9. Investigation Process

Overview

There has been an extensive investigation process associated with the Waterview Connection Project which has spanned over a decade (in the case of the SH20 components and been undertaken since 2007 for the SH16 components). This Chapter of the AEE provides a brief overview of the investigation process to provide background for the remaining Chapters, which detail the outcomes or findings from this investigation.

9.1 Investigation Process

The NZTA has long recognised the importance of an integrated approach between land use and transport network planning, and consideration of the environmental effects of land transport proposals. As a result, the NZTA has developed procedures relating to developing and funding State highway Projects and the environmental assessments that go alongside these. In particular, guidance on this process is provided in the NZTA policy manual. The manual clearly sets out the specific considerations that the NZTA gives to the development of State highway Projects and their development phases.

In line with the NZTA's planning processes, the investigation process for the Waterview Connection Project has been undertaken over four key phases:

1. Scoping and Corridor Assessments – this includes the NZTA's scoping and feasibility phase;
2. Route Option Investigation – this is included in the NZTA's investigation and reporting phase;
3. Alignment and Construction Investigation – this is included in the NZTA's investigation and reporting phase; and
4. Assessment of the preferred option (the subject of this AEE and the supporting environmental assessment reports) – this is included in the NZTA's investigation and reporting phase and their design phase for Project development.

This Chapter of the AEE provides an outline of the investigation process with respect to these key phases. This is outlined in Figure 9.1 below.

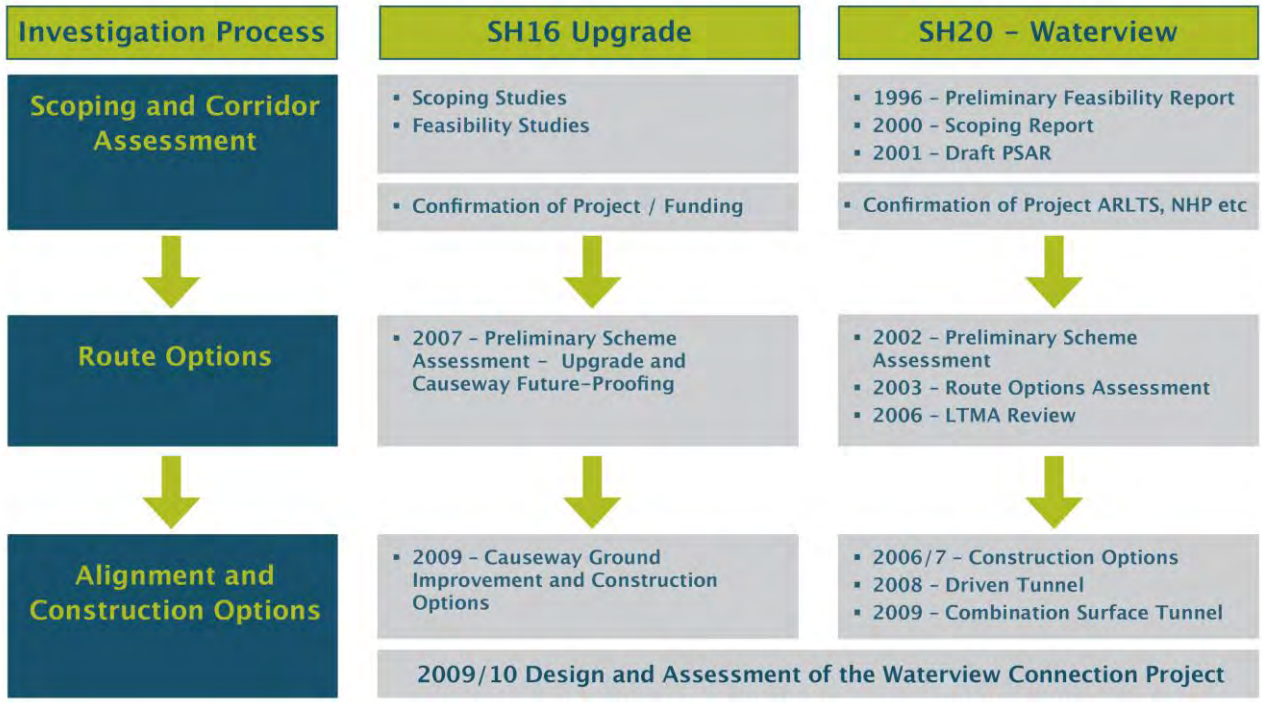


Figure 9.1 – Investigation Process Summary

9.1.1 Project History

In 2009, two projects were brought together as the 'Waterview Connection Project'. Prior to 2009, investigations have been undertaken on two separate projects, being:

The Waterview Connection Project includes the SH20– Waterview Connection and SH16 Causeway Projects

- The SH20 Waterview Connection – this project comprised a new State highway link between SH20 and SH16 and capacity improvements on SH16 between the Great North Road and the St Lukes Interchanges, with connection to SH16 at the Great North Road Interchange and completion of 'north facing' ramps at the Maioro Street Interchange; and
- The SH16 Upgrade Project – this project comprised capacity enhancements and raising of the SH16 causeway to improve the resilience of the State highway network, as well as improvements to the Te Atatu Interchange.

Given this history, the following description of the first three phases of the investigation process for the Waterview Connection Project, include (in turn) a description of each previously separate Project.

9.1.2 Scoping and Corridor Assessments

Scoping & Corridor Assessments confirmed the need for the Project and set funding

The initial stages for investigation were to consider the feasibility and estimated costs of the proposed Project, including scoping of alternatives and concept designs for the main route options. This phase of assessment included scoping of the social and environmental issues for the Project. The outcome of this phase was to confirm the Project, identify key route options for consideration and highlight the specific investigation requirements to progress development of the Projects.

On the SH16 Upgrade Project, this work commenced with the *Preliminary Scheme Assessment,* 2007 and for the SH20 Waterview Project, the work commenced with the *Project Feasibility Report*, 1999 and the *Project Scoping Report*, 2000/2001.

Further specific detail on the consultation and assessment of alternatives undertaken in this phase of the investigation is provided in Chapters 10 and 11 of this AEE.

9.1.3 Route Option Development

Route Option assessment including consultation and assessment of environmental effects

The purpose of this phase of the investigations was to undertake more detailed investigation of route options (including preliminary design) to assess and confirm the preferred route option. Investigation over this period included engineering, economic, planning, environmental and social assessments. These investigations included consultation with stakeholders and the community (see Chapter 10).

For the SH16 Upgrade Project, this work commenced with the *Preliminary Scheme Assessment* in 2007 and various alternatives investigated in the *Managed Priority Lanes Option Assessment* in 2008. The preferred design was finalised in 2009.

For the SH20 Waterview Project, the work commenced with the *Preliminary Scheme Assessment* finalised in 2002 and culminated in the finalised *Route Options Assessment Report*, which was released in 2006 and confirmed the preferred route for the SH20 connection from SH20 Mt Roskill through to the SH16, at the Great North Road Interchange (Waterview).

Further specific detail on the consultation and assessment of alternatives undertaken in this phase of the investigation is provided in Chapters 10 and 11 of this AEE.

9.1.4 Alignment and Construction

Detailed assessment has been undertaken on the preferred route alignment and construction

The purpose of this phase of the investigations was to undertake specific detailed investigation of the alignment and construction options for the preferred routes. The intention of this work was to assess and confirm alignment and construction alternatives for the preferred route option. Investigation over this period included detailed engineering (e.g. geotechnical and hydro geological investigations), transportation and economic assessment, environmental and social assessments and planning. Included in this phase was revision to

the Benefit Cost Ratios and cost assessments for the Project. These investigations included significant consultation with stakeholders and the community (see Chapter 10).

Over this period, the design and investigation included development and assessment of a number of alignment options and construction alternatives (for both the SH16 Upgrade and the SH20 Waterview Project). These options have been subject to detailed assessment, the key elements of which are summarised in Chapter 11.

For the SH16 Upgrade Project, the development of alignment and construction options has particularly included consideration of alternative construction methods (e.g. bridging or reclamation) in the coastal marine area, designs and alternatives for bridges and lane configurations and stormwater management.

For the SH20 Waterview Project, key investigations have focussed on alignment design (including capacity considerations) and construction methods (e.g. the extent and methods of tunnelling). In 2009, the NZTA confirmed the preferred construction option for the Waterview Connection Project.

9.1.5 Assessment of the Preferred Option

Since 2009, detailed investigations, including engineering design and social and environmental assessments have been undertaken on both aspects of the now – combined Waterview Connection Project. This phase has also included significant assessment of design options which are summarised in Chapter 11 of this AEE.

As design has progressed, investigation work in this phase has included design of sufficient detail for preparation of management plans, landscape plans and other design sufficient to support the resource consents for both construction and operation of the Project.

9.2 Investigation Process Conclusions

Given the long history of the Project, there have been a number of phases in the investigation process. Of particular relevance to this AEE, these investigation phases have included design, social and environmental assessments (including assessment of transportation effects), and consultation / stakeholder engagement. The outcomes of these investigation processes are set out in the following Chapters of this AEE.

10. Consultation

Overview

Extensive consultation has been undertaken with the community and stakeholders for the SH16 section of the Project (from 2007), the SH20 section of the Project (from 2000), and the combined SH16-20 Project (from 2010). This Chapter of the AEE will outline the following:

1. Consultation objectives;
2. Consultation drivers;
3. Parties consulted with;
4. Consultation phases and reporting;
5. Stakeholder and community feedback; and
6. How feedback has been considered/responded to by the NZTA.

Consultation reporting has been undertaken at key stages of the Project. Therefore, this Chapter is intended to provide an overview of consultation undertaken and feedback received, but not to repeat the detail of reporting already undertaken. Consultation will be ongoing throughout the life of the Project.

10.1 Consultation Objectives

Consultation objectives were set for the separate SH16 and SH20 Projects

Consultation objectives set for the SH20 Project (in 2000) were:

- To keep the community informed;
- To identify and take into account community views, opinions, issues and concerns;
- To provide opportunity for the affected community to give feedback and for the NZTA to respond to those issues and concerns;
- To recognise community knowledge and resources in the identification of matters to consider in options development;
- To meet the requirements of consultation under the Resource Management Act 1991 (RMA) and Land Transport Management Act 2003 (LTMA); and
- To achieve better outcomes for the Project.

Consultation objectives set for the SH16 Project (in 2007) were:

- To inform and/or consult affected persons and stakeholders (to the NZTA's requirements) who are affected by, or have an interest in, the Project;
- To ensure that all factors affecting the Project are considered and documented;

- To ensure that any options developed endeavour to meet stakeholder expectations by recording the way that issues raised are addressed;
- To ensure that Project constraints and impacts (engineering and environment) are conveyed to stakeholders during the design and investigation phase;
- To meet the NZTA's obligations under the RMA and the LTMA; and
- To consult with relevant iwi in accordance with the relevant NZTA Memoranda of Understanding.

10.2 Consultation Drivers

10.2.1 Resource Management Act 1991 (RMA)

The RMA, LTMA and NZTA Public Engagement Policy were important consultation drivers

Consultation objectives were developed to assist the investigation and reporting phases of the Project relating to the new designations, alterations to designations, and resource consents sought for the Project. In terms of the RMA, the following have been important drivers for the Project:

- Taking into account the views of 'affected communities';
- Avoiding adverse effects on the environment; and
- Ensuring that adequate consideration has been given to alternative sites, routes, and methods of undertaking the proposed works, in recognition that aspects of the work may have significant environmental impacts.

10.2.2 Land Transport Management Act 2003 (LTMA)

Following the enactment of the LTMA in 2003, the NZTA undertook comprehensive consultation with other land transport providers and land use managers in the Project area. This consultation has been particularly focused on developing options for the package of 'land transport' measures that will contribute to sustainably developing and managing land transport in the Project corridor.

Section 96(1) of the LTMA requires the NZTA to exhibit a sense of 'social and environmental responsibility' in meeting its objectives and undertaking its functions. This is further detailed to include avoiding, to the extent reasonable in the circumstances, adverse effects on the environment.

These principles are considered to be consistent with the consultation objectives that were set for the individual Projects at the outset.

10.2.3 NZTA Public Engagement Policy 2008

The NZTA Public Engagement Policy identifies four key commitments to public engagement, consistent with SH16 and SH20 consultation objectives:

- Providing genuine opportunities for public contributions;
- Ensuring people are informed;
- Adopting an inclusive and representative approach to public engagement; and
- Maintaining high professional public engagement standards.

10.3 Consultation Work Streams

Consultation for the Project was undertaken in each of the three phases of investigation, as shown in Figure 10.1. These phases correlate to the Project investigation process discussed in Chapter 9 of this AEE.

10.4 Parties Consulted With

10.4.1 Stakeholders

Recognising the diverse range of spatial interest in the Project, consultation has aimed to engage with stakeholders covering local, regional and national interests (see Figure 10.2). Table 10.1 provides a summary of the stakeholders engaged on the Project. Later in this Chapter, Table 10.2 provides an overview of the methods used to consult with stakeholders.

A broad range of stakeholders were consulted with

Consultation was undertaken in each phase of the investigation process

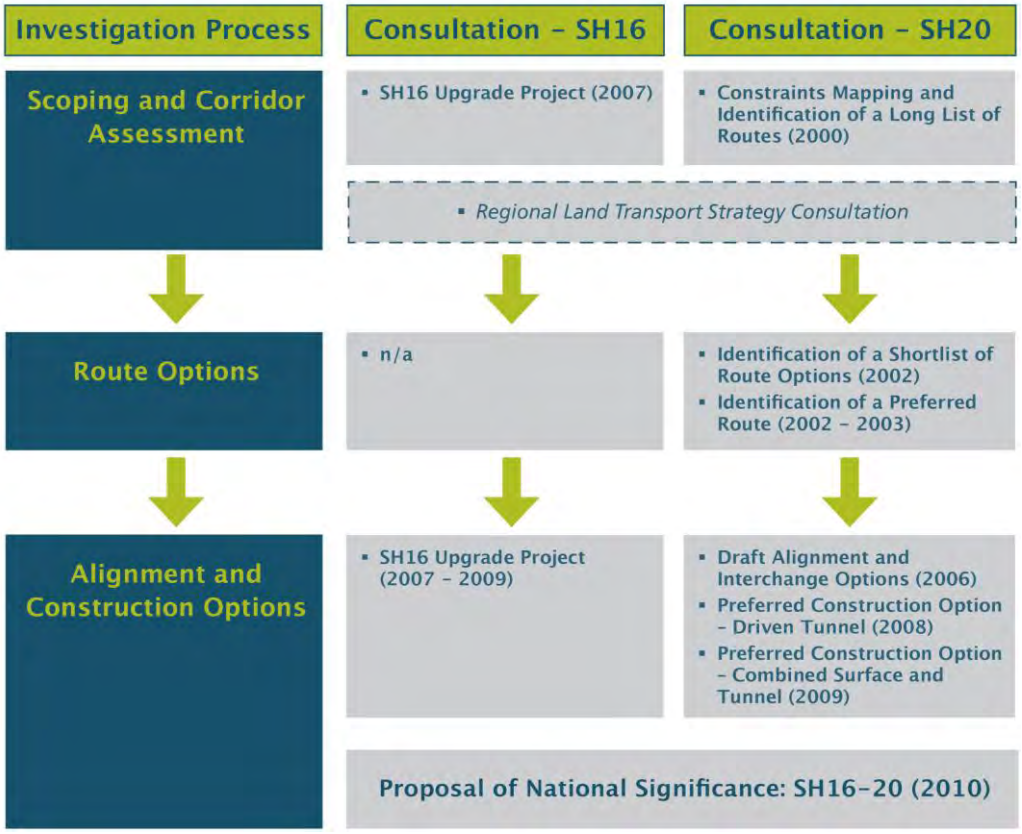


Figure 10.1: Project Investigation Process and Consultation Undertaken

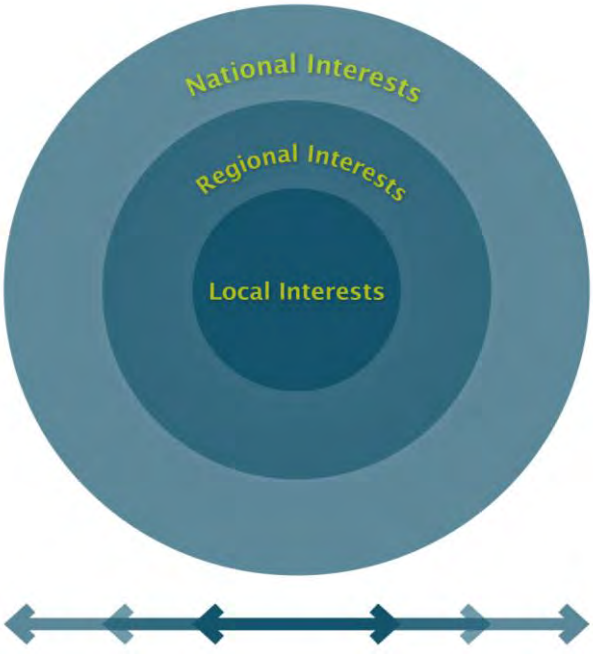


Figure 10.2: Project Consultation Spectrum

Table 10.1: Stakeholders Consulted With

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Auckland Regional Council	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
Auckland City Council	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Waitakere City Council	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Manukau City Council		✓		✓		✓					✓	✓	
North Shore City Council		✓		✓		✓					✓		✓
Rodney District Council		✓		✓		✓							✓
Auckland Regional Transport Authority[1]	✓	✓				✓					✓	✓	✓
Housing New Zealand	✓				✓				✓	✓	✓	✓	✓
Unitec	✓				✓	✓			✓	✓	✓	✓	✓
New Zealand Railways Corporation[2]	✓					✓			✓		✓	✓	✓
NZ Historic Places Trust	✓							✓				✓	✓
Ministry of Education	✓				✓				✓	✓	✓	✓	✓
Ministry of Health		✓								✓	✓	✓	✓
Waitemata District Health Board[3]	✓									✓	✓	✓	✓

1 Previous consultation was undertaken with Infrastructure Auckland.

2 Previous consultation was undertaken with ONTRACK and Rail Corp.

3 Including A+ Rehab Plus and the Mason Clinic.

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Auckland District Health Board	✓	✓								✓			✓
Department of Conservation/Auckland Conservation Board	✓		✓					✓			✓	✓	✓
Royal Forest & Bird Protection Society	✓							✓			✓	✓	✓
Ngati Whatua o Orakei Trust Board	✓	✓			✓			✓		✓	✓	✓	✓
Ngati Paoa Trust Board		✓						✓		✓	✓	✓	✓
Te Kawerau-a-Maki Trust	✓							✓		✓	✓	✓	✓
Hauraki Maori Trust Board		✓						✓		✓		✓	✓
Ngai Tai ki Tamaki Tribal Trust		✓						✓		✓	✓	✓	✓
Waipareira Trust		✓			✓					✓	✓	✓	✓
Te Atatu Marae Committee	✓								✓	✓			✓
Utility Providers[4]	✓	✓	✓				✓	✓	✓		✓	✓	✓
Waterview Primary School	✓				✓			✓	✓		✓	✓	✓
Waterview Kindergarten/ Auckland Kindergarten Association	✓				✓			✓	✓			✓	✓
Owairaka District School	✓				✓			✓			✓	✓	✓
St Francis School	✓				✓			✓			✓	✓	✓
Christ the King School	✓				✓			✓	✓		✓	✓	✓

[4] Telecom, TelstraClear, Contact Energy, Mercury Energy, Vector, Transpower, Watercare, Metrowater, Ecowater, Vodafone, Radio NZ and Natural Gas Corporation.

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Samoan Assembly of God	✓				✓				✓		✓	✓	✓
Akarana Dog Training Club	✓				✓				✓		✓	✓	✓
Rutherford College	✓				✓			✓					✓
Te Puna Reo O Manawanui	✓				✓								✓
Mt Albert Grammar School	✓				✓							✓	✓
Avondale College/ Intermediate School	✓				✓						✓	✓	✓
Mt Albert Kindergarten	✓				✓				✓				✓
Te Atatu Rugby League Club	✓				✓				✓				✓
Te Atatu Pony Club	✓				✓			✓					✓
Rosebank Kartsport Club / Speedway Riders Club	✓				✓								✓
Te Atatu Boating Club	✓				✓			✓					✓
Pt Chevalier RSA Bowls Club	✓				✓				✓		✓	✓	✓
Metro Sports Club	✓				✓						✓	✓	✓
Avondale Motor Park	✓							✓	✓			✓	✓
Nga Manaia O Whau	✓							✓			✓	✓	
Avondale Business Association	✓				✓		✓	✓			✓	✓	✓
Rosebank Business Association	✓						✓				✓	✓	✓
North Western Community Association	✓				✓			✓			✓	✓	✓
Auckland Indian Association	✓	✓			✓						✓	✓	

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Chinese Friendship Society	✓	✓			✓						✓	✓	
Springleigh Residents Association	✓				✓			✓			✓	✓	✓
Tai Tangaroa	✓				✓						✓	✓	
Waterview Environmental Society	✓							✓			✓	✓	✓
Waitemata Harbour and Hauraki Gulf Protection Society	✓	✓						✓			✓	✓	
Friends of the Whau	✓							✓			✓	✓	✓
Living Communities	✓				✓			✓			✓	✓	✓
Greenbelt Inc	✓	✓						✓			✓	✓	
Tunnel or Nothing Group[5]	✓				✓			✓					✓
Friends of Oakley (Te Auaunga) Creek	✓							✓			✓	✓	✓
Pollen Island Care Group	✓							✓					✓
National Trading Company of New Zealand/Pak'n Save	✓						✓		✓		✓	✓	✓
Auckland Business Forum		✓					✓					✓	✓
Employers and Manufacturers Association		✓					✓						✓
Auckland International Airport		✓				✓	✓					✓	✓
Land Transport New Zealand[6] (LTNZ)		✓	✓			✓					✓	✓	

[5] Which was formed following the route alignment phase.

[6] Prior to the amalgamation of LTNZ into the NZTA. Previous consultation was undertaken with Transfund.

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Cycle Representatives[7]	✓	✓				✓					✓	✓	✓
Transport Operators/Representatives[8]	✓	✓	✓			✓					✓	✓	✓
Transport Interest Groups[9]		✓				✓							✓
Auckland City Residents and Ratepayers Association	✓				✓								✓
Point Chevalier Community Committee	✓				✓			✓					✓
Te Atatu Residents and Ratepayers	✓				✓			✓					✓
Avondale Residents and Ratepayers Association	✓				✓			✓			✓	✓	✓
Mt Albert Residents Association	✓				✓								✓
ACC Community Boards[10]	✓				✓			✓			✓	✓	✓
WCC Community Boards[11]	✓				✓			✓					✓
Political Representatives – Central[12]			✓		✓	✓	✓	✓			✓	✓	✓

7 Including Cycle Action Auckland, Bike NZ, the Auckland Cycle and Touring Association, the Auckland City Triathlon Club and the Auckland Mountain Bike Club.

8 Including the NZ Automobile Association, bus companies (including Stagecoach, InterCity Coachlines, the Bus and Coach Association), taxi companies/representatives, courier companies and truck companies/heavy haulage representatives (including the Heavy Haulage Association) and the National Road Carriers Association.

9 Including the Road Transport Forum, Highway Action Trust, Campaign for Better Transport and Centre for Transport Studies.

10 Including the Eden-Albert, Western Bays and Avondale Community Boards.

11 Including the Henderson and Massey Community Boards.

Stakeholder	Scope			Primary Interest(s)							Phase		
	Local	Regional	National	Territorial Authority	Community	Transport	Business/Economics	Environmental	Potential Propert y Owner	Other	Scope	Route/Alignment	Construction
Political Representatives – Local[13]	✓	✓			✓	✓	✓	✓			✓	✓	✓
Waitangi National Trust Board			✓							✓		✓	
Accident Compensation Corporation			✓							✓		✓	
Emergency Service Providers[14]	✓		✓							✓		✓	✓

12 Including the Prime Minister, Minister of Transport, Minister for the Environment, Minister of Conservation, Minister for Education, Minister for Housing, MP for Auckland, Mt Roskill MP and Mt Albert MP.

13 Including the Auckland City Mayor/Councillors and Waitakere City Mayor/Councillors.

14 Including the NZ Fire Service (Auckland District), St John Ambulance and NZ Police (Auckland District).

10.4.2 General Public

Given the significant public interest in the Project, consultation has been undertaken with members of the public on a local, district and regional level.

10.4.2.1 Delivery Mechanisms for Public Consultation Material

Consultation was publicised to members of the public on a local, district and regional level

Distribution to the Project Study Area

At the outset of each individual Project, a local study area was set for the purpose of consultation with property owners/occupiers within a geographic area of interest (see Figure 10.3). The SH20 study area was significantly broader than that set for SH16, recognising the scale of investigation associated with each Project (e.g. route option evaluation for SH20). The SH16 study area focused on directly affected property owners/occupiers as well as those located adjacent to the existing motorway where widening was proposed to take place.

Figure 10.3: Project Study Area

Distribution of Consultation Material to General Public

Local and regional information releases for the Project

In recognition of the wide public interest in the respective Projects (appealing to both local and regional audiences), media releases and consultation material were released to the general public via community and regional newspapers, including the following:

- Avondale Spider Web (local distribution – Avondale and surrounds);
- Auckland City Harbour News (distribution in Auckland City);
- Cityscene (distribution in Auckland City);
- Central Leader (distribution in Auckland City);
- Western Leader (distribution in Waitakere City);
- The Aucklander (regional distribution); and
- New Zealand Herald (regional distribution).

Posters and advertising materials were circulated to community notice boards within the Project area, at locations such as the following:

- Local schools (e.g. Waterview Primary School/Kindergarten);
- Avondale and Mt Albert Community Centres;
- Mt Albert, Avondale and Point Chevalier Libraries;
- Rosebank Business Association;
- Local petrol stations; and
- Local shops, including Mt Albert Pak'n Save, Waterview Superette and ethnic food stores.

Consultation Database

Consultation databases have been maintained for the SH16 and SH20 Projects

The Project Planning/Consultation team has maintained three consultation databases for the SH16 and SH20 Projects:

- Mail database (addresses of all residences within the identified study area and people who have registered with the Project team to receive Project updates by mail);
- Email database (people who have registered with the Project team to receive Project updates by email); and
- Stakeholder database (organisations and members of the community that have been identified by the Project team as having a particular interest in the Project).

These databases were developed at the outset of each Project and have been updated as necessary (e.g. obsolete addresses/emails removed in order to maintain the integrity of the database).

The SH16 and SH20 databases were combined upon joining the two Projects. At the time of preparing this AEE, there are around 5,700 addresses on the mail database, and the email database has grown to 1,200 addresses.

10.4.3 Affected Property Owners

Given the significant property acquisition required for the SH20 section of the Project, the process of property negotiations and purchase has been running alongside the planning process for the Project. This has involved working with individuals in the community to purchase properties on a 'willing seller, willing buyer' basis for potentially affected properties along the route during Project investigations. This proactive advance purchase strategy has also included working with Housing New Zealand to provide adequate lead times for their replacement of housing stock.

Targeted consultation has been undertaken with potentially affected property owners

10.5 Consultation Methods

A range of consultation methods was employed to share information and seek feedback from stakeholders and the wider community. This range was intended to recognise the diverse levels of Project interest and to maximise opportunities for interested parties to be involved in the consultation process. Table 10.2 provides an outline of the function, audience and stage(s) of use for each method.

A range of consultation methods were used reflecting the diverse levels of Project interest

Table 10.2: Consultation Methods

Method	Audience	Phase(s)	Purpose		Response to Feedback (If Applicable)
			Inform	Feedback	
Project Website The Project website has been used as the main source of web based information, providing: • Information on the Project including route maps and visualisations; • Current documents (e.g. presentations/information sheets, minutes from key meetings); • Copies of feedback forms (during those periods where feedback was being sought); • Frequently asked questions; and • Contact details for information about the Project.	 • Stakeholders • Public	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✗	• n/a[15]
Project Newsletter/Feedback Form Project newsletters were used to inform stakeholders, study area residents and members of the wider public about key Project updates. Two types of newsletters were used: • Newsletters to keep people informed; and • Newsletters with feedback form. Newsletters/feedback forms were available on the NZTA website, at open days, and were widely distributed among stakeholders, study area residents (between 10,000-18,000 newsletters were typically sent out in each round of consultation for SH20, and approximately 100 newsletters/letters for SH16), and people who had registered their details on the Project database(s). Newsletters/feedback were translated on request.	 • Stakeholders • Public	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✓	• Consultation report produced for each consultation phase using feedback form • Feedback provided to relevant Project technical assessments • Project database updated

[15] Responses received through the Project Website were responded to via email

Method	Audience	Phase(s)	Purpose		Response to Feedback (If Applicable)
			Inform	Feedback	
Media Releases and Advertisements Media releases have been used to inform the media of 'newsworthy' issues linked to key Project stages/decisions. Advertisements in local and ethnic media were used to inform people of key stages of the Project where input is sought, ways to become involved, and to advertise open/information days. Radio advertisements on community and mainstream stations were also used. Recognising the ethnic composition of the SH20 Project area, print advertising included Chinese language versions, and radio advertising was played on a local Indian radio station.	 • Stakeholders • Public	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✗	• n/a
Stakeholder/Affected Party Meetings and Workshops Briefings, meetings and workshops/working groups with key stakeholders and directly affected parties (e.g. adjacent property owners) have been held to advise of Project progress, discuss specific issues and seek feedback and ideas. Meetings were held either at the request of stakeholders, or at the request of the NZTA (in the case of directly affected parties or stakeholders with specific issues). Engagement with key stakeholders (of particular note, ARC, ACC and WCC) over design issues associated with the preferred alignment has been ongoing through the Alignment and Construction Options phase.	 • Stakeholders • Directly affected parties	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✓	• Minutes and actions recorded • Queries responded to • Feedback provided to relevant Project technical assessments • Project database updated

Method	Audience	Phase(s)	Purpose		Response to Feedback (If Applicable)
			Inform	Feedback	
Letters Letters have been used as a communication method with affected property owners and stakeholders, to advise on Project progress, upcoming consultation and how people may be affected by the Project. From 2006 – 2010, letters to affected residents were hand delivered by NZTA representatives via door knocking.	 • Stakeholders • Affected property owners	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✗	• Queries responded to
Open Days Open days were held to present information to the community (initially to outline the results of route assessment exercises, and then to present preferred construction option(s)), and to invite community feedback. Members of the Project team (including NZTA representatives and technical experts) were available to respond to questions and receive verbal feedback. Open/information days were advertised on the NZTA website, by email to the Project email database, paid advertising in print media (including local and ethnic papers), and media releases.	 • Stakeholders • Public	• Route Options • Alignment and Construction Options	✓	✓	• Queries responded to • Feedback and actions recorded • Feedback provided to relevant Project technical assessments • Project database updated
Drop In Centres Drop in centres were held in 2002 and 2006 to provide members of the community with an informal opportunity to meet and ask questions of representatives of the Project team. The information provided at drop in centres was the same as at open days.	 • Public	• Route Options • Alignment and Construction Options	✓	✓	• Queries responded to • Feedback / actions recorded • Feedback provided to relevant Project technical assessments • Project database updated

Method	Audience	Phase(s)	Purpose		Response to Feedback (If Applicable)
			Inform	Feedback	
Seminars/Workshops Seminars/workshops were held at key stages of the Project, to present the findings of technical assessments to the public and stakeholders.	 • Public • Stakeholders	• Alignment and Construction Options	✓	✓	• Queries responded to • Feedback provided to relevant Project technical assessments
Telephone and Email Contact Project team representatives were available to respond directly to telephone and email inquiries, and to receive verbal or email feedback. Contact details were advertised on the Project website, in newsletters and by paid advertising in print media.	 • Stakeholders (local, regional and national) • Public	• Scoping and Corridor Assessment • Route Options • Alignment and Construction Options	✓	✓	• Queries responded to • Feedback and actions recorded • Feedback provided to relevant Project technical assessments • Project database updated

Method	Audience	Phase(s)	Purpose		Response to Feedback (If Applicable)
			Inform	Feedback	
Focus Groups Focus groups were held at key stages of consultation to inform interested people on the Project on a comparatively detailed level (in contrast with other consultation mechanisms), and to provide people with the opportunity to participate in the development of various aspects of the Project (in particular possible mitigation measures). Topics included community sites/facilities, key linkages and values, air quality, noise, parks/reserves and Oakley Creek. Focus group recruitment was advertised in newsletters, at open days, drop-in centres and the Project website.	 • Public	• Route Options • Alignment and Construction Options	✓	✓	• Queries responded to • Feedback and actions recorded • Feedback provided to relevant Project technical assessments
In Depth Interviews In depth interviews were held with randomly selected residents in Te Atatu, Waterview and Owairaka, to validate the scope of issues and concerns identified in previous community consultation/focus groups. The interviews provided a means of obtaining targeted feedback from members of the community who may not have otherwise been involved in consultation[16].	 • Public	• Alignment and Construction Options	✓	✓	• Interview report produced • Feedback provided to relevant Project technical assessments
Public Meetings Public meetings were held at various stages of the Project, as requested by members of the public and/or community groups. Public meetings addressed specific issues and areas of concern and provided opportunity for questions to be answered.	 • Stakeholders • Public	• Route Options • Alignment and Construction Options	✓	✓ (limited)	• Queries responded to • Feedback and actions recorded

[16] This method was specifically intended to address issues of representativeness in SH20 Project consultation, to represent a balanced community perspective

10.6 Consultation Reporting

Table 10.3 details the consultation reporting that has been undertaken for the Project. These documents provide a detailed overview of each round of consultation undertaken including methods, feedback and how key issues have been responded to by the NZTA.

Consultation reporting at key stages of the Project

Table 10.3: Consultation Reporting 2000 – 2010

Phase	Key Documents supporting Consultation Process
All Phases (Summary)	*Waterview Connection Consultation Summary Report 2000 – 2010* (April 2010)
Scoping and Corridor Assessment	*SH20 Avondale Extension Consultation Summary – Newsletter 1* (October 2000)
	No reporting undertaken in this phase for the SH16 Upgrade Project
Route Options	*SH20 Avondale Extension Consultation Summary Report – Responses to Newsletter 3 and the draft Preliminary Scheme Assessment Report (PSAR)* (September 2002)
	SH20 Avondale Extension Consultation Summary Report – Responses to Newsletter 6 and the Draft Options SAR & AEE (December 2003)
Alignment and Construction Options	*Final Route Options (2003) Report* (January 2006)
	Waterview Connection Consultation Summary Report – Responses to the Draft Alignment and Interchanges (May 2006)
	Waterview Connection – Report on Community Engagement (Driven Tunnel) (April 2008)
	Waterview Connection – Report on Community Engagement (Combined Surface and Tunnel) (August 2009)
	Waterview Connection – Report on In-Depth Interviews (May 2010)[17]
	Waterview Connection Consultation Summary Report 2000 – 2010 (July 2010)[18] (Refer to Appendix E.5 of the AEE).

Consultation from the above phases is summarised below in Sections 10.7 to 10.9.

10.7 Scoping and Corridor Assessment Consultation

Completion of the WRR (including SH16 Causeway Upgrade and SH20 Waterview Connection Projects) was confirmed as part of the 2010 Auckland Regional Land Transport Strategy (ARLTS). At a strategic level, the development of the 2005 and new 2010 ARLTS were informed by consultation undertaken by the Auckland Regional Transport Committee. That consultation is not repeated in this AEE.

Consultation for the ARLTS is not repeated in this document

[17] Included as an appendix to the Waterview Connection Consultation Summary Report 2000 – 2010.

[18] Includes reporting on consultation for the SH16 causeway widening project and the combined SH16-20 Project.

10.7.1 SH20 Constraints Mapping and Identification of a Long List of Routes (2000)

10.7.1.1 Introduction and Purpose of Consultation

As part of the SH20 Preliminary Scheme Assessment (PSA) investigations, consultation was undertaken in 2000 to gather input from the community on issues, concerns and values. This consultation process provided data for the 'community values map' and subsequent coarse environmental screening of the long list of options.

Consultation on the SH20 Preliminary Scheme Assessment

10.7.1.2 Consultation Methods[19]

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Newsletter #1 – approximately 18,000 were distributed (purpose was to gather feedback via feedback form) Newsletter #2 –distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform/update on Project progress)
Media Releases and Advertisements		
Stakeholder/Affected Party Meetings	✓	Presentations on the Project and its purpose
Letters		
Open Days		
Drop In Centres		
Seminars/Workshops		
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews		
Public Meetings		

10.7.1.3 Consultation Feedback

Approximately 800 responses were received to the October 2000 Newsletter #1, with 45% being from Avondale/New Windsor, 25% from Mt Albert/Owairaka and 15% from Waterview. Responses were also received from DoC, the Auckland Conservation Board, Iwi groups, Waitemata Harbour Protection Society, the ARC, ACC and WCC.

Approximately 800 responses were received from members of the public

[19] Used at various stages during this phase of consultation.

Responses were summarised into three themes (in accordance with the format of the Newsletter):

- Feedback on environmental values/specific environmental issues;
- The identification of options and route corridors; and
- Feedback and general comments.

Overall, the following areas were identified as most highly valued:

- Ecological values;
- Heritage/archaeological sites;
- Open space/reserves; and
- Residential areas.

Infrastructure sites and commercial areas were generally identified by the community as the least valued.

Most of the route options drawn from the community were contained within the study area. Within this area there was a high degree of diversity in the options proposed.

General issues raised in consultation included:

- That there should be no motorway;
- That the Project should include passenger transport;
- Identification of specific social/environmental issues for consideration (including impacts on open space, Oakley Creek, traffic, housing take and community impacts;
- Project timeframes – that the Project should be built as soon as possible;
- Completeness of the constraints map in Newsletter #1 – that some sites of importance (e.g. educational facilities) were identified as 'missing'; and
- Matters relating to the consultation process – including that more consultation should be undertaken, or consultation should be undertaken in a different format.

10.7.1.4 Response to Feedback

Response to the PSAR Feedback

The feedback and information received was incorporated into the technical and environmental investigations for the PSA. In particular, information on specific sites and areas of heritage, ecological, visual or archaeological value were included in the constraints mapping and supplied to the relevant Project team technical specialists to ensure that these matters were considered in the environmental investigations.

The route options identified by the community assisted the Project team in developing a 'long list' of 20 route options. The following conclusions were drawn with respect to the options generated from the community:

- There are a large number of geographically specific constraints within the area that are valued differently by different members of the community;
- There was no clear community unanimity on a route option or corridor; and
- Route corridors need to be relatively narrowly defined, to recognise the specific environmental issues and physical constraints of the study area.

The Project team responded to the following general concerns raised in consultation:

- Traffic: The Project team acknowledged that traffic flow information for the local networks and existing link roads would need to be provided to assist in consideration of route options;
- 'No Motorway': The Project team highlighted that, at this stage of the Project, it had not been determined if the SH20 extension would be a standard 'motorway' connection, but that there were defined Project objectives for transport outcomes;
- Passenger Transport: The Project team highlighted that (at the time of consultation) the NZTA had no jurisdiction to allocate funds or resources to passenger transport, though SH20 design options would not preclude passenger transport options and road based passenger transport options would be considered in route options;
- Open Space: The Project team acknowledged that any effect on open space within the study area would need to be addressed in the AEE;
- Community Impacts: The Project team acknowledged that the social impacts of the Project on land use linkages and potential community severance issues would require further investigation;
- Completeness of the Constraints Map: The Project team acknowledged three schools were identified by the community as being 'missing' from the original constraints map included in Newsletter #1. These sites were acknowledged and recorded; and
- Project Timeframes: The Project team endeavoured to take all reasonable steps to reduce timeframes for the assessment and evaluation of the 'long list of options' and identification of the 'short list', due to concerns regarding the potential community and social impact of a protracted process.

10.8 Route Options Consultation

10.8.1 SH20 Identification of a Short List of Route Options (2002)

10.8.1.1 Introduction and Purpose of Consultation

Consultation on the SH20 Short List of Route Options

Environmental investigations through 2001 included assessment of the potential impacts of a 'long list' of options for the motorway route. A total of 20 general route options were 'screened' using geotechnical, geometric, traffic, environmental, and economic criteria to revise the list to 12 routes which connected to SH16 at either Rosebank Road (AR options) or the Waterview interchange (AW options). These were summarised in the Preliminary Scheme Assessment Report (PSAR) which was released for public comment in 2002.

The purpose of consultation in this phase was to provide the community with an opportunity to review and comment on the investigations undertaken and recommended short-list of routes, before more detailed scheme assessment and environmental investigations would be undertaken. This consultation phase was included in response to requests from the community in November 2000 to be consulted on the short list of options.

10.8.1.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Newsletter #3 – approximately 17,500 were distributed (purpose was to gather feedback via feedback form) Newsletter #4 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform/update on feedback received and remind people of drop in centres) Newsletter #5 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform/update on Project progress and remind people of drop in centres)
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	Approximately 24 presentations were held
Letters		
Open Days	✓	Approximately 650-700 people attended
Drop In Centres	✓	
Seminars/Workshops		
Telephone and Email Contact	✓	
Focus Groups	✓	Approximately 180 people participated

Method	Used	Detail
In Depth Interviews		
Public Meetings		

10.8.1.3 Consultation Feedback

Feedback was received from a broad range of stakeholders

The following provides a summary of the key feedback given by stakeholders:

- The ARC did not state a preferred option, however raised issues associated with impacts on the coastal environment, reserves, fauna, changes in future demand for the Project, passenger transport provision, integration and cost;
- WCC did not state a preferred route option, however raised issues associated with environmental impacts, network integration, pedestrian/cycle provision, cost and timing;
- The Avondale Community Board and Eden/Albert Community Board both supported the completion of the Project but raised issues relating to construction methodology, integration of the alignment/interchanges with the local road network, and mitigation;
- DoC and the Auckland Conservation Board did not state a preferred option but expressed concern over potential impact on conservation values, including impacts on the Motu Manawa (Pollen Island) Marine Reserve and Oakley Creek;
- Housing New Zealand did not state a preferred option but raised concerns over the impact of the Project and its construction on residential areas (particularly Hendon Avenue) and traffic;
- Infrastructure Auckland did not state a preferred option but raised concerns over the type and validity of traffic growth modelling information;
- Unitec opposed all route options shortlisted, and raised issues associated with the loss of land/facilities and environmental, social and traffic impacts;
- Ngati Whatua O Orakei opposed options involving the Great North Road Interchange (AW1 and AW4), due to impact on the Oakley Creek area and land that was planned for high density student apartments;
- The Ngati Paoa Whanau Trust did not indicate a preference for route options;
- The Avondale Business Association stated the Rosebank option (AR1) was the best option, due to the protection the Association considered it afforded to the natural environment;
- The Avondale Residents and Ratepayers Association stated a preference for the Project to be located elsewhere rather than Avondale;
- The North Western Community Association opposed all shortlisted route options, expressing concern over the effect on reserves, flora and fauna, air and water pollution and community disruption;

- The Royal Forest and Bird Protection Society did not state a preferred option and requested greater investigation into the social cost of the Project and possibilities for public transport integration;
- The Waitemata Harbour and Hauraki Gulf Protection Society preferred the route option connecting at the Rosebank Interchange (AR1); and
- The Waterview Environmental Society opposed all route options.

Around 500 newsletter responses were received

In total, around 500 newsletter responses were received as well as approximately 200 emails, many of which sought points of clarification rather than detailed comments.

While the focus of this phase of consultation was on identifying issues and alternatives to the recommended short-list of routes, a number of public submissions made general comments in support or opposition to the Project overall. Approximately 60% of public responses indicated support for the Project (including conditional support). Approximately 20% of respondents indicated opposition to the Project (which included respondents who indicated that there should be 'no motorway' or that public transport options should be prioritised instead). The remaining 20% of respondents did not express a preference.

Of the 40% of respondents who indicated a preference for a route option(s), approximately 55% supported the route option connecting at the Rosebank Interchange (AR1), with the remaining preferring route options connecting at the Great North Road Interchange (either AW1 or AW4, or both).

Comments made in support of the Rosebank route option (AR1) cited the following:

- Accessibility to the Northwestern Motorway, reduced traffic flows on the Causeway, and less impact on the Great North Road Interchange;
- Less community disruption/avoidance of impacts on community facilities and open space;
- Perceived avoidance of environmental impacts on fragile areas within the study area;
- Better access between industrial areas and Auckland International Airport; and
- Longer term solution.

Comments made in support of route option AW1 cited the following:

- Least environmental impact and disturbance to Oakley Creek;
- Cheapest option – incorporating Great North Road/shorter and cheaper than AR1;
- Less impact on the CMA;
- Least impact on landscapes and open space; and
- Opportunity for mitigation (undergrounding).

Comments made in support of route option AW4 cited the following:

- Less impact on residential areas/community disruption;

- Least impact on the CMA;
- Less impact on industrial areas;
- Most direct route to the city (from the south, via SH20);
- Least cost/damage to existing roads and buildings;
- Shorter and cheaper than AR1; and
- Opportunity for mitigation (undergrounding).

Overall the results from the feedback indicated that while there were some concerns with the impacts of the short-listed route options (particularly with regard to effect on residential properties, Oakley Creek and environmental concerns), there was the potential to mitigate some of these effects, and the route options short-listed were appropriate for future detailed investigation of SH20 Avondale Extension.

10.8.1.4 Response to Feedback

Responses on the Short-list of Route Options

During the consultation process, a number of additional route options were identified. In response to this feedback, another Rosebank Interchange route option (AR3) was added back into the short-list (having earlier been dismissed). This route was included as it provided an efficient transport option while avoiding the sensitive reserve and ecological area of Oakley Creek (north of New North Road).

The PSAR was also updated to reflect more detailed consideration of the following options:

- Great North Road option (existing arterial road connection to SH16);
- St Lukes Road option (connection to St Lukes Road); and
- "Western" route option (via New Lynn).

However, these options were not ultimately included in the final short-list of routes.

Additional issues identified for investigation in subsequent phases of the Project included the location of potential interchanges/connections, arterial upgrades, impacts on parks/reserves, environmental impacts, construction options and mitigation methods.

Following community feedback on the recommended short-list of options, the PSAR concluded that four route options should be taken forward for further assessment – two connecting at Rosebank, and two connecting at the Great North Road Interchange.

10.8.2 SH20 Identification of a Preferred Route (2002 – 2003)

10.8.2.1 Introduction and Purpose of Consultation

Consultation on the SH20 Preferred Route Options

The four recommended short-listed routes were investigated in the 2003 Technical Options Ranking Paper, from which two feasible routes (one connecting at Rosebank – AR1, and one connecting at the Great North Road Interchange – AW1) were advanced for further assessment. The NZTA released their preferred route (AW1) for consultation in late 2003.

The purpose of this consultation phase was to provide the community and stakeholders with an opportunity to review and comment on the investigations undertaken and the draft preferred route option before finalisation of a preferred route.

10.8.2.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Newsletter #6 – approximately 10,000 were distributed (purpose was to gather feedback via feedback form)
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters		
Open Days	✓	Approximately 250-300 people attended the 2 open days held in 2 locations
Drop In Centres	✓	Held in October and November 2003
Seminars/Workshops	✓	
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews		
Public Meetings	✓	Held in response to requests from members of the community. Meetings were held at Unitec, the Avondale Community Centre and with the Rosebank Business Forum.

10.8.2.3 Consultation Feedback

Feedback was received from Councils, DoC and the Natural gas Corporation

The following provides a summary of the key feedback given by stakeholders:

- ARC raised issues associated with integration with future projects/Council strategies, land use, funding and staging, traffic effects and stormwater treatment;
- ACC raised issues associated with integration with future projects and Council strategies, air quality, land use/severance, funding and staging, traffic effects, open space and water quality/stormwater/hydrology impacts;

- WCC raised issues associated with traffic, road user benefits, environmental and economic impacts;
- DoC and the Auckland Conservation Board were generally more supportive of the SH20 extension to pass along the AW1 route, provided any adverse effects on Oakley Creek and stormwater discharge to the marine environment were avoided, remedied or mitigated;
- The Natural Gas Corporation indicated that the draft preferred route option would not directly affect its oil and gas pipelines in the area.

Approximately 170 responses were received from members of the public

Around 170 public responses were received (by newsletter and email)[20]. Approximately 40-45% of the public responses received indicated support for the preferred option, 25-30% were not clearly in support or opposition, and 30% of the responses indicated opposition to the draft preferred route.

Key reasons in support of the preferred route (AW1) noted the following:

- Requires less homes to be taken;
- More direct connection between the city and Auckland International Airport;
- Potential for tunnel mitigation; and
- Potential integration with public transport/rail.

Feedback in support of the preferred route was often subject to mitigation/design requirements (such as noise mitigation, landscaping and under-grounding).

Feedback in opposition included those opposed to the Project outright as well as those opposed to the preferred route. Common reasons for opposition noted the following:

- Traffic impacts;
- Impacts on open space/reserves and the Oakley Creek walkway; and
- Requires SH16 widening to accommodate the Project.
- Concerns raised by members of the public (whether they supported or opposed the preferred route) related to effects on open space, coastal areas, Oakley Creek, noise, pollution, access, traffic, residential properties, and the provision for walkways and cycle ways. Project timelines were also mentioned, with emphasis on constructing the SH20 Avondale Extension as soon as possible.

[20] Response rates were significantly lower than for earlier consultation phases. The Project team considers the main reason for this was due to the fact that the Project now had an inclination towards a particular route option, which consequently reduced the number of potentially affected community members.

10.8.2.4 Response to Feedback

Responses on the Preferred Route 2002-03

Feedback received was recorded and distributed to the technical team as required to assist in option development and assessment. It also formed the basis for development of issue-based focus groups for the detailed alignment option development.

In response to consultation feedback, the Project team developed potential cut and cover segments to reinstate reserves following construction. It was also decided that additional investigations into the feasibility and impacts associated with further undergrounding of the alignment would be undertaken.

Through the consultation process, further issues were identified for investigation once the preferred route option of AW1 was confirmed. These included:

- Location of potential interchanges/connections/ramps;
- Potential impacts of staging on local road networks/potential need for upgrading local and regional road networks;
- Potential impacts on open space, Oakley Creek, and options for replacement of any lost open space;
- Mitigation for impacts on Oakley Creek, noise, visual and community severance;
- Provision for cycle linkages, and integration of rail and rail station locations;
- Stormwater treatment issues including compatibility with the existing environment, potential to improve local stormwater quality, and stormwater discharges into the Motu Manawa (Pollen Island) Marine Reserve;
- Alternative funding mechanisms, and implications of the Land Transport Amendment Act;
- Statutory processes and the potential 'fast tracking' of the Project; and
- Air quality considerations, including ventilation systems for parts of route that may be tunnelled.

10.8.3 SH20 Consultation during the Project LTMA Review (2004 – 2005)

LTMA Consultation

10.8.3.1 Introduction and Purpose of Consultation

Following the review of the Project in light of the enactment of the LTMA in late 2003[21], the NZTA undertook consultation with a number of key stakeholders and transport partners.

[21] The LTMA set a new objective for Transit 'to operate the state highway system in a way that contributes to an integrated, safe, responsive, and sustainable land transport system' (section 77(1) – now repealed).

10.8.3.2 Consultation Methods

Method	Used	Detail
Project Website		
Project Newsletter/Feedback Form	✓	Newsletter #7 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to update on Project timeframes)
Media Releases and Advertisements		
Stakeholder/Affected Party Meetings	✓	Presentations, meetings and workshops between the NZTA and ARC, ACC and WCC22
Letters		
Open Days		
Drop In Centres		
Seminars/Workshops		
Telephone and Email Contact		
Focus Groups		
In Depth Interviews		
Public Meetings		

10.8.3.3 Consultation Feedback

Feedback was received from key stakeholders and transport partners

The consultation undertaken provided these stakeholders with a better understanding of the Project and enabled parties to make decisions regarding their preferred alignment:

- In December 2005, ACC resolved that (in principle) they support the NZTA's draft route preference of AW1, subject to the development of mitigation and enhancement measures to the satisfaction of ACC;
- In February 2006, WCC formally confirmed the AW1 route as their preference; and
- In March 2006, the ARC resolved that while they supported the Project, their route preference was the Rosebank or AR1 option.

10.8.3.4 Response to Feedback

Responses to LTMA Consultation

The consultation undertaken progressed a working relationship between the relevant Councils (as land transport providers), ARTA and the NZTA. In particular, the establishment of regular discussion forums provided a mechanism for ongoing input by land transport providers, including discussion/review of option development and assessment. In particular, the resolution by ACC identified a number of specific matters that were considered further in development of the alignment, interchanges and mitigation for the preferred option (discussed below).

[22] Including consultation on the Southwestern Transport Corridor and meetings with the ACC Major Projects Group.

10.9 Alignment and Construction Options Consultation

10.9.1 SH20 Draft Alignment and Interchange Options (2006)

10.9.1.1 Introduction and Purpose of Consultation

Consultation on the SH20 Draft Alignment and Interchange Options

After taking into consideration consultation with key stakeholders and the public, the NZTA confirmed that AW1 was their preferred route. In March 2006 the Project team released a draft alignment. The purpose of consultation was to provide the community and stakeholders with an opportunity to review and comment on the draft alignment and interchanges for the AW1 route.

10.9.1.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Newsletter #8 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to update on Project progress and inform of focus groups) Newsletter #9 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform/update on Project progress) Newsletter #10 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform of delayed Project timeframes) Newsletter #11 – distributed to all residences in the SH20 study area and to those on the Project database (purpose was to inform/update on Project progress)
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters	✓	
Open Days	✓	Approximately 500 people attended the community open day
Drop In Centres	✓	Held monthly between March – July 2006
Seminars/Workshops		
Telephone and Email Contact	✓	
Focus Groups	✓	Held monthly between April – August 2006
In Depth Interviews		
Public Meetings	✓	

10.9.1.3 Consultation Feedback

Feedback was received from a broad range of stakeholders

Key stakeholder feedback is summarised as follows:

- ACC resolved to support the AW1 route subject to the implementation of a suite of mitigation and enhancement works;
- ARC expressed a preference for the dismissed AR1 route;
- ARTA requested further information on traffic modelling, tunnelling, interchanges, rail integration and tolling;
- Meetings were held with ONTRACK to discuss potential impacts on the future Avondale Southdown rail corridor, future development of the western rail line and integration with other future rail projects;
- Unitec expressed concern about potential construction and operational impacts such as noise, impact on local air quality and the structural integrity of buildings;
- The Metro Soccer Club identified issues associated with ensuring adequate lead time for relocation (should this be necessary) and the benefits associated with a cut and cover option for the club, and wanted to be provided with certainty in order to limit potential impacts on future enrolments; and
- A Hikoi was held with Ngati Whatua, followed by a site visit with iwi to identify sites of cultural significance.

Approximately 60 responses were received from members of the public

In total 60 responses were received using the public response forms that were available at open days, drop in centres and on the Project website. A petition signed by over 500 people was presented to ACC, ARC and the NZTA opposing the motorway running through the Waterview suburb. A second petition to ACC also signed by over 500 people sought tunnelling between Richardson Road and Waterview Interchange.

Two petitions were presented seeking tunnelling of the Waterview Connection alignment

Feedback on the Draft Alignment:

- Opposition to motorways (belief that the Project should only provide passenger transport);
- Support for the link, seeking it to go ahead as soon as possible;
- Extent of tunnelling/location of interchanges;
- Decision making process, in particular questions as to how community feedback has been incorporated;
- Social impact on communities, schools and kindergartens (including impacts from lost housing stock);
- Heritage impacts e.g. on the Star Mill site;
- Loss of open space and impacts on access to Oakley Creek;
- Construction/traffic impacts on wider area; and
- Noise and air pollution.

Feedback on the Maioro Street Interchange:

- The interchange should be built as part of the Mt Roskill development;
- Support for this connection which will relieve local road congestion; and
- Social impacts/impacts on local communities.

