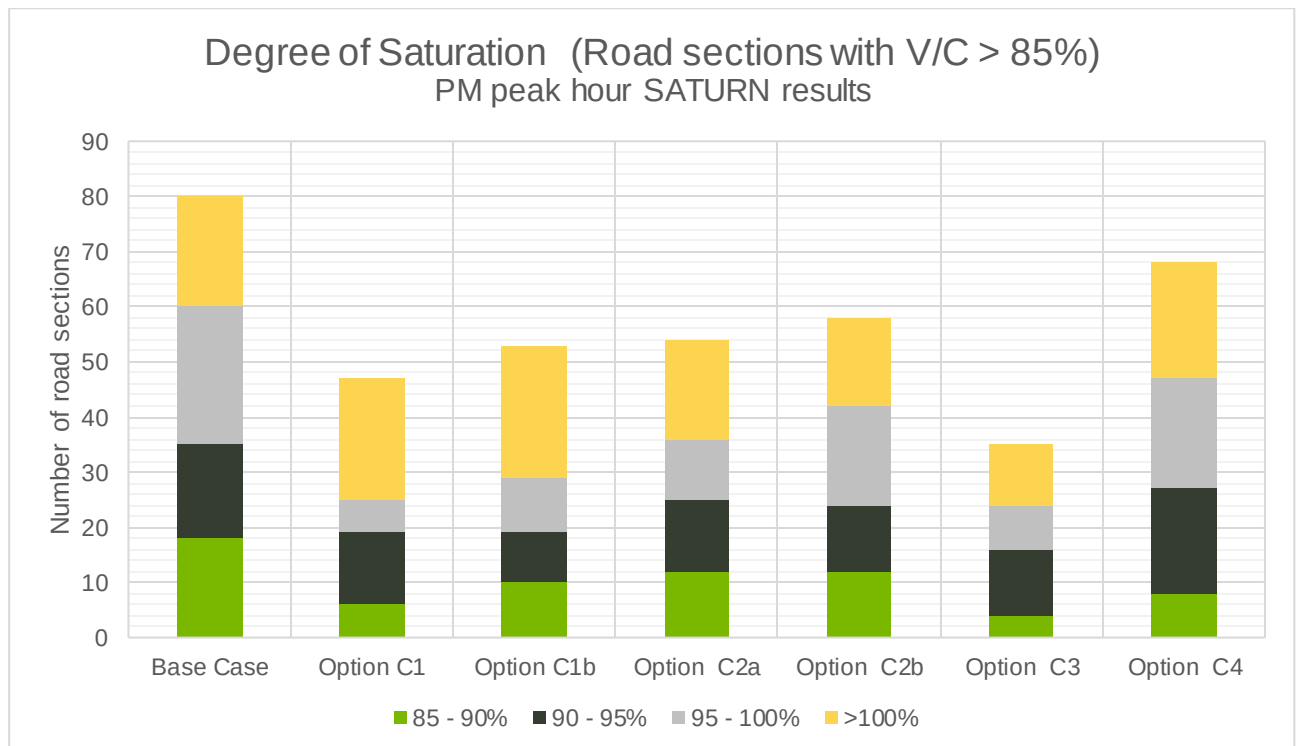


Figure 9: Degree of saturation assessment (PM peak)

The analysis indicates that most long list options are expected to perform better than the Base Case as they will have lower total number of road sections with high saturation.

Figure 8 and Figure 9 demonstrate that the degree of saturation varies significantly between AM and PM peak for each option. This effect was considered when scoring each option and adjusted for by using the sum of the AM and PM V/C values.

Table 5 shows the KPI 1 score. Option C3 yields the lowest count of saturated road sections across all time periods, and as such is the most highly rated.

Table 5: Scoring overview of KPI 1

		Option C1	Option C1b	Option C2a	Option C2b	Option C3	Option C4
KPI 1	KPI measures						
Capacity vs forecast demand	Degree of saturation of key links and intersections						

2.2 KPI 2: Separation of movements and amount of conflict in the system

Table 6: KPI 2 framework

Discipline	Problem	Benefit	Investment Objectives	KPI 2	KPI measures
Transport Planning	Inadequate transport system capacity, connections, and management to/from/within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	To improve the reliability and resilience of the transport system	Separation of movements and amount of conflict in the system	Number and performance of grade separations, grade junctions and intersections

To assess the separation of movements and the amount of conflict for each option the number of grade separations were counted, and the performance of the network qualitatively assessed.

Factors that influenced the score for KPI 2 include:

- The number of grade separated intersections
- The additional connections between state highways such as the one between SH20 and SH20A
- The network performance of each option when compared to the Base Case for both AM and PM peaks

To visualise the impact on the network performance maps showing the degree of saturation for all road sections in the study area were extracted from the SATURN model. Road sections and intersections have been colour-coded, reflecting an increase or decrease in network saturation compared to the Base Case. All options were compared to the base case number of grade separations and modelled grade of saturation.

Figure 10 shows the degree of saturation of road sections as determined by the SATURN model for the Base Case. Grade separations are circled and the road sections with a saturation above 85% are marked in shades of red.

Figure 11 is an example of how options were assessed. It illustrates the number of grade separations and the grade of saturation for Option C1. The aggregate of these factors forms the score. Option C1 improved the overall situation while worsening the network performance in some of the road sections (i.e. northern SH20 and southern SH20b). An overview of the KPI 2 scores of all options is given in Table 7.

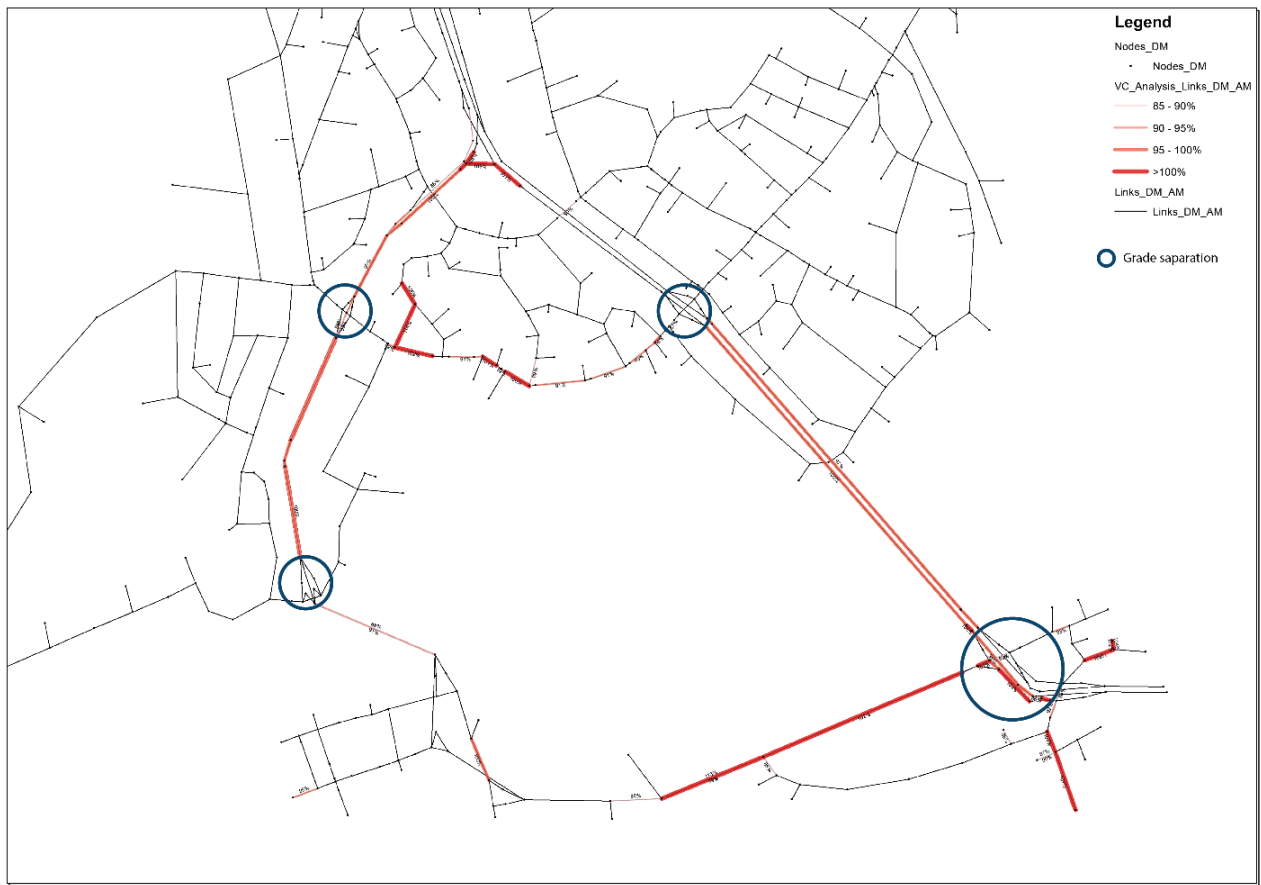


Figure 10: Degree of saturation AM peak Base Case

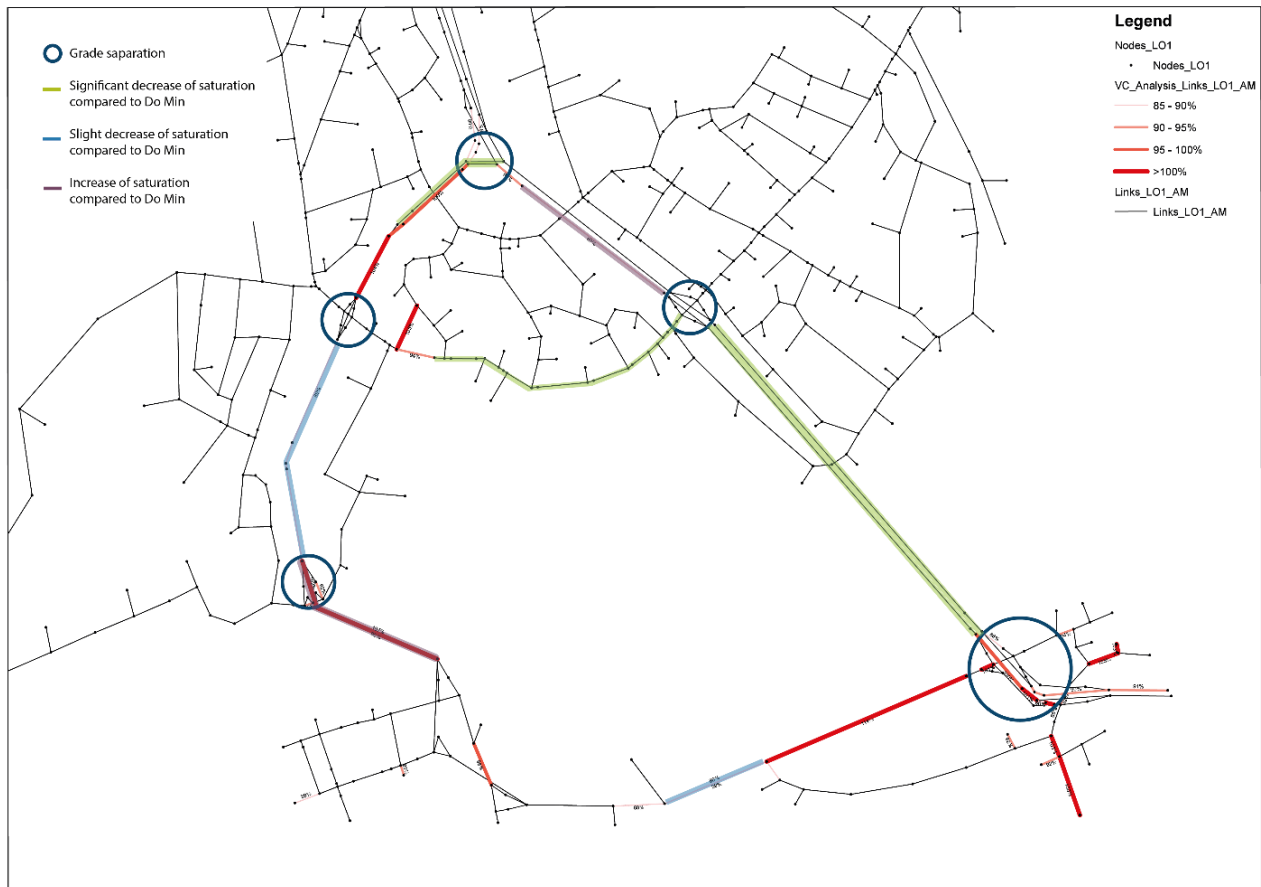


Figure 11: Assessment of degree of saturation for Option 1 compared to Base Case (AM peak)

Table 7: Scoring overview of KPI 2

		Option C1	Option C1b	Option C2a	Option C2b	Option C3	Option C4
KPI 2	KPI measures						
Separation of movements and amount of conflict in the system	Number and performance of grade separations, grade junctions and intersections						

2.3 KPI 3 and 4: Population and job accessibility

Table 8: KPI 3 and 4 framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Transport Planning	Lack of reliable and readily accessible travel choices limits access to the airport, and surrounding area, for both customers and the reliable movement of people and goods	A more prosperous Airport Precinct area, Auckland and New Zealand.	To improve economic performance of the airport area, Auckland and New Zealand	KPI 3: Population with Access to Airport	Population within 30-minute trip during peak hours 2046
				KPI 4: Job Accessibility	Jobs within 30-minute trip during peak hours. Correlated with deprivation and Do Min levels of access

Outputs from the MSM and the SATURN model were used to assess the accessibility of each option.

MSM outputs indicated that Scenario 4, a combination of high public transport and road investment, would have the largest catchment during the PM peak. The PM peak yields the smallest catchment area, with greater congestion the PM peak represents the “worst case” transport times. The level of infrastructure investment in scenario 4 of the MSM model and Option C3 in the SATURN model are similar; this combined with having the largest catchment means C3 is a good baseline for measuring KPI 3 and 4. The average PM peak travel times were used for the KPI scoring.

Option C3 and Scenario 4 closely represent each other, however no other options were well represented by any of the MSM Scenarios so there was not a direct matching of catchment zones to SATURN modelling. The average travel speed, a SATURN model output, was found to be the most applicable to accessibility measures as it combines travel distance and time to reflect overall network performance. To find the average travel speeds SATURN model outputs were required – these outputs being an appropriate measure of performance against the accessibility baseline set by Option C3.

Figure 12 summarises the network travel speeds for each option and for the Base Case.

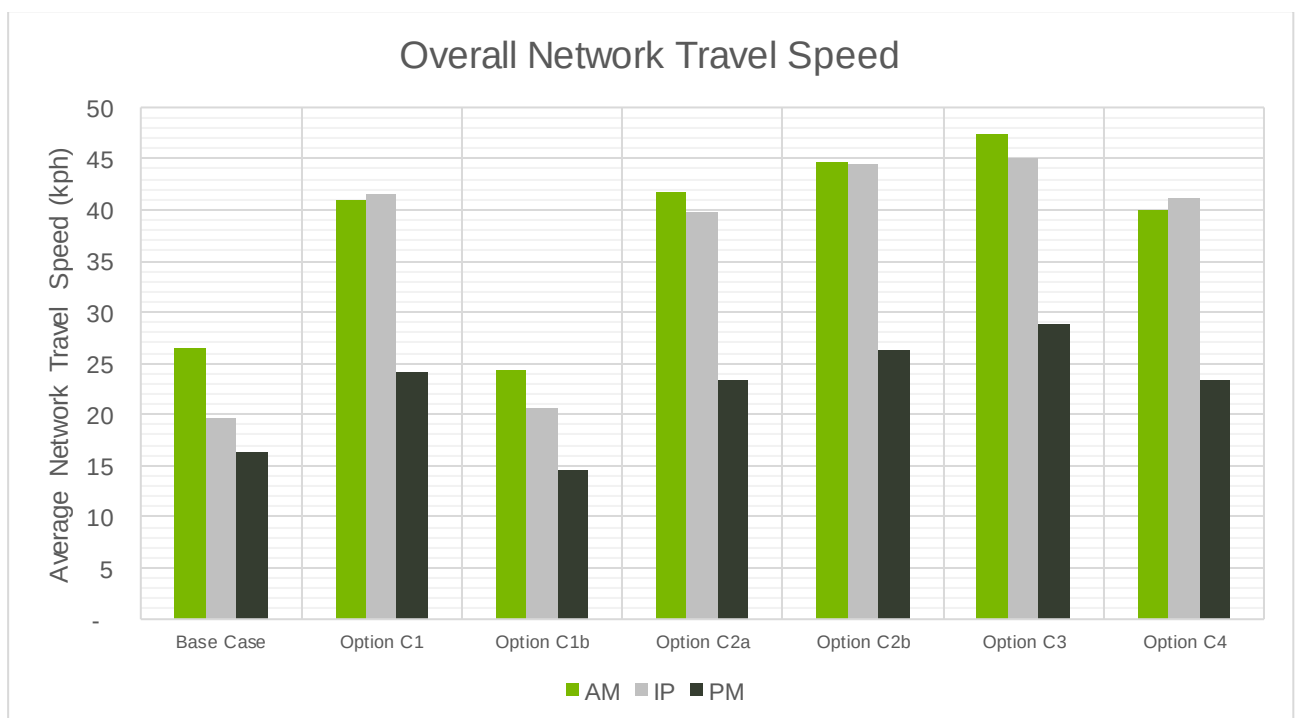


Figure 12: Overall network travel speeds (SATURN)

Option C3 resulted in the highest average network speed of 29km/h, this correlates with having the largest accessibility catchment (refer Figure 5). All options, except for Option C1b, result in faster average speeds than the Base Case.

To score KPIs the average speed in each option was compared against this average network speed. The average network speed of Option C4 was calculated as 23km/h - 21% slower than Option C3. This means Option C4 is expected to reach 21% less of the catchment that Option C3 reaches, giving fewer people proximity in access to the Airport and the potential jobs in the area.

Table 9: Scoring overview of KPI 3 and 4

		Option C1	Option C1b	Option C2a	Option C2b	Option C3	Option C4
KPI	KPI measures						
KPI 3: Population access to Airport	Population within 30-minute trip during peak hours 2046						
KPI 4: Job accessibility	Jobs within 30-minute trip during peak hours 2046. Correlate with deprivation and Base Case levels of access						

2.4 KPI 5: Travel time and reliability for key routes

Table 10: KPI 5 framework

Discipline	Problem	Benefit	Investment Objectives	KPI 5	KPI measures
Transport Planning	Lack of reliable and readily accessible travel choices limits access to the airport, and surrounding area, for both customers and the reliable movement of people and goods	A more prosperous Airport Precinct area, Auckland and New Zealand.	To improve economic performance of the airport area, Auckland and New Zealand	Travel time and reliability for key routes	Overall Network travel times within the SATURN model (vehicle hours)
				Travel time and reliability for key routes	Assessment of reliability for each key journey

Travel times variations are important to understand the extent of the network's reliability, as measured by the variability of route travel times between peaks. Travel times during the AM, inter-peak and PM showed that various treatments affected each corridor differently. For example, the Massey Road eastbound route had higher travel times where the SH20A southbound ramp was not modelled.

