



7 Assessment of Alternatives

7.1 Introduction

This section provides a summary of the alternatives assessment process undertaken in the development of the Project.

The development of the Project has been an iterative process over a two-year period, since its inception as one of Auckland's Accelerated Roding Projects in June 2014, although many elements of the Project were subject to earlier investigations and studies. Preliminary work commenced in July 2014 and has continued through to preliminary design during 2016, as part of the pre-implementation phase of the overall Project. At each stage, a process of identifying and evaluating alternatives was undertaken, commensurate with the level of detail at that stage, taking into account the existing natural and built environment, as well as social and cultural values.

The Project is essentially an integrated package of connection and linkage improvements for an existing transport network structure, to improve the functionality and capacity of that network and thereby provide the local, regional and interregional benefits being sought by the Project objectives. Therefore, the alternatives assessments that have been undertaken have focused on specific design options for the various connection improvements, including alignment and siting options, as well as determining appropriate arrangements of elements to ensure the greatest level of efficiency and safety.

The alternatives assessment process was informed by and responded to a series of staged stakeholder and community engagement as investigations and options were developed. The information derived from this process was fully considered and incorporated into the decision-making process during the development of the final Project scheme.

This Section summarises the decision-making process involved in the consideration of alternative routes (alignments), sites and methods, with reference to the relevant statutory requirements, and the key steps involved in the assessment process, which were as follows:

- Indicative Business Case (IBC) – an assessment of the key alternative concepts;
- Detailed Business Case (DBC) – an assessment of the alignment and interchange alternatives and development of concept design; and
- Preliminary design – design refinement.

7.2 Statutory Requirement to Consider Alternatives

To implement the Project, a number of authorisations under the RMA will be needed, including new designations, alterations to existing designations, and various resource consents.

The new designations and designation alterations will be obtained by lodging NoRs with the EPA, to be determined by a BoI established under Part 6AA of the RMA (Proposals of National Significance). Related resource consent applications will be lodged with the EPA at the same time.

Under the RMA, a consideration of alternative routes, sites and methods is relevant in certain respects:

- In relation to notices of requirement, where a requiring authority does not have an interest in the land sufficient for undertaking the work, or it is likely that work will have a significant adverse effect on the environment (s171(1)(b));
- In relation to resource consent applications, the information to be included in an AEE must include a description of possible alternative locations or methods for undertaking the activity where it is



likely that the activity will have a significant adverse effect on the environment (Schedule 4, Clause 6);

- In relation to applications for discharge permits, “any possible alternative methods of discharge, including discharge into any other receiving environment” (s105 and Schedule 4, Clause 6); and
- The “best practicable option” shall be adopted to ensure that the emission of noise from that land or water does not exceed a reasonable level, which implies consideration of options (s16).

7.2.1 Notices of Requirement – Sections 168 and 171(1)(b)

The RMA allows requiring authorities approved under section 167 of the RMA to notify requirements for land for a project or work. The NZ Transport Agency is approved as a requiring authority for:

...(a) all existing roads that are State highways as defined in section 2(1) of the Government Roading Powers Act 1989; and

(b) the maintenance and improvement of the safe and efficient operation of the existing State highways in New Zealand [and specified projects]⁸

...the construction and operation (including the maintenance, improvement, enhancement, expansion, realignment and alteration) of any State highway or motorway, pursuant to the [Transit New Zealand Act 1989]⁹ and

...the purpose of constructing or operating (or proposing to construct or operate) and maintaining cycleways and shared paths in New Zealand pursuant to the Government Roading Powers Act 1989 and the Land Transport Management Act 2003.¹⁰

When considering a NoR, Section 171(1)(b) of the RMA requires the consenting authority to have particular regard to whether adequate consideration has been given to alternative sites, routes and methods of undertaking the work in cases where either –

- The requiring authority does not have an interest in the land sufficient for undertaking the work, or
- It is likely the work will have a significant adverse effect on the environment.

Through section 181(2), the consideration of alternatives is also required when considering alterations to existing designations under the same circumstances.

Section 171(1)(b) requires the NZ Transport Agency as a requiring authority to demonstrate that its investigation of alternatives has not been carried out in an arbitrary or cursory way¹¹. This does not mean that it is required to consider the full suite of alternatives available, or to select the best option in assessing the relative merits of the alternatives identified¹². However, while section 171(1)(b) does not necessitate a requiring authority to fully evaluate every non-suppositious alternative with potentially reduced environmental effects (i.e. every possible feasible option), nevertheless the adequacy of the consideration of alternatives needs to be in proportion to the impact of the proposed designation: that is, greater scrutiny is required where the impacts are likely to be higher, both in terms of the impact on land not held by the requiring authority and in relation to the severity of the adverse effects of an option. If there is a non-suppositious option that would have reduced effects, then it should be evaluated in a transparent and replicable manner.

⁸ Resource Management (Approval of New Zealand Transport Agency as Requiring Authority) Order 1992.

⁹ Resource Management (Approval of Transit New Zealand as Requiring Authority) Notice 1994, notified in the Government Gazette on 3 March 1994. Under clause 29 of Schedule 2 of the Land Transport Management Amendment Act 2008, the NZ Transport Agency replaced Transit New Zealand as the requiring authority approved under this Gazette Notice. Under section 47(1)(c) of the Land Transport Management Amendment Act 2008, from 1 July 2008 the Transit New Zealand Act 1989 is to be called the Government Roading Powers Act 1989.

¹⁰ Resource Management (Approval of NZ Transport Agency as a Requiring Authority) Notice 2015, published in the Gazette on 19 November 2015, No 126, page 6742.

¹¹ Refer *Environmental Defence Society v Mangonui County Council* (HC Auckland, M101/81, 23 October 1981); *Waimairi District Council v Christchurch City Council* (Planning Tribunal, 030/82, 13 July 1982) and *Villages of NZ (Mt Wellington) Ltd v Auckland City Council* (Environment Court, A023/09, 20 March 2009).

¹² Refer *Beda Family Trust v Transit New Zealand* (Environment Court, A139/04, 10 November 2004).



Where there are options requiring land in which the requiring authority does not have sufficient interest to undertake the proposed work (such as by ownership or easement), then there is a requirement to establish an appropriate range of alternatives and adequately consider them. The measure of adequacy will depend on the extent of the land affected by the designation. The greater the impact on private land, the more careful the assessment of alternative sites not affecting private land will be¹³.

A similar approach must be adopted in relation to adverse effects on the environment: i.e., the greater the adverse effects, the more rigorous the assessment of alternatives that may have lesser effects¹⁴.

7.2.2 Resource Consent Applications – Schedule 4 & Section 105

Schedule 4 of the RMA requires an assessment of alternatives in specific instances, namely:

- Where it is likely that an activity will result in any significant adverse effect on the environment, alternative locations or methods for undertaking the activity must be described (Clause 6(1)(a)); and
- Where the activity includes the discharge of any contaminant, any possible alternative methods of discharge, including discharge into any other receiving environment must be described (Clause 6(1)(d)(ii)).

The latter consideration aligns with the requirement under section 105, under which the consent authority in considering an application for a discharge or coastal permit must, in addition to the matters in section 104(1), have regard to any possible alternative methods of discharge, including discharge into any other receiving environment.

For the resource consent applications (including discharge permit applications), the available choice of locations or methods is constrained by the Project for which the designations are sought. That is, locations or methods that will not enable the work for which the designations are sought are not 'possible' alternatives. In this sense, the alternatives to be considered in relation to both the designations and resource consents must align.

Detail on the proposed methods for discharges are contained in the relevant Section 5 and within the Assessment of Stormwater Management (**Technical Assessment 11**).

7.3 Overview of Project Design Process

7.3.1 Strategic History

Prior to mid-June 2014, a number of investigations and studies had been undertaken by the NZ Transport Agency (as well as AC and AT), on a number of the components that now form part of the Project. These include:

- **SH1/Greville Road Interchange Upgrade** – this component was outlined and assessed in the Albany Land Use and Transportation Study: Final Report, Beca, September 2010, which concluded that a direct grade separated connection between SH1 and the Albany Expressway at the Greville Road Interchange would best address capacity and congestion issues.
- **SH1/SH18 Interchange Upgrade** – the options for improving the intersection between SH1 and SH18 were assessed in the North Harbour Strategic Scoping Study (Opus October 2010), and State Highway 1 Upper Harbour to Greville Interchange Improvement Assessment – Traffic Assessment and Economic Evaluation (Flow March 2011).
- **State Highway 18 Intersection Optimisation Improvements** – this component involved looking at various interim options for improving congestion along the section of SH18 between Unsworth Drive and the SH1/Constellation interchange in response to the predicted increase in traffic brought about by the completion of the WRR. The preferred option involved a series of intersection upgrades, providing additional lanes and additional length to existing turn bays to mitigate impacts

13 Refer *Queenstown Airport Corporation Limited v Queenstown Lakes District Council* [2013] NZHC 2347, at [97].

14 Refer *NZ Transport Agency v Architectural Centre Inc* [2015] NZHC 1991, at [140].



from queuing. The assessment was reported on by Aurecon in May 2011, Preliminary Project Feasibility Report SH18 Paul Matthews Drive/ Caribbean Drive Investigation.

- **SH1/UHH to Greville Road Upgrade** – this component involved a new third lane of the northbound lanes of the SH1 motorway between Upper Harbour Highway and Greville Road: this was investigated and reported on in the SH1 Upper Harbour Highway to Greville Northbound Improvements Scheme Assessment Report. Construction of this widening commenced in 2012, and was completed earlier this year.
- **Northern Busway Extension to Albany** – A 2011 scoping report, Northern Busway Extension Constellation to Orewa Scoping Report was followed by a Scheme Assessment Report, Northern Busway Extension Constellation to Orewa Scheme Assessment Report (SAR), which was completed in February 2012. This report examined options to extend the current Northern Busway, which terminates at the Constellation Bus Station, to the Albany Bus Station. The report recommended that an Eastern alignment be progressed as this was the most effective and efficient option for any future Northern Busway Extension.

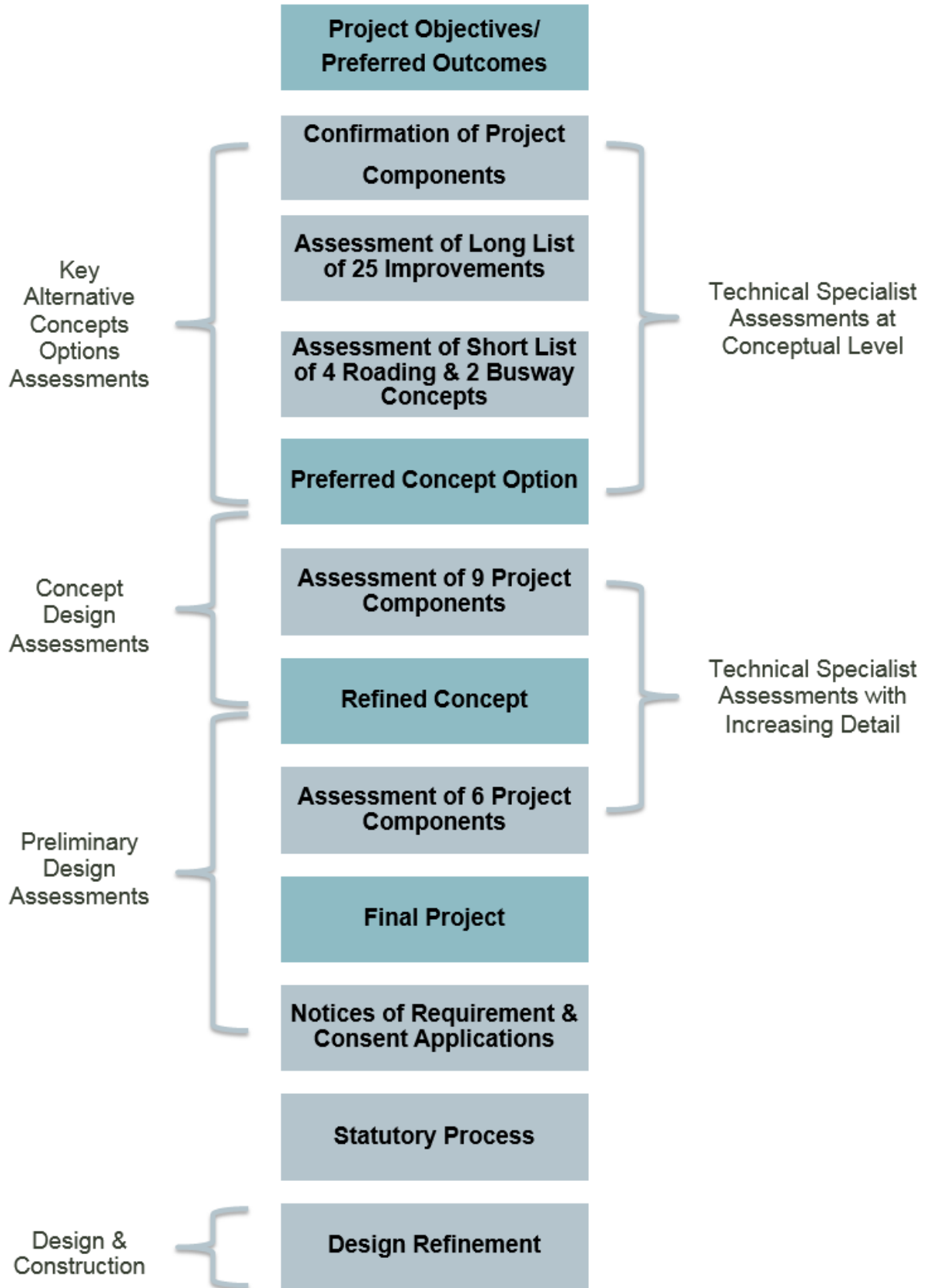
7.4 Northern Corridor Improvements Project 2014

The Project has evolved out of the various separate transport improvement investigations and schemes that have been undertaken or considered over the last decade in the Project area as indicated in **Figure 25**.

These components were all brought together to form the Project as one of the Government's Accelerated Regional Roding Projects in 2014 (but without the SH1/UHH to Greville Road Upgrade for which construction was already underway). In addition to the roading and Busway components, the Project also sought to address the constraints and opportunities for improving the walking and cycling connections in the Project area to provide a fully integrated multi-modal approach to the area's transportation functionality.