Feedback on the (then proposed) Blockhouse Bay/Great North Road Interchange:

- Oppose change in the draft preferred interchange from New North Road to Great North Road;
- Preference for previous New North Road ramp connections;
- The interchange should be removed in its entirety/the interchange duplicates the existing Waterview Interchange and is therefore unnecessary;
- Vehicle noise, light and air pollution (and associated social and health impacts);
- Cost to community (e.g. community severance) and its amenities;
- Impact on open space, Oakley Creek, the walkway and waterfall;
- Pedestrian and cycle connections between Avondale and Mt Albert; and
- Support for interchange as it will relieve gridlock.

Feedback on the Waterview Interchange:

- Impact on entrance to the Waterview suburb;
- Impact on archaeological sites and historic houses;
- Visual impact of ramps;
- Noise and air pollution (particularly at the surface);
- Social impacts/impacts on the Waterview community
- Pedestrian safety issues and pedestrian connections between Waterview and Point Chevalier; and
- Support for interchange as it will relieve gridlock.

10.9.1.4 Response to Feedback

Responses to Feedback on the Alignment and Construction Options

In response to the feedback received, the Project team identified that further consideration would be given to the following:

- Review of interchange options and design, including traffic effects;
- Alternative alignment options (including increased tunnelling extent);
- Pedestrian and cycle connections to and across Oakley Creek;
- Development of reserve replacement options and integration of pedestrian/cycle linkages with ACC;
- Potential impacts on archaeological sites;

- Progress and provide the community with further detail on construction impacts and constructability, and options to mitigate noise and air quality impacts;
- Construction/ Traffic Management Plans;
- Social/community impacts;
- Visual/landscape effects; and
- Continued community consultation through focus groups and newsletters.

In September 2006, the NZTA announced that having reviewed community and stakeholder comment, it would delay the lodgement of the NoR to enable further design and investigation of the draft alignment and interchanges, including consideration of options for further undergrounding.

10.9.2 SH20 Preferred Construction Option – Driven Tunnel (2008)

10.9.2.1 Introduction and Purpose of Consultation

Consultation in relation to the SH20 Driven Tunnel Option

In early 2008, the NZTA sought community and stakeholder feedback on the proposal to construct the Project as a driven tunnel. The purpose of this round of consultation was to inform stakeholders and the wider community of the NZTA's draft preferred option, to seek support, opposition, or otherwise for the preferred option, and to receive input on issues and matters considered significant in moving forward with the Project.

10.9.2.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Approximately 10,000 copies of the Flyer, Information Brochure and Feedback Form were distributed
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters	✓	
Open Days	✓	Approximately 360-440 people attended 4 open/information days held in 2 locations
Drop In Centres		
Seminars/Workshops	✓	
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews		
Public Meetings		

Figure 10.4: Community Open Day (2008)

10.9.2.3 Consultation Feedback

Feedback was received from a broad range of stakeholders

The following provides a summary of the comments made by key stakeholders:

- ARC and ACC supported the tunnel concept subject to mitigation and enhancement measures;
- NSCC supported the concept but expressed concern about the limited capacity of a 2 lane tunnel;
- ARTA supported the completion of the WRR and the Waterview Connection, but reserved support for the tunnel option pending further information;
- RDC and Housing New Zealand were neutral to the tunnel option;
- The Waitemata District Health Board and the Auckland Kindergarten Association expressed concern about effects on local air quality;
- Waterview Primary School and Waterview Kindergarten were opposed to the tunnel due to construction effects and the perceived effect of the tunnel on health (due to the proximity of the air discharge from vents);
- The Rosebank Business Association, AA and Auckland International Airport supported the proposal but considered that 2 lanes were inadequate to meet future demand. The AA opposed the use of tolling;
- The Highways Action Trust opposed the excessive cost, limited capacity and lack of adequate consideration of alternative options;
- The Auckland Citizens and Ratepayers Association, Foodstuffs, Friends of Oakley Creek and Mt Albert Residents Association supported the tunnel option due to the social and environmental benefits (as compared to other options); and

- The North Western Community Association opposed the excessive cost of the tunnel and sought funds to be spent on public transport instead.

Approximately 750 responses were received from members of the public

Of the 747 public responses received, 76% were in support and 18% were in opposition. In addition there was a petition (with 72 signatures) received from the Waterview Kindergarten Parent Committee in opposition to the tunnel. The remainder of responses (6%) indicated they 'did not mind' or did not express any preference.

The key reasons given in support of the driven tunnel included:

- That the NZTA have listened to community concerns;
- The ability to retain open space/protect the Oakley Creek environment;
- The need for fewer homes to be taken;
- The tunnel would be less disruptive to community values;
- Improving traffic congestion in Auckland; and
- Containing the effects (e.g. noise, visual) of the motorway underground.

Submissions in support and opposition of the Driven Tunnel

The key reasons given in opposition to the driven tunnel included:

- Community disruption and effects during construction (especially noise, dust and traffic impacts);
- Impact of loss of houses on Waterview Primary School/Kindergarten and 'sense of community';
- Concern that the dispersion of emissions to air from the ventilation stacks could have health effects on local residents and school (including Waterview Primary School and Kindergarten);
- Cost – that $1.9 to $2.3 billion is excessive for one project and 'the tunnel money' could be better spent on multiple transport projects/public transport, and the cost of operation and maintenance;
- That future fuel price increases make this the wrong investment for New Zealand;
- That too much political influence has informed the Project; and
- Impact on property values.

Concerns were expressed, or further information sought, regarding the following matters:

- Whether two lanes would provide sufficient capacity to cope with future demand;
- How the tunnels will be vented/filtered, effects on local air quality and a desire for more information or explanation about the vents (including air quality modelling, monitoring and information on impacts);
- Construction effects in the form of noise, vibration and heavy construction vehicles on local roads;

- Operational effects such as noise from open sections of the route and ramps, noise from the ventilation stacks/buildings, and expected traffic increases on local roads;
- Whether the route would be tolled and what effect this would have on usage;
- Limited information on the alternative (cut and cover) options made it difficult to weigh up whether the additional costs were justified; and
- Distance to access the tunnel for Waterview residents.

10.9.2.4 Response to Feedback

Responses made to the Driven Tunnel Option 2008

Consultation feedback was reported to the NZTA Board at a public Board meeting in June 2008 for consideration. At this Board meeting it was confirmed that a tunnel was the NZTA's preferred construction option. In response to the feedback presented, the Board sought further investigation into two key areas of concern highlighted during public consultation. These areas were:

- Tunnel capacity (twin 2 lanes tunnels versus twin 3 lane tunnels); and
- Management of tunnel air emissions, with reference to international best practice.

In response to this, the NZTA undertook additional technical/environmental assessments of the effects of a 3 lane tunnel option. It also commissioned a review of international practices on the management of vehicle emissions which benchmarked the proposed Waterview Connection emission management design against international examples. Three workshops were held with members of the public within the Project area to discuss air quality. Key stakeholders were also briefed on the air quality effects report.

In late 2008, the Government announced that the driven tunnel option would be too expensive to build within the available land transport budget, and that it would consider alternative alignments and construction methodologies to complete the Waterview Connection within the budget available.

10.9.3 SH20 Preferred Construction Option – Combined Surface and Tunnel (2009)

10.9.3.1 Introduction and Purpose of Consultation

Consultation on the SH20 Combined Surface and Tunnel (CST) Option

In May 2009, the NZTA announced a new construction option for the Waterview Connection, a combined tunnel and surface (CST) option (refer to Figure 10.6), to provide capacity for 3 lanes and at a cost considered to be achievable within the available land transport budget. The purpose of this consultation phase was to inform people of the new preferred option and to seek feedback from stakeholders and the community on their views, issues and concerns with the option.

10.9.3.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Approximately 9,000 copies were distributed
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters	✓	
Open Days	✓	Approximately 650 people attended the 4 community open days held in 3 locations
Drop In Centres		
Seminars/Workshops		
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews		
Public Meetings		

Figure 10.5: Community Open Day (2009)

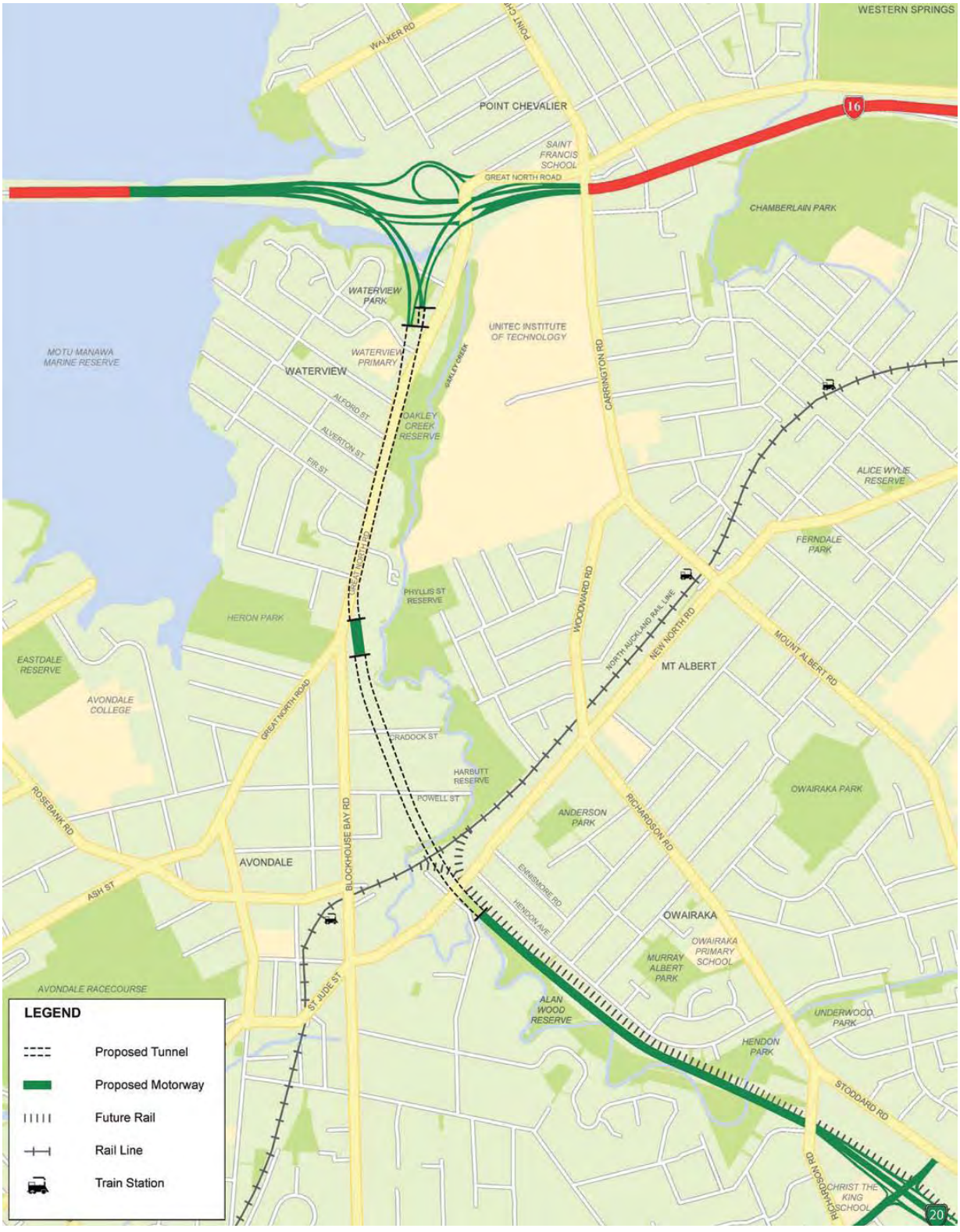


Figure 10.6: Original CST Alignment

10.9.3.3 Consultation Feedback

Feedback was received from a broad range of stakeholders

The following provides a summary of the comments made by stakeholders in August 2009:

- The ARC supported completion of the WRR but was concerned about impacts of the option on local communities/centres, open space, Oakley Creek, traffic and cultural and natural heritage;
- ACC supported the NZTA's proposal in principle and identified key areas for mitigation and enhancement, including bus/cycle provisions, improved landscaping and pedestrian access, open space replacement, careful treatment of tunnel air emissions and providing for built form/land uses;
- WCC supported the proposal subject to mitigation and enhancement measures, mainly relating to cycle and public transport infrastructure. It was particularly concerned about effects of the (then proposed) open trench area between the two tunnels (in the Blockhouse Bay Road area), and construction disruption;
- RDC considered there is urgent need for the early completion of the WRR and commends the NZTA's proposal to complete the Project at a lower cost;
- The Eden Albert Community Board opposed the proposal based on environmental, social, health and community concerns, and the Avondale Community Board opposes the proposal and would only consider supporting a full bored tunnel option;
- Waterview Primary School strongly opposed the Project on the basis of impacts on the school learning environment, potential reduction to the school roll, and impacts on the Waterview community;
- The Waterview Kindergarten Parent Committee strongly opposed the Project, citing concerns over the impact on the kindergarten roll, the potential need for the kindergarten to be relocated, impacts on children's health, and community disruption;
- The Auckland Kindergarten Association opposed the Project due to impacts on Waterview Kindergarten;
- Owairaka District School stated that parents had expressed concern over the loss of open space, noise, air quality and pedestrian safety;
- The Mount Albert Playcentre expressed concern about noise and dust impacts during construction, the effect of air quality on educational facilities in the area, operational noise around the southern portal, and negative impacts on the Waterview community;
- Unitec supported the Project and sought roading and accessibility improvements to and from Unitec to be included. Unitec is prepared to provide land for this purpose;
- The Auckland Business Forum, Employers and Manufacturers Association, Auckland International Airport and National Road Carriers Association strongly supported the Project, citing economic, accessibility and productivity benefits;

- The AA supported the proposal, believing it will significantly reduce social and environmental disruption (compared to a full surface option) while maintaining some of the benefits of tunnelling;
- The National Trading Company (owner of the Mt Albert Pak n' Save), supported the Project proceeding as soon as possible, stating the proposed route is acceptable providing adverse effects are addressed;
- The Centre for Urban and Transport Studies supported the completion of the WRR but believed it should be constructed as a full surface road option;
- Ngati Whatua o Orakei opposed the proposal, citing concern over open space and archaeological impacts, and believing that money should be put towards public transport. Further, Ngati Whatua o Orakei prepared a Cultural Assessment for the CST option in July 2009 which has informed this AEE:
- The Tunnel or Nothing Group, Springleigh Residents Association, Living Communities and North Western Community Association opposed the proposal, citing concern over community impacts including loss of open space, amenity, impacts on schools/community infrastructure, air pollution, noise pollution, ecological impacts, potential health impacts and archaeological impacts;
- Friends of Oakley Creek opposed the proposal, due to impacts on Oakley Creek, ecological impacts, loss of open space, amenity, noise and archaeological impacts.

Around 465 responses were received

Overall, 465 responses were received from members of the public. Approximately 44% of responses expressed opposition to the early completion of the WRR, 42% expressed support/conditional support, and 14% did not express a preference. Of those who identified themselves as living in the Project area, approximately 47% supported the early completion of the WRR and 45% opposed it.

Support and Opposition to the CST Option

The key reasons given in support of the CST option included:

- Traffic benefits;
- Cost effectiveness/good balance between environmental, social and economic considerations;
- Economic and strategic importance to the Auckland Region;
- Increased capacity/ability to add future capacity.

The key reasons given in opposition to the CST option included:

- The whole alignment should be tunnelled;
- Money would be better spent elsewhere – for example, on public transport or multiple roading projects;
- Concern over calculation of cost/benefits;
- Environmental and community impacts (detailed below); and
- That the Project cost is still too high.

The effects of the CST option that the community were most concerned about were:

- Air quality and associated potential for health effects;
- Impact on open space;
- Community effects including severance, loss of 'liveability', property acquisition and the impact on community facilities including local schools;
- Noise impacts (during construction and operation);
- Traffic impacts;
- Environmental impacts including impacts on ecology, Oakley Creek and water quality/stormwater;

  Visual/amenity impacts;
- The section of surface road at the top of Blockhouse Bay Road (in between the two tunnels);
- Archaeological/heritage impacts;
- Impact on property values; and
- Impacts on the Avondale Southdown rail corridor.

The following suggestions were most commonly made to reduce the impacts of the CST proposal:

- Extend tunnel cover/change in alignment;
- Increased property acquisition/compensation;
- Mitigation of open space, noise, dust and ecological and stormwater impacts;
- Good design/urban design (including visual screening);
- Traffic planning/mitigation, including the maintenance of access for residents during construction and maintenance of access for pedestrians and cyclists;
- Construction of walkways and cycle ways;
- Add on/off-ramp for local residents (for example, a central interchange);
- Air quality filtering/monitoring; and
- Improve public transport/ensure that the future Avondale Southdown rail line is not adversely affected;

Some respondents also requested that a local Hearing be held for the Project (rather than a Board of Inquiry).

10.9.3.4 Response to Feedback

Responses to the CST Option

In December 2009, the NZTA Board confirmed a revised alignment for the Project to respond to some of the key concerns raised in consultation. Design modifications made as a result of consultation feedback included:

- A reduction in the length of 'cut and cover' tunnel section to reduce construction impacts in this area;
- A continuous tunnel design to eliminate the previous gap between the two tunnelled sections (near Blockhouse Bay Road); and
- A reduction in the number of houses affected to 205 compared to the 365 estimated in May 2009 when the CST option was initially announced.

Environmental investigations were scoped on the basis of the revised design and concerns raised in consultation. Detailed urban design concepts were also progressed.

10.9.4 SH16 Upgrade Project (2007 – 2009)

10.9.4.1 Introduction and Purpose of Consultation

Consultation on the SH16 Upgrade Project

The purpose of this consultation phase was to inform people of the NZTA's SH16 upgrade Project between Great North Road and Te Atatu Road, and to seek feedback from stakeholders and the community on issues and concerns with the Project.

10.9.4.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Approximately 100 newsletters/letters were distributed
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters	✓	
Open Days	✓	Approximately 270 people attended 4 community open days held in 3 locations
Drop In Centres		
Seminars/Workshops		
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews		
Public Meetings		

10.9.4.3 Consultation Feedback

The following provides a summary of the comments made by key stakeholders:

Feedback was received from a broad range of stakeholders

- The ARC Transport Committee requested information on the environmental impacts of the Project (including stormwater and DoC reserves), queried whether the NZTA has considered declaiming the Causeway to allow more flushing, and raised the need to review litter management along SH16;
- WCC supported improvements to the Te Atatu Interchange, but also the need to manage associated environmental and community impacts. Support was also expressed for assessing the wider ecological impacts of the Project (looking further than Traherne Island), and for providing a complementary package of cycle way projects with WCC;
- The ACC Transport Committee raised questions about what was being done to improve/limit impacts on Pollen Island and improve stormwater quality in Oakley Creek. ACC also suggested reinstating the cycle path along the length of Chamberlain Park, using the area within the Great North Road Interchange (eastbound on-ramp loop) as a stormwater pond, and providing for improved pedestrian access along the St Lukes interchange (if this formed part of the upgrade);

Responses were received from members of the public by email and at the Open Day

- The Eden Albert Community Board were concerned about impacts on Chamberlain Park (including amenity impacts), queried whether the NZTA had considered providing improved access over SH16 between St Lukes and Western Springs, and queried whether the NZTA would be speaking with all affected people face to face;
- The Avondale Community Board queried the Project cost, whether the Causeway was sinking or whether the impact was being caused by climate change, and why the NZTA proposed to widen the Northwestern Cycleway (when there is a perception that it is not well used). The Board also sought confirmation that there would be no loss of business within the Rosebank Peninsula, and whether the NZTA would contribute resources towards helping affected people find new homes;
- The Western Bays Community Board welcomed the proposal to improve stomwater treatment around Pollen and Traherne Islands, and sought clarification on the extent of the NZTA's maintenance boundaries. The Board also raised the need to address traffic concerns at the St Lukes and Te Atatu interchanges, and suggested providing for pedestrians on both sides of the St Lukes interchange and using the area within the Great North Road Interchange (eastbound on-ramp loop) as a stormwater pond;
- The Royal Forest and Bird Protection Society and Pollen Island Care Group expressed concern about potential impacts on the Motu Manawa (Pollen Island) Marine Reserve;
- The NZTA contacted Te Kawerau a Maki to seek feedback on the Project. Te Kawerau a Maki are currently preparing a Cultural Impact Assessment for the widening of SH16. This will be provided when it comes to hand;
- Ngati Whatua prepared a Cultural Impact Assessment for SH16 widening between Waterview and Westgate in December 2009. The report has informed this AEE;

- Rutherford College was primarily concerned with providing a safe pedestrian connection for students to cross the Te Atatu Interchange;
- The Te Atatu Boating Club outlined the need for the navigational channel underneath the Whau River to remain open during construction; and
- The Rosebank Kartsport Club was generally happy with the Project, and wanted to be kept in contact.

Meetings were also held with DoC, Massey Community Board, Henderson Community Board, Te Atatu Residents and Ratepayers, the Te Atatu Boating Club and TelstraClear.

Key issues raised by the wider public included:

- Impacts of property acquisition, including the creation of uncertainty with respect to future house sales;
- Potential impact on property values;
- Construction and operational noise;
- Disruptions to property access and perceived security/nuisance issues associated with the proposed McCormick Green accessway;
- Amenity impacts (including from light pollution);
- Effects on property enjoyment (for residents that would border the newly widened sections of motorway).

10.9.4.4 Response to Feedback

Response to feedback on the construction options

The Project team have made the following design changes to respond to issues raised in consultation:

- Development of an alternative access for Te Atatu Road residents affected by the Project (replacing the previously proposed McCormick Green accessway);
- Development of noise mitigation options in conjunction with affected residents;
- Navigational channel under Whau River to be kept clear and unobstructed during construction.

The Project team scoped the Technical Assessments and mitigation measures on the basis of feedback received. A detailed Social Impact Assessment of the Causeway widening Project was also commissioned, in order to understand the social issues associated with the Project and recommend measures to avoid or mitigate social impacts.

10.9.5 Proposal of National Significance: SH16-20 (2010)

10.9.5.1 Introduction and Purpose of Consultation

Consultation on the Project

The purpose of this consultation phase was to inform people of the NZTA's decision to join the SH20 and SH16 Projects as a single proposal of national significance, and to detail the design modifications made to the SH20 section of the Project following consultation feedback on the CST option in 2009. This phase of consultation sought feedback on the revised Project including on urban design concepts, mitigation options and concerns held by members of the community.

10.9.5.2 Consultation Methods

Method	Used	Detail
Project Website	✓	
Project Newsletter/Feedback Form	✓	Approximately 150 Expo Feedback Forms distributed
Media Releases and Advertisements	✓	
Stakeholder/Affected Party Meetings	✓	
Letters	✓	
Open Days	✓	Approximately 440 people attended 4 Project Expos held in 4 locations
Drop In Centres		
Seminars/Workshops	✓	
Telephone and Email Contact	✓	
Focus Groups		
In Depth Interviews	✓	
Public Meetings		

10.9.5.3 Consultation Feedback and Response to Feedback

The following provides a summary of involvement with key stakeholders, which builds on engagement with stakeholders in 2009 over the separate SH20 and SH16 Projects:

Council Consultation

- Ongoing meetings have been held with ARC, ACC (including the ACC Urban Design Panel) and WCC to discuss Project design and mitigation planning, urban design concepts, reserve reinstatement and other key issues;
- In July 2010 the ACC Transport Committee and Arts, Culture and Recreation Committee resolved that Council's submission on the Project will endorse a number of mitigation actions in the areas of open space, transport, and social and community. ACC supports the initiative of urban redevelopment on surplus NZTA land once the motorway is completed, and has recommended that this be presented

to the Auckland Council for consideration;

- The NZTA have presented to the ACC and WCC Community Boards regularly to discuss the Project and proposed mitigation, community concerns and other key issues;
- The NZTA has met regularly with the Auckland Kindergarten Association, Waterview Primary School and Ministry of Education to discuss Project and construction issues for Waterview Primary School and Kindergarten;
- The NZTA has met with DoC regarding impacts on the Motu Manawa (Pollen Island) Marine Reserve;
- Rutherford College has been contacted to discuss elements of the Project relevant to the school, in particular pedestrian crossing options at the Te Atatu interchange. The school is primarily concerned with providing a safe pedestrian connection for students (over the Te Atatu Interchange), and over traffic impacts, particularly during construction;
- Consultation with New Zealand Railways Corporation regarding the designation for the Avondale Southdown rail corridor has been ongoing through the Project design process;
- The NZTA has contacted Ngati Whatua and Te Kawerau a Maki to seek feedback on the combined Project, and to seek input/updates to Cultural Impact Assessments for the Project. At the time of writing this AEE comment was still pending;
- The NZTA has contacted Housing New Zealand (HNZ) regarding a proposed joint approach to reinstatement of social housing affected by the Project. HNZ has yet to confirm its ability to participate;
- The Point Chevalier Community Committee has expressed concern over the proposal to remove the right turn option from the westbound SH16 off-ramp at Great North Road Interchange;
- Consultation will be undertaken with the NZ Historic Places Trust following the completion of the draft Archaeological Assessment, in conjunction with the consultation required as part of the Historic Places Act 1993; and
- Consultation has been undertaken with Vector, Telecom, Watercare, Vodafone, TelstraClear and Metrowater to determine the location of utilities/infrastructure and to agree how impacts on utilities will be managed during construction and operation of the Project.

Community Expos to present information and gather feedback from residents

At Project Expos, members of the public were asked how they wanted to be kept informed through the construction period. The most common ways were through newsletters, the Project website, a community liaison group/local Board, email and media advertising. Texting, via elected representation and via focus groups were also suggested ideas. People wanted to be kept informed about the following:

- Construction timeframes, hours of operation and details of work being undertaken in each location (especially for particularly disruptive activities);

- Advance notice of road closures, details of alternative routes and clear signage of alternative routes;
- Progress of works;
- Likely effect of disturbances, noise impacts and disruptions to access/traffic;
- Details of compliance requirements (e.g. for noise);
- A contact person to call regarding construction/compliance issues; and
- Results of noise and air quality monitoring at local schools.

This feedback has been incorporated into the Construction Environmental Management Plan (CEMP) prepared for the Project.

Responses to consultation on the Project

Table 10.4 provides a summary of stakeholder and public issues relating to the current Project, and how these issues have been addressed in the AEE.

Table 10.4: Current Issues from Consultation

Issue	Design/Management Response	Relevant Sections of AEE
Concern over impacts on local schools (e.g. Waterview Primary School), particularly during construction.	Tunnel avoids many operational impacts on Waterview Primary School and Kindergarten (compared with a surface road) Construction impacts (including noise, vibration, air/dust and traffic/pedestrian impacts) will be managed by the CEMP prepared for the Project Where possible, haulage routes avoid local roads	• Sections 14.4, 18.4, 20.5 and 22.5 Assessment of Social Effects – Operation and Construction (Sectors 1, 5, 7 and 9); • Technical Report G.1 Assessment of Air Quality Effects (and associated Construction Air Quality Management Plan/Concrete Batching and Crushing Plant Management Plan); • Technical Report G.5 Assessment of Construction Noise Effects (and associated Construction Noise and Vibration Management Plan); • Technical Report G.13 Assessment of Ground Settlement Effects (and associated Settlement Effects Management Plan); • Technical Report G.16 Assessment of Temporary Traffic Effects (and associated Construction Traffic Management Plan); • Technical Report G.19 Assessment of Vibration Effects (and associated Construction Noise and Vibration Management Plan); and • Technical Report G.21Construction Environmental Management Plan.
Waterview Primary School and Kindergarten are concerned over a potential drop in roll numbers as a result of the Project (during construction and once operational).	Monitoring of roll numbers as part of the Social Impact Assessment, with management measures to be agreed between the NZTA, Ministry of Education, Waterview Primary School and Waterview Kindergarten should roll numbers drop further as a result of the Project	• Section 20.5: Assessment of Social Effects – Operation and Construction (Sector 7).
Concern that the ventilation stacks could cause health impacts for neighbouring residents and school students	Ventilation stack designed to disperse emissions and meet the National Environmental Standard for Ambient Air Quality	• Sections 20.13 and 22.15: Assessment of Air Quality Effects – Operation (Sectors 7 and 9); and • Sections 20.5 and 22.5: Assessment of Social Effects – Operation (Sectors 7 and 9).
Mixed feedback over the proposal to remove the right turn option from the westbound SH16 off-ramp at Great North Road Interchange – some residents stated the option should remain (being widely used and the most convenient option), while others did not see any issues with the proposed ban	The right turn option has been retained in the Project design	• n/a.

Issue	Design/Management Response	Relevant Sections of AEE
General support for closing the existing underpass at the Te Atatu Interchange and replacing it with a safer, better designed underpass and/or overbridge. Grade separated options were generally preferred for pedestrian safety reasons	Improved underpass facility at Te Atatu Interchange, in addition to the proposed at grade pedestrian crossings	• n/a.
Concern over loss of homes	Reduction in the number of full properties required from 365 to approximately 132	• Sections 14.4, 18.4, 19.4, 20.5 and 22.5 Assessment of Social Effects – Operation and Construction (Sectors 1, 5, 6, 7 and 9).
Concern that the community has not been consulted enough on the Project and development of mitigation options, and should be informed about the legal/consenting process and further consultation opportunities	Further consultation to be undertaken following the lodgement of statutory approvals	• Section 10.10 (this Chapter).
That Waterview/Point Chevalier residents should have access to the new tunnel via the Great North Road Interchange	Access not possible due to a variety of constraints including space physical/geometric limitations, safety/design reasons, the need to minimise impacts on Oakley Creek, traffic reasons and cost	• n/a.
Concern over loss of local, accessible open space, and the importance of appropriate landscaping/reserve replacement, including the convenient location of replacement open space for affected residents and inclusion of facilities for children/teenagers Support for some form of open space mitigation at Waterview Reserve (recognising the local community function that the park currently serves)	Reserve reinstatement measures to be implemented at Waterview Reserve rather than enhancement works at other reserves in the vicinity. Revised configuration of stormwater ponds and sportsfields in Alan Wood Reserve to enable better sportsfield configuration All existing facilities to be replaced in both reserves23	• Sections 14.2, 18.2, 19.2, 20.2 and 22.2: Assessment of Land Use Effects – Operation and Construction (Sectors 1, 5, 6, 7 and 9); and • Sections 14.4, 18.4, 19.4, 20.5 and 22.5 Assessment of Social Effects – Operation and Construction (Sectors 1, 5, 6, 7 and 9).

[23] Except the disused netball/tennis court in Waterview Reserve

Issue	Design/Management Response	Relevant Sections of AEE
Construction issues (including impacts associated with noise, vibration, dust, traffic disruption/safety and impacts on pedestrian/cycle access) Construction disruption was highlighted as a particular concern for sensitive residents (e.g. children and the elderly), and given the long construction duration Concern over access to facilities including recreation during construction	Construction impacts (including noise, vibration, air/dust and traffic/pedestrian impacts) will be managed by the CEMP prepared for the Project Where possible construction yards have in the first instance been located as far as possible from sensitive land uses, particularly residential areas. Where this has not been possible, buffer areas have been proposed within the construction yards to minimise adverse effects from such things as light spill and hazardous facilities. Where possible, construction yards are located away from sensitive sites and haulage routes avoid local roads	• Chapters 14 and 18-22: Assessment of Environmental Effects - Operation and Construction (Sectors 1 and 5-9); • Technical Report G.21Construction Environmental Management Plan; • Technical Report G.1 Assessment of Air Quality Effects (and associated Construction Air Quality Management Plan/Concrete Batching and Crushing Plant Management Plan); • Technical Reports G.5 Assessment of Construction Noise Effects and G.19 Assessment of Vibration Effects (and associated Construction Noise and Vibration Management Plan); • Technical Report G.16 Assessment of Temporary Traffic Effects (and associated Construction Traffic Management Plan); • Technical Report G.13 Assessment of Ground Settlement Effects (and associated Settlement Effects Management Plan); • Technical Report G.9 Assessment of Land and Groundwater Contamination Effects (and associated Contaminated Soil Management Plan); • Technical Reports G.3 Assessment of Avian Ecological Effects, G.6 Assessment of Freshwater Ecological Effects, G.8 Assessment of Herpetofanua Ecological Effects, G.11 Assessment of Marine Ecological Effects and G.17 Assessment of Terrestrial Vegetation Effects (and associated Ecological Management Plan); • Technical Report G.15 Assessment of Stormwater and Streamworks Effects (and associated Temporary Stormwater Management Plan); • Technical Report G.7 Assessment of Groundwater Effects (and associated Groundwater Management Plan); • Technical Report G.22 Erosion and Sediment Control Plan; and • Technical Report G.2 Assessment of Archaeological Effects (and associated Archaeological Site Management Plan).
Issues associated with the cycle way design, including lighting/security considerations, width, grade separation, alternative proposed routes and the continuation of the cycle way between Great North Road and Blockhouse Bay Road	Cycle way designed in accordance with all relevant standards The cycle way between Great North Road and Blockhouse Bay Road is outside of the scope of the Project	• n/a.
Concern over potential impacts on property values	• n/a (outside scope of the RMA)	

Issue	Design/Management Response	Relevant Sections of AEE
Visual impacts of noise barriers, ramps and other structures	Development of noise mitigation designs based on the views of affected residents Visual/urban design treatment incorporated in Project design to a) reduce visual intrusiveness, and b) where this is not possible, make a positive design contribution	• Sections 14.6, 15.1, 16.5, 17.5, 18.7, 19.6, 20.7 and 22.7: Assessment of Landscape and Visual Effects – Operation (Sectors 1–7 and 9).
Good management of graffiti	Graffiti will be managed by the Auckland Motorway Alliance Environmental Management Plan	• n/a.
Mixed feedback regarding pedestrian/cycle bridges and noise barrier concepts – many respondents liked the bold designs while some preferred a more subtle design (in terms of colour and scale)	Most urban design elements retained in their existing design	• Sections 14.6, 15.1, 16.5, 17.5, 18.7, 19.6, 20.7 and 22.7: Assessment of Landscape and Visual Effects – Operation (Sectors 1–7 and 9).
Mixed feedback regarding the ventilation stack concepts – some respondents liked the modern design, while others did not think the stack should be a 'feature'	Most urban design elements retained in their existing design	• Sections 14.6, 15.1, 16.5, 17.5, 18.7, 19.6, 20.7 and 22.7: Assessment of Landscape and Visual Effects – Operation (Sectors 1–7 and 9).
Exacerbation of severance between Waterview and Point Chevalier That additional walking/cycling bridges should be provided (for example, from Waterview–Point Chevalier/Waterview–Unitec)	Further pedestrian/cycle bridge across SH16 not provided as part of the Project Existing connectivity and cross–motorway routes (pedestrian, cycle and vehicle) to be maintained	• Technical Report G.14 Assessment of Social Effects; and • Technical Report G.18 Assessment of Transport Effects.
Some people expressed concern over traffic impacts, while others believed that local traffic would improve following the completion of the Project	Technical Report G.18 Assessment of Transport Effects shows that traffic on local roads will generally reduce once the Project is operational	• Sections 13.2, 14.3, 15.3, 17.3, 18.3, 19.3, 20.3 and 22.3: Assessment of Transport Effects – Operation (Regional Assessment and Sectors 1–7 and 9); • Technical Report G.16 Assessment of Temporary Traffic Effects (and associated Construction Traffic Management Plan); and • Technical Report G.21Construction Environmental Management Plan.

Issue	Design/Management Response	Relevant Sections of AEE
Environmental impacts, including those associated with the realignment of Oakley Creek and impacts on the Motu Manawa (Pollen Island) Marine Reserve	Rehabilitation of areas of Oakley Creek as a design/mitigation response. Footprint in CMA/Marine Reserve minimised as far as practicable	• Chapters 13-22: Assessment of Environmental Effects – Operation and Construction (Regional Assessment and Sectors 1-9); • Technical Report G.15 Assessment of Stormwater and Streamworks Effects (and associated Operational Stormwater Management Plan); • Technical Report G.21Construction Environmental Management Plan; • Technical Reports G.3 Assessment of Avian Ecological Effects, G.6 Assessment of Freshwater Ecological Effects, G.8 Assessment of Herpetofanua Ecological Effects, G.11 Assessment of Marine Ecological Effects and G.17 Assessment of Terrestrial Vegetation Effects (and associated Ecological Management Plan); • Technical Report G.9 Assessment of Land and Groundwater Contamination Effects (and associated Contaminated Soil Management Plan); • Technical Report G.15 Assessment of Stormwater and Streamworks Effects (and associated Temporary Stormwater Management Plan); • Technical Report G.7 Assessment of Groundwater Effects (and associated Groundwater Management Plan); and • Technical Report G.22 Erosion and Sediment Control Plan.
Concern that the stormwater ponds could smell and attract mosquitoes	Stormwater ponds will be maintained in accordance with the Auckland Motorway Alliance Environmental Management Plan	• Technical Report G.14 Assessment of Social Effects.
That public transport should be prioritised over motorways	n/a – this decision was made at earlier stages of the Project investigation	• Chapter 11: Assessment of Alternatives.
The future Avondale Southdown rail line should be enabled	The Project does not preclude the future Avondale Southdown rail line, and provides the physical space for the rail line to be established in the future	• n/a.
New national consenting process excludes community input	NZTA is working with EPA to facilitate community involvement during this process	• n/a

10.10 Further Consultation

Ongoing Consultation

Further consultation will be undertaken in late 2010, following the lodgement of applications for statutory approvals under the RMA. In particular, this consultation will seek targeted feedback regarding the design changes made following the Project Expos in 2010.

10.11 Consultation Conclusions

The consultation meets the requirements of RMA, LTMA and the NZTA consultation objectives

From the consultation undertaken for the SH16 section of the Project, the SH20 section of the Project and the combined SH16-20 Project, the following conclusions have been drawn:

- Consultation undertaken has kept stakeholders and the community informed of the Project as it has developed;
    - There are a diverse range of views on the Project given its scale and location within an existing urban environment;
    - Stakeholders and the community have had an opportunity to provide feedback on community values, route option development, the final construction form and mitigation measures. The NZTA has considered and responded to issues and concerns that have been identified;
    - Consultation has recognised and utilised community knowledge and resources in the identification of AEE matters to consider;
    - Consultation has identified a number of alternative alignment and construction options and methods which have been considered by the Project team;
    - Consultation feedback has been taken into account in decision making throughout the process; and
    - The NZTA has considered and responded to issues and concerns raised during the consultation process and reported these in publicly released documents.

Overall, the consultation undertaken is considered to have met the requirements of the RMA (and the LTMA and NZTA consultation objectives).

11. Assessment of Alternatives

Overview

The Resource Management Act 1991 requires an applicant to have adequate consideration to alternative sites, routes and methods of undertaking the work, when lodging a notice of requirement and to alternative methods and locations when applying for resource consents. This chapter provides a discussion on the alternatives that have been considered in the investigation of the Waterview Connection Project.

Since 2000 there has been extensive consideration of alternatives for the Project, including corridors, routes and alignment options for various elements of the Project. These alternatives have been cognisant of the existing built environment (particularly the existing SH16 corridor (Northwestern Motorway) and the termination of SH20 at the Maioro Interchange in Mt Roskill.

The process of assessment has included information obtained through desk top studies, field work, consultation (both with stakeholders and the community) and detailed site investigations. The assessment of alternatives demonstrates that the NZTA has considered:

- Alternative routes and corridors (as appropriate and including integration of transport modes);
- Alternative alignments and interchanges / connections to the transport network;
- Alternative forms for the alignment, including construction methods and designs and alternative measures to avoid, remedy and mitigate the identified adverse effects; and
- Alternative methods to achieve the purpose of the designation (designations vs consents, etc).

The assessment of alternatives has been an iterative process refining the extent of investigation and increasing the technical detail in this assessment as we have gone through. The assessment process has assisted the NZTA to confirm a preferred route, alignment construction methodology and design for the Project. These assessments have been undertaken through the use of a number of evaluation processes and frameworks that have had regard to Part 2 of the RMA, objectives of the Project and national policy directives. This process has been thorough and robust in terms of the requirements of Sections 171 and 181 and Schedule 4 of the RMA.

11.1 Outline of Assessment of Alternatives Process

Section 171(1)(b) of the RMA requires the consenting authority when considering a Notice of Requirement (NoR) to have particular regard to whether adequate consideration has been given to alternative sites, routes and methods of undertaking the public work (in cases where the requiring authority does not have an interest in the land for the work or where it is likely the work will have a significant adverse effect on the environment). Section 181(2) also requires an assessment of alternatives when considering alterations to designations.

S171 of the RMA requires an assessment of alternatives as part of an NOR application

The RMA requires an assessment of alternatives as part of the AEE for consents

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

- Where it is likely that an activity will result in any significant adverse effect on the environment (subclause b); and
- Where the activity includes the discharge of any contaminant, a description of any possible alternative methods of discharge, including discharge into any other receiving environment (subclause f).

Since 2000 the NZTA has undertaken significant route evaluation and option assessment for the Project. For the extension of SH20 between Mt Roskill and SH16, this option evaluation has been undertaken since commencing the Investigation and Reporting project in 2000. For the SH16 elements of the Project, the assessment of options has been undertaken since 2006.

The assessment of alternatives has been made available to stakeholders and the community over the last 9 years as documented in Section 10. Consultation of this AEE has assisted the NZTA in confirming its option for the Project as presented in the Project Description (Chapters 4 and 5).

There are a number of matters that are relevant and have been incorporated in the assessment of options for the Project. In summary, these are:

- The NZTA's strategic objectives and statutory obligations (as defined in the LTMA and Statement of Intent), including the 'affordability' and cost efficiency of options (Chapter 3);
- The objectives for the Project (Chapter 3);
- The Resource Management Act and in particular the matters of Part II of the Act (Chapter 6); and
- The input from stakeholders and the community (Chapter 10).

The assessment process applied to this Project has focused on identifying the most appropriate corridor, route, alignment and construction method or option for the Project. The assessment process is summarised in Figure 9.1 – Investigation Process Summary within Chapter 9 – Investigation Process.

Iterative assessment of alternatives

The assessment process has started from a broad scale level of assessment and systematically narrowed the geographic area of assessment to identification of corridors, routes, alignments and construction methods. This process included at the outset a constraints mapping process, which recognised the existing natural and built environment. For example, given the significant existing physical resource of SH16 (Northwestern Motorway), the assessment of alternatives for the SH16 elements of the Project focussed on the existing route (and therefore on alignment and construction options only).

In tandem with the iterative and more detailed assessment of 'options' particularly for the SH20 Waterview section the inputs to the assessment process have increased in design and technical detail. Initial assessment was based primarily on desk top studies and preliminary consultation, while subsequent option assessments have supplemented this with more detailed field investigations and targeted stakeholder and community consultation (e.g. community focus groups). In assessment of options for the final design, the assessment has included (where appropriate) traffic modelling to more accurately and comparatively assess the options.

This assessment process has provided information sufficient for the NZTA to confirm a single preferred alignment and construction options which form the basis of the Project as described in Part A (Chapters 4 and 5) of the AEE and are the subject of the Notices of Requirement and resource consent applications.

The remainder of this section describes key steps in the alternatives assessment process and the outcomes of each phase of this assessment1. Further detail on the assessment of construction and design options is provided in the AEE Technical Reports (Part G). This detail is provided where the alternatives have been considered to address specific or potential environmental effects associated with the Project and particular, this relates to the assessment of mitigation design options.

Construction and design options are also assessed in in Part G of this AEE

In summary, the remainder of this Chapter describes the following:

- Corridor Assessment;
- Route Option Assessment (for SH20);
- Project Design Assessment (alignment and construction design); and
- Project Design Assessment (mitigation design).

11.2 Corridor Assessment

In the confirming investigation and reporting phases of any project, the NZTA (with other land transport stakeholders) first confirms the feasibility of and likely corridors for route option assessments. These assessments consider the wider national and regional transportation system, land use integration and relevant national and regional strategies, for example the Auckland Regional Land Transport Strategy 2010 is relevant to the Project.

[1] Some steps of assessment are only relevant to particular sectors of the project and this is reflected in the summary.

11.2.1.1 The Regional Land Transport Strategy 2010

The ARLTS confirmed completion of the Western Ring Route as part of the region's strategic land transport solution

The 2010 Auckland Regional Land Transport Strategy (ARLTS) sets the direction for the region's transport system for the next 30 years. It has been prepared so that the transport network supports the greater Auckland vision regarding society, economy and the environment (as defined in the Regional Growth Strategy and relevant Long Term Council Community Plans). The ARLTS identifies and confirms the need for completion of the Western Ring Route as a priority roading project for the region's transport network and the preferred strategic option for the region assumes upgrading of SH16 (see Section 3.4.1 of the AEE). The ARLTS is prepared by the Regional Transport Committee which includes representatives of local government, land transport providers, economic development, cultural and environmental representatives, public health and others)[2].

In developing the ARLTS, the regional land transport stakeholders have considered options for the transport network. Of relevance to the assessment of alternatives, a Technical Advisory Committee was established for the preparation of the ARLTS. This Advisory Committee led the development of a number of technical working papers, many of which addressed consideration of transport (and non-network transport policy) options (including health impacts, evaluation of strategic options and evaluation of network and non-network policy options). The Advisory Committee included representatives from the territorial authorities of Auckland, as well as government agencies including the NZTA, ARTA, Ministry of Transport and the Regional Public Health Service.

The regional land transport stakeholders involved in developing the ARLTS include 'RLTS Partners' of over 300 individuals and organisations who were given the opportunity to provide early feedback in the development of the strategy (see section 1.5 of the ARLTS for further detail on these stakeholders).

In developing the ARLTS consideration was given to alternative options for the regions land transport network

The ARLTS sets out strategies and policies for the regional land transport network over the next 30 years. In the Strategic Priorities (section 4.1) the ARLTS acknowledges there is a need for additional roading capacity in some situations. In particular, the policies recognise that additional road capacity will be focussed on improving access to economic activity, supporting land use intensification and providing connectivity.

Of relevance to this Project, these Policy 6 states that the region will '*Selectively increase the capacity of the road network where alternative management options are not sufficient to address growth in travel demand*'. Furthermore, Policy 6.2 identifies that the regional land transport providers will '*Undertake a programme to develop the roading network to give effect to the preferred strategic option, including completion of the strategic road network as identified in Map 4*'. (Under section 6.2.1 of the ARLTS, this includes implementation of the road network improvements of high regional significance one of which is the Western Ring Route).

[2] See page 1 of the ARLTS 2010-2040, for a full list of the Land Transport Committee.

11.3 SH20 Route Option Assessment (Sectors 5, 7, 8 & 9)

When the Project commenced in 2000, the assessment of alternatives included a phase for corridor and route assessment. The following provides a summary of this assessment for the SH20 elements of the Project. This assessment was undertaken from 2000 through to its finalisation of a preferred route option in 2006.

There has been extensive assessment of route options for the SH20 component of the project

There were three main stages of this phase of option assessment:

- Base mapping and constraints;
- Generation of a long-list of route options and assessment; and
- Assessment of the short-list of route options.

11.3.1 Base Information – Constraints Analysis

This phase included development of a Digital Terrain Model, constraints analysis and generation of a long list of route options. The long list included development of a "do minimum" option using the existing road network between the Maioro Interchange and Rosebank Road.

Constraints mapping recognises the existing built and natural environment

The constraints mapping included desktop analysis, examination of the existing environment and consultation with the community to identify sites and areas of 'environmental' significance (including social and cultural value). The following data layers were compiled in the constraints analysis:

- **Topography and** Geology - physical constraints and opportunities in the Study Area, including areas of faults and mapped instability hazards.
- **Land Uses** - property information, zoning and existing land uses and designations.
- **Transport networks** - roading and other transport modes (both existing and planned).
- **Ecology** - vegetation (terrestrial and aquatic), avifauna, fish and aquatic fauna.
- **Landscape** – identified landscape and visual amenity areas, view shafts and other key visual catchments.
- **Archaeology** – sites and areas of archaeological interest (e.g. sites registered with the New Zealand Historic Places Trust).
- **Population** – population distribution, dwellings and growth projections.
- **Sites of Social Value** - resources, sites, trees, schools and other locations were identified as areas of perceived high value by the community.

This constraints map was used as the basis for generating and assessing the corridor options.

11.3.2 Assessment of the SH20 Long List of Route Options

The Route Option Assessment for SH20 was undertaken in 2001 – 2003

This phase included assessment of route options, including the 'do-minimum' (local upgrading options) and new routes. Route option development sought to avoid sensitive sites and potential adverse impacts identified in the constraints mapping. Preliminary assessment including consideration of traffic performance, construction, economic performance and environmental impacts (Part 2 of the RMA). The outcome of this assessment was a conclusion on the recommended short-list of route options. This initial assessment also included a corridor strategy on the likely timing strategy for construction of the routes.

The following provides an overview of this assessment process, which was documented at the conclusion of this phase, in the *Preliminary Scheme Assessment Report*, 2002 (the 'PSAR').

An initial process of option generation was undertaken. This included review of the initial corridors identified and input from the community. From this process 20 general route options were identified. These options were then screened using environmental threshold criteria based on the Project objectives and Part 2 of the RMA, with the constraints map a key information source. The outcome of the initial screening was a "Revised Long List" of 12 routes which were considered to warrant further specific investigation.

The 12 routes connected to SH16 at either Rosebank Road (referred to as the 'AR options') or the Waterview interchange (referred to as the 'AW options'). These options are depicted on Figures 11.1 and 11.2. The route option assessment included option "AR6" (shown in Figure 11.1), which was a "do minimum" option (a connection via the local road using Rosebank Road/Blockhouse Bay Road, and connecting to SH16 at the Rosebank / Patiki Road Interchange). The route options were developed and assessed on the basis of a range of different construction options and interchanges. Construction alternatives considered included both surface and below ground construction. To maintain the opportunity for connectivity to the local road network, the preliminary design of the route options included an assessment of connections and interchanges to confirm that intersections were feasible (local connections at Maioro Road, New North Road, Great North Road, Ash Street, and Honan/Mead Streets were identified, depending on the options).

The 12 "Revised Long List" of routes was then subject to a more detailed option assessment. This included technical investigations into construction alternatives, connections and interchanges and environmental assessment. Again, these criteria for option assessment were identified on the basis of the Project objectives and relevant statutory matters, particularly Part 2 of the RMA.

The PSAR summarises the route option assessment

Technical and environmental investigations were used to assess the "Revised Long List" and to identify and recommend a shortlist of routes. A recommended short-list of route options was identified including options: AR1, AR3, AW1 and AW4 (see Figure 11.3). Table 11.1 summarises the comparative performance of the options as documented in the PSAR.

11.3.3 Assessment of the SH20 Short-list of Route Options

Assessment of the short-list of route options reported 2003

Following confirmation of the short-list of route option, a more detailed assessment was undertaken. The purpose of this assessment was to identify a technically preferred route option to assist the NZTA in identifying a preferred route for alignment development and assessment. This assessment process was documented in the Route Options Assessment Report, 2003.

11.3.3.1 Technical Ranking of Route Options

An iterative assessment process reduced the route options being considered

The initial assessment in this phase included the ranking of the options by the technical (design and environmental) project teams. This included the following:

- **Option Development** – This involved development of feasible alignment and interchange options within the route options being considered (including development of construction alternatives and various connections to the local road network). The principle behind the development of these options was to identify a 'corridor or envelope', by which the various route options could be assessed and compared.
- **Phase I Review** – On the basis of existing environmental information (from the Preliminary Scheme Assessment Report phase of investigations) and technical standards, an initial review was undertaken and refinement made to alignment designs and route options. For example, opportunities to avoid potentially adverse environmental effects were identified and designs modified to respond to these where possible.
- **Assessment** – Following the refinement and confirmation of the 'route option' designs, environmental and technical assessment was undertaken. This assessment included identification and evaluation of the options against environmental and technical criteria (including physical, natural, built and social environment criteria and consideration of overall consenting issues and cost, design, efficiency, constructability, safety and construction programme criteria).
- **Ranking** – Following the environmental and technical assessment, the designs and therefore 'route options' were ranked on the basis of the various criteria developed;

The outcome of this work was a technical options ranking paper that recommended the short-list be further refined to two options: AR1 and AW1. This process was reported in a Technical Option Ranking Paper in May 2003.

Figure 11.1 'AR Route Options': Routes from SH20 (Maioro Street Interchange) to the Rosebank / Patiki Interchange

Figure 11.2 'AW Route Options: Routes from SH20 (Maioro Street Interchange) to the Great North Road Interchange

Figure 11.3 'Short-list' of Route Options

Table 11.1 Summary of Environmental Assessment of Route Options

Assessment Criteria	BEST → WORST						
Relative Traffic Performace	AR4 AR7 AR2	AR1 AR3 AR5	AW1 AW2 AW3 AW4	AW5	AR6		
Connection Flexibility [2]	AR6	AR1	AR3 AR7 AW1	AW2	AR2 AR4 AR5	AW3 AW4	AW5
Ease of future AWHC Connections [3]	AW1 AW3	AW4 AW5	AW2	AR1	AR3	AR6 AR7	AR2 AR4 AR5
Staging [4]	AR6	AR1	AR7 AW1 AW2	AR3	AW3 AW4	AR2	AR4 AR5 AW5
Staging for AWHC Connection	AR1	AR3	AR6 AR7	AR2 AW1 AW2 AW3 AW4 AW5	AR4 AR5		
Potential Physical Environmental Impacts [5]	AR6	AR7	AR2 AR3	AW4 AW5	AR1 AW1 AW3	AR5	
Potential Social Environmental Impacts [5]	AR1	AW1	AW2	AW4	AW3 AR3	AR6	AR4 AR5	AR7	AR2 AW5
Staging for AWHC Connection [6]	AR6	AW1 AW2 AW3 AW4	AR1 AR3 AW5	AR2 AR4 AR5 AR7			

[1] Based on 2011 traffic with and without the Whau Crossing
[2] Potential for two or more intermediate connections
[3] Potential to provide a connection to the Additional Waitemata Harbour Crossing
[4] Potential for staged construction
[5] Includes groundwater, archaeological, ecological and landscape/visual impacts; considerations have included potential mitigation including tunnelling
[6] Includes severance, loss of sites of significance to the community and impact on sites of value to tangata whenua / other spiritual sites
[7] Construction cost and land cost (assuming land purchase also required for tunnels)

11.3.3.2 AW1 and AR1 Route Option Assessment

The revised shortlist (AW1 and AR1) was the subject of further technical, environmental and consultation investigations. The findings of this assessment were documented in the *Draft Options Scheme Assessment and Assessment of Environmental Effects Report* which was released for stakeholders and the community to review and comment in 2003. The report included the identification of a technically preferred option: AW1. Table 11.2 summarises the assessment of the route options AW1 and AR1 against the assessment criteria.

Table 11.2 Summary of Options Assessment (AW1 and AR1)

Assessment Criteria	Route Preference	Reasons for Preference
Traffic performance	Marginal preference for AR1	• AR1 generates slightly greater road user benefits; • AR1 provides a slightly better overall reduction of delays in the network; • AR1 attracts marginally more travel from the local road network; • AW1 has significantly more traffic on SH16 between Waterview and Patiki;
Potential Physical Environmental impacts	AW1	• AR1 has a larger overall footprint and therefore has a greater extent of physical impacts; • AR1 route options and associated works would be likely to damage and / or destroy a number or archaeological sites;
Potential Human Environmental impacts	AW1	• AR1 route options have the potential to significantly impact on heavy industry and moderate to heavy industry; • AR1 would require more noise mitigation than AW1; • AR1 route is considered to have greater adverse social impacts than AW1;
Constructability	AW1	• AR1 has potential construction issues associated with significant depth to bedrock along the coastal edge of the peninsula; • The varying topography along the edge of Oakley Creek poses potential construction issues for both routes; • Both routes have construction issues associated with basalt and groundwater;
Economic Analysis	AW1	• The additional cost of the AR1 options is not economically justified by the additional road user benefits.

The investigation and reporting phase of the Project was put on hold between 2003 and 2005 to enable a review of the Project against the requirements of the Land Transport Management Act (LTMA). The findings of this assessment were presented in the *SH20 Avondale Extension: Project Update Report,* 2006. This provided a summary of the results of the review and concluded that the assessment process was appropriate.