A summary of the overall network travel times and the average travel time variability for each modelled option is shown in Figure 14.

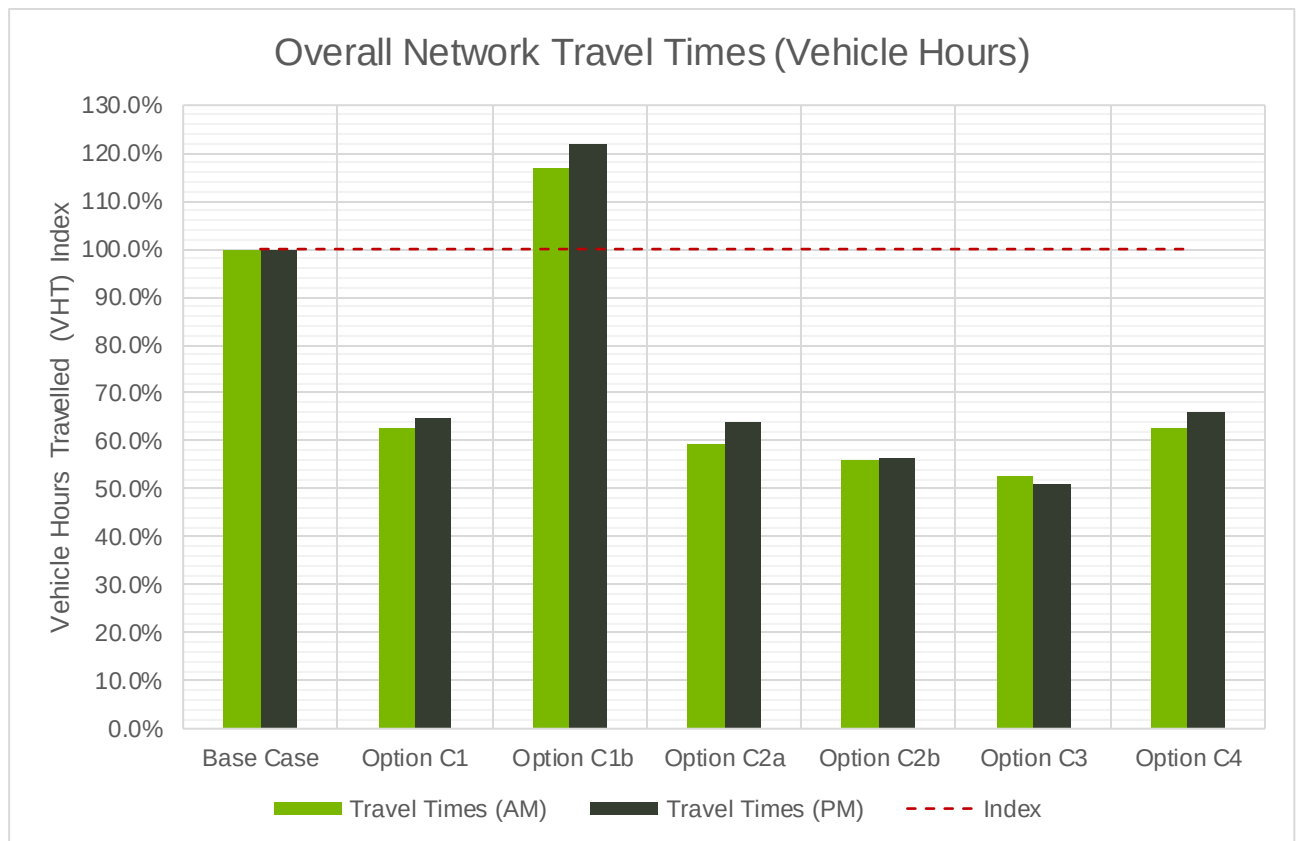


Figure 13 Overall network travel times (vehicle hours)

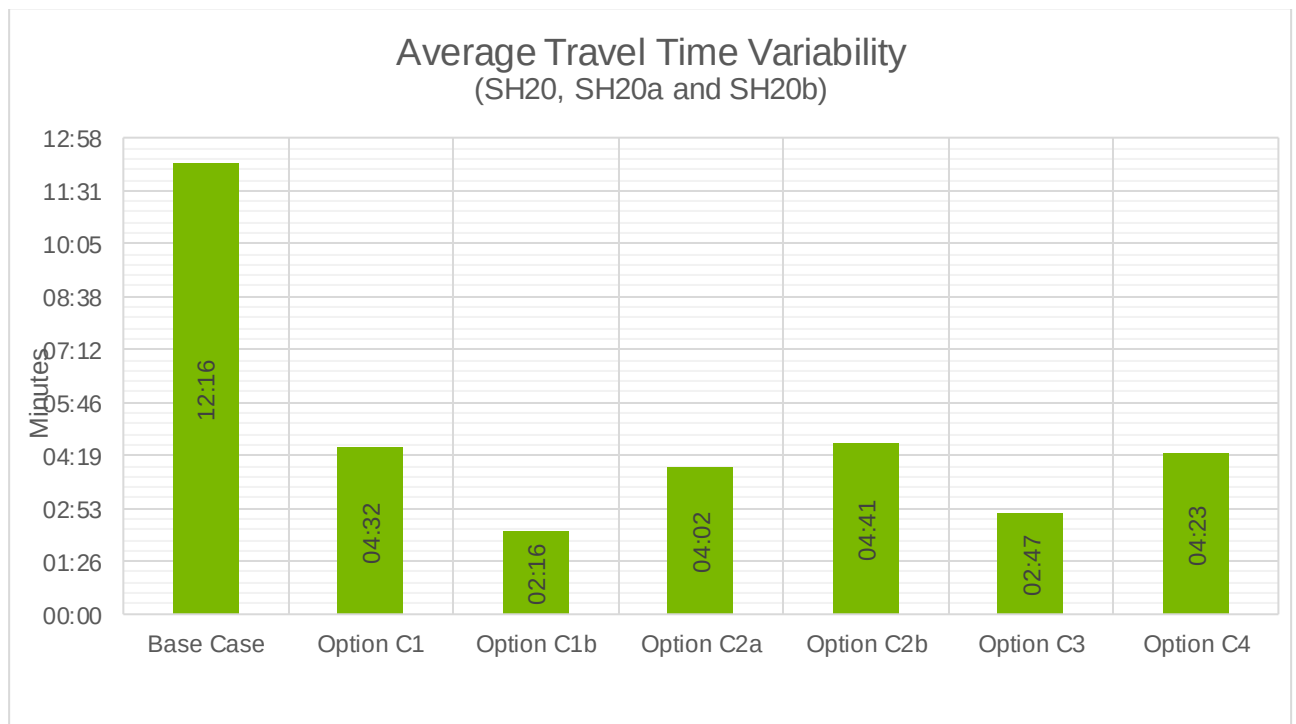


Figure 14: Average travel time variability of key routes for each option (SATURN)

Figure 14 demonstrate that the Base Case varies significantly between peaks, this high variation means it is difficult to estimate travel time for journeys and results in less reliable networks.

Results indicate that each option will improve transport network reliability from the Base Case. Option C1b will be the most reliable, followed closely by Option C3. These options are the most consistent in trip duration, and travel times are not expected to vary significantly between peaks.

Table 11: Scoring overview of KPI 5

		Option C1	Option C1b	Option C2a	Option C2b	Option C3	Option C4
KPI 5	KPI measures						
Travel time and reliability for key routes	Overall network travel times within the SATURN model (vehicle hours)						
	Assessment of reliability for each key journey						

2.5 KPI 6: Air quality/emissions from the transport system

Table 12: KPI 6 framework

Discipline	Problem	Benefit	Investment Objectives	KPI 6	KPI measures
Environmental Cultural Social	Current transport system has adverse environmental effects and does not recognise cultural identity and taonga	Local environment is protected and enhanced	Reduce the effects of the transport system on the environment and taonga	Transport system impact on air quality/emissions	Emissions model assessment

The SATURN model outputs provide insights regarding overall network vehicle emission cost in each option, and as such is included in this technical note as additional measure for evaluating the options. KPI 6 is not allocated as a Transport Planning assessment.

Overall vehicle network speeds are a factor of overall network travel speeds and distances and are expressed in dollar values. For the purposes of this options assessment, model outputs have only been used to compare each option to each other. Calibration of emission factors was not included in scope for modelling, however given the emissions parameters are consistent across options, the comparative assessment of the options (using model outputs) is fit for purpose.

The comparison of overall vehicle emission cost of each option is shown in Figure 15.

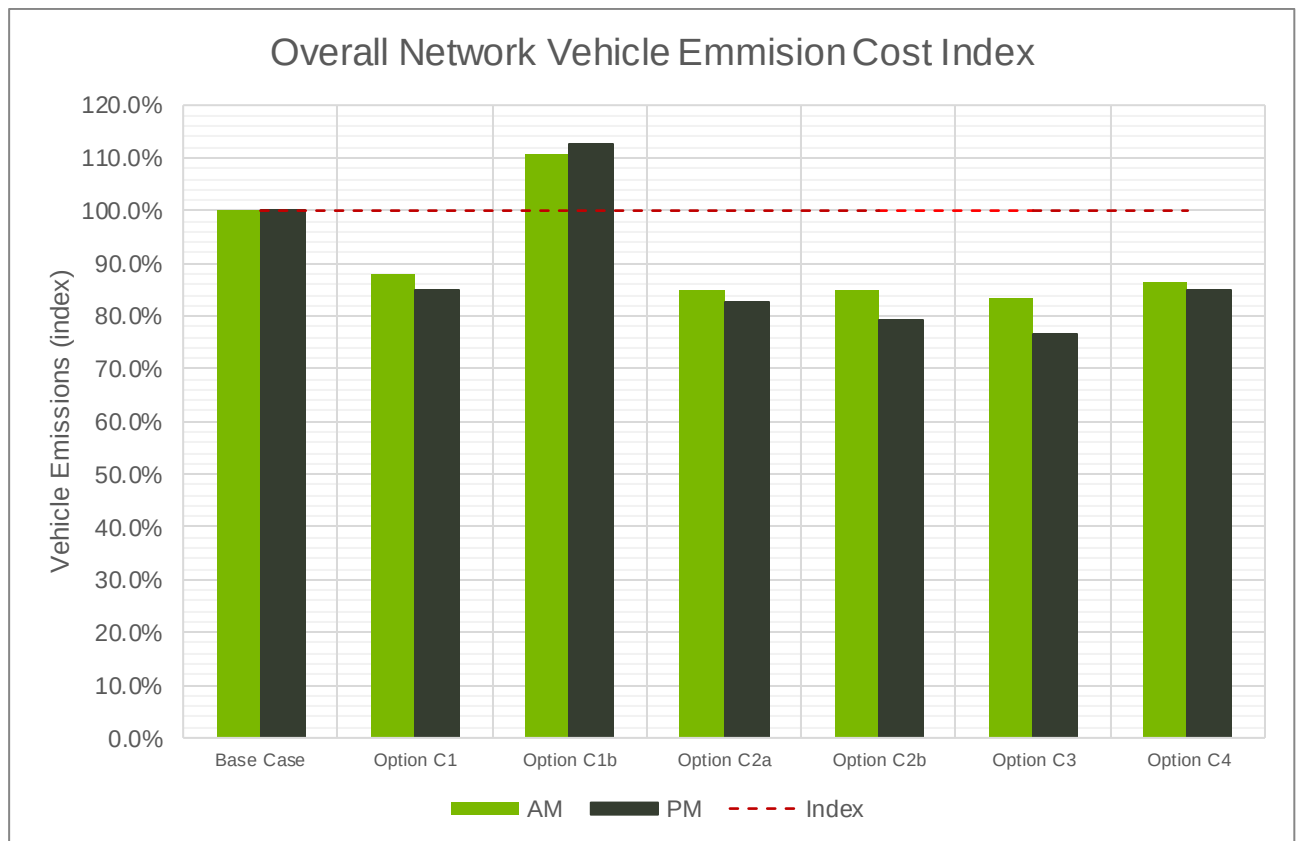


Figure 15: Overall network vehicle emission cost index (SATURN)

The analysis indicates that Option C3 performs best with about 20 to 30% lower vehicle emissions as compared to the Base Case during peaks.

Option C1b is the worst performing options with increased vehicle emission compared to the Base Case.

Table 13: Scoring overview of KPI 6

		Option C1	Option C1b	Option C2a	Option C2b	Option C3	Option C4
KPI 6	KPI measures						
Transport system impact on air quality/emissions	Emissions model assessment						

Approvals:

	Name	Title	Signature	Date
Authored by:				
Reviewed by:				

Technical Note

To	NZ Transport Agency	From	20Connect Team
Copy		Reference	501094-4401-TEC-NN-0011
Date	2019-07-19	Pages (including this page)	149
Subject	20Connect – Multi Criteria Analysis Scoring of Long List Options		

A preliminary assessment of the potential effects on the environment was carried out for the 20Connect Multi Criteria Analysis ('MCA') of the long list options, the purpose of which is to inform the Single Stage Business Case ('SSBC') for 20Connect to enable the selection of a short list for further consideration and assessment.

This cover note provides a summary of the method and assumptions used, a summary of the scores, and a summary of the main points raised by the environmental specialists.

Attachments to this cover note include:

- Attachment A: Environmental Context Maps; and
- Attachment B: Technical notes issued by environmental specialists.

1 Methodology and assumptions

Specialist assessments were undertaken in the topic areas including ecology (marine, terrestrial and freshwater), coastal processes, visual and landscape, heritage and archaeology, land contamination, noise and vibration, stormwater and social effects.

The assessments are based on the descriptions and schematics of the long list options provided. Overall, nine options were assessed.

Each of the specialists assigned each option a score ranging between -3 (Un-mitigatable adverse effect) to 3 (Significant positive benefit) (**Table 1**). The focus was on the assessment of the option, as opposed to a focus on the score itself. Weighting has not been applied to the scores.

Table 1 Scoring scale

Scoring scale
3 (Significant positive)
2 (Moderate positive)
1 (Minor positive)
0 (Neutral)
-1 (Minor/moderate adverse)
-2 (Significant adverse)
-3 (Significant Adverse/Un-mitigatable)

2 Description of the long list options

There are nine long list options for 20Connect which included a mix of high investment and balanced investment options as summarised in **Table 2** below.

Table 2 20Connect option summary

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

The assessments were undertaken based on the following assumptions and restrictions:

- The project extent was defined as north of Landing Drive on SH20A and east of Orrs Road on SH20B;
- Auckland International Airport Limited (AIAL) will develop their own network response (road and public transport) outside of the assumed design footprint and within the Airport Precinct, as such this area was outside the scope of the assessment.
- The SSBC for the Airport to Botany (A2B) project is being carried out separately and therefore, any options which overlap with 20Connect have not been assessed as part of the 20Connect Long List options scope.
- The allowance for Rapid Transit Corridor (RTC) as part of the 20Connect long list options are not to be taken as fixed options and are subject to change. The RTC is based on the outcome of the A2B SSBC.
- All long list options allow for walking and cycling / shared use path component (to be further investigated).
- All existing and proposed interchange on/off-ramps would be realigned to connect to new lane arrangements.
- Corridor widths:
 - 50m either side of the existing carriageway on SH20A (from Landing Drive to SH20) and SH20 (from Mangere Bridge to SH1)
 - 50m north of the existing SH20B carriageway, 100m south of the existing SH20B carriageway.
- The construction footprint would be contained within the corridor widths stated above.
- Specialists were requested to assume the following RTC facilities were included, unless explicitly stated and to provide comment as part of their assessment although it was not part of the scope of each option.

Table 3 RTC provision for the 20Connect SSBC

Project Name	Road Controlling Authority (RCA)	Affected State Highway Corridor	Rapid Transit Corridor (RTC) facility and description
Airport to Mangere	NZ Transport Agency	SH20A	Two-way median Mass Rapid Transit (MRT) / Light Rail Transit (LRT) corridor on SH20A from the airport to the city.
Airport to Botany	Auckland Transport	SH20B	New segregated two-way Rapid Transit Corridor (RTC) connection on the southern side of SH20B.
		SH20	New segregated two-way Rapid Transit Corridor (RTC) connection on the eastern side of SH20, between SH20A and SH20B.
		SH20	New segregated two-way Rapid Transit Corridor (RTC) connection on the western side of SH20, north of the SH20A interchange.

3 Summary of the MCA scores for the environmental workstream

The long list options received scores ranging between -3 (Significant Adverse/Un-mitigatable) and 1 (Minor Positive) (Table 2). While for the majority of the assessment topics there was very little variation among the options, there were a few key areas where differentiation was identified being coastal processes, social and community impact, archaeology and built heritage and contaminated land. These assessments are high level and require further investigation at short list phase.

It is to be noted that the specialists were asked not to score options C1b and C4b (as seen in Table 4 below) however they were attributed scoring in the overall MCA. The reason for this is that options C1b and C4b are physically the same as options C1a and C4a (respectively) and therefore the same scoring was attributed to those options. The differences in these options were related to sensitivities in relation to other related but less certain projects (e.g. LRT) and were therefore assessed in regard to non-environmental aspects.

