IN THE MATTER OF	the Fast-track Approvals Act 2024 ("FTAA")
AND	
IN THE MATTER OF	an application for approvals by **NZ Transport Agency Waka Kotahi** to construct, operate and maintain the State Highway 1 Wellington Improvements project

STATE HIGHWAY 1 WELLINGTON IMPROVEMENTS PROJECT
TECHNICAL REPORT #4
DESIGN ASSESSMENT

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1. INTRODUCTION

1. My full name is Gareth Andrew McKay. I am the Design Team Lead for the Consent Design.

2. I have been involved in the investigation and development of the proposed improvements to State Highway 1 (SH1) through Wellington for the last two years. My role as Design Team lead began with an assessment of alternative tunnel solutions through the Investment Case to the current pre-implementation phase for the NZ Transport Agency's (NZTA) SH1 Wellington Improvements Project (the Project). Most recently my role has been focussed on leading the team developing the Consent Design over the period from July 2025 through to July 2026.

Qualifications and experience

3. I have the following qualifications and experience relevant to this assessment:

   i. BE (Civil)(Hons), University of Canterbury, 1999

   ii. CPEng (Chartered Professional Engineer), and MIPENZ (Member of the Institute of Professional Engineers New Zealand)

   iii. 30 years of design, design management and advisory work for clients in New Zealand, Canada, USA, Scotland and England, including managing design for large scale and complex transportation projects and, in that context, leading design decision making informed by inputs by specialists, stakeholders and the public. In New Zealand, this work has included technical and leadership roles on the Basin Bridge Proposal, the Peka Peka to Ōtaki section of the Kāpiti Expressway, and other NZTA projects in the Wellington Region

4. I am very familiar with the area that the Project covers having visited the Project site on many occasions in a professional capacity, but also as a Wellingtonian.

5. I was involved in all the public engagement sessions (held in November and December 2025) and have been closely involved in engagement with many Project stakeholders.

Code of conduct

6. I confirm that I have read the code of conduct for expert witnesses contained in the Environment Court Practice Note 2023. This assessment has been prepared in compliance with that code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Project description

7. The Project is a Road of National Significance (RoNS) which improves SH1 in Wellington City. The Project includes the construction of improvements to SH1 within Wellington City from north of the Terrace Tunnel to Kilbirnie.

8. The Project will provide for more efficient and reliable access on SH1 and includes duplicate tunnels at The Terrace and Mount Victoria, a new layout at the Basin Reserve, and improvements along the remainder of the SH1 corridor from north of the Terrace Tunnel to the intersection of Cobham Drive and Evans Bay Parade. The Project aims to unblock critical bottlenecks on the state highway, maintain access for local movements and active modes and enable public transport growth.

9. The NZTA's stated objective for the Project is **"to provide more efficient and reliable access on State Highway 1 from north of the Terrace Tunnel to Wellington Airport and**

Wellington Hospital to support regional economic growth". The outcome sought is to support regional economic growth and productivity by improving access through reduced travel times (efficient) and improved journey time reliability (reliable) for all traffic on SH1 through Wellington city centre. The investment is targeting SH1 in both directions between the north of the Terrace Tunnel and Wellington International Airport, and sections thereof, as this route is part of many journeys to and from the airport, the regional hospital, and the central city.

Scope of assessment

10. My assessment addresses the following matters:

    i. Design philosophy and design process

    ii. Key design decisions and the basis for these decisions

    iii. Design refinement based on:

    - Feedback from specialists
    - Feedback from public and stakeholder engagement

Assumptions and exclusions in this assessment

11. This report does not explain the overall process that has been undertaken by the NZTA to consider alternative sites, routes and methods for undertaking the works associated with the Project which has included drawing on and updating information gathered during previous, related transport investigations. These matters are separately addressed in Technical Report #1 Consideration of Alternatives, prepared by Mr Phil Peet.

2. EXECUTIVE SUMMARY

12. A robust approach has been adopted to develop the Consent Design to achieve consistency with the Project objective and respond appropriately to environmental, social, and cultural factors.

13. The design team has developed the Project's design across five areas described as: Terrace Tunnel, Te Aro, Basin Reserve, Mt Victoria Tunnel and Eastern Connections.

14. For all Project sections, consideration of design solutions has included thoroughly assessing options based on a range of factors including engineering feasibility, cost, social impact, landscape and visual impact, property impact, other environmental effects, constructability and transport outcomes.

15. Development of the design has involved a staged process and consideration of inputs from mana whenua and technical specialists to allow the relevant constraints and possible responses to be factored into the design, and to allow further mitigation measures and proposed conditions to be developed to guide detailed design, construction and operation of the Project.

16. This has led to a robust design for the consenting process, drawing on high-quality information. Other benefits of this iterative process have included ensuring an appropriate balance between the SH1 outcomes and its integration with the local transport network, environment and communities. Examples of this approach include:

    i. Vivian Street intersections through Te Aro have been developed to ensure local road and active mode crossings (e.g. Cuba Street and Tory Street) are not disadvantaged by the Project. Key bus corridors at Willis Street, Taranaki Street and Kent/Cambridge Terraces have also not been disadvantaged

    ii. Improved active mode provision from Evans Bay to the Basin Reserve that will provide alternative routes to Moxham Avenue and connect to Wellington City Council (WCC) active mode facilities at either end

    iii. Stormwater solutions that improve water quality in pipes, piped awa and Wellington Harbour

    iv. New spaces and connectivity between Pukeahu, the Basin Reserve and Kent/Cambridge Terrace

    v. Utilising reduced traffic in the southeast corner of the Basin Reserve to enhance safety and access to schools, the Basin Reserve, and Government House

17. In my opinion, the design of the Project has benefited from environmental and site information collected, advice provided by mana whenua, project specialists, and feedback provided by stakeholders and the public through engagement with them.

3. DESIGN PHILOSOPHY AND PROCESS

NZTA Project Objective and the Design Philosophy

18. The NZTA's objective for the Project is: "**To provide more efficient and reliable access on State Highway 1 from north of the Terrace Tunnel to Wellington Airport and Wellington Hospital to support regional economic growth**". Again, the outcome sought is to support regional economic growth and productivity by improving access through reduced travel times (efficient) and improved journey time reliability (reliable) for all traffic on SH1 through Wellington city centre. The investment is targeting SH1 in both directions between the north of the Terrace Tunnel and Wellington International Airport, and sections thereof, as this route is part of many journeys to and from the airport, the regional hospital, and the central city.

19. Achieving this objective will provide the following benefits:

    i. Improved travel times

    ii. Improved travel time reliability

    iii. Improved access to nationally and regionally important places

20. In developing the design my team has worked to achieve the Project objective while minimising impacts on Town Belt land, heritage/cultural sites, and ecological values (among others), and seeking to maintain (if not improve) overall connectivity to neighbouring communities and key adjacent/intersecting modal corridors.

21. While the Project focuses on improving SH1 through Wellington City, the design team has been highly cognisant that SH1 is one part (albeit an integral one) of the overall transport network that includes public transport routes and active mode connections. Network integration is critical to the success of the transport solutions offered by the Project. The network integration philosophy has considered the following:

    i. Improving SH1 will encourage traffic to use it as the strategic movement corridor, which in turn will reduce traffic on local roads and enable opportunities for other modes and spaces to be realised by others

    ii. Application of road hierarchy principles to minimise local road connections to keep SH1 moving efficiently while maintaining key access to/from local destinations between the Terrace and Mount Victoria Tunnels and through Hataitai and Kilbirnie

    iii. Maintaining key bus and active mode routes and enabling opportunities for future use of SH1 by public transport services

    iv. Retaining connectivity and reducing severance across SH1 for active modes where practical (such as through provision for active modes on the Hataitai Connection Bridge)

22. My design team includes an Urban Design and Landscape Architecture (UDLA) component, which is integral in demonstrating alignment with relevant district plan objectives and national and regional policy statements. This approach is defined by a commitment to cultural advocacy, environmental needs and quality urban outcomes. The following principles have been used as a foundation for consent design development. The 10 urban design principles are adapted from NZTA's Bridging the Gap documentation which captures NZTA's expectations for the integration of urban design outcomes in its projects:

    i. Designing for context

    ii. Integrating transport modes and land use

    iii. Contributing to good urban form

    iv. Supporting community cohesion

    v. Maintaining local connectivity

vi. Uphold Mana Whenua values

vii. Respecting cultural & heritage values

viii. Integrating green infrastructure

ix. Creating positive road user experience

x. Achieving a low maintenance design

xi. Crime prevention through environmental design

23. In applying these principles, the design solution contributes to a transport network that is integrated into the urban and natural systems of the city, environmentally responsible and culturally grounded. An example of this is the design response on the North side of the Basin Reserve where the design has considered the cultural significance of the Waitangi Awa, the heritage significance of the area, the everyday use by a range of transport modes, and the needs of event days at the Basin Reserve.

24. Further discussion on the urban design principles and how these have influenced the consent design is included in Annexure A.

25. The consent design has also been developed to be delivered within the investment envelope (the expected, and risk adjusted, project cost defined through the Investment Case process) and with ongoing consideration of the following objectives developed by the design team for this Project and to align with the Government Policy Statement on Land Transport (2024):

i. Cost efficiency

ii. Operation and maintenance efficiency

iii. Safety by Design – managing health and safety risks throughout the lifecycle of the project

iv. Maintenance in Design – designing assets with their entire lifecycle in mind

v. Making best use of existing assets

vi. Minimising impacts during construction

Investment Case Design Key Features

26. The Investment Case design that formed the basis for the Consent Design incorporated features that reflected the Project design philosophy and expected mitigation. These items are described in Table 1.

Table 1: Investment Case Design Key Features

Item	Description	Outcomes Achieved
Terrace Tunnel - Shell Gully Overbridge	Reconfiguring to accommodate four lanes (currently three) on the northern approach to the Terrace Tunnel.	• Significant cost efficiency (of parallel viaduct structure and approaches) through maximising the use of the existing asset.
Avoiding direct impact on the Basin Reserve Heritage Area	Optimising the design to ensure that there is no impact on the boundary fence and trees associated with the Basin Reserve.	• Respecting heritage and landscape values.
Shared use path around the Basin Reserve	Providing a separated walking and cycling path around the eastern side as an alternative to the path through the Basin.	• Improved connectivity. • Improved safety during events (when basin route is closed) and at night providing improved CPTED outcomes
Sussex Street Trench	Lowering Sussex Street under the new state highway lanes in the north-west corner of the Basin Reserve.	• Significantly reduced construction disruption. • Reduced extent of works and direct property impacts.

Item	Description	Outcomes Achieved
		• Opportunity for improved connection from Pukeahu to Basin Reserve.
Pukeahu Land Bridge	Providing a green connection linking Pukeahu, Cambridge Terrace and the Basin Reserve.	• Addressing potential severance from the Sussex Street trench alignment, and related heritage and urban form effects.
Accessibility around the Basin Reserve	Assessing and reinstating local access through design solutions including: • Retaining access to Ellice Street (with reduced connectivity to improve safety). • Direct access from Adelaide Road to the Mt Victoria Tunnel. • Accessibility between Pukeahu and Cambridge Terrace via the land bridge.	• Maintaining local connectivity.
Hataitai property impact	Selecting a design alternative that removes direct or indirect (shading) impact on properties along Ruahine Street and Wellington Road.	• Maintaining urban form and minimising property effects.
Stormwater treatment	Incorporating stormwater treatment to mitigate additional pavement area and traffic volumes.	• Improved or maintained water quality in piped awa and harbour receiving environments to respond to Mana Whenua key area of effect concern.

Design Standards

27. As a RoNS, the Project is expected to be in general accordance with the NZTA Standardised Design Solutions for Use on State Highway Roads of National Significance Version 2, August 2024. The primary focus of this document is geometric design (road cross section and intersection arrangements) but it also covers standard details for Intelligent Transport Systems (ITS), bridges, pavements, geotechnical, drainage and landscape treatments. Most of the Project geometric design does not meet the RoNS standardised design solution because of its location in a constrained urban environment and low speed limits.

28. Instead, the vertical and horizontal geometry and superelevation have been designed to be in general accordance with the Austroads Guide to Road Design for the proposed posted speed limits:

    i. Transition from motorway (100 km/hr) to 80 km/hr (or 60km/hr through the variable speed limit section) through the Terrace Tunnel then 60 km/hr

    ii. 50 km/hr through the urban section of the Inner City (Te Aro/Basin Reserve)

    iii. Transition to 60 km/hr through the Mt Victoria Tunnel and along Ruahine Street and Wellington Road to Cobham Drive

29. Current or future local roads have been designed to be in general accordance with the WCC Code of Practice, 2012.

Design Process

30. The Project consent design has been developed to define the extent of the Project footprint, the size and scale of the Project and for the purposes of assessing social and environmental effects.