Due to the lengthy period involved in finalisation of the documentation on the route option assessment, the revised Options Report was prepared as a draft for consultation with key stakeholders. In addition, a multidisciplinary review was undertaken of the assessment framework, investigation components and conclusions. The release of the *Final Options Assessment Report* (renamed the *Final Route Options Report*) in 2006 was the last stage in the process of confirming the preferred route for SH20: AW1.

11.3.3.3 The Preferred Route Option for SH20

The AW1 route was the preferred option

While either of the short-listed routes (being AR1 or AW1), was considered to contribute to completion of the Western Ring Route and to provide a high standard strategic connection to SH16, the outcome of the assessment concluded that a connection between SH20 at Maioro Street Interchange and SH16 at the Great North Road Interchange (the AW1 Route Option) was preferred for the following reasons:

- To provide long term inter-motorway connectivity there was a strategic benefit for the SH20 corridor to connect eastbound on SH16 towards the city centre. The impacts (both cost and environmental) were considered less for the AW1 option compared to AR1;
- AW1 had a smaller overall footprint and therefore has a lesser area of impact, posed less construction and physical impacts.
- AW1 had less potential for adverse effects on:
    - The Coastal Marine Area (CMA), including areas identified in the Auckland Regional Plan as CPA1 (the highest protection area) and the gazetted Motu Manawa (Pollen Island) Marine Reserve;
    - Open space areas; and
    - Economically significant business zoned land, prime industrial land (Rosebank Peninsula);
- AW1 was also considered to pose less risk associated with overall consenting, due to the reduced direct impacts on the CMA; and
- The economic analysis indicated that the cost estimates for AW1 options were approximately 30% less than AR1 options and that AW1 options therefore also had higher benefit to cost ratios.

11.3.3.4 Tolling

Consultation in 2006 lead to the outcome that the route would not be tolled

In October 2006, the NZTA also undertook consultation on an option to toll the Western Ring Route to contribute revenue for funding of the SH20 elements of the Project. The outcome of this consultation was that the route would not be tolled.

11.4 Assessment of Alignment Options

This phase of investigation related to the development and identification of the preferred construction option for projects within the Western Ring Route: being the SH16 Causeway Widening and the SH20 Waterview Connection projects.

Over the course of this assessment, the two projects were separate so these assessments are discussed in turn.

11.4.1 Assessment SH16 Alignment

11.4.1.1 2007 Assessment

The investigation of options to establish the necessary footprint for the upgrade of SH16 was initiated in 2007 as a stand-alone highway upgrade project. The project was aimed at improving the transport function of the section between the Waterview and Royal Road Interchanges, future-proofing the existing causeway section against settlement and sea level rise and supporting the WRR strategy to provide an alternative to SH1 through Greater Auckland.

The necessary corridor improvements to establish the required footprint for the Waterview to Te Atatu section of this project were assessed as including the provision of 4 eastbound and westbound traffic lanes, 2 bus shoulders, an upgraded pedestrian/cycle way, together with median shoulders service berms and barriers.

11.4.1.2 2008 Managed Priority Lane Assessment

2008 investigations considered spatial requirements for a Managed Priority Lane and for freight and high occupancy vehicles

In 2008 investigations were initiated into the provision of a Managed Priority Lane (MPL) connection to the WRR Waterview Interchange and extended westwards up to the Royal Road Interchange. Initially consideration in this investigation was given to providing a dedicated priority lane for freight vehicles. Further investigation showed that there was insufficient demand for a dedicated priority lane for freight vehicles only and the study was broadened to consideration of the spatial requirements for an MPL to accommodate freight and/or High Occupancy Vehicles (HOVs).

The study initially generated a long list of 15 potential mainline and intersection arrangements. This list was refined to 5 options that were the subject of detailed investigation. These were:

- Option 1 – Two lane MPL with connections to:
    - Waterview Interchange.
    - Rosebank Road.
    - Patiki Road.
    - Te Atatu Road (east facing ramps only).
    - Lincoln Road,

    With access to all interchanges via at-grade “gates”.

- Option 2 – Two lane MPL with connections to:
  - Waterview Interchange.
  - Rosebank Road
  - Patiki Road
  - Lincoln Road

  With access to all interchanges via at-grade "gates".
- Option 3 – Two lane MPL with connections to:
  - SH 20 Waterview Interchange (at grade).
  - Rosebank Road (at grade).
  - Patiki Road (at grade),
  - Te Atatu Road (east facing grade separated ramps)
  - Lincoln Road (grade-separated ramps)
- Option 4 – Two lane MPL with connections to:
  - SH20 Waterview Interchange (at grade).
  - Rosebank Road and Patiki Road (through mid-block grade separated ramps.
  - Lincoln Road via mid-block grade separated ramps.
- Option 5 - A Reversible priority lane from the St Lukes off-ramp with potential connections via at-grade gates at the SH20 Waterview interchange, Rosebank Road. Patiki Road Te Atatu and Lincoln Road.

These investigations included a traffic assessment of options, the development of engineering concepts and a comparison of land and environmental impacts of the footprint required for each alternative.

The Reversible Priority Lane option was discounted as traffic modelling showed that the existing tidal flow characteristic of traffic on SH16 would dissipate in the future and because this option created operational and safety issues at access and egress points.

Option 3 was selected as a preferred Option

The investigation of other options concluded that while the options with at-grade access into and out of the priority lane at intersections were the most cost-effective, there were no overall journey time savings for priority vehicles because of the significant amounts of merging, weaving and general delays that would be a consequence.

Option 3 was selected as the preferred option for the following reasons:

- Grade separated ramp access at Te Atatu (east facing ramps) provided an efficient connection would attract increased use from HOV and freight vehicles;

- Substantial travel time savings could be achieved for HOV vehicles between the Waterview Interchange and Te Atatu;
- This option provided the greatest value for money outcome; and
- Land take and environmental effects were no greater than the other options considered.

Accordingly Option 3 was selected as the preferred option. It was also considered that this option provided a footprint which could accommodate a range of alternative transport solutions into the future.

11.4.2 Assessment SH20 Alignment

11.4.2.1 2006 Assessment

An initial alignment option was presented in 2006

The assessment process for alignment options on SH20 has included a number of stages of assessment. An initial alignment option for the AW1 route (later referred to as a Partial Cover or 'base option' alignment) was developed and released to the public and stakeholders for comment in March 2006. The alignment included potential sections of 'cut and cover' tunnelling through Owairaka and Mt Albert (approximately 1.2km in length) and along the Waterview straight beside Oakley Creek (approximately 120m in length). Interchanges (with on and off ramps in both directions) were proposed at Maioro Street, Great North Road (south of the intersection with Blockhouse Bay Road) and with SH16 at the Great North Road Interchange.

In May 2006, NZTA announced that, having reviewed community and stakeholder comment, it would delay the lodgement of the Notices of Requirement to enable further design and investigation of the draft alignment and interchanges.

In September 2006 NZTA announced it would also look at different construction options for further undergrounding. The options developed included an option combining open road and cut-cover sections, an option with extended cut and cover tunnelling and a driven tunnel (the 'Driven Tunnel Option'). These construction options were the subject of technical and environmental assessments between 2006 and 2007.

Further alignment options were developed in 2006

In developing alternative construction options, particularly the Driven Tunnel Option, further consideration was given to appropriate alignments (though all within the general AW1 route). This was largely in recognition that the environmental and technical constraints for driven tunnelling construction option were different from the 'cut-cover' construction alignments that had been developed within the AW1 route option up to that time.

11.4.2.2 Comparing Construction Options 2007/2008

Evaluation criteria were based on the NZTA's objectives and RMA matters

In 2007 an evaluation framework was developed to consider the above construction options. The framework had regard to the Project objectives, strategic objectives of NZTA (at the time of the evaluation, Transit NZ), statutory obligations and practices (including Part 2 matters of the RMA). The evaluation built on previous option evaluations undertaken on previous phases of the Project. In particular, this included an update to reflect the introduction of the LTMA in 2003, the shift in Project focus since 2006, from 'route' options to 'alignment options', and the release in 2007 of the Ministerial Advisory Group report on major roading project costs.

- In total, six evaluation criteria were developed for the evaluation:
- **Cost** - construction cost, property cost, operation cost (whole of life and average annual cost) and incremental net present value;
- **Traffic Effectiveness** - traffic benefits, accident savings, security of transport system, integration with other transport modes, improvements to access and mobility and the contribution to the WRR;
- **Physical Environmental Impacts** - land stability / geotechnical stability, sites/areas of geological interest (e.g. basalt flows); coastal marine area and receiving environment; groundwater; natural habitats and fauna (coastal, terrestrial and streams), coastal processes as they contribute to natural character of coastal environment; landscapes; and contaminated sites;
- **Social Environmental Impacts** - sites of cultural significance, community linkages and connectivity, population impacts / displacement, health and wellbeing, community services and facilities, recreation and reserve areas, urban amenity and business and economic opportunities;
- **Timeliness** - RMA process timeframes and construction programme; and
- **Sustainability** - energy efficiency (includes vehicle energy use & the operating costs), land transport integration (supporting regional growth), future proofing (capacity within the facility and opportunity for change in mode), agglomeration and intensification potential; and opportunities for travel demand management[3].

In February 2008 the Driven Tunnel Option was the preferred construction method for the Project

For each variable of the above criteria, the evaluation included an assessment of:

- The extent of impact / effect (national, regional, district or local);
- The duration of impact (each variable was assessed either during the construction or operation period);
- The degree of impact / benefit (options were assessed using an impact scale); and
- The probability or uncertainty of the assessment.

[3] The criteria were later reduced to five (cost, network flexibility, physical environmental impacts, social environmental impacts, and timeliness) with aspects of sustainability incorporated across the other five criteria.

The option evaluation by the Project Team did not identify a 'preferred option' but rather sought to inform the NZTA on the relative 'benefits' and 'disbenefits' of the options being considered. The purpose of this process was to assist decision makers in confirming a preferred option.

In February 2008, the NZTA Board identified the Driven Tunnel Option as the preferred construction method for the Project and sought community and stakeholder feedback (February to June 2008) on that option. Following this, the Driven Tunnel Option was then the subject of detailed design, environmental assessment and costing.

11.4.2.3 Review of the Design Options

In 2009 three further route options were considered

In January 2009, the Minister of Transport requested the NZTA to investigate alternatives to the proposed Driven Tunnel option of that time. In particular, the Minister was concerned that the scheme as developed at that time was not affordable and did not provide for the capacity sought for a 'balanced network' (as discussed in Section 3.3 of this AEE).

In early 2009, NZTA carried out a review of route and scheme options. The previously evaluated options were reviewed and new direct surface options were considered. From this review, three route options were developed for further consideration.

All three options presented connected SH20 to SH16 at the Great North Road Interchange. Each option was described in terms of horizontal alignment (e.g. surface or below ground) but also highlighted areas where progressive levels of mitigation could be provided through scheme design (e.g. to allow sections of each of the options to be built in 'cut' or in 'cut and cover' or in tunnels).

In summary, these options (as shown on Figure 11.4) were:

- **Direct alignment:** - As a surface route it runs through the Owairaka/Mt Albert housing area northeast of Hendon Avenue. The highway would cross New North Road in a bridge and then run through the Harbutt and Phyllis Street reserves before crossing the Oakley Creek to join SH16 at the Great North Road Interchange (Option 1).
- **AW1 alignment option** – As a surface route this runs adjacent to the rail designation through Alan Wood reserve, crosses New North Road east of Pak N'Save on a bridge and then runs through the Harbutt and Phyllis Street reserves. It can follow a similar alignment across Oakley Creek to the direct alignment, although the option presented illustrated an alternative bridge location before SH20 linked to SH16 at Waterview (Great North Road interchange) (Option 2).
- **Avondale Heights option** – As a surface option this route runs through the Alan Wood reserve corridor then through the Avondale Heights area before running parallel to great North Road to eventually join SH16 at Waterview (Option 3).

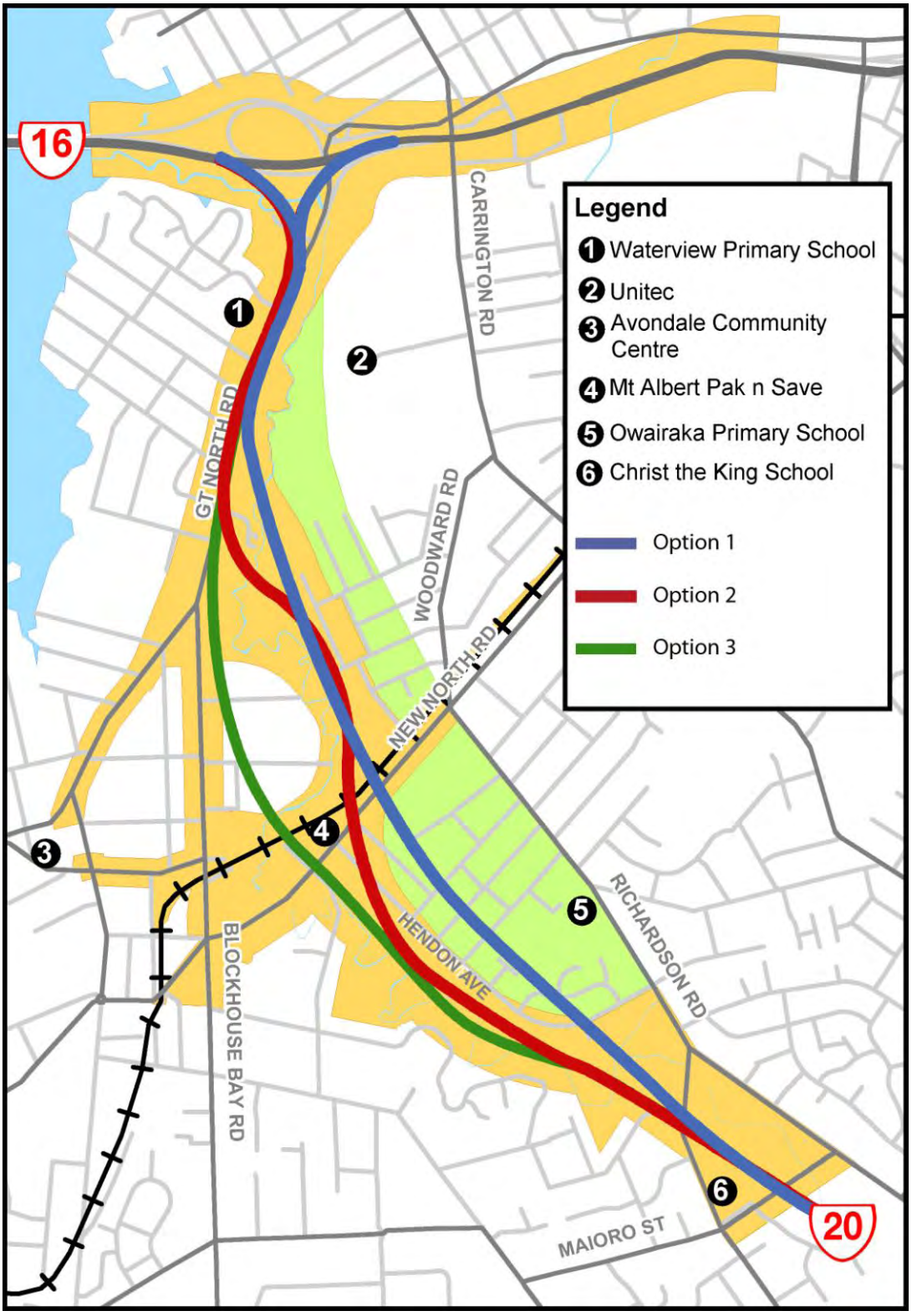


Figure 11.4: SH16/SH20 Connection Options – January 2009

For each option the NZTA considered levels of appropriate mitigation related to construction as well as the costs, social and environmental impacts and traffic performance. As a result the NZTA concluded that the most appropriate route option was the 'Avondale Heights' alignment, with the section through Avondale Heights constructed in a tunnel (Option 3 in Figure 11.4 above). This was referred to as the 'Combined Surface Tunnel Option'.

In May 2009, the NZTA publicly confirmed that the preferred option to link SH20 to SH16 at Waterview was a 'Combined Surface Tunnel option'. The reasons for this option preference included: the balance of value for money and improved capacity of the project combined with the reduced social and environmental effects compared particularly with the surface alignments. In light of the above assessment, the NZTA released an alignment option based on the combination of surface and tunnel construction, for community and stakeholder comment (May 2009).

11.4.3 Combined Surface Tunnel Option (CST)

Geotechnical investigations identified further options for lowering the alignment to enable two tunnel sections to be joined

Following the May 2009 consultation, the feedback received from stakeholders and the community, and the environmental assessments, identified concerns about the effects of the open section of motorway between the driven and cut-cover tunnel sections. As a result, further geotechnical investigations were undertaken to identify options for lowering the alignment to enable the two tunnel sections to be joined, thus removing the short section of open cut. There were geological constraints with this connection and the proximity of Oakley Creek raised issues with respect of potential impacts on this sensitive environment.

As an outcome of this work, the geotechnical investigations identified the opportunity to move the alignment to the east, so that the alignment was positioned in material more compatible with tunnelling. This presented the opportunity to extend the length of the bored tunnel section, with a subsequent reduction in the length of cut and cover tunnel, which also had the benefit of a reduced impact on Great North Road and the adjoining properties. A detailed assessment of these alignment and design alternatives was undertaken, including consideration of the Project objectives, costs and environmental considerations (particularly with respect of Part 2 of the RMA). It was concluded that while the revisions proposed to the alignment did impact on different properties from the earlier alignment (albeit only with respect to subsurface effects), there was generally a reduction in the adverse effects on other properties and the receiving environment.

The NZTA confirmed the CST option as its preferred option

On the basis of this assessment, a revised alignment was identified and in December 2009, the NZTA Board confirmed that it intended to proceed with this as its preferred option for the Project. A comparison between the May 2009 and December 2009 alignments for the option are provided in Figure 11.5. The 'December 2009' option is described in Chapters 4 and 5 of this AEE (Project Description).

Figure 11.5: Comparison of the May and December 2009 Options

11.4.4 Waterview Connection Project

In December 2009, the NZTA confirmed that it intended to proceed with the SH16 upgrade and the SH20 Waterview project as a single project of national significance (ie Road of National Significance), as discussed in Chapter 9 of this AEE setting out the investigation process overview.

11.5 Option Design Assessment

Option assessment has continued through the investigation design

Since December 2009, further detailed work has been done on design elements of the Project. These option assessments are within the 'preferred alignment' option of the Project but identify options considered in design. For example, this assessment has been undertaken where:

- There are potentially significant environmental effects (resulting from Project design or construction design);
- The Project requires land not currently owned by the NZTA;
- The relevant planning instruments require that regard be had to alternatives.
- There are potentially significant costs; and
- There are design alternatives for mitigation and these mitigation options need to be considered in terms of considering a range of environmental effects (e.g. a best practicable option for noise mitigation considering the potential noise benefits, visual impacts, stormwater / drainage requirements and costs). (Design alternatives for mitigation are discussed separately in section 11.6 of this Chapter as Mitigation Option Assessment).

11.5.1 Design Assessment Process

The wider Project Team have been involved in evaluating options

For key elements of the design, option assessments have involved a process of evaluating alternatives with the wider Project Team (including representatives from the design team and those undertaking the environmental assessments). This approach has been undertaken to provide a balanced consideration of the costs and benefits of options, the opportunities for mitigation of the effects of options and the overall balance of potential adverse effects and benefits of different design solutions. In particular, this assessment process has followed a process of identifying standard assessment criteria by which the design alternatives have been assessed to assist the team in confirming the most appropriate option to take forward.

The general process of this option assessment process has been as follows:

- Scope of Options being considered – a physical or technical description of the options being considered has been prepared to provide the Project Team the means to comparatively assess the options;
- Review of assessment criteria to confirm the scope of criteria appropriate to the design option;
- Distribution of information to the Project team;
- Workshop discussion to complete and review the assessment of effects by the Project team; and
- Discussion and identification of a 'preferred option' for the Project Team, for approval by the NZTA.

Standard assessment criteria have assisted the team to confirm the best practicable mitigation option for noise mitigation

The criteria for assessment of design options depended on the scale of impact and the environment that had the potential to be affected by the options being considered. Assessment criteria drew from the NZTA and Project objectives and the Part 2 matters of the RMA. In summary, the assessment criteria included consideration of the following:

- An assessment of the potential impacts of the option on the social and cultural environment, particularly the community. This included consideration of the land take and land requirements for options (and impacts of land use change), matters of health and safety (for both road users and the surrounding community), the views and concerns of residents and others consulted in the community of the impacts on amenity, emissions (noise and air), visual impacts and impacts on urban design / urban form matters (e.g. integration with the aesthetics of the existing built environment);
- An assessment of the potential impacts of the option on the physical environment, including: on the natural character of the coastal environment and other wetlands, streams and water bodies, on indigenous vegetation or habitat for significant indigenous fauna, on public access to and along the coastal marine area, on heritage and historic resources, on known hazards (including flooding) and of climate change; and
- The potential impacts of the option on the safe and efficient operation of the Project (including compliance with relevant safety Standards and guidelines), on the technical feasibility of the option, the value for money delivered by the design option (including any ongoing maintenance costs) and the availability of land to construct and maintain the option.

Sections 11.5.2 through to 11.5.10 highlight key option assessments undertaken within each sector of the project and the conclusion of this assessment. Where relevant, reference is made to more detail in the option assessment reporting in other environmental assessments.

11.6 Design Assessments – By Sector

11.6.1 Sector 1 – Te Atatu Interchange

11.6.1.1 Jack Colvin Park Water Quality Wetland

ARC standards were a key element in preliminary design work

This is required to treat water from the existing and new pavement at the Te Atatu Interchange. A key element in the preliminary design work for the project was the accommodation of design options for stormwater provision to treat all new impervious areas in line with Auckland Regional Council (ARC) standards. The preliminary design initially submitted to NZTA provided a stormwater treatment pond in the Te Atatu Rugby League Club grounds within the Jack Colvin Park Reserve. However, the significant cost and social impacts associated with relocating the rugby fields were considered undesirable. Accordingly stormwater alternatives that would not affect the existing rugby grounds were assessed.

A long list of eight alternative treatment devices and their respective land requirements was narrowed to two options which would have the least land requirement as follows:

Option 1 - Wetland Design with reclamation.

Option 2 - Wet Pond Design.

A Best Practicable Option (BPO) approach was used to compare these two stormwater treatment options, using the following criteria:

- Land requirements
- Ecological effects
- Stormwater quality
- Impact with existing utilities
- Maintenance
- Safety and amenity.

Reclamation associated with Option 1 is considered to have a no more than minor effect

Option 1 is a wetland sized to provide stormwater quality treatment of 75% total suspended solids (TSS) removal to the full catchment (both new and existing impervious motorway) between Te Atatu Bridge and Henderson Creek which requires some .0.1ha. of reclamation.

Option 2 consists of a wetland and a wet pond as separate devices. The combined catchment for the wet pond and wetland is the same as that for Option 1.

After reviewing both options against the criteria set out above, Option 1 was selected as the preferred design. This option consists of a single wetland designed to treat the runoff catchment to at least 75% total suspended solids. Minor reclamation of the CMA is required for construction, however this was assessed as not creating more than minor environmental effect (see G.11 *Assessment of Marine Ecological Effects*). In addition, this option could be largely located to the west of Jack Colvin Park on a small area of land administered by NZTA. Only a small area of land within Jack Colvin Park that is not used for recreation is required for the selected option.

11.6.1.2 Extension of the Northwestern Cycleway

The following options were evaluated when considering the extending the existing Northwestern Cycleway as pedestrian/cycle way through the Te Atatu Interchange to Henderson Creek.

Option 2A was selected as the preferred option

Option 1 – Use of Existing On-road and Off-road Pedestrian/cycle Route from Te Atatu Road through McCormick Green to Henderson Creek Bridge.
This option would retain the existing route with possible minor improvements, such as widening footpaths.

Option 2 – Proposed Pedestrian/cycle Way within the State Highway Corridor.
This option would provide the preferred cross section between Te Atatu Interchange and Henderson Creek Bridge, with the pedestrian/cycle way located on the southern side of the motorway carriageway.

For this option to be feasible it was considered that property impacts should be minimised, particularly to the electricity sub station at CH5900. This option affects properties between CH5650 and CH6400 when compared to the widening required for the motorway only; however with retaining walls, no buildings are affected.

Alternative arrangements considered for this option were:

Option 2A: This sub-option requires the cycleway to be diverted around a pylon at 23/25 Marewa Street.

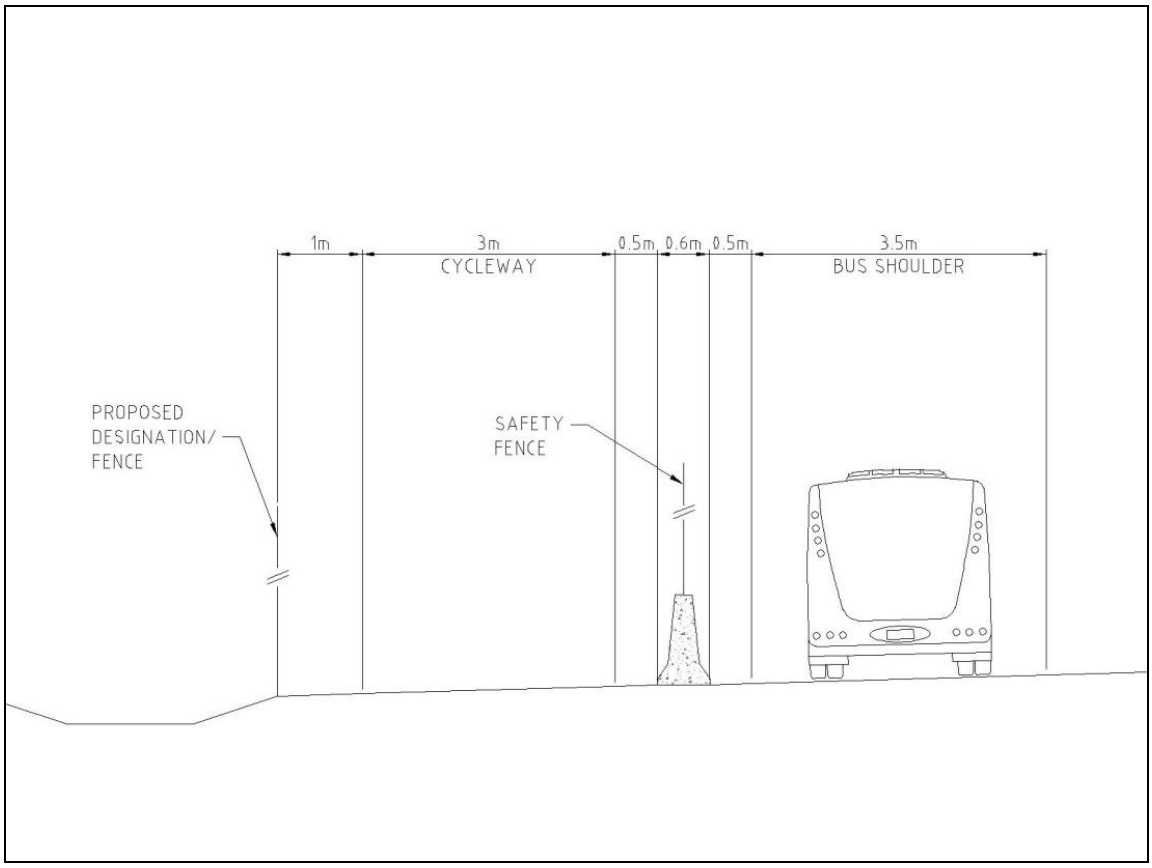


Figure 11.6: Typical Cycleway Cross Section Adjacent to Motorway

Option 2B

This sub-option is similar to 2A with the pedestrian/cycle way positioned along the motorway corridor, and between the supporting legs of the pylon referred to above.

Option 2C –

This sub-option involves either replacing the pylon with a tubular high mast column structure or relocating the pylon with a structure similar to the existing 'grillage' pylon. In this option the cycleway would run parallel to the SH16 motorway with no diversion.

Option 3 – Alternative Cycleway adjacent to Motorway (Northern Side of SH16 Motorway)

An alternative route was assessed with the cycleway located adjacent to the motorway between Te Atatu Interchange and Henderson Creek Bridge, but on the northern side and through Jack Colvin Park.

Option 2A was selected as the preferred option for the following reasons:

- Provides a direct cycling route within the motorway corridor.
- Provides a safe and cost effective cycling route.
- Provides the minimum gradients over the longest practicable length at reasonable cost. And
- Improves geometric alignment when compared to other cycle options
- does not require additional use of recreational reserve land (Jack Colvin park)

11.6.1.3 Te Atatu Pedestrian Underpass

The underpass is used by pedestrians traversing from Te Atatu to Henderson

It is necessary to replace the existing Te Atatu Pedestrian Underpass as part of the works at the Te Atatu Interchange. Design considerations for the replacement underpass included the following:

- The underpass could be widened to 5.0m which offers more open space, greater sight lines through the underpass and an increased sense of personal security.
- The cycle/pedestrian path at the southern approach could be realigned to provide improved sight lines through the underpass.
- Inclusion of an underpass route would create a new green space at the Titoki St / Te Atatu Road intersection for provision of the northern approach path.
- Provision of an additional underpass route could encourage more cyclists to leave the roadway, removing conflict at the developing left turn lane. In addition, vehicle travel time benefits would be realised at the eastbound on-ramp loop through a reduction in delays created by the 'on-demand' pedestrian crossing.

Alternatives have been investigated on or close to the current underpass alignment. The alignment detailed on the plans shown in Part F provides the optimum vertical grade through the underpass and on the approaches. The underpasses vertical grade is in line with AUSTROADS standards.

Option 1 Alignment
Option 1 uses the line of the existing underpass with the extended alignment passing under the proposed eastbound off-ramp at close to 90˚. The northern entry point is situated in land currently occupied by 4 Titoki Street. Under this option land currently occupied by 2 and 4 Titoki Street would be used to create an open space area with a shared-use footway on an alignment providing good sight lines through the underpass. The required underpass length is 45 metres.

Option 2 Alignment
Option 2 runs on a line approximately 10 to 15˚ off the existing underpass alignment, shifting the northern entry point into land currently occupied by 2 Titoki Street. Under this option land currently occupied by 2 Titoki Street would be converted into an open green space with a shared pedestrian cycle path constructed to provide continuous sight lines through the underpass. The required underpass length is 50 metres.

Option 2 has the advantage of retaining 4 Titoki Street, with the compromise of an underpass 5m greater in length. Option 1 provides the shortest underpass.

Option 1 was selected as the preferred option

Option 1 was considered the most favourable option for the following reasons:

- Land currently occupied by 2 Titoki Street is required for both alignment options discussed.
- Land currently occupied by 4 Titoki Street is required for alignment option 1 only.

11.6.1.4 McCormick Green Property Accessway

Options to retain access to properties on Te Atatu Road were considered

Modifications to Te Atatu Interchange have resulted in Te Atatu Road south being widened to facilitate geometric improvements. In widening Te Atatu Road south, an existing local access road or service lane has been restricted, blocking access to 354, 356 and 358 Te Atatu Road. The design considered two options, both aiming to retain access to the above properties, whilst also facilitating the required modifications to Te Atatu Road south:

- Option 1 – Provide access via a service lane between 84 and 86 Royal View Road.
- Option 2 – Provide access through the purchase of 94 Royal View Road.

Option 1 requires the use of an existing private access way between 84 and 86 Royal View Road, extending it into McCormick Green and connecting with the properties on Te Atatu Road south

This option had the following advantages and disadvantages.

Advantages:

- Avoids the need to purchase a whole property
- Access on Royal View Road is over 100m from the T-junction with Royal View Road/Te Atatu Road

Disadvantages:

- Purchase of the Private Access way
- Enhancement of the existing local access way may have an impact on the adjacent buildings
- Need to use part of McCormick Green
- Need to remove a number of trees within McCormick Green
- Need to acquire a small section of land from 358 Te Atatu Road
- Need to remove a car port servicing 84/86 Royal View Road
- Longer length of carriageway construction.

Option 2 proposes a more direct and straightforward road layout. It will require the purchase of 94 Royal View Road, which is on the corner of Royal View Road and Te Atatu Road south. Access will be provided off Royal View Road.

This option has the following advantages and disadvantages.

Option 2 was selected as the preferred option

Advantages

- Provides a direct route for vehicles wishing to access 354, 356 & 358 Te Atatu Road.
- Avoids the need to purchase any land in McCormick Green.
- Access way remains similar to the current layout.
- Shorter length of carriageway construction required.

Disadvantages

- Requires purchase of 94 Royal View Road.
- Access to Royal View Road is approx 30 from the T-junction with Royal View Road/Te Atatu Road, although vehicle numbers will be very low.

Option 2 was considered to provide a similar layout to the existing arrangement, thereby reducing the extent of modification. Accordingly this option was selected.

11.6.1.5 Orangihina Park Construction Yard

As part of the Project, several site compounds are required throughout the Project area to accommodate various construction activities during the life of the construction contract.

These activities include:

- Offices/ablutions
- Employee parking
- Storage and lay down areas
- Workshop
- Waste management/storage
- Refuelling facility
- Aggregate stockpile.

Harbourview-Orangihina Park, located north east of Te Atatu Interchange, was identified as offering a large area of currently land with low / no use close to the Project.

Other areas were investigated, with preference given to areas within close proximity to the project area. Rosebank Peninsula was investigated for possible locations, however no areas were identified that offered sufficient flat vacant land adjacent to the Project works with access to services and suitable site access (it is noted that a smaller construction laydown yard is provided at Patiki however this offers minimal land).

11.6.2 Sector 2 – Whau River

11.6.2.1 Pedestrian Bridge

Two options were considered for the safe passage of cyclists/ pedestrians over the Whau River

Two options were considered to facilitate the safe passage of cyclists and pedestrians across the Whau River; first maintaining the footway on a widened Whau Bridge or second creating a separate bridge to accommodate pedestrians and cyclists. The second of these options was considered to offer the following benefits:

- Better alignment with a wider motorway section.
- Future-proofing benefits (separated bridge offers flexibility for future widening proposals.)
- Offers flexibility for construction staging and allows enhanced pedestrian cyclist safety during construction.
- Provides separation from traffic noise, vibration and fumes
- Improved views for pedestrians and cyclists.
- Avoids unsightly fence/screen on the barrier between the cycleway and the traffic lanes. And
- Separation allows vertical and horizontal alignment freedom. Ties in well horizontally to the proposed layout of the road / filter strip alignments on the eastern side. Greater vertical freedom in tying in to the cutting land from on the western side.

11.6.3 Sector 3 – Rosebank Terrestrial

11.6.3.1 Rosebank Peninsula Pedestrian / Cycle Way

Proposed 3m wide cycleway through Project area

The proposed design adopts a 3m wide cycleway throughout Project area (in line with AUSTROADS), offering enhanced facilities for those pedestrians/cyclists using the SH16 Corridor. However, when the pedestrian/cycleway reaches Rosebank Peninsula, available land becomes very restricted due to adjacent Industrial land and telecommunication equipment.

The cycleway has been reduced to 2m to avoid the need to purchase/relocate a (Vodafone) Cell Tower (approx CH3350) and a large Industrial (Sika) building (approx CH3550). The costs were considered to outweigh the benefits associated with maintaining the cycle way's desirable width (3m) while complying with AUSTROADS standards.

11.6.4 Sector 4 – Causeway / Reclamation

11.6.4.1 Causeway Upgrade Options

Reclamation options were considered – Option D was preferred

In accordance with the direction in Policy 4.1.6 of the New Zealand Coastal Policy Statement 1994 the Auckland Regional Policy Statement requires that, where reclamation is proposed, regard be had to alternatives. Accordingly several alternatives to reclamation were considered in order to provide the increased footprint and height above that of the existing SH 16 causeway required for the project. These options were:

- forming a tunnel;
- to place a viaduct structure over the existing causeway; and
- raising and extending the existing causeway laterally with cantilevered viaduct structures.

The tunnel alternative was found to have fundamental limitations early in the evaluation process. Essentially these arise out of the poor ground conditions within the estuary which would require two tunnel bores in either direction and thus make this option prohibitively expensive.

The other two alternatives to reclamation above were taken forward for more intensive assessment, along with several reclamation options as a suite of six upgrade options as follows:

- Option A: - widening of the existing Causeway with wall structures to form a 'trough'.
- Option B: - widening of the existing Causeway with rock armour slope revetments to form a 'trough'.
- Option C: - widening and raising of the existing Causeway with walls.
- Option D: - widening and raising of the existing Causeway with rock armour slope revetments.
- Option E: - Placing a viaduct structure over the existing causeway.
- Option F: - raising the existing Causeway and widening with viaduct structures.

These options were assessed against the following criteria:

Environmental Considerations; including possible effects of scour and erosion, removal of flora and habitat, effects on estuarine channels and extent of reclamation required.

Coastal Processes; including dissipation of wave energy, risk of overtopping, resistance to erosion and scour from wave attack, protection against inundation of pavement.

Geotechnical; including consideration of the compressibility and low sheer strength of the marine muds adjacent to the existing causeway.

Constructability issues: including traffic management amount, works required within intertidal areas and the nature of ground improvements required.

Construction Cost and Maintenance

The assessment of the options above is described in detail in the Causeway Options Assessment Report (see Technical Report G.23: *Coastal Works*).

In summary Options A and B were rejected as they could not adequately secure the highway against future sea level rise, pavement inundation and manage stormwater runoff. These limitations were considered significant given the requirements of the project to secure a reliable motorway and future proof it against sea level rise.

While Options E and F do not require reclamation in both cases they required additional elevation above the existing height of the causeway to secure the highway against sea level rise. With option F this would require fill to be placed upon the existing causeway. This option was discounted because of the likelihood of differential settlement between the raised causeway and the viaduct structures and the effects of this on the pavement and stormwater treatment devices thus necessitating expensive on-going maintenance and correction.

While Option E would not suffer the limitations of Option F in that the majority of the geotechnical risk such as settlement and stability could be mitigated using a viaduct founded on driven or bored piles. The cost of the viaduct was found to be approximately twice that of reclamation along the edge of the existing causeway with rock revetments. It was considered to have significant construction cost due to the need to sink the necessary piles to extreme depths. This, together with the relatively high maintenance costs associated with a viaduct structure were the main considerations in eliminating this option. In addition to these issues it was considered that an elevated viaduct structure placed over the existing causeway may have adverse effects on the visual amenity of the Estuary.

The use of rock armour revetments for reclamation (Option D) was considered preferable to vertical walls (Option C) because rock armour revetments are more efficient in mitigating the effects of wave action. While wall structures may limit the reclamation footprint they would require extensive pile foundations. In addition, it was considered that a rock revetment would have a lesser effect on the visual amenity of the estuary than a vertical wall.

11.6.4.2 Causeway Width

The widening of the Causeway was determined by a number of factors including,

The widening of the causeway was determined by a number of factors

- The lane capacity of the SH16 portion of the Project as set out in Section 3.5;
- Providing for the development of a Quality Transport Network as identified in the Auckland Regional Land Transport Strategy in Section 3.4.2;

- Maintaining the expansive views and natural character values of the inner Harbour (e.g. no safety barriers) as set out in Chapter 17 and Technical Report G.20 *Assessment of Visual and Landscape Effects*;
- Use of planted biofilter strips as set out in Chapter 17 and Technical Report G.15 *Assessment of Stormwater and Streamworks Effects;* and
- Engineering design requirements for the height/width relationship as set out in Technical Supporting Report G.23 *Coastal Works*.

11.6.4.3 Management of Effects of Reclamation on Estuarine Channels

Mitigation for channel realignment is detailed in Technical Report G.23 Coastal Works

Estuarine channels within Oakley Creek Inlet and Waterview Estuary Inlet both have meanders which pass close to the existing Causeway. The proposed reclamation required to increase the width of the existing Causeway will occupy these channel meanders and thus require their re-alignment. Two alternatives were considered to address this issue. These were:

1. Reclaim into the channel meanders and allow them to re-establish beyond the toe of the reclamation;

2. Pre-emptively re-align the channels prior to reclamation.

It was considered that any adverse effects resulting from the channel re-alignment could be most effectively avoided by pre-emptively re-aligning these channels. The reasons for this approach are detailed in Technical Report G.23 *Coastal Works*. While it was considered that, as the existing meanders were filled laterally the opposite flanks of the channels would erode naturally and thus cause the meander to migrate to a new alignment. The effects of the erosion process may however create erosion instabilities from scouring and disperse contaminated sediment with the attendant risk of adverse ecological effects. Accordingly it was considered that such effects could be avoided by the dredging of a new channel alignment prior to the process of reclamation. The techniques to be used to do this are detailed in Technical Report G.23 *Coastal Works*.

Pollen Island Drainage Channel

This drainage channel is located adjacent to the Rosebank road on-ramp and drains a large area of estuarine wetland south of Pollen Island. This channel is important in maintaining drainage of the wetland and for this reason any constriction would inhibit flushing of the wetland and thus have potential adverse ecological effects. In order to avoid these effects vertical walls are to be used to retain the reclamation works adjacent to this channel rather than sloping rock revetments. The detailed rationale for the selection of this option is contained in Technical Report G.23 *Coastal Works*.

11.6.4.4 Provision of Stormwater Treatment on the Causeway

Existing treatment of stormwater does not meet ARC TP10 guidelines

Existing treatment of stormwater from the motorway pavement on the Causeway is rudimentary and does not meet the ARC TP10 guidelines and must be replaced. As part of the Project it is intended to provide treatment of all existing and proposed pavement. The alternative forms of treatment considered were either a reticulated option or planted filter strips.

The causeway has zero longitudinal gradient making it difficult to not only collect stormwater but also convey it to an outfall point. A "traditional" gravity reticulated network would be deep or of large diameter in order to provide an efficient gradient to the outfall. This would result in pipes being placed well below sea level.

As it is considered costly and impracticable to build the road level to a height where the outlet pipes would never be submerged, a 'shallow drainage system' must be proposed.

Two 'shallow drainage system' options considered were:

- open channel & cartridge filters based upon minimising the causeway width;
- grassed filter strips (or similar grassed traversable swale) requiring a wider causeway.This 'shallow system' proposed a sloping invert, open grated channel (ACO channel or similar approved) at the edge of the shoulders to capture the run-off during the Water Quality (WQ) event. The channel is limited in capacity and therefore the outlets from this system, discharging to the intertidal areas, could be as close as approximately 165m.

At each outfall a system of water quality treatment is required. It is therefore proposed to use vaults containing propriety cartridge filters (Stormwater 360 or similar approved). The total headloss through this system is approximately 1.5m, equating to an outlet reduced level of 1.5m RL (assuming a 3m RL crest elevation). This is 130mm below existing MHWS (defined as 1.63m RL).

It is difficult to predict the amount and uniformity of settlement that the raised and widened causeway will undergo throughout both its construction period and operational life. The sloping invert open grated channel relies on a shallow gradient of 0.25% to convey the stormwater to the treatment vaults. Expected longitudinal differential settlement therefore has the potential to alter the channel gradients to such an extent that they no longer convey the stormwater effectively to the treatment vaults.

In addition, transverse differential settlement has the potential to damage the proposed outlet pipes that connect the treatment vaults to the outfall structures, causing the treatment vaults to silt up if the vaults settle more than their respective outfalls. Detailing to mitigate this potential effect will be required in future phases of the Project.

Planted biofilter strips (or similar grassed traversable swale) can be used as an alternative 'shallow drainage system' if minimising the proposed causeway footprint is not a key requirement.

Biofilter strips are a uniformly graded and densely vegetated strip of grass designed to treat stormwater runoff by filtration, infiltration, adsorption and biological uptake. Biofilter strips accept distributed or sheet flow and convey the runoff laterally from the roadside. The required width of a filter strip is determined by ensuring that the hydraulic residence time for the water quality event is at least 9 minutes.

A filter strip is an extremely 'shallow' system. The headloss across a filter strip, of say 7m wide and cross fall of 1% is 70mm. This is significantly less then the 1.5m headloss required for the cartridge filter and open channel system. Therefore the impacts of sea level rise, high tides and large storm events will be minimal (in terms of outlet inundation) if filter strips are adopted.

Like the Cartridge Filter System, it is difficult to predict the amount and uniformity of settlement that the raised and widened causeway will undergo throughout both its construction period and operational life. It is expected that the filter strips will be less susceptible to both lateral and longitudinal differential settlement as required gradients are steeper then those for the open grated channel & cartridge vault system.

- Design tolerances for the grassed filter strips (or similar grassed traversable swale) provide greater flexibility in combating the effects and uncertainty of differential settlement across and along the causeway;
- Maintenance of the grassed filter strips is less stringent and intensive then that of the filter cartridges and open grated channels;
- Grass Filter Strips will require less construction time to install when compared to the reticulated cartridge filter system; and
- Grassed Filter strips offer significant cost savings compared to the reticulated system.

Grassed filter strips were chosen as the preferred stormwater design

Grassed filter strips were chosen as the preferred stormwater design along the Causeway.

11.6.5 Sector 5 – Great North Road Interchange

11.6.5.1 Interchange Design Options

Design of the interchange has recognised the constrained environment

The SH20 Motorway will join the Northwestern Motorway (SH16) at the Great North Road Interchange. The requirement to incorporate a motorway to motorway connection while maintaining the local road connections is key to delivering the Project objectives. However, the existing road, motorway and pedestrian / cycle ways and the geomorphology of the environment, results in very complex geometry for the ramp connections. Numerous constraints limit the design, and reduce or constrain the options that have been considered. In particular, the following constraints have been identified in the development of interchange design options:

The Oakley Inlet Heritage Area

- **Archaeological Site**
  The archaeological assessment identified the existence of the Star Mill and Tannery site located on the banks of the Oakley Creek and other surrounding archaeological sites as a significant historic area (in accordance with Section 6(f) and 6(e) of the RMA) (refer Plan F.I of this AEE). The extent of this site is such that it limits the opportunity to position bridge piers within the interchange, and constrains the ramp design. A detailed assessment of the site has been undertaken, and has identified where the bridge structures can span over the site and where piers can be provided within the site. Sufficient working area is required around the piers during construction.

The CMA is CPA1

- **Coastal Marine Area**
  Access to and along the Coastal Marine Area (CMA) and the environment itself is recognised as a matter of national importance (e.g. with regard to Sections 6(a), 6(d), 7(d), 7(e) and 7(f)). While some piers are considered necessary within this area, the design has recognised limitations including seeking to minimise the number of bridge piers within the CMA, avoiding the channels for the Oakley Inlet, and maintaining provision for public access to and along the CMA. The bridge piers that are proposed within the CMA will be located beyond the Oakley Creek channel. The extent of the works proposed in relation to the CMA in this area, is indicated in Plan F.1 of this AEE.

- **Carrington Road Bridge**
  The motorway ramp connection from SH20 will join SH16 city bound in the vicinity of Carrington Road Bridge. This Bridge is a two span bridge, and there is limited width available either side of the existing lanes to provide for the additional SH20 ramps. An increase in the length of this bridge would either require closure or construction of a new bridge to maintain the traffic flows.

Carrington Road is a busy arterial road, carrying over 20,000 vehicles per day, and closure of the bridge for any length of time would have a significant impact on traffic flows in the wider area. While realignment of the bridge to maintain Carrington Road is technically feasible, this option is further limited by other resources and features in this area, including the Unitec site, Gladstone Primary School, the Point Chevalier commercial area and Great North Road.

Given the impacts of disruption or loss of the transport resource (even in a temporary manner) and the surrounding infrastructure and community facilities which are considered significant existing physical resources (pursuant to section 7(b) of the RMA), design has been developed on the basis that Carrington Road would remain operational throughout the Project. For these reasons, the need to accommodate the Great North Road Interchange ramps beneath the existing Carrington Road bridge structure has been considered a constraint.

- **Unitec Education Purposes Designation**
  The land to the south-east of the interchange is occupied by Unitec, and is designated for education purposes. This designation recognises the site as an important physical resource for the region and therefore is considered a constraint on alignment design (e.g. design options have sought to minimise disruption to this site and its facilities). In addition, the Carrington Hospital (1-62 Carrington Road within the Unitec campus) is a Category 1 heritage site and a significant historic heritage feature (section 6(f)). These features and areas have been considered a design constraint, with the greatest impact on the SH16 (east) to SH20 ramp connection and the local road off ramp to Great North Road.

In addition to the above constraints, it is necessary to maintain a high standard of geometry to cater for the high vehicle volumes and speeds associated with a motorway connection. The design response has sought to maintain the interchange design speed to at least 80km/h to provide a balance between the strategic requirements of the motorway and the numerous constraints outlined above. Physical implications of this design include:

- There are horizontal and vertical design requirements that govern the position of the ramps (particularly to maintain the ability to tie in with the existing motorway); and
- There are minimum requirements for curve radii and superelevation to achieve an 80km/h design speed.

Physical design outcomes resulting from the above include:

- The ramps extending further south, into Waterview Reserve, from the existing designation footprint of the Great North Road Interchange; and
- The separation between Ramps 1 and 2 across the CMA (see the Operation Scheme Plans for this interchange in Part F.2 - sheet 109 of this AEE)).

The extent of the structures has been optimised to provide a balance between the amount of earthworks embankments provided and the structure. Structures have been provided across sensitive areas such as the CMA and archaeological sites, as well as the existing motorway. In other areas, embankments provide increased opportunity for landscaping to be used in visual screening, for example on the north-western extent of Ramp 3, see the operation scheme plan in Part F.B – sheet 109 of this AEE.

11.6.5.2 Retaining Movements of the Existing Great North Road Interchange

The interchange design retains all local road movements onto Great North Road

In addition to the above discussion, the design of the interchange has sought to retain all existing movements of the Great North Road Interchange. In February/March 2010, the design option presented to the community and stakeholders included a proposal for the existing connection from SH16 (west bound) to Great North Road north bound to be closed (i.e. removing the ability to use the Great North Road Interchange for someone travelling from the Auckland CBD to Point Chevalier). This was not supported in the consultation feedback, particularly concerns were raised regarding the ability for the St Lukes interchange to accommodate the additional traffic flows.

In response to this concern, further design work was undertaken to identify an alignment that provided improved geometry while maintaining the movement. This was achieved by separating the traffic movements for Great North Road off-ramp and SH20 southbound ramp (Ramp 1), which were initially provided from a single lane. While this option requires additional retaining structures adjacent to the existing SH16, these are within the designation footprint (avoiding any additional land take).

11.6.5.3 Northwestern Cycleway

The Cycle way currently runs from Great North Road Interchange along the southern side of SH16

In this area, the Northwestern Cycleway currently extends from the Great North Road interchange along the southern side of the SH16. The proposed ramps to SH20 will require some realignment of the existing pedestrian / cycle way. In particular, the proposed westbound ramp from SH20 (Ramp 2) will impact this facility, as Ramp 2 emerges from the tunnel and extends over the CMA at a similar level to the existing ground level. This ramp alignment has been developed to allow for the continuation of the cycle way. Several options were considered for the cycleway at this point:

- Boardwalk above CMA; and
- Cycleway on esplanade.

Taking into account the potential impacts of a boardwalk (as an additional structure) in and over the CMA, an option for a minor realignment of Ramp 2 has been developed. This option raised the vertical alignment of Ramp 2 and provided for the Northwestern Cycleway to pass beneath the ramp on esplanade adjacent to the CMA. In summary, this was considered the best practicable option, balancing the natural and physical impacts on the CMA with visual and amenity considerations (with the slight increase in elevation of Ramp 2). The detail of the preferred option is provided in Plan F.2 of this AEE.

11.6.5.4 Other Pedestrian Connections over the Great North Road Interchange

Concepts linking Waterview to the Point Chevalier community have been investigated

In addition to the Northwestern Cycleway, there have been a number of concepts developed in the Project (including during in consultation with the community) for pedestrian connection across SH16, in particular linking Waterview to the Point Chevalier community. Options identified have included:

- A bridge extending from Waterview to Eric Armishaw Park; and
- A bridge connection reinstating the connection at Pah Road (north and south).

It is acknowledged that the existing Northwestern Motorway has created a severance of these communities (circa 1950's). Accordingly, there are no existing connections across the motorway at this point. The Project is not considered to create an adverse impact with respect to this connectivity. It is considered that these connections do not contribute to achieving the project objectives and as such, it is not proposed that they be advanced as part of this project.

In addition, these connections could themselves result in additional potentially adverse effects (including visual impacts and property and land requirements). It is considered that these effects can be avoided without impact the Project objectives and as such, it is not proposed that they be advanced as part of this Project.[4]

11.6.5.5 Local Road Connection to SH20 southbound

As discussed above, the Great North Road Interchange maintains existing local road connections to and from SH16 and between Waterview and Point Chevalier. However, the design does not provide access to/from SH20 for local traffic at the Interchange. People travelling from this area (e.g. Point Chevalier) on SH20, would need to access the highway from the SH16 ramps (by travelling to SH16 from either St Lukes Road or Rosebank Road) or alternatively driving south on Great North Road / Carrington Road to access SH20 at the Maioro Road Interchange (similar movements would be required if travelling from SH20).

During consultation with public and stakeholders, the desire for this connection has been identified (see Chapter 10). While this connection has been assessed, a local road connection is not considered appropriate at this location due to the environmental and safety impacts of the options.

[4] As it is recognised that these pedestrian connections would result in other benefits (particularly relating to social cohesion and community linkages), some of these concepts have been included and developed in wider urban design and visioning documents. However, these extend beyond the scope of this Project, and would more appropriately be advanced as separate projects.

The ability to provide additional local road connections at the Great North Road Interchange is restricted

In summary, the ability to provide additional local road connections at the Great North Road Interchange is restricted due to safety and sight-distance requirements. In particular, the following are noted:

- A southbound onramp from Great North Road onto SH20 cannot be provided due to either:
    - The physical conflict with structures associated with SH16 and the city bound SH20 ramp (Ramp 4) (if the connection was from Great North Road, north of SH16); or
    - The need to cross the northbound flow on Great North Road, the extent of the structure required (e.g. the potential encroachment of Oakley Creek and potentially the Mason Clinic site), and the short distance for a merge of an additional lane prior to the tunnel entrance (for the connection off Great North Road south of SH16);
- A southbound onramp from Carrington Road would require land from the existing education facility of Unitec, have a potentially significant impact on the Category 1 Carrington Hospital Heritage Building and would require additional structure through the interchange to merge with Ramp 2 in the vicinity of the Oakley Creek Inlet (increasing the width of ramps over the CMA in this area);
- An offramp to Great North Road (north of SH16) would require additional structure to pass over the southbound motorway ramps as well as the citybound traffic on Great North Road; and
- An offramp to Carrington Road would compromise safety being located too close to the Carrington Road / Great North Road intersection. This would also likely result in traffic operation impacts at this local road intersection.

11.6.5.6 Use of the CMA for Conveyor – Construction Methodology

Earth excavated from the tunnel during construction may be potentially suitable for use in the raising and widening of the Causeway

During construction, a large volume of earth will be excavated from the tunnel. This material is potentially suitable for use in the raising and widening of the SH16 Causeway. To enable this use, the excavated material will need to be transported from the tunnel construction yard in Waterview (Construction Yard 6) to the Causeway construction site(s). A key construction site identified for the Causeway construction is Yard 3, which would be located within the eastbound onramp loop of the Great North Road Interchange. The excavated material could be transported by truck to this site. However, this method for construction would require multiple handling and may become inefficient during morning peak periods when there is a high traffic demand through the interchange and (also with respect to the peak traffic flows). It also has the potential to generate adverse effects to existing users of the Interchange and the wider transport networks of the Project area.

On this basis, the option of a conveyor extending from the northern portal (through Waterview Reserve and over the CMA and Northwestern Motorway) to the Yard 3, would improve the efficiency of the operation and reduce the traffic impacts on the local road network of construction. While it is acknowledged that this option requires temporary

occupation of airspace in the CMA, the potential adverse effects on this environment can be managed and mitigated. For example, by avoiding piers for this temporary structure in the CMA and maintaining cover on the conveyor system, so that material being transported is contained, therefore reducing the risk of discharge of contaminants (sediment) to the CMA.