Figure 25 Summary Diagram of the Project Assessment Process





Unlike many transportation projects where investigations into new routes are a critical primary stage of the assessment of alternatives, there is no route selection component to the Project. Rather the Project is essentially an integrated package of connection improvements for an existing transport network structure to improve the functionality and capacity of that network, and thereby provide the local, regional and interregional benefits being sought by the Project objectives. Therefore, the alternatives assessment that has been undertaken has focused on specific design options for the various connection improvements, including alignment and siting options.

7.5 Assessment of Key Alternative Concepts 2014-15

Following the inception of the Project in mid-2014, Beca and Opus were engaged to develop an IBC for the Project, reviewing the overarching strategic case for the improvements and scoping the high level options for bringing about the strategic outcomes sought by the Project. The purpose of this phase was to:

- Provide a summary of the problems, benefits and measures and to assess them;
- Develop a long list of options to address the problems identified and deliver the benefits identified;
- Assess the transport performance of and social/environmental impacts of the long list of options and short list of options; and
- Identify a recommended option(s) to proceed to further analysis in the next stage.

To inform the process, stakeholder and public consultation was undertaken in June-July 2014, seeking feedback on the various connection improvement concepts being investigated for SH1 and SH18. These concepts are shown diagrammatically in **Figure 26** below.

Specifically, feedback was sought on:

- Urban design ideas, given the Northern Corridor runs through both residential and industrial areas, several natural features, and follows the North-West Wildlink corridor;
- A potential additional bus station on the new Busway extension, with Park and Ride options, in the Rosedale area to service a major employment area;
- Where the community would like improved walking and cycling links and access points built; and
- Whether a local road bridge at Unsworth Drive would improve connectivity for local residents.



Figure 26 Project Key Components



Source: NZ Transport Agency



The study confirmed the strategic case for the Project, which is summarised in **Section 2** above. In brief, it concluded that the Project has a 'High Strategic Fit' as it forms part of the WRR which has been developed through the RoNS programme, and has the potential for a nationally significant contribution to economic growth and productivity through significant improvements in:

- Journey time reliability;
- Easing of severe congestion in major urban areas;
- Relieving capacity constraints;
- More efficient freight supply chains; and
- By providing a secure and resilient transport network.

The problems, opportunities and constraints for improving network connections in the area were identified, including the land use, social, property, infrastructure and environmental constraints. The base case, or 'do-nothing option', was also identified, against which the performance of the options could be compared. The base case presumed a number of future network improvements outside the Project that would affect overall network performance, including elements of the Project.

The alternatives assessment process involved a two-staged approach:

1. A Multi Criteria Assessment (MCA) was undertaken on a **long list** of 26 options, comprising various alternatives for each of the Project's four components, drawing on previous technical investigations. The components of the Project were identified at a conceptual level only – for example, it assessed the option of having a northbound link from SH18 to SH1 but not options for the specific location and design of such a link. From this assessment, a number of project elements were discarded from further evaluation or as potential complimentary measures; and
2. A second MCA was undertaken of a **short list** of component options to develop an overall package of elements.

A summary of these two assessments is provided below.

7.5.1 Long List MCA

For the long list, a number of options were identified for each of the following four key components of the Project:

- SH18 UHH/Constellation Drive Interchange;
- SH1/Greville Road Interchange;
- Local Roads off SH18 and SH1; and
- Busway Extension.

A number of walking and cycling improvements that could be implemented regardless of the roading or busway options were also identified, being:

- A new north/south connection adjacent to the new Busway from Constellation Bus Station to Albany Bus Station;
- Improved access to the NHHS; and
- Connection of the walking and cycling facilities along SH18 to the existing underpass east of Unsworth Drive.

The 26 long-listed options were evaluated using a MCA, applying a wide range of criteria, under the following categories:

- Performance against Project Objectives
- Transport
- Safety
- Economic efficiency



- Consentability
- Urban Design
- Natural environment
- Culture and heritage
- Land requirement
- Constructability
- Social
- Public Health
- Construction disturbance

The suite of assessment criteria covered a range of matters relevant to meeting the sustainable management purpose of the RMA, including health and safety, social and economic wellbeing, heritage and cultural, and a range of environmental impacts. The MCA Framework was developed with consideration of the NZ Transport Agency's z19 Environment and Social Responsibility Standard (June 2014) and incorporated criteria that aligned to the Agency's Social and Environmental Screen. The options were evaluated by appropriate experts, who provided their assessment on each of the 26 options.

The findings of this MCA were then evaluated through a workshop to determine feasible options for combining into a single overall package of Project elements, screening out concepts that did not meet or support project objectives. As part of this evaluation, key land or environmental impacts were identified. While most of the options were either discarded or retained, the evaluation also identified opportunities for future proofing for other options or retaining as complimentary measures to the main options.

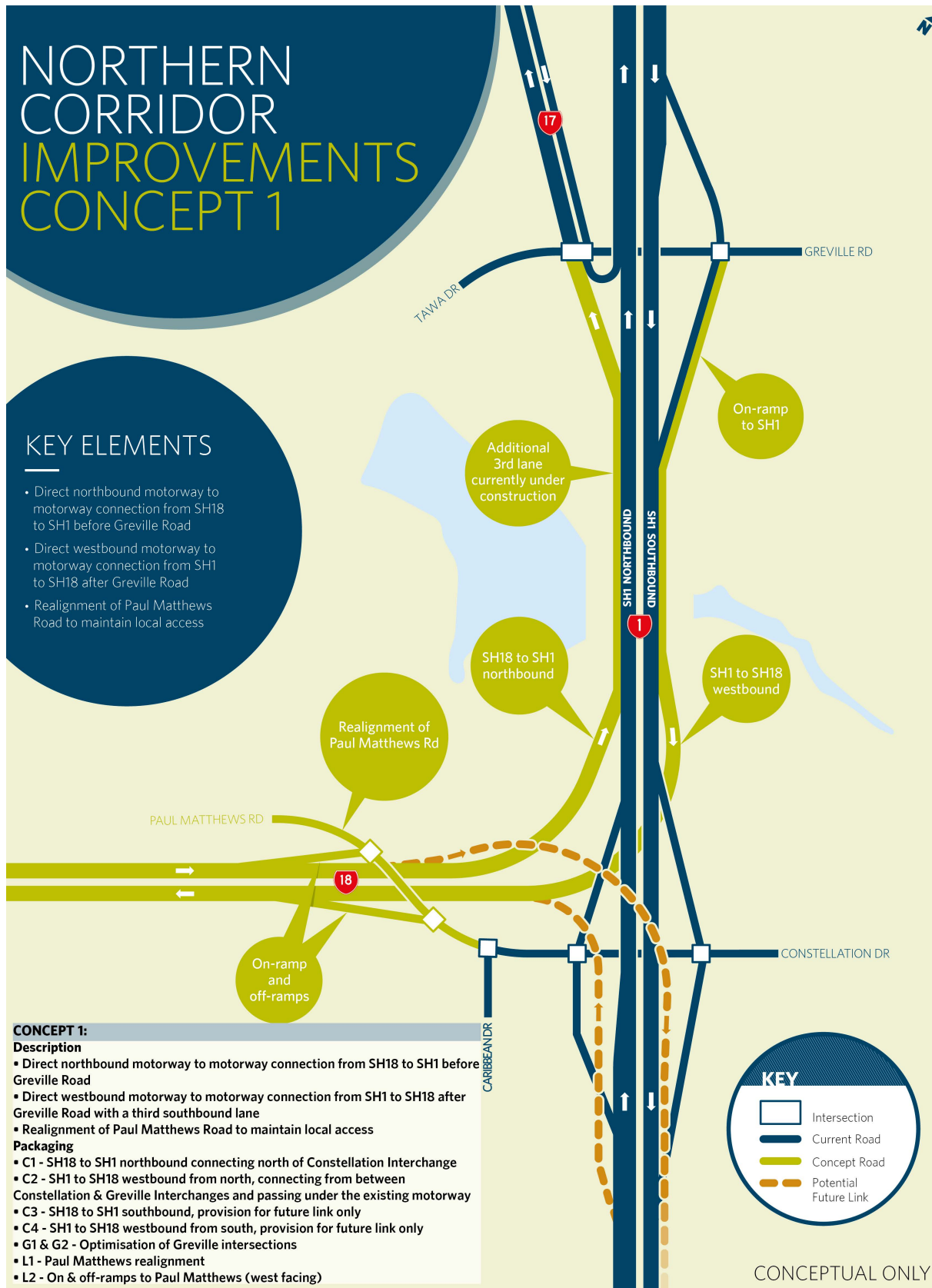
7.5.2 Short List MCA Evaluation Framework

From the long list evaluation, a number of short-listed concept options were developed by packaging together the discrete components identified from the long list assessment, and presented in simple diagrammatic illustrations. The outcome was a total of four motorway 'improvement' concepts and two busway concepts. The four motorway concepts were essentially a cumulative packaging of different design elements, with Concept 1 being the "base package" and hence the lowest cost option. All motorway concepts allowed for the busway to be extended northwards towards the Albany Bus Station.

A summary of each concept option with an illustrative diagram is provided below in **Figures 27 – 31**.