Table 4 Summary of MCA scores for long list options

Discipline	Sub-topic		Option C1a	Option C1a1	Option C1b	Option C2a	Option C2b	Option C3	Option C4a	Option C4b	Option C4c
Ecology	Aquatic ecology	Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1	Do not score	-1	-1	-1	-1	Do not score	-1
	Terrestrial ecology	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1		-1	-1	-1	-1		-1
	Marine ecology	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1		-1	-1	-1	-1		0
Coastal processes	Construction effects on CMA	Extent of temporary effects on coastal physical processes.	-1	-1		-1	-1	-1	-1		-1
	Geomorphology/s edimentation & tidal flows	Extent of permanent effects on coastal physical processes, including effects of geomorphology, exacerbating sedimentation and changes in tidal and storm-tide flows in the upper creeks.	-1	-1		-1	-1	-1	-1		-1
	Sea-level rise and coastal climate change	Extent of increasing impacts on coastal physical processes from sea-level rise and climate change, including vulnerability of the works (present and proposed) and opportunities to improve resilience.	-1	-1		-1	-1	-1	-2		-2
Stormwater	Stormwater quality	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	-1	-1		-1	-1	-1	-1		-1
	Stormwater quantity	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	-1	-1		-1	-1	-1	-1		-1
Landscape, visual and urban design	Natural character and landscape	Extent, nature and degree of effects on natural character, features, and landscape.	-1	-1		-1	-1	-1	-1		-1
	Visual	Extent, nature and degree of effects on visual amenity.	-1	-1		-1	-1	-1	-1		-1
	Urban design	Extent, nature and degree of effects on urban design, including open space.	1	1		1	1	1	1		1
Social/ community impact	Accessibility	Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses.	1	1		1	1	1	1		1

Discipline	Sub-topic		Option C1a	Option C1a1	Option C1b	Option C2a	Option C2b	Option C3	Option C4a	Option C4b	Option C4c
Noise and vibration	Community	Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans.	-2	-2		-2	-3	-2	-1		-1
	Health and safety	Extent and degree of effects on human health and safety.	-1	-1		-1	-1	-1	-1		-1
	Operational noise and vibration	Impact of operational noise and vibration on sensitive receivers. Ability to mitigate adverse impact.	-1	-1		-1	-1	-1	-1		-1
	Construction noise and vibration	Impact of operational noise and vibration on sensitive receivers. Ability to mitigate adverse impact.	-1	-1		-1	-1	-1	-1		-1
Archaeology and built heritage		Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-3	-3		-2	-3	-2	-3		-1
Contaminated land	Construction management	Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1	-1		-1	-1	-1	-1		-1
	Construction management	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1	-1		-1	-1	-1	-1		-1
	Passive discharge	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0	0		-1	-1	-1	0		0
	Potential for new or cross contamination	Potential for the works to mobilise or place contamination within the project area	-2	-2		-2	-2	-2	-2		-1
	Built Environment Risk	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1	-1		-1	-1	-1	-1		-1
	H&S of construction workers	Risk to construction workers from soil or groundwater	-1	-1		-1	-1	-1	-1		-1
	Acid sulphate soil	Risk to the environment from the discharge of acid generating soils	-2	-2		-3	-3	-3	-2		-1
Air quality	Operational air quality	Extent and degree of effects on human health arising from operational air pollution.	-1	-1		-1	-1	-1	-1		-1
	Construction air quality	Extent and degree of effects on human health arising from discharges to air from construction activities.	-1	-1		-1	-1	-1	-1		-1

4 Summary of main points raised by each environmental specialist

This section provides an overview of any potential environmental effects of the long list options raised by the relevant specialist that will need to be taken into consideration as the project progresses into the short list phase.

The full assessments are attached at **Attachment B** with a visual capture of the key areas spatially provided at the environmental features map contained at **Attachment C**.

4.1 Ecology

Freshwater ecology: Each option contains the likely streamworks including culvert extensions or bridge widening. Opportunities exist for restoration and/or enhancement of fish passage and riparian planting.

Terrestrial ecology: The assessment identified the presence of Banded Rail near Mangere Bridge, and that other areas within the Project extent are likely to support herpetofauna. Mitigation opportunities exist through construction timing to avoid breeding season, pre-construction surveys and lizard management plans as well as replacement planting to mitigate loss of indigenous vegetation.

Marine ecology: There is a Significant Ecological Area (SEA) along parts of the coastal area (SEA – Marine 2) and each option requires one or more crossings of the SEA area and coastal marine area¹ (CMA) crossings. The exception is Option C4c which does not impact the CMA or coastal margins.

4.2 Coastal processes

The assessment of coastal processes was considered in three parts being, construction effects on the CMA, then effects on geomorphology, sedimentation and tidal flows, and finally sea level rise and tidal flows. The only differentiation among the options related to Option 4 which concerned variations in sea level rise and coastal climate change. These variations would arise due to the northern widening of SH20B resulting in further encroachment on the active tidal zone of the three southern Waokauri Creek arms around Prices Road.

4.3 Stormwater

The stormwater assessment considered both quality and quantity. All options would require additional areas of impervious surfaces and therefore, would increase in the quantity of stormwater runoff. All options scored the same on the basis that there may be potential minor adverse effects if stormwater considerations were not mitigated appropriately. There is the potential for positive effects, however, should some of the existing untreated pavement be treated.

4.4 Landscape, visual and urban design

Natural character and landscape: All options except C4c have the potential to cause minor adverse effects on natural character due to the proximity of Nga Kapua Kohu Ora / Crater Hill which is subject to an Outstanding Natural Feature overlay due to SH20 widening. All options also have potential for minor adverse effects on amenity of parks/reserves adjacent to the Project. Identified loss of vegetation and rural countryside at SH20B (however noted that is appropriate given its zoning and likely future development).

Visual: The assessment noted changes to the focal point of Regionally Significant Viewshaft M4 toward Mangere Mountain and also changes to residential amenity effects due to loss/change of vegetation and earth bunds potentially increasing motorway visibility. As such, all options scored -1.

¹ Boundary as identified in the Auckland Unitary Plan Operative in Part (AUP) maps. The true extent of which would need to be confirmed by survey.

Urban design: The options scored +1 as pedestrian and cycling facilities would be provided, however, the assessment noted that limited urban design opportunities would be available due to the narrow corridor. Concerning the various permeations of Options C2 and C3, it was noted that the revocation of SH20B from state highway to local road would have a positive outcome.

4.5 Social and community impact

The scoring for accessibility and health and safety had no differentiation for the following reasons:

- Additional traffic lanes would improve accessibility but noted that no new connection is provided that was not previously available.
- Sensitive receivers may experience adverse effects during construction; and
- The walking and cycling / shared use path (SUP) would encourage active modes in transport.

The differentiation in this topic resulted from the assessment of potential community effects. The variations of option C4 scored a -1 as it was recognised that there would be potential for direct impacts to sensitive receivers along SH20A but unlikely if widening was kept to the north. There would also be minor property impact along SH20B frontages. Option C2b scored -3 due to potential disinterment of graves at Memorial Gardens as a result of the north facing ramps. All other options scored -2 due to the potential for adverse impact to sensitive receivers on both SH20A and the property impact of the offline SH20B options.

4.6 Noise and vibration

All options scored -1 for construction and operational noise as noise (and vibration for construction) is likely to be noticeable at dwellings near the Project, particularly where dwellings directly adjacent the alignment would be removed resulting in changes to the noise environment (screening and separation distance) of dwellings beyond.

4.7 Archaeology and built heritage

The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill, a heritage landscape of outstanding archaeological and heritage value as well as having significance at a local, regional and national level. The specialist recommended that any works undertaken through this portion of SH20 on the western side of the motorway should be avoided (resulting in a -3 score) and options only impacting the eastern side while still adverse, were significant (and so scored -2). It is also possible that Item 2625 in the Auckland Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' would be affected if the Project extended into its extent of place. Option C4c avoids Nga Kapua Kohu Ora / Crater Hill but there is still the potential to encounter sub-surface archaeological or heritage material and therefore, scored -1.

4.8 Contaminated land

Contaminated land was assessed based on seven criteria. Below are the key findings:

- Construction within the quarry/landfill near Cavendish Road may create new pathways, worsening existing passive discharge arrangements in this area (this relates to the new offline SH20B options resulting in a -1 score for these options for passive discharges).
- Acid soils may be present. Exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater. A significant area near SH20B would be excavated under Options C2a, 2b and C3. This is closer to potential receptors and would involve more disturbance of 'greenfield' land as a result of these offline SH20B options and thus they scored -3, while the other options scored -2 (with the exception of Option C4c which scored -1).

4.9 Air quality

There was no differentiation in scoring for air quality either in terms of construction or operation. It is considered that the cumulative increase in traffic volumes (as a result of additional lanes) would likely result in overall minor increases in emissions. Adverse effects resulting from discharges to air from construction activities (e.g. dust) are likely to occur for all options. It is considered that these can be managed through appropriate construction management measures. It is noted that any further investigation should be undertaken by an air quality specialist.

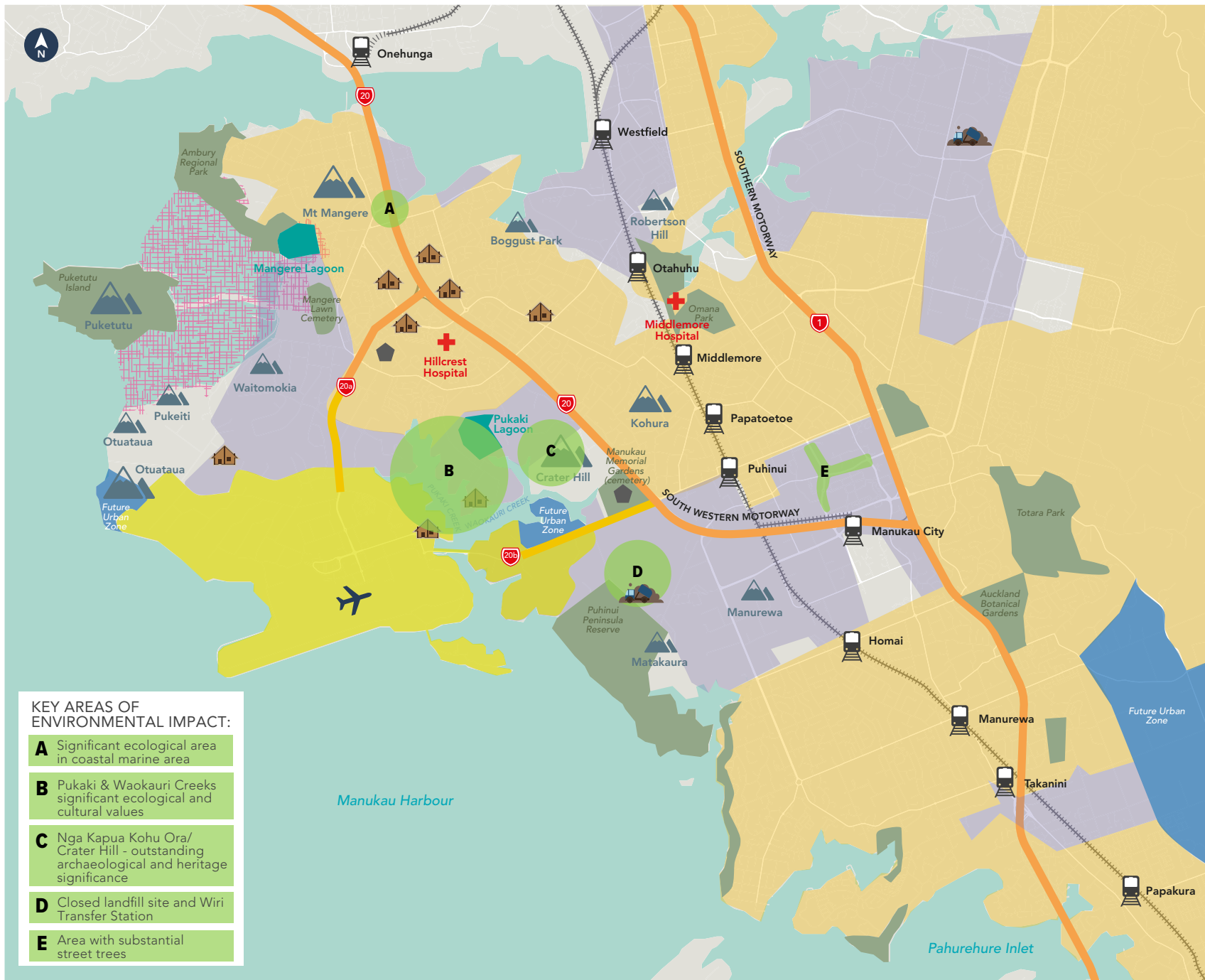
Attachments:

- Attachment A: Environmental Context Maps
- Attachment B: Technical Environmental Specialist notes

Approvals:

	Name	Title	Signature
Authored by:		Principal, Environment and Planning	
	and 	Senior Consultant, Environment and Planning	
Reviewed by:		Associate, Environment and Planning	

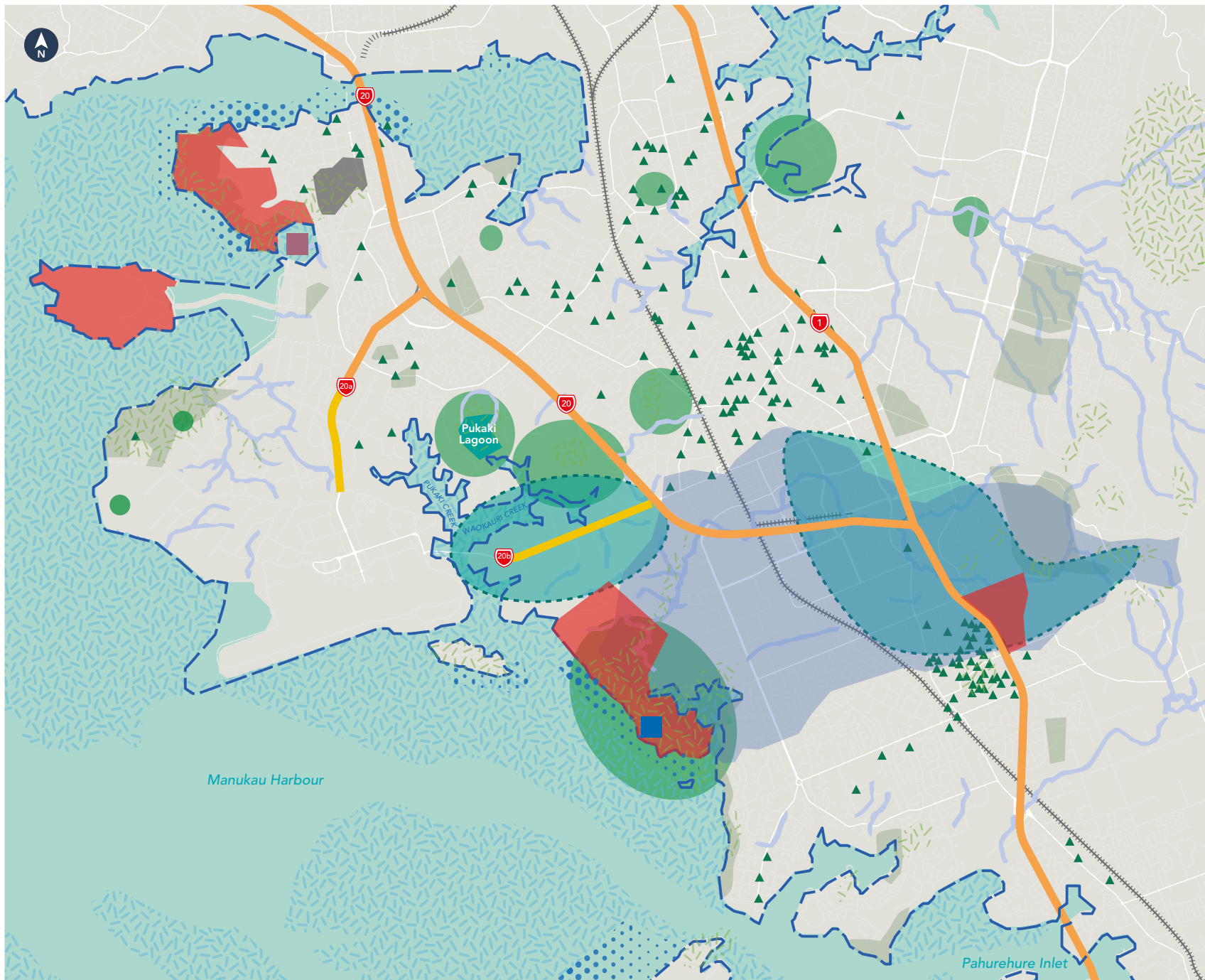
Appendix A: Environmental Context Maps



ENVIRONMENTAL FEATURES OVERVIEW

LEGEND

- Auckland Airport
- Auckland Airport area
- Motorway
- Major road
- Railway
- Train station
- Future Urban Zone
- Auckland Airport area
- Commercial
- Residential
- Regional & major parks
- Marae
- Volcanic cones
- Watercare area
- Lagoons
- Hospital
- Key environmental areas of interest
- Closed landfill
- Trees

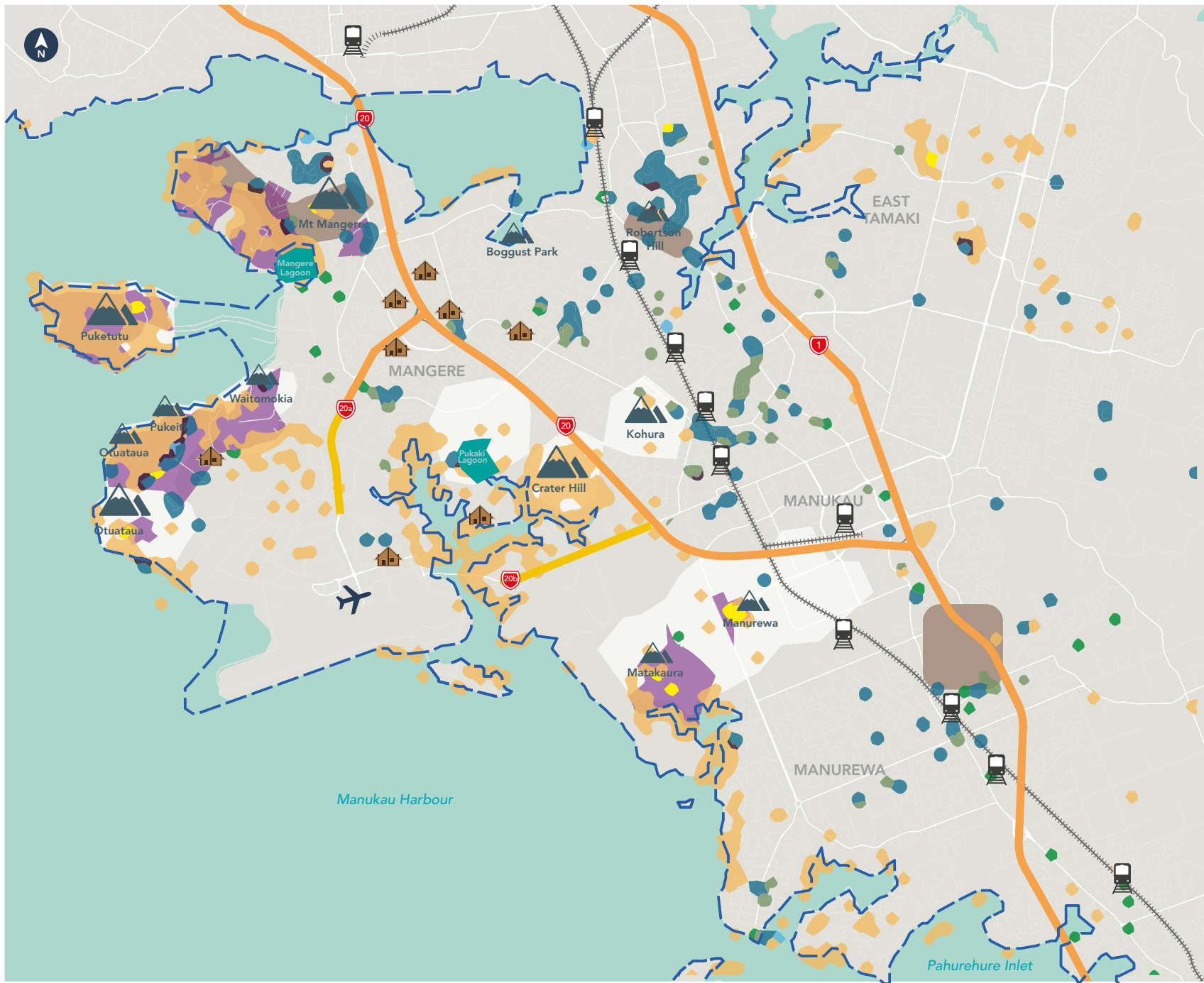


ENVIRONMENTAL CONTEXT MAP

NATURAL FEATURES

LEGEND

- Motorway
- Major road
- + + + + Railway
- - - - Stormwater management areas (Flow 1 & 2)
- Regional parks
- Parks
- Indicative coastline
- Mangere Mountain
- Waterways
- High-use stream management areas
- Outstanding natural features
- ▲ Notable trees
- Wetland management areas
- Mangere lagoon
- Significant Ecological Areas:**
 - - - - Terrestrial
 - - - - Marine 1
 - Marine 2