11.6.6 Sector 6 – SH16 to St Lukes

11.6.6.1 Sutherland Road Cycleway

Options have been considered for continuing the Cycleway along SH16 within this Sector

The existing route for the Northwestern Cycleway includes a section of the local road network along Sutherland Road. Through the majority of this sector, the pedestrian / cycle way is located adjacent to the westbound side of SH16. As the cycle route nears the Carrington Road Bridge, it winds behind residential properties and ties in with Sutherland Road. From Sutherland Road, the route crosses Carrington Road, before continuing through the Unitec land to the west and linking to Great North Road and the Northwester Cycleway west from the Great North Road Interchange.

Options have been considered for continuing the cycleway adjacent to SH16, consistent with the route to the east. However, as mentioned above, Carrington Road Bridge is width constrained, and it is not considered feasible to incorporate the cycleway beneath it in addition to the required traffic lanes.

Consideration has also been given to providing the Northwestern Cycleway through this section as an 'off-line' route. However, such works would require land take from private residential properties and it was considered that the benefit of providing this corridor (compared to the existing Sutherland Road connection) was not big enough to warrant additional residential land take.

11.6.7 Sector 7 – Great North Road Underpass

11.6.7.1 Extent of Excavated Tunnels

The northern extent of the excavated tunnels has been reviewed and optimised on the basis of geotechnical conditions and environmental effects

The northern extent of the excavated tunnels, which is the interface between the Great North Road Underpass (constructed by cut and cover tunnelling methods) and the excavated tunnels, has been reviewed and optimised on the basis of the geotechnical conditions and environmental effects.

The excavated tunnel is predominantly in Waitemata sandstones, but as the alignment rises to the north it encounters weaker weathered materials and soft Tauranga Group deposits which are unfavourable for tunnelling by 'driven' methods. This is due to the amount of ground support required to keep the excavation open and safe in these weak materials, and the potential effects associated with settlement or failure of the excavation. Consideration has been given to the practicality of tunnelling further north with increased ground support compared to the considerable difficulty imposed by deepening the cut and cover sections.

The practical limit for cut and cover tunnelling was set at around 20m depth; below this level the cost and construction risks were considered to increase significantly. This resulted in different locations for the interface with the cut-cover section for the two tunnels:

1) Southbound: The geology and ground contours are more favourable on this alignment. The interface between the cut-cover tunnel (Underpass) and the bored tunnel is proposed to be at Chainage 3,780m, shown on Plan F.2: 20.1.11-3-D-910-114. At this chainage the tunnel is still just within the Waitemata sandstones and the cut and cover depth is approximately 20m.

2) Northbound: The geology originally set the interface at Chainage 3,840m to stay within the Waitemata sandstones but this required the cut and cover tunnels to be around 30m deep. Extending the bored tunnel north of Chainage 3,840 required an increased level of support as the geology changes to weathered materials and Tauranga Group. While the increased support methodology could extend the tunnel significantly further, it was judged that the same 20m depth was a practicable balance point, considering the costs and construction risks (e.g. certainty of support decreases once the tunnel has less than about 10m cover). The proposed interface is therefore at Chainage 3,840m, as shown on Plan F.2: 20.1.11-3-D-910-114.

11.6.7.2 Ventilation Buildings and Stacks

The ventilation buildings are required to house the tunnel exhaust ventilation system equipment, tunnel power supply substations and associated control room and ancillaries. A ventilation discharge stack structure will be integrated into each building.

Ventilation Building Location

It is not economically viable to located the building at distance from the tunnel

The ventilation building configuration, position and layout are driven by the requirement to meet the mechanical and electrical, geological, structural, topographical and architectural requirements alongside environmental constraints (particularly landscape and amenity).

A key consideration is the construction cost of the system within the extract shaft which means that it is not economically viable to locate the building at distance from the tunnel (e.g. there are additional tunnelling and operating system requirements if the ventilation stacks are located at distance from the portals).

The northern ventilation station is located between Waterview School and the Great North Road Underpass. This site meets the engineering design and air quality requirements (e.g. the topographical requirements). The building for the ventilation system is partially buried with the ventilation equipment housed in the below-ground level floor, while the substation infrastructure, control room, equipment removal gantry and vehicle access are all located in the ground level floor. The tunnel air extract point (ventilation stack) is approximately 180m back from the tunnel portal. The below ground structure requires excavation and perimeter retaining walls, and will need to be waterproofed.

The key mechanical and electrical engineering drivers for locating the ventilation buildings include adequate building footprint and headroom to house the mechanical and engineering systems and adequate access to enable truck movements for major equipment (fans,

transformers and switch gear) maintenance/replacement works. The ventilation station building footprint is sufficient to accommodate the mechanical and electrical equipment, and vehicle access can be provided with careful design (access can be provided by a ramp recessed into the roof of the building that slopes down to floor level).

A number of alternatives were considered for the ventilation systems building, including above and below ground options:

- A completely below ground option for the ventilation systems building has the advantage of simplifying the connection between the vent building and the tunnel including the interfaces for the tunnel air extraction point and the smoke extraction duct respectively; and
- A fully above ground option has both disadvantages and advantages, particularly with respect to environmental effects. In particular, the above ground structure of this building has potential impacts on the residential character and amenity of the neighbourhood (Waterview) and will potentially increase the 'urban gap' between Point Chevalier and Waterview. However, some above ground structure also provides an opportunity to shield the Waterview School from Great North Road visual and noise effects.

On balance, the partial construction of this building above and below ground was considered an appropriate balance of construction, cost and environmental considerations.

Ventilation Stack Locations

Alternative locations were considered for the ventilation stacks

In addition to the ventilation building, alternative locations were considered for the ventilation stacks. The dispersion modelling assessment is based on concept locations for the northern and southern ventilation stacks. The proposed stack locations underwent a number of iterations as the Project detailed design developed. However, it was determined that the dispersion modelling results were relatively insensitive to small shifts in the location of the ventilation stacks (within several hundred metres) as the ground level concentrations predicted by the modelling are minor, and tend to be well away from the vent locations.

The proposed ventilation stack locations were selected by the Project team, taking into consideration a wide range of project constraints including:

- Urban design, visual impact and architectural considerations
- Land availability (e.g. within construction footprint/ Project designation);
- Avoiding areas of archaeological significance and the coastal protection area; and
- Avoiding volcanic sight lines for the southern portal.

The proposed locations of the vents are the optimal location for the vents based on constructability, cost and energy efficiency. In summary, options considered for the northern ventilation stack included:

Option 1:
Waterview Reserve between the proposed SH16 on-ramps. This location was preferable from an urban design perspective as the building would be in a modified environment and partially screened by the proposed SH16 ramps. However, the option was unsuitable from an engineering perspective, in particular the site provided only restricted operational access and there was complexity and costs associated with the exhaust system required for this location.

Option 2:
Waterview Reserve to the west of the proposed SH16 on-ramps. This location was rejected on both environmental and engineering grounds. In particular, the stack (and building if shared) would be highly visible (e.g. from within the Waterview community). In addition, construction costs were greater due to the increased length of the exhaust shaft.

Option 3:
The ventilation building and stack located between Waterview School and the Great North Road Underpass. This site was selected as the stack meets the engineering design and air quality requirements and, as noted above, the ventilation building provides opportunities for mitigation of the environmental effects (particularly visual and noise amenity).

Ventilation Stacks

Tunnels afford a greater opportunity to manage vehicle emissions than surface roads

Tunnels afford a greater opportunity to manage vehicle emissions than surface roads. Air quality outside tunnels can be managed through any combination of measures including:

- Dispersion methodologies; and
- Emission treatment technologies.

The Waterview tunnels propose a longitudinal ventilation system, with the main discharge points being ventilation stacks located close to the tunnel portals. Discharges of vehicle exhaust emissions via the ventilation stacks will have minimal impact on concentrations of air pollutants. Dispersion, via ventilation stacks, is where emissions are collected and discharged at high velocity into the atmosphere from tall vents. Ventilation through use of stacks is a very efficient way of dispersing air from the tunnel – removing surface traffic from heavily trafficked roads and discharging the same amount of contaminants from a ventilation exhaust (with sufficient height) results in much lower concentrations at ground level where people are most likely to be exposed.

Air quality assessment work investigated both 15 and 25m stack height options. Selection of the ventilation stack height depends on a number of Project and site specific factors including:

The air quality assessment report is located in Part G.1 of this AEE

- local topography;
- height of nearby buildings;
- tunnel length and traffic volumes; and
- number of vents.

The height of the tunnel ventilation stacks also has a visual impact on the surrounding area, and these effects need to be considered when designing the optimum height. Dispersion modelling has also been used to confirm that the height achieves sufficient dispersion to meet the air quality standards. The basic principle of dispersion is that the greater the height of discharge above ground, the more effective the dispersion, i.e. the smaller the impact at ground level.

The height of 25m was selected based on consideration of the surrounding topography and land use. The surrounding land use in the area of the northern portal is predominantly residential with building heights typically not taller than 8-10 metres. While sensitivity modelling of a 15m stack indicated that this may be suitable, it was not 'preferred' from an air quality or risk management perspective, as it was considered that greater height would further minimise the effects of the discharge from the stacks. In particular, it is best for the stacks to be taller than anything else that is, or might be, built close to it in the future (including allowance for such buildings to be built on higher ground than the base of the stacks).

11.6.7.3 Construction Sequence for Great North Road

The northern cut and cover tunnel is located beneath Great North Road. During construction, sections of Great North Road will be realigned so that the current traffic demand can be managed. Following completion of the construction works, it will be repositioned back onto its current alignment.

The complete closure of Great North Road was not considered an appropriate construction option

Complete closure of Great North Road was not considered an appropriate construction option. This option would have required redirection of traffic to either Rosebank Road to SH16 or other local roads, such as Carrington Road. Given the significance of this route, it was considered that this option would have significant impacts on the existing road network (as a physical resource).

11.6.8 Sector 8 – Avondale Heights Tunnel

11.6.8.1 Tunnel Construction Options (e.g. single and double bore)

The proposed tunnel cross section comprises two tunnels running parallel, one for northbound traffic and one for southbound. In developing this design, an alternative was considered: a single tunnel bore with the three northbound traffic lanes stacked above the three southbound lanes.

A single tunnel bore would reduce the extent of strata title required for the Project (reduced land impacts) and may provide opportunity for a more efficient construction method. However, the evaluation of this option concluded that a single bore tunnel would have a significantly greater cross-sectional area, increasing construction risks, which would require increased construction support requirements and contractor / environmental risks. For example, portal excavations would be significantly deeper, increasing the depth of groundwater cut-off and therefore potential groundwater and associated settlement impacts. On the basis of this assessment, the stacked tunnel arrangement was determined to be less favourable than the dual tunnel bore arrangement (as proposed by the Project).

11.6.8.2 Depth of Tunnel

Varying depths of the deep tunnels were investigated

In developing the Project, consideration was given in the design to varying depths of the deep tunnels. In particular, the options considered factors of geology, groundwater and road geometry (and the environmental effects of these factors). The current alignment (described in the Project Description in Chapter 4 of this AEE), presents a balance of these considerations. In summary, the conclusions of the tunnel design with respect to depth are as follows:

- The geology of the Project area varies along the route of the tunnels (see Drawing Set F.10 of this AEE which provides a geological profile of the tunnels environment). In particular, the geology includes basalt at the southern end of the project. This basalt is considered a constraint for tunnelling as significant tunnelling through basalt would add considerable cost to the Project. There are also areas and depths weathered sediments and Tauranga group materials. These are considered too soft to support a tunnel which results in either considerable cost or environmental impact risks (e.g. settlement for above ground structures). These geological considerations set the minimum depths considered appropriate for the tunnels.
- As the tunnel alignment gets deeper the groundwater pressure increases, requiring increases in structural strength of the tunnel lining. In this regard, the groundwater regime provides drivers (but not constraints) to keep the tunnel shallow.
- As the tunnel gets deeper the road gets steeper and both slows traffic and makes the environment less safe for users. The geometric standards required for a motorway set constraints on how deep the tunnel can be.

11.6.8.3 Emergency Smoke Exhaust

As discussed in Section 4.4.8, in the event of a fire in the tunnel, smoke will be discharged via an emergency smoke exhaust located off Cradock Street (source 12m in height). The smoke exhaust is not part of the ventilation exhaust system for air quality control and will only be used in the event of an emergency.

The smoke exhaust stack is not part of the tunnel ventilation exhaust system and will only be used in the event of an emergency

This location for the exhaust stack was chosen for the following reasons:

- The distance from the stack to the tunnel portals ensures that smoke is not re-circulated back into the tunnels through the portals;
- The location is approximately at the mid-point of the tunnel, allowing a more hydraulically efficient and therefore more cost-effective design to be implemented;
- The use of the emergency exhaust will be very rare. This facility has no function apart from in an emergency event;
- The location does not require land from existing open space areas used for active recreation; and
- The location is not visually prominent and can be partially screened from neighbours to the north and east by existing vegetation.

An alternative design considered exhausting smoke through the ventilation stacks located at either end of the tunnel. This was considered less favourable because of the risks of smoke re-entrainment into the portals (if both stacks were used simultaneously), the requirement for more cross-connecting ducts and a greater number of smoke extraction fans resulting in a more complex system and reduced reliability.

Alternative locations were also considered for the exhaust stack. While other potential sites included the Phyllis Street Reserve and Harbutt Reserve areas, further effects on open space (in particular, visual, loss of facilities and disruption to recreation facilities) as a result of the Project was not considered appropriate. The Phyllis Reserve site in particular was considered a significant physical resource given the established sportsfields, in this area.

11.6.9 Sector 9 – Alan Wood Reserve

11.6.9.1 Alignment Development

The motorway through Sector 9 is a surface alignment that extends from the current termination of the SH20 Motorway at Maioro St to the tunnel portal. The motorway geometry has been developed so that it is consistent with the design of the Maioro Street Interchange. As a result, the location of the crossing beneath Richardson Road is constrained by the approach geometry of this tie-in with the existing SH20 alignment.

The motorway has been developed to tie into SH20 at the Maioro Street Interchange

Beneath the Richardson Road Bridge, there is an existing designation for the future Southdown Rail Line and the design has accommodated both road and rail in this portion of the alignment. In this area, future rail is provided for adjacent to the southbound traffic lanes (i.e. on the northeastern side of the motorway). This is consistent with the design through the existing SH20 alignment.

The geometric standards for road (and rail) have influenced design. There is restricted ability to move the road alignment north away from Valonia Street in this location to maintain safe geometric standards. Therefore the design of the Project proposed realignment of a short section of Valonia Street to maintain a safe and full connection from Valonia Street to Richardson Road. This alignment also means the alignment physically impacts on the large undeveloped residential site off Valonia Street.

Once beneath Richardson Road, the Project alignment follows Alan Wood Reserve to the southern tunnel portals. This corridor is constrained either side by Oakley Creek to the southwest and Hendon Ave to the northeast. Sufficient width has been provided through this corridor for SH20, the pedestrian / cycle way, realigned Oakley Creek Stream and a 20m wide land corridor to replace the land required from the existing Southdown-Avondale Rail corridor.

The Corridor is constrained by Oakley Creek to the southwest and Hendon Avenue to the northeast

The southern portal location has been determined based on it being as far southwest as practicable (maximising the length of tunnel) with optimum geological conditions for the excavation (e.g. reducing the extent of tunnelling or cutting required in the basalt materials). In this regard, the horizontal alignment through this sector is constrained by the proposed portal location, the need to provide for the Oakley Creek Stream and the alignment beneath Richardson Road bridge.

Options considered for variations to this horizontal alignment have been considered. The alignment proposed by the Project has been developed to balance between the extent of stream realignment required (Oakley Creek) and impacts on existing residential communities (particularly the extent of impact on properties on Hendon Ave).

Technical Report G.15 describes the best practicable option for stream works

The alignment was shifted slightly east, to minimise disruption to Oakley Creek. Further detail and a description of the best practicable option for stream works is described in the *Assessment of Stormwater and Streamworks*, Technical Report G.15 attached to this AEE.
Through the southern section of Alan Wood Reserve, the alignment is elevated above surrounding ground levels. This area has been identified as a flood plain, and there needs to be adequate flood protection to the motorway. Therefore the level of the motorway has been developed to remain a suitable height above flood level.

11.6.9.2 Location of the Southern Portal

The location of the southern tunnel portals has sought to maximise the extent of tunnelling for the Project taking into account the geology of the area. In particular the portal location minimises the take of open space land and is in more favourable geology, which can result in reduced construction risk and a possible reduction in the duration of construction.

In confirming the location of the southern portal, options that increased the length of tunnel were not considered practicable as this design resulted in conflicts with the flood plain and Oakley Creek. To avoid these constraints, a more southern portal option would need to be located close to Richardson Road which would require the Project alignment to descend rapidly from the Maioro Street Interchange, resulting in steep north facing ramps for the interchange. In addition to cost issues, this design has potential safety limitations (e.g. the design is not considered appropriate for ramp signals).

11.6.9.3 Southern Ventilation System Building

The location of the southern ventilation building is above the southern portal, as an above ground structure (as described in the Project Description, Chapter 4 of this AEE). The option assessment considered a below ground structure (to minimise impacts on the open space land take and visual / amenity impacts). However, a below ground ventilation building would require a strong building structure, capable of withstanding lateral seismic loads transferred from the adjacent cut faces, and this significantly increases construction costs.

The location of the southern ventilation building is above the southern portal

11.6.9.4 Grout Curtain

As a result of the geology, topography and hydrology of the area[5], the groundwater table in the vicinity of the southern portal is relatively high (approximately 2m below ground level) and occurs as a perched water table within a basalt aquifer. Due to the fractured and jointed nature of the basalt, it has a relatively high permeability and without some form of barrier, large volumes of groundwater would flow into the portal excavation both during construction and during operation. This would, in the long term, result in excessive groundwater drawdown of the basalt aquifer which is an adverse effect. This drawdown would be costly and difficult to control by means of pumping. In addition, it may also result in excessive ground settlement for an extended distance away from the portal excavation with potential damage to surrounding buildings. On this basis, ongoing management (e.g. pumping) of the groundwater drawdown is not considered a practicable option.

Grout curtain is required to control groundwater levels in the long term

Mitigation options have concluded that a groundwater cut-off (a barrier to the groundwater flows) is therefore required around the perimeter of the portal excavation. In situations where basalt is not present this is practicably achieved by means of a secant pile or

[5] In particular the basalt flows from Owairaka / Mount Albert, the relatively flat and low lying surrounded to the west and east by moderately (to steeply) sloping ground and Oakley Creek following a meandering path through the area and immediately to west of the proposed portal.

diaphragm wall. These methods however are not suitable where extremely strong rock such as basalt is present as the machinery is not able to effectively excavate or pile through rock of this strength. In these cases, a grout curtain cut-off is considered the most appropriate option to provide this cut-off.

It is expected that the grout curtain will extend from the ground surface to the base of the basalt layer (i.e. varying depths from ground surface to approximately 15m) and set back from the basalt cut face by at least 20m. This distance is considered appropriate, in order to provide sufficient stability (e.g. to minimise the potential for a basalt block sliding on top of the underlying Tauranga Group materials).

As the grout curtain will be required to control groundwater levels in the long term it is important that it is not damaged by future works and that it is incorporated within the Project designation.

11.6.9.5 Stormwater Treatment and Flood Plain Management

A number of options were considered for stormwater treatment – The BPO and design solutions are described in Technical Report G.15

A number of options were considered for the location and design of stormwater treatment in this sector. The selection of stormwater treatment options was developed using a best practicable option approach for stormwater treatment levels and assessment of the impacts of the mitigation options, in accordance with the design assessment for options provided at the outset of this section.

Options considered included treatment wetlands on the eastern and western side of the alignment, and to the north and south.

On the basis of this assessment, two stormwater wetlands were identified as preferred: one located in Alan Wood Reserve and on the residential zoned land south of Valonia Reserve (currently not developed). Factors considered in identifying this as preferred included:

- Social impacts (a wetland on the eastern side of the alignment required land take from a number of existing residential dwellings. While the western side requires land take from residential zoned land, this is currently not developed and therefore the social disruption impacts were considered less);
- Visual and urban amenity impacts (retaining existing areas of open land with wetlands which can be developed as an amenity area) and considering the significant noise wall mitigation that would be required for residential properties on the western side of the alignment (which was considered to have a potential adverse visual and amenity effect);
- Ongoing operating costs and operating resources, amalgamation of wetland treatment areas to the north or south would require ongoing pumping of stormwater for treatment (to the single facility);
- Environmental risks for the operating system, considering the pumping requirements for a single large wetland treatment option.

A full description of the BPO and proposed design solutions is described in the *Assessment of Stormwater and Streamworks* Technical Report G.15 of this AEE.

11.6.9.6 Oakley Creek Bridge

Both bridge and culvert options were considered for the SH20 alignment crossing of Oakley Creek, in Sector 9. The culvert option would consist of two 3.5 m wide by 2.0 m deep and one 3.5 m wide by 2.5 m deep concrete box culverts. The bridge option would require a 38m wide road bridge with a span of 12 m. The bridge option was selected due to its greater hydraulic efficiency, lower risk of blockage, and environmental benefits. A full description of the BPO and proposed design solutions is described in the *Assessment of Stormwater and Streamworks* Technical Report G.15 of this AEE.

11.6.9.7 25 Valonia Street

The designation proposes to take the entire section at 25 Valonia Street for a number of reasons

The designation proposes to take the whole section at 25 Valonia Street, There are a number of overlapping issues that have resulted in the recommendation for this land take, including the consideration of the alignment (section 11.6.9.1, 11.6.9.5 and option assessment for open space mitigation (the overview of this process is provided in section 11.6 below).

While not seeking to repeat this assessment, the following provides a summary of factors considered in identifying the complete land take of this site as the preferred option:

- The scale of impact from the Project, taking into account the proposed stormwater wetland, stream realignment and construction works proposed for the Project, means that significant revision would be required (from the consented development) for this site. On this basis, and in light of consultation feedback from the landowner, the proposals for partial take were considered to have a significant land use impact for the remainder of the site (this was considered particularly relevant given the conditions of consent for development of the site, including the raising of ground levels);
- Social impacts (land take from this site, which is currently not developed) were considered to have less significant social disruption effects for the community (compared to land take from residential properties on Hendon Avenue which would be required for stormwater and open space mitigation options);
- The impacts for residential development on this site were considered significant and would require substantial mitigation measures, particularly for noise emissions. Any requirements for this noise wall was also considered to have a potential adverse visual and amenity effect both for future residents in this area and for the amenity of the remnant open space areas alongside the Project;
- The provision of the entire site provides greater construction management opportunities, particularly for temporary stormwater treatment and for the provision of the rock crusher (which has been located to be away from existing housing);

- The provision of this land creates an opportunity for a temporary sportsfield over the construction period (subject to confirmation with the Auckland Council that this is appropriate);
- In the longer term this option provides for the mitigation of open space impacts of the Project. In particular, it creates an opportunity for reinstatement of recreation facilities to be undertaken on a 'like-for-like basis' (in respect of both land area and sportsfield provision), maintaining the provision of this open space within the local community. The development of this mitigation would be subject to further mitigation planning with the Auckland Council; and
- Retention of this area as open space creates an opportunity for flood storage to be retained that would have otherwise been lost by the proposed, consented development of 25 Valonia Street. Retention of this area will assist flood management for upstream flooding issues (e.g. by increasing the ability for Metrowater to pass forward flows which is being considered as a flood mitigation option for the O'Donnell Ave area), and minimising potential increases in downstream flooding (e.g. Bollard Avenue). The former is an opportunity identified for the Project while the latter is mitigation of the Project.

11.6.9.8 Construction Methods – Rock Crusher

A rock crusher is required to break down basalt during construction

In this sector it is proposed that a rock crusher be used to break down basalt extracted during construction to achieve a size manageable for reuse or removal off site. A number of alternative construction methods have also been considered and these are briefly discussed in turn:

- Removal by truck for crushing off-site. This option will increase truck movements and potentially would need to be considered in tandem with the construction methods below (if material required some additional resizing prior to transportation). This option would also limit the ability for reuse of basalt material within the construction Project.
- Additional blasting. This option would extend the adverse effects of blasting activities from the Project.
- Use of rock breakers rather than a crusher. This option would increase the duration of construction works, thus increasing both the costs and duration of construction effects.

On this basis, flexibility for use of a rock crusher as a construction method was considered appropriate.

11.7 Mitigation Option Assessment

Assessment of mitigation options has also been undertaken through the design and development of the Project, particularly where potential significant effects have been identified. While the process of assessing mitigation options has been similar to that for design elements (described in 11.5.1 above), the following specific mitigation option assessments are noted. Further details on these assessments are provided in the referenced technical reports.

11.7.1 Noise Mitigation Option Assessment

An assessment of noise mitigation options has been considered for each sector of the Project. The options have been compared against a "Do-Minimum" scenario (which for the purpose of the noise assessment is the road without specific noise mitigation measures), to identify a 'Best Practicable Option' (BPO) for noise mitigation. This process is in accordance with the New Zealand Standard for assessing road noise (NZS 6808:2010) and further detail is provided in the *Assessment of Operational Noise Effects Report* (G.12 of this AEE).

Integrated Mitigation Options for noise have been considered – see the Operational Noise Effects Assessment Report (report G.12 of this AEE)

For each Sector, the assessment of noise mitigation options (to determine the BPO in each case) has been undertaken by means of standardised criteria for assessment and workshops attended by the Project team. Prior to workshops, noise mitigation options were circulated to the Project team, and an assessment matrix for each assessment area was completed (by the relevant team members). Discussion during the workshop served to refine the pre-circulated mitigation options. Based on the outcomes of the workshop and the completed matrices, the BPO has been identified for areas within each sector (the 'Project option'). This option has then been re-modelled for the final calculation of noise levels and is documented in the *Assessment of Operational Noise Effects Report* (G.12 of this AEE).

The criteria for assessment included consideration of the following:

Assessment criteria have been used to confirm the best practicable mitigation option for noise mitigation

- The impacts of the option on the community both in terms of noise impacts but also with regard to health and safety, amenity, visual impacts and integration with the aesthetics of the existing built environment;
- The impacts of the option on the physical environment; and
- The impacts of the option on the safe and efficient operation of the Project, the value for money delivered by the option, and the availability of land to construct and maintain the option.

The matrices containing a summary of information used to identify the preferred mitigation options for receiving environments within each Sector of the Project are attached in the report: *Assessment of Operational Noise Effects* (Appendix F(i) to F(iv)) (Report No. G.12 of this AEE).

11.7.2 Open Space Option Assessment

A number of open space mitigation options have been considered

While the assessment of effects and options for remediation and mitigation has been considered within each 'sector', an overall assessment of the impacts of the Project on open space is also appropriate, given the wider use and value that this physical resource has for the community (in other words, recognising that the effects on open space from the Project have the potential to have wider effects than the immediate local community or sector).

An assessment of options for the mitigation and replacement of open space has been undertaken for the Project. The assessment has considered both the quantity of open space impacted and the quality of this space. Mitigation and remediation solutions have sought to address both of these issues (in other words seeking to both replace 'land for land' and to provide for the replacement use of open space land). Within each Sector, consideration has been given to the provision of local open space and recreation opportunities. However, for 'District Wide' reserve functions (e.g. sportsfields) the option assessment has been considered on a Project wide basis.

The assessment of options has involved consultation with Auckland City Council, Waitakere City Council and other key stakeholders

In assessing options for open space replacement and mitigation, consideration has been given to the design assessment criteria (discussed above). In addition, the assessment has involved consultation with the relevant territorial authorities (Auckland City Council and Waitakere City Council) as the owners and managers of open space and recreation facilities within the Project area, as well as other stakeholders (e.g. sports clubs and others who lease these open space areas and wider community). Further detail on the consultation process is provided in Chapter 10 of this AEE.

On the basis of this consultation, the following specific principles have guided the development of the open space options:

- Retain land for land mitigation options. Where possible the mitigation should create equivalent land area available for open space (rather than enhancement of existing facilities); and
- Active reserve facilities should be provided as much as practicable in combined facilities, e.g. sportsfields should be located together for maintenance and use benefits (rather than scattered).

The assessment of open space impacts and the consideration of options for open space remediation and mitigation is provided further in Chapters 13 through to 22 of this AEE.

11.7.3 Stormwater Management Solutions

Stormwater treatment proposed provides water quality treatment for all new impervious surfaces as well as existing impervious surfaces where practicable

A number of options were considered for the location and design of stormwater treatment in this Sector. The selection of stormwater treatment options was developed using a BPO approach, in accordance with the ARC's Technical Papers.

The stormwater treatment for the Project aims to provide water quality treatment to all new additional impervious areas, as well as existing impervious areas of the State highway network, where this is practicable. Considerations for the options for management and treatment have included:

- Topology and land gradients (e.g. for swales);
- Availability of land minimising the need for land take beyond the existing designation) (e.g. for swales and wetlands);
- Sustainability and ongoing maintenance costs of design options (e.g. for filter strips and cartridge systems); and
- Ability to integrate with landscaping and ecological mitigation solutions (e.g. riparian planting, establishment of wetlands) (e.g. for swales, wetlands and treatment ponds).

A full description of the Best Practicable Option assessment undertaken for mitigation options is described in the *Assessment of Stormwater and Streamworks* Technical Report G.15 of this AEE.

11.7.4 Landscape and Urban Design Assessment

The assessment of effects and options for landscaping and urban design has been considered both for each 'sector' and overall for the Project. In assessing options for the landscape and urban design concepts, consideration has been given to the design assessment criteria (discussed above) and the wider Urban and Landscape Design Framework that the NZTA has developed with stakeholders setting a vision for the Project and the wider area. In addition, the assessment has involved specific consultation with the relevant territorial authorities (Auckland City Council and Waitakere City Council), as well as other stakeholders (e.g. the urban design panel for Auckland City).

A number of principles have guided the development of landscaping and urban design options

On the basis of this process, the following specific principles have guided the development of the landscaping and urban design options:

1. The Design Vision:
    - reinforcing the travel sequence of coast, causeway, valley and urban character;
    - connecting neighbourhoods and public open spaces severed by the corridor;
    - minimising impacts of the project on the surrounding communities;

- visually relating the Project to the setting in the scale and type of structures and planting;
- Having structures that contribute positively to the environment, integrate functionality with elegant and refined design, and serve to orient the viewer

2. Existing design themes:
    - The green route (SH16); and
    - The volcanic highway (SH20)

3. Integration with other assessment elements for the Project:
    - Ecological Integration (e.g. rehabilitation principles for Oakley Creek and the coast / harbour) and planting / vegetation mitigation requirements;
    - Functional design requirements of structures (e.g. lane and elevation requirements for the ramps and operational requirements for the ventilation buildings / stacks);
    - Noise walls (height and location requirements);
    - Highway Furniture (lighting signage etc); and
    - Community plans and consultation feedback.

12. Assessment of Effects – Overview

Overview

The following Chapters (Chapters 13 – 24) provide an assessment of effects in relation to the construction and operation of the Project. The effects assessed include socio-cultural, physical, ecological, and natural environment effects, the impacts of emissions and effects in relation to natural hazards and hazardous substances. These effects are discussed in turn as relevant to each Sector of the Project.

This chapter briefly describes the approach taken for presenting the assessment information, given the scale of the Project. For ease of understanding, the assessment has been broken down into an assessment of regional effects and an assessment of effects by Project sector (geographic area of the Project).

The following Chapters of the AEE: Chapters 13 – 24, provide an assessment of the Project's actual and potential effects during construction and operation.

Chapters 13 – 24 provide the Assessment of Environmental Effects

Given the scale of the Project, the assessment has been broken down in the following way:

- Assessment of the Project on a regional and Project-wide basis during operation (Chapter 13);
- Assessment of the Project by Sector (Chapters 14 through to 22);
- Assessment of the Project against Planning Matters (Chapter 23); and
- Summary of the Mitigation and Monitoring Proposed (Chapter 24).

In considering the actual or potential effects of the Project on the environment, specific consideration has been given to positive and adverse, as well as cumulative effects.

The assessment draws on information provided in the technical assessments that support the AEE and has addressed the matters that should be considered when preparing an assessment of effects on the environment. Table 12-1 summaries the assessments and relevant Technical Reports that have been prepared to support the AEE. Within each row, the words highlighted in **bold** refers to the section headings used in the following Chapters.

Where relevant, reference is made in the Table to Section 2 of Schedule 4 of the RMA: Assessment of Environmental Effects.

Table 12-1 Assessment and Technical Reports Presented in this AEE

Matters Considered	Technical Reports in AEE (Part G) or (Appendices in Part E)
Human Environment (this assessment includes effects on neighbourhood and wider community including socio-economic and cultural effects (s2(a))[1]	
Land Use assessment, including assessment of impacts on Open Space	*E.4: Open Space Restoration Option*
Transport assessment, including assessment of impacts on the transport network during construction and operation	*G.16: Assessment of Temporary Traffic Effects* *G.18: Assessment of Transport Effects*
Effects of **Ground Settlement** (resulting from construction and operation of the Project) on built resources and the neighbourhood	*G.13: Assessment of Ground Settlement Effects*
Social impact assessment, including assessment of impacts of the construction and operation of the Project on communities and neighbourhoods	*G.14: Assessment of Social Impacts*
Cultural assessment, including assessment of impacts of the construction and operation of the Project on cultural values	*E.6: Cultural Impact Reports – Ngati Whatua o Orakei*
Physical Locality Effects (this assessment includes effects on the locality, including landscape and visual (s2(b))	
Visual and Landscape assessment, including consideration of amenity impacts during construction and operation	*G20: Assessment of Visual and Landscape Effects*
Assessment of impacts of construction and operation of the Project on **Amenity Trees**	*E.7: Schedule of Trees*
Effects on Natural and Physical Resources (this assessment includes effects on natural and physical resources of special value (s2(d))	
Assessment of **Archaeology and Heritage** effects, including identification and assessment of impacts of construction and operation of the Project on sites and areas of heritage and historic value	*G.2: Assessment of Archaeological Effects*
Assessment of the effects on **Streams** (as a natural resource), including the effects of stream realignment associated with the construction and operation of the Project	*G.15: Assessment of Stormwater and Streamworks Effects*
Assessment of the effects on **Coastal Processes**: the impacts and changes to the physical processes of the coastal marine environment (as a natural resource)	*G.4: Assessment of Coastal Processes*
Assessment of **Groundwater** (as a natural resource) effects of the construction and operation of the Project	*G.7: Assessment of Groundwater Effects*
Ecosystem Effects (this assessment includes effects on plants, animals and habitats (s2(c))	
Avian Ecology, including consideration of impacts on avifauna and habitats for avifauna over construction and operation of the Project	*G.3: Assessment of Avian Ecological Effects*
Marine Ecology, including consideration of impacts on fauna and habitats for fauna in the coastal marine area	*G.11: Assessment of Marine Ecological Effects*
Herpetofauna Ecology, including consideration of impacts herpetofauna and habitats for herpetofauna over construction and operation of the Project	*G.8: Assessment of Herpetofauna Ecological Effects*
Freshwater Ecology, including consideration of impacts on fauna and habitats for fauna in freshwater areas	*G.6: Assessment of Freshwater Ecological Effects*
Vegetation ecology, including consideration of impacts of construction and operation of the project on significant vegetation and habitats for fauna	*G.17: Assessment of Terrestrial Vegetation Effects*

[1] In reference to Section 2 of Schedule 4 of the RMA.

Matters Considered	Technical Reports in AEE (Part G) or (Appendices in Part E)
Effects of the Discharge of Contaminants into the Environment (this assessment includes the effects of discharge of noise, air, light and vibration (s2(e))	
Air Emissions, including assessment of impacts from the emissions to air during construction and operation of the Project	*G.1: Assessment of Air Quality Effects*
Noise Emissions, including assessment of impacts from noise emitting from the Project during construction and operation	*G.5: Assessment of Construction Noise Effects* *G12: Assessment of Operational Noise Effects*
Vibration Emissions, including assessment of impacts from vibration emitting from the Project during construction and operation	*G.19: Assessment of Vibration Effects*
Light Emissions, including assessment of impacts from light-spill from the Project during construction and operation	*G.10: Assessment of Lighting Effects*
Discharge of Contaminants **(stormwater)**: including the effects of land disturbing activities and the discharge of contaminants from these activities to receiving environments	*G.15: Assessment of Stormwater and Streamworks Effects* *G.22 Erosion and Sediment Control Plan*
Contamination Effects, including the effects of construction works on contaminated land	*G.9: Assessment of Land and Groundwater Contamination*
Other Effects on the neighbourhood and community through natural hazards or the use of hazardous substances (s2(f))	
Effects of **Flooding** (resulting from construction and operation of the Project in the floodplain)	*G.15: Assessment of Stormwater and Streamworks Effects*

The assessment chapters summaries the key findings of the Technical Reports

The full technical assessment reports describe in detail the existing environments, potential effects and mitigation measures with respect to specific natural and physical resources (or emissions) of that report. Where relevant, an environmental management plan has been developed setting out the proposed mitigation and monitoring detailed in the technical assessment reports. For ease of reference, Table 12-2 summarises the environmental management plans that have been prepared and their location within the Technical Reports.

The purpose of the following Chapters, therefore, is to identify the key aspects from each technical assessment, rather than recite the entire report verbatim. Where aspects are not considered to be significant to the geographic area being considered (be it Sector or the wider region), they are not discussed in that Chapter. Reference should therefore be made to the specific technical reports for further information.

The assessment chapters do not describe the methodologies used for undertaking the specific technical or environmental assessments. The overall assessment approach is described in Chapter 9 Investigative Process, with the detailed methodologies for undertaking each specific or environmental assessment provided in the relevant Technical Report.

Table 12-2: Summary of Technical Reports and Environmental Management Plans

Report No.	Technical Report	Relevant Environmental Management Plan(s) (including Location in Technical Report)	
		Appendix Ref	Title
G.1	*Assessment of Air Quality Effects*	Appendix M	Construction Air Quality Management Plan
		Appendix N	Concrete Batching and Crushing Plant Management Plan
		Appendix O	Operational air quality management procedure
G.2	*Assessment of Archaeological Effects*	Appendix D	Archaeological Site Management Plan
G.3	*Assessment of Avian Ecological Effects*	Appendix J	*Avian Excerpts of* Ecological Management Plan
G.5	*Assessment of Construction Noise Effects*	Appendix C	Construction Noise and Vibration Management Plan
		Appendix E	Concrete Batching and Crushing Plant Management Plan
G.6	*Assessment of Freshwater Ecological Effects*	Appendix C	*Freshwater Excerpts of* Ecological Management Plan
G.7	*Assessment of Groundwater Effects*	Appendix H	Groundwater Management Plan
G.9	*Assessment of Land and Groundwater Contamination*	Appendix O	Contaminated Soil Management Plan
G.8	*Assessment of Herpetofauna Ecological Effects*	Appendix A	Lizard Management Plan
G.11	*Assessment of Marine Ecological Effects*	Appendix G	*Marine Excerpts of* Ecological Management Plan
G.13	*Assessment of Ground Settlement Effects*	Appendix H	Settlement Effects Management Plan
G.15	*Assessment of Stormwater and Streamworks Effects*	Appendix D	Operational Stormwater Management Plan
		Appendix E	Temporary Stormwater Management Plan
		Appendix F	Concrete Batching and Crushing Plant Management Plan
G.16	*Assessment of Temporary Traffic Effects*	Appendix A	Construction Traffic Management Plan
G.17	*Assessment of Terrestrial Vegetation Effects*	Appendix C	*Vegetation Excerpts of* Ecological Management Plan
G.19	*Assessment of Vibration Effects*	Appendix L	Construction Noise and Vibration Management Plan
G.21	*Construction Environmental Management Plan (CEMP)*		
G.22	*Erosion and Sediment Control Plan (ESCP)*		

13. Assessment of Effects - Regional and Project Wide

Overview

This Chapter assesses the actual and potential effects of the Project on a Project-wide and broader Region basis. This recognises that whilst there will be specific local effects from the Project, once operational the Project will have some significant benefits to the Region and wider Project Area. It also recognises that some environmental effects of the Project extend beyond any one Sector.

Overall the key Regional and Project-wide effects are positive and include:

- Completing the WWR and providing improved capacity, travel times, accessibility and transport connections across the Region and improving utilisation of the Region's strategic transport network;
- As a result, easing congestion on both the local and regional network, particularly during the AM and PM peak period, and creating opportunities on the local and regional network for other transport modes (particularly passenger transport);
- Economic agglomeration benefits for businesses across the Region, particularly those to the south and west of the City (e.g. Westgate, Te Atatu, Rosebank, Stoddard, Manukau); and
- Improved accessibility for the Region's residents to places of work, recreation and other community facilities (e.g. health services).

While the Project has these wider regional benefits, it is also recognised that some environmental effects of the Project extend beyond any one Sector and these effects are also considered in this Chapter. In particular, the following effects are assessed and conclusions made:

- The Project requires reclamation of a portion of the coastal marine area (CMA) in Auckland's Waitemata Harbour. Overall the works involve permanent reclamation of around 4.7ha and permanent occupation of around 4.1ha of the foreshore and seabed. Overall, the works will only cause minor adjustments to the inter-tidal geomorphology and other effects on coastal processes. Impacts on marine ecology can be minimised through construction design and through off-set mitigation;
- The Projects impact on the avian ecology of the wider Project area. However the effects will be minor, with no notable terrestrial avifauna identified and the Project works avoiding significant areas of marine avifauna wading and roosting;
- Temporary construction traffic will have network wide effects. However, these effects can be managed and mitigated through careful construction management;
- The Project is located within an environment that is recognised as significant (a taonga) by tangata whenua, and these values have been taken into account in the Project design, including its mitigation; and
- The Project has negligible impacts on the regional air shed, with air quality across the Region predicted to improve (irrespective of this Project) with renewal of the vehicle fleet and technological improvements to this fleet.

13.1 Introduction

Some effects of the Project extend to the full extent of the Project area and the wider Region

This Chapter provides an overall assessment of the actual and potential effects of the Project (construction and operation) on the environment, over a Project-wide and broader Region basis. While the following Chapters (14 through to 22) consider the effects of the Project on the specific local environment (as defined by the Sectors), it is recognised that some elements of the effects of the Project need to be considered in terms of both the wider Region and the full extent of the Project area. In particular, key potential effects identified and discussed in this Chapter include effects on regional transport networks, both following completion of the Project and during operation; social and cultural effects, effects on the coastal environment, particularly the Waitemata Harbour; effects on avian ecology and effects on regional air quality[1].

It is noted that in many cases, for example for the assessment of the effects of the Project on air quality, the assessment documented in this AEE is both at a regional/Project-wide assessment and at a local assessment (defined by the Sectors described in Chapters 14 to 22). In terms of freshwater ecology, while the Oakley Creek catchment spans Sectors 5, 7, 8 and 9, the effects on the Oakley Creek stream channel due to the proposed stream realignment in Sector 9 are considered in Chapter 22.

The remainder of this Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project.

13.2 Transport

A more detailed assessment of transport effects of the Project is provided in Technical Report G.18

A full description of the existing environment and transport effects is provided in Technical Report G.18 *Assessment of Transport Effects*. This section is a summary of that report.

13.2.1 Existing Environment

There are a combination of motorways, arterial roads and local roads within and around the Project. The existing transport network includes strategic routes such as the SH16 and SH20 motorway network; regional arterial roads such as Te Atatu Road, Great North Road (GNR), St Lukes Road and New North Road; and local roads such as Cowley Street and Olympus Street that provide access to residential and commercial properties in the area. The following provides a summary of the existing transport environment in terms of:

- State Highways – SH16 and SH20;
- Local Road Network;
- Passenger Transport; and
- Pedestrian and Cycle Connections.

13.2.1.1 State Highways - SH16 and SH20

SH16 and SH20 are identified as Strategic Routes in regional land transport planning

SH16 and SH20 are defined as "Strategic Routes" within the Auckland City District Plan and are part of the Regional Strategic Network in the Auckland Regional Land Transport Strategy (ARLTS). These routes are identified as strategic routes forming part of the network of strategic national importance, and include routes that link the Region to other regions or connect strategic facilities[2]. The main function of these roads is to carry major traffic movements between the principal sectors of the region (i.e. predominantly "through" traffic).

Within the Project area, SH20 is yet to be constructed and currently terminates at the Maioro Street Interchange, connecting to the local road network at Maioro Street and Stoddard Road. South of the Maioro Street Interchange, SH20 currently has two lanes in each direction, with a round-about access road to Maioro Street and Stoddard Roads. Work is currently underway for the grade separation of the Maioro Street Interchange and construction of south facing ramps.

SH16 currently has three lanes in each direction (with two lanes in each direction west of Te Atatu Interchange). Within the Project area, SH16 has on/off-ramps at Te Atatu Interchange, Patiki Road, Rosebank Road, GNR and St Lukes Road.

[2] Auckland District Plan, ARLTS 2010-2040 and Regional Arterial Road Plan, 2009, ARTA.

Existing Travel Flow Patterns along SH16

Within the Project area SH16 currently (2006) carries in excess of 100,000 vehicles per day. This corridor experiences an AM peak between 6am and 10am for the eastbound traffic lanes, as commuter traffic approaches Auckland City, and a PM peak spread across a number of hours between 2pm and 7pm for westbound traffic flow. The PM peak has a wider 'peak' because traffic is more staggered (e.g. school and the traditional work day ending at different times).

Expected Growth in Traffic Volumes on SH16

As a regionally significant traffic corridor in the Auckland Region, the volumes of traffic on SH16 are generally expected to increase as the Region continues to grow. Section 4.2.4 of this AEE, provides a comparison of traffic volumes from 2006 to 2016 and 2026. These expected daily traffic volumes are increases in flow without the Project.

The volumes of traffic on SH16 are expected to increase as the Region grows

While overall there are increases in traffic volume expected on SH16, capacity constraints means that growth is limited and in some cases there are sections on SH16 where there are even minor decreases in traffic volume expected. This is most evident east of Te Atatu, where SH16 is expected to be at or approaching capacity in 2006. In contrast, the completion of the Upper Harbour Bridge Duplication and extension to SH16: Brigham Creek, which are expected before 2016, is evident in the significant increases in traffic volume on these sections of SH16[3].

13.2.1.2 Local Road Network

The Project extends across a number of arterial and local roads across the western parts of Auckland. Key arterial roads include Te Atatu Road, GNR, St Lukes Road, New North Road, Richardson Road and Stoddard Road. These arterial roads are recognised as having a wider transport and community function (e.g. through Auckland City's Liveable Arterials Plan), including maintaining movement of vehicles (e.g. Richardson Road), promoting local condition and amenity (e.g. Carrington Road), passenger transport provision (e.g. GNR) and for the movement of freight (e.g. Maioro Street).

Expected Traffic Volumes on Local Road Network

As for SH16 described above, the volumes of traffic on the wider local road network are generally expected to increase as the Auckland Region continues to grow. Table 13.1 provides a comparison of traffic volumes on key local roads (those highlighted are in close proximity of the Project) from 2006 to 2016 and 2026. These expected volumes are without the Project.

[3] These capacity improvements enable traffic to divert from local roads to this strategic route, and as specific urban growth planned in these areas progresses (e.g. the Massey North development area).

Table 13.1: Comparison of 2006 with 2016 and 2026 Traffic Flows on Selected Routes (vpd) without the Project

Location	2006	2016	2006-2016 % Change	2026	2006-2026 % Change
Manukau Road (south of Greenlane)	31,400	30,900	-1.6%	30,900	-1.6%
Gillies Avenue	16,200	17,900	10.5%	20,100	24.1%
Mt Eden Road	22,300	22,100	-0.9%	21,700	-2.7%
New North Road	29,800	28,600	-4.0%	28,200	-5.4%
Dominion Road	16,900	21,600	27.8%	21,600	27.8%
Sandringham Road	14,700	15,600	6.1%	15,400	4.8%
Tiverton/Wolverton	17,800	27,300	53.4%	28,400	59.6%
Mt Albert Road	18,600	16,600	-10.8%	16,400	-11.8%
Carrington Road	28,100	30,800	9.6%	32,400	15.3%
GNR (west of New Lynn)	37,000	35,800	-3.2%	37,800	2.2%
GNR (north of Blockhouse Bay Road)	48,200	46,700	-3.1%	46,300	-3.9%
Rosebank Road	25,000	25,700	2.8%	27,200	8.8%
Blockhouse Bay Road	13,600	15,100	11.0%	15,200	11.8%
St Lukes Road	30,600	34,400	12.4%	34,600	13.1%
Te Atatu Road	42,800	43,300	1.2%	44,100	3.0%
Lincoln Road	44,800	44,400	-0.9%	48,800	8.9%

In 2009 the SH20 Mt Roskill extension to Maioro Street was completed and opened. This has resulted in a reduction in traffic flows on roads such as Mt Albert Road and an increase in traffic flows on roads such as Gilles Avenue with more vehicles using these roads to access the SH20 extension. Other widening projects such as the Tiverton/Wolverton Street Upgrade Project have resulted in increased traffic flows on this corridor.

Travel Times

The Project Assignment Model (see Technical Report G.18 *Assessment of Transport Effects*) predicts travel times along selected routes within the wider Project area (these routes are shown in Figure 13.1). The AM and PM period predicted travel times for 2016 and 2026 (without the Project) are shown in Table 13.2.

The table illustrates that between 2016 and 2026 a number of routes are expected to experience an increase in travel times (from congestion) due to the growth in traffic volumes over the 10 year period. Overall, there are general increases in peak period travel times expected for local and regional (SH16) routes. Two roads in the PM Peak are observed with a minor decrease (less than 2%) between 2016 and 2026.

Figure 13.1: 'Travel Time' Routes

Table 13.2: 2016 DM and 2026 DM Total Travel Times along Selected Routes

Route	Direction	Length (km)	Travel Times (minutes)					
			2016 AM	2026 AM	Change	2016 PM	2026 PM	Change (%)
SH16 (Royal Road to St Lukes)	E/B	11.5	9.4	12.1	**2.7 (28%)**	7.2	7.2	**0.0 (0%)**
	W/B	11.0	6.9	6.9	**0.0 (0%)**	14.2	16.5	**2.3 (16%)**
Rosebank Road	E/B	4.1	7.1	7.3	**0.2 (3%)**	9.1	9.3	**0.2 (2%)**
	W/B	4.1	10.1	10.3	**0.3 (3%)**	7.8	8.2	**0.5 (6%)**
Tiverton/ Wolverton	E/B	3.5	8.5	8.5	**0.1 (1%)**	6.2	6.2	**0.0 (0%)**
	W/B	3.5	6.1	6.1	**0.0 (0%)**	6.9	6.9	**0.1 (1%)**
GNR/ New North Road	N/B	6.1	13.7	13.9	**0.2 (1%)**	13.4	13.4	**0.0 (0%)**
	S/B	6.1	12.8	12.9	**0.0 (0%)**	14.0	13.8	**-0.2 (-2%)**
GNR	N/B	3.4	5.7	5.7	**0.0 (0%)**	5.7	5.7	**0.0 (1%)**
	S/B	3.4	5.9	5.9	**0.0 (0%)**	6.4	6.8	**0.3 (5%)**
Carrington Road	N/B	5.0	7.6	7.8	**0.2 (3%)**	7.4	7.6	**0.2 (3%)**
	S/B	5.0	8.3	8.3	**0.0 (0%)**	7.1	7.2	**0.0 (0%)**
Dominion Road	N/B	4.4	9.0	9.0	**0.0 (0%)**	8.6	8.6	**0.0 (0%)**
	S/B	4.4	8.0	8.0	**0.0 (0%)**	9.0	8.9	**-0.1(-1%)**
Te Atatu Road	N/B	3.3	6.3	6.6	**0.3 (4%)**	6.5	6.6	**0.1 (1%)**
	S/B	3.3	5.5	5.5	**0.0 (0%)**	6.4	6.4	**0.0 (1%)**
Lincoln Road	N/B	2.9	7.3	7.7	**0.4 (5%)**	7.2	7.8	**0.6 (8%)**
	S/B	2.9	5.8	5.9	**0.1 (1%)**	6.1	6.3	**0.2 (3%)**

13.2.1.3 Passenger Transport

QTN Routes through the area of the Project

Passenger transport includes bus services that operate within and through the Project area, notably along corridors such as SH16, Great North Road, Te Atatu Road, Richardson Road and Rosebank Road[4].

In Sector 8 the North Auckland Rail Line runs parallel to New North Road. A future strategic rail connection is also identified (and land is designated) for the Avondale – Southdown Rail Line, through the Alan Wood Reserve area (Sector 9).

The Local Transit Network (LCN), Quality Transit Network (QTN) and Rapid Transit Network (RTN) outlined in the ARTA Passenger Transport Network Plan 2006-2016 are illustrated in Figure 13.2.

[4] Technical Report G.18 *Assessment of Transport Effects* outlines the bus routes which operate within each of the Project sectors and the frequency of buses on these roads.

13.2.1.4 Pedestrian and Cycle Connections

13.2.2

On and Off Road Pedestrian and Cycle Ways have been Identified

Cycle routes and pedestrian paths identified by ARTA are also included in Figure 13.2[5]. Cycling within the Project area is mainly provided for via on-road cycle lanes and shared pedestrian and cycling paths off-road. Walking facilities consist mainly of footpaths on the side of local roads. Key pedestrian/cycle way routes located in the vicinity of the Project include:

- Off-road commuter facilities, such as the Northwestern Cycleway along SH16 (Sectors 1 – 6), a shared walking and cycle path along GNR between GNR Interchange and the intersection of Blockhouse Bay Road (Sectors 7 and 8), and the pedestrian/cycle way provided along the southern side of SH20 and between Maioro Street and Stoddard Road via the SH20 roundabout termination (Sector 9);
- On-Road commuter facilities, such as on-road cycle lanes along Te Atatu Road North, Carrington Road and Mt Albert Road to the intersection with Sandringham Road;
- Recreation routes, including the walking path through Oakley Creek Esplanade Reserve (Sectors 7 and 8) and through Underwood Reserve to Hendon Park (south of Sector 9); and
- The pedestrian subway to the western side of Te Atatu Road (Sector 1), is also noted as a grade separated facility to provide pedestrian access across SH16 (which links to the on-road cycle facilities in this area).

13.2.3 Assessment – Operation

The traffic modelling methodology[6] assesses the transport effects in 2016 and 2026 future years (at or near opening and ten years after completion).

13.2.3.1 Wider Strategic Network Traffic Effects

Traffic Volume

Table 13.3 provides a summary of the predicted changes in daily traffic on key State highway links, between the 'do minimum' (without the Project) and 'the Project' (in 2016 and 2026). For comparison purposes, the current (2006) daily traffic flows are also included, though the '% Change' is a reference to with or without the Project (not a comparison between years).

---

5 Auckland City Council has also produced a proposed 20 year cycle network plan (in line with its Liveable Arterials Plan and Future Planning Framework). Future strategic links identified on this Plan include along Stoddard Road, through Hendon Park, through Alan Wood Reserve across New North Road and through Harbutt and Phyllis Reserve to link with the Oakley Creek route. A number of other regional links are shown on the Plan and identified along arterial roads within the future cycle network e.g. GNR, New North Road and Stoddard Road.

6 The traffic modelling methodology undertaken to assess the effects of the Project is outlined in Section 3.1 of Technical Report G.18 *Assessment of Transport Effects*.