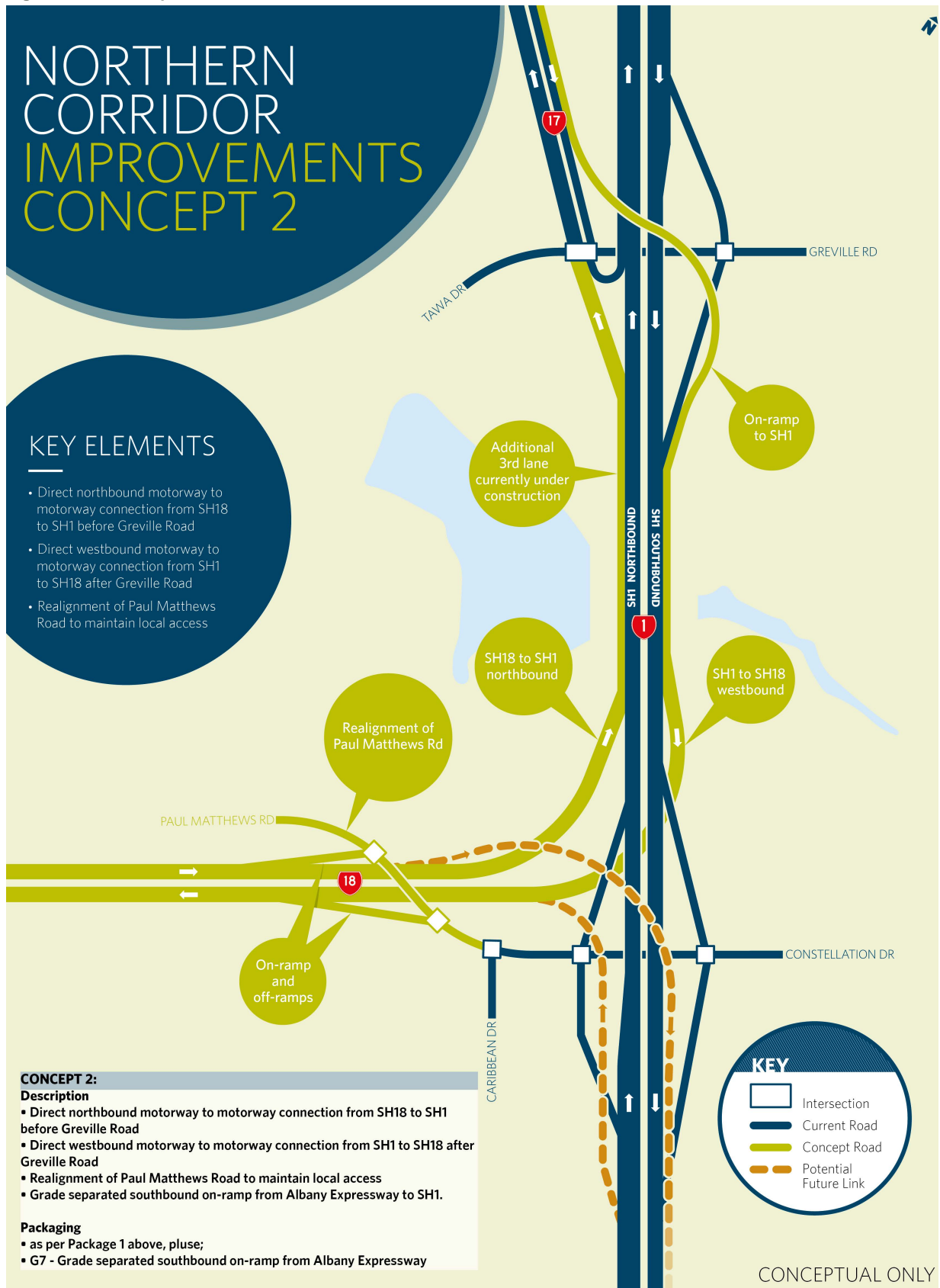
Figure 27 Concept 1



Source: NZ Transport Agency



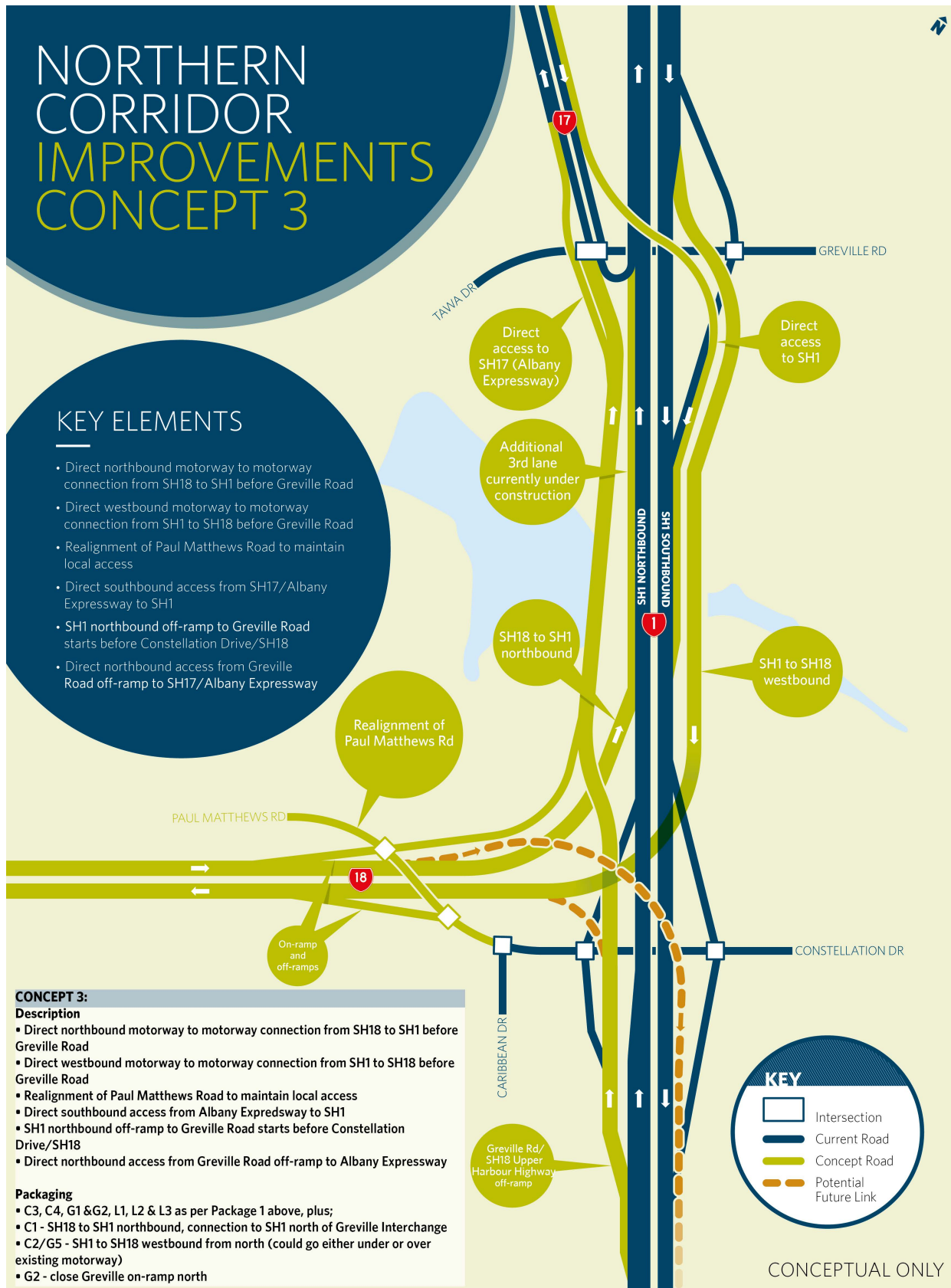
Figure 28 Concept 2



Source: NZ Transport Agency



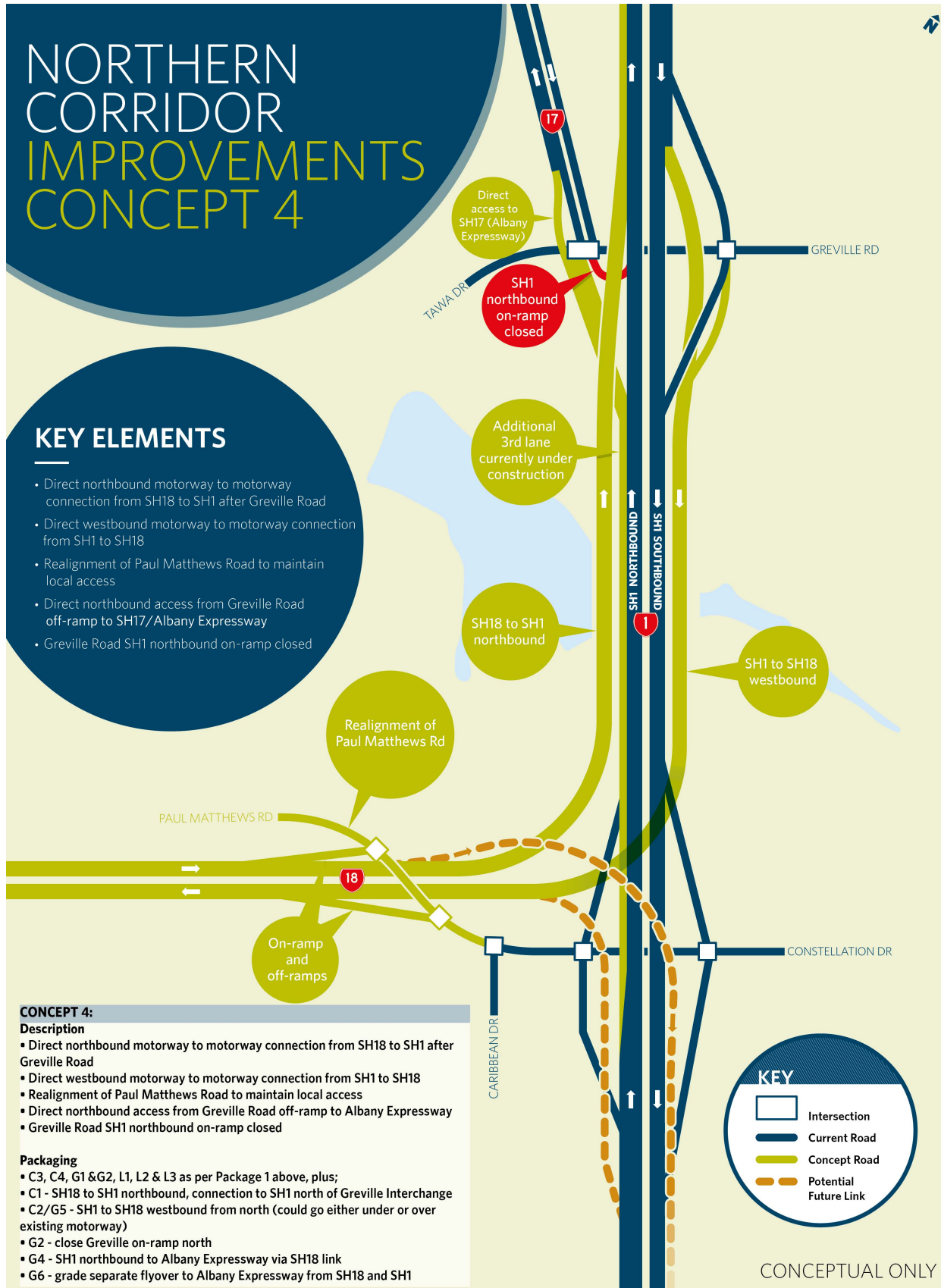
Figure 29 Concept 3



Source: NZ Transport Agency



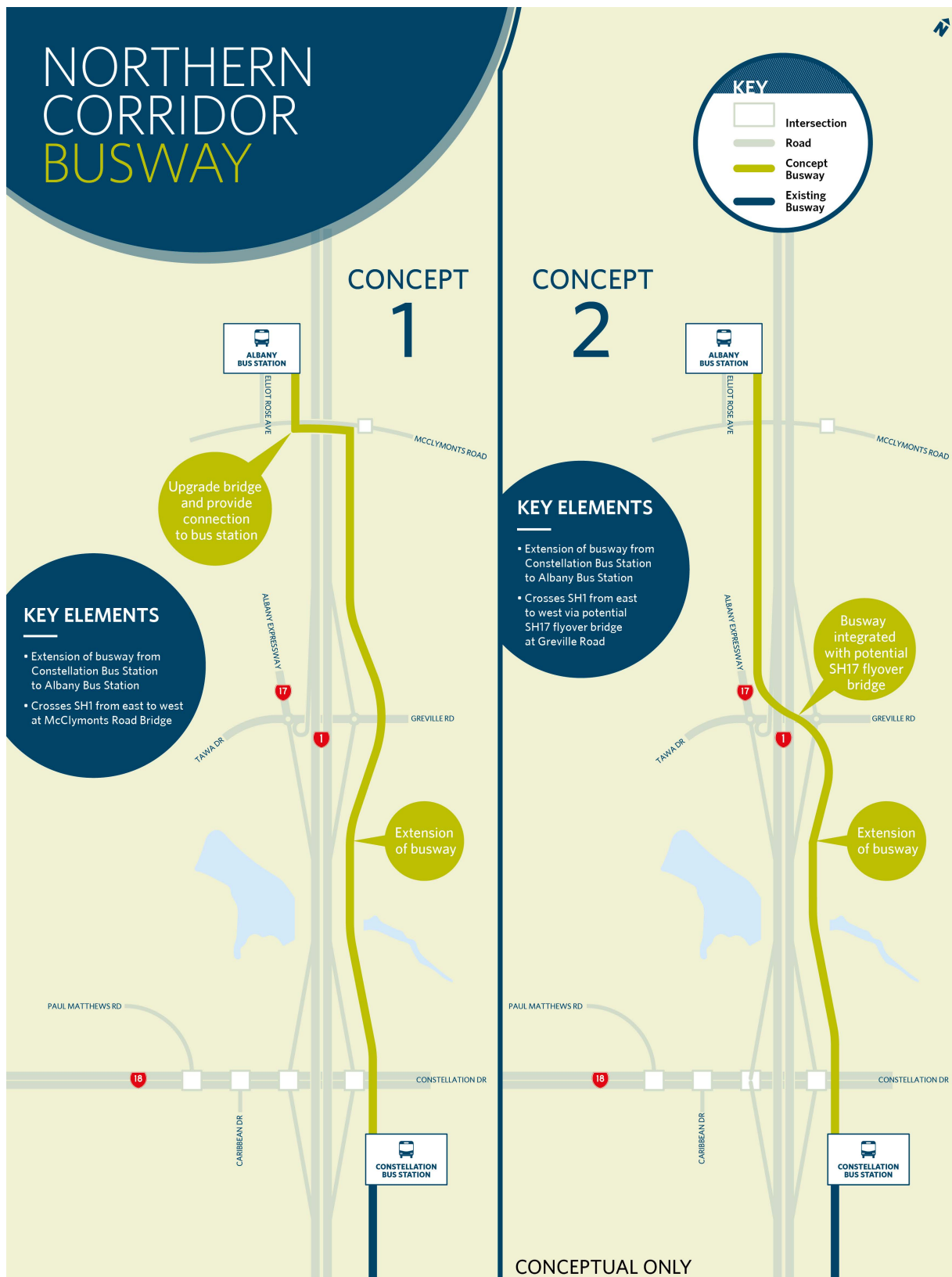
Figure 30 Concept 4



Source: NZ Transport Agency



Figure 31 Busway Concept 1 and 2



Source: NZ Transport Agency



Busway Concept 1	Busway Concept 2
<p>Description</p> <ul style="list-style-type: none"> ▶ Extension of busway from Constellation Bus Station to Albany Bus Station. ▶ Remains on the eastern side of the motorway from Constellation Bus Station to Albany. ▶ Bridge over Constellation Drive. ▶ Bridge over Greville Road. ▶ Direct bus connection to Albany Bus Station in the vicinity of McClymonts Road. ▶ Accommodate future extension of the busway on the eastern side further north to Silverdale. <p>Packaging</p> <ul style="list-style-type: none"> ▶ Can be provided with all. 	<p>Description</p> <ul style="list-style-type: none"> ▶ Extension of busway from Constellation Bus Station to Albany Bus Station. ▶ Remains on the eastern side of the motorway from Constellation Bus Station to Greville Road. ▶ Bridge over Constellation Drive. ▶ At Greville Road Interchange, the busway crosses to the western side of SH1. ▶ Busway passes beneath McClymonts Road to access Albany Bus Station. ▶ A new bridge structure will be required across SH1 north of McClymonts Road to accommodate future extension of the busway on the eastern side further north to Silverdale. <p>Packaging</p> <ul style="list-style-type: none"> ▶ This option was primarily identified in response to the opportunity to construct the bridge at Greville Road in conjunction with the new ramp to SH17 (Long List concept G7 above).

The concept design for each of the above shortlisted options was refined through further geometric investigations, as well as consideration of operational performance (from transport modelling, stormwater design), safety concerns, knowledge of existing utility services, land ownership and impacts on sensitive areas (environmentally and socially).

In November 2014, the initial range of concept options proposed for the Project were announced and discussed with stakeholders, Mana Whenua, local businesses and residents and the wider community at a series of public events. More than 500 submissions were made, and this feedback, along with further detailed analysis and geotechnical work, was used to help inform a second MCA evaluation in February 2015.

The short list options were assessed using the same MCA Framework in the long list assessment, with a number of refinements, including adding community and stakeholder feedback, and operations and maintenance.

A wider range of technical specialists were involved in the short list options assessment, whereby the Social and Environmental specialists' assessments were collated and challenged at a Short List Evaluation Workshop. The final assessment of the short list of options against the criteria is shown in detail in the Appendix 4 of the IBC.

The assessment was undertaken by technical specialists within the Project team, and was based on a five point scale, as shown in **Table 29** below:



Table 29 Scoring used in MCA evaluation of Short-listed Options

Score	Scale of Impact	Description
2	Significantly Contributes/Enhancing	Significantly contributes to the criteria/Significantly enhances qualities and characteristics of the existing environment
1	Contributes/Enhancing	Contributes to the criteria/Enhances qualities and characteristics of the existing environment
0	Neutral	Neutral to the criteria/Has no more than minor impacts on qualities and characteristics of the existing environment
-1	Detracts/Adverse	Detracts from the criteria/Adversely impacts on qualities and characteristics of the existing environment
-2	Significantly detracts/Significantly adverse	Significantly detracts from the criteria/Significantly adversely impacts on qualities and characteristics of the existing environment

The options were examined according to performance against objectives and problem statements, and against various transport, economic, environmental, social, cultural and other ‘topics’. There were a total of 15 MCA ‘topics’, which were broken down into a total of 56 assessment criteria, generating a complex evaluation matrix. Each criterion was scored by the appropriate expert, using the above spectrum, which was reviewed and challenged in the workshop. There was no ‘weighting’ applied to the assessment criteria – all criteria were considered equally.

The short-list options were also assessed for their strategic fit with the outcomes being sought by the Project, their economic performance, and for their transport performance in addressing the specified transport problem statements:

- Improved journey times along SH1/SH18 corridor;
- Improved connectivity and efficient access for local traffic;
- Greater travel choice for local trips; and
- Efficient and reliable public transport operations through the Project area.

The assessment of the shortlisted options included technical specialists’ input on the remaining MCA categories, including safety, social and community impacts, potential effects on the natural environment, consentability, constructability, construction disturbance.