31. Extensive information gathered in past processes and the current Project phase, much of which is summarised in Mr Peet's report, has provided a broad basis for the design team's work to date.

32. The design will be developed in more detail over future design phases as summarised in Figure 1. Future design phases will involve NZTA working with Mana Whenua, WCC, Greater Wellington Regional Council (GWRC) and other stakeholders to develop the design details and manage the construction effects.

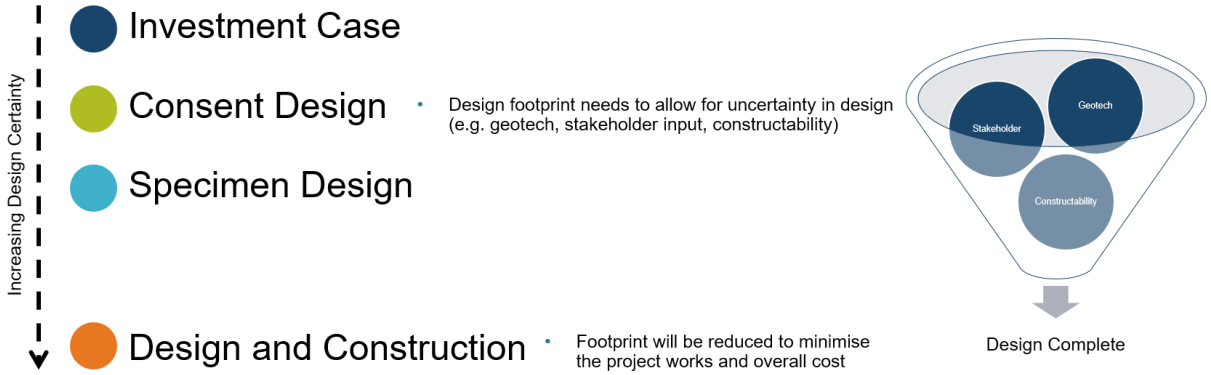

Figure 1 – Typical Design Development Process

33. For the purposes of the FTAA application the Consent Design has been informed by several phases of design development that have considered numerous inputs, including the following:

    i. Concept design to inform the Investment Case (completed April 2025)

    ii. Safe Systems Audit (SSA, June 2025)

    iii. Initial updates to the Investment Case design to reflect the level of detail required for consent purposes (September 2025)

    iv. Feedback from Project specialists and Mana Whenua on initial design concepts (received September 2025)

    v. Feedback received from public engagement (November/December 2025)

34. Feedback from stakeholder engagement with WCC, GWRC, Ministry of Culture and Heritage (MCH), Ministry of Education (MOE), Automobile Association (AA), local area schools and others (commencing November 2025 and ongoing)

    i. Findings from geotechnical investigations east of the Mt Victoria Tunnel (February 2026)

    ii. Further feedback from specialists and WCC/GWRC on draft consent design (April 2026)

35. A Safe Systems Audit (SSA) was undertaken as part of the Investment Case for the Project. This process is part of a best practice approach to developing safe roading projects. The process involves a team of independent safety advisors challenging the Project to inform design development. The findings from the Investment Case SSA have been agreed with NZTA and incorporated in the design where appropriate. Examples of how the SSA has influenced the design include the following:

36. The area outside Wellington College, St Mark's School, and Government House (Basin Reserve) was reconfigured to provide additional safe bus facilities and clearer delineation of space to improve safety at pick-up and drop-off areas.

    i. Changes to intersections were made to improve pedestrian safety, for example removal of the slip lane from Vivian Street to Willis Street to become signal controlled

ii. Changes to geometry to improve user safety, for example improving the access from Kent Terrace to Ellice Street to make this intersection easier to use

37. A Safety by Design (SbD) process was undertaken during the development of the Consent Design. The SbD process is a structured, risk-based approach to identifying, assessing, and eliminating or minimising health and safety risks through design. The process is a part of a best practice approach to deliver safe roading projects and involves structured risk identification and review by the design team, with consideration of construction methodology, operational use, maintenance access, and residual risks. The outcomes have been reflected in design refinements and supporting documentation.

38. Multiple reviews (most recently in February 2026) have been undertaken with the Wellington Transport Alliance (WTA), which is responsible for maintenance and operation of the state highway network in the Wellington Region. These reviews assessed the maintenance and operational implications of the design.

4. DESIGN APPLICATION AND DECISIONS

Introduction

39. This section describes the key components of the design and the decisions that have influenced the design outcome.

40. The Project design (and the following sections) is split into general overarching items and the five geographical areas: Terrace Tunnel, Te Aro, Basin Reserve, Mt Victoria Tunnel and Eastern Connections (from left to right in Figure 2).

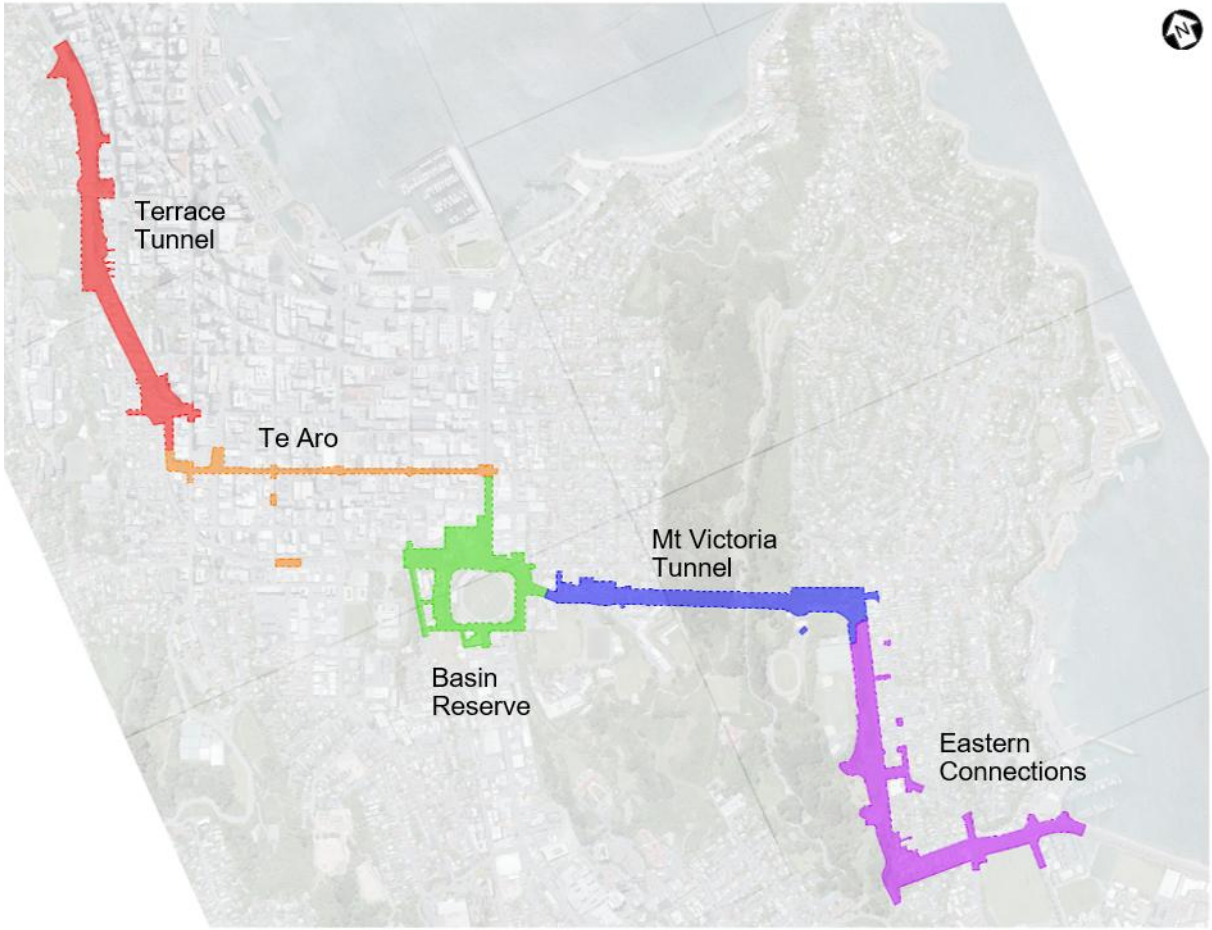

Figure 2 – Project Geographic Areas

41. Key design disciplines for which I have been responsible and are described here include roading alignments and intersections, tunnels, bridge structures, geotechnical and ground engineering, utility diversions, stormwater, and urban design and landscape architecture (UDLA).

42. Some specific aspects of the design are not referred to until later in this report, particularly where they have been influenced by specialist, public or stakeholder feedback.

Roading - General

43. SH1 is the key national and regional road corridor to and through Wellington City. More than 85,000 vehicles per day travel on SH1 (north of Aotea Quay) into or from Wellington City. By improving efficiency and reliability, the aim is to keep or attract traffic on SH1 and reduce traffic on other key routes such as the Harbour Quays (which are desired to carry more public

transport) and other sensitive adjacent spaces. To achieve these efficiency and reliability outcomes and to minimise property impact on adjacent property, the existing road corridor infrastructure is to be maximised in its use. To do this, some local traffic access is removed (e.g. Hataitai access to SH1 focussed to specific intersections) and on-street parking will be reduced (e.g. on Vivian Street to provide additional SH1 capacity to enable the use by more vehicles while maintaining cross connections for local traffic, active modes and bus route corridors).

Stormwater – General

44. The stormwater design has been based on considerations of water quality and flooding associated with the new state highway works. The analysis considers the effects of climate and modelled increased traffic along the route to 2033, includes modelling of flooding on and beyond the Project and the anticipated present-day and future contaminant loads in runoff.

45. Stormwater has also been an important area of focus for Mana Whenua and input from the iwi integration team has guided the design development.

46. The general stormwater philosophy is to capture, convey, treat and discharge runoff from the state highway and impacted local roads and convey existing overland flow across the alignment without increasing existing flood risk. This is achieved by adopting the Best Practicable Option (BPO) for both quantity and quality and thereby minimising effects on the receiving environment. Further details on the stormwater treatment philosophy are included in Annexure B.

47. Stormwater treatment devices are included in the design to reduce contaminants discharged downstream, thus improving water quality to piped awa and marine receiving environments. The treatment devices are designed to receive and treat runoff from the direct catchment to the device. This includes existing state highway and new pavement from the Project, and (in some locations) local road pavement and areas beyond the Project that nonetheless will flow to the device. Figure 3 provides an example of this approach for one treatment device. Further details (and additional figures) are included in the stormwater assessment by Mr. Bassett.

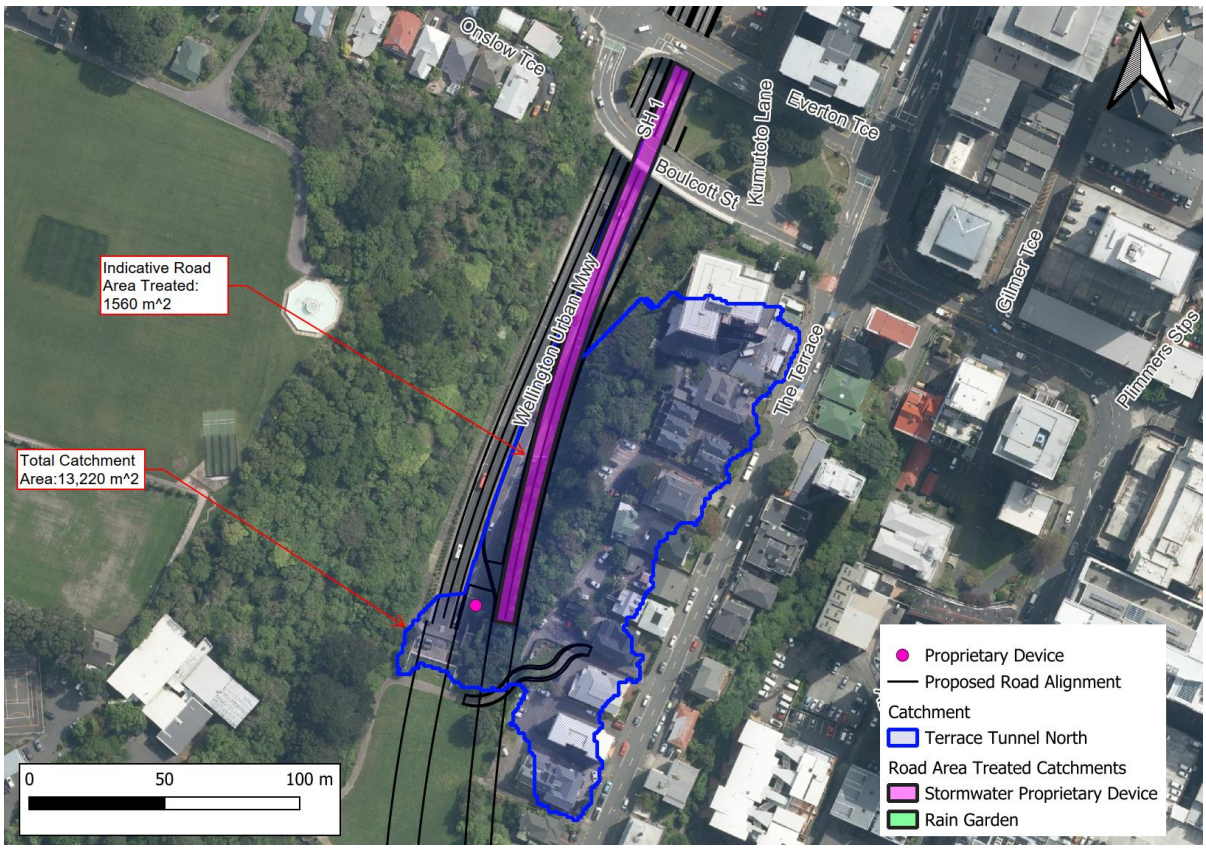

Figure 3. Example of catchment area treated by proposed stormwater device – North of Terrace Tunnel.