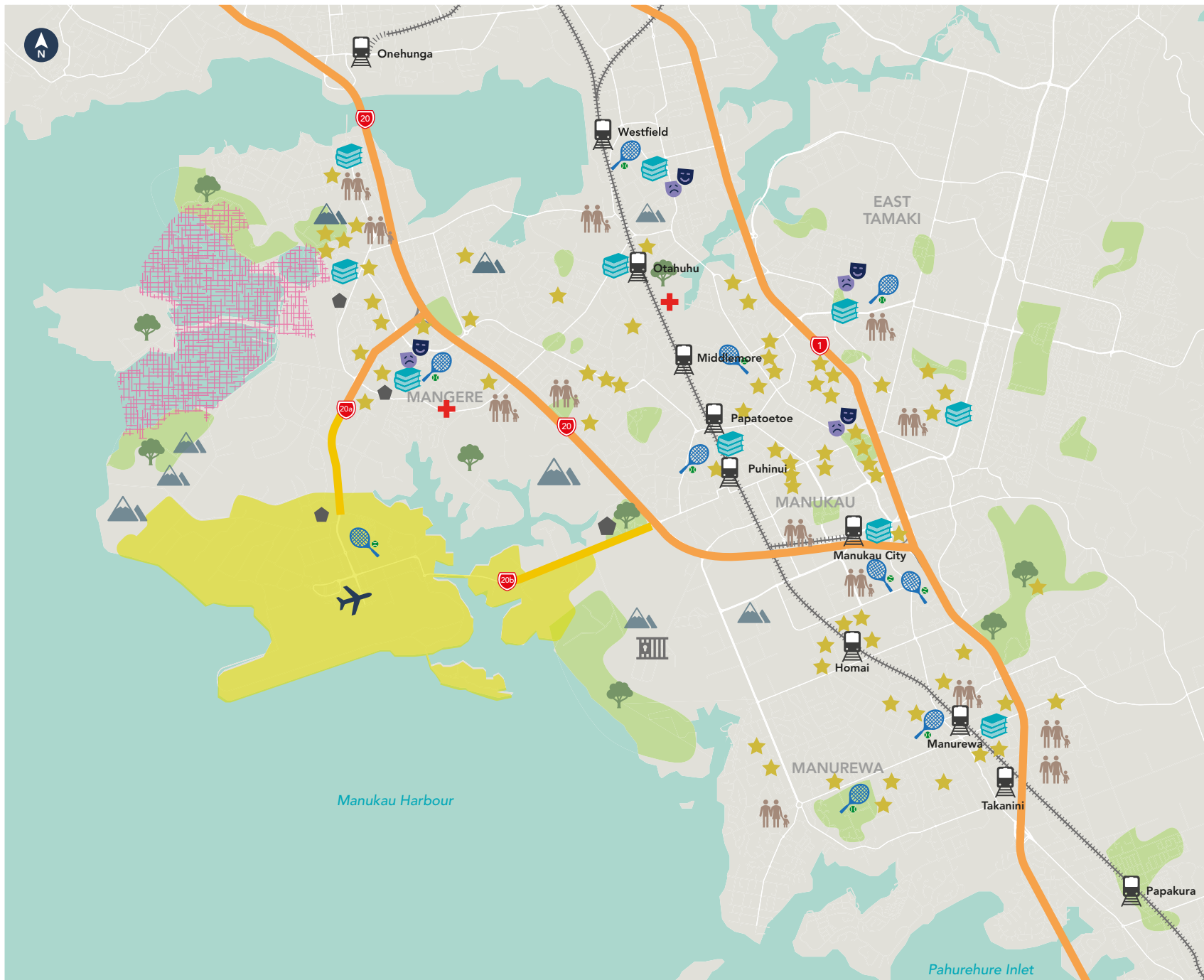


ENVIRONMENTAL CONTEXT MAP

HERITAGE & CULTURE & GEOLOGICAL FEATURES

LEGEND

- Marae
 - Motorway
 - Major Road
 - Indicative Coastline
 - Railway
 - Train Stations
 - Built Heritage & Character
 - Sites and Places of Significance to Mana Whenua (Auckland Unitary Plan)
 - Volcanic cones
 - Lagoons
 - Auckland Airport
 - Volcanic geological features (includes stone and lava fields)
- Cultural Heritage Inventory (Public):**
- Archaeological Site
 - Historical Botanical Site
 - Historic Structure
 - Maori Heritage Area
 - Maritime Site
 - Reported Historic Site



ENVIRONMENTAL CONTEXT MAP

SOCIAL FEATURES & INFRASTRUCTURE

LEGEND

- Auckland Airport
- Auckland Airport area
- Motorway
- Major road
- Railway
- Train station
- Regional/Major park
- Community centre
- Library
- School
- Hospital
- Rainbows End
- Cemetery
- South Auckland Corrections Centret
- Arts centre
- Recreational centre
- Watercare area
- Volcanic cones

Appendix B: Technical Environmental Specialist notes

Technical Note

To		From	
Copy		Reference	501094
Date	2018-08-21	Pages (including this page)	8
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Freshwater Ecology		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

The source information assessed was based on desktop analysis only. The freshwater ecological assessments were based on:

- The 20Connect long-list schematics (dated 13 August 2018 and the long-list options descriptions and assumptions (dated 13 August 2018).
- Aurecon drawing number 501094 – Design footprint for ecology requirements 20 August 2018 (in part).
- Auckland Council GeoMaps, with Natural Resources and Catchment and Hydrology overlays; Google Maps; Google Earth; Auckland Unitary Plan E3, Lakes, rivers, streams and wetlands.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for streamworks</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for streamworks	-1
Potential for streamworks			
-1			
Reasons / Comments ■ Widening of SH20A SH20A - Culverts at SH20A/SH20 interchange for Widening. Widening of SH20 north of SH20A - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/SH20A intersection culverts. Widening of SH20 south of SH20A - North of Bader Drive. - South of Massey Road ramps. - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20B on ramp. - Puhinui Creek in vicinity of and south of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. Assumptions ■ Under the AUP stream works are usually non-complying or discretionary at the minimum. ■ Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon ■ Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for streamworks</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for streamworks	-1
Potential for streamworks			
-1			
Reasons / Comments - Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way at: SH20A - Culverts and stream at SH20A/SH20 interchange for Widening. Widening of SH20 north of SH20A - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/20A intersection culverts. Widening of SH20 south of SH20a - North of Bader Drive. - South of Massey Road ramps. - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20b on ramp. - Puhinui Creek in vicinity of and south of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. Assumptions - Stream works are usually non-complying or discretionary at the minimum. - Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table><tr><td>Potential streamworks</td></tr><tr><td>-1</td></tr></table>		Potential streamworks	-1
Potential streamworks			
-1			
Reasons / Comments ■ Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e.50m of carriage way at: Widening of SH20 (north of SH20A) - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/20A intersection culverts and stream. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20B on ramp. - Puhinui Creek in vicinity of and south of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. SH20B/SH20 system interchange ramp connections - Puhinui Road – SH20B on ramp SH20B new offline motorway - Upper Puhinui Creek – three crossings; one within the CMA and SEA-Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area.			
Assumptions ■ SH20B – assessed east of Orrs Road only. ■ Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. ■ Under the AUP stream works are usually non-complying or discretionary at the minimum.			

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps			
Name of assessor (incl. qualifications and organisation)	M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1" style="margin-top: 10px;"> <tr> <td>Potential streamworks</td> </tr> <tr> <td style="text-align: center;">-1</td> </tr> </table>		Potential streamworks	-1
Potential streamworks			
-1			
Reasons / Comments ■ <i>Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way at:</i> Widening of SH20 north of SH20A - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/20A intersection culverts and stream. Widening of SH20 south of SH20A - North of Bader Drive. - South of Massey Road ramps. - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20B on ramp. - Puhinui Creek in vicinity of and south of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. SH20B new offline motorway - Upper Puhinui Creek – three crossings; one within the CMA and SEA-Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area. Assumptions ■ Under the AUP stream works are usually non-complying or discretionary at the minimum. ■ Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon ■ Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential streamworks</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential streamworks	-1
Potential streamworks			
-1			
Reasons / Comments - Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way at: Widening of SH20 north of SH20A - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/20A intersection culverts and stream. Widening of SH20 south of SH20A - North of Bader Drive. - South of Massey Road ramps (x2). - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20b on & off ramps. - Puhinui Creek in vicinity of and west of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. SH20B new offline motorway - Upper Puhinui Creek – three crossings; one within the CMA and SEA-Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area. Assumptions - Under the AUP stream works are usually non-complying or discretionary at the minimum. - Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential Streamworks</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential Streamworks	-1
Potential Streamworks			
-1			
Reasons / Comments - Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way at: SH20A / SH20 System interchange ramp connections - Several culverts and streams at interchange within the corridor. Widening of SH20 north of SH20A - Stream crossing (bridge) near Walmsley Road off ramp. - SH20/20A intersection culverts and stream. - Stormwater pond and stream crossing. Widening of SH20 south of SH20A - North of Bader Drive. - South of Massey Road ramps – culverts x 2. - Upper tributary to Puhinui Creek north of Capital Place. - Puhinui Road – SH20b on ramp. - Puhinui Creek in vicinity of and south of Cavendish Drive ramps. - Bridge crossing of Puhinui Creek east of Cavendish Drive. - Culvert for Puhinui Creek west of Plunket Avenue. - Puhinui Creek crossing near Lambie Drive. Assumptions - Under the AUP stream works are usually non-complying or discretionary at the minimum. - Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening			
Name of assessor (incl. qualifications and organisation)	[Redacted], M.Sc. (Hons) Bioresearches [Insert]		
Area of assessment	Freshwater Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td>Potential Streamworks</td> </tr> <tr> <td style="text-align: center;">-1</td> </tr> </table>		Potential Streamworks	-1
Potential Streamworks			
-1			
Reasons / Comments ■ <i>Potential streamworks – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way at:</i> SH20A / SH20 System interchange ramp connections - Several culverts and streams at interchange within the corridor. Assumptions Option 4c is the same as Option 4a with no SH20 widening, i.e. only the SH20a / SH20 system interchange ramp connections are to be assessed. ■ Under the AUP stream works are usually non-complying or discretionary at the minimum. ■ Assumptions listed in 1.1 of the Scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon ■ Auckland Unitary Plan E3, Lakes, Rivers, streams and wetlands.			

Approved by:

Title	Name	Qualification	Signature	Date
Author	[Redacted]	M.Sc. (Hons)	[Redacted]	19/9/2018
Reviewer	[Redacted]	M.Sc. (Hons)	[Redacted]	19/9/2018

Technical Note

To		From	
Copy		Reference	Bior#61946
Date		Pages (including this page)	8
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Marine Ecology		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

The source information assessed was based on desktop analysis only. The freshwater ecological assessments were based on:

- The 20Connect long-list schematics (dated 13 August 2018 and the long-list options descriptions and assumptions (dated 13 August 2018).
- Aurecon drawing number 501094 – Design footprint for ecology requirements 20 August 2018 (in part).
- Auckland Council GeoMaps, with Natural Resources overlays; Google Maps; Google Earth.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Potential impacts in SEA-Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> - As listed on page 1.			

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Potential impacts in SEA- Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> - As listed on page 1.			

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only			
Name of assessor (incl. qualifications and organisation)	[REDACTED] [REDACTED]		
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Potential impacts in SEA- Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp. SH20B new offline motorway - Upper Puhinui Creek crossings - one within the CMA and SEA Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> - As listed on page 1.			

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Potential impacts in SEA-Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp. SH20B new offline motorway - Upper Puhinui Creek crossings - one within the CMA and SEA-Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> - As listed on page 1.			

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Potential impacts in SEA-Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp. SH20B new offline motorway - Upper Puhinui Creek crossings - one within the CMA and SEA-Marine 2, one with the CMA and SEA-Marine 2 immediately downstream of works area. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> As listed on page 1.			

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway			
Name of assessor (incl. qualifications and organisation)	[Redacted]		
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for works in the CMA or SEA Marine	-1
Potential for works in the CMA or SEA Marine			
-1			
<u>Reasons / Comments</u> - Potential works within the CMA – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way <u>Widening of SH20 north of SH20A</u> - Potential impacts in SEA-Marine 2 and CMA at crossing (bridge) near Walmsley Road off ramp. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> As listed on page 1.			

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening			
Name of assessor (incl. qualifications and organisation)	[Redacted]		
Area of assessment	Marine Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive			
<table border="1"> <tr> <td>No potential for works in the CMA or SEA Marine</td> </tr> <tr> <td>0</td> </tr> </table>		No potential for works in the CMA or SEA Marine	0
No potential for works in the CMA or SEA Marine			
0			
<u>Reasons / Comments</u> - No potential works within or in close proximity to the CMA <u>Assumptions</u> - Option 4c is the same as Option 4a with no SH20 widening, i.e. only the SH20a / SH20 system interchange ramp connections are to be assessed. - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> As listed on page 1.			

Approved by:

Title	Name	Qualification	Signature	Date
Author	[Redacted]	M.Sc. (Hons)	[Redacted]	19/9/2018
Reviewer	[Redacted]	M.Sc. (Hons)	[Redacted]	19/9/2018

Technical Note

To		From	
Copy		Reference	501084
Date	2018-08-21	Pages (including this page)	8
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Terrestrial Ecology		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

The source information assessed was based on desktop analysis only. The freshwater ecological assessments were based on:

- The 20Connect long-list schematics (dated 13 August 2018 and the long-list options descriptions and assumptions (dated 13 August 2018).
- Aurecon drawing number 501094 – Design footprint for ecology requirements 20 August 2018 (in part).
- Auckland Council GeoMaps, with Natural Resources overlays; Google Maps; Google Earth.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA and/or fauna</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA and/or fauna	-1
Potential for effects on SEA and/or fauna			
-1			
Notes: <u>Reasons / Comments</u> ■ Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. ■ Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e.50m of carriage way. <u>Widening of SH20 north of SH20A</u> - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. <u>Widening of SH20 south of SH20A</u> - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA-Marine 2, north of Capital Place. - SEA terrestrial vegetation in vicinity and south of Cavendish Road ramps. - Notable tree within footprint on 307 Puhinui Road, near SH20B/20 interchange. <u>Assumptions</u> ■ Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> ■ As listed on Page 1.			

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA	-1
Potential for effects on SEA			
-1			
<u>Reasons / Comments</u> - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. - Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA Marine, north of Capital Place. - SEA terrestrial vegetation in vicinity and south of Cavendish Road ramps. - Notable tree within footprint on 307 Puhinui Road, near SH20B/20 interchange. <u>Assumptions</u> - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> - As listed on Page 1.			

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only			
Name of assessor (incl. qualifications and organisation)	██████████, M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA or significant vegetation</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA or significant vegetation	-1
Potential for effects on SEA or significant vegetation			
-1			
Reasons / Comments - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. - Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA Marine, north of Capital Place. - SEA terrestrial vegetation in vicinity and south of Cavendish Road ramps. - Notable tree within footprint on 307 Puhinui Road, near SH20B/20 interchange. SH20B new offline motorway - Upper Puhinui Creek – three crossings; contiguous vegetation linking with extensive riparian vegetation of SEA-Marine 2 areas - Established vegetation at Manukau Gardens potential skink habitat. Assumptions - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - As listed on Page 1.			

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA or significant areas of vegetation</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA or significant areas of vegetation	-1
Potential for effects on SEA or significant areas of vegetation			
-1			
Reasons / Comments - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. - Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way for Widening of SH20 north of SH20A - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA-Marine 2, north of Capital Place. - Notable tree within footprint on 307 Puhinui Road, near SH20B/20 interchange. SH20B new offline motorway - Upper Puhinui Creek – three crossings; contiguous vegetation linking with extensive riparian vegetation of SEA-Marine 2 areas - Established vegetation at Manukau Gardens potential skink habitat. Assumptions - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - As listed on Page 1.			

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA or significant areas of vegetation</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA or significant areas of vegetation	-1
Potential for effects on SEA or significant areas of vegetation			
-1			
Reasons / Comments - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. - Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA-Marine 2, north of Capital Place - Notable tree within footprint on 307 Puhinui Road, near 20b/20 interchange. SH20B new offline motorway - Upper Puhinui Creek – three crossings; contiguous vegetation linking with extensive riparian vegetation of SEA-Marine 2 areas. - Established vegetation at Manukau Gardens potential skink habitat. Assumptions - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - As listed on Page 1.			

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway			
Name of assessor (incl. qualifications and organisation)	[REDACTED], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for effects on SEA or significant areas vegetation</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for effects on SEA or significant areas vegetation	-1
Potential for effects on SEA or significant areas vegetation			
-1			
Reasons / Comments - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. - Potential effect on SEA and contiguous areas of vegetation with good potential habitat for herpetofauna – dependent upon whether working within existing berm or outside and within corridor i.e. 50m of carriage way Widening of SH20 north of SH20A - Banded rail present in SEA-Marine 2 near Mangere Bridge in Mangere Inlet. Widening of SH20 south of SH20A - Upper tributary to Puhinui Creek contiguous vegetation linking with extensive riparian vegetation adjacent to SEA-Marine 2, north of Capital Place. - Notable tree within footprint on 307 Puhinui Road, near 20b/20 interchange. Assumptions - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. Other Information relied upon - As listed on Page 1.			