Figure 13.2: Existing Environment Transport Map

Table 13.3: Daily Flows on Key State Highway Links

Location	Scenario						
		2016 (vpd)			2026 (vpd)		
	2006	Without Project	With Project	% Change	Without Project	With Project	% Change
SH1 Auckland Harbour Bridge	184,100	191,600	191,800	**200 (0%)**	193,400	194,000	**600 (0%)**
SH18 Upper Harbour Bridge	26,500	57,100	58,000	**900 (2%)**	66,800	68,000	**1,200 (2%)**
SH20 Mt Roskill	-	49,400	84,300	**34,900 (71%)**	51,400	98,800	**47,400 (92%)**
SH20 Manukau Harbour Bridge	-	126,100	133,100	**7,000 (6%)**	133,100	141,800	**8,700 (7%)**
SH1 Greenlane East to Market Road	180,500	186,600	183,400	**-3,200 (-2%)**	188,900	184,400	**-4,500 (-2%)**
SH1 CMJ (south of SH16)	159,600	194,000	182,100	**-11,900 (-6%)**	201,300	186,100	**-15,200 (-8%)**

In summary, the effects on the wider strategic network include:

The Project will result in decreases in traffic flows on SH1

- In 2016 and 2026, the increase in daily traffic flows on SH18 Upper Harbour Bridge, comparing the traffic volumes with and without Project is only 2% (or around 900 and 1,200 vehicles per day). This compares with the expected growth in total traffic flows on this section of SH18 over these assessment periods (e.g. between 2016 and 2026 17% growth is expected). This indicates that the Project is not increasing vehicle trips to and from the North Shore as much as growth in traffic on SH16 overall;
- The Project will result in decreases in traffic flows on SH1, particularly in Central Motorway Junction (CMJ) south of SH16. This is considered to be a result of drivers choosing to use the completed SH20 and WRR and indicates that the Project provides an alternative to the existing SH1, linking northern, western and southern parts of Auckland. However, it is also noted that modelling indicates that available capacity on SH1 is then likely taken up by vehicles diverting from the local road network onto the State highway. This reduces the evidence of diversion off SH1 onto SH20, in the above figures; and
- With the Project in place, there is an increase in traffic flows expected on SH20 as the WRR is completed and provides the full strategic transport route as planned. This increase is most evident close to the Project (e.g. at Mt Roskill) but also on the Manukau Harbour Bridge.

The Project provides for 'through traffic'

Analysis has also be undertaken to understand where traffic using the Project comes from (e.g. from across the wider network). The modelled origins and destinations of vehicles using the SH20 section of the Project at a daily level indicated that:

- 11% of traffic was to/from the North Shore;
- 30% of traffic was to/from Manukau and the south (including the airport);
- 9% of traffic was to/from Auckland CBD;
- 20% of traffic was to/from Waitakere; and
- 30% of traffic was to/from Auckland City, excluding the CBD.

These results indicate that the SH20 section of the Project provides a 'through traffic' function (for movement across the region) rather than providing for local traffic. It is anticipated that local traffic is left to use the local road network.

Travel Times

While looking at total traffic volumes provides an overview of the effects on the wider strategic network, an assessment of travel times provides a quantum of the transport effects for accessibility and the connectivity and efficiency of the network.

Travel Times decrease with the completion of the Project

The traffic modelling has been used to assess the changes in average travel time during the AM and PM peak periods to and from a number of selected origin and destinations. This assessment considers travel times with the Project (compared to without) in 2026. The origin and destination pairs included Westlake, Auckland CBD, Penrose, Manukau, Airport, Westgate, Henderson, New Lynn, Avondale College, Rosebank and Lynfield.

The key findings identified that AM peak travel times between most origin/destination pairs decreased with the completion of the Project. The largest decreases in travel times were identified from Westgate to the south, and for destinations along the WRR, such as Henderson and Avondale. There were also decreases in travel time for trips from the airport and Manukau especially when paired to Rosebank, Westgate and Westlake. During the PM peak period, a similar pattern of changes were observed, although it was noted that decreases in travel times were greater than during the AM peak period.

However, increases in travel time were also observed though these were smaller in number and quantum (both AM and PM peak periods). This was identified as being due to increases in delay on other parts of SH16 or SH20 (outside of the Project), rather than delays on SH16 and SH20 within the Project corridor. Furthermore, these increases are relatively minor, especially when compared to the larger travel time savings on most other journeys.

In summary, considering the origin/destination pairs, there is a significant overall reduction in average travel time during both the AM and PM peak periods in 2026. Furthermore, when these travel times are compared with the 2006 AM and PM models, reductions in travel times are also observed (in other words, the Project is expected to reduce travel times in 2026 compared with the existing situation).

Conclusions for Strategic Network Effects

The Project improves capacity, resilience and accessibility for the Region's strategy transport network

The traffic modelling indicates that the Project will:

- Improve the capacity of the WRR (SH16 and SH20);
- Improve the resilience and reliability of the State highway network (by completing the WRR and an alternative strategic corridor to SH1); and
- Improve accessibility and the effectiveness and efficiency of the State highway network by increasing capacity on the strategic network and improving travel times between key business, employment and residential areas.

The assessments also indicate benefits in the separation of through and local traffic by improving the function of the State highway network (and creating opportunity for improvements to the function of these parts of the network).

13.2.3.2 Traffic Effects on SH16 and SH20

Traffic Effects on SH20

In 2016, the SH20 component of the Project (i.e. between Maioro Street Interchange and GNR Interchange) is predicted to attract 70,000 vehicles per day (vpd). By 2026, the modelled '10 years after opening', this is anticipated to rise to 83,000vpd. Table 13.4 details Peak Period (2 hour) volumes on the SH20 'mainline' and ramps to SH16, in 2016 and 2026.

Table 13.4: Peak Period (2 hour) Users of SH20 Waterview Connection

Location	Direction	2016		2026	
		AM	PM	AM	PM
SH20 Waterview Connection mainline	N/B	4,700	5800	5,000	**6,900**
	S/B	5,500	3,800	6,500	**4,100**
East Facing Ramps	To city	2,700	2,500	2,800	**3,000**
	From SH16	1,800	1,800	2,200	**2,000**
West Facing Ramps	To West	2,000	3,300	2,200	**3,800**
	From SH16	**3,600**	**2,000**	**4,400**	**2,200**

With an assumed lane capacity of 2,100 vehicles per hour (vph), it is anticipated that both the daily and two-hour peak period capacity in both direction (northbound and southbound) of a typical three lane motorway carriageway would be around 150,000 and 12,600 vehicles respectively. Whilst these capacities would be reduced under certain conditions, such as the operating conditions in the tunnel or inclined grades, the predicted 2026 traffic volumes would still be anticipated to be adequately accommodated (e.g. in 2026 the total daily traffic volume of 82,300 can be accommodated in the capacity of 150,000 vehicles).

The Project has been designed at sufficient traffic capacity for expected traffic flows

With regard to the SH16/SH20 motorway to motorway ramps, the predicted 2026 daily and two-hour peak period traffic flows are around 22,000 and 4,500 respectively (AM peak direction from SH16 to SH20). With the exception of the westbound off-ramp SH16 to SH20 (which is a single lane), the three other motorway to motorway ramps are proposed to be provided with two lanes. Consequently using the same lane capacity of 2,100 vph, even considering ramps grades, it is anticipated that the ramps would adequately accommodate the predicted 2026 traffic flows.

Traffic Effects on SH16

The predicted effects of the Project in relation to the changes in daily traffic flows on SH16 in both the 2016 and 2026 future years, when compared with the 'do minimum' scenario (without the Project), are summarised in Table 13.5 below.

Table 13.5: Daily Traffic Flows on SH16 (2 directional)

Location	Scenario						
		2016			2026		
	2006	Without Project	With Project	% Change	Without Project	With Project	% Change
Newton Road to St Lukes Road	126,900	135,100	148,400	**13,300 (10%)**	137,900	156,000	**18,100 (13%)**
St Lukes to GNR	116,700	113,700	138,800	**25,100 (22%)**	117,000	147,700	**30,700 (26%)**
GNR to Rosebank	104,000	105,300	120,200	**14,900 (14%)**	115,500	133,000	**17,500 (15%)**
Rosebank to Patiki	88,400	89,000	101,500	**12,500 (14%)**	97,600	113,200	**15,600 (16%)**
Patiki to Te Atatu Toad	105,400	106,200	118,600	**12,400 (12%)**	116,500	132,200	**15,700 (13%)**
Te Atatu Road to Lincoln Road	76,600	82,600	93,500	**10,900 (13%)**	91,300	109,700	**18,400 (20%)**
Lincoln Road to Royal Road	61,100	75,500	77,400	**1,900 (3%)**	86,200	96,100	**9,900 (11%)**
Royal Road to Westgate	42,800	54,600	55,900	**1,300 (2%)**	69,000	75,300	**6,300 (9%)**

As noted in Section 13.2.1.1, an increase in traffic flows on most sections of SH16 is expected between 2006 and 2016 and 2026, even without the Project. The following observations are made to the changes in traffic flows on SH16 as a result of the Project:

Capacity improvements result in an increase utilisation of the WRR

- There is an increase in traffic flows on SH16 with the increased capacity (e.g. a 22% increase on SH16 between St Lukes Road Interchange and GNR Interchange in 2016). Given the limited growth on this section of SH16 without the Project (e.g. between 2006 and 2016 there is a 2% decrease) this is considered to reflect the capacity constraint that exists on this section of this strategic route.
- The modelling used to assess traffic flows on SH16 reflects the expected timing of widening of SH16 beyond the Project (e.g. west of Lincoln Road Interchange). The differences in traffic flows on sections west of Lincoln Road Interchange in 2016 are limited to 10% or less. However, once the full widening of SH16 is complete (expected beyond 2016 but before 2026) the increases in flows are between 9% and 20%.

Significant improvements in the lane capacity along SH16

The Project will provide significant improvements in the lane capacity along SH16 in both the eastbound and westbound directions. This capacity is taken up with increases in traffic flow. Between 2006 and 2026, traffic flows on SH16 eastbound (with the Project) are expected to increase by approximately 25%. In the westbound direction, during the evening peak period, traffic flows are predicted to increase by approximately 35% over this same period.

During the morning period, 2016 eastbound travel times on SH16 (e.g. to the city) are expected to improve with the completion of the Project. However, the operational model observations indicate that queuing would still be anticipated from east of St Lukes Interchange toward the GNR Interchange. By 2026, eastbound travel times are predicted to increase compared to 2016, but are still anticipated to be improved compared with 2006 travel times.

In 2016 (with the Project) westbound on SH16 in the evening peak period, queuing is observed to extend back from the approach to the Te Atatu westbound off-ramp to west of the GNR Interchange westbound on-ramps. The travel times predicted are similar to those experienced in 2006. By 2026, significant queuing and increases in travel times are predicted during the evening peak period (from Te Atatu Interchange back to the GNR Interchange).

Because of the extra traffic accommodated by the Project and constraints on the feeder roads, some significant queuing is expected around the Interchanges. It is considered this may be reduced with further refinement to the optimisation and coordination at the surrounding intersections (e.g. improving light phasing for signal controls). It is proposed that management plans for accommodating this are proposed to be developed (see Section 13.2.3below). In relation to St Lukes Interchange, it is noted that NZTA is already progressing a separate study to consider improvements.

Traffic Effects on SH20

SH20 is generally observed to operate satisfactorily

As noted above, the queuing and increases in travel time during the PM peak period extends from Te Atatu Interchange, back to the GNR Interchange. This queuing also impacts along the SH20-SH16 westbound on-ramp and has the potential to cause queuing into the SH20 tunnels. It is therefore proposed that a tunnel management plan or strategy is developed to control the northbound traffic flows on SH20 through the tunnel, to be effective by 2026. This will avoid the potential impacts of congestion within the tunnel, during any affected period.

Other than the predicted effects on SH16 above, SH20 is generally observed to operate satisfactorily in both the northbound and southbound directions. Some slow moving traffic is observed to occur on the southbound approach to the Maioro Street Interchange with reduced vehicle speeds of Heavy Commercial Vehicles (HCVs) at the exit gradients of the tunnel. However, this is not observed to result in queuing back into the tunnel.

Summary of SH16 and SH20

In summary with the Project, the SH16 and SH20 corridors are expected to accommodate up to 25% and 35% respectively more morning and evening peak hour traffic in 2026 compared with the 2006 baseline. During the morning peak in 2026, the performance is observed to be improved in the eastbound peak direction, whilst in the westbound direction during the evening peak the performance of the SH16 corridor is not materially different, when compared with the 2006 baseline.

13.2.3.3 Effects on Arterial/Local Road Network

Traffic Flow Effects

Table 13.6 shows the predicted changes in daily flows on selected arterial routes in the local road network.

Table 13.6: Forecasted Daily Flows on Arterial Routes

Location	Scenarios						
		2016			2026		
	2006	Without Project	With Project	Change	Without Project	With Project	Change
Manukau Road (south of Greenlane)	31,400	30,900	28,900	-2,000 (-6%)	30,900	28,500	-2,400 (-8%)
Gillies Avenue	16,200	17,900	12,100	-5,800 (-32%)	20,100	10,700	-9,400 (-47%)
Mt Eden Road	22,300	22,100	19,900	-2,200 (-10%)	21,700	19,000	-2,700 (-12%)
New North Road	29,800	28,600	29,600	1,000 (3%)	28,200	29,200	1,000 (4%)
Dominion Road	16,900	21,600	16,900	-4,700 (-22%)	21,600	16,800	-4,800 (-22%)
Sandringham Road	14,700	15,600	13,200	-2,400 (-15%)	15,400	12,900	-2,500 (-16%)
Tiverton/Wolverton	17,800	27,300	23,700	-3,600 (-13%)	28,400	24,300	-4,100 (-14%)
Mt Albert Road	18,600	16,600	14,300	-2,300 (-14%)	16,400	13,000	-3,400 (-21%)
Carrington Road	28,100	30,800	23,000	-7,800 (-25%)	32,400	23,000	-9,400 (-29%)
GNR (West of New Lynn)	37,000	35,800	33,100	-2,700 (-8%)	37,800	34,700	-3,100 (-8%)
GNR (north of Blockhouse Bay Road)	48,200	46,700	42,700	-4,000 (-9%)	46,300	42,200	-4,100 (-9%)
Rosebank Road	25,000	25,700	25,800	100 (0%)	27,200	27,400	200 (1%)
Blockhouse Bay Road	13,600	15,100	10,300	-4,800 (-32%)	15,200	10,300	-4,900 (-32%)
St Lukes Road	30,600	34,400	27,700	-6,700 (-19%)	34,600	26,500	-8,100 (-23%)
Te Atatu Road	42,800	43,300	46,200	2,900 (7%)	44,100	48,400	4,300 (10%)
Lincoln Road	44,800	44,400	44,200	-200 (0%)	48,800	49,900	1,100 (2%)

As identified in Table 13.6, the following observations are made with regard to effects on the local road network:

The Project will see a reduction in daily traffic flows on many key local roads

- Compared to the network without the Project, it is expected that the Project will result in a reduction in daily traffic flows on the majority of local roads identified in Table 13.6, in both 2016 and 2026. As an average, the reduction in daily traffic flows on local roads, as a result of the Project, is expected to be around 12% in 2016 and 14%

in 2026. This indicates that the Project does act as an alternative strategic route, diverting traffic from the local road network to the State highway network; and

- In many cases (with Tiverton/Wolverton Roads a notable exception), the traffic flows in 2026 with the Project are expected to be lower than current (2006) flows.

Te Atatu Road is a four-lane arterial road, but much of the current congestion on this road is currently observed to occur around the SH16 Interchange. The Project will provide significant improvements to the capacity for both through traffic on Te Atatu Road and traffic accessing SH16 at the Interchange. It is anticipated that this will enable the Interchange to better accommodate the predicted increases in daily and peak period traffic on Te Atatu Road.

Moreover, it is noted that Waitakere City Council is investigating improvements to the Te Atatu Road corridor, under a separate project. The Te Atatu Road corridor (Edmonton Road to the SH16 Interchange) is also identified as a prioritised corridor within the Regional Arterial Road Plan. The identified improvements for this corridor include improvements for buses and high occupancy vehicles (HOV), which will be enhanced by the priority/bus lanes provided at the Interchange, identified as part of this Project.

In the case of the Tiverton/Wolverton route, significant traffic growth by 2016 is associated with the corridor improvements that will occur as part of a separate project (SH20 Mt Roskill).

Travel Times

Details of the total travel times along arterial routes for the AM and PM peaks in the 2026 without Project and with Project scenarios are outlined in Table 13.7 below.

Table 13.7: 2026 Travel Times along Selected Routes (Refer Figure 13.2 above for location of route)

Route	Direction	Length (km)	Travel Times (minutes)					
			AM			PM		
			Without Project	With Project	Change	Without Project	With Project	Change
Rosebank Road	E/B	4.1	7.3	8.4	1.1 (15%)	9.3	9.0	-0.3 (-3%)
	W/B	4.1	10.3	9.6	-0.7 (-7%)	8.2	8.8	0.6 (7%)
Tiverton/Wolverton	E/B	3.5	8.5	7.4	-1.1 (-13%)	6.2	6.1	-0.1 (-2%)
	W/B	3.5	6.1	6.2	0.1 (2%)	6.9	6.1	-0.8 (-12%)
GNR/New North Road	N/B	6.1	13.9	13.2	-0.7 (-5%)	13.5	12.3	-1.2 (-9%)
	S/B	6.1	12.9	12.1	-0.8 (-6%)	13.8	12.3	-1.5 (-11%)
GNR	N/B	3.4	5.7	5.6	-0.1 (-2%)	5.7	5.5	-0.2 (-4%)
	S/B	3.4	5.9	5.6	-0.3 (-5%)	6.8	6.1	-0.7 (-10%)
Carrington Road	N/B	5.0	7.8	7.2	-0.6 (-8%)	7.6	7.1	-0.5 (-7%)
	S/B	5.0	8.3	7.0	-1.3 (-16%)	7.2	7.0	-0.2 (-3%)
Dominion Road	N/B	4.4	9.0	8.2	-0.8 (-9%)	8.6	8.3	-0.3 (-3%)
	S/B	4.4	8.0	7.8	-0.2 (-3%)	8.9	8.5	-0.4 (-4%)
Te Atatu Road	N/B	3.3	6.6	7.4	0.8 (12%)	6.6	6.5	-0.1 (-2%)
	S/B	3.3	5.5	6.1	0.6 (11%)	6.4	7.7	1.3 (20%)
Lincoln Road	N/B	2.9	7.7	8.0	0.3 (4%)	7.8	6.5	-1.3 (-17%)
	S/B	2.9	5.9	5.8	-0.1 (-2%)	6.3	7.7	1.4 (22%)

Most arterial routes have improved travel times with the Project

The modelling results show that travel times along the above arterial routes have similar patterns to the traffic flows (in terms of reductions in times with the Project compared to without the Project). In particular, the following assessment conclusions are made:

- In 2026 travel times along the Tiverton/Wolverton corridor are up to 13% faster with the Project. This is considered to be due to traffic diverting from this corridor to the Project, when it is in place;
- In 2026 travel times along GNR are up to 10% faster in the southbound direction with the Project (due to predicted reductions in traffic on GNR and on the roads accessing GNR);
- In 2026 travel times along Carrington Road are up to 16% (AM peak southbound) with the Project, due to the reductions in traffic flow;
- In 2026 travel times along Dominion Road are improved by up to 9%, when the Project is in place;
- In 2026 travel times along Te Atatu Road are increased by around 12% in the AM peak (both northbound and southbound) due to extra traffic accessing SH16; and
- In 2026 travel times along Te Atatu Road and Lincoln Road are increased by 20 - 22% in the AM peak (southbound) due to extra traffic accessing SH16.

The Project reduced HCV traffic flows on arterial and local roads

Reductions in daily HCV traffic flows and the HCV vehicle kilometres travelled on arterial and local roads are predicted with the Project (mainly GNR, Blockhouse Bay Road, Carrington Road, Mt Albert Road, Sandringham Road, Dominion Road, Manukau Road and Rosebank Road). These predictions are in line with the overall reduction in total traffic using these roads. It is considered that this would be primarily associated with the opportunity for HCVs to use SH20 or SH16 as strategic freight routes. This is further demonstrated in the predicted percentage increase in the daily vehicle kilometres travelled by HCVs on motorways in both the Project area and across the Auckland Region, with an associated reduction in percentage of HCVs travelling on local arterial roads.

The lower daily and peak period traffic volumes on the majority of these arterial routes compared to 2026 without the Project and 2006 in the case of the daily traffic flows, provides opportunities for the future provision of pedestrian, cycle and passenger transport facilities along these corridors (discussed further below).

Te Atatu Road (Edmonton Road to SH16) and GNR (Blockhouse Bay Road to SH16) are identified in the Regional Arterial Road Plan, as prioritised corridors for which corridor management plans are to be developed. As discussed above, the improvements to the Te Atatu Interchange (as proposed by this Project) should complement any Te Atatu Road corridor project. The identified reductions in daily and peak period traffic flows and travel times on GNR should also assist in the development of the corridor management plan for this route (though this would be undertaken as part of a separate project).

The reductions in traffic flows and improved travel times on both GNR (Avondale to Pt Chevalier) and Carrington Road / Mt Albert Road (which are provided by this Project) will complement the role, future strategic direction and short-term function of these routes (as identified in the Regional Arterial Road Plan). Furthermore, the additional capacity or functioning of these routes will assist in providing for a range of transport opportunities for connections between centres (though it is acknowledged that these would not be delivered by the Project).

13.2.3.4 Effects on Property Access and Parking

The effects of the Project on property access and parking are considered within the effects assessment of each relevant Sector (see Chapters 14, 16, 18, 20 and 22 in particular).

13.2.3.5 Effects on the Passenger Transport Network

The Project Description in Chapter 4 of this AEE and Section 2.3 of Technical Report *G.18 Assessment of Transport Effects* describe the proposed bus priority measures proposed as part of the Project.

Bus Priority Measures

The bus priority measures proposed as part of the Project are described in Chapter 4 of the AEE. The bus priority improvements include:

The Project will almost double the existing length of bus shoulder on SH16 between Te Atatu Road and GNR Interchanges

- Bus shoulders along SH16 between Henderson Creek and GNR Interchange. Further to the west, beyond Henderson Creek, the proposed bus shoulders will connect with bus shoulders to be provided as part of separate projects;
- Additional bus priority measures provided through the continuation of the westbound bus shoulder on SH16 along the eastbound off-ramp at Te Atatu Interchange to the signalised intersection for left turn lanes at Te Atatu Road. This will improve the existing provision on this off-ramp, enabling buses to bypass and queuing on the off-ramp and have priority at the Te Atatu Road intersection. No bus stops on Te Atatu Road will need to be relocated following completion of the Project[7].

The overall change in bus shoulder provision along the length of SH16 between Henderson Creek and GNR Interchange is summarised in Table 13.7:

Table 13.8: Summary of Proposed Change in SH16 Bus Shoulders (though to GNR Interchange)

Direction	Existing (metres)	Proposed (metres)	Change (metres)
Westbound	1,450	4,400	**+2.950**
Eastbound	3,150	4,450	**+1,300**
Total Eastbound and Westbound	4,600	8,850	**+4,250**

The Project proposals will almost double the existing length of bus shoulder provision along

[7] There are no dedicated facilities through SH20 as it is not anticipated that there is currently a requirement for these facilities, specifically bus shoulders.

the section of SH16 between Te Atatu Road Interchange and GNR Interchange. The most significant improvement in the provision of the bus shoulder provision will be for westbound buses, particularly from west of the Rosebank Road off-ramp to the Te Atatu Road Interchange. The more continuous provision of bus shoulders along SH16 is anticipated to provide significant benefits to the operation of peak direction (weekday AM peak – eastbound, weekday PM peak – westbound) buses along SH16, particularly when combined with bus shoulder provision further to the west on SH16 (as part of separate projects).

Around 20 – 40 buses currently use the Patiki Road eastbound on-ramp on a daily basis. These buses exit at the Te Atatu Road Interchange westbound off-ramp. Consequently in combination with the proposed facilities at Te Atatu Road Interchange, the bus shoulder provision will provide a continuous bus priority lane from Patiki Road to Te Atatu Road. There are some west-bound 'express-flyer' bus services which will continue through Te Atatu Interchange along SH16 towards Henderson Creek. These buses will be required to exit the bus shoulder in advance of Te Atatu Road Interchange to continue with the mainline. It is considered that appropriate signage on the westbound approach to Te Atatu Interchange will minimise effects of the operation of buses or mainline traffic.

The proposed improvements at the Te Atatu Interchange include bus priority measures for buses using the east facing ramps. These Project proposals will be complemented by future improvements to the Te Atatu Road corridor.

The bus shoulder on SH16 eastbound between Carrington Road and the Western Springs off-ramp (within Sector 6) will be retained. As discussed in Technical Report *G.18 Assessment of Transport Effects,* there is limited opportunity for bus priority measures or dedicated passenger transport facilities within Sectors 5 and 6 due to the associated merging and diverging of ramps and mainline carriageway within this area.

Enabling Other Future Passenger Transport Opportunities

The Project enables future opportunities for improvements to passenger transport provision, particularly bus services, on arterial roads primarily with regard to the future QTN including GNR and the Mt Albert Road / Carrington Road corridor. On both QTN routes, with the predicted improvements in travel times and traffic flow reductions with the Project, greater reliability of QTN services along these routes may be able to be achieved following the completion of the Project. Anticipated reductions on other arterial roads could also benefit LCN services on these roads.

Opportunities for QTN created

As noted in Chapter 4, the Project also maintains the opportunity for the future strategic transport route on the Avondale-Southdown Rail Line.

Future Avondale – Southdown Rail Line Protected

13.2.3.6 Effects on Cyclists and Pedestrians

The Project Description in Chapter 4 of this AEE and Section 2.2 of Technical Report *G.18 Assessment of Transport Effects* describes the proposed pedestrian/cycle way reinstatement and improvements proposed as part of the Project.

The proposed improvements to the Northwestern Cycleway will enhance access between the cycle way and the surrounding future pedestrian and cycle networks identified by territorial authorities. The Northwestern Cycleway will provide a more convenient, comfortable and reliable experience for either commuting or recreational cyclists. The further extension of the Northwestern Cycleway to the west of the Te Atatu Road Interchange (to Henderson Creek) will provide a more direct connection between the Interchange and the existing routes along and around Henderson Creek. This is consistent with the future provision of 'Type 1' routes alongside SH16 (within the State highway corridor) between Te Atatu Road and Henderson Creek as identified in the Waitakere Walking and Cycling Strategy.

Improvements to the Northwestern Cycleway will enhance access between it and the surrounding future pedestrian and cycle networks

The SH20 Cycle way aligns well with the future strategic and arterial routes identified by ACC in its 20 year cycle network plan along a north-south corridor between Mt Roskill (at the existing SH20 termination) and SH16. The SH20 Cycleway (in particular the Hendon Bridge) also complements east-west corridors within the area which will enhance connections between surrounding communities.

The SH20 Cycleway contributes to future strategic and arterial routes planned

Local roads within the wider Project area will experience a reduction in traffic flows. This potentially provides opportunities for future pedestrian improvements in line with local plans (including Mt Albert Road (14% reduction)/Carrington Road (25% reduction), GNR (north of Blockhouse Bay Road) (9-12% reduction) and Blockhouse Bay Road (32% reduction).

A number of other enhancements to the existing pedestrian/cycle way connections have been identified in Chapter 4 of this AEE. The effects of these are briefly discussed with respect to transport:

- Improvements and extension of the existing subway (Sector 1) will allow pedestrians and cyclists to directly access the subway on the southern side of the Titoki Street / Te Atatu Road intersection and continue uninterrupted under the on/off-ramps to the new shared path provided along the western side of the SH16 overbridge providing a safer and more direct connection;
- The proposed raising of the Causeway and the pedestrian/cycle way will improve overall reliability along the Northwestern Cycleway; and
- The proposed Hendon Bridge and pedestrian/cycle way within Sector 9 will provide access to the reserve areas and new connections between Owairaka and New Windsor through the different connections to the surrounding existing street network Richardson Road, Valonia Street, Methuen Road, Bollard Avenue, New North Road and Hendon Avenue (where there are several access points).

In summary, the proposals for enhancements and extensions to the existing Northwestern Cycleway, coupled with the new and improved facilities provided for the SH20 pedestrian/cycle way facilities, provide a positive effect and align with the objectives of the Project.

13.2.4 Mitigation – Operation

13.2.4.1 Operational Traffic

Tunnel Traffic Management Plan

In 2026 (some ten years after opening), it is predicted that the traffic flows on SH16 and SH20 are sufficient to accommodate the predicted traffic flows. However, by 2026 traffic flow on the westbound lanes of SH16 predicted to result in queuing extending back to just west of GNR (similar to the current conditions in 2006). The implication of this is that queuing may also be experienced on the SH20 to SH16 westbound on-ramp, resulting in slow moving traffic in the northern end of the tunnel. To address this, it is proposed that a tunnel management plan or strategy is developed to manage northbound traffic flows on SH20 (for any affected period). Similarly, performance and capacity along SH20, indicates that the corridor will operate satisfactorily. It is acknowledged that the traffic models used to assess performance are based on 'average' traffic conditions (rather than extraordinary events). A tunnel management plan would also be able to plan for response to these events.

Network Integration Plan

A Network Integration Plan is also proposed as it would enable the following traffic operation matters to be addressed:

- Opportunities for corridor improvements along Te Atatu Road and their timing with works for the Te Atatu Road Interchange;
- Integration of service improvements for HOVs and buses on Te Atatu, with the works proposed for the Te Atatu Road Interchange;
- Optimisation and co-ordination of operational performance at intersections surrounding the St Lukes and Maioro Street Interchanges; and
- Optimisation and co-ordination of QTN and RTN projects with the completion of the Project (e.g. Mt Albert / Carrington Road).

13.2.4.2 Parking and Access

The effects of the Project in relation to property access and parking can be satisfactorily managed such that there would be no more than minor adverse effects resulting from the operation of the Project. The effects of the Project on property access and parking and the associated mitigation measures are considered within the effects assessment of each relevant Sector (see Chapters 14, 16, 18, 20 and 22 in particular).

13.3 Construction Traffic Effects

Section 6 of Technical Report G.18 *Assessment of Transport Effects* identifies potential effects arising in relation to construction of the Project. Further development and management planning of this construction traffic is assessed and reported in Technical Report G.16 *Assessment of Temporary Traffic Effects.* This latter document also establishes a management planning approach for temporary traffic during construction (Appendix A of that report).

13.3.1 Assessment – Construction

13.3.1.1 Expected Construction Vehicle Traffic Flow

Indicative estimates of daily construction traffic (including HCVs and workers) on the motorway and arterial road network have been derived based on anticipated works across the Project as a whole[8]. The 'peak' period of daily vehicle movements for concurrent works across the Project are summarised in Table 13.9 below.

There are 12 construction yards proposed along the route of the Project. Within all sectors it is anticipated that construction traffic, particularly HCVs should be able to use State highways (SH16, SH20, SH18 and SH1) for the majority of their routes and for access to construction yards/work areas. However, there will be some instances where construction workers may use the arterial road network.

Main construction routes directly to and from the State highways

Table 13.9: Estimated Daily Construction Vehicle Movements across Project in 'Peak' Period (Two way vehicle movements)

Car and Light Vehicle Movements	HCV Movements	Total Vehicle Movements
3,770	3,420	**7,190**

To assess the potential effects of construction traffic, the model has used the 2014 daily traffic volumes (as a representative 'peak' time when construction works will be underway). The traffic assessment has assigned 'cordons' around the Project, and assessed the amalgamated traffic flows on the State highway and local road networks in these areas[9].

Table 13.10 provides a summary of traffic moving through the 'cordon' area, from 'origin' to 'destination' (this reflects the traffic moving through the Project area ('external to external' traffic), traffic travelling into the area ('external to internal') and traffic travelling within the area ('internal to internal').

[8] Details relating to the number and routing of construction vehicles associated with the construction of the Project will be specifically defined with contractor(s).

[9] Two cordons have been used in this assessment: 1., along SH16, Te Atatu Peninsula, GNR to St Lukes Interchange; and 2., around SH20, Richardson Road, Owairaka / Stoddard Road and Maioro Street. See Figures 6-2 and 6-3 of Technical Report G.18 *Assessment of Transport Effects* for further detail.

In total, the traffic flow travelling through the wider Project area is around 320,000 vehicles per day. Comparing this to the peak construction traffic daily flow (7,200), the effects of the increase in traffic from construction traffic are considered minor (in the order of 2-3% increase in flows). However, it is acknowledged that the effects of construction traffic on the operation of Interchanges and during specific peak periods does have the potential to have significant effects on the operation of the transport network. On this basis, specific mitigation measures are proposed to address these issues (see 13.3.2 below). Specific impacts of construction for the Sectors are provided (Chapters 14 to 22 of this AEE).

Construction traffic represents 2-3% of existing daily traffic flows in the Project area

Table 13.10: Daily Traffic Flows for Areas Surrounding the State Highway Project Area

Daily Traffic Movements (vpd)			
	External	**Internal**	**Total**
External	319,710	33,311	353,021
Internal	33,229	6,670	39,899
Total	352,938	39,981	392,919

13.3.1.2 Wider Construction Network Effects

Construction traffic can impact the wider network by changes to travel time, traffic diversions and closures

The implementation of construction activities and traffic management methodologies (such as the realignment/narrowing of lanes and the installation of a temporary speed limit of 80kph) can create delays and increases in travel times due to reduced traffic capacity, speed and increased construction site access movements. These effects are discussed in the following summary.

Effects on Travel Flows and Capacity

Experience on other projects undertaken in the Auckland Region (such as the Victoria Park Tunnel Project) indicates that the impacts to motorway capacity as a result of narrowing lanes and implementing temporary speed limits can increase travel times by approximately 10%. However, such effects are highly dependent on a number of other variables (e.g. the design standards of construction site road layouts, the sight distances maintained, and presence and location of shoulders) (See Section 6.1.3 of Technical Report G.16 *Assessment of Temporary Transport Effects* for more information).

The potential change in travel times along SH16 has been modelled in the 2014 operational traffic model, based on lane narrowing and temporary speed limits that are proposed for construction of the Project[10]. The results are illustrated in Table 13.11 below (comparing 'without Project' and 'with Project' Construction').

[10] It is noted that a number of other network projects are expected to be completed by 2014, which means that the travel times reported in this AEE are not directly comparable to existing traffic flows. For example, the modelling includes traffic flow changes resulting from completion of the Newmarket Viaduct Replacement and Victoria Park Tunnel project as key examples.

Travel times on the SH16 eastbound movements are shown to increase (by between 8% and 29%), while travel times on the other SH16 westbound movements are shown to increase by between 16% and 22% (with notable exceptions discussed below).

Travel time impacts of up to 29% on SH16

These results indicate that there is an impact on travel times, particularly for routes that include GNR and Te Atatu Road, as a result of the Project. In particular, the works at the Interchanges and on the arterial road network are predicted to have the greatest impacts on travel times. In this regard, special mitigation attention will need to be given to the effects of construction works on GNR and Te Atatu Road.

The highest travel time impact of construction works is anticipated at Te Atatu Road eastbound (travelling to SH16 towards the city or eastbound) (highlighted in Table 13.11), with an estimated 6 min increase in travel time through this link. Further analysis of the model on this impact indicates that the operational signals (traffic lights) have a major impact on the travel times through this link (as they are currently co-ordinated on the basis of a 50kph speed environment). Mitigation in this area is therefore proposed to include operational review of the traffic signals; to optimise capacity of the Interchange.

The phasing of the intersection at Te Atatu increases travel time

Table 13.11: Effect of SH16 Lane Narrowing and Temporary Speed Limits: SH16 (and Local Road Interchanges)[11]

Route	AM (minutes:seconds)			PM (minutes:seconds)		
	Without Project	With Project Construction	% Change	Without Project	With Project Construction	% Change
GNR (Blockhouse Bay Road) **to SH16 eastbound** (east of GNR)	07:13	09:51	37%	07:55	06:07	-23%
GNR (Blockhouse Bay Road) **to SH16 westbound** (west of GNR)	05:51	08:35	47%	06:39	06:03	-9%
SH16 westbound (east of GNR) **to GNR** (Blockhouse Bay Road)	02:54	03:36	24%	03:11	03:53	22%
SH16 eastbound (west of GNR) to **GNR** (Blockhouse Bay Road)	03:55	04:36	17%	04:29	05:46	29%
SH16 eastbound between Te Atatu and GNR Interchanges (mainline only)	09:29	09:36	1%	03:36	03:53	8%
SH16 westbound between GNR and Te Atatu Interchanges (mainline only)	03:40	03:58	8%	09:15	11:20	22%
SH16 eastbound between Te Atatu and St Luke's Interchanges (mainline only)	13:05	11:30	-12%	05:18	05:43	8%
SH16 westbound between St Luke's and Te Atatu Interchanges (mainline only)	05:35	05:59	7%	12:57	15:01	16%
Te Atatu Road (Edmonton Road) **to SH16 eastbound** (east of Te Atatu Road)	11:43	12:38	8%	03:41	09:49	167%
SH16 westbound (East of Te Atatu Road) **to Te Atatu Road** (Edmonton Road)	02:45	02:53	5%	03:22	03:41	9%

[11] It is important to note that the changes in travel times noted in this Table are based on a scenario that includes all temporary work sites along SH16 and GNR being implemented at the same time. Therefore, the figures quoted above are a 'worst case' or conservative estimate of the effects on the network.

While increases in travel times are observed for many links on SH16, the modelling indicates improved travel times for the following:

- GNR to SH16 Eastbound in the PM peak, for which it is predicted there will be a 23% improvement in travel times;
- GNR to SH16 Westbound in the PM peak, for which it is predicted there will be a 9% improvement in travel times; and
- SH16 eastbound Te Atatu Interchange to St Luke's Interchange, for which it is predicted there will be a 12% reduction in travel times.

It is expected that these improved travel time effects are the result of drivers whose destination is through the Project area, diverting off SH16 and therefore improving capacity up to the Project area. In addition, it is considered that travel time savings on SH16 between Te Atatu Interchange and St Lukes Interchange are occurring as a result of the change in travel times on GNR northbound in the AM peak, which increase by between 37% and 47%. This increase in travel times on GNR constrains flows onto SH16 in the AM peak and therefore, SH16 to the east of the Interchange is receiving some benefit.

Capacity reductions on SH16 are expected to divert traffic onto the local road network. The effects are expected to be greatest on those roads and networks in the immediate vicinity of the Project, particularly where there are feasible alternative routes. Examples of affected local roads include GNR, New North Road, Rosebank Road and Meola Road. Where there are not alternative routes, the impact of construction activity is represented in greater travel time delays on the SH16 network (e.g. around Te Atatu Interchange and Whau River Bridge).

Impacts Arising from Temporary Lane Closures

It is expected that a number of lane closures on SH16 will be necessary to facilitate construction works. These activities may require one or two lanes to be closed at any one point. The effect of lane closures again relates to travel time delays and diversions to the local road network.

To minimise the impact of lane closures, it is proposed (through the Construction Traffic Management Plan (CTMP) (Appendix A of Technical Report G.16: *Assessment of Temporary Traffic Effects)* and through development of Site Specific Traffic Management Plans (SSTMPs), discussed below) to restrict lane closures to periods where traffic flows are sufficiently reduced to accommodate this (in accordance with the NZTA adopted Code of Practice for Temporary Traffic Management). To illustrate, for a three lane section of SH16, traffic flows will need to be below 2,800vph (or for scale 700 vehicles in a 15 minute period) to enable a single lane closure. Implementation of this management approach will mean that the effects of temporary lane closures are managed and mitigated.

13.3.2 Mitigation – Construction

Management of construction traffic is proposed

To manage and mitigate construction traffic effects, a suite of measures is proposed (see section 6.1.6 of the Technical Report G.16 *Assessment of Temporary Traffic Effects*). In summary, these measures include:

- Preparation of the CTMP (Appendix A of Technical Report G.16 *Assessment of Temporary Traffic Effects)* to set out the general processes and procedures for traffic management during construction. Within this Management Plan the following:
    - Formation of a traffic management project governance group (TMPGG) is proposed to be established with key stakeholders who will monitor traffic issues on a regular basis during construction;
    - Early liaison with passenger transport agencies and operators to determine impact of changes to provision of bus lanes on passenger transport services and develop appropriate mitigation measures e.g. additional services;
    - Road user education campaigns/warnings will focus on informing road users on the main originating routes through the use of VMS and Project signage. Public notification campaigns within the newspaper of traffic management methodologies required throughout the Project e.g. reduction in speed limits and diversions and letter drops for residents as appropriate;
    - Predetermined selection of detour routes, for when each road is closed by the Project; and
    - Liaison with major traffic generating activities and sites (e.g. Unitec and schools) to advise on construction traffic management and processes and to integrate with any employer travel plans to minimise demand on the road network.
- Preparation and acceptance of SSTMPs to detail specific traffic management protocols for each stage of construction work, in accordance with the Construction Traffic Management Plan (Appendix A of Technical Report G.16 *Assessment of Temporary Traffic Effects)*. These site specific plans will include details on the following:
    - VMS and Project signage for specific works, e.g. motorists will be advised of off-ramp closures at the previous Interchange in advance and during off-ramp closures;
    - Provision of convenient detour routes well in advance of specific closures;
    - Review and optimisation of traffic signals is proposed to occur on detour routes to maximise efficiency, particularly on GNR, New North Road, Rosebank Road;
    - Appropriate signage adjacent to cycle lanes; and
    - Letter drop distribution areas for site specific works.

The effectiveness of the mitigation methods approved within the CTMP and SSTMPs is proposed to be monitored against traffic management auditing, travel speeds and operating efficiency. The following monitoring measures are proposed:

- Traffic Management Auditing - A random monthly audit by a party external to the preparation of the SSTMP will be undertaken during both the day and night. The audits will be weighted by Average Annual Daily Traffic (AADT);
- Operating Speeds - A monthly measurement of operating speeds will be undertaken. A pre-construction survey will set a benchmark for operating speeds at agreed points; and
- Operating Efficiency - The daily, peak hour and off-peak traffic volumes will be taken at the same agreed points as the operation speeds. This will be reported on monthly intervals to the Project team to monitor the efficiency of the road network.

It is expected that further key performance indicators will be implemented as part of the Project; the form and requirements of these will be confirmed once the procurement model for each Sector is confirmed.

13.4 Social Impacts

13.4.1 Existing Environment

This section of the AEE considers social impacts on a regional level. Thus, relevant aspects of the existing environment include the following:

- Auckland's population of more than 1.3 million residents;
- The residential and community/business land uses in the Region (including those regionally significant community facilities within the local study area, e.g. the cluster of health facilities/rehabilitation/addiction units around Carrington Road); and
- The transport linkages that connect local and regional communities in Auckland, including walking and cycling routes, the State highway network (SH1, SH16, SH18, SH20) and public transport systems/routes.

13.4.2 Assessment – Operation

A regional assessment framework was developed to assess social impacts and is set out in Technical Report G.14 *Assessment of Social Effects*. In summary from that assessment, the Project is considered to result in the following regional social benefits and impacts:

The Project will improve access to residential, community, educational, employment and recreation opportunities

- **Accessibility and Connectivity**
  As discussed in the previous section, there will be significant improvements to the regional transport network in Auckland. Regional public transport opportunities between Waitakere City and Auckland City will also be improved (e.g. existing length

of bus shoulder provision along SH16 between Te Atatu Interchange and GNR Interchange will be almost doubled by the Project). These transport outcomes represent a significant positive social outcome for the Regions population way of life through improvement to travel times (and associated reduced frustration over congestion), public transport and cycle opportunities, and accessibility between different areas in Auckland. The Project will improve regional access to residential areas, community facilities and educational, employment and recreational opportunities. Improvements to passenger transport and pedestrian/cycle access also provides for the more vulnerable in the community (who often have less access to other transport modes). The Project is also projected to decrease traffic from local streets elsewhere in Auckland, which again provides for improved mobility for more vulnerable groups in the community.

- **Economic Growth and Development:**
  The Project will provide for access to and between centres of future economic development across the Region. It is expected that this will generate productivity increases. This will result in significantly positive social benefits in terms of people's economic wellbeing, by improving access to employment opportunities, and opportunities to materially provide for quality of life. In the longer term, this is expected to result in enhanced quality of living and working spaces across the region and the overall urban form of the region (consistent with the Auckland Regional Growth Strategy (ARGS)).

The Project will provide for access to and between centres for productivity increases

- **Sustainable Living Spaces/Perceptions of Environmental Quality:**
  The negative environmental/ecological impacts associated with the proposed reclamation are counterbalanced by the wider social/accessibility benefits and the environmental mitigation/improvement proposed as part of the Project. In the long term the Project will have an overall positive impact on the health and amenity of Oakley Creek, the Motu Manawa (Pollen Island) Marine Reserve and Traherne Island, through the suite of stormwater and ecological mitigation proposed. This will result in a positive social impact in relation to people's attitudes, expectations, aspirations and wellbeing, given the importance of these environments to the community (expressed in consultation). The Project is projected to decrease traffic from local streets elsewhere in Auckland (notably from Manukau Road, Gillies Avenue, Mt Eden Road, New North Road, Dominion Road and Sandringham Road), increasing 'liveability' and safety for pedestrians, cyclists and local motorists in these areas.

- **Healthy Communities:**
  Overall, the Project itself will facilitate generally positive regional outcomes in relation to 'healthy communities'. Access and mobility to healthcare facilities is expected to increase on a regional level, and traffic safety outcomes are expected to improve. Access to active modes of transport will also increase as a result of elements of the Project (discussed above) which provides opportunities for the community to improve their health. Air quality is generally expected to improve on a regional level, in line with improvements to emissions of the vehicle fleet (though this is not specific to the Project), and there are reductions in emissions around arterial roads in the network (which are often areas of higher population activity). It is recognised that the projections of the ARLTS Health Impact Assessment indicate that the transportation

The Project contributes to healthy communities

situation of the Region will continue to have negative health consequences for Auckland residents (albeit that these are not worsened by the existence of the Project/WRR).

Social impacts will also occur on a local scale. These impacts are discussed in Chapters 14 to 22.

13.5 Cultural Impacts

13.5.1 Existing Environment – Iwi with Manawhenua

Kawerau a Maki and Ngati Whatua have manawhenua status

Te Kawerau a Maki and Ngati Whatua o Orakei are recognised manawhenua (Iwi with customary authority) within Auckland (west) and Waitakere City[12]. In this regard, these Iwi have a role in managing the environment and the way it is cared for.

13.5.1.1 Te Kawerau a Maki

Te Kawerau a Maki identify that they are the tangata whenua (people of the land) of Waitakere City, who hold customary authority or manawhenua status. They identify themselves as descendents from the earliest inhabitants of the area and following the land wars, they re-established themselves in west Auckland, including a settlement at Kopupaka and Maanu Te Whau near the mouth of the Henderson Creek, at Orukuwai (Te Atatu) (circa 1830's). Through the 1880's and 1890's Te Kawerau a Maki state that much of this land was acquired by the Crown and they cite this as a period of disillusionment, cultural isolation and population decline for the Iwi. However, Te Kawerau a Maki maintain that they have retained *ahi ka roa* and manawhenua (have kept the home fires burning and have customary authority over this land).

13.5.1.2 Ngati Whatua o Orakei

Ngati Whatua identify an association and manawhenua status with Auckland (west) and also Waitakere.

The Auckland Isthmus (Tamaki Makaurau) has seen some nine hundred years of Maori occupation and use. Many tribes descended from ancestral waka and have flourished in Tamaki as the volcanic soils provided nutrient rich material for gardening across the Isthmus. There were a number of peace marriages between Te Taoa and Waiohua and two new sub-tribes evolved under the names Nga Oho (reviving an ancient name for Waiohua antecedants) and Te Uringutu (constituting an amalgam of the two groups). Today the three hapu, Te Taoa, Nga Oho and Te Uringutu are otherwise known as 'Ngati Whatua o Orakei'.

[12] As identified in the Waitakere District Plan, Auckland District Plan and the Regional Policy Statement.

The Whau River was an important early transport route for Maori to gain access to the waters and resources of either the Manukau or Waitemata Harbours. There were once numerous seasonal camps and kainga (villages) along the edges of Te Whau River. Seasonal camps were used particularly around the Whau to hunt for the kuaka or godwit. Numerous middens (collections of shell, bone, stone and charcoal associated with food preparation and consumption) alongside the river, testify to its importance in the resource cycle of the tangata whenua of Tamaki.

The association with Waitakere commenced through their intermarriage with the descendants of Toi which links them back to the first inhabitants of Waitakere. In particular, Ngati Whatua cites periods where they sought haven in the Waitakere's during the period of settlement between Tamaki and Kaipara. Ngati Whatua also identify the Waitemata, with their settlement at Tamaki.

The association with Auckland (west) dates back to Ngati Whatua hapu (Te Taoa, Nga Oho and Te Uringutu) settling in the Auckland isthmus from further north and other regions. Mauri is a critical aspect of the spiritual relationship of Maori with their environment and specific features (such as maunga and waterways) within it. Of relevance, Ngati Whatua identifies the mauri of Oakley Creek (Te Auaunga)/Te Wai o Rakataura (the catchment wetlands associated with Oakley Creek), Owairaka (Mt Albert), Puketapapa (Mt Roskill) as important cultural sites. These natural features are important to Ngati Whatua as kaitiaki (guardians) and in sustaining their own wellbeing. Early Maori used Oakley Creek for native crayfish, eels, weka, flax and raupo, and Ōwairaka (Mt Albert), Puketapapa (Mt Roskill) for defence purposes.

13.5.1.3 Engagement with Iwi

The NZTA has sought to engage directly with Kawerau a Maki Trust and Ngati Whatua

The NZTA has a Memorandum of Understanding with iwi setting out how consultation and engagement will be undertaken[13]. This engagement indicates that the NZTA will consult and seek engagement with iwi directly to inform projects on the cultural issues and impacts of projects. Consultation has been undertaken with both Ngati Whatua o Orakei and Te Kawerau a Maki on the Project (see Chapter 10) and input has been sought from both parties on the cultural impacts and appropriate management responses for the Project.

To date, the following provides a summary of issues of importance to Te Kawerau a Maki and Ngati Whatua o Orakei, as identified in existing published sources. Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Further Project specific assessment has been sought from Te Kawerau a Maki and Ngati Whatua o Orakei. At the time of writing this AEE no further comment has been received.

[13] This includes an MOU between Ngati Whatua o Orakei Maori Trust Board and Transit NZ Auckland Region dated 03/12/2002, and an MOU between Te Kawerau a Maki and Transit NZ Auckland Region dated 07/05/2002

13.5.2 Assessment of Cultural Effects

13.5.2.1 Cultural Effects – Te Kawerau a Maki Trust

Of relevance to the Project, Te Kawerau Iwi Tribal Authority identifies the following environmental and resource issues:

Cultural issues identified have influenced Project design and mitigation

- That the mauri of all natural waterways is protected, and that the food producing capacity of natural waterways is protected and enhanced, as is their life supporting capacity. They also advocate the treatment of stormwater before it is discharged into waterways;
- That heritage sites, water quality, the quality and availability of kaimoana (seafood) are protected including managing any development and use of coastal space to avoid adverse effects on water quality and coastal character;
- That sustainable land management and the protection of its productive capacity is promoted, ensuring that native bush and fauna are protected and that the cultural meaning, amenity and aesthetic values of the landscape are protected;
- That the following are provided for: access to flora and fauna for cultural harvest and craft, protecting and enhancing indigenous flora and fauna and their ecosystems, and eradicating exotic plants and animals that are damaging, destroying or competing with native species or their ecosystems; and
- In terms of heritage, that there is protection without necessarily prohibiting all use and development in areas associated with the Iwi's heritage, to ensure recognition of and provision for, cultural and spiritual values in decision-making, and that there are opportunities for Te Kawerau a Maki to manage, enhance and monitor heritage concerns relating to waahi tapu.

These issues have been taken into account in the Technical Assessments and are reflected in the design of the Project and in the scope and design of the mitigation measures proposed.

13.5.2.2 Cultural Effects – Ngati Whatua o Orakei

Of relevance to the Project, Ngati Whatua o Orakei identifies the following environmental and resource issues, generally and specifically with respect of this Project:

Cultural issues identified have influenced Project design and mitigation

- Ngati Whatua o Orakei believe that, as a general principle, priority should be given to improving Auckland's public transport network rather than investing in new motorway development;
- Removal of ngahere (bush) in an unsustainable manner and the associated erosion from vegetation removal, is considered to be detrimental to the mana of Ngati Whatua o Orakei. The mauri of the ngahere and its ability to sustain life is an integral part of the survival of humanity;

- They wish to see the retainment and enhancement of natural native forests and the replanting of vegetation alongside the waterways, including the protection of small stands of native species (including manuka, kanuka and also the numerous native species of flax and ngahere), and the protection and enhancement of all native ecosystems and the management and eradication of exotic and pest species;
- The mauri, amenity and ecological health of the freshwater and coastal environment. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects;
- Impacts on areas of cultural heritage value/known Maori archaeological sites; and
- Water represents the tears of Ranginui, the life blood of Papatuanuku and is the domain of Tangaroa. Water must be managed holistically and nurtured as a living entity. Matters of concern include stormwater discharges to waterways, sedimentation and erosion, avoiding the mixing of waters (from different sources), the need to reintroduce and retain wetlands, and the discharge of wastes to land (rather than directly to receiving waters).

Project-specific mitigation proposed is reported in Chapters 14 – 22 of this AEE. These issues have been taken into account in the Technical Assessments and are reflected in the design of the Project and in the scope and design of the mitigation measures proposed.

Beyond this, it is noted that, with respect to transport modes, the Project was confirmed as part of the ARLTS. The ARLTS seeks to develop the Region's transport network in a way which balances public and private transportation modes (recognising the importance of focused investment in public transport, but also in completing the strategic WRR to meet additional road capacity requirements).

13.6 Coastal Processes

A full assessment of effects on coastal processes is provided in Technical Report G.4

The following provides an assessment of the wider coastal process effects of the Project on the CMA. This summary has been included in this Chapter as it is recognised that the effects on coastal processes are not constrained by the same geographic and physical boundaries that have defined the Project Sectors. However, it is noted that more local impacts and effects of the Project are discussed in each relevant coastal Sector (e.g. Chapters 14, 15, 17 and 18 of this AEE). More detailed assessment of coastal processes is also provided in Technical Report G.4 *Assessment of Coastal Processes.*

13.6.1 Existing Environment

The coastal environment is described in Section 8.2.2 of this AEE. The Central Waitemata Harbour, being the area between the Auckland Harbour Bridge and the Upper Harbour Bridge, receives runoff from a 205km^2 land catchment area. The seabed material of the Harbour generally consists of sand with a higher proportion of fine grained sediment (muds and silts) typically found along the intertidal and sheltered embankment areas of the Harbour.

The CMA surrounding Pollen Island on the northern (seaward) side of the Causeway is largely unmodified. The upper-intertidal morphology and associated chenier (shell) ridges also appear to have been relatively stable throughout the last 60 years and offshore chenier ridges do not appear to have been affected by the introduction of the Causeway.

13.6.2 Assessment – Construction

During construction, temporary occupation of the CMA will be required for construction of the bridges and reclamation. This occupation has the potential to impact on tidal streams and currents in the CMA. Construction activities also have the potential to generate sediment discharges or disturbance of sediments, from both the construction of structures and works for the reclamation.

The flow around piers and under bridges during construction will essentially be parallel to the orientation of the existing bridge piles (in the case of Whau River and Causeway Bridges). Overall, the flows passing through the channel and Whau River on ebb and flood tides would be much the same as present and therefore the changes to flushing over the construction period are considered to be negligible.

Disturbance during construction will be managed by the construction methodology proposed and implementation of construction management measures (particularly in regard to erosion and sediment control).

Sheet piling or a temporary coffer dam will be established to create a dry working area and allow construction at all stages of the tide. Installation and dismantling will be done outside tidal inundation periods, to minimise the potential to discharge contaminants. Other works will be undertaken in accordance with erosion and sediment control measures (see Technical Report G.22 *Erosion and Sediment Control*). Therefore, the construction activity is considered likely to result in less than minor effects on coastal processes.

13.6.3 Assessment – Operation

Works in the CMA have the potential to impact on coastal processes in the following ways:

- Impacts in the tidal prism and hydrology of the CMA as a result of reclamation, physical barriers or changes in coastal flows; and

- Changes to the geomorphology and resulting disturbance of sediment (erosion or accretion), as a result of changing flows.

This Section focuses on the Region or wider effects of operation. Localised coastal effects of the Project are discussed in the relevant Sector assessment.