48. New pavement and modification of existing landform can change overland flow paths, increase runoff, and have effects on existing flooding patterns. These potential effects have been investigated by the stormwater design team using computational hydraulic modelling. There will be some increased flood depths along the route, including on new lanes to be created. The results from the modelling incorporating the new design show that the effects of the Project on existing widespread flooding along the route can be mitigated to avoid potential effects to property upstream and downstream. Flood mitigation includes:

    i. Stormwater storage tank north of the Terrace Tunnel to mitigate the existing downstream pipe capacity constraint

    ii. Proposed stormwater overflow opening in Hataitai Connection Bridge ramp embankment. This, or other design solutions are required to mitigate the effect from the Project on adjacent properties

Tunnels - General

49. Both new tunnels will include fire and life safety systems, ventilation systems and control systems. These systems have been considered in accordance with relevant New Zealand and Australian Standards (which are extensive).

50. The new tunnels will be connected to the existing tunnels by cross passages to enable access from one tunnel to the other during an emergency event.

51. Water for a fire deluge system is proposed to be stored in new tanks on the high side of each tunnel, and storage tanks are placed on the low side to catch the deluge water and quarantine it if it is contaminated. Existing tunnel fire suppression systems will be updated with connections to these tanks to support a deluge system.

52. New tunnel control buildings have been provided at each end of each tunnel. The tunnel control buildings will be fitted with new equipment, providing both the new and existing tunnels with modern safety, ventilation and operational control systems.

Tunnel Strata

53. The presence of the tunnel may have some effect on future development of the land above. The Project is seeking designation for below ground level strata (Tunnel Strata) to manage future impact on the tunnel and its associated stabilisation works. This will restrict construction works that may add additional structural load to the tunnel, or excavation that may result in instability of the tunnel structure.

54. Figure 4 illustrates the protected and operational designation strata areas and describes the depth restrictions associated with these designations. The operational designation includes the tunnel, and stabilisation works (e.g. rock bolts) that extend beyond the tunnel footprint. The protected designation requires a landowner to consult and seek consent from NZTA for construction work in this area.

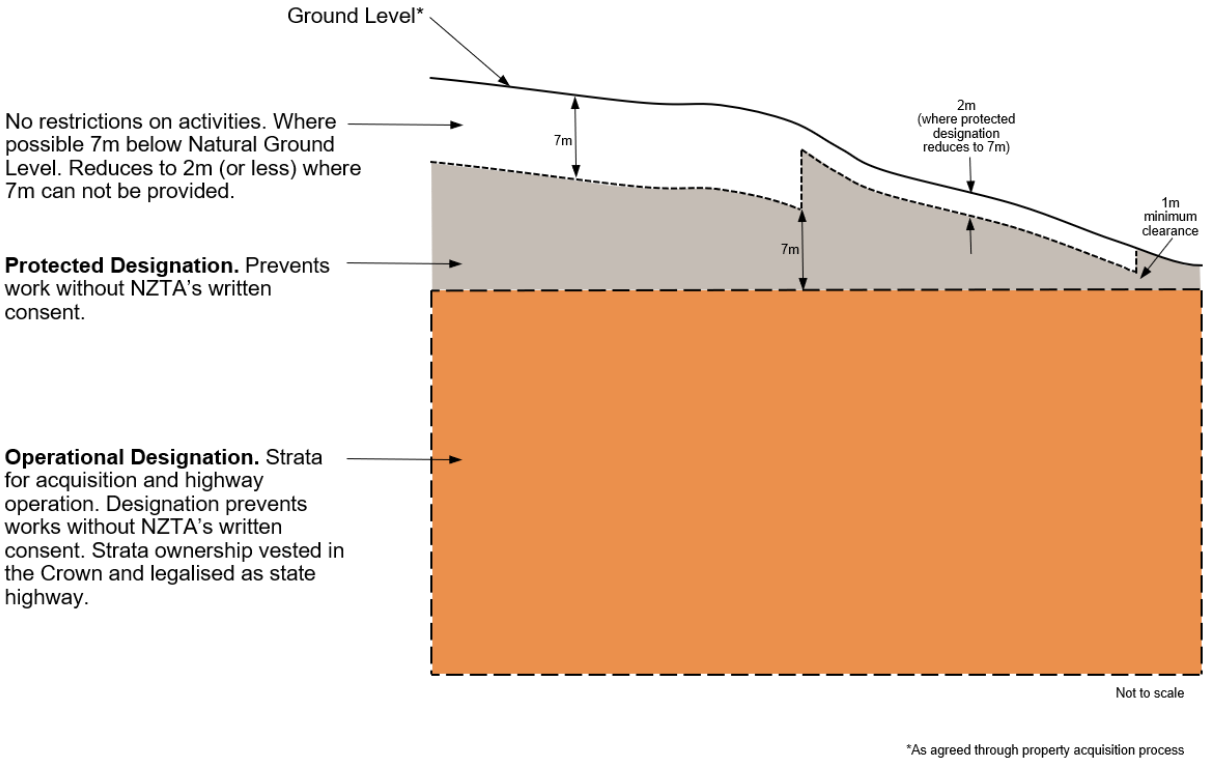

Figure 4. Illustration of protected and operational designation areas and depths.

55. In most instances the designation will not cover the first 7m below ground level. This 7m depth allows for typical pile foundations and basements with foundations. At the end of each tunnel, where the natural ground level is closest to the tunnel the depth to the protected designation will reduce to 2m. This 2m depth allows a landowner to undertake typical landscape (e.g. retaining wall) works.

56. The different effects (to property) of Tunnel Strata restrictions will be considered in negotiations with affected property owners. This property acquisition process will also confirm ground level (e.g. through existing ground survey) for the purpose of defining restricted zones.

Terrace Tunnel

57. The new Terrace Tunnel will be uni-directional (southbound) and two lanes wide. On completion of the Project the existing tunnel will also become uni-directional (northbound) and have the cross section adjusted to operate with only two lanes. As part of the Investment Case, analysis of traffic demands was undertaken by the Project team to confirm that a new three-lane southbound tunnel is not warranted as the traffic capacity is constrained by the downstream signals along Vivian Street.

58. The approach from the north to the tunnel will remain on the existing Shell Gully Overbridge with two narrower lanes in each direction (currently two northbound lanes and one southbound lane). A departure from standards for narrower lanes (7.6m carriageway width each direction (two lanes and shoulders) against RoNS standard cross section of 9.25m) has been approved in principle by the NZTA Chief Engineers Advisory Group (CEAG), noting that the lane width will be consistent with existing SH1 lane widths to the north of the bridge. Retaining both directions (four lanes) on the existing structure means that an expensive new bridge does not need to be constructed for the additional southbound lanes.

59. During the Investment Case, my team gave consideration to whether the existing tunnel could be widened to add an additional lane without construction of a new tunnel. Assessments showed that widening the tunnel would not save time or money, would require the management of complex health and safety risks during construction, would likely result in increased disruption and, once completed, would offer poorer resilience outcomes.

Terrace Tunnel Northern Approach – New Cut Face

60. The excavation of the portal for the new Terrace Tunnel is proposed to involve a steep batter slope, up to 20m or higher, supported with ground anchors. The slope will be approximately 60 degrees, which will limit property impact. The slopes at the tunnel portal will be vertical for the first 5m.

61. Options for these slopes as steep as vertical (requiring props and ground anchors) and as flat as 1V to 1.5H were considered in an options review during the development of the Consent Design. The geology of the area was examined, and the solutions tested for feasibility, and assumptions were tested for reasonableness.

62. The selected option was chosen because it is the most technically feasible option that minimises the impact on property. These slopes can be constructed without impact on existing structures.

Ghuznee Street Bridge

63. The existing Ghuznee Street bridge will be replaced or upgraded to provide the space underneath for the two new southbound lanes exiting the new tunnel. A replacement would be constructed adjacent to the existing bridge. An upgrade would consider the approach to lengthening the existing bridge to accommodate the additional SH1 lanes from the new tunnel. A decision on replacement or upgrading will be made during detailed design based on the efficiency, cost and disruption effects of the alternative approaches.

Terrace Tunnel Control Facilities

64. The new tunnel control buildings will be built on sites to the east of the tunnel at both ends and be located near to the new deluge water tanks.

65. Several potential locations were considered at either end of the tunnel including above the southern portal and in the dog exercise area at the northern end of the tunnel. Following refinement of the sizing of the tanks and buildings, the current locations were chosen to

simplify construction, maximise use of Crown/NZTA owned land, and utilise land within the footprint otherwise required for construction.

66. The area where the northern tanks and buildings are proposed to be located will be used as a construction zone for tunnel construction prior to the tanks and buildings being constructed.

67. The area where the southern tanks and buildings are proposed to be located is currently a carpark on land owned by the Crown/NZTA, near to the former Ghuznee St offramp.

68. Options to bury the tanks were considered, but the preferred (above-ground) options provide sufficient space for the required tanks at reduced cost.

Te Aro

69. To accommodate three lanes of traffic along the full length of Vivian Street (and provide transport outcomes in line with the objective for the Project), parking is to be removed, and some kerblines will be adjusted. Several properties will require their verandahs – which currently encroach into the SH1 corridor – to be modified to provide a suitable offset from the new carriageway to the structure.

70. Seven verandahs need to be modified to provide necessary clearance. Figure 5 provides an example of one of the locations where modifications are required. Without modification, there would be an increased risk of verandahs being struck (i.e. due to new locations for vehicles within the carriageway either where parking is removed or where kerblines are adjusted).

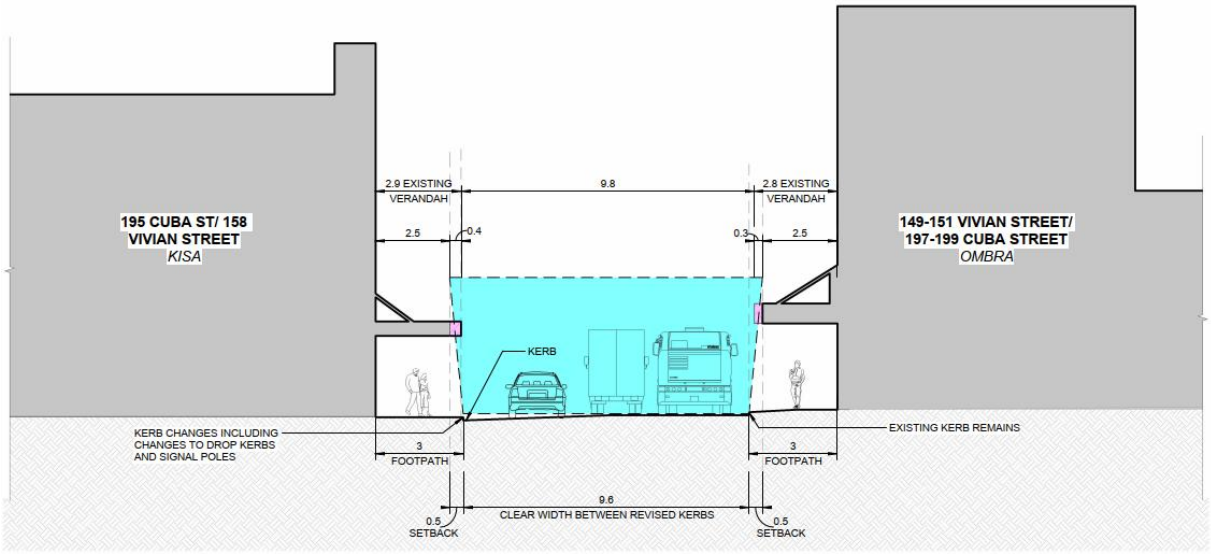

Figure 5 – Section through 195 Cuba Street and 197-199 Cuba Street

71. The performance of the intersections along Vivian Street and Karo Drive was assessed by my transportation planning team to consider the outcomes of removing turning movements from/to local roads. The assessment considered the appropriateness of alternative routes that would be required and safety/efficiency of those routes. This assessment resulted in some movements being proposed to be removed to improve the efficiency of the intersections. These movements include the left and right turns from Vivian Street and Arthur Street onto Cuba Street. An initial proposal to remove turns from Vivian Street to Tory Street was reversed as alternative routes were not seen as appropriate and these movements could be retained without a significant impact on the efficiency of the intersection.