Consultation feedback on the shortlisted options was summarised into key themes which informed the scoring of the ‘community and stakeholder engagement’ criterion, using the same five point scoring system. The key themes were:

- Overall acknowledgement that improvements to the SH1/SH18 section of the motorway network are necessary to relieve current congestion and provide for future growth and demand;
- Preference for Concept 1 as it is much cheaper and less complicated than the other options;
- Extend the third northbound lane on SH1 across Constellation Drive;
- Keep the northbound on-ramp at Greville Road open;
- Maintain local road connections as a minimum;
- Support for the Busway extension to Albany with many stating that this should be the priority ahead of the roading upgrades, and providing more parking at the bus stations;
- No clear preference for Busway options, but a clear desire for another station between Constellation and Albany Bus Stations;
- Support for providing walking and cycling especially from the Constellation Bus Station to Unsworth Heights and further afield to Albany business areas, Massey University and schools; and
- Concern about the effects on Paul Matthews Road and other businesses adjacent to SH1, on the NHHS complex, and on adjacent open space areas.



The IBC was prepared in several stages, with the first draft report completed in May 2015, with the preliminary findings and recommendations from the MCA process, and the final report completed in September 2015. This two-staged process allowed for public consultation to inform the final assessment and recommendations.

7.5.3 Short List MCA Motorway Evaluation

For the four motorway concept options, the scoring against each criterion was agglomerated under each of the 15 topics (shown in **Table 30** below):



Table 30 Summary of MCA assessment across Short-listed Motorway Options

MCA Topic	Concept 1 North	Concept 1 South	Concept 2 North	Concept 2 South	Concept 3 North	Concept 3 South	Concept 4 North	Concept 4 South	Comments
Performance against objectives	+1	+1	+1	+2	+2	+2	+2	+2	All four motorway concepts and two busway concepts meet the project objectives.
Performance against problem statements	+1	+1	+1	+1	+1	+1	+1	+1	All four motorway concepts and two busway concepts provide opportunity to address the transport problems identified.
Safety	0	0	0	-1	-1	0	0	+1	Concept 2 southbound and Concept 3 northbound are less safe than the existing situation/do minimum option.
Affordability	+1	+1	+1	+1	-2	-1	-1	-1	Concept 1 and 2 are able to be constructed within targeted budget.
Trade Offs									
Consentability	+1	+1	+1	+1	0	0	0	0	No complex consenting challenges for Concept 1 & 2. Opportunities to avoid, remedy or mitigate environmental effects for all concepts.
Constructability	-1	-1	-1	-1	-1	-2	-1	-1	Concept 3 southbound will require complex construction management for cut and cover trench under the SH1.
Urban Design	-1	-1	-1	-1	-2	-2	-2	-2	Concept 3 and 4 have larger footprint, impacts on pedestrian and cyclist environment, and North Harbour Hockey Stadium.
Social	0	0	0	0	-1	-1	-1	-1	Concept 3 and 4 impact on North Harbour Hockey Stadium, Council Parks and Watercare land more due to a larger footprint.
Natural Environment	0	0	0	-1	-1	-1	-1	-1	Concept 3 and 4 encroach further into the Rosedale Closed Landfill through the larger volume of cut required.
Public Health	+1	0	0	0	0	0	0	-1	Concept 1 northbound improves air quality for nearby educational facilities due to decreased traffic volume and has a low contamination risk.
Cultural and Heritage	0	0	0	0	0	0	0	0	There are no scheduled heritage sites or Maori sites of significance within the project footprint of all concepts.
Construction Disturbance	-1	-2	-1	-1	-2	-2	-1	-1	Concept 1 southbound and Concept 3 require complex construction management for cut and cover trench under the SH1.
Land requirement	-1	-1	-1	-1	-2	-2	-2	-2	Concept 3 and 4 require greater land take due to larger project footprint.
Community and Stakeholder engagement	0	0	0	0	0	-1	-1	-1	Concept 3 southbound and 4 impact on local business, Harbour hockey, Council parks and Watercare land. Also concerns expressed over cost and complexity of Concepts 3 and 4.

This information then fed into the final evaluation process, which focused on the concept options' performance against the principal transportation and economic outcomes (highlighting their MCA scores), with the other assessment criteria being used to highlight the main potential issues or impacts of each option, such as land take, impact on recreation and public assets, visual and social impacts.



The option with the highest MCA score was not necessarily preferred. Rather, the MCA scores allowed relative comparisons. An example of this evaluation is shown in **Table 31** below:

Table 31 Example of Summary evaluation of Short-listed Concept Options

CONCEPT 4 SOUTHBOUND		
MCA Category	Score (Average)	Comment
Performance against Project objectives	+2	Significantly enhances wbd motorway connectivity and delivers additional capacity. Benefit includes separation of UHH demands from strategic regional traffic. Provides additional sbd capacity, enhancing network resilience. Improves journey time and network speed. Provides benefit to freight movement although quantifiable benefits not as significant as Concept 3.
Performance against Problem Statements	+1	Forecast to reduce daily average travel times from SH1 to SH18 Wbd by 65% and travel times along SH1 Sbd by 30% compared to the do minimum in 2026. Concept 4 forecast to reduce total network travel time by 2.3 million pcu hours per annum. Improved walking and cycling facilities, thus mitigating existing severance issues and improving connectivity between surrounding commercial and residential land uses.
Safety	+1	Reduction of weaving on SH1. Best option for southbound departures. Best number of south/east bound conflict points, only 3 compared to the 12 existing.
Affordability	-1	\$256M - High cost impact, with additional land requirement. May be able to be constructed within budget available, although a significant level of cost efficiency will need to be identified.
Operations and Maintenance	-2	NPV for Whole of life costs (nbd and sbd) is \$20.6 million. A significant increase in pavement area, and a new structure provided sbd across the Rosedale treatment pond (east side). A wide area between the sbd ramp and the motorway will also need to be maintained.
Trade Offs		
<ul style="list-style-type: none"> ■ Consentability - Achieves objectives and outcomes. Overlapping designations, relying on approval from other requiring authorities. ■ Constructability – Traffic management for pier construction and night-time closure required for bridge over SH1. Significant encroachment into the landfill. ■ Urban Design – Greatest visual severance due to corridor width. Significant change in scale and high retaining wall cut into landfill impacts on sense of neighbourhood, concept creates illegible road environment and undermines clear visual/physical connection for sbd vehicles from SH17. Negative impacts on commercial areas. ■ Social – Improved connectivity for all modes. SH18/SH1 ramps and Paul Matthews Road realignment impact on Harbour Hockey Site and Watercare/Council Parks land. The large footprint and complexity also creates an adverse effect on amenity. ■ Natural Environment – Second biggest cut into landfill, with highest contaminant discharge risk, and issue with disposal of cut material. High visual effects associated with elevated ramps and retaining walls. Low – moderate mitigation potential for visual effects. ■ Public Health – Excavation in landfill is a significant risk to workers due to leachate and risk of explosion of landfill gas pockets. Risks to human health can be minimised via a Contaminated Soils Management Plan and Health and Safety procedures. ■ Cultural and Heritage – No sites of significance to mana whenua. No scheduled archaeological sites or heritage features. 		



- Construction Disturbance – Community impacted during construction of Greville Road bridges. Issue with construction traffic management near live lanes and relocation of major utilities. Opportunity to avoid some service relocations by bridging over SH1.
- Land Requirement - Second largest footprint. Significant land required of Council Parks and Watercare land, as well as localised businesses on both the western and eastern sides of SH1.
- Community and Stakeholder Engagement - Concern with the scale, cost and impact on Harbour Hockey, Watercare and Council Parks land. Impact on businesses on Paul Matthews Rd, near Rosedale and Greville Roads, and along SH1 (eastern and western side).

The summary evaluation of the four motorway concept options is shown in **Table 32** below:

Table 32 Summary of Assessment of Motorway Concept Options

Concept 1
<ul style="list-style-type: none"> ■ Represents the low cost option. Costs currently include a cut and cover tunnel beneath SH1 for the SH1 to18 westbound connection. This could be bridged, further reducing cost. ■ This option has the smallest footprint, minimising social and environmental impacts, and the impact on adjacent land. ■ Least impact on the contaminated landfill site
Concept 2
<ul style="list-style-type: none"> ■ Relatively low cost, with additional cost associated with SH17 to 1 southbound ramp. This ramp increases the benefits significantly, resulting in the highest incremental BCR (value for money). ■ As with Concept 1, the footprint and subsequent environmental impacts are low relative to Concepts 3 and 4.
Concept 3
<ul style="list-style-type: none"> ■ Highest cost option, although it also has the greatest benefits and therefore contributes best to the objective of improved efficiency of the corridor ■ If Concept 3 is selected for both north and southbound directions, a tunnel will be required beneath SH1, resulting in significant disruption to SH1 traffic during construction. ■ Options for realigning Paul Matthews Road become challenging due to the long northbound to Greville Road. ■ SH17 to SH1 in Concept 3 is worst performing as the provision of this connection will push traffic onto Bush Road, creating a congestion point in this area, even though it will relieve congestion from the interchange. ■ Largest footprint - greatest environmental and property impacts
Concept 4
<ul style="list-style-type: none"> ■ Concept 4 has the second best travel time and contributes to the objectives through improved transport corridor efficiency. ■ Concept 4 southbound is hard to achieve because of its proximity to the landfill, and gas pipeline. ■ Without the SH17-1 connection, an investment in local road improvements (e.g. Tawa Drive/Rosedale Road) could assist congestion at Greville Road. ■ Oteha Valley Road interchange improvements could be explored at DBC phase to ease Greville Rd/other local road congestion. ■ Concept 4 has large footprint with significant environmental and property impacts.

The two busway concepts were also evaluated, using the same assessment criteria, scoring system and technical experts. A summary of the MCA scores are provided in **Table 33** below:



Table 33 Summary of MCA Assessment across Short-listed Busway Options

MCA Topic	Busway 1	Busway 2
Performance against objectives	+2	+2
Performance against problem statement 4	+2	+2
Safety	-1	-1
Affordability	0	0
Operations and Maintenance	0	0
Consentability	0	+1
Constructability	0	-1
Urban Design	0	+1
Social	+1	+1
Natural Environment	0	-1
Public Health	-1	0
Cultural and Heritage	0	0
Construction Disturbance	-1	-1
Land requirement	-1	-1
Community and Stakeholder engagement	+1	+1

The alignment for Busway Concept 2 was developed based on the premise that it could be constructed as part of the bridge structure provided for the SH17 to SH1 southbound ramp connection (i.e., a new bridge for traffic from the Albany Expressway directly joining the southbound lanes on the SH1 Motorway at the Greville Road Interchange, under Long list motorway concept G7). However, subsequent design review identified that this opportunity could not be realised due to differing geometric requirements, and that a separate bridge structure would need to be provided, which significantly increased the cost of this option compared with Busway Concept 1.

A Scheme Assessment for the extension of the Northern Busway to Silverdale, undertaken separately to the Project concept option investigations, recommended that an Eastern alignment be progressed as a preferred option as this was most effective and efficient for any future Northern Busway Extension. This was primarily due to a site of ecological significance at the Lucas Creek West Bush (just north of the Oteha Valley Road Interchange to the west of SH1). Therefore, for Concept 2, the future extension of the Busway to Silverdale would need to cross back over SH1 north of the Greville Road Interchange but before Oteha Valley Road in order to connect with the Albany Bus Station and the future extension on the western side of the motorway to Silverdale. This would require an additional bridge structure with associated costs and environmental impacts. Therefore, any environment benefits associated with Concept 2 are negated by the need to provide this additional crossing.

Identification of an option to connect the Busway from the eastern side of SH1 to Albany Bus Station was developed as Concept 1. This option was identified as the preferred option for moving forward, with confirmation of an appropriate crossing (location and form) over SH1 to be part of the concept design investigations, working collaboratively with AC and AT.

7.5.4 Walking and Cycling Network Improvements

Working with AT, and informed by feedback from the initial consultation undertaken in mid-2014, investigations and the design process were undertaken separately to identify the opportunities for improving cycling and walking links and connections within the Project area.

Arising from this workstream, a draft Walking and Cycling Network Plan was developed. This recommended a new shared path between the bus stations following the Busway extension between



Constellation Drive and the Oteha Valley Interchange, with multiple options and crossings for paths along UHH that would link up to the new paths being built along Albany Highway. The Plan also looked at connecting with future paths in the area.

Walking and cycling connections were consistent between options and were recommended to be considered further in developing the subsequent concept design phase.

7.5.5 Draft Assessment Conclusions

In terms of the four motorway concept options, the draft assessment concluded that, while Concept 3 contributed the greatest degree of cumulative benefit of the four motorway improvement options identified, it also had significantly higher costs. The draft assessment also concluded that Concept 1 could still achieve significant benefits, reducing journey times by nearly 50%, improving the capacity of the northern corridor, enhancing network resilience and easing congestion for all modes of transport. It was also considered likely to have the least impact on landholdings and the environment of the four options. Based on these factors, the draft assessment therefore determined Concept 1 to be the recommended motorway improvement option.

However, some potentially significant benefits associated with improving connections with the Albany Expressway at the Greville Road Intersection under Concept 2 were also identified. Consequently, this option was also recommended as worth evaluating further during the DBC.

7.5.6 Consultation on Draft Findings and Recommendations

In August 2015, the short listed design concept drawn from the draft assessment was announced for further community consultation and feedback, with the submission period for feedback closing on 18 September 2015. A summary map of the recommended design concept is shown in **Figure 32** below.