On the basis of the assessment of coastal processes, the following comments are made with respect to Project wide effects:

- Given the historic in-filling or high elevation inter-tidal mudflats, the long term effects of widened reclamations on tidal flows, drainage across the inter-tidal area and geomorphology are considered no more than minor;
- The proposed reclamations in the Central Waitemata Harbour are not expected to change the flow regime of this environment, particularly as most of the reclamation works are on elevated inter-tidal areas that are only inundated around high tide;
- Minor adjustments to the inter-tidal geomorphology would occur over periods of months and any disturbances or discharges into this waterbody will be rapidly diluted and thus effects will be minimal outside a zone of reasonable mixing;
- The reclamation will require filling of existing sub-tidal channels in the CMA, which could result in disturbance, upstream and downstream instabilities, or slumping on the flanks of the sub-tidal channel as associated backwater effects. Mitigation is proposed for these potential effects;
- The proposed alignment and spacing of piers within the CMA has ameliorated any potential operational effects on physical coastal processes in Oakley Inlet;
- Structures within the Whau River include additional permanent bridge piers and abutments. Although the pile or pier groups are skewed to the tidal flow, the overall effects of these structures on hydrodynamics and geomorphology are expected to be no more than minor. This takes into account the effect of wakes, scour and tidal flushing;
- For those structures associated with the Causeway bridges, the flow will essentially be parallel to the orientation of the existing bridge piles and the flow volumes passing through the channel on ebb and flood tides would be much the same as present. Therefore the changes to flushing are considered to be negligible; and
- There will be a no more than minor change to the flow regime within the Waterview Estuary and Oakley Inlet as a result of new and widened structures compared to the existing environment. This takes into account the effects of wakes, backwater effects, scour and tidal flushing. The potential effects from discharge including potential discharges of sediments and contaminants sourced from Oakley Creek will be no more than minor due to the existing background water quality including turbidity. Three separate channel realignments (two in Oakley Inlet and one in Waterview estuary) are proposed to mitigate potential hydrodynamic and geomorphological effects of the existing channels being in-filled by reclamations to widen the Causeway. With these channel-realignment options the physical effects from construction or permanent occupation is assessed as no more than minor.

13.6.4 Mitigation

13.6.4.1 Avoidance of Impact through Construction Design

To mitigate the effects of construction on coastal processes in the CMA, the following construction design is proposed:

- The use of temporary coffer dams (or sheet piling) to support construction of the main Causeway to temporarily maintain dry working areas for erosion and sediment control;
- Given the importance of tidal-drainage channels for wetlands at Pollen Island, encroachments and reclamations into these drainage channels have been avoided by adopting vertical retaining walls to support the widened carriageway; and
- The use of managed excavations for new by-pass channels to reduce and contain disturbance. While it is acknowledged that this design will cause some seabed disturbance and sediment discharges, it is considered these would be much less than the alternative of leaving natural erosion processes to form a new channel, generating substantial sediment discharges in the transition period).

13.6.4.2 Construction

To mitigate the effects of construction on coastal processes in the CMA, the following mitigation is proposed:

- Erosion and sediment control measures in accordance with ARC Technical Publication Number 90: Erosion and Sediment Control Guidelines for Land Disturbing Activities (TP90) and allowing for reasonable mixing of any discharges of like sediments (i.e. similar sediments that already contribute to turbidity) will ensure that the physical effects and aesthetic effects of discharges from disturbance activities are minor;
- Stormwater control measures designed in accordance with ARC Technical Publication Number 10: Stormwater Management Devices Design Guidelines Manual (TP10) will manage the sediment and contaminant load entering into Oakley Creek and then ultimately discharged into the CMA;
- The layout and size of piles that are proposed to support the temporary staging platforms have been designed to minimise the number of piles and hence minimise the effects of piles on flow resistance;
- The use of steel casings for permanent piers will minimise discharges during excavations of the seabed sediment prior to in-situ casing; and

Where burial of shell deposits (cheniers) will occur under the widened reclamations, or where construction works will potentially disturb or damage the shell material, it is proposed that the vulnerable shell layers are excavated and stockpiled. After completion of the revetment works, this shell material will be replaced on the beach in front of the new reclamation at the same geographical locations. Waves during high spring tides will eventually sort the shells back towards an equilibrium beach profile and re-build the chenier ridge.

13.7 Marine Ecology

A full assessment of effects on the marine ecology is provided in Technical Report G.11

The following provides an assessment of the ecological effects of the Project on marine ecology. As with the assessment of coastal processes, this summary has been included in this Chapter as it is recognised that marine ecology is not constrained by the same geographic and physical boundaries that have defined the Project Sectors. However, where there are local effects on marine ecology associated with the Project, these are also discussed in the specific Sector assessments (see Chapters 14, 15, 17 and 18). More detail on this assessment can be found in Technical Report G.11 *Assessment of Marine Ecological Effects.*

13.7.1 Existing Environment

The Project occurs within the Waitemata Harbour, with the eastern boundary being Oakley Inlet and the western boundary being a tidal tributary of Henderson Creek (Pixie Inlet). There are a number of coastal environments identified in the marine ecological assessment, including the Waitemata Harbour, Waterview Estuary (see in particular Chapter 17), Oakley Inlet (Chapter 18), Whau River (Chapter 15) and other stream outlet (Chapter 14).

The Waterview Estuary is a relatively modified marine environment, as a result of the original construction of SH16 in the 1950's and other urban land use practices. The original construction of the SH16 Causeway has had a significant effect on flow dynamics and restricted tidal flushing considerably. This is evident in the build-up of soft sediments throughout the Estuary. The intertidal flats and subtidal channels of this inner harbour estuary comprise deep soft mud and the flats are dominated by mangroves. Within the intertidal habitat there are some small shellbank areas where sediment grain size is coarse and some saltmarsh vegetation is supported.

The marine reserve is dominated by intertidal mudflats, tidal channels and extensive areas of mangrove. Smaller areas of saltmarsh and shellbanks are present adjacent to Pollen and Traherne Island. The mudflats and shell banks support a typical diversity of coastal invertebrates and fish. In addition these mudflats and sandflats are important feeding areas for a wide variety of shore bird species, both resident and non-resident. These feeding areas are directly influenced by outflows from Oakley Creek.

13.7.2 Assessment – Construction

Key potential impacts associated with construction works for marine ecology relate to the following:

- Alteration to flows and erosion of intertidal mud banks resulting from construction works;
- Discharge of construction phase stormwater;
- Discharge of sediment-bound contaminants arising from channel re-alignments;
- Discharge of treated stormwater;

- Disturbance from noise and vibration;
- Shading of saline vegetation;
- Temporary alteration to flow;
- Temporary habitat loss (e.g. as a result of the Causeway embankment rock toe silt fence, piles, Rosebank Domain rock toe silt fence, staging platform piers and coffer dams; and
- Temporary occupation of CMA for erosion and sediment controls.

Construction associated with the Project will have adverse effects on marine ecological values. The above effects are expected to extend over an area of approximately 6.63 ha (though it is noted that not all effects will occur over this whole area). For all of these effects, the magnitude of impact is low to neutral, with the exception of some rechanneling work which is considered to have a moderate magnitude of ecological impact. Given the scale (duration), the significance of the effect is considered either minor or negligible, subject to the proposed mitigation set out in Section 13.7.5.

13.7.3 Assessment – Reclamation

While the construction activities above are considered minor, the reclamation of the CMA for the Project is recognised as having an adverse and permanent impact. Overall, some 4.7ha of the CMA is permanently reclaimed. From the perspective of marine ecology, the areas affected by the proposed reclamation are of moderate to low value (with the exception of a small area of the northern side of the Causeway considered moderate/high ecological value). The magnitude is considered to be a permanent change in the ecological receptor but no permanent change in its overall integrity. Given the permanent nature of the impact, its significance is considered moderate.

Other operational impacts of the Project on marine ecology relate to the discharge of stormwater, alteration of flows in the tidal waters, shading of vegetation and disturbance (noise and vibration). In all cases, while these are considered permanent impacts, the magnitude is considered to be neutral (in that there is no measurable change in the ecological receptor expected) and the effects are therefore considered negligible.

13.7.4 Assessment – Cumulative Effects

The primary potential cumulative Sector-wide effects that need to be considered relate to the ongoing discharge of stormwater, both within and adjacent to the Project area and the wider Waitemata Harbour system.

Ongoing discharges of stormwater into the CMA (and Motu Manawa (Pollen Island) Marine Reserve (MMMR)) contribute to the accumulation of contaminants in marine sediment over time. The higher the level of treatment provided prior to the stormwater being discharged, the longer the time period until adverse effects on ecological values are likely to occur. The Project seeks to treat all runoff from the additional impervious surfaces constructed, in addition to the treatment of the existing currently untreated alignment. This will reduce the

rate of accumulation of contaminants in marine sediments. However the treated stormwater discharged will contain a level of residual contaminants, which will contribute to the accumulation of contaminants in marine sediments.

13.7.5 Mitigation

It is propsoed that the following mitigation (for some of the potential effects associated with this) be included for the Project:

- Installation of erosion and sediment control devices;
- Temporary stormwater treatment devices for construction management;
- Long-term permanent stormwater treatment devices for operational stormwater discharges;
- The use of coffer dams (discussed above) and other construction management practices to remove and treat contaminated water or carrying out disturbance works during low tide to minimise suspended sediment generation; and
- The removal and replacement of the shell banks (also noted above).

Reclamation to be off-set by other measures

It is difficult to directly mitigate for both temporary habitat loss (considered a minor adverse ecological effect) and permanent habitat loss (considered a moderate adverse ecological effect), and the cumulative effects associated with the ongoing discharge of stormwater contaminants. In addition to the design noted above. The following measures will be implemented for 'off-set' mitigation:

- Providing a habitat remediation zone on either side of the reclamation revetments. It is proposed to construct this area by remediating a 3m wide area of intertidal habitat by mudcreting to 0.5m below the present sediment surface and replacing the marine sediment excavated. This will allow marine organisms to recolonise the area of disturbed sediment over time as the replaced sediment depth over 0.5m is more than sufficient to support infaunal and burrowing organisms, as well as vegetation such as mangroves;
- Improving the efficiency of contaminant removal from operational phase stormwater discharging into the CMA (e.g. to 80% or greater treatment Total Suspended Solids) and treating stormwater runoff from the existing alignment, in addition to the new alignment;
- Restoration of coastal fringe habitat along the alignment (involving weed control and revegetation) and planting into the rock revetment along sheltered parts of the Causeway embankment as proposed in the plans F.16: *Urban Design and Landscape Plans*; and
- Removal of litter and debris from within and adjacent to the CMA along the alignment.

On balance, it is considered that implementation of the mitigation opportunities identified above sufficiently offsets the moderate adverse effects on marine ecological values arising from permanent marine benthic habitat loss and the minor effects arising from temporary habitat loss.

13.8 Avian Ecology

A full assessment of effects on the avian ecology is provided in Technical Report G.3

The following provides an assessment of the ecological effects of the Project on avifauna (birds). This summary has been included in this Chapter as it is recognised that birds are not constrained by the same geographic and physical boundaries that have defined the Project Sectors. More detail on this assessment can be found in Technical Report G.3 *Assessment of Avian Ecological Effects.*

13.8.1 Existing Environment

Within the Project area there are essentially two broad habitat areas: coastal (Sectors 2 to 5) and terrestrial (Sectors 1, 4 (reclamation area) and 5 to 9).

Within 'terrestrial' there are two further habitat distinctions: the urban areas of the Project (Oakley Creek, Alan Wood Reserve etc) and the SH16 corridor (with its maritime influence)[14]. General urban habitat types included mature exotic and weed trees, native plantings, regenerating bush, open grassland, playing fields and remnant rock forest. The maritime SH16 terrestrial habitat includes mangroves, saltmarsh, flax, wattle and other 'edge' shrub species.

Within the 'coastal' habitats, there are the intertidal and sub-tidal flats, the estuary and coastal marshes. Coastal birds were surveyed in areas of the Waitemata Harbour within Sectors 2 to 5[15].

13.8.1.1 Terrestrial Avifauna

The terrestrial avifauna is characterised by common species of native and introduced birds, most of which are typical of developed urban environments.

The urban environment does not provide significant habitat for indigenous avifauna

The area supporting the most number of native bird species was Hendon Park (with red-billed gull, black-backed gull, masked lapwing and pukeko) (four species). On the terrestrial environment of the reclamation, grey warbler, silvereye and pukeko were recorded (3 species) and similarly, at the GNR Interchange red-billed gull, silvereye and white-faced heron were observed[16]. Other indigenous species observed at other survey periods, in the terrestrial environments of the Project (e.g. around the mouth of Oakley Creek and GNR Interchange), included kingfisher, pied oystercatcher, fantail, harrier, pied shag, little shag, tui, and welcome swallow.

14 Sector 8 was excluded as this comprises a tunnel that will have little, if any, effect on urban birds.

15 Surveys and investigations have been undertaken between 2000 and 2008 and their results provided in Technical Report G.3.

16 Previously, it has also been observed that the NZ Dotteral has attempted to nest in this area.

In relation to introduced species, starling and house sparrow were the most frequently observed species, being particularly abundant around the reclamation and GNR Interchange. Starlings were also abundant at Heron Park. A range of other birds were identified in the Project area, including blackbird, songthrush and mallard.

In the wider terrestrial habitat (e.g. beyond the Project area), a total of 32 bird species have been observed, with 17 of these being native and 15 introduced. In summary it is concluded that the urban environment of the Project area does not provide significant habitat for indigenous avifauna, with the exception of the historic record of the NZ Dotteral (which is 'nationally vulnerable', but was not observed in the surveys undertaken for the Project). The red-billed gull is identified as a threatened species.

13.8.1.2 Coastal Avifauna

A range of common bird species was observed in the coastal area of the Project (particularly at low tide). Species including waders, gulls, pied oystercatcher, black-backed gull, white-faced heron and pied stilt. Some threatened and 'at risk' species were recorded. Threatened species included red-billed gull, pied shag, caspian tern, reef heron and wrybill. Overall diversity is considered to be relatively high in this area. Generally most of the birds utilising the coastal marine area were transient which are relatively tolerant of noise. Species that are not transient include the little shag, pied shag, New Zealand kingfisher and white-faced heron.

Overall coastal bird diversity is considered to be relatively high in this area

Key observations with respect of the coastal birds in the Project Area include:

- The highest periods of bird abundance are at low tide (around five times higher than at high tide); and
- There were 18 species of coastal birds observed:
    - Overall, of the 18 species of coastal birds nine were waders[17] and the others gulls, terms, shags, heron and waterfowl species;
    - In the high tide, 12 species were recorded (most common being pied oyster catcher, black-backed gull, white-heron, pied shag, pied stilt); and
    - In the low tide, 18 species were recorded (most common being pied oyster catcher, red-billed gull, white-heron, bar-tailed godwit, and pied shag).

Threatened species observed include caspian tern, pied shag, red-billed gull, reef heron, wrybill (all classified as 'nationally vulnerable'). 'At Risk' species observed included pied stilt, black shag, little black shag, South Island oystercatcher, variable oystercatcher and white-fronted tern.

[17] Waders included banded dotterel, NZ dotterel, bar-tailed godwit, lesser knot, pied oystercatcher, variable oystercatcher, spur-winged plover, pied stilt and wrybill.

In addition, in Sector 1 Harbourview- Orangihina Park is an area identified as a 'traditional roosting site' for coastal birds. Observed species included banded dotterel*, New Zealand dotterel*, wrybill*, South Island oystercatcher*, white-faced heron, spur-winged plover, pied stilt and variable oystercatcher (* denotes threatened species).

13.8.1.3 Marsh Birds

While the habitat along the margins of the State highway are considered appropriate for Marsh birds (e.g. banded rail or fernbird), they were absent from the Project Area. These species have been observed on Pollen Island and banded rail on Traherne Island.

13.8.2 Assessment – Construction

Potential effects on avifauna as a result of the Project relate to clearance of vegetation, clearance of significance individual trees (together these relate to loss of habitat, changes to habitat (e.g. edge effects), direct mortality of birds, loss of habitat (intertidal associated with reclamation), disturbance effects and damage to habitat from discharges.

13.8.2.1 The Clearance of Vegetation

The clearance of vegetation can result in direct and consequential ecological effects. For example, it reduces the overall size of habitat (food and shelter sources) and if significant enough it may affect the functionality of remaining habitat (e.g. through edge effects changing composition of remaining habitat).

The extent of vegetated habitat removal and its effect on common urban species would both be minor

The effects assessment for terrestrial vegetation concluded that there would be very minor vegetation clearance[18] with most of the removal involving already compromised edge habitats. Therefore the level of terrestrial habitat removal and the significance of that removal will both also be relatively minor, particularly as the affected species are all common birds that have adapted to exploit patchy urban environments.

On a Project wide basis the predominant vegetated habitat that would be removed would be exotic vegetation. While exotic trees and shrubs provide nesting opportunities and often a seasonal abundance of food (e.g. privet berries) for urban birds, it is a lower value habitat overall, compared to native/indigenous vegetation. Overall, the extent of vegetated habitat removal and its effect on common urban species will both be minor.

[18] While some individual trees such as Gum, Macrocarpa and Flowering Cherries will be removed as part of the Project, on balance the ecological significance of the removal of these trees as it pertains to urban birds is minor. Technical Report G.17 *Assessment of Terrestrial Ecology* states that no significant individual trees (as a habitat) will be removed and therefore no notable nesting, roosting or feeding resource for terrestrial birds will be affected.

13.8.2.2 Direct Mortality of Birds

The clearance of vegetation and other habitat features may result in the direct loss (i.e. mortality) of eggs and young birds still in nests. The potential for this effect is accentuated when the clearance of trees takes place within the bird breeding season, and is of most concern in relation to notable native bird species such as nesting kereru and tui.

There is the potential for birds to be killed by direct collision with vehicles and for egg and juvenile mortality as a result of vegetation clearance removing nests during the breeding season. Most breeding season mortality could be avoided by restricting any substantial vegetation clearance (e.g. at the GNR Interchange/Oakley Creek) to the period outside September to December inclusive which is the main breeding season. However, it is acknowledged that this is a key construction period (e.g. in relation to sediment control and the 'earthworks season').

13.8.2.3 Intertidal Habitat Reduction

The Project includes the need for works in the CMA, including bridges, piers and temporary and permanent reclamation. This will result in a loss of intertidal habitat. The total area of reclamation is the greatest influence on the loss of intertidal habitat.

The construction of the realignment channel within the estuary (proposed as mitigation for the reclamation work), will intrude into a very small area of an intertidal bank that consists of soft mud. This area is used for feeding by wrybill (in particular). This will be an adverse effect but is considered minor as the area affected is small. Furthermore, it is noted that the wrybill is relatively resilient to disturbance. Overall, this is considered to be a minor effect.

Roosting habitat will be lost during construction

Habitat reduction of a more significant effect relates to the loss of roosting habitat. Roosting areas along the Causeway are sparse, especially during higher neap or spring tides. Roosting areas will either be removed (Causeway rock rubble and bridge abutments) or rendered unsuitable as a result of construction activity (such as noise). As the presence of pied shags is a key avifaunal feature of the Causeway area and the pied shag is a threatened species, this is considered an adverse effect. Mitigation is proposed to address this (see Section 13.8.4 for detail). Following the works it is probable that the newly established Causeway sides will provide roosting for birds.

There is also the possibility of displacement of birds away from the Project as a result of a combination of habitat loss and the motorway moving closer to preferred feeding areas (i.e. the potential disturbances arising such as noise, lighting, traffic and pedestrian movement). Displacement due to fright reactions would be temporary and displacement of birds from the key feeding banks on either side of the motorway is unlikely under normal operating conditions. At present birds feed along the immediate edge of the motorway but numbers are considered generally low (relative to numbers further beyond the motorway).

13.8.2.4 Disturbance Effects

With regard to terrestrial birds the location of the proposed motorway is in close proximity to the Oakley Creek bush, and also traverses open spaces intermittently utilised by native birds as roosts and foraging areas (at the northern and southern portals). Given this there is a potential risk in relation to disturbance effects (i.e. construction and operational phase noise, light and movement disturbances).

Although the Project area is already a well-lit, noisy environment, there will be changes as a result of both construction and operation of the new corridor and effects on the marine habitats that are used by coastal birds in the vicinity of Oakley Creek to SH16 Causeway – primarily due to increases in noise levels.

The Causeway works in particular have the potential to result in significant increases in the noise levels for the duration of construction. However, it is noted that birds in the vicinity of the route will have acclimatised to traffic noise and also general background and short-term noise associated with an urban environment.

During construction there are likely to be frequent fright reactions. For example sheet pile placement will likely displace birds from the vicinity of the works. This will be a short-term and temporary effect without any significant long-term consequences.

13.8.2.5 Construction and Operational Discharges

There will be discharges to the marine environment during construction. Those discharges have the potential to adversely affect intertidal feeding areas for birds as a result of siltation, the accumulation of contaminants and a decrease in water clarity. At present the receiving environment is subject to both point and diffuse discharges from a wide industrial and residential catchment, and there is limited stormwater management in place for the existing roadway surfaces of SH20 and SH16.

Well-managed sediment control devices (as proposed through Technical Report G.22 *Erosion and Sediment Control Plan*) would not result in discharges that (a) rendered the intertidal habitats unsuitable for feeding and (b) in isolation, adversely affected visual feeders such as terns and shags as a result of turbidity increases. The effects of discharges during construction are unlikely to be any greater than the natural variations in water quality conditions that occur at present during rainfall events with appropriate management.

13.8.3 Assessment – Operation

13.8.3.1 Direct Mortality

Mortality of birds as a result of collision occurs at present on SH16. With additional lanes the probability of collision is likely to increase. The area where this could be most significant ecologically would be across the Causeway where wading birds, typically start to feed on the southern side adjacent to the Causeway and then fly over the motorway to the northern side as feeding areas became exposed. However, it is evident that the fence along the motorway

footprint and the other structures (sign gantry, light poles) assist birds to maintain a safe clearance height over the motorway footprint. During the Causeway surveys no birds were observed to be at sufficiently low a height to risk collision and no carcasses were found. Light poles will be situated within the median barrier (as at present) so similar conditions will prevail (i.e. the partial barrier is likely to induce birds to attain a safe height well above the traffic when crossing the motorway, therefore the existing design provides for sufficient mitigation of this issue).

13.8.3.2 Edge Effects

Another factor which needs to be considered in terms of assessing the potential ecological effects associated with the Project is the extent to which new edges will be created within areas of existing habitat / vegetation, and the likely adverse effects which may eventuate as a result. Edge effects are likely to be more of an issue in forested habitats which would be truncated by a new Motorway, and are generally of far less concern in relation to this Project which is in an urban area where edge conditions, species and processes already dominate.

13.8.3.3 Habitat Fragmentation

As is the case with edge effects, habitat fragmentation is more of an issue in native forest habitats (e.g. habitat which is truncated by a new motorway), and is generally not an issue in relation to motorways in urban areas where fragmentation and isolation are already characteristics of the habitats available to birds. The privet-dominated habitat near the GNR Interchange is already isolated by GNR itself (that is four lanes wide). Similarly the more linear habitats beside the motorway from the GNR Interchange to Te Atatu would retain their present form.

13.8.3.4 Operational Disturbance

Operational noise impacts will have little effect on avifauna

For the majority of the CMA area of significance for avifauna there will be an increase in the average noise level out a further 25m from the Motorway. This area will impact on mangrove (potential banded rail habitat). The vegetated area of Pollen Island will not be affected by this change in noise environment. Furthermore, with barriers, there will be a decrease in noise levels at the Whau River Bridge (though this is also relatively minor). On balance the operational noise impacts are considered to have little effect on bird presence, diversity and behaviour and are considered a minor effect.

Artificial lighting, especially white and red light, can affect the orientation of migrating birds. In the case of the Project area, however, the majority of flight movements would be relatively low altitude around the Upper Waitemata Harbour and across the Auckland Isthmus, both of which are already well-lit environments, as are the existing Northwestern Motorway and associated local roadways.

The feeding patterns of wading birds at least, are dictated by tidal patterns and feeding therefore occurs under a wide range of light conditions. Species that are tactile feeders are unlikely to be affected. Visual feeders may be advantaged at night by increased ambient light levels over a wider area of feeding habitat. Some shorebird species vary their feeding strategy according to feeding habitat conditions.

It is anticipated if there is any effect on the adjacent intertidal areas as a result of changed lighting it will be minor and the existing characteristics of the avifauna adjacent to the Project Area, will not diminish the significance of those areas as coastal bird habitats (refer the Shoal Bay example in Technical Report G.3. *Assessment of Avian Ecological Effects)*.

The suburban portion of the route (i.e. SH20) is through an already lit (urban) environment that contains an avifauna that has adapted to relatively high ambient levels at night. The same diversity of birds will continue to utilise areas adjacent to the new roadway and there is unlikely to be any reduction in bird abundance as new efficient lighting will be roadway-focused rather than illuminating areas of nearby parkland. As with ambient noise, measures in mitigation regarding lighting that are primarily directed at protecting local residents will also be beneficial to birds in these areas.

13.8.3.5 Operational Discharges

There will be discharges to the marine environment during operational phases. Those discharges have the potential to adversely affect intertidal feeding areas for birds as a result of siltation, the accumulation of contaminants and a decrease in water clarity. At present the receiving environment is subject to both point and diffuse discharges from a wide industrial and residential catchment, and there is limited stormwater management in place for the existing roadway surfaces of SH20 and SH16.

Stormwater wetlands will provide habitat for common species, such as mallard and pukeko

As discussed in the Project description and assessed in further detail in the stormwater assessments (see discussion in each Sector Assessment, Chapters 14 to 22), stormwater quality with the Project will be higher than at present, with the treatment of both 100% of proposed impermeable surface and treatment of most existing impermeable surface areas of the Motorway. In addition, the stormwater wetlands themselves will provide habitat for common species, such as mallard and pukeko.

13.8.4 Mitigation Measures

13.8.4.1 Avoidance of Impacts Through Design

Following the investigation of Construction Yard 1 at Te Atatu, the design has been amended to avoid a traditional high tide roosting area for coastal birds (i.e. the size of the Construction Area is reduced to accommodate the bird roost).

13.8.4.2 Mitigation

Mitigation includes temporary bird roosting and management of vegetation clearance

Technical Report G.3 *Assessment of Avian Ecological Effects* concludes that the effect of the Project on terrestrial and coastal birds will be minor and will not result in a decrease in the diversity of birdlife. Any effects that do result from the Project are likely to be temporary and would be mitigated by the following:

- The installation of temporary roosting structures (e.g. posts, rails, floating platform) during the construction period adjacent to the Causeway Bridge. At this stage, temporary rather than permanent roosting structures are proposed (within the construction footprint) because it is considered that pied shags will use the new Causeway revetment and bridge abutments once construction has ceased; and
- As far as practicable major vegetation clearance should be scheduled to occur outside the bird breeding season (September to December) as far as practicable, to avoid the destruction of nests containing eggs and juveniles. Replanted areas will provide new habitat for terrestrial birds.

The Ecological Management Plan (Appendix C of Technical Report G.21 *Construction Environmental Management Plan)* includes provision for vegetation management (specifically weed control) and animal pest control on Traherne Island (northern and southern sides) and on the MMMR frontage from Traherne Island North to Whau Creek to mitigate cumulative impacts of habitat removal, including the permanent loss associated with reclamation.

Technical Report G.1 provides further information on the effects of the Project on air quality

13.9 Air Quality

Technical Report G.1: *Assessment of Air Quality Effects* provides a more detailed assessment of the effects of the Project on local and regional air quality. The following is a summary from that report.

13.9.1 Existing Environment

The Project is largely within an Urban Air Quality Management Area under the PARP: ALW, though the area adjoining Rosebank Peninsula is within an Industrial Air Quality Management Area. This Urban Air Quality Management Area includes the majority of highly populated areas in the Auckland Region, comprising a mix of residential, commercial and light industrial land uses as the regions transport networks.

Auckland's meteorology is also important for regional air quality. In particular, compared to more continental cities, there is a short duration of calm wind conditions. The result in terms of air quality is that pollutants are typically dispersed from the Auckland airshed in under 24 hours and there is very little evidence of accumulation of pollutants over several days.

In 2004, the ARC indicated that emissions from transport were estimated to contribute around 47% of the total annual mass emissions from particulate matter (PM_{10}) and 85% of the carbon monoxide.

Air quality is monitored by the ARC across a number of sites in the region. The regional trends in air quality indicate the following:

- There is little consistent trend for long-term average concentrations of particulate matter (PM_{10}) and the sites of monitoring by the Regional Council indicate that they are currently complying with the National Environmental Standards for Air Quality (AQNES) (and are within the limit of 50µ/m^3 by 10 µ/m^3). However, in the case of finer particulate matter ($PM_{2.5}$), the regional results indicate that compliance with Regional Targets is currently highly marginal;
- Annual mean levels of Nitrogen Dioxide (NO_2) are relatively low and comply with WHO guidelines. There is no significant current trend in ozone levels in Auckland nor evidence to suggest that typical levels will change in the next two decades; and
- Ambient concentrations of carbon monoxide in Auckland are low and have been falling since monitoring began. This fall is attributed in large part to the technological developments in the vehicle fleet and a corresponding reduction in vehicle emissions.

13.9.2 Assessment – Operation

The Project has negligible impacts on regional air quality

The assessment of the air quality impacts of the Project has been made over two time periods: 2016 and 2026 (around opening and ten years of operation). Modelling results are used to compare air quality with and without the Project. The following effects are identified with respect of pollutants[19] to air for the Project area and wider Region:

- Once operational, the Project will have a negligible impact on the overall mass of emissions of air pollutants from road transport to the Regions air shed (e.g. changes of less than 1.5%);
- Across the Project area concentrations of pollutants to air are predicted to decrease (on average) between the 2006 base year and 2016 (either with or without the Project);
- People living, working or spending time close to existing busy roads and arterial routes in the Project area are predicted to have a reduced exposure to vehicle related air pollutants as a result of the Project (e.g. around Te Atatu and GNR);
- When comparing the two modelled scenarios for 2016 (with and without the Project), many of the modelled the receptors in the Project area are predicted to experience small increases in concentrations of contaminants;
- Approximately one quarter of the receptors identified across the Project area experience a net increase in PM_{10} and NO_2 concentrations in 2016 with the Project (compared to without it), while approximately another quarter of the receptors experience a net decrease in PM_{10}, though fewer experience a decrease in NO_2;

[19] These pollutants include particulate matter, nitrogen dioxide, carbon monoxide and benzene.

- When comparing air quality within the Project area, the biggest increases in concentrations of pollutants to air are in Sector 9, between the southern tunnel portal and the Maioro Street Interchange. This is because this area has only comparatively minor roads with low traffic volumes in the area without the Project;
- The modelling for air pollutants in 2026 indicates a further reduction in air pollutant concentrations compared to 2016 (both with and without the Project). This is attributed to assumed improvements in fuel efficiency and emission control in the vehicle fleet (irrespective of the Project);
- Exposure levels from the Project are predicted to comply with the AQNES, which are set to protect the health of the most vulnerable individuals in the community; and
- Tunnel vents of 25m high are designed to provide effective and efficient dispersion of vehicle emissions and the operation of the tunnels is predicted to improve air quality in many parts of the Project area, due to emissions being taken off local roads and then being vented and dispersed higher in the atmosphere.

Overall, the assessment on air quality effects concludes that there will be no adverse air quality impacts as a result of the Project.

13.9.3 Monitoring – Operation

Monitoring will confirm predicted effects on air quality

While the assessment for air quality concludes that there will be no adverse effects, monitoring is proposed in order to demonstrate that the 'modelled effects' are realised through the operation of the Project. Detail on this operational air monitoring is provided in Chapter 10 of Technical Report G.1 *Assessment of Air Quality Effects*. In summary, this monitoring includes:

- In tunnel air quality monitoring to assist in the operation of the ventilation system of the tunnel; and
- Ambient air quality monitoring near the northern and southern portals (e.g. Alan Wood Reserve and in proximity to Waterview Primary School) prior to commencement of tunnel operations and through for 24 months from operations commencing. This monitoring is proposed to:
    - Be undertaken continuously;
    - Be reviewed against the relevant ambient air quality criteria (e.g. national standards);
    - Include continuous meteorological monitoring and recording of vehicle numbers travelling through the tunnel; and
    - The first 12 months of monitoring results shall be reported through monthly monitoring reports.

14. Assessment of Effects – Sector 1

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 1. The works in this Sector comprise the widening and realigning of the SH16 west of Te Atatu Interchange to the Whau Bridge, and the improvements to Te Atatu Interchange itself. Overall, the key environmental effects identified and considered in Sector 1 relate to the potential impacts on the existing established residential communities of Te Atatu, for both construction and operation and the receiving coastal environment. Through the Project design and the proposed mitigation, it is considered that most effects can be managed to be minor. For those effects which cannot be fully mitigated, the following comments are made:

- The potential enhancements for stormwater treatment provide some off-set of adverse effects on marine ecology resulting from the permanent reclamation of the CMA;
- The adverse effects of construction emissions (particularly noise and vibration) are comparatively short term and can be managed; and
- The adverse visual effects for residents will, in the longer term, be mitigated by establishment of screening and planting proposed by the Project.

On balance, and considering both the potential adverse and positive effects of the Project on the environment and community in this Sector and for the wider region, it is considered that the Project manages the use, development and protection of natural and physical resources in a sustainable way.

14.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 1.

This Chapter assesses the effects of the Project in Sector 1

As described in Chapters 4 and 5, the main elements of the Project in this area are:

- Realignment and widening SH16;
- Improvements to Te Atatu Interchange; and
- A small area of reclamation and a stormwater wetland pond at Jack Colvin Park.

Specific details on scheme elements in this Sector are described in Section 4.4.1 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans*, (Sheet 1 and 2 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.1 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheet 1 and 2 for this Sector).

The works located within this area are located within an urban environment dominated by SH16. Sensitive receptors include residential areas adjacent Te Atatu Interchange. The receiving environment includes the Henderson Creek and Pixie Stream to the west and the Waitemata Harbour to the east.

Key issues relate to the existing residential environment and coastal marine area

Given the existing environment, the key issues identified in the assessment of environmental effects for the Project relate to impacts on the existing community, transport networks and the physical residential environment[1].. Effects on the receiving environment, particularly waterways and the coastal marine area have also been considered and are discussed in the following sections of this Chapter. The construction footprint has been designed so as to avoid the key archaeological sites identified in the vicinity of Construction Yard 1.

This Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (e.g. there is no reporting of effects on archaeology).

14.2 Land Use

14.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 14.1. The information within this figure has been extracted from the Waitakere District Plan (refer Appendix E.2 for the district plan maps). The Plans in Part F.1: *Designation Plans* contain further detail on designations and other restrictions. Key land uses in this area are the existing transport infrastructure (particularly SH16), open space areas and residential environment.

14.2.1.1 Transport Environment Land Use

Land use is dominated by existing transport infrastructure (SH16)

The existing Te Atatu Interchange and SH16 are zoned as Transport Environment in the Waitakere District Plan and designated for Motorway purposes (reference NZTA1, discussed below in section 14.2.1.4). This zoning includes the existing cycleway which runs parallel to the State Highway on the southern side. The local roads which connect to Te Atatu Interchange (Te Atatu Road, Royal View Road) are also zoned Transport Environment.

14.2.1.2 Open Space Environment Land Use

Three areas of open space are located in the Sector 1 area

There are three areas of open space within Sector 1:

- Harbourview – Orangihina Park;
- McCormick Green; and
- Jack Colvin Park.

Harbourview – Orangihina Park is located to the north of Te Atatu Interchange and comprises some 83 hectares (made up of a number of separate parcels owned by the Waitakere City Council, the Crown and Waitakere Properties Ltd (to be vested in Council)).

The southern part of the Harbourview – Orangihina Park, adjoining Te Atatu Interchange, is identified in the Harbourview – Orangihina Management Plan as being for recreation reserve and includes an area for a future marae (identified as Special Area Environment). This part of the Park is fenced off from public use and leased to Te Atatu Pony Club. Areas have also been set aside for jumps and water features.

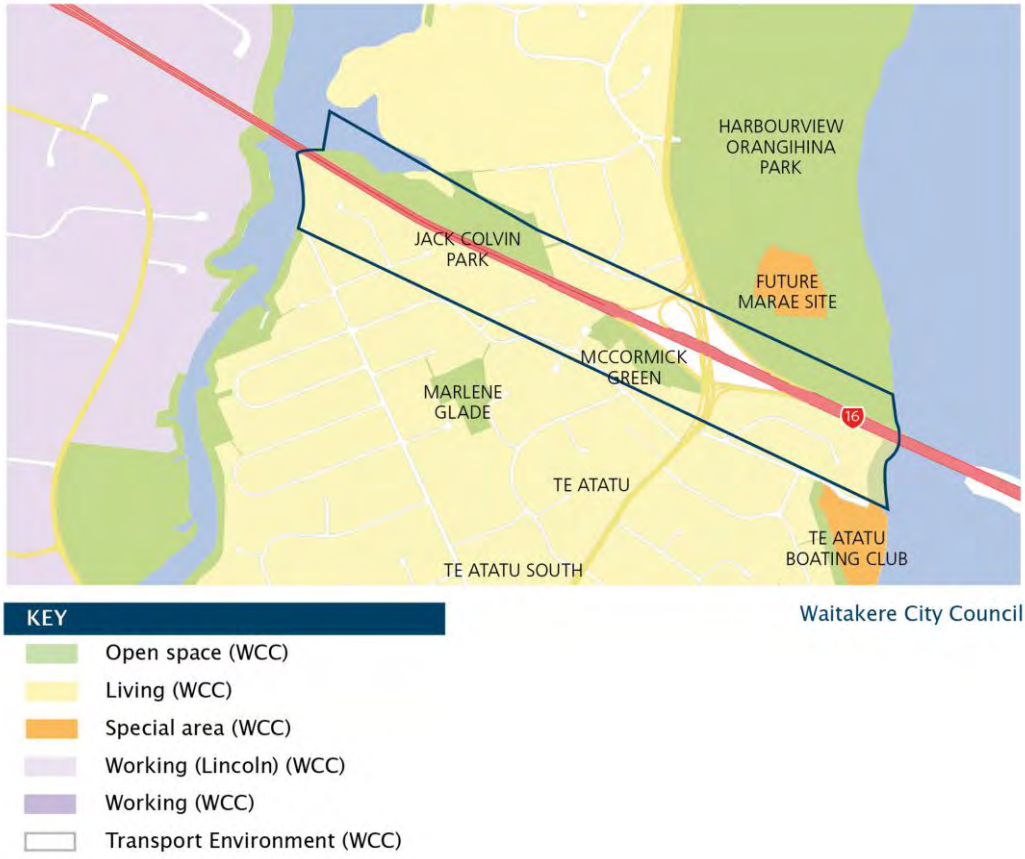


Figure 14.1: Land Use Zones in Sector 1 (Not to Scale)

McCormick Green and Jack Colvin Park are Recreation Reserves (under the Reserves Act 1971)

The northern part of the Park has been set aside as a Scenic Reserve and is open to the public. This northern scenic reserve area will be unaffected by the Project. Harbourview – Orangihina Park is not classified as a Reserve under the Reserves Act 1971.

McCormick Green is located on the southern side of Te Atatu Interchange and separates the State Highway from Royal View Road. McCormick Green contains approximately 1.5ha of open space and has an existing pedestrian/cycle way running along the southern boundary adjoining the State Highway. There are no other facilities provided within McCormick Green. McCormick Green is gazetted as Recreation Reserve under the Reserves Act 1971.

Jack Colvin Park is located on the northern side of SH16 and comprises approximately 4.3ha of land. Jack Colvin Park is home to Te Atatu Rugby League Club and contains their clubrooms and playing fields. Jack Colvin Park borders the Henderson Creek. A large Transpower pylon is also located on the western side of the Park. The Park is gazetted as Recreation Reserve under the Reserves Act 1971.

14.2.1.3 Living Environment Land Use

Particularly on the southern side of SH16, land use is residential. All of the residential zoned land in this area is zoned Living 1 Environment in the Waitakere District Plan. This zone provides for and recognises the slightly smaller lot sizes (around 800m^2) that are common in areas such as Te Atatu and Kelston.

Residential land use surrounds the Project

West of Te Atatu Interchange and south of the Motorway is generally residential development characterised by detached dwellings on medium sized sites (e.g. characteristic of this zone at around 800m^2). There are a few pockets of medium density living where properties have been subdivided into two or more lots however these are not characteristic of the residential area.

14.2.1.4 Existing Designations

Existing designations within Sector 1 are shown on the Plans in F.1: Designation Plans and includes Designation NZTA1 and Designation TP2. Designation NZTA1 provides for SH16 between Auckland and Kumeu. The purpose of the designation is "Auckland-Kumeu Motorway (SH16)". Designation TP2 indicates Transpower High Powered Lines. However, the Waitakere City Council has confirmed that only the Transpower substation is designated (situated in Hepburn Road, Massey) and not the lines.

Plans F.1 Designation Plans shows existing designations

14.2.2 Assessment – Operation

Land use impacts associated with the operation of the Project relate to the scale of permanent land take from surrounding land use areas described below. In particular, effects include the loss of the land uses as a result of the Project and the potential loss of viability for the remaining surrounding land use areas.

Land use impacts relate to the land take

14.2.2.1 Impacts: Transport Environment Zone

The existing SH16 and associated interchange, bridges and ramps are currently zoned Transport Environment. There will be no adverse land use impact on this Transport Environment, as the Project is consistent with the purpose and activities envisaged within this zone.

14.2.2.2 Impacts: Living Environment Zone

The proposed realignment of the motorway corridor in Sector 1 will require residential property take in Titoki Street, Alwyn Avenue, Marewa Street, Milich Terrace and Te Atatu Road. The number of residential properties to be taken for the Project is discussed further in the assessment of construction impacts (14.2.3 below). While a number of these properties are required for the construction of the Project, it is anticipated that some sites may be available for residential development following construction works. This would reduce the total impact on the Living Environment (L1) zone as a result of the Project. While the area of land available for Living Environment cannot be confirmed, it is anticipated that between 5

and 10 properties may be available for reinstatement of residential land uses[2].

On balance, and given the extent of Living Environment zoned in the wider area surrounding the Project, the adverse effects of the loss of a small proportion of this land use are not considered significant.

14.2.2.3 Impacts: Open Space Environment Zone

Approximately 0.7ha of Harbourview - Orangihina Park will be permanently acquired to accommodate the upgraded Te Atatu Interchange. The area of the Park affected is currently fenced off from public use and leased to Te Atatu Pony Club. Given that this land take represents a minor take from the total area of the Park and that geographically, it is a narrow strip of land alongside the existing State Highway, the effects of this land take are considered no more than minor.

Part of McCormick Green (approximately 0.20ha) is required for the Project. Specifically, the operation land take in this area is required for the upgrade of the Northwestern pedestrian/cycle way. The use of this land is consistent with its current use and therefore the impacts of land take are no more than minor.

Approximately 0.6ha of Jack Colvin Park is required for the operation of the Project. The majority of the land required is for the proposed stormwater wetland and is currently inaccessible land. There is also a minor land requirement for the extension to the designation along the side of Jack Colvin Park Reserve (adjacent to SH16) which will require seating for the sports fields and amenity trees to be relocated within the Reserve. Overall the scale of the land take is considered minor. There is a potential adverse effect on the recreation use of this Reserve however the additional landscaping proposed within this area and reinstatement of seating on the Reserve (through the Open Space Restoration Plans developed with Council) will offset these amenity and land use impacts.

14.2.3 Assessment - Construction

As noted above, the majority of the Project within this area will be constructed within land designated for Motorway purposes (reference NZTA 1) and zoned Transport Environment in the Waitakere City District Plan.

The Project requires land take (residential and open space)

There will however, be some land take required from properties on either side of the State highway for the construction (as noted in 14.2.2 above). These properties are for the most part zoned for residential purposes (L1) and open space (Open Space Environment).

[2] The final land available for return to residential land use will be determined following construction.

14.2.3.1 Impact on Land Zoned as Living Environment

The proposed realignment of the Motorway corridor at Te Atatu will require property take in Titoki Street, Alwyn Avenue and Royal View Road. Table 14.1 below outlines which properties are physically affected by the designation and for what use, as defined by the proposed designation.

Table 14.1: Summary of Sector 1 Land Take from Living Environment (APPROXIMATE)

Impact	Take Requirement	Parcels	Dwellings
Titoki Street	Construction and Permanent Works on northern side of SH16 (stormwater wetland, widening of SH16, noise mitigation and associated land formation / earthworks)	21	18
Alwyn Avenue	Construction and Permanent Works on south eastern side of SH16 (widening of SH16, noise mitigation and associated land formation / earthworks)	13	15
Marewa Street, Milich Terrace, Te Atatu Road, McCormick Road and Paton Avenue	Construction and Permanent Works on south western side of SH16 (widening of SH16, noise mitigation and associated land formation / earthworks)	25	8

14.2.3.2 Impact on Land Zoned As Open Space Environment

4.7ha of Harbourview – Orangihina Park will be required for construction

Approximately 4.7ha of Harbourview – Orangihina Park will be required for construction, including Construction Yard 1. This take will require temporary reconfiguration of The Te Atatu Pony Club. However, the majority of the land available for grazing remains and access between the land and the club rooms will be provided (behind Construction Yard 1). If necessary it is considered that these temporary effects can be further mitigated by provision of supplementary feed for the ponies if required.

In addition to the land taken from McCormick Green for the Northwestern Cycleway (discussed in Section 14.2.2.3), an area of the reserve will be required for temporary stormwater treatment during construction. This impact is considered temporary and not significant.

Approximately 0.9ha of Jack Colvin Park will be required during construction. The majority of this land is currently inaccessible and is not part of the Park used for active recreation. Providing that the Park is restored following construction, these temporary construction land use effects are not considered significant.

14.2.4 Mitigation – Operation

14.2.4.1 Avoiding Effects through Design

The potential adverse land use effects have been minimised on the Open Space and Living Environments in design of the interchange and SH16 widening works. In particular, design has sought to locate the works within land already designated for Motorway purposes and zoned Transport Environment as practicable. As discussed in Chapter 11 of this AEE, the assessment of alternatives for the Construction Yard has also specifically sought to minimise land use impacts, by avoiding residential land take and minimising the size and optimizing the location of the Construction Yard to enable ongoing operation of Te Atatu Pony Club.

Land use effects have been minimised through design

14.2.4.2 Mitigation Recommendations

The following mitigation measures are proposed:

Mitigation includes planned withdrawal of designation following construction and open space restoration

- Once construction is complete the designation should be uplifted from surplus land within the designation to allow for reinstatement of residential and open space / recreation areas.
- Development of Open Space Restoration Plans with key stakeholders, including the [Auckland Council] to inform the restoration and reinstatement of open space and reserve areas affected by the Project. In particular and in respect of the land use effects assessment, this would include:
    - Replacement of seating, fencing and amenity tree planting within Jack Colvin Park; and
    - Reinstatement of open space and recreation facilities in the Harbourview – Orangihina Park.

14.2.5 Mitigation – Construction

During construction the following mitigation is proposed:

- Liaison with Te Atatu Pony Club to confirm:
    - The viability of the remnant leased area of Harbourview – Orangihina Park for grazing by Te Atatu Pony Club and if necessary to provide feed supplement over the construction period (to off-set the lost grazing area); and
    - Advise the Club on construction works and programmes to minimise potential disruption to the Club's activities.

14.3 Transport Effects

Technical Reports G.16 and G.18 provide further detail on the assessment of transport effects

Traffic effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment Transport Effects*). The following is a summary from this assessment.

14.3.1 Existing Environment

14.3.1.1 Roading Environment

This sector comprises SH16, Te Atatu Interchange and Te Atatu Road. SH16 has two lanes of traffic in each direction and the Interchange has three on-ramps and two off-ramps. There is a priority lane on the Te Atatu Peninsula on-ramp which HOV's including trucks, buses and motorbikes can use if they meet the requirements. The existing traffic flow patterns and volumes along SH16 are described in Chapter 13.

14.3.1.2 Pedestrian/Cycling Environment

Existing transport environment is dominated by SH16, Te Atatu Interchange and Te Atatu Road

There is an existing shared walking and cycling path that forms part of the North Western Cycleway running parallel to SH16. This facility is separated from the motorway traffic.

To the south of SH16, footpaths are located on either side of Te Atatu Road. There are signalised crossings to allow movement across the on-ramp/off-ramp and across Te Atatu Road. There is also a pedestrian subway located under the north-western side of the Interchange, providing access across the SH16 off-ramp for pedestrians connecting to Titoki Street.

14.3.1.3 Passenger Transport

There are three bus routes that pass through Sector 1: a route which travels along the Motorway only; a route that travels along the Motorway and Te Atatu Road; and a route that travels north-south on Te Atatu Road.

There is a priority lane on the SH16 on-ramp that buses can use and the westbound off-ramp turns into three left turn lanes at the intersection with Te Atatu Road, one of which is a bus lane. This section of bus lane at the signals is accessed from the right hand turn lane, which allows buses to move into a short bus lane on Te Atatu Road before merging with the main traffic on Te Atatu Road.

14.3.2 Assessment – Operation

Chapter 13 provides a regional assessment of transport effects

The overview of the transport assessment for the operation of the Project is provided in Chapter 13 of the AEE (regional assessment). The assessment provides for the anticipated effects of the Project on the wider motorway network, arterial roads and the local roading network. Further detail on this assessment is provided in Technical Report G.18 *Assessment Transport Effects.*

With the widening of the southern approach to Te Atatu Interchange access for property numbers 356, 356A and 358 on Te Atatu Road will be removed. An alternative provision for access to these three properties will be by a new accessway via the property at 94 Royal Road.

The location of this access and the associated vehicle movements (for the properties using this accessway) will have negligible effects on the operation of the Royal View Road and Te Atatu Road intersection.

14.3.3 Assessment – Construction

Construction traffic impacts relate to loss of capacity in the network and access restrictions

The upgrading of Te Atatu Interchange and SH16 widening is planned to be constructed over three phases so that the existing functionality and lanes in the interchange can be maintained throughout construction. Site access to the work site will be established off Te Atatu Road and potentially to and from Te Atatu's on and off-ramps

During construction potential effects include: reduced capacity on roads within the Project site, resulting in travel time delays and diversions off these roads onto other roads in the network (increasing congestion and travel times on these routes) and potentially loss of access for users of the network through the construction site (e.g. if road closures etc are left unmanaged).

Traffic management methods will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. This is discussed further in Section 14.3.4. Technical Report G.16 *Assessment of Temporary Traffic Effects* provides further detail on these management methods.

14.3.3.1 Effects of Realignment and Narrowing of Lanes

During the works it is expected that lanes on SH16 will be narrowed to a minimum width of 3.35m and shoulders to a minimum width of 0.3m. The existing number of lanes on the mainline and on the ramps will remain operational throughout works, with the exception of closure of one lane on the approach to the ramp meter on Te Atatu Road loop on-ramp.

Wherever lane narrowing or realignments are installed to facilitate offline construction activities, temporary TL-3 barriers will be installed to isolate the work site from passing traffic with gaps provided for site access from the Motorway and temporary lighting installed. The prescribed warning signage will be installed in advance of the works and an 80 kph temporary speed limit will be installed over the length of motorway.

Works on the Te Atatu bridge widening will be undertaken over a number of phases so that the existing functionality and lanes in the interchange will be maintained throughout the works. Necessary work on the bridges over SH16 or in the "live lanes" will be conducted during night closures of SH16 and Te Atatu Road under an approved site-specific traffic management plan (SSTMP).

Table 14.2 provides a summary of the proposed realignment/narrowing included in this Sector.

Table 14.2 Realignment/Narrowing of Lanes during Construction Phases

Phase	Proposed Realignment/Narrowing of Lanes
1	The widening of SH16 eastbound will require Motorway eastbound lanes and shoulders to be narrowed. The widening of SH16 westbound between Te Atatu ramps will require the westbound lanes and shoulders to be narrowed.
2	The second phase of widening SH16 will shift the SH16 eastbound traffic on the newly constructed carriageway. This will reopen the eastbound shoulder bus lane. The length of SH16 adjacent to the eastbound off ramp will remain aligned to the centre of SH16 to allow for the construction of a retaining wall adjacent to the off-ramp. The SH16 westbound lanes and shoulders will be narrowed. The construction of the new pedestrian/cycle way bridge to the west of Te Atatu Road will require the southbound lanes of Te Atatu Road to be shifted to the right and narrowed.
3	The widening of SH16 will shift the SH16 westbound traffic on to the newly constructed carriageway. The shift will open the westbound shoulder bus lane. The length of SH16 adjacent to the eastbound off-ramp will be realigned to its final arrangement once construction of the retaining wall is complete. The Te Atatu Interchange westbound off-ramp will be shifted onto its final alignment in Phase 3. Lanes in both directions on Te Atatu Road will be closed over night to allow construction of Te Atatu Road, north of the Te Atatu bridges. Temporary lane adjustments will be required at both intersections either ends of Te Atatu Road bridges to safely direct motorists through a contra-flow arrangement.

A regional assessment has been undertaken of the effect of these works (as discussed in Chapter 13 of this AEE). The assessment indicates that capacity reductions on SH16 are likely to increase travel times along SH16 and divert traffic onto the arterial network across the Isthmus and extend out to North Shore in some instances. The SSTMP developed will be important in managing these effects.

Technical Report G.16 concludes that the impact of the temporary work site at Te Atatu Road is likely to result in increased travel times for those travelling along Te Atatu Road across the Interchange (e.g. a maximum of approximately 6 minutes additional travel time is expected in the PM Peak from Edmonton Road to Harbour View Road). In order to reduce this impact, the coordination of signals will need to be reviewed in light of temporary speed limits to optimise capacity through the Interchange.

14.3.3.2 Effects arising from Temporary Closures

There will be some temporary night time closures required for the Project in this Sector particularly to enable works on the bridges over SH16 or in the live lanes.

Night works will be required

Potential closures in this area include:

- SH16 through Te Atatu Interchange;
- SH16 east of Te Atatu Interchange for bridge construction/widening;
- Westbound Te Atatu off-ramp;
- Eastbound Te Atatu off-ramp;
- Te Atatu Interchange Eastbound Loop on-ramp; and
- Te Atatu Interchange Eastbound on-ramp.

The traffic assessment indicates that the majority of trips passing through Te Atatu Interchange originate from Westgate, Te Atatu Road northbound and Lincoln Road. The SH16 eastbound trips through the Interchange are likely to be impacted by works at one time or another and diverted appropriately via the Interchange ramps. Appropriate management of the temporary closures is required to mitigate these effects (e.g. signage/increased awareness/appropriate diversion routes).

14.3.3.3 Effects on Pedestrians and Cyclists

During the reconstruction of Te Atatu Bridge over SH16 pedestrians will be detoured to either side of the bridge (at the signalised intersection on the southern side and at a temporary pedestrian refuge installed on the northern side of the interchange). Access along the cycleway can be maintained throughout construction with negligible effects on cyclists. Therefore the effects are considered to be less than minor.

Pedestrian and cycle access will be maintained through construction

14.3.3.4 Effects arising from Construction Site and Work Site Access

The construction site for the widening of Te Atatu Interchange will be set up in Harbourview - Orangihina Park (Construction Yard 1). The site will be accessed off Te Atatu Road. A right turn bay will be marked on Te Atatu Road median for vehicles turning right and an area of Te Atatu Road southbound lanes (in front of the access) will be marked to avoid queuing across the site access. Temporary lighting and TL-3 barriers will be installed to isolate the work site from passing traffic (with gaps provided where necessary for site access). Site access will be designed to minimise the effect on the road network and agreed in a Site Specific Traffic Management Plan (SSTMP).

Site access to Construction Yard 1 will require appropriate management to ensure there minimal effects on the network

Site access points for each work zone will be positioned on the local road network where possible. Any site access points on SH16 will not be in operation during peak hour times. Where acceleration/deceleration lanes cannot be provided for site access points on SH16, further temporary lane closures will be installed outside peak hours to provide for these. With appropriate management the effects are minor.