Basin Reserve

72. At the Basin Reserve, separation of north/south (local) and westbound (SH1) traffic is achieved by the provision of a new overbridge on Buckle St over Sussex St. Sussex St becomes two-way, connecting Adelaide Road to Kent and Cambridge Terrace. The level of existing Sussex Street is to be lowered over its northern half in a trench under Buckle Street.

73. The Project will result in some local road connections and movements being removed or altered around the Basin Reserve and between Kent Terrace and Mt Victoria. Through the development of the Consent Design my transportation planning team considered the appropriateness of alternative routes that would be required and the safety/ efficiency of those routes.

Geometric Design of Sussex Street

74. The design of Sussex Street (from Cambridge/Kent Terrace to Rugby Street) has been developed to accommodate width, gradient and turning radii design parameters that are consistent with those considered in the Let's Get Wellington Moving (LGWM) project to accommodate Mass Rapid Transit (MRT).

75. Rugby Street from Sussex Street to Adelaide Road has a more constrained footprint, in terms of the available space between the Basin Reserve and property on the south side of Rugby Street. Future property purchase (or impacts on the Basin Reserve) would be required to provide road geometry consistent with the MRT parameters. These impacts on adjacent property are not required for the Project but are not precluded by the proposed design.

76. On completion of the Project, Sussex Street will become a local road. The design of this and other future local roads will be developed in consultation with WCC.

Sussex Street Trench Construction Approach

77. An assessment of settlement effects has shown that the trench for Sussex Street (as it passes under Buckle Street) can be designed as a drained or undrained structure. A drained structure has formed the basis for the Consent Design as it will be cheaper to construct (than an undrained, 'tanked' structure). While it will have the potential for greater settlement effects, these effects have been considered by Mr Brabhaharan and Mr Van Nieuwkerk and appropriate mitigation measures are available.

Schools Area (Dufferin Street)

78. Reduced traffic volumes on Dufferin Street (SH1 moved to north side of Basin Reserve and north-south local movement concentrated on Sussex Street) enable design updates for bus stops and drop-off zones near the schools. The current indicative design has been developed and updated in light of feedback provided during engagement with WCC, GWRC and the schools, and detailed design (also informed by further consultation) will provide further refinements in due course.

Mt Victoria Tunnel

79. The new Mt Victoria tunnel will be uni-directional (eastbound) and two lanes wide and include a shared use path to replace the existing path. On completion of the Project the existing tunnel will also be uni-directional (westbound).

80. A walking and cycling facility is proposed in the new tunnel at 3.6m wide. This width was chosen through the Investment Case based on expected use numbers. A wider path would come with very high marginal costs. This width was considered again through the Consent

Design process, taking into account new usage data and feedback from stakeholders; this is discussed further in Section 5 of this report.

81. Fire and life safety systems in both tunnels will be updated to meet modern requirements, including fire suppression and ventilation. The tunnels will be connected by cross passages at approximately 150m intervals.

82. The approach to the new tunnel requires a widened excavation, which will have the effect of removing the current alignment of Paterson St and the properties that currently front it. Paterson St will be rebuilt along a new alignment to the north of the new tunnel portal.

Tunnel Separation

83. For the basis of the Consent Design the tunnels are (indicatively) to be separated by 9m. In developing the Consent Design my tunnel design/constructability team and the geotechnical specialist jointly undertook an assessment to determine the spacing required to ensure that the seismic resilience of the existing tunnel is preserved by the proposed works.

84. The investigation considered separation distances of 6m, 9m and 20m. All options were technically feasible with different resilience outcomes and property effects. The analysis found that the 6m separation may cause some interaction between the new tunnel and the existing one during a seismic event, and that may cause some damage to the lining of the existing tunnel in certain events. This risk can be mitigated by adding safety features to the new tunnel. A 9m separation reduces seismic interactions between the two tunnels so that the tunnel lining is not damaged, and balances seismic risk against cost and the additional property impact that would be required to achieve a 20m separation. Detailed design will consider this further and the Project will be implemented so as to ensure that the new and old tunnels are resilient.

Mt Victoria Tunnel Control Facilities

85. On both sides of Mt Victoria, the deluge storage tanks will be buried under the new roadway. This decision has been made to minimise the property effect, and to ensure existing active mode connections to the tunnel can be retained.

86. The new western tunnel control building will be built on top of the western portal. The receiving tank for the deluge water system will be buried under the western approach to the new tunnel.

87. The positioning of the western tunnel control building and tanks have been decided based on feedback from Heritage and Landscape specialists. The location of the tunnel control building allows preferred placement of the heritage buildings that will be moved by the Project, provides future development areas, and is less intrusive from a Landscape and Visual Assessment perspective.

88. The new eastern control building will be built on the northern side of Taurima St alongside the proposed pump building. This pump building is likely to incorporate some public toilets to replace the facility currently in Taurima St, which will be removed to allow for construction of the new eastern tunnel portal and associated tunnel infrastructure.

89. The position of the tunnel control building, tanks and pump house has been planned to be as co-located as possible. Burying the tanks in the hillside was considered, but this is more expensive and disruptive to construct. Various locations were tested for the tunnel control building, but requirements for access, impact on the Town Belt, and the ability to be alongside other tunnel infrastructure supported the proposed location.

Eastern Portal Cut Slope

90. The eastern portal cut slope has been designed with ground anchors and a section of unreinforced cut. An alternate option of a flatter cut slope with no anchors was assessed by

the design team and discarded, primarily due to the property impact and amount of Town Belt land impacted.

91. A higher tied-back retaining wall (up to 1 in 0.5) was considered to retain additional Town Belt land at the top of the slope. However, this option required a substantially larger wall with longer tensioned ground anchors extending beneath private property, along with increased maintenance requirements. The current arrangement was preferred from a landscape / visual perspective and better integrates with the adjacent portal structure. It also provides a more cost-efficient and resilient portal slope design.

Eastern Connections

92. Local road connectivity options were explored through multi-criteria assessments that have been documented in the Alternatives Report prepared by Mr Peet. There are challenges with providing access between Hataitai and SH1 while minimising the impact on Town Belt land. Existing priority-controlled intersections with SH1 at Taurima Street, Goa Street and Wellington Road are becoming increasingly difficult and less safe to use as traffic numbers increase. Access from Taurima Street to SH1 blocks back during the morning peak into the Hataitai Village area which affects local traffic and bus movements. The proposed wider SH1 alignment means that the existing priority-controlled intersections are no longer appropriate.

93. Signalising the intersections would create delay on SH1 and the local roads, the local roads approaching SH1 have short block lengths which means that queuing from any signalised intersections can easily block back onto the local road network (e.g. Moxham Avenue).

94. The proposed design provides safer access from the City to/from Hataitai through access into Hataitai at Taurima Street (as existing) and out of Hataitai at the Hataitai Connection Bridge. The bridge also provides enhanced (safer) access to Hataitai Park.

95. The proposed SH1 cross section (to provide a consistent SH1 and remove bottlenecks) is unable to fit within the existing road corridor and requires the road corridor to be widened. Options that widened into the Town Belt or widened into private property were considered during earlier iterations of the Project and confirmed during the current phase. The proposed Project widens into the Town Belt along the length of Ruahine Street with property only required for connectivity or where the road curves around into Wellington Road. This is the option referred to as the Hybrid Option in Technical Report #1 Consideration of Alternatives, prepared by Mr Phil Peet.

96. The intersection of the Hataitai Connection Bridge and Moxham Avenue is proposed to be a priority-controlled (give way) intersection with a dedicated right turn bay on Moxham Avenue for vehicles queueing to access the bridge. Traffic modelling demonstrates this layout operates effectively and minimises the delay to buses along Moxham Avenue (when compared to a signalised intersection).

97. The Wellington Road section of SH1 has been designed to:

    i. Efficiently connect SH1 between Ruahine Street and Cobham Drive

    ii. Maintain access to properties on the north side of Wellington Road while removing the safety concern of direct access onto the state highway. This is achieved by the use of a service lane that will also form part of the shared use path for walking and cycling connecting Mt Victoria tunnel to Evans Bay

    iii. Minimise the impact on Kilbirnie Park

    iv. Minimise disruption from building the new state highway lanes on top of the existing lanes without going as far as affecting additional property

98. Intersections of SH1 with Kilbirnie Crescent/Hamilton Road and Evans Bay Parade are proposed to be reconfigured. These intersections will have some right turns removed to simplify the signal phases and improve efficiency. At Hamilton Road/ Kilbirnie Crescent all right turns are removed. This provides more green time for SH1 and for the local road connection between Kilbirnie and Hataitai which is an important bus connection. The removal of right turns will require local traffic to take alternative routes.

Location of Hataitai Connection Bridge

99. A connection between Hataitai and Hataitai Park is to be provided by a new overpass bridge, located to the south of Goa Street. This bridge connects from Moxham Avenue and also provides access into Hataitai from the east and out of Hataitai towards the City. The design has attempted to minimise the impact on the Town Belt by matching the existing topography.

100. In November 2025, an assessment was undertaken of alternative locations for the grade separated structure at or near Goa Street. These included three options to the north of the base option (including an option on Goa Street) and an option to the south.

101. This assessment carried out a comparative assessment of options considering the following criteria: local traffic, safety and efficiency; Town Belt impact; flooding risk; construction and property cost; and other considerations including environmental effects.

102. The assessment concluded that the proposed option was preferable because:

    i. Although a southern option would perform slightly better in terms of local traffic, safety and efficiency and has more space to mitigate flooding risk, it also would involve significant social effects (due to the impact on The Church of Jesus Christ of Latter Day Saints) land and would be more expensive

    ii. The northern options all had greater impacts and costs, as well as slightly worse traffic performance. In particular, the northern options all increased the amount of Town Belt land that is required for the Project

103. In addition to these options, an underpass option was considered. However, an initial review identified significant feasibility concerns, including greater impact on Town Belt, CPTED, stormwater, and construction issues, as well as complexities associated with the property access service lane. It was therefore not progressed further.

104. The overpass and its associated onramp will impact some wetlands in Hataitai Park, discussed in Technical Assessment #11 – Freshwater and Wetland Ecology by Mr Markham and further in Section 5 of this report.

Ruahine Street Service Lane

105. A service lane is to be provided along a section of Ruahine St. This lane will provide access to properties that currently have vehicle access directly onto SH1. Minimising the extent of this lane reduces the impacts the Project would otherwise have on the Town Belt. This service lane also forms part of the walking and cycling connection between the Mt Victoria tunnel and Evans Bay.

106. Between November 2025 and May 2026, an assessment was undertaken of alternative service lane options. The options considered included service lanes starting from Taurima or Tapiri Streets, an option with direct property access from Ruahine Street and an option which provided two-way access from Goa Street.

107. A comparative assessment of options was carried out, considering the following criteria: transport outcomes, Town Belt impact, impact on parking, cost, social and environmental factors and the ability of each option to provide temporary access to Hataitai when Taurima Street will be closed.

108. In addition, different options for a service lane from Moxham Avenue were considered.

109. The assessment concluded that the proposed option was preferable for a number of reasons, including:

i. It provides the most direct access to the properties on Ruahine Street

ii. It provides additional active mode connectivity by providing an additional access point between Ruahine Street and Moxham Avenue

iii. It requires less land from the Town Belt

iv. It provides a simpler solution for temporary access from SH1 to Hataitai during construction

SH1 Stormwater Design

110. Management of additional stormwater flows, due to the widened road, will be achieved by the construction of a new stormwater main from Hataitai along Ruahine St and Wellington Road to an upgraded existing outfall at Evans Bay.

111. In March 2026, assessment was undertaken for four options for the provision of the new stormwater system, and the route that it would take to discharge into Evans Bay.

112. These routes included two direct routes under Hataitai to Evans Bay, one route along local streets (e.g. Hamilton Road) to join the network at Wellington Road, and one that followed the new alignment of SH1, along Ruahine Street and Wellington Road to Evans Bay.