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening			
Name of assessor (incl. qualifications and organisation)	[Redacted], M.Sc. (Hons) Bioresearches		
Area of assessment	Terrestrial Ecology		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive <table border="1"> <tr> <td>Potential for skink habitat</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential for skink habitat	-1
Potential for skink habitat			
-1			
<u>Reasons / Comments</u> - Areas of established vegetation and/or weedy scrub and/or debris that may support herpetofauna will need to be assessed at detailed design. <u>Assumptions</u> - Option 4c is the same as Option 4a with no SH20 widening, i.e. only the SH20A / SH20 system interchange ramp connections are to be assessed. - Assumptions listed in 1.1 of the scope for environmental specialists apply, specifically design footprint is north of Landing Drive on SH20A and east of Orrs Road on SH20B. <u>Other Information relied upon</u> As listed on Page 1.			

Approved by:

Title	Name	Qualification	Signature	Date
Author	[Redacted]	M.Sc. (Hons)	[Redacted]	19/9/2018
Reviewer	[Redacted]	M.Sc. (Hons)		19/9/2018

Technical Note

To	██████████ (Aurecon)	From	██████████ (NIWA)
Copy	██████████ (Aurecon)	Reference	501094
Date	2018-08-24	Pages (including this page)	17
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Coastal Processes		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 24 August 2018).

The source information assessed was based on desktop analysis only. The Coastal Processes assessments were based on:

- The 20Connect long-list schematics (dated 14-Aug-2018 and for Option 2Ca, 21 August 2018) and the long-list options descriptions and assumptions (dated 14 August 2018).
- Maps of land elevation from the Parliamentary Commissioner for the Environment report “Preparing New Zealand for rising seas: Certainty and Uncertainty”, 2015:
<https://www.pce.parliament.nz/publications/regional-land-elevation-maps>.
- Ministry for the Environment Coastal Hazards and Climate Change: Guidance for Local Government (December 2017): <http://www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government>.
- Auckland Council GeoMaps including Coastal Storm Inundation Layer (Unitary Plan) and 1959 historical aerial photography: <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Stephens, S., Wadhwa, S and Tuckey, B (2016). Coastal inundation by storm-tides and waves in the Auckland region. Prepared by the National Institute for Water and Atmospheric Research, NIWA and DHI Ltd for Auckland Council. Auckland Council Technical Report, TR2016/017.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway

Option	High-level description
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening



Figure 1: Areas in Pukaki Creek where the proposed project options may impinge on the coastal environment and coastal marine area (CMA). *Basemap:* Auckland Council GeoMaps – hatched areas cover the Coastal Storm Inundation Layer in the Unitary Plan (1% AEP coastal flooding plus 1 m sea-level rise).



Figure 2: Area in Tararata Creek (Mangere Inlet) where the proposed project options may impinge on the coastal environment and coastal marine area (CMA). *Basemap:* Auckland Council GeoMaps – hatched areas cover the Coastal Storm Inundation Layer in the Unitary Plan (1% AEP coastal flooding plus 1 m sea-level rise).

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-1
Notes (refer to Figures 1 and 2): Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN crossings south of SH20B of side creeks in Waokauri and Otaimako Creeks, and additional north and south lanes on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek), and also may require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). However with this option, only the new RTN (rather than new carriageways) would apply to the present SH20B and be located 100 m south, which is essentially on land at present beyond the present upper tidal limit (apart from creek arm immediately to west of Prices Road), so scored lower for C1 options than other options involving new lanes for SH20B. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options. Assumptions ■ Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 southbound and northbound lanes (between Portage Road and		

Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) RTN corridor south of SH20B(Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) RTN corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.

- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20a (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)	██████████, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-1
Notes: (refer to Figures 1 and 2) <u>Reasons / Comments</u> ■ <i>Construction effects on CMA:</i> - Reasons/comments: Proposed RTN crossings south of SH20B of side creeks in Waokauri and Otaimako Creeks, and additional north and south lanes on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> - Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> - Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). However, with this option, only the new RTN (rather than new carriageways) would apply to the present SH20B and be located 100 m south, which is essentially on land at present beyond the present upper tidal limit (apart from creek arm immediately to west of Prices Road), so scored lower for C1 options than other options involving new lanes for SH20B. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options. <u>Assumptions</u> ■ Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 southbound and northbound lanes (between Portage Road and		

Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) RTN corridor south of SH20B (Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) RTN corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.

- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20a (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-1
Notes: (refer to Figures 1 and 2) Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN and new SH20B lane crossings south of the present SH20B of side creeks in Waokauri and Otaimako Creeks, and an additional south-bound lane only on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). However, with this option, the new RTN and road carriageways would apply to the south (up to 100 m) of the present SH20B, which is essentially on land at present beyond the present upper tidal limit (apart from creek arm immediately to west of Prices Road), so scored lower the for options involving new lanes for the present SH20B. Also for this option, there is only a south-bound lane for SH20 (further east up the creek) – no north-bound lane. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options.		

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 southbound lane (between Portage Road and Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) RTN and road corridors south of SH20B (Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-1
Notes: (refer to Figures 1 and 2) Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN and road crossings south of SH20B of side creeks in Waokauri and Otaimako Creeks, and addition north and south lanes on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). However, with this option, the new RTN and road carriageways, and on/off interchange lanes into/out of Puhinui Road, would apply to the south (up to 100 m) of the present SH20B, which is essentially on land at present beyond the present upper tidal limit (apart from creek arm immediately to west of Prices Road), so scored lower than options involving new lanes added to the present SH20B. Compared to the previous Option C2a, there is also a new north-bound lane for SH20 and the extra lanes up to just past Prices Road for on/off access to the Puhinui Rd I/C with SH20, so is becoming marginal towards a score between -1 to -2. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options.		

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 southbound and northbound lanes (between Portage Road and Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) Corridors south alongside SH20B (Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-1
Notes: (refer to Figures 1 and 2) Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN and road crossings south of SH20B of side creeks in Waokauri and Otaimako Creeks, and addition north and south lanes on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). However, with this option, the new RTN and road carriageways would apply to the south (up to 100 m) of the present SH20B, which is essentially on land at present beyond the present upper tidal limit (apart from creek arm immediately to west of Prices Road), so scored lower the for options involving new lanes for the present SH20B. Also for this option, there is only a south-bound lane for SH20 (further east up the creek) – no north-bound lane. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options.		

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 southbound lane only (between Portage Road and Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) Corridors south alongside SH20B (Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Driv) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-2
Notes: (refer to Figures 1 and 2) Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN crossings south of SH20B and east- and west-bound SH20B lane crossings of side creeks in Waokauri and Otaimako Creeks, and additional north and south lanes on SH20 (between Portage Road and Puhinui Road I/C) are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). With this option, new east- and west-bound lanes attached to the present SH20B would apply both to the north (50 m) as well as the south (up to 100 m), with the northern extension encroaching more on the active tidal zone of the three southern Waokauri Creek arms around Prices Road. Also for this option, there are both a south- and north-bound lanes for SH20. Consequently, this option has been scored "lower" at -2 than other options involving new carriageways <u>to the south</u> of the present SH20B. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options.		

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in three areas: i) Extra SH20 north- and south-bound lanes (between Portage Road and Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) Corridors north and south alongside SH20B (Puhinui Road) around Prices Road up to Campana Road – 3 arms of upper southern Waokauri Creek; iii) corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening		
Name of assessor (incl. qualifications and organisation)	, PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton	
Area of assessment	Coastal processes and coastal climate change and sea-level rise	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Construction effects on CMA	Geomorphology/sedimentation & tidal flows	Sea-level rise and coastal climate change
-1	-1	-2
Notes: (refer to Figures 1 and 2) Reasons / Comments ■ <i>Construction effects on CMA:</i> – Reasons/comments: Proposed RTN crossings south of SH20B and east- and west-bound SH20B lane crossings of side creeks in Waokauri and Otaimako Creeks, are at the upper reaches of the present-day tidal limit – so assuming sediment & erosion control measures can be effectively implemented in these very sheltered (low wave) environments. ■ <i>Geomorphology/sedimentation & tidal flows:</i> – Reasons/comments: Similarly, because of the location of these crossings at the landward head of these arms of Waokauri and Otaimako Creeks, and the historically modified coastal environments, unlikely to be more than minor changes from the proposed new works. ■ <i>Sea-level rise and coastal climate change:</i> – Reasons/comments: Sea-level rise and associated increases in extreme storm-tide water levels in the next 100 years, will encroach permanently (and further inland intermittently during storms) onto adjoining land at the head of these creeks (off Pukaki Creek) and may also require larger culverts and/or short bridge crossings (based on a desk-top assessment with no field reconnaissance). With this option, new east- and west-bound lanes attached to the present SH20b would apply both to the north (50 m) as well as the south (up to 100 m), with the northern extension encroaching more on the active tidal zone of the three southern Waokauri Creek arms around Prices Road. Consequently, this option has been scored “lower” at -2 than other options involving new carriageways <u>to the south</u> of the present SH20B. Extra southbound lane on SH20 over Tararata Creek (Mangere Inlet) is a bridged section and common to all options.		

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in two areas: i) Extra SH20 north- and south-bound lanes (between Portage Road and Puhinui Road I/C) – upper eastern Waokauri Creek opposite end of Daphne Road; ii) corridor south of Puhinui Road (SH20), to the east of Orrs Road at the boundary with the Airport precinct - upper Otaimako Creek.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Drive) and SH20 (other than opposite the end of Daphne Road) – therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these Creeks over time on the back of SLR.
- Culverts and bridges crossing the creeks (SH20B, SH20), including present culverts and short bridges, may need to be upgraded and increased to accommodate SLR and associated storm-tide flows and water levels.

Other Information relied upon

- See list of references and maps on page 1.

Approved by:

Title	Name	Qualification	Signature	Date
Author		PhD (Civil Engineering), CPEng		18-Sep-2018
Reviewer		PhD (Ocean Engineering)		13-Sep-2018

Technical Note

To		From	
Copy		Reference	501094
Date	2018-08-22	Pages (including this page)	18
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Natural Character, Landscape, Visual and Urban Design		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 22nd August 2018).

The source information assessed was based on desktop analysis only. The assessments were based on:

- The 20Connect long-list schematics (dated 14th August 2018) and the long-list options descriptions and assumptions (dated 14th August 2018).
- Google Earth, Google Maps and Google Street View
- Auckland Council Unitary Plan GeoMaps System (<https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>)
- NZ Topographic Maps Online (<https://www.topomap.co.nz/>)
- Te Araroa Trail website and maps (<https://www.teararoa.org.nz/>)
- NZTA Landscape Guidelines (Final Draft) and NZTA Bridging the Gap (Urban Design Guidelines)
- Local knowledge of the site and locality

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A								
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd							
Area of assessment	Landscape, Natural Character, Visual and Urban Design							
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive								
<table border="1"> <thead> <tr> <th>Natural Character and Landscape Effects</th> <th>Visual Effects</th> <th>Urban Design Outcomes</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> <td>+1</td> </tr> </tbody> </table>	Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes	-1	-1	+1		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes						
-1	-1	+1						
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Shorter term landscape effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i>								

- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Shorter term visual effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges.

■ **Urban Design Outcomes:**

- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Loss of offramp to Bader Drive from SH20A considered minor adverse UD outcome only as other local connections are available.

Assumptions

- 
- RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A								
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd							
Area of assessment	Landscape, Natural Character, Visual and Urban Design							
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive								
<table border="1"> <thead> <tr> <th>Natural Character and Landscape Effects</th> <th>Visual Effects</th> <th>Urban Design Outcomes</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> <td>+1</td> </tr> </tbody> </table>	Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes	-1	-1	+1		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes						
-1	-1	+1						
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Shorter term landscape effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i>								

- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Shorter term visual effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges.

■ *Urban Design Outcomes:*

- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Loss of offramp to Bader Drive from SH20A considered minor adverse UD outcome only as other local connections are available.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 3 Multi Criteria Analysis Scoring Sheet

Option C1b: Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN		
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd	
Area of assessment	Landscape, Natural Character, Visual and Urban Design	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes
N/A	N/A	N/A
Notes: This option has not been assessed as per the direction provided		

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only								
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd							
Area of assessment	Landscape, Natural Character, Visual and Urban Design							
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive								
<table border="1"> <thead> <tr> <th>Natural Character and Landscape Effects</th> <th>Visual Effects</th> <th>Urban Design Outcomes</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> <td>+1</td> </tr> </tbody> </table>	Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes	-1	-1	+1		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes						
-1	-1	+1						
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Shorter term landscape effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i>								

- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Shorter term visual effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges.

■ **Urban Design Outcomes:**

- Returning existing SH20B (Puhinui Road) to a local road and diverting airport traffic onto offline option considered a positive UD outcome due to reduced traffic volumes (and potential other works) to a road flanked by local businesses and residential properties. Positive outcome for Memorial Gardens/Cemetery also.
- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- SH20B and RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Existing SH20B (Puhinui Road) will be disconnected from airport in order to promote use of offline option and return this road to local use only.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps		
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd	
Area of assessment	Landscape, Natural Character, Visual and Urban Design	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes
-1	-1	+1
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Shorter term landscape effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i> – The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the		

viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 RTC connection may impact this viewshaft.

- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Visual effects possible on Memorial Gardens/Cemetery as a result of north-facing connection ramps SH20B/SH20. Likely difficult to mitigate, although planting may assist.
- Shorter term visual effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges.

■ *Urban Design Outcomes:*

- Returning existing SH20B (Puhinui Road) to a local road and diverting airport traffic onto offline option considered a positive UD outcome due to reduced traffic volumes (and potential other works) to a road flanked by local businesses and residential properties. Positive outcome for Memorial Gardens/Cemetery also.
- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- SH20B and RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Existing SH20B (Puhinui Road) will be disconnected from airport in order to promote use of offline option and return this road to local use only.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment		
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd	
Area of assessment	Landscape, Natural Character, Visual and Urban Design	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes
-1	-1	+1
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Shorter term landscape effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i>		

- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Shorter term visual effects may be likely from SH20B and RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges.

■ *Urban Design Outcomes:*

- Returning existing SH20B (Puhinui Road) to a local road and diverting airport traffic onto offline option considered a positive UD outcome due to reduced traffic volumes (and potential other works) to a road flanked by local businesses and residential properties. Positive outcome for Memorial Gardens/Cemetery also.
- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Loss of offramp to Bader Drive from SH20A considered minor adverse UD outcome only as other local connections are available.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- SH20B and RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Existing SH20B (Puhinui Road) will be disconnected from airport in order to promote use of offline option and return this road to local use only.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway		
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd	
Area of assessment	Landscape, Natural Character, Visual and Urban Design	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes
-1	-1	+1
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, although noted that this ONF is already impacted by existing motorway and quarry activity. – Road widening of SH20 could affect Historic Heritage in Mangere Centre Park, and amenity of the park itself (east side of SH20 on Bader Drive). Could be mitigated with planting and specific design response. – Road widening of SH20 could affect amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Road widening of SH20B may have minor impact on natural character and landscape of coastal environment and waterways where there are existing crossings. – Shorter term landscape effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – SH20 is flanked by relatively mature vegetation (particularly the eastern side) resulting in a green corridor through the city. Widening may result in the loss of this vegetation (and associated habitat). Can be partially mitigated through further planting, if space allows. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area.		

■ *Visual Effects:*

- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds, which may be affected by widening works, increasing visibility of the motorway corridor from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor.
- Shorter term visual effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan.
- Limited residential properties near main interchanges. Increased visual effects for existing residences on SH20B.

■ *Urban Design Outcomes:*

- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- Widening of SH20B in existing location likely to diminish UD outcomes for existing local residents and businesses.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Loss of offramp to Bader Drive from SH20A considered minor adverse UD outcome only as other local connections are available.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Table 8 Multi Criteria Analysis Scoring Sheet

Option C4b: Balanced approach – SH20B Expressway with enhanced Airport connection		
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd	
Area of assessment	Landscape, Natural Character, Visual and Urban Design	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes
N/A	N/A	N/A
Notes: This option has not been assessed as per the direction provided		

Table 9 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening								
Name of assessor (incl. qualifications and organisation)	Registered Landscape Architect Wayfinder Landscape Planning & Strategy Ltd							
Area of assessment	Landscape, Natural Character, Visual and Urban Design							
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive								
<table border="1"> <thead> <tr> <th>Natural Character and Landscape Effects</th> <th>Visual Effects</th> <th>Urban Design Outcomes</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> <td>+1</td> </tr> </tbody> </table>	Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes	-1	-1	+1		
Natural Character and Landscape Effects	Visual Effects	Urban Design Outcomes						
-1	-1	+1						
Notes: <u>Reasons / Comments</u> ■ <i>Natural Character and Landscape Effects:</i> – Road widening of SH20A could affect amenity of Williams Park (north side of SH20A). Could be mitigated with planting and specific design response. – Road widening of SH20B may have minor impact on natural character and landscape of coastal environment and waterways where there are existing crossings. – Shorter term landscape effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future landscape changes in this area are provided for in the Auckland Unitary Plan. – Note presence of Notable Tree 1526, Flowering Gum, on Puhinui Road road reserve east of SH20/SH20B interchange, however this is likely beyond the site area. ■ <i>Visual Effects:</i> – The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the offramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. A new eastbound SH20A to SH20 connection may impact this viewshaft. – Shorter term visual effects may be likely from RTC through open rural area by Prices Road, however this is zoned Business and future visual changes in this area are provided for in the Auckland Unitary Plan. – Limited residential properties near main interchanges. Increased visual effects for existing residences on SH20B.								

■ **Urban Design Outcomes:**

- Inclusion of SUPs throughout whole corridor is positive for walking and cycling.
- Inclusion of SUP along SH20B positive for completing a safe, walkable portion of the Te Araroa Trail.
- Inclusion of MRT/LRT/RTC to airport is a positive UD outcome.
- Widening of SH20B in existing location likely to diminish UD outcomes for existing local residents and businesses.
- SH20A travels through a narrow corridor and there may be limited opportunities for high quality urban design outcomes as a result.
- Changes to recently completed Kirkbride Road interchange will be considered adverse from a longer-term UD planning perspective.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Loss of offramp to Bader Drive from SH20A considered minor adverse UD outcome only as other local connections are available.

Assumptions

- Assumptions as per Memorandum provided by [REDACTED] to 20Connect Environment Specialists dated 14th August 2018.
- RTC is likely to affect natural character of the coastal environment at airport end of SH20B, including Pukaki Creek and Otaimako Creek estuarine areas, and upper tributaries of Waokauri Creek. May also have impact on cultural value in this area. Mitigation possible through design of infrastructure and inclusion of planting. However this is currently outside the scope of the project.
- Auckland International Airport will provide appropriate links within their designated land area and as part of this will develop appropriate gateway landscape concepts such that these do not have to be incorporated within the NZTA project area.

Other Information relied upon

- As outlined above.