14.3.3.5 Effects on Public Transport

It is expected that there will be some effects on the operation and performance of buses during construction due to reduced capacity on roads within the Project area, resulting in travel time delays and diversions off these roads onto other roads in the network. Appropriate management will be required to mitigate these effects (e.g. reinstatement of bus lanes and /or priority as rapidly as possible; liaison with passenger transport authorities throughout the works to arrange appropriate alternative routes).

14.3.3.6 Effects on Property Access and Parking

The existing Royal View Road and Bridge Avenue intersections off Te Atatu Road to the south of the interchange, as well as the existing Titoki Street intersection to the north of the interchange, will not be affected by the widening on the approach of the interchange. Due to the current parking restrictions in place in the vicinity of Te Atatu Road Interchange, there is considered to be no effect on parking associated with the widening on the approach to the interchange. Overall, it is anticipated that the Project will have a less than minor effect on existing property access or parking in Sector 1.

14.3.4 Mitigation – Construction

Mitigation and management measures to minimise the effects of construction on traffic are outlined in the Construction Traffic Management Plan

Traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management measures to minimise the effects of construction on traffic are outlined in the Construction Traffic Management Plan (CTMP) (see Appendix A of Technical report G.16 *Assessment of Temporary Traffic Effects*). An overview of the CTMP is provided in Section 13.3.4 of this report).

Traffic management for specific areas of the construction site will be formed and agreed within Site Specific Traffic Management Plans (SSTMP's) as outlined in the CTMP. In particular, in this area, particular management measures include:

- Limiting road closures to partial road closure on Te Atatu Road (so that residents in Te Atatu Peninsula have continued access);
- Restricting access to SH16 from Construction Yard 1 in Peak Traffic Periods;
- Maintaining pedestrian access across SH16, particularly the alternative route provided for pedestrian access in construction of the underpass and replacement of Te Atatu Bridge; and
- Coordination of traffic signals with the temporary speed limits to optimise travel times and capacity.

14.4 Social Impacts

A full social impact assessment is provided in G.14: Assessment of Social Effects

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14 *Assessment of Social Effects*). This social assessment provides a holistic 'lens' on the potential effects of the Project on neighbourhoods and wider communities, including social, economic and cultural effects. The following is a summary from that assessment.

14.4.1 Existing Environment

Social effects of works in Sector 1 have the potential to impact on communities in Te Atatu South and Te Atatu Peninsula

This area covers the residential areas of Te Atatu/Te Atatu South (south of SH16) and Te Atatu Peninsula (north of SH16). These areas are currently separated by SH16 and Te Atatu Interchange, though there is evidence of strong social connections between these areas (e.g. schools, community facilities and shopping areas connected by Te Atatu Road). There are community centres on either side of SH16 (Te Atatu South and on Te Atatu Peninsula).

The Te Atatu Peninsula town centre and community have developed substantially since the development of SH16 in the 1950's, and there has been a period of rapid growth in the last decade. The area is identified by the Waitakere City Council as an important growth area, to deliver on the growth outcomes of the ARGS.

Key community sites and facilities of interest in this Sector are shown in Figure 14.2.

Population growth in this area has been high since 2006. Most residents work either in Auckland city or Waitakere city. The predominant ethnic groups in this area are European, Asian, Maori and Pacific Island. The majority of people living in this area own/partly own, their own home. Socio-economic indicators are summarised in the Ministry of Health's deprivation indices. These indicate that the Census Meshblocks that will be affected by property acquisition on the Project are either comparable to the Auckland regional average (5), or have comparatively high rates of deprivation (8).

Important transport linkages in this area include SH16, the local road/footpath network and the Northwestern Cycleway (as a pedestrian/cycle way). There is a shared pedestrian/cycle path along both sides of Te Atatu Road over the interchange, and also a pedestrian underpass beneath Te Atatu Interchange.

As described in Section 14.2.1, there are a number of reserves, open space and recreation areas located in this area including Jack Colvin Park, McCormick Green and Harbourview – Orangihina Park.

EDUCATIONAL FACILITIES

- E1 Funtimes Childcare
- E2 Rutherford College
- E3 Te Kura Kaupapa Maori o Te Kotuku School
- E4 Rutherford Primary School
- E5 Te Puna Reo o Manawanui Early Childhood Centre
- E6 Viti Centre Pre-school
- E7 Flanshaw Road School
- E8 Flanshaw Early Childhood Centre

OPEN SPACE

- A1 Jack Colvin Park
- A2 McCormick Green
- A3 Harbourview-Orangihina Park

PLACES OF RELIGIOUS ASSEMBLY

- R1 Te Atatu Bible Chapel
- R2 Holy Family Parish
- R3 Anglican Church (St Pauls)
- R4 Methodist Church
- R5 Congregational Church of Samoa
- R6 Baptist Church - Te Atatu
- R7 Te Atatu Congregational Church

COMMUNITY CENTRES

- C1 Te Atatu Peninsula
- C2 Te Atatu South

RETAIL AREAS & OTHER COMMUNITY FACILITIES

- B1 Hospice West Auckland
- B2 The Peninsula Medical Centre
- B3 Te Atatu Boating Club

OTHER

- Archaeology Sites
- CAU Boundaries

Figure 14.2: Community Infrastructure in Sector 1

14.4.2 Assessment – Operation[3]

14.4.2.1 Effects from Property Acquisition

As discussed in the land use assessment above, residential property acquisition will reduce population size in Te Atatu[4]. The impact of residential land take will result in (at least initially) a high degree of change for these communities. The potential social effects of the loss of these dwellings include:

- Impacts on community cohesiveness, given that some residents may not be able to relocate within the same neighbourhood;
- Impacts on the ability of residents to participate in social/cultural activities (for example, attend community events or a local church).

Social Impacts relate to impacts on people's way of life, health and wellbeing, accessibility and connectivity and impacts on community infrastructure

For the Project, and given the scale of the overall property take relative to the wider community, it is acknowledged that the property acquisition may result in an initially high degree of change, but in the long term is not expected to generate any significant impact as people adjust their living patterns and social networks (eg. joining new facilities).

These effects are further offset with the improved accessibility within and between local communities for the wider study area (as discussed in Chapter 13). This will result in an increase in people's accessibility, and consequently their ability to participate in social/cultural activities. This is discussed further on the next page.

14.4.2.2 Effects from New Motorway Structures

Operation noise, vibration, visual and air emissions have the potential to generate nuisance, amenity and health effects (which are discussed more specifically in terms of emissions, in later sections of this AEE). Specifically, for the social impact assessment, these effects have the potential to impact on people's wellbeing and quality of life.

Given the effects of the existing State highway in this Sector, these potential operational effects will be similar to those already experienced by residents and it is considered that over time, people will adjust to the new environment as it becomes a normal part of their day to day surroundings.

[3] It is recognised that social impacts have been occurring in the planning phase of the Project at the local level, mainly in terms of the uncertainty caused by the Project, particularly surrounding potential property acquisition.

[4] It is acknowledged that these impacts will occur from the construction phase, due to the timing of property acquisition.

The effects of emissions from the Project in this area are assessed in more detail in the later sections of this AEE (see Sections 14.13, 14.14, 14.15, and 14.16). Overall, the change in effect of emissions is either neutral or in some cases (e.g. noise) slightly positive (as the proposed mitigation for noise improves the ambient noise environment for residential properties) this does not result in a substantial social effect (either positive or negative). This is because the scale of these changes is minor.

Taking into account the visual effects of the Project and the proposed landscaping, it is considered the Project represents minor to moderate adverse social effects on local resident's wellbeing and sense of satisfaction with their living situation, depending on the specific outlook of individual properties. Overall these adverse effects are not considered to be widespread (with wider social benefits identified).

The Project will generate accessibility and connectivity improvements

Overall, the Project will generate accessibility and connectivity improvements for local residents in this area. This will result in positive social impacts to people's patterns of daily living. These benefits are attributed to:

- Improved accessibility to and across the State highway network improving accessibility to places of work, community facilities and facilities of regional importance in the wider area;
- The bus shoulders along SH16 and the bus priority lane at Te Atatu Interchange will also provide benefits to bus travel times, which will particularly benefit residents in this area and those residents without access to a vehicle;
- Safety and amenity improvements to the underpass and improvements to the phasing of signalised pedestrian crossings will improve accessibility and connectivity for pedestrians across SH16, notably for local residents and Rutherford College students; and
- Improved accessibility for users of the Northwestern Cycleway (overall making the user experience more pleasant with increased separation from vehicular traffic, route improvements and widening to 3m along most of the Project area).

It is acknowledged however that travel times on Te Atatu Road are predicted to increase with the Project which will result in some delays to non-bus users in Te Atatu and Te Atatu Peninsula.

14.4.2.3 Effects on Community Infrastructure

Overall, the impacts on schools and educational facilities are considered to be positive as a result of the Project. In particular the following are noted:

- Emissions will be improved (albeit slightly) for sites such as Te Puna Reo O Manawanui Early Childhood Centre (e.g. noise and air quality)
- Pedestrian and cyclist connectivity will improve across SH16, which is an access used by students of Rutherford College.

However, it is noted that there may be some minor impacts associated with accessibility to educational facilities, given the increase to travel times projected for vehicles crossing Te Atatu Interchange.

Given the split of property acquisition on either side of SH16 (and the large roll and catchment in the case of Rutherford College), the extent of potential roll impact on these education facilities is not considered adverse.

Potential impacts on recreation opportunities are considered neutral. The minor land take impacts (discussed in Section 14.2.2.3) are not considered to compromise existing recreation activities or opportunities for local residents in this area. Likewise, it is considered that council plans to establish a public transport facility and/or marae on site are not impeded by the Project, following reinstatement of open space areas following construction.

14.4.3 Assessment – Construction

14.4.3.1 Effects on Residents

Construction has potential adverse social impacts on the community and its residents

Overall, construction activities are considered to result in reduced 'liveability' for the community in this area affecting people's quality of life and wellbeing at least over the period of construction. In particular, these effects are associated with the emissions from construction (noise, vibration and air discharges).

Construction Yard 1 is located within this Sector, and will be a major construction yard through the construction period. The presence of construction yards will challenge some local resident's expectations of neighbourhood amenity, character and safety. This may affect people's pride in neighbourhood but is considered to have little impact on wellbeing or way of life overall. In particular, these effects are associated with the physical impact of construction works and the changing visual character of the locality over the construction period (eg. removal of trees and vegetation or the presence of buildings, stockpiling and machinery).

The traffic disruptions projected during construction within this sector may cause minor impacts in restricting people's accessibility to go about their normal living patterns and participate in social/cultural activities during construction. While these effects are considered in terms of travel times, the overall impact of such delays in terms of living patterns and connections are relatively minor and able to be countered through management measures (as discussed in the traffic effects assessment above). Likewise, while pedestrian access in some areas may be made somewhat more difficult, the overall impact is such that it will not limit people's ability to go about their normal lives.

Over the construction period, there is also potential that construction works will have positive socio-economic outcomes as the construction workforce will increase demand for retail and other services (eg. food outlets, service stations and vehicle servicing) and, given the duration of construction, potentially housing (particularly rental) demand. Experience in other major construction sites indicates that, if well managed, the construction site and the associated workforce can become a positive part of the community (involved in community services, such as education) and hosting community events (eg. community planting days).

In terms of population change, feedback to date has indicated that residents in Te Atatu/Te Atatu Peninsula are unlikely to relocate as a result of the construction of the Project, though some movement may take place once construction has commenced. The population loss associated with the necessary property acquisition is discussed under the social impacts of the operational Project (above). The daily influx of temporary construction workers will increase the daytime population of the local community, and increase the associated sense of 'busy-ness' in the area. For some residents this will heighten the sense of impact/disruption to their daily lives during construction. For others, this is accepted as a necessary part of construction and is not seen as a negative impact and may even be positive (eg. the socio-economic activity associated with this population).

14.4.3.2 Effects on Community Infrastructure

There will also be impacts on community infrastructure over construction, particularly associated with emissions from construction (eg. noise), resulting from traffic delays and some temporary effects on pedestrian routes. However, the mitigation measures proposed with respect of these matters are considered sufficient to address these social impacts.

Recreation and open space impacts are considered minor, including:

- Loss of use of part of Harbourview-Orangihina Park by Te Atatu Pony Club; and
- Limited change to public access to the CMA, or the existing limitations to access of the Whau River navigation channel (used by Te Atatu Boating Club).

14.4.4 Mitigation - Operation

14.4.4.1 Avoidance of Impacts through Design

In order to minimise property acquisition impacts, proactive and early property purchase has played a role in reducing the uncertainty for individual households in the Project area.

In addition, partial property acquisition has been minimised as far as practicable in order to avoid unacceptable residential amenity impacts (e.g. situations where residents would lose a significant part of their outdoor living area).

14.4.4.2 Mitigation and Management Measures

It is recommended that the NZTA continue and further develop the staged property purchase strategy currently implemented, to minimise uncertainty within the community and provide residents sufficient time to relocate.

A number of other mechanisms proposed to address the operational effects of the Project (particularly for noise and vibration emissions and visual/landscape effects) address adverse social impacts.

These are discussed in specific following sectors. In addition, the following specific measures are proposed:

- Provision of information to residents on the land acquisition process;
- Involvement of the community and stakeholders (including Iwi) in the restoration of open space and recreation areas; and
- Measures to manage and remedy any graffiti (this was raised as an issue in consultation).

14.4.5 Mitigation – Construction

14.4.5.1 Avoidance of Impacts through Design

Construction Yard 1 has been located on existing open space within Harbourview – Orangihina Park, providing a significant buffer to nearby residential properties.

14.4.5.2 Mitigation and Management Measures

The following general mitigation will be undertaken to manage potential social effects:

Communication with the community and residents throughout construction is key to mitigating adverse social effects

- Development of a communications strategy to keep the community and stakeholders informed about construction activities and the construction programme. This strategy would include information on the management of emissions from the Project (e.g. noise and vibration during construction) and as appropriate involvement in the construction works (e.g. community planting days);
- Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of the CEMP;
- That where particularly noisy works are proposed in close proximity to adjacent schools/childcare centres, these works be carried out outside of school hours or during school holidays where practicable;
- Advise school on pedestrian management during underpass construction; and
- Implementation of a formal complaints/feedback process as part of the management of construction (eg. through the CEMP).

14.5 Cultural Impacts

14.5.1 Existing Environment – Iwi with Manawhenua

Te Kawerau a Maki and Ngati Whatua o Orakei are recognised manawhenua (Iwi with customary authority) within Waitakere City and in this Sector[5]. In this regard, these Iwi have a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

14.5.2 Assessment of Cultural Effects

14.5.2.1 Cultural Effects – Te Kawerau a Maki Trust

Of relevance to the Project in this Sector, Te Kawerau a Maki Trust identifies the following environmental and resource issues:

- That the mauri of all natural waterways is protected; and
- That heritage sites, water quality, the quality and availability of kaimoana (seafood) are protected.

Specific comment has been sought from Te Kawerau a Maki Trust. At the time of writing this AEE no comment had been received.

14.5.2.2 Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua o Orakei identifies the following environmental and resource issues:

The mauri, amenity and ecological health of the coastal environment. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects. Ngati Whatua o Orakei support the improvement of this environment through 'careful design and enhancement works', and believe that water must be managed holistically and nurtured as a living entity. Ngati Whatua o Orakei believe that the improvement of this environment would provide benefits to tangata whenua (as kaitiaki, caretakers and advocates for this environment, and to make use of natural resources from the harbour); and

The potential for SH16 widening works to impact on areas of cultural heritage value/known Maori archaeological sites.

Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE no comment had been received.

[5] As identified in the Waitakere District Plan.

14.5.3 Mitigation of Cultural Effects

The Project avoids sites of known archaeological/Maori heritage value in this Sector. Ngati Whatua o Orakei have made a series of recommendations relevant to the SH16 widening Project:

Cultural issues identified have influenced Project design and mitigation

- Native planting on motorway verges: This has been incorporated in the Project landscape plans (refer to Plan Set F.16);
- Stormwater treatment: The Project proposes treatment of all stormwater from new motorway surfaces, and some currently untreated areas along the existing SH16 (design is based on ARC TP10); and
- Minimising visual impacts (eg. by minimising vertical structures): This has been incorporated into the Project design.

14.6 Landscape and Visual Effects

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

14.6.1 Existing Environment

The existing visual and landscape environment in this area has been broken down into a range of elements.

14.6.1.1 Landscape

The landscape is dominated by residential areas and SH16

This sector largely comprises the suburban environment of Te Atatu at the junction of Te Atatu South and Te Atatu Peninsula. Te Atatu South comprises a large catchment of traditional suburban development dominated by housing from the 1950s – 1960s. The seaward 'face' of Te Atatu Peninsula is dominated by an open expanse of land (Harbourview – Orangihina Park) and medium density residential development associated with the Harbourview Estate. West of Te Atatu Peninsula, the landscape is almost entirely dominated by traditional bungalows although the open sportsfields of Jack Colvin Park and the adjoining Rutherford College are also prominent.

14.6.1.2 Motorway Corridor

The existing Motorway corridor begins at Henderson Creek, a deeply incised stream channel flanked by mangroves. To the south of SH16 mature trees soften the interface with a small substation and a solid swathe of traditional residential housing. The receiving environment is dominated by residential housing (with fencing and vegetation). Closer to Te Atatu Interchange, McCormick Green separates the residential dwellings (on Royal View Drive) from the Motorway.

To the north of SH16, the situation is similar, with a number of houses in close proximity to the Motorway (i.e. in the vicinity of Titoki Street). Again, closer to Henderson Creek, open space (Jack Colvin Park) creates a substantial buffer to nearby residential housing.

The relatively flat nature of the terrain surrounding SH16 helps to limit the visual link to the Motorway from its wider surrounds. Visual awareness is largely confined to the narrow band of residential properties adjoining the Motorway together with Jack Colvin Park and parts of Rutherford College.

A stand of eucalypts is prominent on the steep coastal escarpment overlooking the Whau River, and a scattering of trees is also evident among the Motorway and Alwyn Avenue.

14.6.1.3 Volcanic Sightlines

Proposed Change 8 of the ARPS includes a new sightline (reference A13) that extends from an origin point on the SH16 carriageway immediately west of Te Atatu Interchange to the flanks of Owairaka / Mt Albert. This sightline provides for the views to Owairaka / Mt Albert.

14.6.2 Assessment – Operation

The visual catchment and related audiences potentially affected by the proposed redevelopment have been identified within Sector 1 for the assessment of landscape and visual effects. Overall, 12 public realm and 21 private residential viewpoints are assessed.

Specific catchments are identified in Technical Report G.20

The potential effects of the Project, in terms of landscape, amenity and natural character values are described in detail in Technical Report G.20. In summary, a significant and fundamental change to the local environment and outlook of many residents in close proximity to the motorway corridor e.g. Alwyn Avenue and Titoki Street will occur. This is due to the removal of vegetation, existing dwellings, provision of new slip/access lanes and the proposed changes to the motorway infrastructure. It is noted that the first tier of dwellings and properties abutting the motorway would be most affected and act as a substantial buffer between SH16 and other residential properties.

Only minor, (even positive in some circumstances) changes will occur in relation to the outlook experienced around McCormick Green and nearby parts of Royal View Road and Te Atatu Road due to the separation of the existing Interchange and the introduction of new planting. The removal of housing at Titoki Street and Alwyn Avenue creates a significant change to the interface of the motorway infrastructure with other neighbouring residential dwellings. Bunding, planting and noise walls will obscure the infrastructure from some of these receiving environments.

In the longer term, extensive planting (as defined in the plans F.16: *Urban Design and Landscape Plans*), focused upon stands of Pohutukawa trees and coastal forest will soften and screen much of the interchange with acoustic panelling initially visible. This will be especially so, between the Interchange and the Whau River, but also in close proximity to the visual catchment at Titoki Street and Alwyn Avenue.

Extensive planting proposed will soften and screen much of the interchange

Between Te Atatu and Henderson Creek, the removal of vegetation on both sides of the motorway (including a line of Macrocarpa trees) will expose local residents and Jack Colvin Park more directly to the motorway. These effects will be mitigated to a limited degree by proposed planting, fencing and terraces; however the loss of these trees will have a moderate to high level of impact on local amenity and landscape values.

In terms of visual effects experienced while travelling along the motorway, the removal of mature trees located on either side of the motorway would initially degrade the general appearance of the motorway. However, it is expected that the proposed planting will provide a more appealing visual environment in the long term than that which currently exists.

14.6.3 Assessment – Construction

The construction works within Sector 1 will have a major impact on the perception of the Interchange and its periphery throughout the period of reconstruction (with the bulk of the main effects confined to the existing motorway corridor).

Visual impacts with the loss of vegetation cover in this area

The residents of Titoki Street and Alwyn Avenue will be particularly affected during the construction works (particularly those adjoining residential dwellings being removed). These temporary effects could be significant, although the installation of solid screen / safety fencing during the period of construction may assist in alleviating some concerns in this respect. Bunding, noise walls and planting will eventually screen both of these residential enclaves from virtually all of the motorway system; however during construction local residents at these locations would be exposed.

In addition to these effects, the widening of the motorway through to Henderson Creek and the related removal of trees within that section of SH16 would have a temporary effect on the local landscape within and across the motorway from Jack Colvin Park.

The increased exposure to a widened motorway corridor, combined with the loss of greenery and natural character value, will have a significant and immediate impact on local amenity values. Although planting next to Jack Colvin Park (as defined in the plans F.16: Urban Design and Landscape Plans) will provide some remediation in the longer term, it does not entirely off-set or mitigate the loss of the current vegetation cover.

14.6.4 Mitigation – Operation

Enhancement planting along the length of the works is proposed, as defined in the plans F.16: *Urban Design and Landscape Plans* and includes:

- A Pohutukawa parkland node (comprising Pohutukawa, coastal forest, native shrubs and screen planting) to be developed at Te Atatu Interchange to create a buffer between the Motorway system and nearby housing; and
- Riparian wetland planting.

14.6.5 Mitigation – Construction

The following mitigation is proposed:

- The installation of solid screen / safety fencing during the construction period to minimise views into the construction areas; and
- Early placement of bunding and noise walls to screen the construction area.

14.7 Amenity Trees

14.7.1 Existing Environment

A number of trees in this Sector appear to be in generally good health and form. While there were no trees 'scheduled' within the District Plan several trees are considered valuable to the amenity and urban environment. A schedule of trees identified in and around the Project area (outside of the existing designated area) is provided in Appendix E.7 of this AEE. This Schedule has been prepared by a qualified arborist.

A Schedule of Trees identified in the Project area is in Appendix E.7 of this AEE

14.7.2 Assessment – Construction

Potential construction effects associated with development of the new wetland in Jack Colvin Park may require the removal of an identified Ash tree. Furthermore, this area has been planted with a variety of native revegetation species that are just starting to establish and contribute to the visual amenity. While loss of this vegetation is a potential adverse effect of the Project, replacement planting provides mitigation (as detailed in the Urban and Landscaping Plans, Part F.16 of this AEE).

Trees that contribute to the locality of the environment

An established Elm tree (located on private land at 28 Alwyn Avenue) is also considered to be a good specimen and it is recommended that consideration be given to preservation of this particular tree (in construction planning). In addition, a number of other trees located upon private land along the northern side of Alwyn Avenue that appear to be in good health and overall form, will be removed as a result of the Project. Replacement planting will be necessary but the planting of 'new' trees will not necessarily mitigate the removal of the larger

established native and exotic trees in the short-term.

The area proposed to be used as Construction Yard 1, northeast side of Te Atatu Interchange within the pony club, has no trees of significance.

14.7.3 Mitigation Measures

It is proposed that detailed construction planning should, where practicable, give consideration to retaining the above valued trees (i.e. where such trees are not required for the permanent works of the Project, consideration should be given to construction methods that avoid the need for tree removal). It is proposed that this planning and management can be provided through the Construction Environmental Management Plan and associated management plans (Technical Report G.21).

The loss of trees can be mitigated by appropriate landscape and specimen planting

Where removal of these trees is required appropriate mitigation and landscape planting can mitigate these effects, in accordance with the urban and landscape design plans proposed (see Plans in F.16 of this AEE).

14.8 Coastal Processes

A full assessment of effects on coastal processes is provided in Technical Report G.4

The following provides a summary of the detailed assessment undertaken in Technical Report G.4 *Assessment of Coastal Processes*. More detail on the impacts of both construction and operation of the Project on coastal processes is provided in Chapter 13 of this AEE, which focuses on region and district wide effects.

14.8.1 Existing Environment

The coastal works in Sector 1 are limited to the works within the estuarine area of the Pixie Stream, which is a permanent stream and tributary of the Henderson Creek. The Pixie Stream runs along the northern boundary of Jack Colvin Park in a westerly direction.

14.8.2 Assessment – Operation

The reclamation of a portion of the inter-tidal area of the Pixie Stream is required to develop an operational stormwater settling basin to treat stormwater from SH16. As the reclamation is at the upper elevation of the inter-tidal area, out of the sub-tidal channel, the effects on the hydrodynamics, flushing and geomorphology of the Pixie Stream are considered to be minor.

A small portion of Pixie Stream Coastal Inlet is required for a permanent stormwater pond

The catchment size serviced by the Pixie Stream is small, which together with the widening of the Pixie Stream inlet where the reclamation is to occur, means the backwater effects or retardation of stream flood waters would be negligible.

14.8.3 Assessment – Construction

Occupation of the CMA (in the tidal tributary of the Pixie Stream) is required for a temporary rock-toe silt fence. This silt fence is a component of the stormwater management system and erosion and sediment control methodology during construction. It is proposed that this silt fence be located above the mean tide level and out of the main sub-tidal channel of this small side inlet of Henderson Creek. Given this, there will be minimal effects on water movement especially when flow velocities diminish around the high tide period. Furthermore, as discussed in section 14.9.3.1, these minimal effects of temporary occupation are considered to be outweighed by the potential beneficial effects of having this treatment device.

14.8.4 Mitigation

Given the minor effects, no specific mitigation is considered necessary other than widening of the Pixie Stream inlet where the reclamation is to occur, to avoid backwater effects or retardation of stream flood waters.

14.9 Marine Ecology

A full assessment of effects on the marine ecology is provided in Technical Report G.6

The following provides a summary of the detailed assessment undertaken in Technical Report G.11 *Assessment of Marine Ecology Effects*. A description of the marine ecology from a Regional and Project wide is provided in Chapter 13.

14.9.1 Existing Environment

Pixie Stream estuarine environment is dominated by mangroves and common estuarine epifauna

The marine environment in this area consists of the estuarine area of the Pixie Stream. The upper reaches of the Pixie Stream estuarine environment are dominated by mangroves and common estuarine animals, including mud crabs and a small gastropod species (benthic animals living on the substrate). Stormwater from the adjacent residential catchment discharges into the estuarine habitat. The ecology in the area is considered to be in relatively good health given the adjoining residential and industrial land use.

14.9.2 Assessment – Operation

14.9.2.1 Stormwater Treatment

The treatment of runoff from the Project in this area will be through a stormwater treatment wetland and swales. Both the wetland and the swales have been designed to remove an average of 80% of total suspended sediment and associated contaminants (further details provided in Technical Report G.15 *Assessment of Stormwater and Streamworks)*.

Compared to the existing situation (where there are untreated discharges from this part of SH16), the Project proposes to divert presently untreated stormwater into the above treatment devices which will result in a net improvement in the quality of the discharges. (though recognising that the quantities of discharge will increase, with the increased impermeable surface area). Therefore, the adverse effects of discharges on marine ecological values are considered to be negligible.

Treatment devices will improve stormwater quality discharging to the CMA

However, it is acknowledged that stormwater contaminants will continue to accumulate in marine sediments (as they do currently). There is a potential for cumulative adverse effects on marine organisms (should concentrations of contaminants ultimately reach or exceed an effects threshold), in the long term (albeit that any exceedance will be deferred with the improved treatment proposed by the Project).

14.9.2.2 Permanent Intertidal Habitat Loss

The construction of the permanent stormwater treatment wetland within Jack Colvin Park requires the reclamation of approximately 0.1ha of intertidal CMA within Pixie Stream. The ecological values of the area of permanent habitat loss is considered moderate with common estuarine organisms present beneath a canopy of mangroves. In particular there is a high abundance of common estuarine gastropods (*Potamopyrgus estuarinus*).

A small amount of permanent habitat loss will result from reclamation

14.9.3 Assessment – Construction

The predominant construction activities in Sector 1 that affect the ecological values of the marine environment include the construction of the permanent stormwater treatment wetland in Jack Colvin Park, the discharge of treated construction runoff from sediment retention ponds and decanting earth bunds, and the extension of an existing stormwater culvert within Pixie Stream (discussed in section 0). These activities may affect marine ecological values through permanent intertidal habitat loss, temporary intertidal habitat disturbance and the discharge of construction runoff.

14.9.3.1 Temporary Habitat Disturbance

An area of around 540m2 of intertidal marine habitat is proposed to be temporarily disturbed during construction of the stormwater treatment wetland. This disturbance primarily relates to the establishment of erosion and sediment control treatment, in order to protect the downstream environment. The construction of a rock toe silt fence at the foot of the wetland embankment will reduce the potential for suspended sediment to be discharged downstream.

Minor temporary habitat disturbance will occur during construction

Adverse effects as a result of construction of the rock toe silt fence will be temporary habitat loss, mortality of benthic invertebrates through smothering, reduced oxygenation of benthic sediment, mangrove removal, trampling of sediment and temporary increase in suspended sediment during construction and removal of the silt fence. However, these adverse effects are temporary and minor and the potential beneficial effects of providing downstream protection outweigh these. Following removal of the structure, mangroves and benthic organisms will

recolonise the area over time with minimal effects in the long term anticipated.

There will be some temporary low level noise and vibration disturbance to the surrounding marine habitat. Adverse effects on marine organisms may include reduced movement and foraging of mobile invertebrates (e.g mud crabs and gastropods) and possible temporary avoidance of the surrounding subtidal channels by fish.

Overall, the effects on temporary habitat disturbance are considered to be minor.

14.9.3.2 Discharge of Construction Stormwater

As discussed in section 0, given the high percentage of sediment removal estimated to be provided by the proposed treatment devices and the dilution provided by the receiving environment, the adverse effects on marine ecological values from the discharge of treated runoff are considered to be negligible.

14.9.4 Mitigation – Construction and Operation

A range of measures will be used to offset the effect of permanent habitat loss

In order to mitigate potential sediment and contaminant discharges into the marine environment, a range of measures will be implemented. These include the installation of erosion and sediment control devices, temporary stormwater devices, long term permanent stormwater treatment devices, the use of practices such as suction trucks to remove contaminated water and the timing of works (e.g carrying out disturbance works during low tide to minimise sediment generation). A number of these mitigation measures are discussed elsewhere in this AEE (e.g. in respect of stormwater management).

Temporary habitat loss as a result of construction is considered to be minor and an acceptable adverse effect, whereas permanent habitat loss as a result of operation is considered to be a moderate adverse effect requiring mitigation.

It is difficult to directly mitigate the effects of permanent habitat loss (the area of reclamation). However opportunities exist to off-set these effects through:

- Improving the efficiency of the removal of contaminants from the operational phase of stormwater discharge (as discussed in section 14.17);
- Treating the runoff from the currently untreated existing State highway (as discussed in section 14.17);
- Restoration of coastal fringe habitat (as discussed in section 14.12); and
- Removal of gross litter and debris from within and adjacent to the CMA.

It is considered that the implementation of the mitigation opportunities identified above sufficiently offsets the adverse effects on marine ecological values arising from permanent marine habitat loss.

14.9.4.1 Monitoring

Ecological monitoring is proposed for pre, during and post construction. This is set out in the Ecological Management Plan (Appendix G of Technical Report G.11 *Assessment of Marine Ecological Effects*). Monitoring of suspended sediments, pH and benthic invertebrate community composition are proposed as part of the Ecological Management Plan. This monitoring assists in ensuring that construction mitigation measures proposed are effective in protecting the marine ecological values.

Ecological monitoring will be undertaken, pre, construction and post construction

14.10 Effects on Herpetofauna

A full assessment of effects on herpetofauna is provided in Technical Report G.8

The following provides a summary of the detailed assessment undertaken in Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*.

14.10.1 Existing Environment

The land around Sector 1 contains a variety of habitats including motorway side vegetation, traffic islands and open space areas (McCormick Green and Jack Colvin Park). The vegetation includes patches of mixed native and exotic scrubland and stands of mature trees. Although large areas of short mown grass exist and are not considered suitable as a lizard habitat, the edge habitat, where the mown grass meets scrubland/bush habitats, is considered to be a suitable habitat for native lizards.

The native Copper Skink was found in Sector 1

Two species of lizards (rainbow skinks and copper skinks) were detected in surveys of this area although only copper skinks are native to NZ. Copper skinks were found in Jack Colvin Park and the westbound edge of the Whau River. The copper skink is widespread throughout the North Island and is not considered threatened.

14.10.2 Assessment – Construction

Any potential effects in relation to copper skinks will be during construction, and the potential disturbance of their habitat.

Construction activities that pose the greatest threat to the skink population include the clearance of vegetation and habitat features potentially reducing the availability of habitat and resources. Noise and vibration created by construction activities are likely to have short term effects however these are considered to be no more than minor given the already close proximity of the skink population to existing highway traffic.

14.10.3 Mitigation – Construction

Potential adverse effects on the copper skink population can be mitigated by relocating the skink population in this area to sites or habitat outside of the construction footprint (e.g. beyond the construction areas in the designation or beyond the designation).

The process for this mitigation is generally proposed to be managed through the implementation of a Ecological Management Plan (relevant sections attached to Appendix A of Technical Report G.8 Assessment of Herpetofauna Ecological Effects)6. This process provides for the collection of lizards from the construction areas prior to and throughout vegetation clearance, for identification of suitable habitats for relocation of lizards, including (if necessary) the planting of areas within the network and habitat enhancement, pest management and post release monitoring. Suitable habitat has been identified in reserve areas (e.g. at Harbutt Reserve and Heron Park, subject to Auckland Council Approval) and within the State highway network (e.g. SH20 south of Maioro Interchange). It is noted that, for Harbutt Reserve, additional habitat enhancement to account for the existing skink population would be warranted (again subject to agreement by the [Auckland Council]).

A full assessment of effects on freshwater ecology is provided in Technical Report G.6

14.11 Freshwater Ecology

The following provides a summary of the detailed assessment undertaken in Technical Report G.6 Assessment of Freshwater Ecological Effects.

14.11.1 Existing Environment

The Pixie Stream is a tributary of Henderson Creek and flows along the northern boundary of Jack Colvin Park, Te Atatu South, before discharging to the estuarine reaches of Henderson Creek. Its catchment has a predominantly urban (residential) land-use. The majority of the stream has been piped, with the only stretch of open channel being confined to the reaches downstream of the existing SH16 carriageway. The ecology of the estuarine section of Pixie Stream is described in Section 14.10.

Pixie Stream has been modified upstream of SH16

Pixie Stream is a permanent stream which is generally shallow with some deeper pools and the substrate comprises soft mud. It is classed as a 'Highly Disturbed Urban Stream' in the PARP:ALW due to the high percentage of impervious catchment. The ARC identifies that these streams typically have lower natural values, but may allow fish passage to upstream habitats. However, in the case of Pixie Stream, there is no open channel habitat upstream of the motorway, and therefore this part of the stream is not a significant corridor for fish passage. The ARC's management priorities for this type of stream also include public amenity, hydrology and water quality. The physical habitat of Pixie Stream is shown in Table 14.3.

Ecological value of lower Pixie Stream is considered moderate

[6] A separate approval process will be required under the Wildlife Act for the lizard relocations.

Table 14.3: Physical Habitat of Pixie Stream

Pixie Stream		
Modification	Moderate (unchannelised)	
Riparian vegetation	Riparian trees and shrubs	
Overhead shade	Good, partial canopy	
Substrate	Gravel and soft sediment	
Fish habitat	Moderate	
Fish access	Good	
Water quality	Poor (stormwater, CSO's)	

The lower reaches of the stream enter the mangroves of the Henderson Creek. This section is classified by the PARP:ALW as a Stream Mouth Urban Stream, for which management of inanga spawning areas is an additional priority[7].

Downstream of SH16, a small range of native fish species have been recorded, including shortfin eel, longfin eel, inanga and bullies and it is considered of 'good' habitat quality or connectivity for fish migrations. The macroinvertebrate community of this waterway has moderate diversity, dominated by snails (78%) and, it is considered to have 'poor' in stream habitat quality for macroinvertebrates. No habitat was recorded upstream of the motorway. Overall, the stream ecological value is considered moderate[8].

14.11.2 Assessment – Operation

During operation the potential effects on freshwater ecology are considered to arise from the generation of additional stormwater discharge and loss of in-stream habitat as a result of proposed shoulder widening to the existing Motorway.

For the Project, stormwater discharge will occur from stormwater treatment swales and from a stormwater treatment wetland pond located west of Jack Colvin Park. As stormwater discharges will be to the coastal marine area rather than the stream itself, any effects on Pixie Stream will be largely avoided. The only potential for treated discharges to enter the stream would be in situations where the wetland was discharging on an in-coming tide.

In these instances, it is noted that as the stormwater treatment standard will be 80% TSS removal that exceeds the minimum required by ARC TP10 guidelines, and the discharge would be diluted in the seawater, therefore it should not result in effects that are any worse than those currently being experienced. Furthermore, compared to the existing situation (where there are untreated discharges from this part of SH16), the Project proposes to divert presently untreated stormwater into the treatment devices, which will result in a net reduction in suspended solids, Zinc and Copper being discharged from the motorway.

7 While not part of the freshwater ecology, it is also noted that the Pixie Stream discharges to the Henderson Creek which is further described in section 14.9 of this Chapter.

8 Note that these conclusions are based on index scores which are detailed and described further in Technical Report G.6: *Assessment of Freshwater Ecological Effects.*

The existing culvert under SH16 will be extended as part of the work, resulting in the loss of approximately 15-20m of modified stream channel below the existing culvert outlet to Pixie Stream. The stream here is considered to be degraded and in general poor health (although it still retains moderate ecological values). The effects of this relatively modest culvert extension are not considered to be ecologically significant. The upstream length of proposed culvert extension is not considered to generate any potential or actual adverse effects as it is already piped.

14.11.3 Assessment – Construction

The proposed works in the vicinity of Pixie Stream have a relatively high risk of affecting this small waterway. The culvert extension in the active stream channel will release sediment, although these works will be of short duration, and will be undertaken in a period without preceding rainfall.

Temporary stormwater and erosion and sediment controls will be used to minimise discharges during construction

The small size of this stream means it has a relatively low capacity to dilute discharges and flush them from the stream system. As a result, visible deposits of sediment are likely to be evident and these elevated sediment loads are likely to reduce the abundance of macroinvertebrates and fish during the construction period. These impacts may also reduce spawning success (assuming the stream mouth is an active spawning site).

However, notwithstanding the above, the stream habitats and communities are expected to recover relatively rapidly once construction is completed. Overall, while some effects are likely to be evident during construction they are not likely to be ecologically significant, given the existing compromised nature of the stream and its generally poor health, provided that the works (and associated sediment discharges) are of a relatively short duration. In addition, proposed sediment controls are designed to capture some 94% of sediment from construction surface run off.

14.11.4 Mitigation – Operation

No mitigation measures are proposed for stormwater effects on freshwater ecology, as the potential adverse effects are avoided by the discharge directly to the CMA.

It is proposed that the loss of stream length could be compensated by riparian planting at a suitable recipient site however no recipient site has been identified yet. As a result, it is not known how much riparian planting compensation would be required because this is dependent on the recipient site9. No mitigation is proposed for the upstream culverting (as it is already piped).

[9] Technical Report G.6: *Assessment of Freshwater Ecological Effects* identifies that it is appropriate to apply the Environmental Compensation Ratio (ECR) calculated for the Oakley Creek realignments to Pixie Stream.

14.11.5 Mitigation – Construction

14.11.5.1 Mitigation and Management Measures

During construction mitigation measures will be required to minimise contaminants from entering freshwater.

A temporary sediment retention pond will be constructed on the eastern side of Pixie Stream, close to the streams maximum upstream extent (on the southern side of SH16). The pond will discharge treated stormwater from construction activity into the stream. (Technical Report G.15 Assessment of Stormwater and Streamworks Effects).

Mitigation measures for freshwater ecological effects are set out in Technical Report G.22: Erosion and Sediment Control Plan. In this area these measures include: additional sediment control measures in the vicinity of Pixie Stream, such as silt fences, super silt fences, decanting earth bunds, and clean and dirty water diversion bunds, and progressive stabilisation of the earth-worked areas (to minimise the exposure period of disturbed soils and therefore the potential areas for sediment discharge).

14.11.5.2 Monitoring

In addition to the management proposed in the Erosion and Sediment Control Plan, monitoring is proposed in this plan to confirm that the measures of these plans are effective in removing contaminants from water discharging from the construction site. In addition, it is proposed that monitoring of the freshwater ecological habitat is undertaken (as per the relevant sections of the Ecological Management Plan, provided in Appendix C of Technical Report G.6). If the monitoring indicates adverse effects on freshwater habitat, the management plan also proposes remediation actions to address these impacts.

14.12 Vegetation

A full assessment of effects on vegetation is provided in Technical Report G.17

The following provides an assessment of the ecological effects of the Project on vegetation. This is a summary of the detailed assessment undertaken in Technical Report G.17 *Assessment of Terrestrial Vegetation Effects.*

14.12.1 Existing Environment

Indigenous vegetation in this area is limited to the eastern extents by the Whau River. Elsewhere in Sector 1 planted trees and shrubbery exist, both within the designation footprint and in private properties and local roads. However, this vegetation does not have any botanical value.

Vegetation on the landward side close to the Whau River Bridge mainly comprises young mangroves. The lower rocky part has only a few salt marsh plants. Higher up there is weedy scrub including privet, karamu and pampas.

14.12.2 Assessment – Construction

During construction a saltmarsh community on the upstream side of Henderson Creek will be lost and vegetation removal is also required for the construction of the wetland pond in Jack Colvin Park. It is anticipated that with appropriate planting, loss would be minor.

14.12.3 Mitigation – Construction

During construction, measures will be implemented to minimise the extent of disturbance to vegetation and waterways and to protect existing areas of vegetation. These measures are set out in the Ecological Management Plan (ECOMP) that is Appendix C to Technical Report G.17 *Assessment of Terrestrial Vegetation Effects.* In order to offset the small amount of vegetation lost the following will also be undertaken:

- Replanting of the embankments of the Henderson Creek with locally sourced and appropriate indigenous species (including potentially those plants removed during construction); and

- Replanting programme for wetland and coastal margin areas within Jack Colvin Park with locally sourced and appropriate indigenous species. This should include consideration of opportunities to plant rare coastal species such as *Carex litterosa* or possibly to create habitat suitable for transplanting *Mimulus repens*

14.13 Air Quality

A full assessment of effects on air quality is provided in Technical Report G.1

Technical Report G.1 *Assessment of Air Quality Effects* provides an assessment of the potential impacts of the Project on air quality, both during construction and operation. The following assessment of the air quality effects of construction is summarised from that report. It is noted that, given the regional nature of air quality impacts, operation effects on air quality (which are overall positive) are discussed in Chapter 13 of this AEE.

14.13.1 Assessment – Construction

In assessing effects on air quality during construction, key receptors are considered to be residential areas, schools, preschools and healthcare facilities. Within Sector 1, a number of residential properties are located within 100m of the work area, specifically those on Alwyn Avenue, Titoki Street and Te Atatu Road.

During construction, the main potential effect is as a result of dust generation and other air contaminant discharges which are liable to cause nuisance beyond the site boundary, and are generally considered to be localised effects. Dust maybe generated during earthworks and

construction activities, or as a result of vehicle movements around the site. Vehicle emissions may also arise from construction vehicles. Effects on the key receptors are unlikely to result in any significant effects with appropriate environmental management and mitigation in place.

14.13.2 Mitigation – Construction

A range of measures will be put in place to manage dust and road construction activities

Dust can be managed with a range of mitigation measures. The following describes typical measures that can be applied, as described in the Construction Air Quality Management Plan (refer Appendix M of Technical Report G.1: *Assessment of Air Quality Effects*):

Managing the surfaces of the construction site area (e.g. use of wind breaks, damping down exposed/open areas from water sprinklers or water trucks, covering tunnel spoil (e.g. using covered buildings));

Managing the handling of sediment and other dust generating materials (e.g. managing and unloading of vehicles, stabilising earthworks areas, minimising drop heights for spoil stockpiling); and

Managing vehicles operating within and exiting construction areas (e.g. stabilising haul roads and construction yards with metal, installing wheel wash facilities at the egress/exit points of construction yards, speed limits for construction vehicles and managing loading of trucks for spoil transport).

Monitoring will be undertaken to assess air quality effects of construction methods

To ensure that the effects of construction on air quality are being effectively managed, it is also proposed to monitor dust levels throughout the construction period. For example,

- Undertaking total suspended particulate (TSP) monitoring using continuous particulate monitors;
- Daily visual inspections of operational sites and surrounding areas for evidence of dust discharges; and
- Regular visual inspections of exposed surface areas and stockpiles to ensure they are either dampened down or covered appropriately.

Should such monitoring indicate that there are adverse effects to air quality during construction, remedial action (e.g. changes to construction methods) can be implemented to manage these effects.

14.14 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.12 and G.5

The following provides an assessment of the effects of the Project on noise emissions. This is a summary of the detailed assessment undertaken in Technical Report G.5 *Assessment of Construction Noise Effects* and G.12: *Assessment of Operational Noise Effects*.

14.14.1 Existing Environment

Existing ambient noise environment is relatively high due to proximity of SH16

The existing noise environment within this Sector is relatively high, with the proximity to SH16 being the dominant ambient noise source. Existing noise levels for residents within close proximity to the Project area (e.g. Milich Terrace, Titoki Street and Alwyn Ave) are between 50dBL $_{Aeq(24h)}$ to 69dBL $_{Aeq(24h)}$. A significant number of residential properties are in close proximity to SH16.

14.14.2 Assessment – Operation

Technical Report *G.12 Assessment of Operational Noise Effects* provides detail on the assessment of operation noise, including the methodology and detail on the assessment standards applied. Three receiving environments have been identified in relation to traffic noise impacts within this assessment, and the potential effects of the Project assessed. The results are summarised in Table 14.4 below.

Table 14.4: Traffic Noise Effects within Sector 1 (operation)

Receiving Environment	Potential Effect (without mitigation)
North of SH16 – Te Atatu Peninsula Dwellings within 100m of the road include properties on Titoki, Toru and Karamu Streets. 51 positions were assessed.	Moderate effect – with noise increases up to 5 decibels in some locations. Of the assessed positions, 13 were predicted to exceed the Category A criterion[10] and another two the Category B criterion without the implementation of noise mitigation measures[1].
South East of SH16 and Te Atatu Road Dwellings within 100m of the road included properties on Alwyn and Bridge Avenues. 36 positions were assessed.	Moderate effect – with noise increases by up to 8 decibels for some assessment Positions. Of the assessed positions, 8 were predicted to exceed the Category A criterion and another three, the Category B criterion. Without mitigation, noise levels are predicted to increase for almost all receivers with the implementation of the Project.
South West of SH16 and Te Atatu Road to Henderson Creek A large number of properties are within 100m of the road, including properties on Milich Terrace, Paton Avenue, Royal View Road and Te Atatu Road. 98 positions were assessed.	Virtually no change in effect, however noise levels are already very high and NZS6806 provides for a reduction in noise levels beyond those presently existing if this is feasible with the adoption of the BPO.
[1] From NZS6806, Category A = primary external noise criterion of 64 dBL$_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 dBL$_{Aeq(24hr)}$, Category C = internal noise criterion of 40 dBL$_{Aeq(24hr)}$).	

[10] The Criterion cited here are in accordance with the NZS6806, with the Primary and Secondary external noise criterion (A and B) and Category C a minimum internal noise criterion.

14.14.3 Assessment – Construction

Construction activities within this Sector will generally be undertaken during the day; however it is likely that night time works may be required for specific activities including: the construction of the north and southbound overbridge, localised sections of the on and off ramps and the vertical realignment and resealing of the motorway. Construction Yard 1 will also be operating over a 24 hour period (given the causeway works on SH16).

The noise assessment has been undertaken in accordance with New Zealand Standard NZS 6803:1999 "Acoustics – Construction Noise" which contains limits generally applied to temporary construction projects. These limits are applied at a distance of 1 metre from nearby facades.

Key conclusions for the construction noise assessment in this area, from Technical Report G.5: *Assessment of Construction Noise Effects*, are as follows:

The existing ambient noise in this area is high and typical average noise levels from construction are generally expected to comply with the guideline daytime noise standards at receivers;

For limited periods, when plant is operating close to receivers, noise levels from some activities will be above the guidelines for daytime noise standards at receivers; and

Majority of construction activities will be during the daytime

While construction noise levels are also expected to be above the night-time noise guideline of 60 dB $L_{Aeq(T)}$, as construction will occur beside the existing busy motorway, the effects of this are not considered significant.

In conclusion, noise from the majority of activity is expected to be reasonable given the largely daytime operation and high ambient noise levels. However, as some activities during the daytime and night-time construction periods may be above the guidelines, noise effects may sometimes be more than minor and therefore mitigation measures are proposed.

14.14.4 Mitigation – Operation

Technical Report G.12 *Assessment of Operational Noise Effects* discusses mitigation options considered for traffic noise from the Project. A summary of the preferred mitigation measures for Sector 1 are set out in Table 14.5 (the full range of mitigation options considered in this Sector are described in the Technical Report G.12).

Table 14.5: Summary Mitigation for Traffic Noise Effects within Sector 1 (Operation)

Receiving Environment	Preferred Mitigation	Residual Effect (with mitigation)
North of SH16 – Te Atatu Peninsula	Option 3 – Extended noise barrier of 2.5m in height along the road and designation boundary	On average a 2 decibels reduction, with individual properties achieving a 3 decibel reduction. 46 assessment positions of the 51 positions assessed are predicted to be within Category A, and the remaining five positions in Category B[1].
	Overall, with mitigation this is considered to be a less than minor effect	
South East of SH16 and Te Atatu Road	Option 1 – A 3m high bund connected to a 2 metre high bund at either end. Up to three dwellings on Alwyn Ave (38, 40A, and 42) may also require building modification mitigation (within Category C). This may include upgraded glazing and installation of alternative ventilation and will be determined by further assessment. These dwellings have extensive views of the estuary which residents indicated that they would like to retain.	On average a 2 decibel reduction, with individual properties achieving up to a 4 decibel reduction. 28 assessment positions of the 36 positions assessed are predicted to be within Category A, 5 within Category B and 3 within Category C.
	Overall, with mitigation, considered to be a moderate effect (with increases of between 1-4 decibels for those buildings within Category C).	
South West of SH16 and Te Atatu Road to Henderson Creek	Option 3 – 3.5m high noise wall. In addition, possible building modifications required to 2 properties (Category C). To be determined by further assessments.	On average 4 decibel noise reductions, with individual dwellings achieving up to 7 decibel reduction. Of the 98 positions assessed, 87 dwellings would be in Category A, 10 in Category B, and 2 in Category C.
	Overall considered to be a positive effect.	

[1] From NZS6806, Category A = primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, Category C = internal noise criterion of 40 $dBL_{Aeq(24hr)}$).

14.14.5 Mitigation – Construction

General noise mitigation measures are contained within the Construction Noise and Vibration Management Plan (CNVMP) (Appendix C of Technical Report G.5 *Assessment of Construction Noise Effects*). Key mitigation measures in this area include strict adherence to the noise management plan, frequent noise monitoring, installation of noise barriers and liaison with residents.

Specific measures will be required in relation to:

- Undertaking noisy activities during the day where practicable, with quieter activities programmed during the night and as far from dwellings as possible;
- Installing the permanent noise barriers as early in the construction programme as possible; and
- Providing temporary noise barriers, particularly in relation to works adjacent to Titoki Street, Milich Terrace, Patton Ave, Marewa street, McCormack Road, Royal View Road and Tatau Way.

The proposed construction method for the pedestrian underpass will be top-down if practicable. This will reduce noise effects during excavation of the underpass.

14.15 Vibration

A full assessment of vibration effects is provided in Technical Report G.19

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of operation and construction vibration effects. The following assessment of the vibration effects of construction is summarised from that report.

14.15.1 Existing Environment

Ambient vibration levels are dominated by traffic related vibration but are generally low

The existing urban environment is dominated by SH16 and Te Atatu Road and it is expected that people experience day to day traffic related vibration. To establish the existing ambient vibration environment, a representative receiver located approximately 30m from SH16 was surveyed. The results indicate that the mean ambient levels of vibration are below the threshold for perceptibility of vibration effects in a residential environment[11].

[11] The survey results recorded a mean ambient Peak Vector Sum (PVS) of 0.28mm/s, which is below the perceptibility level of 0.3mm/s.

14.15.2 Assessment – Operation

Overall, the effects of vibration from road traffic within Sector 1, in particular heavy vehicle movements, are expected to be less than minor (and similar to the existing environment) provided the Project road surface is monitored and maintained in accordance with the NZTA Policy for road roughness.

14.15.3 Assessment – Construction

Potential sources of vibration during construction may arise from the use of excavators and vibration rollers

There are two areas of effects associated with vibration: human perception and building damage. In general the level of vibration that people can perceive is lower than for building damage.

In respect of construction vibration, perception effects are primarily related to the concern that people may have over the potential for damage to their buildings. On this basis, the assessment of effects has focussed on standards or criteria that are intended to avoid superficial damage to buildings[12].

The key vibration sources for construction in this area are vibration rollers and excavators required for the base course and sealing of SH16 and Te Atatu Interchange. Vibration rollers and piling for bridge abutments (for the Whau River) are additional sources of vibration which may have effects on receivers in this area. Table 14.6 below summarises the assessment of vibration during construction.

The assessment results indicate some receivers may have a high risk of exceeding the vibration criterion (this is based on their distance from the vibration source). For these receivers appropriate mitigation will be necessary.

Table 14.6: Risk Assessment for Construction Activities in Sector 1

Source	Soil Class	Design safe distance (m)	Risk	Sensitive Receivers
Vibratory rollers for road construction	II	15m	High	16 Milich Terrace 10 Titoki Street
Excavators	II	3m	High	16 Milich Terrace 1, 12 Alwyn Avenue 92, 92A Royal View Road

[12] It is noted that significantly greater vibration levels would required before vibration caused any structural damage to buildings.

14.15.4 Mitigation – Operation

No specific mitigation is proposed during operation beyond the road surface being regularly monitored and maintained in accordance with the NZTA Policy for road roughness.

14.15.5 Mitigation – Construction

Mitigation and monitoring will be undertaken to manage potential vibration effects

It is proposed that the construction vibration effects are managed through a management plan. The Construction Noise and Vibration Management Plan (CNVMP) has been drafted and included as Appendix K to Technical Report G.19 *Assessment of Vibration Effects.* Mitigation measures include:

- Consultation with residents and 'sensitive receptors' and the implementation of a complaints procedure where by a 24 hour hotline is actively promoted and managed;
- Undertaking pre-construction and post construction building condition surveys of identified 'at risk' buildings, services and structures. The surveys will record if there is any damage which has occurred to these features;
- The monitoring of vibration levels throughout the construction process to assess compliance with the Project criteria; and
- The appropriate mitigation of vibration effects if the monitoring indicates excessive vibration levels. Where practicable this will include the cessation of the activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

It is considered that with these measures in place any potential vibration effect during construction within this Sector will be no more than minor.

14.16 Light Emissions

A full assessment of lighting effects is provided in Technical Report G.10

Technical Report G.10 *Assessment of Lighting Effects* provides an assessment of operation and construction light effects. The following assessment of the light effects of construction is summarised from that report.

14.16.1 Existing Environment

The existing lighting environment on SH16 currently comprises double sided 10m poles with 250W HPS luminaries to the west of Te Atatu Interchange, and double sided 12m poles with 250W HPS luminaries to the east to Whau Bridge. The Te Atatu Interchange has luminaries on 10m poles regularly spaced across the interchange.

The closest residential properties are located adjacent Te Atatu interchange. Residential properties to the west on SH16 are located further away from the Motorway. No residential properties are located between the interchange and Whau Bridge, although properties at Bridge Ave and Alwyn Ave have views onto the Motorway.