113. This study also considered if a new outfall would be constructed in Evans Bay. This was not preferred, as a new outfall could not be located sufficiently distant from the existing one to avoid the impact on kororā that exist at the proposed location.

114. The route following the SH1 road alignment was chosen as it provides the least construction challenges, can be constructed mostly offline without temporarily affecting local bus services, and minimises impact on property by remaining within the proposed NZTA road designation. The selected option will include replacement of the existing outfall in Evans Bay.

Property

115. While a large proportion of the Project works will take place on land already owned by the Crown for state highway purposes, the Project does require additional land to allow for the widening of the corridor in places. The acquisition of property will precede the construction works. Properties affected by the Project have been identified, and those that are not yet owned by the Crown for the Project are in the process of negotiations.

116. Three properties impacted by the Project will result in the demolition of community buildings: The Hataitai Kindergarten, the Badminton Wellington Centre, and the Eastern Suburbs Cricket Club / Marist St Pats Football Club facilities. NZTA is working with WCC and the operators of these facilities to determine how these facilities will be maintained in a new location.

117. The design team has sought to minimise property take where possible, including by the use of steeper reinforced slopes and through placement of Project buildings on land already owned by the Crown for state highway purposes.

5. DESIGN RESPONSE TO FEEDBACK

Introduction

118. A concept design for the Project was completed in September 2025 for the purpose of further specialist review, public consultation and stakeholder feedback. The Consent Design (July 2026) benefited from feedback on this and subsequent design iterations.

Mana Whenua and Specialist Feedback

119. In preparing the Consent Design, the design team drew on a large body of technical information held by NZTA regarding environmental values in the area, gathered by experts during previous investigations, through the Let's Get Wellington Moving programme, and during the Investment Case process for the current Project.

120. Iwi integration representatives (representing Taranaki Whānui ki te Ūpoko o Te Ika and Ngāti Toa Rangatira) were involved in decision-making and Project discussions through development of the Investment Case and Consent Design.

121. Feedback on the September 2025 concept design was received from specialists in Social and Recreational Impact, Heritage, Archaeology, Landscape, Visual and Urban Form, Transport, Geotechnical, Air Quality, Groundwater, Noise and Vibration, Ecology, and Contaminated Land.

122. Following initial specialist feedback, the following areas were reviewed with changes to the design as noted below.

Te Aro - Cuba Street intersection

123. Feedback from the Heritage specialist on the initial design led to refinement of the design at the intersection between Cuba Street and Vivian Street. The Consent Design now:

    i. Increases pedestrian waiting areas at the crossing on the north-east side of Vivian Street including incorporation of key heritage elements (including seating)

    ii. Reduces the pedestrian crossing distance across Cuba Street by narrowing the carriageway for vehicles, both to the north and south of Vivian Street

124. The proposed design widens the pedestrian crossing of Vivian Street on the eastern side of Cuba Street. The western side of Cuba Street remains the same width. Through the removal of turning into Cuba Street the proposed design provides more efficient movement on Vivian Street (SH1) without increasing the waiting time for pedestrians wanting to cross.

Basin Reserve - Rugby Street / Dufferin Street

125. Feedback from the Transport specialist led to refinement of the design along the eastern section of Rugby Street / southern end of Dufferin Street. The proposed design:

    i. Relocated a proposed area of planting to the back of the path to improve sight lines and reduce potential for illegal parking

    ii. Converted the eastern section of Rugby Street to one-way (eastbound), to improve intersection performance and create an anti-clockwise circulation path around the Basin (opposite to existing)

Basin Reserve - Sussex Street Property

126. The initial design included additional provision for walking and cycling along the west side of Sussex Street resulting in pockets of leftover property that were not suitable for future use. Following specialist concerns about the use of leftover property areas, and considering that Tasman Street is a currently identified cycle route the space was reconfigured to remove the

dedicated cycle provision and maximise the leftover property. This change enabled the opportunity for future development in this location. Access to the development sites can be provided from Rugby or Tasman Streets.

Basin Reserve - Paterson Street Property

127. The Investment Case design for Paterson Street included the allowance for relocation of the two listed heritage properties (140 Austin Street and 19 Paterson Street) and a new location of the tunnel control building. Following feedback from specialists, several alternatives were looked at to balance heritage, archaeology, urban design and landscape considerations. The current design also includes retention of the 1868 portion of Laureston House at 7 Paterson Street (in addition to the two listed buildings) and includes an area for future development. The tunnel control building has been relocated to above the tunnel portal.

Basin Reserve - Retaining Wall Treatments

128. Feedback was received from the Urban, Landscape and Visual Specialist on the consistency of retaining wall treatments at several locations along the length of the Project. As a result, the indicative retaining wall treatment / finish has been updated in two locations (Basin Reserve and Hataitai Connection Bridge) from a vegetated finish to a concrete finish.

Basin Reserve - Landscape Mitigation

129. Similarly, feedback was received from the Urban, Landscape and Visual Specialist on the landscape treatment at several locations along the length of the Project. As a result, changes were made to the Consent Design to remove vegetation at the intersection of Rugby Street and Adelaide Road to enable a future building edge and to add vegetation between Sussex Street and the southbound slip lane around the west side of the Basin.

Eastern Connections - Wetlands

130. During the ecological specialists' investigations, four wetlands were identified on the west side of Ruahine Street. Three of them were potentially affected by the proposed design. The design was initially updated to avoid the largest of these wetlands and a potential location for an offset mitigation wetland (existing Badminton Hall site) was identified.

131. Avoidance of the two smaller wetlands would require realignment of SH1 by more than 10m across most of the length of Ruahine Street. This would result in new impact on private property or additional Town Belt impact and is not practicable. Ecological advice identified that both wetlands are of low ecological value, so impacts on property and the communities living there would be disproportionate to the benefits offered by wetland avoidance in this instance.

132. Further design development and hydrogeological assessment identified that the largest wetland, although physically avoided by the Wellington Football Club access road, was likely to be impacted by groundwater drawdown associated with adjacent embankment cuts. The hydrogeological assessment indicated that this wetland would not likely remain wet, resulting in an adverse effect.

133. My team revisited the design to determine if there is any alternative option to change the location of the access road to avoid the effect on the wetland. The use of sheetpiling to prevent water loss was not seen as a feasible solution and alternative access routes to the rugby/gymnastics club were not practicable, due to impact on the Town Belt, increased construction cost and ecological impacts.

134. Consideration of the viability of the potential wetland offset location identified the following:

    i. The hydrogeological specialist identified that to be fed by groundwater the wetland would need to be dropped into the hillside resulting in extensive earthworks

ii. The geotechnical specialist identified geotechnical and pavement risk associated with water from the wetland flowing down through the cut slope adjacent to SH1 and affecting the viability of this slope and the longevity of the highway pavement

iii. Based on these two perspectives it was agreed that for a wetland to be viable in this location it would need to have an impermeable lining. This lined wetland would then require adequate surface water flows

iv. An ecological expert undertook a site visit in May 2026 and identified that there was a stream channel for approximately 150m upstream from the proposed site. Above that the watercourse is defined as ephemeral (only flows during or immediately after rainfall)

v. Hydrology assessment has shown that the expected surface water flow during summer or low flow periods would be inadequate to sustain a wetland of the required size at this location

135. Based on the assessment it is not viable to provide an offset wetland at the initially proposed location. From a technical perspective other sites within the Town Belt are unlikely to be feasible as they would have the same technical challenge of trying to construct a wetland (naturally in low lying areas) on a hillside. Therefore alternative responses are being considered and these are set out in the specialist assessment of Mr Markham.

Eastern Connections - Hataitai Flood Mitigation

136. An assessment of the flooding risk by the design team and specialists identified that the embankment associated with the new Hataitai Connection Bridge changed the existing flood extents around the bridge, which could impact private properties. As mitigation the design has therefore included a flood bypass culvert through the embankment of the bridge to retain similar flood permeability to the existing conditions. Other solutions to mitigate the flooding also exist and could be incorporated into the final design.

Tunnel Control Buildings - Visual Impact

137. Feedback was received from the Urban, Landscape and Visual Specialist on the prominence of the Tunnel Control Buildings at the western end of the Mt Victoria Tunnel and the southern end of the Terrace Tunnel. The indicative design for both locations was amended to lower the buildings into the landscape, to reduce their visual prominence. The lowering of the buildings (1 – 1.5m) will require some areas of the walls to provide a retaining function.

138. Feedback was also received from the Urban, Landscape and Visual Specialist on the visual impact of the above-ground tanks at either end of the Terrace Tunnel. The design for both locations was amended to provide a visual screen around the tanks (a similar outcome could also be achieved by a different form / configuration of tanks).

Public and Stakeholder Feedback

139. NZTA has consulted widely in respect of the Project, as summarised in the substantive application documents. Various feedback received from stakeholders and members of the public has influenced the design; some examples are provided below.

Te Aro - Vivian Street Loading Zones

140. Stakeholder feedback highlighted concern about business servicing along Vivian Street; currently some public carparking spaces along Vivian Street (which are to be removed to add a lane on Vivian Street) are used informally for loading from time to time. The transport design team have reviewed several options for alternative loading zones to be created. One of these options considered off-peak loading on Vivian Street but it was assessed to have a negative impact on efficiency and achievement of the project objective. The project team will continue to work with WCC to implement new loading zones on nearby side streets off SH1.

Basin Reserve - Walking and Cycling Grade Separation

141. Comments were received urging grade separation (pedestrian overbridges, underpasses, tunnels) and other measures to improve safety and reduce delays for people walking and cycling at the Basin Reserve. Commenters were concerned about multiple at-grade crossings, longer waits at traffic lights, and potential conflicts between cars, pedestrians, and cyclists – especially near schools or during major events.

142. These comments generally focused around replacing the two pedestrian crossings on the north (in front of the entrance) and north-east side (Mt Victoria to Dufferin Street (schools) area) of the Basin Reserve.

143. The following challenges exist with providing active mode grade separation in these locations:

i. Pedestrian / cyclists bridges and underpasses require long ramps to achieve accessible grades, which require a lot of space

ii. Long ramps can create challenges with additional travel distance / time when not aligned with all desire lines

iii. There is insufficient space to provide bridges around the Basin without impacting private property, event management spaces, school pick-up and drop-off areas, or the widths of existing/proposed at-grade active mode paths

iv. Bridges impact on viewshafts and urban form, which was one of the consenting challenges with the previous Basin Bridge project

v. There are significant underground utilities and services around the Basin which would be impacted by an underpass and approaches

vi. Underpasses can create personal safety / CPTED issues

vii. Underpasses have a risk of flooding in low lying areas with high water tables like the Basin Reserve

144. There are a lot of complex connections and desire lines around the Basin Reserve with connections from up to four different directions. Applying grade separation would require multiple structures and connections which would exacerbate the concerns listed above.

Basin Reserve - Bus Lanes

145. Based on a request from WCC, the design team has considered providing for dedicated bus lanes around the Basin Reserve connecting existing facilities between Adelaide Road and Cambridge Terrace (northbound) and in the southbound direction. Analysis has shown that bus lanes only provide a benefit for southbound bus travel at the Adelaide/Rugby intersection, with no material benefit for northbound bus travel. Moreover, incorporating dedicated bus lanes would come with a reduction in overall lane capacity and create delays and less reliable regional journeys to the hospital – especially at the Kent/Sussex and Rugby/Adelaide intersections. Bus lanes have not been included in the Project but are not precluded from being added in the future.

Basin Reserve - Event Operations

146. Following feedback from stakeholders and the public around how the Basin Reserve would operate as a venue, the design team has been working with the Basin Reserve Trust and Cricket Wellington to show how events could operate with the new layout. Several adjustments have been made to the design following this process, the most significant of these has been to realign the slip lane from Buckle Street to Cambridge Terrace to provide more space north of the Basin for use during major events.

Basin Reserve - Seventh Day Adventist Church

147. Property negotiation regarding a partial property purchase has raised concerns about the viability of the Seventh Day Adventist Church on Tasman Street with the proposed loss of parking. A solution is proposed that uses some adjacent property (which is otherwise required for the Project) to retain the same level of parking as the church currently has. This has been allowed for within the Consent Design.

Basin Reserve - Former Home of Compassion Creche

148. Feedback from the Ministry of Culture and Heritage (who currently operate the Creche as an education centre) raised concerns about the proposed location in terms of its function as an education centre. The design team and specialists have been working to identify potential alternative locations nearby that would better meet the needs of the Ministry of Culture and Heritage, Mana Whenua and other stakeholders, while not resulting in additional effects. This process is ongoing, and flexibility is sought to locate the Creche in a different place (near its current indicative location) if a solution is identified that is satisfactory to NZTA, the Ministry, and Mana Whenua.