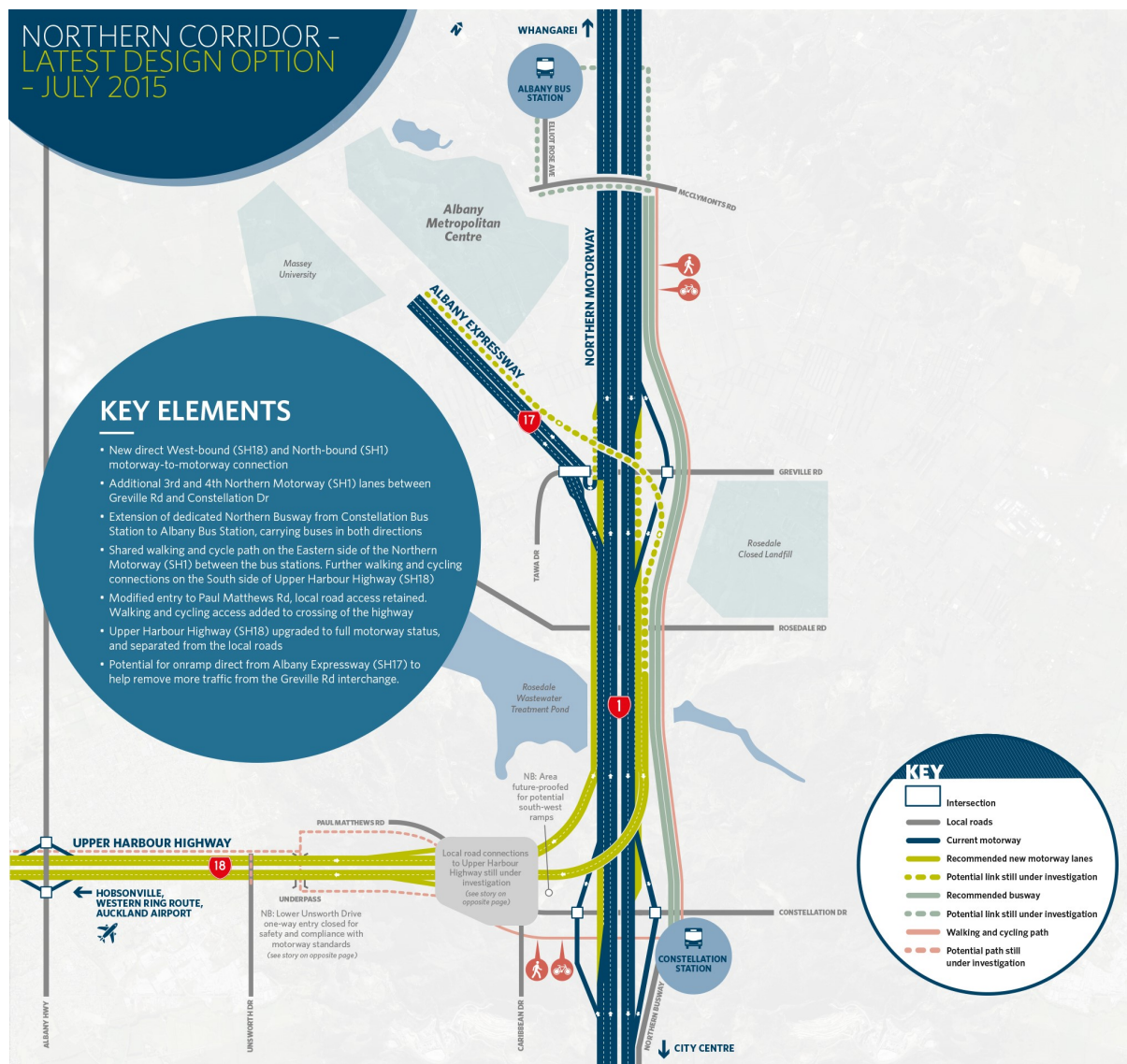
A brochure outlining the plans and asking for feedback on specific design aspects was mailed to households and businesses around the wider Project area, local stakeholder groups and property owners were invited to one-on-one meetings, six open day events were held in different locations, and an online form was made available for the public to send in. More than 1200 people had their say during this period, either visiting one of the six consultation events, or by either phoning, emailing or dropping into the Project Information office. In particular, this consultation focused on inviting feedback on several specific topics:

- The multiple options still being considered for several local road changes required when UHH is upgraded to full motorway status – this included options for new bridges and/or underpasses to ensure community connectivity;
- The design of the Busway extension, walking and cycling path access points, and possible new station options; and
- A proposal for over 5km of walking and cycling paths around the two motorways, and an additional 25km of connecting paths all around the area.

This consultation was held in partnership with AT to progress ideas and consult on all these aspects.



Figure 32 Summary Map of draft Project Design Concept at July 2015



Source: NZ Transport Agency

7.5.7 Other Project Component Assessments

The draft concept assessment recommended an alignment for the Busway extension along the eastern side of SH1 between Constellation Drive and McClymonts Road, but did not detail how it would be connected with the Albany Bus Station on the western side of the highway. A separate options assessment was produced in May 2015, recommending a new bus and walkway/ cycleway bridge over SH1 south of the existing McClymonts Road Bridge.

7.5.8 Final Concept Assessment

After evaluating the feedback from consultation, the assessment and findings were confirmed, including the recommended motorway connection and busway solution. The report, however, identified that further option assessment was required to finalise a number of detailed operational layout decisions. These elements of the Project did not impact on confirmation of the recommended overall Project Design Concept, as they could be considered in isolation from other design elements.



The recommended areas of further assessment were as follows:

- **Operational Layout for SH1 Motorway**

The recommended concept included a direct connection between SH18 to SH1. The lane configuration in the southbound direction would, however, impact on the operation and safety of this section of SH1, particularly in relation to the safety of the weave movement. Further modelling and investigations were recommended to determine the appropriate solution.

- **Paul Matthews Road Interchange**

The configuration of this interchange would impact on Watercare land and AC land. In particular, the NHHS will be impacted to some extent. A separate workstream was therefore recommended to assess the options for the interchange configuration, including a separate assessment being carried out by the wider AC organisation (including Watercare and AT). The future operation of the NHHS and the ability to host international tournaments was a key consideration in this analysis.

- **Direct Connections to Albany Expressway**

The assessment indicated that there was likely to be a significant benefit associated with the provision of direct ramps to Albany Expressway. However, these ramps would be technically challenging to accommodate, and would impact on the operation of the SH1 motorway. Therefore, further assessment of the feasibility and incremental benefit was recommended.

- **Northern Busway Connection to Albany Bus Station**

The recommended option included the extension of the busway along the eastern side of the motorway, with a direct connection to be provided to Albany Bus Station, although specific detail of the form and location for this was to be determined. It was recommended that, working with AT, a separate workstream should determine a suitable connection.

- **Local Road Improvements**

The operational modelling to be undertaken as part of the concept design assessment would identify the impacts on local roads, to enable any effects directly resulting from the Project to be identified, as well as supporting projects that could be programmed and constructed by AT. A Network Integration Plan was recommended to be developed as part of the concept design assessment to demonstrate how the Project will connect with the existing and future local road network.

7.6 Concept Design Assessments 2015-2016

After the IBC was approved in August 2015, Beca and Opus undertook a more detailed analysis of economic, financial and commercial aspects of the Project. This analysis confirmed the Strategic Case for the Project, as well as the constraints and benefits. It also outlined the stakeholder feedback on key concept outcomes and outlined how that feedback had influenced the design of the Project to date.

A number of separate assessments were also undertaken on design components of the Project.



7.6.1 Key Design Assessments

The various workstreams on the design components of the Project were also drawn together, the key outcomes being as follows:

- SH1 Northern Motorway Lane Configuration

This was an operational assessment which concluded that four northbound lanes were required on SH1 between Greville Road and SH18 to ensure that an adequate Level of Service could be provided to address safety issues with weaving, merging and diverging traffic, and to accommodate future traffic volumes, particularly during morning and evening peak traffic flows.

- SH1 to SH17 northbound ramp connection

The concept design proposed the possibility of a direct northbound off-ramp from the SH1 motorway onto the Albany Expressway, crossing over the Tawa Drive/Greville Road intersection via a flyover. After investigation, however, this possibility was discarded, as it would have required the exit point off the motorway to be shifted further south, onto a crest curve where adequate sightlines could not be provided. The additional exit point would also have increased safety concerns with weaving traffic from the SH18/SH1 interchange.

- SH17 to SH1 southbound ramp connection

The concept design originally included a new southbound on-ramp from the Albany Expressway onto the SH1 motorway, requiring the proposed busway extension to be offset approximately 10m further east to accommodate the on-ramp. This in turn would have increased the cut and retaining wall requirements on the edge of the Rosedale Closed Landfill. While this option would significantly reduce the volumes of traffic through the Greville Road interchange, it would also have increased traffic flows onto the motorway. This option was discarded because of the safety concerns where the ramp merges with SH1, only a short distance south of the merge of the Greville Road on-ramp onto the motorway southbound, creating significant weaving issues with westbound traffic leaving the motorway to connect with the SH18 motorway (WRR).

- Northern Busway Construction timing

This assessment examined the costs and benefits of constructing the busway extension as either part of the motorway improvements or as a separate project. The assessment concluded that there were a number of benefits of building the busway extension as part of an integrated package of improvements, compared with as a separate project. In particular, it would avoid requiring a separate period of construction with the consequent additional delays and disruption. Extending the busway as part of the Project would also bring forward the estimated \$39million of travel time benefits from the extension. It would also allow the combined walkway/cycleway to be constructed at the same time.



- Albany Bus Station Connection

Concept 1 in the first stage assessment of alternatives assumed connecting to Albany Bus Station via a widened McClymonts Road bridge, a signal controlled intersection at McClymonts Road / Elliot Rise Avenue and an on street connection to the Bus Station via Elliot Rose Avenue. During the detailed design assessment, a separate workstream was undertaken to determine the appropriate location and form of having the Busway extension cross the SH1 motorway and connect with the Albany Bus Station.

Five options were developed and evaluated within a workshop with AT Public Transport Network planning officers. As the options were all contained either within the SH1 Motorway (designated) corridor or AT land with no external effects, the MCA was limited to a technical assessment regarding performance against relevant Project Objectives (capacity and resilience; reliable bus journey times), as well as geometrics, affordability, safety and operations and maintenance.

The recommended option extends the Busway along the eastern side of SH1, beneath McClymonts Road and then across SH1 on an overbridge into Albany Bus Station. This option readily facilitates the future northern extension of the Busway with no redundancy.

- Busway Stations

AT identified and reviewed the site options for a new bus station, recommending a site off Rosedale Road, on the south-eastern side of SH1. At this stage of the design assessment, the site had not been confirmed, as approval for the station attributes had not been finalised. This process is now being pursued by the NZ Transport Agency separately to the Project.

- Paul Matthews Road Interchange

The concept assessment confirmed the need to provide west-facing ramp connections at Paul Matthews Road, which would serve the Paul Matthews Business area, the residential area of Unsworth Heights, and the areas to the east of the northern motorway. Five options were identified for this interchange, and assessed using a MCA. This is summarised in **Section 7.6.2** below.

- Local Road Improvements

Traffic modelling undertaken of the effects of the Project on surrounding local roads: this assessment identified that the intersection of Unsworth Drive with Albany Highway (south of the Project Area) would face increased pressure. The design assessment recommended the provision of a new road link across SH18 between Unsworth Drive and Omega Place, for which considerable community support was given during public consultation in September 2015. There was no time available to undertake a design options assessment at this stage of the design assessment, so this aspect was therefore recommended for further investigation.

- Walking and Cycling Improvements

An investigation of the surrounding walking and cycling facilities was undertaken jointly with AT to maximise the opportunities for walking and cycling presented by the Project. Arising from the concept assessment phase, it was recommended that a shared path facility be formed alongside the extension of the busway between Oteha Valley Road, Constellation Bus Station and Albany Highway. This facility would provide a 'spine' to future improvements and development of the walking and cycling network within the local area. At this stage, it was recommended that further design be undertaken to confirm its feasibility.



7.6.2 Paul Matthews Realignment and Connections – Assessment of Options

The extension of the SH18 motorway through to connect with the SH1 motorway required the bridging of Paul Matthews Road over the motorway to retain its connection with Constellation Drive and Caribbean Drive. As noted, the design concepts assessment had confirmed the need to provide west-facing ramp connections at Paul Matthews Road to serve the Paul Matthews Business area, the residential area of Unsworth Heights (via Caribbean Drive), and the areas to the east of the northern motorway.

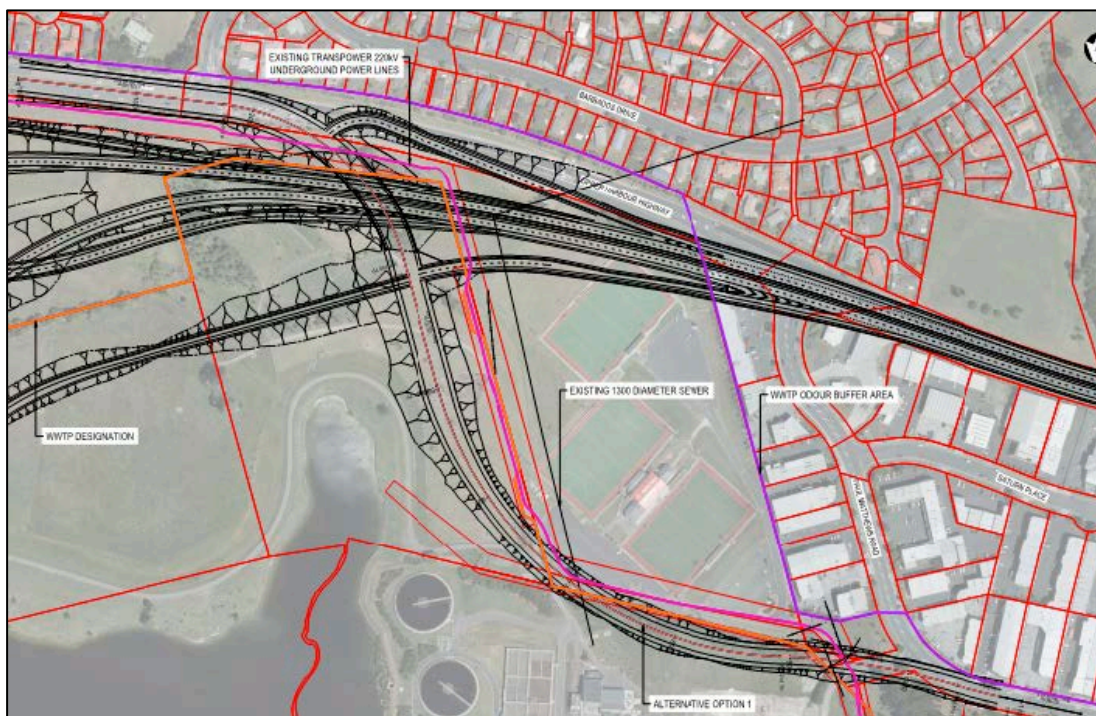
As part of the concept design assessment, further work on options for the Paul Matthews Road overbridge and interchange connections was undertaken. The assessment was separately reported on, but integrated into the overall concept design recommendations.

Land take and property impacts were a particular issue for this aspect of the Project, given its proximity to residential areas and the impact on the NHHS, Watercare's RWWTP and AC's Rosedale South Park.

Five options were identified and assessed, using the same assessment criteria as used for the design concepts' MCA, but some refinements to take into account the particular context of this Project component. The first two options represented the initial options for this component of the Project.