Approved by:

Title	Name	Qualification	Signature	Date
Author	[REDACTED]	B.L.A. (Hons) NZILA Registered Landscape Architect	[REDACTED]	22 nd August 2018
Reviewer				

Technical Note

To		From	
Copy		Reference	501094
Date	2018-08-27	Pages (including this page)	15
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Social		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 14/08/2018).

The source information assessed was based on desktop analysis only. The review of potential social impacts is based on:

- The 20Connect long-list schematics (dated 14 August 2018) and the long-list options descriptions and assumptions (dated 14 August 2018).
- Auckland Council GeoMaps viewer (accessed August 2018).
- Environmental Context Maps (20Connect Single-Stage Business Case Part A: Strategic Context dated 13 August 2018).
- Auckland Plan 2050 (accessed August 2018).
- Southern Initiative (accessed August 2018).

A high-level description of the long list options are outlined in the following table. The MCA scores and accompanying assessments are outlined in Tables 1 to 7.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN (not assessed)
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection (not assessed)
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation) [REDACTED], BPlan (Hons) - Aurecon		
Area of assessment Social		
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-2 (Significant negative)	-1 (Minor negative)
Reasons / Comments ■ Accessibility: - Increased traffic lanes are likely to improve accessibility to and from the Auckland International Airport area and Manukau. The Auckland Plan anticipates that there will be a high number of jobs in the Auckland Airport area by 2036 yet the Mangere-Otahuhu area is identified as one of the most deprived areas in Auckland. Improved accessibility and mobility may aid access to employment opportunities – this supports the Southern Initiative developed from the Auckland Plan. The addition of a rapid transit corridor (RTC) would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). - A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit to community groups. - There may be effects on access to community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and Construction Management Plans. ■ Community: - Widening of SH20A would occur close to several schools, early childhood centres and marae. There is potential to directly impact Mangere Central School, Te Kohanga Reo o Mataatua ki Mangere and Mataatua Marae to the south-east of SH20A. This is potentially a significant social adverse effect with respect to the operations of these community facilities. - Additional State highway lanes will aid businesses (particularly freight), however the proposed improvements are unlikely to provide sizable benefits to community groups. ■ Health and safety: - Sensitive receivers along SH20A and SH20 (including residential properties, marae and educational facilities) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction and as a result of traffic lanes being sited closer during operation. - Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure. Assumptions ■ As the route of the SUP and tie-ins are not confirm, it is assumed that it will run adjacent to the SH20 and SH20A corridors that form part of the project (side of highway unknown).		

- Widening of SH20A to the south would require the physical or construction footprint to fall outside the extent of the existing corridor/designation.
- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH0A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)		[REDACTED], BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-2 (Significant negative)	-1 (Minor negative)
Reasons / Comments ■ <i>Accessibility:</i> - Increased traffic lanes are likely to improve accessibility to and from the Auckland International Airport area and Manukau. The Auckland Plan anticipates that there will be a high number of jobs in the Auckland Airport area by 2036 yet the Mangere-Otahuhu area is identified as one of the most deprived areas in Auckland. Improved accessibility and mobility may aid access to employment opportunities – this supports the Southern Initiative developed from the Auckland Plan. A lack of a RTC limits improvements for public transport. The addition of a RTC would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). - A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit to community groups. - There may be effects on access to community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and Construction Management Plans. ■ <i>Community:</i> - Widening of SH20A would occur close to several schools, early childhood centres and marae. [REDACTED] This is potentially a social significant adverse effect with respect to the operations of these community facilities. - Additional State highway lanes will aid businesses (particularly freight) however the proposed improvements are unlikely to provide sizable benefits to community groups. ■ <i>Health and safety:</i> - Sensitive receivers along SH20A and SH20 (including residential properties, marae and educational facilities) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction and as a result of traffic lanes being sited closer during operation. - Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure. Assumptions ■ As the route of the SUP and tie-ins are not confirm, it is assumed that it will run adjacent to the SH20 and SH20A corridors that form part of the project (side of highway unknown).		

- Widening of SH20A to the south would require the physical or construction footprint to fall outside the extent of the existing corridor/designation.
- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH0A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only		
Name of assessor (incl. qualifications and organisation)		[REDACTED], BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-2 (Significant adverse)	-1 (Minor adverse)
Reasons / Comments ■ <i>Accessibility:</i> – New motorway lanes along SH20B would remove Airport traffic from the existing SH20B/Puhinui Road corridor (which will then become a local road). This would have benefits for those accessing future businesses along Puhinui Road which supports the Southern Initiative developed out of the Auckland Plan, however, it does not provide a new connection that was not previously available. The addition of a RTC would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). – It is unclear whether this route will provide access to the proposed Park and Ride facility or the Puhinui Precinct business area to be located to the south of SH20B/Puhinui Road. There is potential to directly impact both land uses. This is potentially a social adverse effect with respect to the service provided by the Park and Ride facility and the extent of employment opportunities within the business area. – A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit. – There may be effects on access to community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and Construction Management Plans. ■ <i>Community:</i> – Widening of SH20A would occur close to several schools and early childhood centres, however is likely to avoid direct impacts if widening is kept to the north. – Additional State highway lanes will provide benefits to businesses (particularly freight) however the proposed improvements are unlikely to provide sizable benefits to community groups. – There is likely to be significant direct property impacts to the industrial properties at SH20B/Puhinui Road as a result of the alignment which would segregate/hinder access to several large parcels of industrial land to the south of Puhinui Road. This may lead to uncertainty regarding the acquisition process and/or possible loss of customers or business depending if access is severed or changed. Plan changes for the Puhinui Precinct have been lodged for this area to allow for industrial activities with the most well-known being the Southern Gateway Consortium.		

■ *Health and safety:*

- Sensitive receivers along SH20A and SH20 (including residential properties, marae and educational facilities) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction and as a result of traffic lanes being closer during operation.
- Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure.

Assumptions

- As the route of the SUP and tie-ins are not confirmed, it is assumed that it will run adjacent to the SH20 and SH20B corridors that form part of the project (side of highway unknown).
- Carriageway widening of SH20A would occur to the north-west and avoid direct impacts on the educational facilities that border the south-eastern side of SH20A.
- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps		
Name of assessor (incl. qualifications and organisation)		[REDACTED], BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-3 (Significant adverse/un-mitigatable)	-1 (Minor adverse)
Reasons / Comments ■ <i>Accessibility:</i> – New motorway along SH20B would remove Airport traffic from the existing SH20B/Puhinui Road corridor (which will then become a local road). This would have benefits for those accessing future businesses along Puhinui Road however does not provide a new connection that was not previously available. The addition of a RTC would provide more substantial benefits for lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). – It is unclear whether the new SH20B route will provide access to the proposed Park and Ride facility to be located at SH20B/Puhinui Road. – A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit. – There may be impacts to access to community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and the Construction Management Plans. ■ <i>Community:</i> – The extent of the proposed new north facing ramps at Puhinui Road/SH20 is unclear, however, there is potential to directly impact the Memorial Gardens (in particular burial areas and curtilage). This could be considered a significant adverse effect which is potentially unmitigable due to the site's sensitivity as a cemetery with impacts to graves likely to cause upset or distress to some bereaved parties or for some members of the community. Similar impacts were encountered at the Bolton Street Cemetery in Wellington. The impact may be limited to the construction footprint, however, the construction methodology and footprint is also unclear at this stage. – There is likely to be direct impact to the industrial properties at SH20B/Puhinui Road as a result of the alignment which would segregate/hinder access to several large parcels of industrial land to the south of Puhinui Road. This may lead to uncertainty regarding the acquisition process and/or possible loss of customers or business depending if access is severed or changed. Plan changes for the Puhinui Precinct have been lodged for this area to allow for industrial activities with the most well-known being the Southern Gateway Consortium. – Additional State highway lanes will provide benefits to businesses (particularly freight), however, the proposed improvements are unlikely to provide sizable benefits to community groups.		

■ *Health and safety:*

- Sensitive receivers along SH20 (including residential properties, marae and educational facilities) may experience adverse air quality, noise and vibration impacts during construction and as a result of traffic lanes being closer during operation.
- Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure.

Assumptions

- As the route of the SUP and tie-ins are not confirm, it is assumed that it will run adjacent to the SH20 and SH20B corridors that form part of the project (side of highway unknown).
- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH0A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment		
Name of assessor (incl. qualifications and organisation)		[REDACTED], BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-2 (Significant adverse)	-1 (Minor/moderate adverse)
Reasons / Comments ■ <i>Accessibility:</i> - Increased traffic lanes are likely to improve accessibility in terms of travel time for private vehicles and some buses to and from the Auckland International Airport area and Manukau. - New motorway along SH20B would remove Airport traffic from the existing SH20B/Puhinui Road corridor (which will then become a local road). This would have benefits for those accessing future businesses along Puhinui Road, however, it does not provide a new connection that was not previously available. The addition of a RTC would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). - It is unclear whether the new SH20B route will provide access to the proposed Park and Ride facility to be located at SH20B/Puhinui Road. - A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit. - There may be impacts to access to community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and the Construction Management Plans. ■ <i>Community:</i> - Additional State highway lanes will provide benefits to businesses (particularly freight) however the proposed improvements are unlikely to provide sizable benefits to community groups. - Widening of SH20A would occur close to several schools, early childhood centres and marae. [REDACTED] [REDACTED] This is potentially a significant adverse effect. - There is likely to be significant direct property impacts to the industrial properties at SH20B/Puhinui Road as a result of the alignment which would segregate/hinder access to several large parcels of industrial land to the south of Puhinui Road. Plan changes have been lodged for this area to allow for industrial activities with the most well-known being the Southern Gateway Consortium. ■ <i>Health and safety:</i> - Sensitive receivers along SH20 and SH20A (including residential properties, marae and educational facilities) may experience adverse air quality, noise and vibration impacts during construction and as a result of traffic lanes being closer during operation.		

- Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure.

Assumptions

- As the route of the SUP and tie-ins are not confirmed, it is assumed that it will run adjacent to the SH20, SH20A and SH20B corridors that form part of the project (side of highway unknown).
- Widening of SH20A to the south would require the physical or construction footprint to fall outside the extent of the existing corridor/designation.
- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway		
Name of assessor (incl. qualifications and organisation)		[REDACTED], BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-1 (Minor/moderate adverse)	-1 (Minor/moderate adverse)
Notes: <u>Reasons / Comments</u> ■ Accessibility: - Increased traffic lanes are likely to improve accessibility in terms of travel time for private vehicles and some buses to and from the Auckland International Airport area and Manukau. The addition of a RTC would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). A Shared Use Path (SUP) would provide additional accessibility and modal choice. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit. - There may be impacts to access to nearby community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and the Construction Management Plans. ■ Community: - Widening of SH20A would occur close to several schools and early childhood centres, however is likely to avoid direct impacts if widening is kept to the north. - Additional State highway lanes will provide benefits to businesses (particularly freight) however the proposed improvements are unlikely to provide sizable benefits to community groups. - There is likely to be minor impacts to property frontages along SH20B, including the Memorial Gardens (cemetery). However, it is assumed that this option will not directly impact any burial areas or areas of sensitivity at the Memorial Gardens. ■ Health and safety: - Sensitive receivers along SH20A, SH20B and SH20 (including residential properties, marae and educational facilities) may experience adverse air quality, noise and vibration impacts during construction and as a result of traffic lanes being closer during operation. - Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure. <u>Assumptions</u> ■ As the route of the SUP and tie-ins are not confirm, it is assumed that it will run adjacent to the SH20, SH20A and SH20B corridors that form part of the project (side of highway unknown). ■ Carriageway widening of SH20A would occur to the north-west and avoid direct impacts on the educational facilities that border the south-eastern side of SH20A.		

- Widening along SH20 (including construction footprint) would remain within the existing designation corridor.
- It is assumed that widening along SH20B would not directly impact any areas of sensitivity at the Memorial Gardens site.
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH0A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening		
Name of assessor (incl. qualifications and organisation)		██████████ BPlan (Hons) - Aurecon
Area of assessment		Social
Score:		
Accessibility	Community	Health and safety
1 (Minor positive)	-1 (Minor/moderate adverse)	-1 (Minor/moderate adverse)
Notes: <u>Reasons / Comments</u> ■ Accessibility: - Increased traffic lanes are likely to improve accessibility in terms of travel time for private vehicles and some buses to and from the Auckland International Airport area and Manukau. The addition of a RTC would provide more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct (the consideration of the RTC is excluded from the scoring but is noted). - A Shared Use Path (SUP) would provide additional accessibility and modal choice, however would be a long distance pathway. Further analysis of options should be undertaken of potential SUP pathways to confirm a location that provides the most benefit. - There may be impacts to access to nearby community facilities, properties and businesses during construction. These effects are likely to be temporary and could be managed through Stakeholder and Communication Plans and the Construction Management Plans. ■ Community: - Widening of SH20A would occur close to several schools and early childhood centres, however is likely to avoid direct impacts if widening is kept to the north. - Additional State highway lanes will provide benefits to businesses (particularly freight) however the proposed improvements are unlikely to provide sizable benefits to community groups. - There is likely to be minor impacts to property frontages along SH20B, including the Memorial Gardens (cemetery). However it is assumed that this option will not directly impact any graves or areas of sensitivity at the Memorial Gardens. ■ Health and safety: - Sensitive receivers along SH20A (including residential properties, marae and educational facilities) may experience adverse air quality, noise and vibration impacts during construction and as a result of traffic lanes being closer during operation. - Provision of a SUP provides opportunities for active modes of travel where there is not currently any dedicated walking or cycling infrastructure. <u>Assumptions</u> ■ As the route of the SUP and tie-ins are not confirm, it is assumed that it will run adjacent to the SH20, SH20A and SH20B corridors that form part of the project (side of highway unknown). ■ Carriageway widening of SH20A would occur to the north-west and avoid direct impacts on the educational facilities that border the south-eastern side of SH20A.		

- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this long list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH0A and SH20B corridors.
- Property effects have been assessed separately. This technical note assesses social impacts only with high-level commentary on potential economic and property impacts with relation to social effects.
- Community profiling or social baseline has not been carried out for this long list assessment.

Approved by:

Title	Name	Qualification	Signature	Date
Author		BPlan (Hons), Int.NZPI		12.10.2018
Reviewer		MSc City & Regional Planning, ANZPI, MRTPI		12.09.2018

Technical Note

To		From	
Copy		Reference	501094
Date	2018-09-03	Pages (including this page)	15
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Acoustics		

The following provides an acoustic assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

Noise

The source information assessed was based on desktop analysis only. The assessments were based on:

- The 20Connect long-list schematics (dated 13 August 2018) and the long-list options descriptions and assumptions (dated 13 August 2018).
- Traffic flow data for the existing road and a future design year provided by Aurecon.
- Noise level criterion of NZS 6806 and NZS 6803.
- NZTA 'State highway construction noise and vibration guide'.
- NZTA 'Guide to assessing road traffic noise using NZS 6806.
- Auckland Unitary Plan, operative in part (updated 13 July 2018).

Vibration

Noise and vibration emissions during construction of the project should be assessed in accordance with NZS 6803 and against the relevant limits within the Auckland Unitary Plan Operative in Part. A comprehensive construction noise and vibration management plan should be prepared prior to construction of the scheme to ensure potentially adverse effects are mitigated wherever possible.

Future Land Uses

The Auckland Unitary Plan, Operative in Part (updated 13 July 2018), details the future land use in areas to the north and south of Puhinui Road to be 'Business-Light Industrial' (i.e. commercial in nature) and 'Future Urban Zone'. Therefore, whilst there are currently residential premises in the vicinity, the long-term the intention is for this land to become industrial/commercial.

Neither the Auckland Unitary Plan, nor NZS6806:2010 specify internal noise level criteria for commercial premises. On the basis that future commercial buildings could be designed to accommodate the traffic noise levels (i.e. closed windows, mechanical ventilation), the impact of all options on future commercial premises is not considered to be significant.

It should be noted that if dwellings remained in the Business-Light Industrial zone, traffic noise levels at these properties would be assessed in accordance with NZ Standard NZS 6806:2010 would apply.

Assessment of Options

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN (not assessed)
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection (not assessed)
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score:	-1 Minor/Moderate Adverse	
Reasons / Comments		
■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20/SH20A due to the existing elevated traffic noise levels. ■ The widening works involve removal of dwellings directly alongside SH20/SH20A and would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses / low noise road surfaces) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ For SH20B, a future Urban and Light industrial land use along the SH20B corridor between SH20 and the airport is assumed. ■ The possible RTC corridor to the south of SH20B is not expected to noticeably increase noise levels assuming future industrial land use and the existing road traffic. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
Assumptions		
■ Widening of SH20A. ■ SH20A/SH20 system interchange ramp connections. ■ Widening of SH20 (north of SH20A). ■ RTC component includes Median MRT/LRT route on SH20A. ■ Airport to Botany RTC along route of SH20B. ■ The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.		
Other Information relied upon		

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score:	-1 Minor/Moderate Adverse	
<u>Reasons / Comments</u>		
■ The widening works involve removal of dwellings directly alongside SH20/SH20A and would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ For SH20B, future Urban and Light industrial land use along the SH20B corridor between SH20 and the airport is assumed. ■ The possible RTC corridor to the south of SH20B and adjacent to SH20 is not expected to noticeably increase noise levels assuming future industrial land use and the existing road traffic. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u>		
■ Widening of SH20A. ■ SH20A/SH20 system interchange ramp connections. ■ Widening of SH20 (north of SH20A). ■ Airport to Botany RTC along route of SH20B.		
<u>Other Information relied upon</u>		
■ NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects. ■ NZTA State highway construction and maintenance noise and vibration guide. ■ NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road. ■ Auckland Unitary Plan zones, accessed at https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html. ■ Auckland Transport Airport and Mangere rail, accessed at https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/.		

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score: -1 Minor/Moderate Adverse		
<u>Reasons / Comments</u> ■ The schematic shows new motorway for SH20B to the south of Puhinui Road. An LRT is also shown on median of SH20A, with an RTC corridor along SH20 and SH20B. ■ Our assessment is based on the future Urban and Light industrial land use along the SH20B corridor between SH20 and the airport. If any dwellings remain in these zones, the impact rating of this option may change. ■ Any dwellings that remain in the future Industrial or Urban zones along Puhinui Road would experience an increase in traffic noise levels. A detailed noise assessment would be required to assess noise mitigation requirements in accordance with NZS 6806. ■ The widening works involve removal of dwellings directly alongside SH20/SH20A and would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses / low noise road surfaces) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20A or SH20 given existing road traffic noise. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u> ■ Widening of SH20 (north of SH20A). ■ Widening of SH20 (south of SH20A). ■ SH20B/SH20 system interchange. ■ New SH20B offline motorway alongside Puhinui Road. ■ RTC component includes Median MRT/LRT route on SH20A.		