Basin Reserve - Pukeahu Steps

149. Stakeholder and specialist feedback highlighted CPTED concerns around the cul-de-sac footpath on the north side of the Sussex Street extension. The design now includes a staircase from Pukeahu down to the Sussex Street extension in this location to make it a through route for able bodied pedestrians.

Basin Reserve - Cycle access from Pirie Street

150. Stakeholder feedback highlighted concerns about access to the cycle facility on Cambridge Terrace from Pirie Street. Cycle crossings of Pirie Street and Kent Terrace are now proposed in the Consent Design to provide the cycle access.

Basin Reserve - Emergency Services Access

151. Engagement with stakeholders identified two locations where specific access would be beneficial so as not to impact the accessibility of emergency services in an emergency situation. Having flexibility in access reduces response times. These two locations were a U-turn from Kent Terrace to Cambridge Terrace at the intersection with the Sussex Street extension and from the west end of Wellington Road onto Wellington Road eastbound. Both of these access points have been incorporated into the Consent Design.

Mt Victoria Tunnel – Construction closure of active mode facility

152. Concerns were raised by stakeholders about the closure of the active mode facility through the Mt Victoria tunnel during tunnel construction. It is not practicable to safely retain access to the existing active mode facility in the existing Mt Victoria Tunnel throughout construction. The critical area is the eastern portal where, due to construction of the new tunnel, limited space (see Figure 6) is available to maintain traffic and safely accommodate active modes while the new tunnel portal is excavated.

153. This closure is currently estimated at approximately three years. During future phases of design development, opportunities will be explored to minimise the period without access, and NZTA proposes various measures to identify and upgrade alternative walking and cycling routes (such as through the Town Belt) during this period.

Figure 6 – Existing eastern entrance to Mt Victoria Tunnel

Eastern Connections - Moxham Avenue Mitigations

154. The initial design included no infrastructure changes on Moxham Avenue. Following feedback from members of the public and specialists regarding the increased southbound traffic demand on Moxham Avenue resulting from the Project, the design team identified mitigation measures to provide improved pedestrian, public transport access (aligned with the WCC Bus Priority Action Plan) and safety solutions. These measures were tested with specialists and are now included in the Consent Design. Following further engagement with WCC the design was updated to reflect changes to bus stop locations that WCC will implement prior to the Project commencing.

155. In conjunction with the changes on Moxham Avenue itself, the design was amended to include a continuous bike route from the new Mt Victoria Tunnel to Evans Bay Parade alongside SH1 on Ruahine Street and Wellington Road. This bike provision takes the form of shared paths, low volume / low speed access roads and contraflow bike lanes. This facility is expected to be used by cyclists as an alternative to Moxham Avenue and reduce the number of users/conflicts on the local road.

156. A shared path has been added on the south side of the Hataitai Connection Bridge to connect Ruahine Street with Moxham Avenue and improve active mode permeability and access.

157. Sharrows (road marking to indicate the traffic lane is to be shared by cyclists and motorists) have been added to Taurima Street to provide clarity on the route for people on bikes accessing the Hataitai village centre from the new path through the tunnel.

Eastern Connections - Hataitai Pedestrian Connections

158. Public feedback highlighted concerns with the lack of crossing provision for access between Hataitai and Newtown. The design now includes a continuous footpath from the western end of Wellington Road to the new Hataitai Connection bridge, which then provides a grade separated pedestrian connection over SH1 connecting the two suburbs.

Eastern Connections - Right turns from Hataitai

159. Stakeholder and public engagement feedback highlighted concerns about access for the Hataitai catchment particularly from Hataitai to Newtown. NZTA and the design team have reviewed several options. The retention of right turns at Evans Bay Parade and Hamilton Rd were reconsidered.

160. The right turn from Evans Bay Parade (north) to Wellington Road could be considered as a filter turn providing the impact on intersection efficiency can be mitigated through signal optimisation. This option currently has an unreasonable impact on intersection efficiency so has not been included in the design. It should be considered again at detailed design to see if further optimisation can reduce some of these adverse outcomes. If it was implemented at a later stage the Project footprint would not need to alter.

161. Right turns from Hamilton Road would require a third traffic signal phase. This additional phase would introduce delay for SH1 users and local/bus traffic travelling between Hataitai and Kilbirnie. This option would also require additional property and create delays to the majority of users to serve only a small number of vehicles (estimated at 100 per hour). Removing these right turns will require vehicles from Hataitai to instead travel through Kilbirnie to get to Newtown or alternatively use the new Hataitai Connection Bridge to access the City.

Eastern Connections - Hataitai Park pedestrian access and safety

162. Stakeholder feedback highlighted concerns about the proposed pedestrian crossing point at the junction for access to Hataitai Park. This area includes vehicles entering the park from both the south and east, and a large crossing distance required at the intersection. The design has been amended to extend the footpath north along the main park access to allow a shorter crossing distance which will improve access and safety.

Eastern Connections - Town Belt Impact

163. Stakeholder feedback highlighted concerns about the extent of the Project's impact on the Town Belt. Other feedback suggested increased Town Belt impact through the addition of more shared use paths or by providing more buffer or local access provision on the east side of Ruahine Street. Some updates to the design were made to reduce the Project footprint (e.g. width of the slip lane off Ruahine Street towards Hataitai Park has been reduced). These changes were in some instances offset by additional footpaths to provide a new link through to Newtown and safer crossing points at the Hataitai Park intersection.

164. The current design has been developed to define the expected impact on the Town Belt but there may be opportunities to refine the design further to achieve marginal reductions in impact on Town Belt land. These will continue to be explored in future design phases based on further engagement with stakeholders, additional geotechnical information, further safety assessments and constructability considerations.

165. The following design elements that may reduce Town Belt impact have not been implemented at this stage but will be considered through future design phases:

    i. **Mt Victoria Tunnel Eastern Portal Cut.** The cut slope has been designed with a steep retaining wall from ground level, a less steep nailed shotcrete slope and a flatter section of unreinforced cut. This design responds to ground conditions and input from the landscape

and visual specialist to integrate with the existing portal. An alternative option of a full height flatter cut slope with no soil nails was assessed and is not being progressed, primarily due to the additional impact on private property and the Town Belt that a flatter slope would cause. A higher tied-back retaining wall (up to 1 in 0.5) was considered to avoid impacting additional Town Belt land at the top of the slope. However, this option required a substantially larger wall with longer tensioned ground anchors extending beneath private property, along with increased maintenance requirements. The current arrangement provides a more cost efficient and resilient portal slope design

ii. **Lane and Shoulder Widths (Ruahine Street).** The 8.25m wide carriageway (in each direction) is less than the RoNS standard cross sections (9.25m), to minimise the footprint and associated effects on Town Belt land. This cross-section provides sufficient ability for two vehicles to pass a stopped vehicle (2.25m). If only one lane was available when a vehicle was stopped then there would be an impact on both the efficiency and reliability of the corridor. The 8.25m carriageway (with proposed 2.1m median) also enables two lanes to be maintained during maintenance work in the median (e.g. accessing service covers or lighting)

iii. **Median Width.** The median along Ruahine Street varies in width from 2.1m to 5m. The 2.1m median can accommodate a 0.9m wide traffic sign with the necessary 0.6m offsets to the kerb edge. The median may also accommodate lighting and service covers. Maintenance access has been discussed above. At the Hataitai Connection Bridge the median width increases to 4m to accommodate a bridge pier with necessary clearances to traffic lanes. A bridge without a pier would require an increased structural depth which would increase the height of the bridge (or require additional lowering of SH1). At the Ruahine Street and Wellington Road intersection provision for emergency vehicles to safely make a right turn during an emergency event also needs to be considered in future design phases

iv. **Hataitai Park intersection**. The exit off SH1 is designed to enable vehicles to leave the road safely and to provide stacking for vehicles back from the give-way line at the top of the ramp. An acceleration lane is provided for vehicles from Hataitai joining SH1 (towards the City). Austroads guidance suggests acceleration lanes should be considered when vehicle numbers are 300-500 vehicles per hour. The anticipated peak demand for this movement is approximately 530 vehicles. Pushing the exit and entrance to SH1 closer to the bridge would add complexity and reduce safety at the intersection. It could also increase cost by requiring widening of the bridge. Bridge designs that are curved will have impacts on different parts of the Town Belt, would introduce additional bridge/ retaining wall cost, and could create safety challenges

166. Future design phases will identify and explore further opportunities to refine the design to reduce the Town Belt footprint without significantly compromising efficiency/safety and without adding Project cost.

Eastern Connections – Kilbirnie Park Impact

167. Stakeholder feedback highlighted concerns about the extent of the Project's impact on the Kilbirnie Park and the effect on the feasibility of the sports fields within the park.

168. During design development, consideration has already been given to some ways to reduce the impact on the Park. For example, consideration was given to removing properties to the north of SH1 to minimise the impact on the park. However, this option would not avoid impacting the park, would significantly increase the Project cost and would have additional impacts on private property.

169. The proposed edge treatment along Kilbirnie Park is to provide a near vertical wall instead of the tiered seating that currently exists to minimise the impact on the sports fields.

170. As with Ruahine Street, a similar approach will be taken to refining the Project's design along Wellington Road, with a view to minimising the Project's impact on Kilbirnie Park. Future design phases will consider this issue further and seek to reduce the impact on Kilbirnie Park where practicable.

171. However, there are limited opportunities to reduce the width of the cross-section in this area without reducing the level of service for one or more modes of transport.

Project Wide – Other Design Options

172. There were several other design options that were suggested through public engagement that have not been incorporated. These include the following:

i. **Lengthening the Mt Victoria Tunnel.** It was suggested that extending the eastern and western portals of the tunnel would reduce the earthworks at either end of the tunnel and enable retention of existing tunnel systems. Extending the tunnel would result in a significant increase in cost without additional transport benefit

ii. Retaining the right turns Wellington Road/Ruahine Street. Maintaining right turns at this intersection would add delay to SH1 movements, increase the space required for the Project and would have impacts on the Town Belt and Project cost. Suggestions of a single lane roundabout at this location were also provided. This was not considered because a single lane would reduce the capacity of SH1 at this location and increase travel times. Furthermore, a roundabout would not be suitable at this location because the approach grades and the space required would have additional impacts on Town Belt and/or private property

iii. Removing pedestrian crossings at Taranaki Street to improve efficiency. A reduction in the crossing opportunities at this location was not considered appropriate based on the existing demand, and the impact on local access and safety

iv. Reducing signal cycle times at Kilbirnie Crescent/SH1. Shorter cycle times will reduce the overall efficiency of the intersection and reduce transport benefits

v. Increasing the length of the service lane on Ruahine Street. Previous NZTA schemes had included a service lane from Taurima Street along the length of Ruahine Street. The Project design provides a shorter length of service lane. One of the key reasons for this is that this limits the service lane's impact on the Town Belt. In addition, the service lane proposed as part of the Project enables temporary access to Hataitai during the construction period when Taurima Street will be closed

vi. **Raising Ruahine Street** so connection from Hataitai to Kilbirnie Park is possible via an underpass. Raising Ruahine Street would increase cost, introduce constructability challenges (maintaining SH1 traffic flow) and introduce shading effects on property. Transport benefits would not be improved

vii. Trenching Ruahine Street to reduce the height of the connection to Hataitai Park. Higher retaining walls would be required which would increase cost, introduce constructability challenges (maintaining SH1 traffic flow). Transport benefits would not be improved

viii. Include ramps to the Hataitai Connection Bridge on the east side of Ruahine Street. The traffic movements that these ramps would benefit are not significant numbers and would not justify the additional cost and Town Belt (or property) impact

6. CONCLUSION

173. The proposed design reflects the objective of the Project, **"to provide more efficient and reliable access on State Highway 1 from north of the Terrace Tunnel to Wellington Airport and Wellington Hospital to support regional economic growth".**

174. The technical analysis and design undertaken to date reflects a developed understanding of how to meet that objective, and while detail remains to be confirmed in subsequent Project design phases, I am confident that the solutions included in the design are technically sound and define the required footprint of the Project.

175. The design responds to the Project objective to deliver improved traffic performance on the SH1 corridor, while responding in a sensitive way to the environment within which the Project will sit.

176. Feedback from Mana Whenua representatives, environmental specialists, members of the public, and various stakeholders has resulted in numerous changes to the design to reduce effects or otherwise improve urban form / environmental outcomes. The provision of turns for emergency vehicles at Wellington Road and Kent/Cambridge Terrace is one example of this.

177. Where avoidance of adverse effects is not possible, reduction of the effects was sought. Reduced effects to property in Sussex and Paterson Streets, pedestrian connections in Hataitai, provision of carparking at Seventh Day Adventist Church on Sussex St and the stairs to Pukeahu are examples of improvements made in this regard.