The five options were as follows (See Figures 33 – 37):

Figure 33 Option 1 – East of NHHS to UHH



Realignment of Paul Matthews Road to pass between the NHHS and Watercare RWWTP, then bridged over motorway before joining the existing UHH alignment at the intersection of Caribbean Drive. The existing intersection of Paul Matthews Road and UHH would be closed, with a cul-de-sac provided.

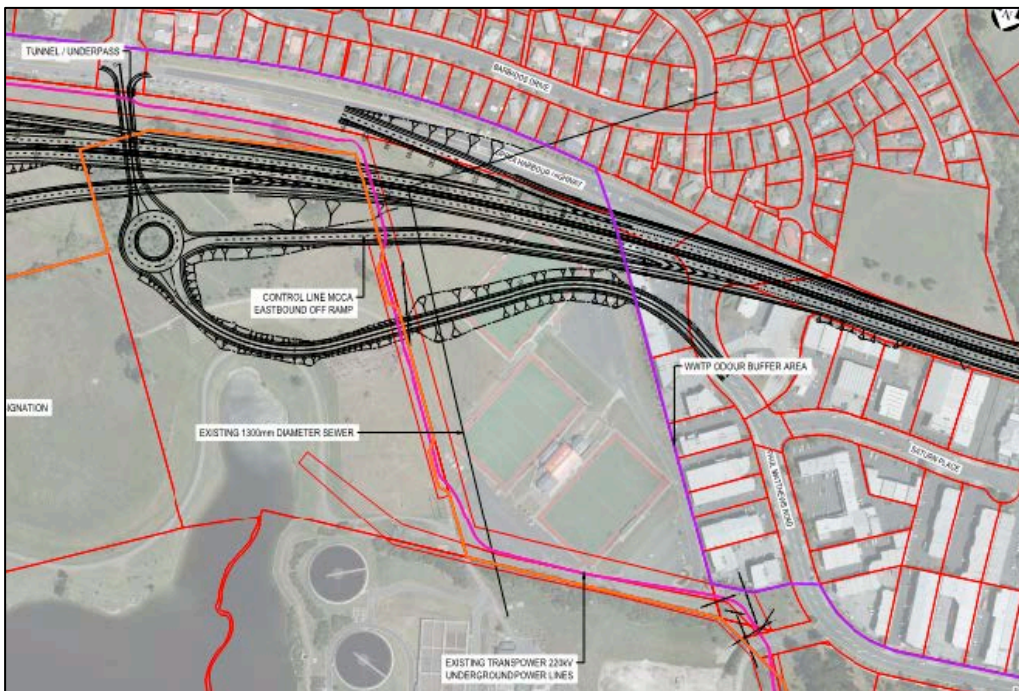


Figure 34 Option 2 – East of NHHS to Caribbean Drive Intersection



Realignment of Paul Matthews Road to pass between NHHS and Watercare RWWTP, then bridged over SH18 motorway before terminating at UHH at the existing intersection of Caribbean Drive. The existing intersection of Paul Matthews Road and UHH will be closed, with a cul-de-sac provided at termination of Paul Matthews Road.

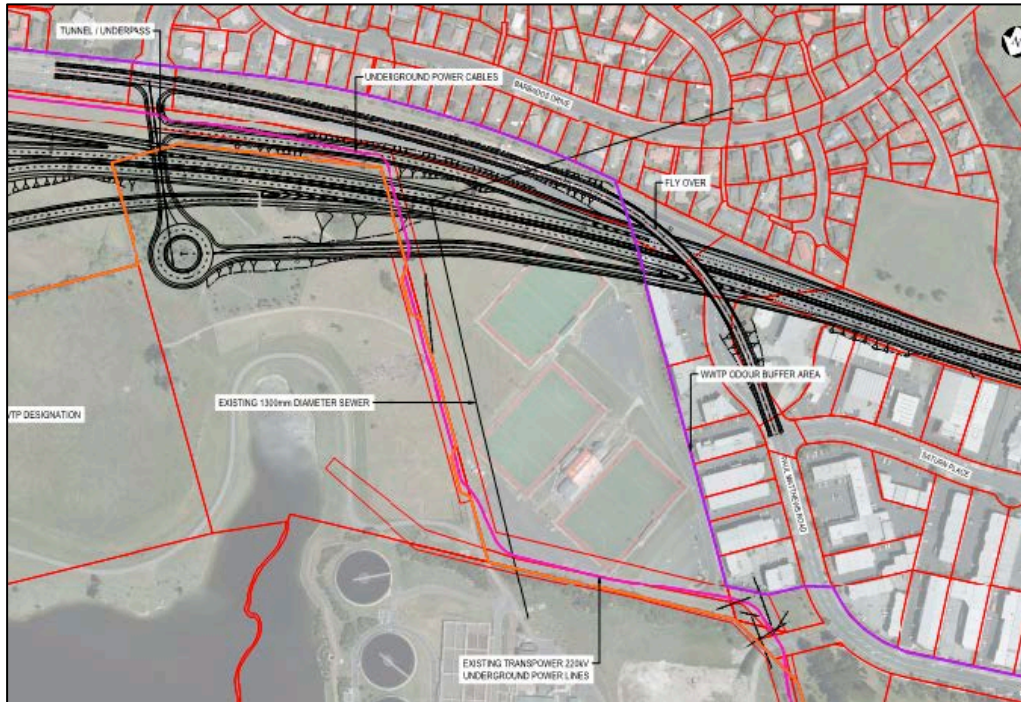
Figure 35 Option 3 – South of NHHS to Caribbean Drive Intersection via Tunnel





Extension of southern end of Paul Matthews Road through the southern part of NHHS, to run alongside the proposed motorway alignment. It then crosses Watercare land to a roundabout connecting to the proposed SH18 eastbound off-ramp. The road then passes beneath the new alignment of the SH18 motorway via underpass, before terminating at the existing UHH/Caribbean Drive intersection.

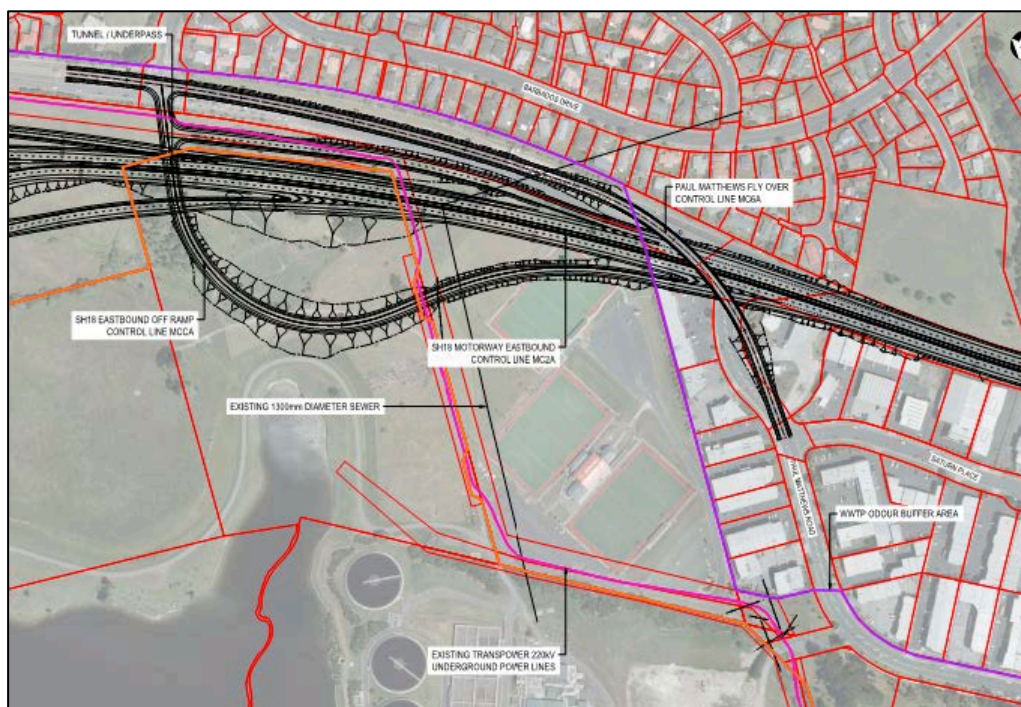
Figure 36 Option 4 – Paul Matthews Flyover, with Underpass for Eastbound Off-Ramp via Roundabout



Connect southern end of Paul Matthews Road to UHH via flyover, with the SH18 off-ramp connected to UHH at Caribbean Drive intersection via an underpass and a faux roundabout.



Figure 37 Option 5 – Paul Matthews Flyover, with Underpass for Eastbound Off-Ramp



Realignment of the southern end of Paul Matthews Road to a flyover to connect with UHH, including a direct connection from the SH18 eastbound off-ramp to the Caribbean Drive intersection.

A summary of the MCA scoring was provided in the DBC report, drawing on the more detailed evaluation matrix in the separate report – this is shown in **Table 33** below:



Table 34 Summary of MCA scoring for Paul Matthews Road Options

Option/Criteria	PM Option 1	PM Option 2	PM Option 3	PM Option 4	PM Option 5
Project Objectives					
Objective 1	1	1	1	1	1
Objective 2	1	2	2	2	2
Objective 3	1	2	2	1	2
Objective 4	2	2	2	1	1
Implementability Appraisal					
Technical	0	0	0	0	0
Consentability	-2	-2	-1	-1	-1
Operational/ Maintenance	-1	-1	-1	-1	-1
Safety and Design Consideration	1	1	1	1	1
Financial	0	0	0	0	0
Public/Stakeholders	-2	-2	-2	-1	-1
MCA					
Economy	1	2	2	2	2
Integration	1	1	1	1	1
Social	-2	-2	-1	-1	-1
Bio-Physical (average Score)	-0.1	-0.3	0	-0.6	-0.6
Contaminated Land - receiving environment	0	-1	0	-1	-1
Groundwater	0	0	-1	-1	-1
Ecological	-1	-1	0	0	0
Stormwater	-1	-1	-1	-1	-1
Landscape	0	0	0	0	0
Visual	0	0	0	-1	-1
Air Quality	0	0	0	0	0
Noise	1	1	2	0	0
Contaminated Land - human health	0	-1	0	-1	-1
Cultural	0	0	0	0	0
Property Impacts	-2	-2	-1	-1	-1
Other Infrastructure	-2	-2	-1	-1	-1
Total - Average (rounded 2 dec places)	-0.18	-0.02	0.24	0.14	0.20
MCA scores based on "scale of impact" only					

From this MCA, Option 5 was identified as the recommended option as it has the least impact on the Watercare Designation and Odour Designation, which would simplify the approvals process with Watercare. While the impacts on the Watercare land are greater than with Option 4, the configuration of the off-ramp of Option 4 is not considered feasible as set out above. This option also utilises the existing road corridor for UHH which would be redundant with the other options.

The MCA identified a number of environmental impacts from the selected options, although it was concluded that these potential effects can be managed or mitigated. These were as follows:

- Overlap of Watercare's designation for RWWTP and Outfall/Odour Buffer Area as well as Vector's designation for 110kV underground electricity transmission line. Approval from these requiring authorities under RMA s177 will need to be obtained before undertaking any work that may prevent or hinder these existing designations.
- The road bridge over the SH18 motorway extension to SH1 will have greater visual and noise effects on the residents to the south of the Project: these effects can be mitigated to some extent through screening and barriers.
- Business North Harbour (formerly North Harbour Business Association) expressed concern at the potential speed of vehicles coming down the bridge and the safety risk associated with the Saturn Place intersection: an appropriate design can be developed to reduce this risk.
- There is potential to impact the underground tanks and fuel lines for the service station and any potential contamination associated with it, with a higher potential for requiring soils disposal to landfill if contamination is found present: contamination risks to the environment would be able to be minimised through a contaminated soils management plan.



During the public and stakeholder consultation, feedback was received that the Project would result in less congestion, and in relation to the options there was general support for Options 4 and 5 (the flyover bridge options).

In extending the SH18 motorway to link with the SH1 motorway, the existing westbound off-ramp from SH18 to Unsworth Drive will have to be closed. In order to improve local accessibility and network resilience, a new bridge over the motorway linking Unsworth Drive and Omega Place was considered: support for such a bridge was expressed during consultation. However, initial investigations into this option indicated a number of potential issues with such a connection. Local topography and property constraints would create difficulties in achieving a bridge design to the appropriate standards, and a number of properties would be required or otherwise adversely affected by its construction. Traffic analysis also concluded that a bridge at this location would redirect significant traffic volumes from arterial roads to collector roads, effectively creating a “rat run” travelling between Glenfield and North Harbour. This would in turn create some capacity and safety issues at a number of intersections, as well as increasing traffic volumes through a primarily residential neighbourhood.

7.6.3 Concept Design Assessment Recommendations

Incorporating the findings of the concept design assessment, the key components of the recommended Project design were as follows:

- UHH upgraded to full motorway status and separated from the local roads;
- New direct westbound (SH1-SH18) and northbound (SH18-SH1) motorway-to-motorway connection;
- Additional third and fourth Northern Motorway (SH1) lanes between Greville Road and UHH;
- Extension of the Northern Busway from Constellation Bus Station to Albany Bus Station;
- Shared walking and cycle path on the eastern side of the Northern Motorway (SH1) between the bus stations. Further walking and cycling connections alongside the Upper Harbour Highway (SH18); and
- Modified connection to Paul Matthews Road, local road access retained and walking and cycling access added to crossing of the SH18 motorway.