- Airport to Botany RTC along route of SH20B.
- The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.

Other Information relied upon

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score: -1 Minor/Moderate Adverse		
<u>Reasons / Comments</u> ■ The schematic shows a new motorway for SH20B to the south of Puhinui Road between SH20 and the airport. An LRT is also shown on the median of SH20A, with an RTC corridor along SH20 and SH20B. ■ Minor adverse (-1) impact is based on the future Urban and Light industrial land use along the SH20B corridor between SH20 and the airport. If any dwellings remain in these zones, the impact rating of this option may change. ■ Any dwellings that remain in the future Industrial or Urban zones along Puhinui Road would experience an increase in traffic noise levels. A detailed noise assessment would be required to assess noise mitigation requirements in accordance with NZS 6806. ■ The widening works involve removal of dwellings directly alongside SH20/SH20A and would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses / low noise road surfaces) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20A or SH20 given existing road traffic noise. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ At the Manukau Memorial Gardens, the SH20 to SH20B connection ramps in Option C2b would increase traffic noise levels in the gardens. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u> ■ Widening of SH20 (north of SH20A). ■ Widening of SH20 (south of SH20A).		

- SH20B/SH20 system interchange ramp connections.
- SH20B new offline motorway.
- RTC component includes Median MRT/LRT route on SH20A.
- Airport to Botany RTC along route of SH20B.
- The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.

Other Information relied upon

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score: -1 Minor/Moderate Adverse		
<u>Reasons / Comments</u> ■ The schematic shows a new motorway for SH20B to the south of Puhinui Road between SH20 and the airport. An LRT is also shown on the median of SH20A, with an RTC corridor along SH20 and SH20B. ■ Any dwellings that remain in the future Industrial or Urban zones along Puhinui Road would experience an increase in traffic noise levels. A detailed noise assessment would be required to assess noise mitigation requirements in accordance with NZS 6806. ■ The widening works which would involve removal of dwellings directly alongside SH20/SH20A would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses / low noise road surfaces) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20A or SH20 given existing road traffic noise. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u> ■ Widening of SH20A. ■ SHO20a/SH20 system interchange ramp connections. ■ Widening of SH20 (north of SH20A). ■ Widening of SH20 (south of SH20A). ■ SH20B/SH20 system interchange ramp connections. ■ RTC component includes Median MRT/LRT route on SH20A.		

- Airport to Botany RTC along route of SH20B.
- The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.

Other Information relied upon

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score: -1 Minor/Moderate Adverse		
<u>Reasons / Comments</u> ■ The indicative layout shows a widening of SH20B and provision of a new RTC along Puhinui Road between SH20 and the airport, with LRT/RTC in the median of SH20A and RTC alongside SH20. ■ Any dwellings that remain in the future Industrial or Urban zones along Puhinui Road would experience an increase in traffic noise levels. A detailed noise assessment would be required to assess noise mitigation requirements in accordance with NZS 6806. ■ The widening works which would involve removal of dwellings directly alongside SH20/SH20A would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses / low noise road surfaces) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20A or SH20 given existing road traffic noise. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u> ■ SH20A/SH20 system interchange ramp connections. ■ Widening of SH20 (north of SH20A). ■ Widening of SH20 (south of SH20A). ■ Widening of Puhinui Road (SH20B). ■ RTC component includes Median MRT/LRT route on SH20A. ■ Airport to Botany RTC along route of SH20B.		

- The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.

Other Information relied upon

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening		
Name of assessor (incl. qualifications and organisation)		MSc, MIOA Aurecon
Area of assessment	Acoustics	
Score: -1 Minor/Moderate Adverse		
<u>Reasons / Comments</u> ■ The indicative layout shows a widening of SH20B and provision of a new RTC along Puhinui Road between SH20 and the airport, with LRT/RTC in the median of SH20A and RTC alongside SH20. ■ Any dwellings that remain in the future Industrial or Urban zones along Puhinui Road would experience an increase in traffic noise levels. A detailed noise assessment would be required to assess noise mitigation requirements in accordance with NZS6806. ■ The widening works which would involve removal of dwellings directly alongside SH20A would change the noise environment for dwellings currently screened by the removed dwellings. It is assumed that some form of noise mitigation (barriers / upgrades to houses) would be implemented where required. ■ Any potential increase in vibration levels from road traffic on the motorway as a result of widening SH20/SH20A is likely to be negligible. ■ The addition of LRT/RTC along the centre of SH20A and adjacent to SH20 is not expected to noticeably change the noise environment near SH20A or SH20 given existing road traffic noise. ■ An increase in vibration levels from operation of the LRT and/or road traffic at PPF's is unlikely but would require consideration. ■ The impact at specific properties would vary and may be higher in some instances. A detailed assessment would be required to assess potential noise and vibration effects and additional noise mitigation such as upgrades to houses may be required in some cases. ■ Overall, this option has been given a -1 (minor adverse) impact rating for operational noise and vibration, based on the existing environment and the implementation of standard noise mitigation measures. ■ NZTA Risk assessment indicates a 'High risk' rating for construction noise and vibration, based on route length of option exceeding 10km.		
<u>Assumptions</u> ■ SH20A/SH20 system interchange ramp connections; ■ Widening of Puhinui Road (SH20B); ■ RTC component includes Median MRT/LRT route on SH20A; ■ Airport to Botany RTC along route of SH20B. ■ The LRT stops are unknown and so it is unclear as to whether there will be any sensitive receptors/PPFs near these locations that may experience adverse effects as a result of braking or bells on the LRT. The impact of this has not been assessed as part of this MCA.		

Other Information relied upon

- NZTA Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects.
- NZTA State highway construction and maintenance noise and vibration guide.
- NZS 6806:2010: Acoustics – Road-traffic noise – new and altered road.
- Auckland Unitary Plan zones, accessed at <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>.
- Auckland Transport Airport and Mangere rail, accessed at <https://at.govt.nz/projects-roadworks/airport-and-mangere-rail/>.

Approved by:

Title	Name	Qualification	Signature	Date
Author		MSc, MIOA		03/09/2018
Reviewer		B.Eng(mech), Member ASNZ		03/09/2018

Technical Note

To		From	
Copy		Reference	501094
Date	2018-08-24	Pages (including this page)	15
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Archaeology and Built Heritage		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

The source information assessed was based on desktop analysis only. The archaeological and built heritage assessments were based on:

- The 20Connect long-list schematics (dated 13 August 2018) and the long-list options descriptions and assumptions (dated 13 August 2018).
- New Zealand Archaeological Association (NZAA) site recording forms within 200m of the proposed works (This distance is used due to the possible inaccuracy of archaeological sites recorded prior to 1990, which could exist within the proposed designation).
- Auckland Council Cultural Heritage Inventory.
- Auckland Council Unitary Plan - Operative in Part.
- *Self Family Trust v Auckland Council* [2018] NZEnvC 49.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-3	-1	-3
Notes: Reasons / Comments ■ <i>Widening of SH20A</i> – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves. ■ <i>SH20A/SH20 interchange</i> – There have been archaeological sites identified near to SH20 and SH20a, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international		

significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.
- No works will be undertaken on SH20B.

Other Information relied upon

- As listed on Page 1.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A		
Name of assessor (incl. qualifications and organisation)	[Redacted] MA (Hons) CFG Heritage Ltd	
Area of assessment	Archaeology and Built Heritage	
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-3	-1	-3
Notes: Reasons / Comments ■ <i>Widening of SH20A</i> – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves. ■ <i>SH20A/SH20 system interchange ramp connections</i> – There have been archaeological sites identified near to SH20 and SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international		

significance. There are 14 recorded archaeological sites within 200m of the road reserve which associated with this archaeological landscape and it is likely that archaeological material exists on both sides of the motorway that would be affected by works.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.
- No works will be undertaken on SH20B.

Other Information relied upon

- As listed on Page 1.

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-2	-1	-2
Notes: Reasons / Comments ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A (Southbound)</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. Although a majority of the recorded sites are on the western side of the motorway, it is likely that these sites extend onto the eastern side of the motorway and that archaeological material associated with this would be uncovered. Works to the east of the motorway are considered mitigatable. ■ <i>SH20/SH20B system interchange ramp connections</i> – This interchange is near to a number of archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified in the vicinity of this interchange but it is		

unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).

■ *SH20B offline motorway*

- There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-3	-1	-3
Notes: Reasons / Comments ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and it is likely that archaeological material exists on both sides of the motorway that would be affected by works. ■ <i>SH20/SH20B system interchange ramp connections</i> – This interchange is near to a number of archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified in the vicinity of this interchange but it is		

unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).

■ **SH20B offline motorway**

- There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-2	-1	-2
Notes: Reasons / Comments ■ <i>Widening of SH20A</i> – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves. ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and it is likely that archaeological material exists on both sides of the motorway that would be affected by works. Works to the east of the motorway can be considered mitigatable.		

■ *SH20/SH20B system interchange ramp connections*

- This interchange is near to a number of archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified in the vicinity of this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).

■ *Widening of SH20 south of SH20B interchange*

- There have been both pre-European and historic sites identified near along this section of motorway, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the designation.

■ *SH20B offline motorway*

- There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-3	-1	-3
Notes: Reasons / Comments ■ <i>SH20A/SH20 system interchange ramp connections</i> – There have been archaeological sites identified near to SH20 and SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 north of SH20A</i> – There are two recorded sites within this scope of the project, one is listed as destroyed and the other has an unknown condition. It cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange. ■ <i>Widening of SH20 south of SH20A</i> – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and it is likely that archaeological material exists on both sides of the motorway that would be affected by works.		

■ *SH20/SH20B system interchange ramp connections*

- This interchange is near to a number of archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified in the vicinity of this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).

■ *Widening of SH20 south of SH20B interchange*

- There have been both pre-European and historic sites identified near along this section of motorway, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the designation.

■ *SH20B Expressway*

- There are six recorded archaeological sites recorded within 200m of the current designation of SH20B. Although some of these sites will be outside the scope of works, it is indicative of the density of archaeological sites in the area, and it cannot be ruled out that sub-surface archaeological features will be encountered during works.

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date.

Other Information relied upon

- As listed on Page 1.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening		
Name of assessor (incl. qualifications and organisation)		MA (Hons) CFG Heritage Ltd
Area of assessment		Archaeology and Built Heritage
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive		
Extent of effects on sites and places of archaeological value and on heritage buildings and places.	KPI 9 Extent of effects on sites, buildings and places of heritage value.	KPI 9 Extent of effects on sites and places of archaeological value.
-1	-1	-1
Notes: <u>Reasons / Comments</u> ■ <i>SH20A/SH20 system interchange ramp connections</i> – There have been archaeological sites identified near to SH20 and SH20A , and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the vicinity of the proposed interchange connection. Although there is no proposed widening for SH20, and related works including lay-downs for this interchange could affect Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park'. This item has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. ■ <i>SH20/SH20B system interchange ramp connections</i> – This interchange is near to a number of archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified in the vicinity of this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part). ■ <i>SH20B Expressway</i> – There are six recorded archaeological sites recorded within 200m of the current designation of SH20B. Although some of these sites will be outside the scope of works, it is indicative of the density of archaeological sites in the area, and it cannot be ruled out that sub-surface archaeological features will be encountered during works.		

Assumptions

- All designations are within 50m of the current road reserves, with the exception of the southern side of SH20B, which will be within 100m.
- Archaeological site records are up to date

Other Information relied upon

- As listed on Page 1.

Approved by:

Title	Name	Qualification		Date
Author		MA (Hons) Auckland		24/08/18
Reviewer		MA (Otago), PhD (Sydney)		24/8/2018

Technical Note

To		From	
Copy		Reference	501094
Date	2018-08-28	Pages (including this page)	15
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Contaminated land		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (received 21 August 2018).

The source information assessed was based on desktop analysis only. The seven assessments were based on:

- The 20Connect long-list schematics (received 21 August 2018) and the long-list options descriptions and assumptions (dated 14 August 2018).
- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.
- Our assumption that excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

We have assumed that the works will be carried out as traditional earthworks with no special consideration given to the management of contaminated land or acid sulphate soil.

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A						
Name of assessor (incl. qualifications and organisation)				[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area.	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.	Risk to construction workers from soil or groundwater.	Risk to the environment from the discharge of acid generating soils.
-1	-1	0	-2	-1	-1	-2
Notes: <u>Reasons / Comments</u> ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Unlikely to affect passive discharge. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may be present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land would likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Assumptions

- Excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A						
Name of assessor (incl. qualifications and organisation)				[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	0	-2	-1	-1	-2
Notes: Reasons / Comments ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Unlikely to affect passive discharge. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land is likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Assumptions

- Excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only						
Name of assessor (incl. qualifications and organisation)				[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	-1	-2	-1	-1	-3
Notes: Reasons / Comments ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Construction within quarry/landfill near Cavendish road may create new pathways, worsening existing passive discharge arrangements in this area. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may be present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land would likely to be disturbed across most of SH20
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater. A significant area near SH20B would likely be excavated, this is closer to the receptors and involves more disturbance of 'greenfield' land.

Assumptions

- Excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps						
Name of assessor (incl. qualifications and organisation)				[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	-1	-2	-1	-1	-3
Notes: Reasons / Comments ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Construction within quarry/landfill near Cavendish Road may create new pathways, worsening existing passive discharge arrangements in this area. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may be present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land would likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater. A significant area near SH20B would likely be excavated, this is closer to the receptors and involves more disturbance of 'greenfield' land.

Assumptions

- Excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment						
Name of assessor (incl. qualifications and organisation)				[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	-1	-2	-1	-1	-3
Notes: Reasons / Comments ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Construction within quarry/landfill near Cavendish Road may create new pathways, worsening existing passive discharge arrangements in this area. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land is likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater. A significant area near SH20B would likely be excavated, this is closer to the receptors and involves more disturbance of 'greenfield' land.

Assumptions

- Excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway						
Name of assessor (incl. qualifications and organisation)				[Redacted] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC		
Area of assessment				Contaminated land		
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	0	-2	-1	-1	-2
Notes: <u>Reasons / Comments</u> ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Unlikely to affect passive discharge ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land is likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Assumptions

- excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening						
Name of assessor (incl. qualifications and organisation)		[REDACTED] – Aurecon. BSc, MSc (Hons), CChem, MRSC, MNZIC				
Area of assessment		Contaminated land				
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive						
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	Potential for the works to mobilise or place contamination within the project area	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	Risk to construction workers from soil or groundwater	Risk to the environment from the discharge of acid generating soils
-1	-1	0	-1	-1	-1	-1
Notes: <u>Reasons / Comments</u> ■ <i>Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.</i> – Contaminated land would likely to be disturbed across most of SH20. ■ <i>Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.</i> – Unlikely to affect passive discharge. ■ <i>Criteria: Potential for the works to mobilise or place contamination within the project area.</i> – Contaminated land would likely be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas. However, scale of works is relatively minor.						

- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
 - Acid soils may present which could weaken concrete structures.
- *Criteria: Risk to construction workers from soil or groundwater.*
 - Contaminated land is likely to be disturbed across most of SH20.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
 - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Assumptions

- excavation may extend in some location to 1.5m below ground surface and that groundwater may be present in some location at 1m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps.
- Our previous project experience in this area.

Approved by:

Title	Name	Qualification	Signature	Date
Author		BSc, MSc (Hons), CChem, MRSC, MNZIC		23/8/18
Reviewer		BSc, CEnvP: SC		28/8/18

Technical Note

To		From	
Copy		Reference	Project number
Date	Select date	Pages (including this page)	16
Subject	20 Connect Long-List Options: Multi-Criteria Analysis Scoring Sheet: Stormwater		

The following provides an assessment of the long-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the long-list options (dated 13 August 2018).

The source information assessed was based on desktop analysis only. The 7 assessments were based on:

- The 20 Connect long-list schematics (dated 17/08/2018) and the long-list options descriptions and assumptions (dated 17/08/2018).
- Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018)
- Auckland Unitary Plan Operative in Part (AUPOIP) - 2016

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option C1a	SH20A high investment only with MRT/LRT on SH20A
Option C1a1	SH20A high investment only without MRT/LRT on SH20A
Option C1b	Option C1a but without access to Airport Precinct from SH20 and SH20B is converted to RTN – Not assessed as per instruction.
Option C2a	SH20B high investment only – Motorway Puhinui south-facing ramps only
Option C2b	SH20B high investment only – Motorway Puhinui all ramps
Option C3	SH20A and SH20B high investment
Option C4a	Balanced approach – SH20B Expressway
Option C4b	Balanced approach – SH20B Expressway with enhanced Airport connection - Not assessed as per instruction.
Option C4c	Balanced approach – SH20B Expressway with no SH20 widening

Table 1 Multi Criteria Analysis Scoring Sheet

Option C1a: SH20A high investment only with MRT/LRT on SH20A	
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE
Area of assessment	Stormwater and treatment
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive	
Water Quality	Water Quantity
-1	-1
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 - AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. - As the option involves upgrade to existing SH20 (between SH20A and SH20B), there is an opportunity to improve water quality as the existing road is not treated. However, depending on the level of treatment achievable on both SH20 and SH20A (TBC during later design phases), there may be minor adverse effects if all new high-use road areas cannot be treated, therefore this criterion has been scored as Minor. WATER QUANTITY CRITERIA ■ SMAF: Score -1 - The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. - Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1	

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 2 Multi Criteria Analysis Scoring Sheet

Option C1a1: SH20A high investment only without MRT/LRT on SH20A					
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE				
Area of assessment	Stormwater and treatment				
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive					
<table border="1"> <thead> <tr> <th>Water Quality</th> <th>Water Quantity</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> </tr> </tbody> </table>	Water Quality	Water Quantity	-1	-1	
Water Quality	Water Quantity				
-1	-1				
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 – AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. – As the option involves upgrade to existing SH20 (between SH20A and SH20B), there is an opportunity to improve water quality as the existing road is not treated. However, depending on the level of treatment achievable on both SH20 and SH20A (TBC during later design phases), there may be minor adverse effects if all new high-use road areas cannot be treated, therefore this criterion has been scored as Minor. WATER QUANTITY CRITERIA ■ SMAF: Score -1 – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1					

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 3 Multi Criteria Analysis Scoring Sheet

Option C2a: SH20B high investment only – Motorway Puhinui south-facing ramps only	
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE
Area of assessment	Stormwater and treatment
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive	
Water Quality	Water Quantity
-1	-1
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 - AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: - SH20B; - Section of SH20 between SH20A and SH20B; and - SH20 / SH20A interchange. - The proposed option replaces existing SH20B and provides new lanes on SH20 (between SH20A and SH20B, where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the new SH20B and existing SH20. However, considering the option as a whole, water quality is rated minor I, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage. WATER QUANTITY CRITERIA ■ SMAF: Score -1 - The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. - Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1	