178. Overall, through a process of design development, and consideration of feedback, key components of the design have been refined to better support the desired transport outcomes and reduce potential adverse effects, as well as reducing costs and Project risk, improving programme duration or certainty, and improving seismic resilience.

TECHNICAL REPORT 4 - ANNEXURE A – Guiding Urban Design Principles

The following guiding urban design principles have been developed as a foundation that has informed and influenced the design development of the Project to date. The urban design principles are adapted from NZ Transport Agency's (NZTA's) Bridging the Gap documentation, which captures NZTA's expectations for the integration of urban design, with the additions of specific principles around respecting cultural values identified by mana whenua, and Crime Prevention Through Environmental Design, recognising that these principles have also been important considerations, influencing the design of some aspects of the Project.

a. Designing for context
b. Integrating transport modes and land use
c. Contributing to good urban form
d. Supporting community cohesion
e. Maintaining local connectivity
f. Upholding Mana Whenua values
g. Respecting cultural & heritage values
h. Integrating green infrastructure
i. Creating positive road user experience
j. Achieving a low maintenance design
k. Crime Prevention Through Environmental Design

These urban design principles are focused on guiding the integration of the Project with its urban and landscape contexts and should be considered and applied in conjunction with the Project objective.

At the consent design phase, these principles have informed the development of design solutions that contribute to a transport network that is integrated into the urban and natural systems of the city, environmentally responsible and culturally grounded, enhancing both the journey and the land it traverses.

Good urban design principles will continue to guide the further design development of the Project, managed through development of an urban design and landscape management plan ("UDLMP"). The UDLMP will demonstrate how various specified urban design and landscape outcomes are achieved, with a focus on areas of sensitivity along the length of the Project.

Further design development shall be done alongside the Mana Whenua Steering Group and/or with their representatives within the Project, building on existing relationships. This will include the opportunity to incorporate Mana Whenua values into elements of the more detailed urban design and landscape design responses.

The following pages document how the guiding design principles have informed the design that is being lodged for FTAA approvals; across the Project from The Terrace Tunnel to Kilbirnie, and opportunities for consideration within each section.

Terrace Tunnel North

Principle	Description
Designing for context	Originally designed in the 1970s as a dual portal marking a city gateway, the SH1 corridor follows the Kumutoto gully between the CBD of The Terrace to the east and Kelburn suburb high above the slope to the west. Now widened to the east with a second southbound tunnel the approach is to follow the existing design language with the new portal and the vegetated slopes above retaining walls as a buffer to existing buildings.
Contributing to good urban form	Steep retaining walls to reflect existing walls provide a coherent design solution and minimise unnecessary land take to maintain existing urban form. Built form and services such as water tanks and tunnel portal buildings to be well integrated into the site and align with the character of the immediate and wider urban and natural context.
Supporting Community Cohesion	Maintain access to dog park/open space above portals. Open space above the portals to remain at the same size and will continue to be used as a local park and dog recreation space.
Maintaining local connectivity	Local access to the dog park/open space above the tunnels and surrounding neighbourhood connections are maintained through reinstated paths and edge treatments where practical. Visual connection is also important, having places reflective of people, connecting people to place through the use of mahi toi, and information boards where appropriate and language.

Principle	Description
Uphold Mana Whenua values	Opportunities for mahi toi along retaining walls, portals, and represented on tunnel control buildings, water tanks and other built elements will be confirmed with Mana Whenua including other forms of cultural expression. The opportunities for acknowledgement and recognition of Kumutoto Awa and Waikoukou Stream and associated pūrākau of the area are important and can be expressed through a process of further development with Mana Whenua. Native, eco-sourced plants to be specified and ecological habitat restored and protected.
Integrating green infrastructure	Slope revegetation using native plants alongside new highway and on top of walls/portals supports long-term visual integration with the surrounding context. Ecological habitat for native species to be protected and where there is opportunity, restore and allow for proposed new ecological habitat to be integrated into the design.
Creating positive road user experience	Opportunities for mahi toi and cultural integration on retaining walls and portals recognising these are important central city gateways. Green corridor flanking arrival to portals.
Achieving a low maintenance design	Concrete portals and return walls provide a low maintenance solution reducing long-term upkeep and operational risk. Low maintenance native planting specified. Tunnel portal buildings will use best practice design solutions and materiality reducing on-going maintenance, extending long term life. Planting will have appropriate buffers to highway and structures for safe maintenance.

Te Aro

Principle	Description
Designing for context	Mid-rise city grid is the predominant condition of Te Aro. Works within the narrow central-city street corridor where pedestrian volumes and crossing experience, veranda continuity and intersection performance are key design considerations. Pedestrian waiting areas at the Cuba Street intersection have been increased, with attention to safety, shelter and pedestrian comfort at a major pedestrian crossing.
Integrating transport and land use	Street layout responds to the sensitivity of SH1 intersecting with an important retail and hospitality street with active ground-floor land uses on each street corner, and the need to carefully integrate changes to the road layout with the pedestrian environment.
Contributing to good urban form	Maintains a coherent street edge and intersection geometry that reinforces the legibility of the Te Aro grid and supports a functional public realm. Minimise impacts on verandas from kerb line adjustments and reinstate verandas to corner buildings at the Cuba St intersection to maintain shelter and pedestrian comfort.
Supporting community cohesion	Widened footpaths at the Cuba Street intersection supports movement along and pedestrian safety to a critical community spine running through Te Aro. Existing features valued by the community including a park bench are relocated within the design. To the south side of the Terrace Tunnel is a community orchard.
Uphold Mana Whenua values	Integration of mahi toi or other suitable cultural expression to reference Waimapihi Awa has been indicated along Vivian St, to be developed and confirmed with Mana Whenua.
Respecting cultural and heritage values	Verandas to heritage buildings are reinstated to maintain heritage values.
Achieving a low maintenance design	Efficient use of space and decluttering of public realm provide a low maintenance environment.

Kent and Cambridge Terraces and Canal Reserve

Principle	Description
Designing for context	The formal boulevard of Kent and Cambridge Terrace connects the Basin Reserve with Courtenay Place and the waterfront two blocks beyond. The southern end at the Basin is the key intersection of the east-west and north south movement spines in the city. Raingardens and planting are incorporated into Canal Reserve as well as a green link extending from Pukeahu to the Basin. Multi modal and pedestrian routes connected into wider networks.
Integrating transport and land use	Residual land to enable redevelopment wherever possible. Ensuring the transport changes continue to provide local access and street frontage to support adjoining land uses.
Contributing to good urban form	Respecting and reinforcing the boulevard geometry of Kent and Cambridge Terraces and the Canal Reserve. Extending the landscape down to Cambridge Terrace provides an enhanced connection between Pukeahu and the Basin. Canal Reserve is maintained with clear viewshafts between the city and Basin Reserve. Where possible, established trees are maintained. Proposed trees seek to enhance current urban form.
Supporting Community Cohesion	Green link provides additional community space and links to the Basin and Canal Reserve. Increased space and new design of public plaza space at main north gate entry to the Basin Reserve supports enhanced use and experience of coming and going on event days and activation of public realm outside the cricket ground.
Maintaining local connectivity	Safe, separated walking and pedestrian connections maintained and enhanced around the Basin Reserve and alongside the Canal Reserve.
Uphold Mana Whenua values	The acknowledgement and recognition of Waitangi Awa and associated pūrākau of the area has informed the design to date. Further opportunities and design development of this key area shall be done alongside the Mana Whenua Steering Group and/or their representatives. Native planting to Canal Reserve chosen to

Principle	Description
	acknowledge and recognise the Waitangi Awa, Pukeahu, Ngā Tapuae o Kāhui Maunga, Hauwai Mahinga Kai, Akatarewa Pā and associated pūrākau of the area as part of cultural landscape expression as identified by Mana Whenua.
Respecting cultural and heritage values	Creche shall be relocated as illustrated on drawing SH1WI-DES-00-GEN-DRG-00121, or to an alternative location within Pukeahu National War Memorial Park as agreed with the Mana Whenua Steering Group, Ministry for Culture and Heritage, and Heritage New Zealand Pouhere Taonga.
Integrating green infrastructure	Raingardens and planting provide nature-based stormwater treatment and a green corridor experience, contributing to biodiversity, enhancing natural character and pedestrian comfort within the Canal Reserve.
Crime Prevention Through Environmental Design	Steps provided to connect footpath on Sussex Street extension with Pukeahu to promote pedestrian movement and natural surveillance along the new street edge and avoid the potential for an entrapment space that is poorly overlooked and encourages anti-social activity.

Basin Reserve / Hauwai

Principle	Description
Designing for context	Street changes around the Basin Reserve / Hauwai enabled by re-routing of SH1 lanes have allowed prioritisation of access for schools and enhanced main entrance to Government House, and enhanced cycle and pedestrian routes that link to Adelaide Road, Pukeahu, Cambridge Terrace and Mt Victoria. Green link to mitigate new road infrastructure and strengthen and enhance connections and spatial composition between Pukeahu, Basin Reserve and Cambridge Terrace.
Integrating transport and land use	Provides a reduced traffic environment adjacent to St Marks School, a widened plaza for events to the Basin.
Contributing to good urban form	Impacts on urban form have been managed with urban redevelopment enabled on residual land wherever possible, and spatial definition and streetscape composition improved through the spatial arrangement and design of new and reconfigured public spaces and landscape treatments around the edge of the Basin Reserve / Hauwai. Maintains visual linkages between Basin Reserve and Canal Reserve and strengthens the axis of public realm running along the Canal Reserve and Pukeahu War Memorial Park that converge at the Basin Reserve.
Supporting community cohesion	Reduces and manages existing severance issues around the Basin Reserve created by traffic-dominated space with streetscape changes that support enhanced everyday movement between key community destinations (schools, parks, the cricket ground, city centre routes) compared to the existing environment. The green link avoids the potential for major severance by the Sussex Street extension road and seamlessly bridges the road infrastructure to create an enlarged and enhanced connective new open space amenity through to the Basin Reserve / Hauwai and Cambridge Terrace that seamlessly joins with Pukeahu. The green link continues to accommodate the Creche that supports a community facility for Pukeahu.
Maintaining local connectivity	Strengthens walking and cycling continuity around the Basin / Hauwai perimeter and improves the ability to move between Te Aro, Pukeahu, Mount Victoria and Newtown.

Principle	Description
	Maintains and enhances local links between Pukeahu, Cambridge Terrace and the Basin Reserve through improved crossings, routes and public space interfaces.
Uphold Mana Whenua values	Opportunity for mahi toi to concrete panels on land bridge as well as integration into design elements such as railings and other built elements, to be worked through with Mana Whenua at next stages of design. Native planting to Canal Reserve chosen to acknowledge and recognise the Waitangi Awa, Pukeahu, Ngā Tapuae o Kāhui Maunga, Hauwai Mahinga Kai, Akatarewa Pā and associated pūrākau of the area as part of cultural landscape expression as identified by Mana Whenua.
Respecting cultural and heritage values	Creche shall be relocated as illustrated on drawing SH1WI-DES-00-GEN-DRG-00121, or to an alternative location within Pukeahu National War Memorial Park as agreed with the Mana Whenua Steering Group, Ministry for Culture and Heritage, and Heritage New Zealand Pouhere Taonga.
Crime Prevention Through Environmental Design	Landscape treatment of residual land on Sussex Street to clearly demarcate street boundary, maintain sightlines and promote natural surveillance of street environment.

Paterson Street

Principle	Description
Designing for context	Paterson St demarcates the southern boundary of the Mt Victoria suburban typology, and with 3 schools and their open space playing fields and courts on the southern side of the SH1 corridor. The eastern context is dominated by the slopes of Mt Victoria and the tunnel portals, and the west borders the Basin Reserve. The Project responds to a steep, constrained edge condition at the interface between SH1, the Mount Victoria neighbourhood and the Town Belt backdrop, using strong retaining elements and a compact corridor footprint that closely integrates the duplicate tunnel with the form and character of the long-established existing tunnel. Reinstated Paterson Street with built form reinstatement maintains integrity of urban form.
Contributing to good urban form	The alignment and width of the new Paterson St reinforce Mount Victoria's historic street grid, which in combination with the enablement of built-form reinstatement on residual land supports a coherent spatial composition with reinstated street and block pattern and continuity of built form.
Maintaining local connectivity	Reinstated Paterson Street continues to provide for local connectivity along this southern edge of the Mt Victoria neighbourhood and avoids the potential for the duplicate tunnel to result in severance.
Respecting cultural and heritage values	Relocation of heritage buildings to front the reinstated Paterson Street.