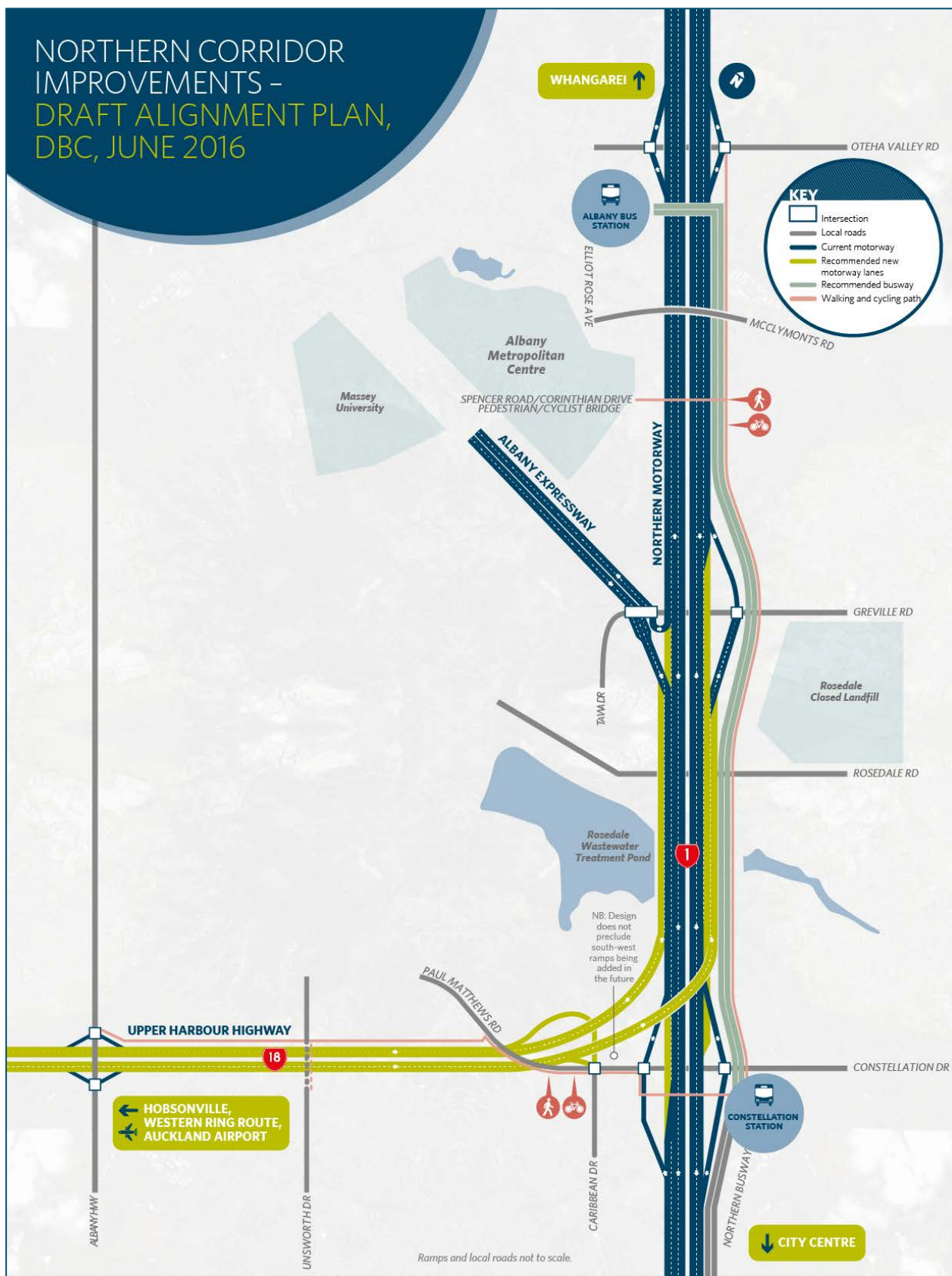
The assessment recommended that further investigations into the possibility of a new road link across SH18 between Unsworth Dive and Omega Place occur during final design.

In conjunction with the extension of the Northern Busway, AT reviewed the potential for additional stations between Constellation Bus Station and Albany Bus Station. Rosedale Road was identified as the preferred location and the Busway extension was accordingly designed to allow for the provision of a bus station at Rosedale.

A plan showing the recommended Project design at this stage of the design process is shown below in **Figure 38**:



Figure 38 Recommended Project Design at June 2016



Source: NZ Transport Agency



In addition to the recommendations regarding the final Project design, a number of property and environmental issues were identified as requiring further investigation, including:

- Options for addressing the impacts on the NHHS;
- Further design work regarding the widening of the SH1 motorway north of the proposed ramps to SH18 through the Watercare site, between Pond 1 and Pond 2; and
- Preparation of a cohesive and integrated urban and landscape design vision for the Northern Corridor, to strengthen both the linear identity of the highways and their connection to the places through which they pass.

The concept design assessment concluded that:

The MCA options assessment undertaken to date ensured that any significant adverse effects associated with each option were identified and consideration was given to whether mitigation was available for these adverse effects or not. The options assessment outcomes informed the selection of the recommended option. (Page 94)

7.7 Preliminary Design Assessments 2016

A number of design elements of the Project were left unresolved at the time the concept design assessment was completed. These elements were investigated and considered as part of the preliminary design process, including the consideration of alternative designs where there were potential property impacts or significant adverse environmental effects.

7.7.1 Unsworth Drive – Omega Street Connection Overbridge

An assessment into options for constructing a new link between Omega Street and Unsworth Drive via an overbridge crossing the extended SH18 Motorway (UHH) was conducted as part of the preliminary design process. This investigation confirmed the findings of the initial investigation, in that:

- A number of properties would be required or otherwise be adversely affected to create the new link;
- A re-analysis of the impacts on traffic flows on the roading network confirmed that a bridge at this location would redirect significant traffic volumes from arterial roads to local collector roads, effectively creating a “rat run” travelling between Glenfield and North Harbour through a residential neighbourhood; and
- This would in turn create some capacity and safety issues at a number of intersections, as well as increasing traffic volumes through a primarily residential neighbourhood.

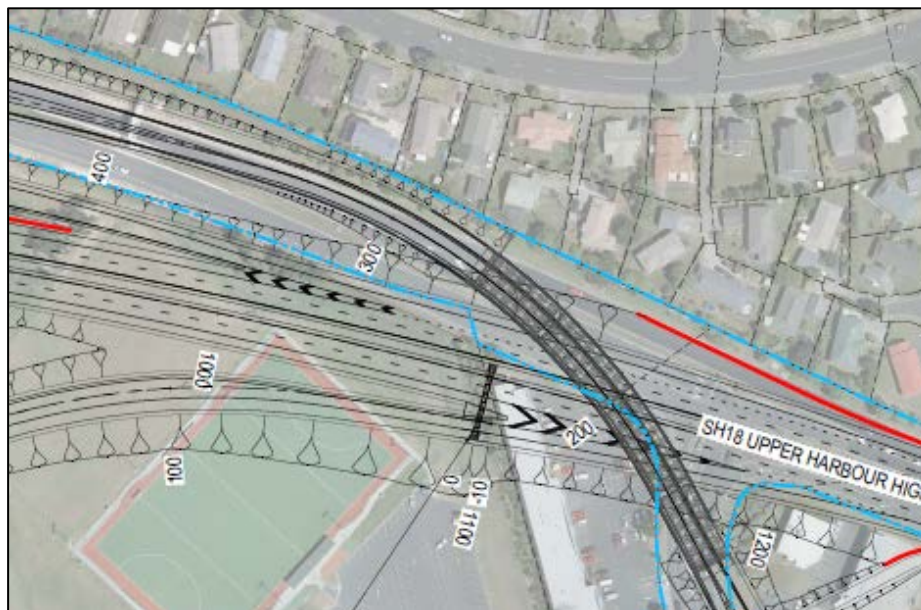
Accordingly, this connection is not proposed as part of this Project.

7.7.2 Paul Matthews Road/SH18 Configuration

As outlined above (**Section 7.6.2**), as part of the concept design assessments that occurred in 2015-2016, a range of options for the Paul Matthews Road realignment and interchange connections were identified and assessed. After undertaking a multi-criteria assessment, Option 5 was recommended as the preferred scheme design. This design involved realigning the southern end of Paul Matthews Road to a flyover to connect with UHH as well as a direct connection from the SH18 eastbound off-ramp to the Caribbean Drive intersection. This option had fewer property and environmental impacts compared with alternative schemes, as well as a lesser impact on the significant infrastructure located in this vicinity (RWWTP, a Transpower service easement, Vector powerlines, and AC’s reserve and recreation facilities). All options, however, would impact on the NHHS to varying degrees, with Option 5 having the eastbound off-ramp from SH18 cutting through Pitch 3 of the Stadium, as well as an area that could be developed for a future fourth pitch. The impact of that option on the NHHS is shown in **Figure 39** below.



Figure 39 Base Option showing Impact on NHHS



As part of the preliminary design process, to ensure that all options for minimising the potential land requirement from NHHS have been thoroughly and robustly investigated, a further assessment was undertaken of potential options for the configuration of the Paul Matthews Road realignment and connections. The Base option was the preferred design from the earlier assessment, Option 5. All of the options were variants of the initial options that were identified for the previous assessment.

Figure 40 Option 1 – Revised Base Option



Option 1 (**Figure 40**) is a revised version of the Base Option, with some geometric amendments to address a number of road safety matters, including ensuring the interchange is future-proofed for potential southbound and westbound ramps at the SH1/SH18 interchange (shown in pale yellow). This option does not alter the land requirements in relation to the NHHS.



Figure 41 Option 2 – Base Option Variant Incorporating SH18 Eastbound Off-Ramp with Roundabout



This option involves a slight realignment of the Paul Matthews Road flyover to connect with UHH, and a SH18 off-ramp to a roundabout as shown above on **Figure 41**. This option also addresses the same safety concerns as per Option 1. The potential future southbound and westbound ramps at the SH1/SH18 interchange are shown in pale blue. This option provides the opportunity for a new dedicated access to the NHHS via the roundabout. This option reduces but does not eliminate the land requirement in the south-east corner of the NHHS.

Figure 42 Option 3 – Realignment of PMR with SH18 Eastbound Off-Ramp to Signalised Intersection



This option (**Figure 42**) re-investigated the possibility of realigned Paul Matthews Road to pass between NHHS and RWWTP to allow direct connection to UHH and Caribbean Drive at a signalised intersection. Under this option, Pitch 3 can be avoided. However, the alignment of Paul Matthews Road has to be south of the Vector easement which provides a key constraint to the north of the NHHS site and consequently this option impacts on Hockey Pitch 2. This is a significant impact due to the interrelation of the clubrooms that are central to Pitches 1 and 2. In addition, this option would still impact on the area of a possible future fourth pitch because of the alignment of the SH18 off-ramp.



Figure 43 Option 4 - Realignment of PMR with SH18 Eastbound Loop Off-Ramp



As with Option 3, this alternative design (**Figure 43**) proposes the realignment of Paul Matthews Road to pass between NHHS and RWWTP to allow direct connection to UHH and Caribbean Drive at a signalised intersection. However, this option includes a SH18 eastbound loop off-ramp to Paul Matthews Road to further reduce the land requirement at the south end of the NHHS site.

The four options were assessed for their ability to reduce property and infrastructure impacts. In summary:

- There are no options available to ensure that the NHHS is not impacted, while also minimising impacts on other stakeholders in the area;
- Options that would avoid impacting on Hockey Pitch 3 (Options 3 and 4) would impact on Pitch 2, a more significant impact given that pitch's relationship with the Hockey clubroom and stadium;
- None of the options would avoid impacting on the site of a potential fourth hockey pitch;
- All options impact on Transpower's service easement, AC's site for future football pitches and on incoming sewer pipelines to the RWWTP;
- All options impact to some extent on the RWWTP site; however, Options 3 and 4 would require the greatest amount of land, and bring Paul Matthews Road within the RWWTP odour buffer area; and
- While all options would impact on commercial properties on Paul Matthews Road to some extent, Option 1 would require the greater extent of commercial property. However, Options 3 and 4 would turn the southern end of Paul Matthews Road into a cul-de-sac, with a consequential significant impact on the commercial activities along this part of the road, including a number relying on passing traffic (for example, a service station and fast food outlet).

For these reasons, the base option, Option 1, which provides the least impact on property and infrastructure, was incorporated into the Project, subject to minor refinements.

7.7.3 Northern Section of Busway and Shared Use Path

As part of the preliminary design work, the design of the northern section of the Busway extension and SUP between McClymonts Road Bridge and Oteha Valley Road was developed to comply with geometric, drainage and maintenance requirements. The design of this component of the Project had to accommodate both north and southbound bus lanes with shoulders and adequate separation from the SH1 motorway. It also had to provide for a 5m wide SUP with provision for separation between the Busway and SUP.

At the McClymonts Road Bridge, however, there is inadequate space between the eastern abutment and the SH1 motorway to accommodate the Busway and SUP. The original design concept sought to



retain the eastern abutment of the McClymonts Road Bridge, and construct a new eastern span, under which the Busway and SUP would be located. To accommodate this alignment, however, the preliminary design determined that one of the townhouse complexes at 60 Masons Road (Block E) would be required to be demolished: Block E comprises 10 residential units.

In response, a number of options were considered to reduce the property impact and significant disruption effects.

One option considered was to remove the SUP between McClymonts Road and the proposed connection at Lavender Garden Lane (therefore avoiding Block E at 60 Masons Road). Between these two points, cyclists and pedestrians would have to use either Medallion Drive (via McClymonts Road) or Masons Road. However, in discussion with AT, this option was discarded because:

- The intersection of McClymonts Road with Medallion Drive, a large roundabout, would be difficult for cyclists to navigate, resulting in potential safety concerns, and this option would create a longer, less direct route; and
- The southern end of Masons Road is a private right-of-way, and is therefore not available for a public SUP route.

An alternative design was developed to avoid the property impacts involved with constructing a new eastern span on the McClymonts Road Bridge to accommodate the busway/SUP. This alternative design involved reducing a number of the horizontal dimensions for accommodating the busway and SUP, and realigning the Busway/SUP to run alongside the southbound lanes of the motorway. To accommodate this realignment, the existing abutment of McClymonts Road Bridge would have to be demolished, and the existing span over the southbound lane of the motorway would have to be replaced with a new 37 long span to accommodate the existing southbound lanes.

The key benefit of this alternative design was the reduction in property impact. While additional land would be required along the western edge of the common ground of 60 Masons Road, the alternative design would avoid requiring the demolition of 60E Masons Road and significantly reduce the impact on the common ground at 60 Masons Road.

However, the rebuilding of the bridge would have required the full closure of McClymonts Road during construction for a significant period of time. This closure would significantly impact not only on local traffic but on the bus route that uses McClymonts Road and on maintaining bus operations from the Albany Bus Station onto SH1.

Accordingly, the option of constructing a new bridge off-line to the south of the existing alignment was considered. A new McClymonts Road Bridge would allow for improved provision for cyclists and pedestrians using McClymonts Road. Another benefit of realigning the McClymonts Road Bridge would be the potential to relocate the western abutment of the bridge further back from the northbound lanes, thereby improving the sightline for northbound SH1 traffic to the Oteha Valley off-ramp.