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 4 Multi Criteria Analysis Scoring Sheet

Option C2b: SH20B high investment only – Motorway Puhinui all ramps	
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE
Area of assessment	Stormwater and treatment
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive	
Water Quality	Water Quantity
-1	-1
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 - AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. - The proposed option replaces existing SH20B and provides new lanes on SH20 (between SH20A and SH20B, where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the new SH20B and existing SH20. However, considering the option as a whole, water quality is rated minor I, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage. WATER QUANTITY CRITERIA ■ SMAF: Score -1 - The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. - Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1	

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 5 Multi Criteria Analysis Scoring Sheet

Option C3: SH20A and SH20B high investment					
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE				
Area of assessment	Stormwater and treatment				
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive					
<table border="1"> <thead> <tr> <th>Water Quality</th> <th>Water Quantity</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> </tr> </tbody> </table>	Water Quality	Water Quantity	-1	-1	
Water Quality	Water Quantity				
-1	-1				
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 – AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. – The proposed option replaces existing SH20B and provides new lanes on SH20 (between SH20A and SH20B, where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the new SH20B and existing SH20. However, considering the option as a whole, water quality is rated minor I, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage. WATER QUANTITY CRITERIA ■ SMAF: Score -1 – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1					

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 6 Multi Criteria Analysis Scoring Sheet

Option C4a: Balanced approach – SH20B Expressway	
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE
Area of assessment	Stormwater and treatment
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive	
Water Quality	Water Quantity
-1	-1
Notes: <u>Reasons / Comments</u> WATER QUALITY CRITERIA ■ Stormwater treatment: Score -1 – AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. – The proposed option provides new lanes on SH20A, SH20B and SH20 (between SH20A and SH20B), where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the existing SH20B and existing SH20. However, considering the option as a whole, water quality is rated minor I, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage. WATER QUANTITY CRITERIA ■ SMAF: Score -1 – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1	

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

■ ***Highway footprint clash with existing streams: Score -1***

- There are locations within the project extents where extension to existing culverts or new culverting will be required to accommodate the proposed option.
- The road alignments should avoid going longitudinally along existing stream alignments as this would require the need for extensive reclamation, stream diversion and/or new culverting.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Table 7 Multi Criteria Analysis Scoring Sheet

Option C4c: Balanced approach – SH20B Expressway with no SH20 widening					
Name of assessor (incl. qualifications and organisation)	[REDACTED], BSc (Hons), MSc, MICE				
Area of assessment	Stormwater and treatment				
Score: -3 Significant Adverse/Un-mitigatable -2 Significant Adverse -1 Minor/Moderate Adverse 0 Neutral 1 Minor Positive 2 Moderate Positive 3 Significant Positive					
<table border="1"> <thead> <tr> <th>Water Quality</th> <th>Water Quantity</th> </tr> </thead> <tbody> <tr> <td>-1</td> <td>-1</td> </tr> </tbody> </table>	Water Quality	Water Quantity	-1	-1	
Water Quality	Water Quantity				
-1	-1				
Notes: <u>Reasons / Comments</u> <i>WATER QUALITY CRITERIA</i> ■ Stormwater treatment: Score -1 – AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment: ■ SH20B; ■ Section of SH20 between SH20A and SH20B; and ■ SH20 / SH20A interchange. – The proposed option provides new lanes on SH20A and SH20B where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the existing SH20B and existing SH20a. However, considering the option as a whole, water quality is rated minor I, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage. <i>WATER QUANTITY CRITERIA</i> ■ SMAF: Score -1 – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. ■ Overland Flow path: Score -1					

- There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development.
- Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the shot-list options assessment.
- As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.

■ ***Flood plain interaction / Detention for larger storm events: Score -1***

- There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.
- Designing for larger storm events may be required for various reasons, including but not limited:
 - Mitigation of flood effects caused by an increase in impervious surfaces
 - Reduction of existing flooding
 - Insufficient network capacity
- As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.

■ ***Highway footprint clash with existing streams: Score -1***

- There are locations within the project extents where extension to existing culverts or new culverting will be required to accommodate the proposed option.
- The road alignments should avoid going longitudinally along existing stream alignments as this would require the need for extensive reclamation, stream diversion and/or new culverting.

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- No area take off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- Any RTCs proposed as part of the option is out with the scope of this assessment.

Other Information relied upon

- This assessment is a desktop study has been carried out using Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).

Approved by:

Title	Name	Qualification	Signature	Date
Author		BSc (Hons), MSc, MICE		03/09/18
Reviewer		BEng (Hons), CPENg		07/09/18

Technical Note

To	NZ Transport Agency	From	20Connect Project Team
Copy		Reference No:	501094-4401-TEC-CC-0008
Date	08/05/2020	Pages (including this page)	10
Subject	Engineering and Design LLA		

Name of assessor

(incl. qualifications and organisation):

CEng MICE MEng Civil Engineering
Aurecon New Zealand Limited

This assessment has taken into consideration the implementation feasibility in relation to the long list options for the 20Connect SSBC and contributes to the long list multi-criteria analysis.

1 Methodology

No surveys, investigations or detailed site visits have been undertaken as part of this assessment.

A high-level desktop assessment of the following criteria for the proposed long list options has been undertaken (Table 1).

Table 1 Assessment criteria

Constructability

Level of complexity:

- How straightforward is it to implement this option?
- Are there any challenges with construction methodology and staging or constraints?
- Consider topography, gradients, utilities, ground conditions, contaminated land, tie-ins to existing infrastructure etc.

Construction disruption	Construction impacts on people and businesses regarding: ■ Traffic ■ Existing access levels ■ Duration ■ Any other impacts on businesses, community, town centres.
Construction cost and risk	Assessed cost for construction of options including: ■ Complexity and risk in construction (including consideration of constructability) ■ Complexity in the programme ■ Cost and complexity of undertaking the works on contaminated land (including health and safety).
Safety in design and construction	Level of design and construction risks: ■ Are there significant hazards associated with the option which pose a health and safety risk in design, build and final product? ■ Can safety be developed into the design process to control it? ■ Level of complexity in risk management through safety in design.

Operation and maintenance	Any factors that may affect the ability to operate or maintain the option over its projected life: - Any major ongoing or additional costs and/or whole of life costs? - Level of maintenance activities required - Capability to carry out maintenance activities.
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Table 2 details the how the engineering and design feasibility criteria has been scored.

Table 2 Scoring

Rating	Description
Green	Minor works & operational cost. Low risk.
Light Green	Moderate works. Low/moderate risk & operational cost.
Yellow	Major works. Moderate/high risk. Moderate operational cost.
Orange	Uncommon works. High risk. Moderate/high operational cost.
Red	Works not done before/often. Extreme risk. High operational cost.

2 Option assessment

Base Case Existing Environment (Do minimum)	Score
n/a	n/a
Summary The Base Case assumes no change to the existing road network with no new construction impacts, except on-going maintenance and operations. For this reason, we have not assessed the implementation feasibility of the Base Case.	

Option C1 High investment SH20A (with MRT considered)	Score
Constructability A total of five local road bridges require replacement (including the recently constructed Kirkbride Road), one pedestrian footbridge over SH20A requires replacement and construction of one new system interchange ramp. The addition of the Mass Rapid Transit (MRT) system along the median of SH20A will require SH20A to be shifted laterally and widened with associated construction impact to utilities, and stormwater infrastructure. As the MRT is a new mode of transport in New Zealand, this may add to the constructability risks as new standards and guidelines are introduced. Although major construction works are involved, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before. However, these works would be within a narrow corridor with high traffic volumes.	
Construction disruption	

Option C1 High investment SH20A (with MRT considered)	Score
Approximately 17km of online widening on SH20A and SH20 is likely to involve significant use of Temporary Traffic Management (TTM). Furthermore, construction of the SH20A / SH20 south facing system interchange ramps will involve works over live traffic lanes and require lane closures, consequently increasing travel times. Significant long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing the following five local road bridges: Walmsley Road, Bader Drive on SH20A and SH20, Kirkbride Road and Portage Road. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. In conjunction with the replacement of the Killington Crescent Pedestrian Footbridge on SH20A, this is likely to cause major disruption as it is the only pedestrian footbridge which solely caters for pedestrian movements across SH20. A large amount of infrastructure is required that will have adverse impacts on journey reliability due to the proximity to the Airport precinct. This option has no direct impact on the existing users of SH20B.	
Construction cost and risk Approximately 192,000m² of new pavement, 10,600m² of new structures, and 2700m of new retaining walls would be required. Whilst the area of new structures is at the lower end of the range amongst the options, the quantity of new pavement and TTM is on the higher end of the range.	
Safety in design and construction Widening of the SH20 and SH20A carriageway would result in sub-standard weave lengths, requiring four weaving departures. An additional departure is also required on the SH20A to SH20 system interchange ramps, due to a steep upward gradient of 6%. These departures are common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20A / SH20 system interchange ramp is ultimately likely to provide a safer southbound transition between SH20A and SH20 with the benefit of reduced travel times.	
Operation and maintenance There are some additional structures and pavement areas with associated maintenance requirements, but nothing out of the ordinary.	
Summary Construction works of this style have been undertaken in NZ before on projects such as Southern Corridor Improvements (SCI) and Northern Corridor Improvements (NCI). However, significant disruption is associated with the replacement of existing local road bridges on SH20A and SH20.	

Option C1a High investment SH20A (without MRT considered)	Score
Constructability The construction works are the same as option C1a, except for replacing the recently built Kirkbride interchange, as the MRT system is not required. The space allocated within the Kirkbride Road underpass for MRT could then be used for the additional general traffic lanes, with the widening limited to the left hand side only with no lateral movement of the existing carriageway. Although major construction works are involved, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before, there is nothing too unusual.	
Construction disruption Same as Option C1a, except the long-term disruption effects may be deemed as moderate. This is due to the omission of the MRT system on SH20A, which subsequently does not require widening of the existing Kirkbride interchange, as it is already future proofed with provisions for an MRT system. Kirkbride Road could provide some mitigation during replacement of the other bridges.	

Option C1a High investment SH20A (without MRT considered)	Score
Construction cost and risk Approximately 165,000m² of new pavement, 9,500m² of new structures, and 2200m of new retaining walls would be required. The area of new structures is at the lower end of the range amongst the options, the quantity of new pavement and TTM is also on the lower end of the range.	
Safety in design and construction Same as Option C1	
Operation and maintenance Same as Option C1	
Summary Moderately standard construction process with less disruption to the local community in comparison to Option C1, due to no MRT system on SH20A and consequently no replacement of the Kirkbride Road interchange.	

Option C1b High Investment SH20A (with SH20B converted to RTN)	Score
Constructability Same as Option C1	
Construction disruption Same as Option C1, except conversion of SH20B may result in additional disruption depending on staging.	
Construction cost and risk Same as Option C1, with some possible savings in pavement areas with SH20B converted to RTN.	
Safety in design and construction Same as Option C1	
Operation and maintenance Same as Option C1	
Summary Construction works of this style have been undertaken in NZ before on projects such as SCI and NCI with the only constraint being the addition of a median MRT system. The conversion of SH20B to Rapid Transit Corridor (RTC) at Pukaki Bridge is expected to be done via lane marking and signage and shall minimise construction effects once the road is closed.	

Option C2a High investment – SH20B – South facing ramps only	Score
Constructability A total of three local road bridges require replacement, one pedestrian footbridge over SH20A requires replacement and construction of two new system interchange ramps. The addition of the MRT system along the median of SH20A will require SH20A to be shifted laterally with associated construction impact to utilities, and stormwater infrastructure. As the MRT is a new mode of transport in New Zealand, this may add to the constructability risks as new standards and guidelines are introduced.	

Option C2a	Score
High investment – SH20B – South facing ramps only	
Although major construction works are involved, the construction methodologies would follow a relatively standard process, with this work being done in NZ before, there is nothing too unusual. Although the Puhinui south facing ramps involve major construction works, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before. Furthermore, considering SH20B involves full offline replacement, there is nothing too unusual.	
Construction disruption 7km of total online widening on SH20A and SH20 is likely to involve moderate use of TTM. Furthermore, construction of the southbound Puhinui south facing system interchange ramps will involve works over live traffic lanes and may require lane closures, consequently increasing travel times. Moderate long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing the following three local road bridges: Walmsley Road, Bader Drive on SH20A, and Portage Road. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a moderate period of time of reduced local access. In conjunction with the replacement of the Killington Crescent Pedestrian Footbridge on SH20A, this is likely to cause major disruption as it is the only pedestrian footbridge which solely caters for pedestrian movements across SH20. The large amount of infrastructure required is considered to have adverse impacts on journey reliability due to close proximity to the Airport precinct. This option has no direct impact on the existing users of SH20B as all works on SH20B are to be offline.	
Construction cost and risk Approximately 175,000m² of new pavement, 11,400m² of new structures, and 3000m of new retaining walls would be required. The area of new structures is in the middle of the range amongst the options, the quantity of new pavement and TTM is also in the middle of the range.	
Safety in design and construction A departure may be required for the proposed Puhinui south facing system interchange ramps, due to a steep upward gradient of 6%. This departure is common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20 / SH20B south facing system interchange ramps would likely provide a safer transition between SH20 and SH20B with the benefit of a consistent route right through to the airport without a staged reduction in speed and subsequently reduced travel times. 4km of total offline widening on SH20 and SH20B is not likely to cause any safety in design issues. A new crossing of the Jetfuel line can be achieved with a structure.	
Operation and maintenance Same as Option C1	
Summary Moderately standard construction process. Construction works of this style have been undertaken in NZ before on projects such as SCI and NCI, with the only constraint being the addition of a median MRT system. There would be minimal construction risks and disruption due to the south facing system interchange ramps as they would predominantly be constructed offline, with partial night traffic lane closure.	

Option C2b	Score
High investment – SH20B – All ramps	

Constructability Same as Option C2a , except the north facing ramps may face some additional constructability risks, due to the close proximity of the Manukau Memorial Gardens cemetery.	
Construction disruption Same as Option C2a , except the north facing ramps may face some additional constructability risks, due to the close proximity of the Manukau Memorial Gardens cemetery. Some additional online widening and TTM on SH20, but nothing unusual.	
Construction cost and risk Approximately 215,500m ² of new pavement, 24,100m ² of new structures, and 4400m of new retaining walls would be required. The area of new structures is at the top end of the range amongst the options, the quantity of new pavement and TTM is also at the top end of the range.	
Safety in design and construction Same as Option C2a	
Operation and maintenance Same as Option C1	
Summary Although a large amount of infrastructure is required for the proposed Puhinui system interchange ramps, the construction process should be relatively standard. Construction works of this style have been undertaken in NZ before on projects such as SCI and NCI, with the only constraint being the addition of a median MRT system. A potential constraint for the north facing Puhinui ramps may be present due to the close proximity of the Manukau Memorial Gardens cemetery.	

Option C3 High investment – SH20A & SH20B	Score
Constructability A total of five local road bridges require replacement (including the recently constructed Kirkbride Road), one pedestrian footbridge over SH20A requires replacement and construction of three new system interchange ramps. The addition of the MRT system along the median of SH20A will require SH20A to be shifted laterally and widened with associated construction impact to utilities, and stormwater infrastructure. As the MRT is a new mode of transport in New Zealand, this may add to the constructability risks as new standards and guidelines are introduced. Although major construction works are involved, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before. However, these works would be within a narrow corridor with high traffic volumes.	

Option C3 High investment – SH20A & SH20B	Score
Construction disruption Approximately 13km of online widening on SH20A and SH20 is likely to involve moderate use of TTM. Furthermore, construction of the system interchange ramps will involve works over live traffic lanes and requiring lane closures, consequently increasing travel times. Significant long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing the following five local road bridges: Walmsley Road, Bader Drive on SH20A and SH20, Kirkbride Road and Portage Road. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. In conjunction with the replacement of the Killington Crescent Pedestrian Footbridge on SH20A, this is likely to cause major disruption as it is the only pedestrian footbridge which solely caters for pedestrian movements across SH20. A large amount of infrastructure is required that will have adverse impacts on journey reliability due to the proximity to the Airport precinct. This option has no direct impact on the existing users of SH20B as all works on SH20B are to be offline. The large amount of infrastructure required is considered to have adverse impacts on journey reliability due to close proximity to the Airport precinct.	
Construction cost and risk Approximately 200,000m² of new pavement, 19,400m² of new structures, and 3600m of new retaining walls would be required. The area of new structures is at the top end of the range amongst the options, the quantity of new pavement and TTM is also at the top end of the range.	
Safety in design and construction Same as Options C1 and C2a	
Operation and maintenance Same as Option C1	
Summary Option C3 has the lowest score due to the vast amount of infrastructure required and the long-term disruption this would cause while the project is in the construction phase. Moderately standard construction process. Construction works of this style have been undertaken in NZ before on projects such as SCI and NCI, with the only constraint being the addition of a median MRT system	

Option C4 Moderate investment – SH20B Expressway	Score
Constructability A total of four local road bridges require replacement, one pedestrian footbridge over SH20A requires replacement and construction of one new system interchange ramp. The addition of the MRT system along the median of SH20A will require SH20A to be shifted laterally with associated construction impact to utilities, and stormwater infrastructure. As the MRT is a new mode of transport in New Zealand, this may add to the constructability risks as new standards and guidelines are introduced. Construction of one system interchange ramp would follow a relatively standard construction process, with only moderate works being required.	

Option C4 Moderate investment – SH20B Expressway	Score
Construction disruption Same as Option C1a, expect SH20B is classified as an Overdimension vehicle route. Therefore, there is an above average movement of freight through this route, including the high percentage of HCV's. Online widening would have a direct impact for the existing users of SH20B as well as affecting journey reliability, due to the close proximity to the airport precinct. This widening could be achieved whilst minimizing disruption.	
Construction cost and risk Approximately 210,000m² of new pavement, 12,500m² of new structures, and 2200m of new retaining walls would be required. The area of new structures is in the middle of the range amongst the options, the quantity of new pavement and TTM is at the top end of the range.	
Safety in design and construction Widening of the SH20 and SH20A carriageway would result in sub-standard weave lengths, requiring three weaving departures. An additional departure may also be required for the proposed system interchange ramps, due to a steep upward gradient of 6%. These departures are common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20A / SH20 system interchange ramp is ultimately likely to provide a safer southbound transition between SH20A and SH20 with the benefit of reduced travel times.	
Operation and maintenance Same as Option C1	
Summary Moderately standard construction process. Construction works of this style have been undertaken in NZ before on projects such as SCI and NCI, with the only constraint being the addition of a median MRT system.	

Approvals:

	Name	Title	Signature
Authored by:		Civil Engineer	
Reviewed by:		Associate	