Mt Victoria West Portal

Principle	Description
Designing for context	Demonstrates a compact portal and retaining solution that fits steep topography and a tightly constrained urban edge beside established neighbourhood fabric. Tunnel control building and associated ancillary infrastructure located and integrated above tunnel portal separated from residential properties.
Contributing to good urban form	Aligns infrastructure with the Mount Victoria grid and places new tunnel portal and approach lanes within the widened trench that relates closely to the existing tunnel and minimises intrusion into the Mt Victoria neighbourhood above.
Maintaining local connectivity	Enhanced walking and cycling path through new tunnel linking Hataitai to central city.
Uphold Mana Whenua values	Opportunities for mahi toi or other forms of cultural expression along retaining walls, portals, and on tunnel control buildings, and other built elements on North side of tunnel arrival, to be worked through with Mana Whenua. The acknowledgement and recognition of Akatarewa Pā, Te Ranga a Hiwi and associated pūrākau of the area is important and expressed through further development with Mana Whenua.
Creating positive road user experience	Opportunities for mahi toi and cultural integration on retaining walls and portals recognising these are important central city gateways.
Achieving a low maintenance design	Simple, robust structural forms and consolidated planted areas reduce future maintenance complexity at a high-stress corridor edge. Planting will have appropriate buffers to highway and structures for safe maintenance.

Mt Victoria East Portal and Taurima Street

Principle	Description
Designing for context	Design has sought to minimise extent of hard retaining walls and permanent cut slopes and reinstate revegetated cut slopes above and alongside new tunnel portal to assist with landscape integration into Town Belt. Near vertical retaining wall to northern edge of new tunnel portal to provide a high-quality edge to active mode path linking new tunnel connection with Taurima Street route to Hataitai local centre. Tunnel control building is to be co-located with replacement toilet block on flat street edge where it avoids additional impacts on Town Belt land.
Integrating transport modes and land use	Changes to traffic access on Taurima Street have enabled streetscape improvements that increase place quality and local connectivity and access at this gateway entry to the Hataitai local centre.
Maintaining local connectivity	Maintains an active mode bridge link to Hataitai Park from Taurima Street. Continues to provide public toilets on Taurima Street in proximity to tunnel link, Town Belt access and Hataitai local centre. Supports safe, comfortable walking and cycling links between the tunnel, Ruahine Street and the Hataitai local centre, whilst accommodating the increase in level of service. Reinforces Taurima Street as the key connection between the tunnel and the local centre for active mode users, with enhanced pathways and zebra crossing connections to reduce severance and increase comfort on this route to/from the local centre for people walking and cycling. Inclusion of public toilets proposed adjacent to new tunnel control building. Reinstatement of existing track network connecting the Town Belt with Hataitai village.
Uphold Mana Whenua values	Opportunities for mahi toi and cultural expression / integration on retaining walls and portals recognising these are important central city gateways. The acknowledgement and recognition of Akatarewa Pā, Te Ranga a Hiwi and associated pūrākau of the area is important and expressed through further development with Mana Whenua.

Principle	Description
Integrating green infrastructure	Integrates planting and landscape buffers that help visually connect built corridor elements with the vegetated Town Belt setting. Ecological habitat for native species to be protected and where there is opportunity, restore and allow for proposed new ecological habitat to be integrated into the design.
Creating positive road user experience	Opportunities for mahi toi and cultural integration on retaining walls and portals recognising these are important central city gateways.
Achieving a low maintenance design	Uses straightforward, robust corridor elements (walls, paths, planting zones) appropriate for long-term maintenance on a heavily used gateway route. Planting will have appropriate buffers to highway and structures for safe maintenance.

Hataitai Connection Bridge

Principle	Description
Designing for context	Integrates planting around ramps/abutments and within corridor margins to soften and visually integrate structures and access roads into the predominantly vegetated landscape character of the Town Belt.
Contributing to good urban form	Hataitai Connections Bridge ties in with the urban grid of Hataitai, connecting to Moxham Avenue.
Supporting community cohesion	Improves everyday access to recreation facilities and Town Belt recreation space without severance by the highway corridor.
Uphold Mana Whenua values	Native planting, chosen to acknowledge the site's pre-colonial history. The acknowledgement and recognition of Te Ranga a Hiwi and associated pūrākau of the area is important and expressed through further development with Mana Whenua.
Integrating green infrastructure	Increase in the vegetated area in this part of Town Belt using majority native plants on cut slopes atop of walls/portals supports long-term landscape and visual integration of tunnel structures and cut slopes within the Town Belt. Ecological habitat for native species to be protected and where there is opportunity, restore and allow for proposed new ecological habitat to be integrated into the design.
Achieving a low maintenance design	Durable bridge forms, straightforward ramp geometry and consolidated planting zones support safe, maintainable long-term operation. Planting will have appropriate buffers to highway and structures for safe maintenance.

Wellington Road

Principle	Description
Designing for context	Creation of a new broad green corridor treatment to southern edge of widened highway along Wellington Road that physically and visually integrates and supports a stronger green connection between the Town Belt, Kilbirnie Park and the coastal foreshore.
Integrating transport and land use	Separates out local access from through traffic with a separated local access lane, including landscape buffer planting where space allows, to the northern side of Wellington Road that enhances residential amenity for adjoining properties that are currently accessed directly off the highway.
Maintaining local connectivity	Maintains and in some places enhances footpath connections along and across both sides of Wellington Road.
Uphold Mana Whenua values	Native planting, chosen to acknowledge the site's pre-colonial history. The acknowledgement and recognition of Te Ranga a Hiwi, Akau Tangi Pā and associated pūrākau of the area is important and expressed through further development with Mana Whenua.
Integrating green infrastructure	Ecological habitat for native species to be protected and where there is opportunity, restore and allow for proposed new ecological habitat to be integrated into the design.
Creating positive road user experience	New green corridor to south of highway forms a memorable green visual link with Town Belt backdrop view heading west from Kilbirnie.

Kilbirnie Park

Principle	Description
Designing for context	Corridor widening has been kept to a minimum to reduce impacts on Kilbirnie Park, including near vertical retaining edge condition to reduce impacts on playing fields. Visually permeable balustrade to highway footpath edge to maintain existing visual permeability and interaction between park and highway users.
Supporting community cohesion	Maintains the usability and accessibility of a key neighbourhood recreation asset.
Maintaining local connectivity	Helps maintain and improve local links between Kilbirnie/Rongotai destinations, the park, and the corridor connections back to the Town Belt and eastern suburbs routes.

TECHNICAL REPORT 4 - ANNEXURE B – Stormwater Treatment Philosophy

Design Philosophy

The Project stormwater philosophy is to capture, convey, treat and discharge runoff from the state highway and impacted local roads and convey existing overland flow across the alignment without increasing existing flood risk. This is achieved by adopting the Best Practicable Option (BPO) for both quantity and quality and thereby minimising effects on the receiving environment. This will focus on a consent driven design strategy to meet regulatory requirements while incorporating cost effective solutions that reduce operation and maintenance costs.

Low impact design approaches using green infrastructure treatment are preferred where practical and appropriate. This helps mimic natural hydrological processes by promoting infiltration, and filtration, thereby improving water quality before runoff enters receiving environments. However, as the proposed road alignment is constrained in an urban environment with narrow designation, utilities, adjoining road and intersections, low impact design in some areas cannot be fully accommodated. Where low impact design is not practical, flow will be collected via catchpits into a piped network.

Site Description

The stormwater treatment strategy has been developed for the Project areas listed below. Each area presents distinct constraints, catchment characteristics, and opportunities, which have influenced the selection and configuration of stormwater treatment solutions. These areas are:

1. **Terrace Tunnel**. This area is characterised by a highly constrained corridor, with limited available space due to the existing tunnel infrastructure, adjacent carriageways, and surrounding urban development. Runoff in this area is predominantly derived from impervious road surfaces with relatively high traffic volumes. Given these constraints, the stormwater strategy primarily relies on conventional piped collection systems with treatment provided via a proposed proprietary device and pre-treatment measures e.g catchpit filters retrofitted to proposed and existing. The use of green infrastructure is limited; however, where feasible, opportunities for incorporating treatment elements have been considered.

    a. **Te Aro.** The Te Aro section passes through a dense urban environment with interfaces between the state highway, local roads, and surrounding commercial and residential areas. Limited corridor width, numerous underground services, and traffic management constraints significantly influence stormwater design. In this area, stormwater is primarily collected through catchpits and piped networks, with treatment provided through the installation of catchpit filters.

    b. **Basin Reserve and Mount Victoria Tunnel.** The Basin Reserve area provides comparatively greater opportunities for integrating green infrastructure and treatment systems, particularly within landscaped and open space areas. This allows for the incorporation of bioretention systems (rain gardens) as part of the stormwater treatment train. Runoff from surrounding roads is directed to these treatment systems, which are designed to provide attenuation, filtration, and improved water quality outcomes.

2. **Hataitai (Eastern Connections).** The Hataitai area is characterised by a mix of residential and transport infrastructure. The constraints differ from the central urban sections but need to consider steep adjacent topography, minimising impact on the Town Belt and existing flooding. Catchments include both road runoff and local drainage inputs, with varying degrees of imperviousness. Stormwater management in this area adopts conventional piped systems and proprietary devices.

The design seeks to optimise the use of available space to deliver effective stormwater treatment while maintaining network performance and minimising impacts on surrounding properties.

Design Standards

The design of stormwater treatment systems has been undertaken with reference to the following key design standards and guidance documents:

a. Standard Specification P46 State Highway Stormwater (NZTA, 2025).

b. Water Sensitive Design for Stormwater Treatment Device Design Guideline (2019).

c. Stormwater Treatment Standard for State Highway Infrastructure (NZTA, 2010).

d. Relevant industry guidance for proprietary device selection.

Design Approach and Methodology

The stormwater treatment design has been based on a combination of hydrological, hydraulic, and water quality assessments as summarised in the following sections.

Catchment and Hydrological Assessment

Contributing catchments were delineated using the proposed roading layout with existing topography and hydraulic constraints. The following key steps were undertaken:

a. Impervious and pervious surface areas were quantified to characterise runoff generation.

b. Rainfall inputs were derived using regionally adopted rainfall data, with runoff volumes and peak flows estimated using standard hydrological methods and the Wellington Water Stormwater model.

c. Catchment characteristics, including slope, flow paths, and connectivity to the drainage network, were considered to inform downstream treatment requirements.

Treatment Device Sizing and Selection

The selection and sizing of stormwater treatment devices have been undertaken in accordance with relevant design standards and recognised good practice. In particular, the design has considered the characteristics of the contributing catchment, including the extent of impervious surfaces, expected contaminant load, catchment size, and existing drainage network. These factors influence both the type of treatment device selected and the treatment volume required to achieve the desired water quality outcomes.

The treatment systems have been configured with the objective of addressing contaminant removal, recognising that performance is influenced by device configuration, hydraulic loading, maintenance regimes, and catchment characteristics. The design performance objectives for contaminant removal focuses on Total Suspended Solids (TSS), Copper (Cu), and Zinc (Zn). The design is based on treatment of the water quality design storm (typically the 90th percentile rainfall event). The actual outcomes may vary depending on detailed design, construction, and operational conditions.

For bioretention systems, sizing is based on a surface area equivalent to approximately 2% of the contributing impervious catchment area, with the design refined based on treatment volume, media properties, hydraulic performance, and site-specific constraints.

For proprietary devices, sizing and configuration were sized and selected based on a combination of hydraulic, water quality, and manufacturer certified performance criteria.

Treatment device performance is dependent on appropriate maintenance, with responsibilities for asset ownership and ongoing operation to be confirmed with the relevant asset owners. Maintenance activities are expected to be undertaken at a frequency in accordance with manufacturer recommendations, asset owner requirements, and site-specific conditions, noting that effective operation is critical to achieving the intended

level of treatment. Maintenance requirements for these devices are to be developed as part of the detailed design phase, with future operational and maintenance manuals prepared for asset handover.

Treatment Train Configuration

Treatment systems have generally been configured to improve performance, typically comprising:

a. Gross pollutant removal through devices such as catchpit filters aimed at capturing litter, debris, coarse sediment and reducing loading on downstream devices.

b. Primary treatment through bioretention devices (raingardens) and proprietary systems (e.g. VortCapture™ and StormFilter™), designed to remove fine sediments and contaminants.

Conclusion

The stormwater treatment philosophy and strategy developed for the Project adopts a balanced and pragmatic approach to managing stormwater across a highly constrained urban environment. The design is aligned with the principles of Best Practicable Option (BPO). The treatment systems have been configured as part of a treatment train approach, incorporating gross pollutant removal and primary treatment to address key contaminants associated with road runoff. Device selection and sizing have been based on catchment characteristics, and recognised design standards. It is acknowledged that the current design is at a concept stage, and further refinement will be undertaken during detailed design. This will include confirmation of hydraulic performance, optimisation of device sizing and configuration, and the development of operation and maintenance requirements in consultation with asset owners.