While the realignment of McClymonts Road Bridge would require additional land at the northern end of 98 McClymonts Road, a large vacant site bounded by McClymonts Road and Don McKinnon Drive, it still had the significant benefit of avoiding the demolition of 60E Masons Road and reducing the impact on the common ground at 60 Masons Road. The remaining land required for the realigned bridge would all be within the existing road corridors. This design would also avoid the significant disruption effects of reconstructing the bridge on the existing alignment.

For these reasons, it was determined to modify the Project design to reconstruct the McClymonts Road Bridge on a more southern alignment and to realign the Busway extension and SUP alongside the southbound lanes of the SH1 motorway.



7.7.4 Rosedale SH1 Widening

As part of the preliminary design work, another design element to be resolved was how to minimise the impact of the Project on the Rosedale Closed Landfill. The widening of the SH1 Motorway north of the interchange with SH18, combined with the extension of the busway and construction of a SUP will require the widening of the corridor into the former landfill site, with the potential need to excavate into part of the Rosedale Closed Landfill and the consequent environmental risks. Accordingly, a number of alternative designs were identified and assessed to seek to minimise such risks while considering the impact on other adjacent properties and other environmental effects.

During the previous design phase, the SUP and Busway extension north of Constellation Drive was proposed to slope downwards from the bridge over Rosedale Road towards the Rosedale Closed Landfill, requiring a cutting into the landfill of up to 10.1m, before descending down towards Greville Road. The width of the corridor is based on certain minimum dimensions, including for the Busway (a 3.5m wide bus lane plus two 1.6m shoulders) and SUP (5m width), plus a 1.1m wide barrier roll allowance between the Busway and SUP and a separation distance from SH1 motorway that provides for maintenance and police enforcement bays. In addition, there are certain requirements for ramp connections from the SUP to Rosedale Road.

The cut into the Rosedale Closed Landfill would require an anchored bored pile wall of approximately 180m in length. The wall anchors would go 15m into the Rosedale Closed Landfill site, although their position some 4.5m below the surface would avoid the refuse zone. However, the depth of the cut and retaining wall would encroach into the refuse layer of the Rosedale Closed Landfill and into the unknown material below the refuse. The alignment of the SUP and Busway at the detailed design stage would occupy part of 121 Rosedale Road, although the remainder would be useable for continued commercial purposes, behind a retaining wall of up to 7.8m high.

The alignment would also require the demolition of the building adjacent to the western boundary and the partial demolition of the property adjacent to the northern side. MSE block walls would be used along the fill beside other adjacent properties to minimise the impact on those properties.

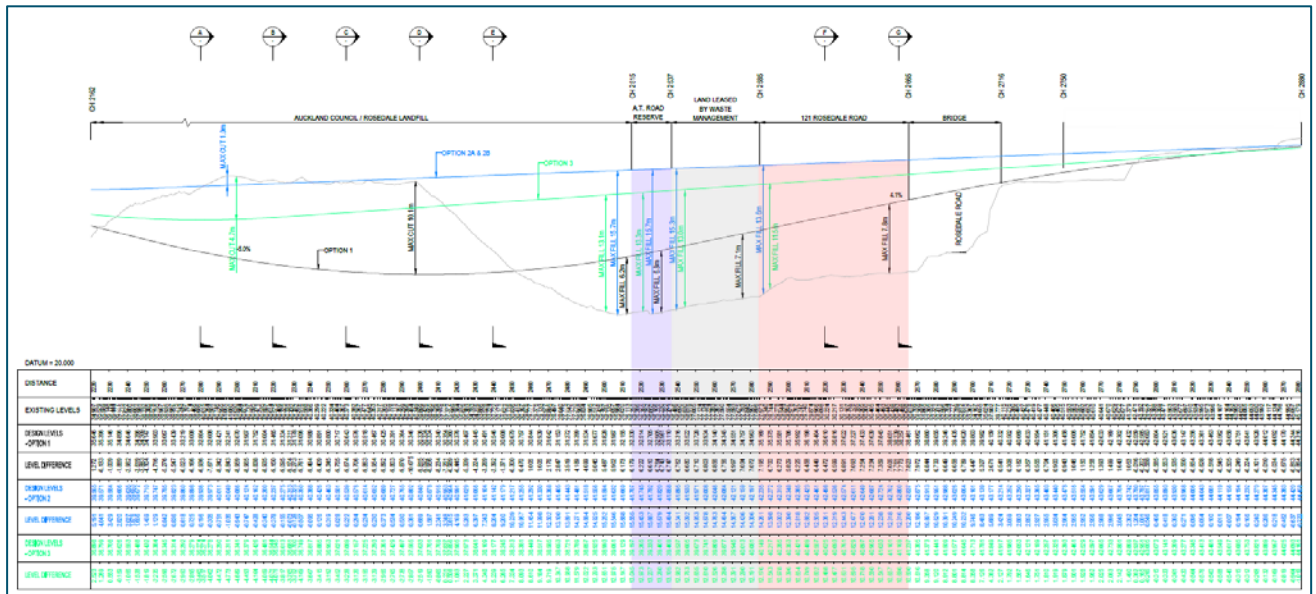
Due to the tight horizontal parameters, providing little scope to make the busway and SUP alignment any narrower to any meaningful degree, the only feasible options were vertical variations in design. Two alternative vertical alignments for the Busway/SUP were developed for north of Rosedale Road bridge, in addition to the original design described above (Option 1).

Option 2 would entail extending the Busway/SUP from the of south of the Rosedale Road bridge up to the existing ground level at the Rosedale Closed Landfill, eliminating the need for cutting into the landfill. However, this would involve a significant increase in height of the Busway/SUP adjacent to the properties south of the Rosedale Closed Landfill, as well as a large fill wall between the Busway and the existing motorway. This element could be accommodated by either a viaduct bridge design (Option 2A) or a retaining wall (Option 2B). Because of the height of the retaining wall option (the highest point of the embankment required to carry the Busway/SUP up to the Rosedale Closed Landfill would be 15.7m above the existing ground level), an additional width of 3.2m would be required to accommodate the wall under Option 2B, which would also require 15m long anchors through the Busway embankment. The viaduct option (Option 2A) would not require any additional corridor width.

Option 3 would entail raising the Busway/SUP up from the Rosedale Road bridge to a point that would involve a cutting into the Rosedale Closed Landfill of only 4.5m in maximum height, allowing for a bored pile wall along the landfill edge that does not require anchors. The maximum fill height required to carry the Busway/SUP south of the Rosedale Closed Landfill would be 13.5m. The reduced height of the embankment would require a shorter length of an anchored bored pile wall between the Busway/SUP and motorway compared with Option 2 (70m compared with 200m). In brief, Option 3 represents the 'midway point' between Options 1 and 2 in terms of vertical alignment.



Figure 44 Comparative Long Sections



Options 1, 2A, 2B and 3 were assessed using a MCA Framework with the input of a wide range of technical specialists (Social and Environmental). The MCA Framework comprised six MCA 'categories', which were broken down into a total of 37 assessment criteria. MCA criteria covered matters such as safety, social impact and potential effects on the natural environment as well as construction risk. Each criterion was scored by the appropriate expert using the same five-point scale as used in MCA assessments for other Project components. The specialists' assessments were collated and challenged at an Evaluation Workshop, at which representatives of Mana Whenua also attended to provide cultural input.

For Options 1, 2A, 2B and 3, the scoring against each criterion was agglomerated under each of the six MCA categories. The MCA Evaluation process concluded that Option 1 was the least acceptable option while Options 2a, 2b and 3 were of equal merit, for the following reasons:

- Option 1 had comparatively greater potential air quality effects, including the excavation of relatively large amounts of material, potentially discharging dust and gases from the old landfill;
- Option 1 had significantly greater visual and landscape effects, involving the truncating of a prominent landform, a highly visible 10m wall running along the SUP, with limited opportunity to mitigate the effects;
- Option 1 posed the greatest risk of exposing hazardous material in the former landfill;
- Although it avoids the effects of cutting into the landfill, the height of Options 2A and 2B above the existing ground level in the Rosedale Road vicinity made these options the most prominent of the options; and
- While Option 3 would still entail cutting into the landfill landform, the cut would avoid exposing the refuse layer, and the stepped profile adjacent to the landfill would result in a reasonable fit, with the lower height walls able to be visually mitigated (for example, through planting).

In all other regards, there were no substantive differences between the options from environmental, cultural or transport perspectives.

From a property perspective, Option 2B (high embankment) had the greatest land requirement, while Option 2A (viaduct) had the least. However, the overall differences in land requirements was not great (a range of 765m²). To accommodate the connecting ramp between Rosedale Road and the SUP, Options 2A, 2B and 3 had the greater land requirement at 121 Rosedale Road; however, this property



would be impacted by all options and under all options the remainder of the site would be able to have a commercial use following completion of the Project.

While the costs of Option 1 were the lowest, the environmental effects were the greatest and therefore this Option was discarded. Option 3 was incorporated into the project as this design had the least cost of the other options, had only minor impact on the Rosedale Closed Landfill, with minor visual and landscape effects that could be readily mitigated.

7.7.5 Other Project Components

7.7.5.1 UHH Stormwater Management Wetlands

As part of the extension of the SH18 motorway to connect it with the SH1 motorway, a number of alternative locations were identified for a new stormwater management pond in the Unsworth Road vicinity to treat stormwater from the new section of motorway. An above ground constructed wetland is considered to be the Best Practicable Option (BPO) for the provision of necessary treatment, detention (stream erosion protection) and level of attenuation (flood mitigation from the additional stormwater run-off from new areas of impervious surface).

Due to the proximity of residential and commercial properties to the UHH, there are limited locations for a wetland of sufficient size capable of treating the estimated volumes of stormwater. The only feasible options are located in areas of open space to the south of and immediately adjoining SH18, which are reserves managed by the AC Parks division.

The location identified for the wetland during the preliminary design phase was a grassed location adjacent to the UHH within Rook Reserve, to the north of Rook Place. AC Parks division expressed concern about the potential loss of functionality that locating a wetland would have on this reserve. In response, two alternative sites were identified, both within the Bluebird Reserve: one site within the grassed open area north of the children's playground, and another in an area of bush within the same reserve.

All options would require the use of a proprietary device to filter the stormwater prior to discharge into the local streams. In all other aspects, the Bluebird Reserve options would provide a comparably suitable area to the Rook Reserve option for a stormwater management wetland that would also provide an amenity feature, accessible by the public.

An MCA process was undertaken in conjunction with AC Parks on all three sites, with the Rook Reserve site being selected as the preferred location for the following reasons:

- The Rook Reserve option performs better from a stormwater functionality perspective, with the least increase in downstream flood flows, the avoidance of the need to fill in a floodplain and the avoidance of the use of culverts to convey the stormwater to the filter before discharging;
- While all three locations would result in a reduction in the functionality of each reserve, the Rook Reserve is larger and therefore has greater opportunities to enhance the reserve's recreational value following the construction of the wetland, including opportunities to integrate the wetland as a community asset; and
- The Bluebird bush location would have relatively much greater adverse freshwater and terrestrial ecology and landscape and visual effects, with the loss of stream and aquatic habitat adversely impacting on Mana Whenua's relationship with water.

A decision from the Upper Harbour Local Board (as manager of the Reserves) was unable to be made prior to lodgement of the NoRs and resource consent applications with the EPA. The NoRs and consent applications, therefore, include both the Rook and Bluebird Reserve options. Once the position of the Local Board is known, the NZ Transport Agency will confirm which alternative it wishes to proceed with, and seek that the BoI assess the NoRs and consents accordingly.



7.7.5.2 SH18 Shared Use Path Connection

As part of the Concept Design Phase, it was proposed to construct a new Shared Use (cycling and walking) bridge over the Northern Motorway SH1 to connect the Constellation Bus Station with the pedestrian and cycling network to the west of the motorway. This bridge would be located between the northern end of the bus station and the embankment on the side of the northbound off-ramp, to the rear of 77 Santiago Crescent. This bridge was envisaged as an enclosed steel truss structure, with sufficient height to future-proof it for possible southbound ramps connecting SH18 with SH1, requiring it to be an estimated 18m above the level of the motorway. This design would require a 300m long ramp on the eastern side and a 420m long ramp on the western side, to connect with Constellation Drive and UHH respectively, to provide the necessary gradients. However, as there is insufficient capacity to provide ramps of these lengths, a lift would be required at either end of the bridge for pedestrians and cyclists: 25m high at the eastern end and 28m high at the western end.

This design, however, presents a number of significant issues, including:

- The relatively high cost of the bridge and lift structures;
- The CPTED safety issues of the use of the lifts, especially at night;
- Significant ongoing operation and maintenance costs for AT and the NZ Transport Agency;
- The visual effects of a high structure for residents, affecting a potentially wide audience;
- The line of desire between the SUP on UHH and the Constellation Bus Station would be to use the footpath under the SH1 motorway bridge, rather than use the ramps and lifts, presenting safety issues for pedestrians and cyclists; and
- The discharge and entry of pedestrians and cyclists at the Constellation Bus Station side would impact on the efficiency and safety of the bus station operation – pedestrians and cyclists accessing the existing the SH1 SUP would also have to go through the Constellation Bus Station.

For these reasons, as part of the preliminary design phase, an alternative design was developed to address these issues. This option involved compressing the width of the road lanes on Constellation Drive under the motorway bridge to accommodate a widened SUP on the southern side of the road. This would allow a 2.0m wide footpath on the northern side of the road, and a 2.9m wide SUP on the southern side of the road. This option has the following benefits over Option 1:

- It provides the shortest trip length from the proposed SUP on Upper Harbour Highway to the SUP on SH1 and the bus station – it is on the expected desire line of pedestrians and cyclists;
- It avoids the need for the bridge;
- It avoids the need for lifts, as a gradient compliant ramp can be provided on the eastside of SH1, utilising the space underneath the busway bridge over Constellation Drive;
- It allows pedestrians and cyclists wishing to join the SUP on SH1 to avoid entering the bus station, and; and
- It only requires modification of the carriageway markings and crossings and construction of a widened path, which will be significantly cheaper than Option 1.

Accordingly, the Project design has been modified to discard the bridge option, and incorporate the underbridge SUP design.

7.8 Conclusion

Since the commencement of the Project, there have been a number of alternatives assessments to progressively refine the options for improving the network connections in the Project area to confirm the preliminary design and hence the Project's land requirements and resource consents.



The assessments have been carried out by way of evaluation frameworks which have had regard to Part 2 of the RMA and the Project's overarching objectives. This process has been thorough and robust in terms of the requirements of sections 171(1) and 181(2) and Schedule 4 of the RMA.