14.16.2 Assessment – Operation

With the widening of SH16 and the changes to the intersection, the lighting on SH16 will provided by central median 20m high columns with four 400w HPS lamps typically at 120m centres. Lighting through the intersection will be provided by 20m high columns with multiple 400W luminaries. The outer ramps will be illuminated via single sided 12m poles. Lighting on the cycleway will be provided by low mounted low wattage luminaries and any pedestrian crossings with white light to enhance crossing markers.

Lighting environment from the new interchange will be similar to the existing

The potential effects of light emissions as a result of the Project relate largely to the potential for light-spill to adjoining residential areas. The area being illuminated at Te Atatu Interchange will be larger. The higher columns proposed for the new lighting arrangements will reduce the overall lighting structures required to illuminate the interchange to the required lighting levels and overall the lighting effect is similar to the existing.

Along SH16, adjacent residential properties will experience a higher level illumination via spill-light, particularly for those properties where residential dwellings currently between them and the motorway will be removed for the Project. However, they will experience only minor changes to illumination (light spill effects), as they are already exposed and familiar to existing adjacent street lighting.

14.16.3 Assessment – Construction

While construction in this Sector will typically occur during the day, some aspects will require night time works (refer Section 5.3 for further details). Temporary lighting will therefore be required, which may affect nearby residents.

Night time works will require temporary lighting

Construction Yard 1 (Harbourview-Orangihina Park) is located within this Sector, and will require access for night time works. Given the location of the construction yard in this Sector, within the pony club fields, there is unlikely to be any significant effects associated with lighting of the yard, provided that lighting is carefully placed to be directed away from nearest residential properties.

With management (mitigation measures proposed below) the effects of construction lighting are considered minor.

14.16.4 Mitigation – Operation

Road lighting will be designed to appropriate New Zealand standards, which will inform the design of the lighting structures and types of luminaries.

14.16.5 Mitigation – Construction

It is proposed that for each construction area, Temporary Construction Lighting Management Plans are prepared by the contractor to demonstrate how construction works will comply with standards in the Waitakere District Plan. Such plans will be verified by an independent lighting specialist prior to works commencing.

For general construction area lighting, it is proposed that asymmetrical floodlights are used with glass visors that are not raised more than 3 degrees above the horizontal plane.

14.17 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

14.17.1 Existing Environment

14.17.1.1 Catchments and Waterways

Three stormwater catchments are located in Sector 1 draining to either Whau River or Henderson Creek

The area is divided into three catchments draining to either the Whau River or Henderson Creek. These catchments are urbanised residential areas. The catchment area to the west of Te Atatu Road falls within the "Project Twin Streams Catchment" for which integrated catchment management planning is still underway.

The Pixie Stream flows along the northern boundary of Jack Colvin Park before discharging to Henderson Creek. The Pixie Stream has been piped for significant lengths, with the only stretch of open channel being the reaches downstream of the existing SH16 carriageway.

Henderson Creek runs through residential and industrial areas, discharging into the Waitemata Harbour to the north-west of Te Atatu Peninsula. SH16 crosses the upper reaches of the Henderson Creek, approximately five kilometres from where it opens up into the Waitemata Harbour, at West Harbour. Henderson Creek at this point is a tidal channel bordered by mangrove covered tidal flats.

14.17.1.2 Drainage of the Existing State Highway

Limited stormwater treatment currently exists along SH16

The motorway from the Whau River Bridge to the Te Atatu Interchange drains from the median barrier to either, the northern and southern outer edges of the carriageway. Stormwater is collected through drains and swales and discharged directly into the Whau River. Runoff from the southbound Te Atatu Road carriageway drains into the catchment east of the interchange via a grass swale adjacent to the eastbound onramp. The grass swale provides stormwater treatment. This is the only treatment device existing in this Sector).

West of Te Atatu Bridge, stormwater from the State highway drains into a 1.2m diameter culvert and discharges to the Pixie Stream. Some drainage from this area is through existing berms/overland flows which are expected to provide some treatment to the Motorway runoff (but would not comply with ARC's TP10 guidelines). In addition, some erosion was detected at the outlets in the Pixie Stream area and there is dense weed and algae at times in the stream as well as floatable litter.

West of Te Atatu Interchange stormwater from SH16 is discharged through drains to culverts and then to the tidal channel at the mouth of the Pixie Stream (into Henderson Creek). There is an existing consent for stormwater discharges in this Sector of the Project.

14.17.2 Assessment – Operation

A new stormwater pond will be located in Jack Colvin Park

In this Sector, it is proposed that a new wetland is established in Jack Colvin Park. This wetland will receive stormwater from a catchment of approximately 9.5ha and will treat stormwater from both the existing SH16 and those elements developed by the Project. For those catchments draining to the Whau River, stormwater from SH16 (again, both existing and proposed) will be collected and treated via grass swales and discharged to the CMA (the Whau River).

In considering the potential effects of stormwater discharge, the effects of water quality and water quantity are considered.

14.17.2.1 Assessment of Water Quality

Proposed stormwater devices will improve current treatment

Following completion of the Project, there will be approximately 11.7ha of impervious surface area in this Sector, and 100% of this will be collected and treated prior to discharge to the receiving environment. This treatment will be in accordance with the ARC's TP10 guideline.

As a result of this proposed treatment, the water quality effects of stormwater discharge on the receiving environment have been appropriately minimised. Further, notwithstanding that there will be a greater volume of stormwater discharged from impervious surfaces, the treatment proposed will result in a reduced effect (lower contaminant discharge or higher water quality levels) than the current discharges in this Sector. This is a beneficial environmental effect from the Project.

14.17.2.2 Assessment of Water Quantity

The effects of increased stormwater quantity include the potential effects of increased flooding and downstream channel erosion (if stormwater is discharged to a stream environment, which is not the case in this Sector). While the Project will increase the total impervious area of SH16 in this Sector by around 47% (from approximately 8ha to 11.7ha), the proposed discharge (for all catchments) is to the CMA and therefore the potential effects of stormwater quantity on flooding are not considered an issue.

In considering erosion, the proposal is for all treatment device outfalls to be fitted with energy dissipation and erosion control measures. On this basis, it is considered the potential adverse effects from erosion or scour from discharge of stormwater during have been avoided.

14.17.3 Assessment – Construction

During construction it is proposed that a sediment retention pond is constructed on the northern side of the Te Atatu eastbound on-ramp, to treat stormwater run-off from north-eastern parts of SH16 at the Interchange and parts of Te Atatu Road, until such time as the existing swale is rebuilt and stabilised. Once the relocated swale is operational, this device will act as a construction treatment device (being retained as a permanent device following construction). The sediment retention pond will then be modified and used as a temporary stormwater pond for treatment of run-off from Construction Yard 1 in this Sector.

The potential effects of stormwater discharge during construction relate particularly to the ecological effects (which have been discussed further in sections 0 and 14.9, but also in relation to coastal processes (the receiving environment of these discharges), discussed in section 14.8). As for the operational effects, consideration is given to water quality and quantity.

14.17.3.1 Assessment of Water Quality

The Auckland Regional planning documents provide direction that water quality treatment design in construction should seek to remove at least 75% of the suspended solid loads for areas of runoff. During construction, areas of construction for the Project (approximately 17ha[13]) will be 100% treated in accordance with the guidance of the ARC's TP10. For the existing SH16, where currently only 1.7% of the catchment is treated, the Project proposes that 4.4% is treated over the construction phase.

Proposed stormwater treatment devices have been designed to meet ARC's planning documents

The proposed stormwater treatment during construction meets the requirements of the Auckland Regional planning documents (including the PARP: ALW). In this regard, it is considered that the effects of stormwater have been appropriately minimised (the residual effects of contaminant discharges are addressed further in the relevant ecological assessments).

14.17.3.2 Assessment of Water Quantity

The effects of increased stormwater quantity include the potential effects of increased flooding and erosion. In Sector 1, during construction, it is proposed that a rock lined swale (which will become a permanent treatment device for operation of the Project) will be constructed. On this basis, it is considered the potential adverse effects from erosion or scour from discharge of stormwater during the construction phase have been avoided.

[13] Note this includes the area of Construction Yard 1, which is 4.2ha

14.17.4 Mitigation – Operation

The above assessment concludes that the overall effects of stormwater discharges have been avoided through the design of the proposed stormwater treatment system. Furthermore, the proposed treatment devices will increase the level of existing stormwater treatment from SH16, which is considered an enhancement of the Project (and identified as an 'off-set' to other ecological effects associated with the Project, as discussed in the ecological effects assessment). On this basis, the following mitigation proposals are made:

Potential stormwater effects have been avoided through design

Stormwater treatment devices and systems be implemented in general accordance with the Best Practicable Options identified in Technical Report G.15: *Assessment of Stormwater and Streamworks*; and

An Operational Stormwater Management Plan be implemented (Appendix D of Technical Report G.15: *Assessment of Stormwater and Streamworks*, for the operation and maintenance of these devices (during operation of the Project), to deliver the continued performance of the stormwater treatment system.

14.17.5 Mitigation – Construction

The above assessment concludes that the overall effects of stormwater discharges have been avoided through the design of the proposed stormwater treatment system during construction. On this basis, the following mitigation proposals are made:

Stormwater treatment devices and systems be implemented in general accordance with the Best Practicable Options identified for construction, in Technical Report G.15: *Assessment of Stormwater and Streamworks*

Erosion and sediment control measures are undertaken in accordance with the plan provided in Technical Report G.22: *Erosion and Sediment Control Plan*, and

A Temporary Stormwater Management Plan be implemented (Appendix E of Technical Report G.15: *Assessment of Stormwater and Streamworks*), for the operation and maintenance of these devices during construction of the Project.

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

14.18 Land Contamination

The following provides a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. As the potential effects of contaminated materials will only be an issue during land disturbance this assessment only looks at construction effects.

14.18.1 Existing Environment

Current land use in this area comprises a mixture of road infrastructure dominated by SH16, residential housing and parkland/recreational. Historically (pre 1900) the general area contained a number of potentially contaminating industrial activities including a brick maker, a tannery, and gelatine and glue factories. At the turn of the century an abattoir was also established at the head of the Whau River. The Whau River was the main freight corridor for these industries and industrial wastes were discharged into the river. Post 1900, the majority of land in the area was used for farming and market gardening.

Intrusive investigations were undertaken to determine the existing quality of soils and groundwater, the potential for any existing contamination to be disturbed during construction activities, and the potential human health risks for workers and the wider public outside the construction footprint[14]. These investigations confirmed the following:

- The underlying geology includes fill in places overlying Tauranga Group (silts and sands) which in turn rest on the Waitemata Group sandstone and siltstone. The fill consists of reworked natural materials (silts and clays with some gravel).
- No waste materials were identified during the investigation.
- None of the soil samples taken along the alignment of SH16 had contaminant levels that exceeded 'permitted baseline' levels for land disturbing activities (as defined in Rules of the PARP: ALW). However, one sample exceeded the human health criterion (residential) for benzo(a)pyrene.
- None of the soil samples undertaken in Jack Colvin Park, had contaminant levels of concern. However, laboratory detection limits of some organochlorine pesticide levels were very high (this is DDD/DDE and DDT levels).

Based on the analysis, approximately 45% of the material in this area is considered potential 'cleanfill'. This means that it could potentially be reused on site (with the remaining 55% 'managed fill', (e.g. requiring disposal offsite).

[14] Refer Technical Report G.9: *Assessment of Land and Groundwater Contamination,* for a description of the methodology of this assessment of the existing environment.

14.18.2 Assessment – Construction

There were three areas where potential effects are considered to warrant specific management

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for the wider community and for workers on the site). The levels of contamination identified in this area did not generally exceed standards and criteria considered as 'triggers' for adverse effects. However, there were three areas where potential effects are considered to warrant specific management:

- Given the exceedance of the human health criteria (residential) for benzo(a)pyrene, in the samples on SH16, measures are required to be put in place to ensure control off-site migration of contaminants and minimise the exposure of construction workers to potentially contaminated soils;
- In Jack Colvin Park given the high detection of some organochlorine pesticide levels, it is proposed that the soils in this area are re-sampled and tested prior to construction of the stormwater pond; and
- Where material excavated does not meet the criteria of 'clean fill' it is proposed that it be disposed of as managed fill.

With the above management measures in place, it is considered that the effects of construction works on contaminated land are appropriately managed so that adverse effects are avoided.

14.18.3 Mitigation – Construction

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils to put at risk workers and the wider public and the environment.

In particular, it is proposed all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) (see Appendix O of Technical Report G.9: *Assessment of Land and Groundwater Contamination*) and a Site Health and Safety Plan. These Plans will form part of the overall Construction Environmental Management Plan (CEMP).

The CSMP has been developed for the Project and is provided in Appendix A of Technical Report G.9: *Assessment of Land and Groundwater Contamination*. It identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

If unexpected contamination is identified, then it is considered that the procedures set out in the CSMP, will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

15. Assessment of Effects – Sector 2

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 2. Works are primarily related to widening the Whau River Bridge to accommodate additional lanes in either direction and providing a separate pedestrian/cycle bridge. A small amount of reclamation is required either side of the Whau Bridges to provide for the widened bridge abutments. There are no residential properties in close proximity to the works and the bridges will be built offline, which will ensure that any potential effects on traffic using SH16 during construction will be minimised.

The main receiving environment in this Sector is the Whau River. The main potential effects, therefore, are related to coastal marine area (CMA). Through the Project design and the proposed mitigation, it is considered that most effects can be managed to be minor. There will be some unavoidable loss of marine habitat as a result of the new structures. However, this effect will be off set by the proposed stormwater treatment for SH16, which is considered to be a significant enhancement of the Project.

15.1 Introduction

Relevant Plans: F2: Operation Scheme Plans and F.5 Construction Scheme Plans (Sheet 3 for this Sector)

This Chapter provides an assessment of the actual and potential effects on the environment of construction activities within Sector 2.

As described in Chapter 4 and 5, the main elements of the Project that will be located within Sector 2 are:

- Widening both the eastbound and westbound Whau River Bridge decks;
- Construction of a new separate 3m wide pedestrian/cycle bridge to the south; and
- Reclamation around the bridge abutments and within the Whau River (on the southern side of the Rosebank Peninsula – approximately 0.25ha).

Specific details on scheme elements in this Sector are described in Section 4.4.2 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans*, (Sheet 3 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.2 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheet 3 for this Sector).

Sector 2 is located within an urban environment dominated by SH16 which runs across the Whau River via two road bridges. Whilst there are no immediately adjacent residential properties, nearby residential properties in Bridge Avenue and Alwyn Avenue have views onto the bridges.

Given the location of the works, the key issues[1] are largely related to works in the Coastal Marine Area (CMA) and potential discharges to the Whau River both during construction and operation. There are no immediately adjacent residential properties, therefore construction effects in relation to noise and air quality are not considered significant, and have not been discussed further in this Chapter. In addition, no archaeological features were identified within this Sector, and the works do not affect any terrestrial vegetation.

Key issues relate to works in the CMA

The Chapter is set out as follows:

15.2 Land Use

15.2.1 Existing Environment

The existing land use environment within this Sector (and Sectors 3 and 4) is shown conceptually in Figure 16.1 within Chapter 16 of this AEE. The information within this figure has been extracted from the Operative Auckland City District Plan (Isthmus Section) 1999 (Auckland District Plan). The Plans in Part F.1 *Designation Plans*, in this AEE contain further detail on designations and other restrictions. Key land uses in this area are: the existing transport infrastructure.

Key landuses in this area relate to the existing transport infrastructure

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (e.g. there is no reporting of effects on archaeology).

The existing SH16 is zoned as Special Purpose 3 in the Auckland District Plan (also designated for Motorway Purposes (reference A07-01), discussed below). This zoning includes the existing pedestrian/cycle way which runs parallel to the State highway on the southern side.

15.2.1.1 Designations

Designation A07-01 as shown on the Plans in Part F.1: *Designation Plans* provides for SH16 between the Central Motorway Junction (CMJ) and Auckland City's western boundary. The purpose of the designation is "Motorway" and the Auckland District Plan does not list any specific conditions in relation to this designation.

Existing designations are shown in Plans F.1

However it is noted that the Whau River Bridge is not zoned or designated as they are within the CMA.

15.2.2 Assessment – Operation

15.2.2.1 Impacts: Special Purpose 3 Zone

The Project is consistent with the existing land use and zoning

As noted above, the existing State highway is currently zoned Special Purpose 3 which underlies an existing designation for Motorway Purposes (reference A07-01). The Project is considered to be consistent with the purpose and activities envisaged within this zone.

15.3 Transport Effects

Technical Reports G.16 and G.18 provide further detail on the assessment of traffic effects

Traffic effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment of Transport Effects*). The following is a summary from this assessment specific to Sector 2 and summarises the key potential construction effects. Operational effects are described in Chapter 13, in relation to the broader Project wide and regional effects.

15.3.1 Existing Environment

15.3.1.1 Roading Environment

This Sector comprises SH16, specifically the Whau Bridge, which has three lanes in each direction on the motorway over the Whau River. The existing traffic flow patterns and volumes along SH16 are described in Chapter 13 (Assessment of Effects – Regional).

15.3.1.2 Pedestrian/Cycling Environment

A pedestrian/cycle way runs over the Whau River, it is narrow (approximately 1m wide) due to the physical constraints of the bridge.

15.3.1.3 Passenger Transport

There are two bus routes which run along SH16 within this Sector. One route runs straight along the motorway, the other enters/exits Rosebank Road On-ramp and Patiki Road On-ramp. Bus shoulders are provided intermittently along the length of SH16 in both eastbound and westbound directions between Te Atatu Interchange and GNR Interchange.

15.3.2 Assessment – Construction

Potential adverse effects of construction traffic on the road network can include: reduced capacity on roads within the Project site, resulting in travel time delays and diversions off these roads onto other roads in the network (increasing congestion and travel times on these routes) and potentially the loss of access for users of the network through the construction site (e.g. if road closures etc are left unmanaged).

Construction will be undertaken over five phases of work, and largely off line to minimise potential effects

It is proposed to undertake the widening of the Whau River Bridge largely offline to ensure that the existing number of lanes are maintained at all times throughout the construction period. However, this will require some narrowing of lanes and realignment which may have some effects, as discussed below.

15.3.2.1 Effects of Realignment and Narrowing of Lanes

During the works it is expected that the existing number of lanes on the motorway will be operational throughout the works. However, to accommodate the works, the carriageway will need to be narrowed to a minimum of 3.35m lanes and 0.3m shoulders and a speed restriction of 80 km/h throughout the construction period. It is expected that SH16 will be realigned by re-marking lanes and installing safety barriers to open up work zones and allow off-line site construction.

It is proposed to undertake the works over 5 phases. Table 15.1 provides a summary of the proposed realignment/narrowing in this Sector during each phase of works.

Table 15.1: Realignment/Narrowing of Lanes during Construction Phases in Sector 2

Phase	Proposed Realignment/Narrowing of Lanes
1	The eastbound lanes and shoulders will be narrowed.
2	The left hand eastbound lane will be repositioned to the northern side of the newly constructed bridge deck to form a 'bull-run'. The lane and shoulders in this lane will be narrowed.
3	The eastbound lanes will be remarked on the northern side of the Whau Bridge. The westbound traffic will be directed to a contra-flow arrangement. Two lanes will be set out on the northern bridge and one on the southern bridge which will carry Te Atatu Interchange Eastbound off-ramp traffic.
4	The lanes and shoulders will be shifted in both directions away from the centreline of the Whau bridge. The bus shoulders will be reopened in both directions.
5	Once bridge modification works are complete, safety barriers will be removed. The final surfacing and pavement will then be undertaken under lane closures at night.

Whilst it will be possible to maintain the existing number of lanes throughout the construction period, the narrowing of lanes is likely to affect the capacity of SH16 during this period. The assessment indicates that capacity reductions on SH16 are likely to divert traffic onto the arterial road network across the Isthmus and extend out to North Shore in some instances.

15.3.2.2 Effects on Cyclists

Temporary pedestrian/ cycle way will be provided throughout the construction period

There are not anticipated to be any effects on cyclists throughout the construction period, as the existing pedestrian/cycleway will be maintained adjacent to SH16. During Phase 4, once the new cycleway bridge is constructed on the southern side of the Whau Bridge, the existing cycle lane will be diverted onto the new cycle bridge.

15.3.2.3 Effects arising from Construction and Work Site Access

Works will be staged and access will be restricted during peak hours.

The works on the Whau Bridge will be staged primarily from Construction Yard 1 (Harbourview-Orangihina Park), which is accessed from Te Atatu Road, north of SH16. Access to and from the site will require specific controls given the busy nature of Te Atatu Road, particularly during peak hours.

In addition, a small construction yard (Construction Yard 2 (in Sector 3)) will be used to store material, which will be accessed from Patiki Road. Access to Construction Yard 2 will also require specific controls to avoid affecting traffic going to SH16 from Patiki Road.

Site access to the work zones for the Whau Bridge works will be accessed off SH16. To minimise effects on existing traffic, the site access points off SH16 will not be able to be accessed during peak hour times.

It is anticipated that with appropriate management, the effects arising from construction site and work site access are no more than minor.

15.3.2.4 Effects on Public Transport

The construction works will require the left hand shoulder/bus lane to be closed during some of the phases to maximise work zones. Therefore bus services will be affected by the works, possibly resulting in delays to bus routes. This is unlikely to result in a significant effect, as the buses will merge with existing traffic through the work area. During Phase Four, bus shoulders will be reopened in each direction along SH16 as construction works allow.

15.3.2.5 Effects on Navigation

The installation of beams and other structures during the works on the Whau River Bridges may obstruct the spans beneath the bridge. It is intended that this work be confined to 2 hours either side of high tide so as to not impeded the passage of craft through these spans.

15.3.3 Mitigation – Construction

Traffic management methodologies will manage effects created by increased construction traffic, work sites and construction of the Project

Traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management measures are outlined in the Construction Traffic Management Plan (CTMP) (Appendix A of Technical Report G.16 *Assessment of Temporary Traffic Effects*). An overview of the CTMP is provided in Section 13.3.3 of this report).

Traffic management for specific areas of the construction site will be formed and agreed within Site Specific Traffic Management Plans (SSTMP's). In particular, in this area, the following mitigation measures include:

- Construction planning over five phases, to allow works to be undertaken offline, and existing number of lanes to be maintained throughout the construction period;
- Temporary cycle bridge to maintain access throughout the construction period;
- The use of temporary lighting and safety barriers to separate traffic from the construction works;
- Limiting access to work zones on SH16 outside peak hours; and
- Works at night to minimise any restriction on waterway users and provide greater safety when lowering bridge beams.

15.4 Cultural Impacts

15.4.1 Existing Environment – Iwi with Manawhenua

Te Kawerau a Maki and Ngati Whatua have manawhenua status

Te Kawerau a Maki and Ngati Whatua o Orakei are recognised manawhenua (Iwi with customary authority) within Auckland (west) and in this Sector. In this regard, this Iwi have a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

15.4.2 Assessment of Cultural Effects

15.4.2.1 Cultural Effects – Te Kawerau a Maki Trust

Of relevance to the Project in this Sector, Te Kawerau a Maki Iwi Tribal Authority identifies the following environmental and resource issues:

- That the mauri of all natural waterways is protected; and
- That heritage sites, water quality, the quality and availability of kaimoana (seafood) are protected.

Specific comment has been sought from Te Kawerau a Maki Iwi Tribal Authority. At the time of writing this AEE, no comment had been received.

15.4.2.2 Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua o Orakei identifies the mauri, amenity and ecological health of the coastal environment. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects. Ngati Whatua o Orakei support the improvement of this environment through 'careful design and enhancement works', and believe that water must be managed holistically and nurtured as a living entity. Ngati Whatua o Orakei believe that the improvement of this environment would provide benefits to tangata whenua (as kaitiaki, caretakers and advocates for this environment, and to make use of natural resources from the harbour).

Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE, no further comment has been received.

15.4.3 Mitigation of Cultural Effects

Cultural issues identified have influenced Project design and mitigation

Ngati Whatua o Orakei has made a series of recommendations relevant to the SH16 widening aspect of the Project:

- Stormwater treatment: The Project proposes treatment of all stormwater from new motorway surfaces, and some currently untreated areas along the existing SH16 (design is based on ARC TP10); and
- Minimising visual impacts (eg. minimising vertical structures): This has been incorporated into the Project design.

15.5 Landscape and Visual Effects

Technical Reports G.20 provide further detail on the assessment of landscape and visual effects

Landscape and visual effects of the Project have been assessed in Technical Report G.20 *Assessment of Landscape and Visual Effects*. The following is a summary from this assessment.

15.5.1 Existing Environment

The eastern banks of Whau River (at Rosebank Peninsula) are as an Outstanding Landscape in the ARP:C

As SH16 crosses the Whau River, SH16 is clearly exposed to residential housing, the Te Atatu Boating Club as well as the outer periphery of Rosebank Park Domain (Sector 3). The existing SH16 bridge is solidly framed by the banks of the Whau River and the margins of Rosebank Park Domain.

The Whau River (on the eastern abutments of the Rosebank Peninsula) is identified as an Outstanding Landscape in the Auckland Regional Plan: Coastal (ARP:C) (See the Planning Maps included in Appendix E.2). The Coastal Protection Area (No. 54) is also noted as these values

create a natural sequence of visually overlapping intertidal mud flats and mangroves.

Proposed Plan Change 8 (PPC8) of the Auckland Regional Policy Statement (ARPS) includes a new sightline (reference A13) that extends from an origin point on the SH16 carriageway immediately west of the Te Atatu Interchange to the flanks of Mt Albert. The sightline traverses the air space and is elevated well over the Whau River bridge.

15.5.2 Assessment – Operation

Specific catchments are identified in Technical Report G.20

The visual catchment and related audiences potentially affected by the proposed redevelopment have been identified within Sector 2 for the assessment of landscape and visual effects. Overall, 4 public realm and 2 private residential viewpoints are assessed.

The potential effects of the Project, in terms of landscape, amenity and natural character values are described in detail in Technical Report G.20 *Assessment of Visual and Landscape Effects*. In summary, the proposed modifications to the existing bridge and provision of a new cycleway bridge will only marginally increase the current encroachment of SH16 into the river environment.

The existing landscape is already heavily modified

Although the existing river is a significant landscape feature in its own right, its corridor is already highly modified and the resulting amplification of such 'development' would be almost indiscernible from the majority of locations. In the future the western embankment will be screened by coastal planting on the margins of Sector 1, while coastal planting in Sectors 3 and 4 will assist in screening the bridge near Pollen Island and Rosebank Domain (refer to Plans F.16 *Urban Design and Landscape Plans*). Overall it is considered that the visual impacts are low.

15.5.3 Assessment – Construction

The proposed construction works within this Sector will have a very limited effect on the wider landscape, amenity and natural character values during the construction period. Although the temporary work site may be disruptive and unsightly, it would occur within a highly modified part of the river corridor and any temporary effects would be similar to those assessed and described already in relation to the long term situation.

15.5.4 Mitigation Measures – Operation

It is proposed that the Whau River Crossing (mainly comprising the bridge over that river) is to be left open, with only limited peripheral planting at its Te Atatu and Rosebank Road 'ends', so as to make the most of views down the river corridor and out to the nearby harbour (Refer Plans F.16 *Urban Design and Landscape Plans*).

15.6 Coastal Processes

A full assessment of effects on coastal processes is provided in Technical Report G.4

The following provides an assessment of the effects of the Project on coastal processes. This is a summary of the detailed assessment undertaken in Technical Report G.4 *Assessment of Coastal Processes*. More detail on the impacts of both construction and operation of the Project on coastal processes is provided in Chapter 13 of this AEE, which focuses on region and district wide effects.

15.6.1 Existing Environment

Chapter 13 assesses district / Regional wide operational effects on coastal processes

The coastal works in Sector 2 are limited to works within the Whau River. The Whau River is a sheltered tidal river, primarily used for recreational boating and mooring. The original embankments and first Whau River Bridge were constructed in the early 1950's. The bed sediments are predominantly fine sand, though a high proportion of mud and silt is found where the river enters the Central Waitemata Harbour.

15.6.2 Assessment

15.6.2.1 Occupation of CMA by piles to support temporary staging platforms

Temporary staging platforms will be used to undertake construction works

During construction, the widening of the existing Whau River Bridges and the new pedestrian/cycle way will be undertaken from temporary staging platforms supported by driven piles. A total of 88 temporary piles will be located within the CMA, and spaced so as to maintain navigation under the higher bridge span towards the west bank. In total the temporary piles will occupy approximately 25m^2 of sea floor area within the CMA.

In order to determine whether the temporary piles (which will be aligned with the existing bridges piers) will affect flows beneath the bridges, a hydrodynamic model has been used to simulate the flow. The results of the modelling indicate that any potential effect on the flows will be less than minor.

15.6.2.2 Excavation for widened bridge abutment and ground treatment works

Excavation and ground improvement works on either side of the bridges

Excavation and ground improvement works will be required to form the widened abutments on either side of the bridges. In areas where mudcrete is proposed, sediments will be returned to the seabed in a strengthened form and in other areas the excavated sediments will be replaced with engineered fill material.

While these activities are likely to be localised in most cases, they will require specific work practices and erosion and sediment control measures to minimise potential disturbance of the seabed, and consequent discharge of suspended sediment (and any potential contaminants) into the adjacent receiving waters.

With erosion and sediment control measures designed to TP90 standards, and after allowing for reasonable mixing of any discharges of like sediments (i.e. similar sediments that already contribute to the Whau River turbidity) with river waters, the physical effects and aesthetic effects of discharges from disturbance activities are likely to be minor.

Greater control on discharges using erosion and sediment control measures can be achieved higher up on the inter-tidal areas adjacent to the sides of the abutments, where the tidal inundation is shorter and current velocities are much slower.

15.6.2.3 Installation and removal of piles for temporary staging platforms

The installation and removal of the temporary piles will result in the disturbance of the seabed, with consequently sediment (and any associated contaminants) being released into the water column. However, any effect is considered to be minor given the relatively high background suspended sediment concentrations, and as the sediments disturbed will be indistinguishable from sediments currently causing turbidity in the Whau River.

Installation and removal of the temporary piles will result in the disturbance of the seabed

15.6.2.4 Construction of permanent piers

The widened bridges will be supported by 42 concrete cast in-situ piers (1.5m diameter). These will be placed in the same orientation as the existing pier groups. The new pedestrian/ cycle way bridge will be supported by 7 cast in-situ piers (1m diameter).

The proposed construction methodology will enable sediment loss to be effectively managed. The piers will be cast insitu. This involves driving steel casing into the seabed to the required depth, extracting the sediments and then casting the concrete inside the casing. The sediments will be able to be effectively captured, and casting the concrete inside the steel casing will minimise potential discharges of concrete.

15.6.2.5 Permanent occupation within CMA of additional bridge piers

As noted above, a number of new bridge piers will be required to support the widened Whau River Bridge and the new pedestrian/cycle way bridge.

The bridges have been designed so that the additional piers are in line with the existing pier groups, which have a skewed orientation to tidal streams. Given this orientation, there is the potential to slightly reduce the tidal flow through the area and widen the zone of wakes that are shed behind each pier. However, the effect of extended pier groups on generating additional wakes is unlikely to hinder navigation of vessels when the tide is running strongly as such wakes are already present from the existing piers and passage is generally parallel to the pier group alignment.

Overall the effects on physical coastal processes as a result of permanent occupation are likely to be localised and no more than minor

Additional scour associated within the longer pier groups is also unlikely to result in any substantial deposition or shoaling from scoured sediments further downstream, as the cross section is relatively deep. Local scouring generally reaches equilibrium relatively quickly in regular spring tidal streams.

Overall the effects on physical coastal processes as a result of permanent occupation are likely to be localised and no more than minor. There is no threat to the stability of the shorelines due to the general accretion that has already occurred behind the bridge abutments. In addition, similar piers as the existing piers have been designed, so as to minimise the effects on additional wake generation.

15.6.2.6 Reclamation of CMA for widened bridge abutments

The bridge reclamations will have little effect on the geomorpholog y, flow paths and flushing of the Whau River

A total of 1,570m^2 is needed for reclamation of the CMA to construct the widened western bridge abutment. The longer 115m existing eastern bridge abutment would require an additional reclamation of approximately 2,500m^2.

There is not expected to be any localised erosion occurring as a result of the wake shedding off the end of the extended abutments given that there is little geomorphological evidence of this occurring as a result of the existing widened abutments.

The additional reclaimed areas will add laterally to the historic abutment reclamations, rather than extend out into the main tidal waterway. Therefore the additional reclamations will have little effect on the geomorphology, flow paths and flushing of the Whau River through the bridges cross section. However, locally the south east corner of the extended eastern abutment which supports the pedestrian/cycle way bridge may cause localised erosion and minor flow contraction at higher water levels.

15.6.2.7 Reclamation of CMA (Whau River) for widened SH16

The reclamations on the southern side of Rosebank will be managed to allow the channel to reform

It is proposed to extend the width of the SH16 carriageway on the southern side (Whau River)[2]. The potential effects of this work relate to the encroachment of a small channel that drains the intertidal area to the west of Rosebank Peninsula, conveying intertidal waters to the Whau River near Rosebank Domain.

The channel is only some 3-5m wide and due to its smaller scale (relative to the channels impacted by the Project in Sector 4), it is proposed that the 125m section of channel should be allowed to naturally migrate and reform. However, to facilitate this, the reclamation and associated ground treatment works need to progress slowly. Mangroves and their rooting systems in this area will need to be removed (from the area on the southern side of the existing drainage channel) to allow the channel to migrate and reform. As current velocities in the channel are modest, the risk of channel bank instabilities or slumping occurring as the channel migrates and reforms is considered low. On the basis of the above management of works, the effect of the reclamation works encroaching on the small drainage channel will be minor.

[2] Note that the northern side widening is discussed in Sector 4.

15.6.3 Mitigation

For structures in the CMA, the following mitigation measures are proposed:

Use of steel casings for piers will minimise discharges during excavations

- The structural bridging works be designed so that they are aligned with the existing piers in order to minimise potential effects on flows beneath the Whau river. A wider gap between the pile groups has been provided towards the western end to retain navigational passage and reduce flow contraction; and
- The use of steel casings in the construction of the permanent piers to minimise discharges during excavation of the seabed sediment.

For reclamation activities, the following mitigation measures are proposed:

- The speed of reclamation works on the southern side of the Rosebank Peninsula (impacting on the Whau River area of the CMA) be matched with the response of the channel to naturally migrate; and
- Mangroves be removed from the southern side of the 125m of channel impacted by the proposed reclamation in this area, to facilitate natural channel migration.

For disturbance activities:

Erosion and sediment control measures are provided in Technical Report G.22

- During construction, erosion and sediment control measures be undertaken in accordance with TP90 (as detailed in Technical Report G.22 *Erosion and Sediment Control Plan*) which will minimise disturbances of the seabed in the CMA and reduce suspended sediment discharges into the adjacent receiving waters. Particular design features of excavations and ground treatment works may be required to withstand stronger channel flows along ends of both abutments and ensure tolerance of higher wave exposure.

15.7 Marine Ecology

A full assessment of effects on the marine ecology is provided in Technical Report G.11

The following provides an assessment of the ecological effects of the Project on marine ecology in relation to Sector 2. This is a summary of the detailed assessment undertaken in Technical Report G.11 *Assessment of Marine Ecology Effects*. A description of the marine ecology from a Regional and Project wide is provided in Chapter 13.

15.7.1 Existing Environment

The Whau River contains a typical collection of sub tidal invertebrates with low sediment contamination concentrations downstream of the Whau River Bridge due to the flushing out of the fine sediment from the immediate area. Upstream of the bridge, sediment quality declines significantly and, as a consequence, ecological values are likely to be adversely affected.

Ecological values of the marine environment are considered moderate with a typical grouping of sub tidal benthic species, moderate diversity of species (dominated by bivalves, polychaete worms and amphipods) and low concentrations of contaminants in the sub tidal sediment. Intertidal marine flora and fauna adjacent to the existing bridge abutment comprise a similar grouping, dominated by mangroves, mud crabs, and polychaete and oligochaete worms.

15.7.2 Assessment – Operation

Operational effects on marine ecology have been considered in terms of runoff from the widened SH16 and potential shading effects of the bridge.

Road runoff will be treated using cartridge filters and filter strips

Road runoff in Sector 2 will be treated using cartridge filters and filter strips and discharged into the Whau River. These discharge structures will have erosion and scour protection. Grass swales will treat runoff from SH16 between the Rosebank Park Domain and the Whau River Bridges and adjacent existing pavement. All stormwater treatment devices have been designed to exceed the guidance provided in TP10, with at least 80% treatment efficiency. Given the high standard of proposed treatment, the effects of the discharge on marine ecological values are considered to be negligible (with enhancement on discharges compared to the current situation). However, it is acknowledged that the discharges will continue to contribute to the contaminant accumulation of marine sediment, albeit at a much reduced level (assessed in Chapter 13 – as a Regional and Project wide overview).

Shading beneath the Whau River Bridge as a result of the bridge widening is not likely to cause any adverse effects on coastal plant growth and colonisation. It is considered that shading of vegetation within Sector 2 will have a negligible effect on marine ecological values.

15.7.3 Assessment – Construction

15.7.3.1 Permanent Loss/Disturbance of Intertidal and Subtidal Habitat

The proposed construction activities will result in permanent habitat loss with consequential mortality of marine invertebrates and mangroves, which is considered to be a moderate adverse effect.

Total permanent habitat loss will be approximately 4,250m^2 in the intertidal area and 60m^2 in the subtidal habitat. There will be permanent loss of mangroves from approximately 2,350m^2 of intertidal habitat. Of the total permanent habitat loss, approximately 3,150m^2 will be located in the Motu Manawa (Pollen Island) Marine Reserve (MMMR).

15.7.3.2 Temporary Loss/Disturbance of Intertidal and Subtidal Habitat

Total temporary habitat loss within Sector 2 will be approximately 4,800m^2 in the intertidal habitat and 10m^2 in the subtidal habitat. The benthic habitat occupied by the temporary piles and associated silt fences and staging platforms will be recolonised by marine invertebrates and mangroves over time. Accordingly the adverse effect of the temporary habitat loss is

considered to be minor and acceptable.

15.7.3.3 Disturbance from Vibration and Noise

During construction works there will be noise disturbance to marine organisms from a large range of machinery and activities.

As a result, there may be some avoidance of the immediate area by fish and possibly transient cetaceans. Some sensitive benthic invertebrates may cease feeding or foraging during the noisiest periods. The temporary construction period is relatively long in comparison to the life cycle of some smaller marine organisms. There is potential that the settlement of some larval stages of invertebrates may not occur in the vicinity of the works during disturbance activities choosing other less disturbed areas as a preference.

In isolation however the effect on marine organisms is considered to be negligible given that the noisy works will mostly be carried out during the day, enabling the organisms to resume normal behaviour and activities during the evenings, and that the noisy works are to be carried out for a finite period.

Vibration during construction will be generated primarily from vibratory rollers for the road construction and bridge piling. Piling activities are more likely to affect the marine environment, due to the activity occurring within or adjacent to the intertidal habitat. During piling, fish and other organisms will avoid the area, and sessile or infaunal marine invertebrates are likely to remain inactive (e.g. not feeding or foraging etc).

Given the short term nature of this disturbance effect, it is considered that the effects on marine organisms will be negligible.

15.7.3.4 Potential Discharge of Cement

In-situ concreting of piles poses a potential risk to the marine environment should cement be accidentally discharged during placement, causing an alteration to ambient pH levels. The use of steel casings and the Tremie Concrete method (refer Technical Report G.23 *Coastal Works Report*) will minimise the risk of cement discharge to the marine environment. Overall, stringent management of concrete placement during piling will ensure negligible loss of cement to the environment.

15.7.4 Mitigation

A range of mitigation measures will be implemented to protect the marine environment from potential sediment and contaminant discharges during construction and operation. These are set out in the Construction Environmental Management Plan (CEMP) (refer Technical Report G.21) and associated management plans.

This includes the installation of erosion and sediment control devices, temporary stormwater devices, long term permanent stormwater treatment devices, the use of practices such as suction trucks to remove contaminated water, removal and post construction replacement of the shellbanks, and the timing of works (e.g carrying out disturbance works during low tide to minimise sediment generation).

While temporary habitat loss is considered to be minor (and acceptable), permanent habitat loss is considered to be a moderate adverse effect requiring mitigation. While it is difficult to directly mitigate these effects, the following measures are considered to off-set these effects:

The moderate effect of permanent marine habitat loss will be offset by enhanced stormwater treatment and restoration of the coastal habitat along SH16

- Improving the efficiency of the removal of contaminants from the operational phase of stormwater discharge. The proposed stormwater treatment devices will meet and exceed ARC's TP10 requirement, and are considered to provide a positive effect of the Project (refer Section 15.8 and Technical Report G.15);
- Treating the runoff from the currently untreated existing State highway. The stormwater treatment proposed includes treating the currently untreated existing motorway;
- Restoration of coastal fringe habitat (refer Plans F.16 *Urban Design and Landscape Plans* of the AEE for details); and
- Removal of gross litter and debris from within and adjacent to the CMA.

Monitoring of the marine environment is proposed to ensure that construction mitigation measures proposed are effective in protecting the marine ecological values. This will include suspended sediments, pH and benthic invertebrate community composition. Details of the proposed monitoring are set out in the Ecological Management Plan (Appendix G of Technical Report G.11 *Assessment of Marine Ecological Effects*).

Monitoring will be undertaken during construction

15.8 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

15.8.1 Existing Environment

The receiving environment for stormwater discharges is the tidal flats of the Whau River and Waitemata Harbour. The marine ecological values of this area have been described above (Section 15.7).

Currently, stormwater management on SH16 can be summarised as follows:

- Between the Rosebank Park Domain and the Whau River Bridge, stormwater runoff is collected by standard cesspits which are connected to a reticulated network which discharges to the CMA on the western side of Rosebank Park Domain; and

- At the eastern abutment of the Whau River Bridges, stormwater runoff runs across vegetated berms and discharges directly to the CMA. While the vegetated areas provide some water quality treatment, these have not been designed to comply with TP10.

15.8.2 Assessment – Operation

Runoff from the widened Whau River Bridges will be intercepted by catchpits and piped eastwards to treatment devices located on both sides of the eastern abutment of the Whau River Bridge and discharged directly into the Whau River.

A cartridge filter system is proposed for stormwater treatment from the eastern abutment of the Whau Bridges westwards. The outfalls will be concrete wingwalls, with flap vales for backflow prevention, integrated into the rock armour revetment with an additional rock apron as necessary along the edge of the wingwall.

It is proposed that stormwater runoff from the motorway between Rosebank Park Domain and the Whau River Bridges will be provided by filter strips located along the side of the motorway to provide treatment to the adjacent pavement area.

Following completion of the Project, there will be approximately 2.17ha of impervious surface area in this Sector and 100% will be collected and treated, in accordance with ARC's TP10, prior to discharge to the receiving environment. The treatment level is expected to be 80% (based on the percentage removal of total suspended solids from stormwater). Energy dissipation and erosion protection will be provided at the discharge outlets.

By providing treatment of both new and existing impervious area, in excess of the TP10 requirement for 75% treatment, the effects from stormwater discharge on water quality environment have been minimised and is considered a positive environmental effect from the Project.

15.8.3 Assessment – Construction

The only construction phase aspects requiring treatment of stormwater consist of the additional impervious area created by the carriageway widening. In this respect, the erosion and sediment control measures will provide temporary stormwater treatment, until the permanent stormwater treatment devices are operational.

15.8.4 Mitigation – Operation

The proposed treatment devices will increase the level of existing stormwater treatment from SH16 which is considered an enhancement of the Project (and identified as an 'off-set' to other ecological effects associated with the Project).

Ongoing operation and maintenance proposed

In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (Appendix D of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

15.8.5 Mitigation – Construction

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan*.

16 Assessment of Effects – Sector 3

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 3. Works are primarily related to widening SH16 and reconfiguring the existing Rosebank Road and Patiki Interchanges. A new pedestrian/cycle way bridge will be provided, and a new access road to Rosebank Park Domain.

The works are located within an urban environment, with adjacent land use being primarily industrial. As there are no residential properties within the vicinity of the works, construction effects are less significant (e.g. in relation to noise, lighting and vibration). The main receiving environment in this Sector is the Waitemata Harbour and other construction activities (e.g. dust and contaminant emissions and discharges) have the potential to impact on this environment. Through the Project design and the proposed mitigation, it is considered that most effects can be managed to be minor.

16.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 3.

As described in Chapters 4 and 5, the main elements of the Project located in Sector 3 are:

- Reconfiguration of the existing Rosebank Road and Patiki interchanges;
- Widening of SH16;
- New pedestrian/cycle way bridge; and
- Construction of a new access road to Rosebank Park Domain.

Specific details on scheme elements in this Sector are described in Section 4.4.3 of this AEE and the overview of the scheme is provided in plans F.2 *Operation Scheme Plans* (Sheets 4 and 5). Details of the proposed construction of these elements are described in Section 5.9.3 of this AEE, with the construction areas and yards provided in the plans F.5 *Construction Scheme Plans* (Sheets 4 and 5).

The works located within Sector 3 are located within an urban environment dominated by SH16 and the industrial area of Rosebank Road/Patiki Road. The main receiving environment in this Sector is the Waitemata Harbour.

Given the existing environment, the key issues[1] identified in the assessment of environmental effects for the Project, relate to impacts on the existing economic landuses, transport networks and the receiving environment. There are no residential properties in close proximity to the works. As such potential construction effects will be less significant, particularly in relation to air quality (e.g. dust generation), lighting and noise. In addition, the works in this Sector are expected to be undertaken largely off-line and under the traffic management described in Sector 4 (Chapter 17).

Key environmental issues include land use, transport and the receiving environment

This Chapter is set out in the following way:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (e.g. there is no reporting of effects on light effects, coastal processes, operational noise and marine, freshwater and avian ecology).

16.2 Land Use

16.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 16.1 below. The information within this figure has been extracted from the Auckland District Plan. The Plans in Part F.1 *Designation Plans*, this AEE and contain further detail on designations and other restrictions. Key land uses in this area are: the existing transport infrastructure (particularly SH16), open space areas and commercial/industrial sites.

Existing land use comprises transport, open space, commercial / industrial

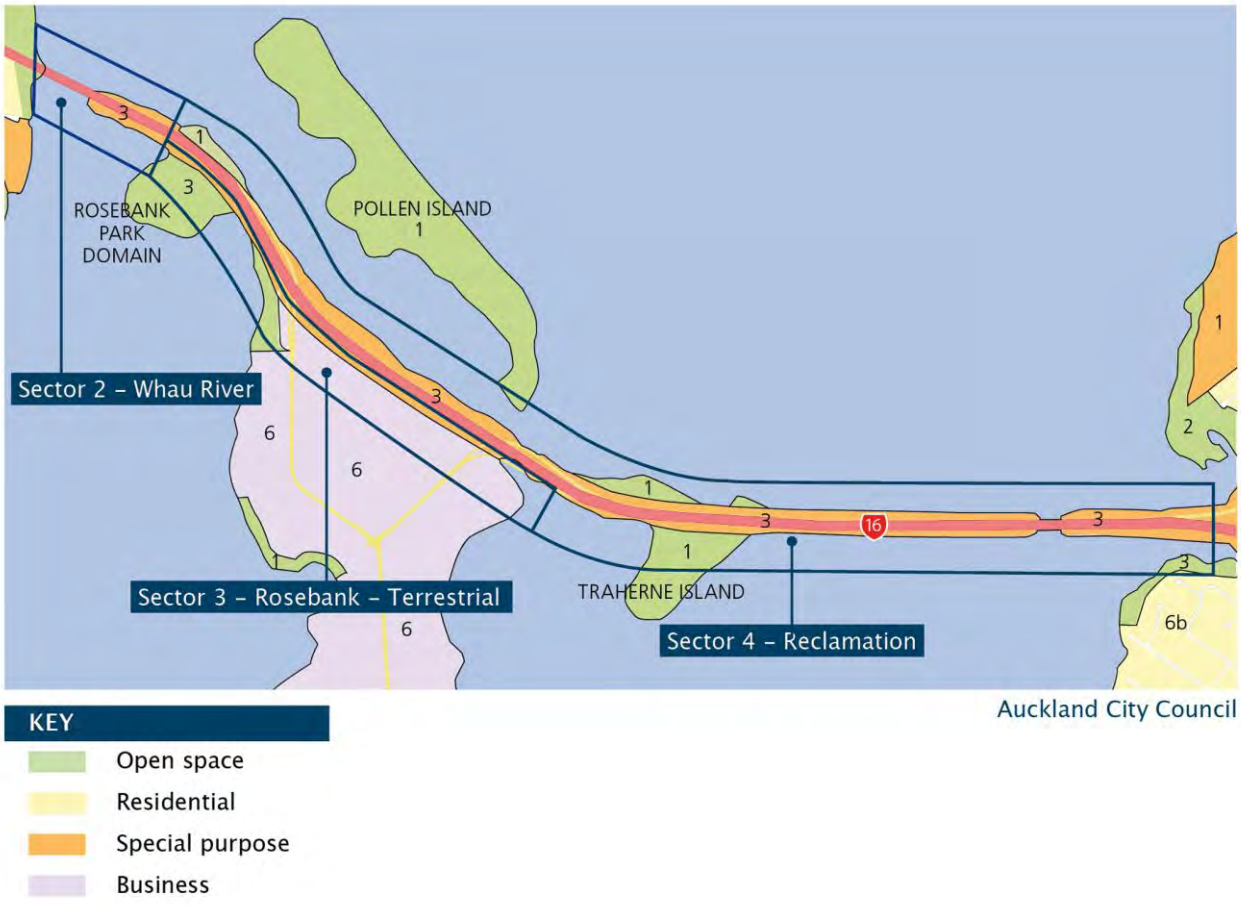


Figure 16.1: Land Use Zones – Sectors 2 -4 (Not to Scale)

16.2.1.1 Special Purpose 3 Land Use and Existing Designations

The existing Rosebank Road Interchange, Patiki Interchange and SH16 are zoned as Special Purpose 3 in the Auckland District Plan.

Plan set F.1 shows existing designations

The majority of the Project within this Sector will be constructed within land already designated for motorway purposes (reference A07-01) and zoned for transportation purposes within the District Plan.

The other designations (C01-01, C02-02, C01-03, C01-05, C01-06 and C01-07) within the Rosebank and Patiki Interchanges all relate to the widening of the Interchanges and local roading connections.

16.2.1.2 Open Space Land Use

Rosebank Park Domain is the only area of open space within Sector 3. Rosebank Park Domain is approximately 6.6ha and is mainly used for recreational activities such as go karting and speedway racing and is zoned Open Space 3. Rosebank Domain is primarily a dirt track with grandstand seating. The domain is leased exclusively to the Auckland Kart Club Inc. and Auckland Speedway Riders Club Inc. Rosebank Park Domain is a Recreational Reserve under the Reserves Act.

The Open Space 3 zone is applied to those sites which are primarily used for organised sports and recreation.

16.2.1.3 Business Land Use

The main land use in Rosebank is commercial/industrial and this is reflected in the Business 6 zoning on the southern side of SH16. This area is occupied by numerous manufacturing and commercial operators including a car wrecking facility.

The Business 6 zone provides for industrial activities deemed heavy, noxious or otherwise unpleasant. These activities typically generate significant effects which may pose a threat to the natural environment and compromise the amenity and safety of surrounding land use.

16.2.1.4 Auckland City Future Planning Framework

The Auckland City Future Planning Framework 2008 (FPF) area plans set out a number of key medium and long-term outcomes that the Council wants to achieve by 2030, from a city planning point of view. Of particular significance to this area of this Project, these mapped aspirations include:

The Rosebank Industrial area to remain a production and distribution node

- The Rosebank Industrial area to remain a production and distribution node surrounded by employment land uses in Avondale;
- Improved pedestrian/cycle facilities and ecological linkages; and
- Patiki and Rosebank Road as key road passenger transport routes.

16.2.2 Assessment – Operation

The majority of the Project in this Sector will be within land designated

16.2.2.1 Impact: Special Purpose Land Use

The majority of the Project within this Sector will be constructed within land designated for motorway purposes (reference A07-01) and zoned for transportation purposes within the District Plan. The Project is considered to be consistent with the intent of the zone.

16.2.2.2 Impact: Open Space Land Use

It will be necessary to permanently occupy approximately 1.19ha of open space zoned land within Rosebank Park Domain, for the upgrading of the existing access into the Domain and the widening of the pedestrian/cycle way. The use of this land is consistent with its current use and therefore the impacts of land take are considered to be no more than minor.

16.2.2.3 Impact on Business Zoned Land Use

Minor land use impacts during operation

The proposed widening of SH16 and the new pedestrian/cycle way will require a partial take of land from some businesses fronting SH16. The amount of land take required has been minimised through design (as shown on Plan Set F.1 *Designation Plans*), and is not considered to affect the viability of the businesses.

16.2.3 Assessment – Construction

16.2.3.1 Impact on Open Space Land Use

Minor land use impacts of construction

It will be necessary to occupy 1.43ha of open space zoned land at Rosebank Park Domain during construction. This provides for a construction yard, temporary stormwater wetlands for the Project, and construction of the Causeway. This impact is considered temporary and not significant.

16.2.4 Mitigation – Operation

16.2.4.1 Avoiding Effects through Design

The potential adverse land use effects have been minimised on the Open Space and Business zones in design of the SH16 widening works. In particular the proposed works are largely located within land already designated for motorway purposes.

16.2.4.2 Mitigation Recommendations

Once construction is complete, it is recommended that the designation be uplifted from any surplus land.

A full social impact assessment is provided in G.14 Assessment of Social Effects

16.3 Social Impacts

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14 *Assessment of Social Effects*). This social assessment provides a holistic 'lens' on the potential effects of the Project and the following is a summary from that assessment.

16.3.1 Existing Environment

Sector 3 includes the Rosebank Peninsula industrial and business area, a regionally significant employment hub. There are no residential areas in Sector 3. In terms of community facilities, the Rosebank Park Domain (located directly adjacent to SH16) provides approximately 6.6ha of recreational land which is used almost solely for go-karting and a speedway, and attracts users from a wide catchment area.

16.3.2 Assessment – Operation

Social impacts relate to impacts on employment structures and recreation opportunities

The edge effects of acquisition on seven Rosebank Road/Patiki Road industrial sites are not considered to have any impact on business feasibility or employment structures. Once operational, the Project will result in accessibility benefits for these businesses including for local residents accessing these and other employment sites (as discussed in the regional transport assessment in Chapter 13, this area has some of the highest travel time savings delivered by the Project (e.g. for access to the Airport and other economic centres of the Region)). Overall, moderately to significantly positive impacts are expected with respect to the economic and accessibility benefits projected for the Rosebank Road industrial areas.

Works to upgrade the access road to Rosebank Park Domain will result in minor positive social impacts associated with improved accessibility for vehicles and pedestrians/cyclists.

16.3.3 Assessment – Construction

Negligible social impacts identified for construction

Impacts on employment structures in Sector 3 are expected to range from minor negative to minor positive impacts during construction, mainly related to a reduction in accessibility to some sites during traffic delays, and the potential increased demand for retail and service business in the local area (from construction workers). Social impacts on Rosebank Park Domain are considered negligible as access to the area can be maintained throughout construction and the activities on this open space area are not considered 'sensitive' to construction emissions.

16.3.4 Mitigation – Construction

Implementation of the Construction Traffic Management Plan (CTMP) (see Appendix A of Technical Report G.16: *Assessment of Temporary of Traffic Effects* and discussed further in Sector 4, Chapter 17) will assist in mitigating the minor negative impacts on employment structures.

16.4 Cultural Impacts

16.4.1 Existing Environment – Iwi with Manawhenua

Te Kawerau a Maki and Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Waitakere City and in this Sector. In this regard, these Iwi have a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

Te Kawerau a Maki and Ngati Whatua have manawhenua status

16.4.2 Assessment of Cultural Effects

16.4.2.1 Cultural Effects – Te Kawerau Iwi Tribal Authority

Of relevance to the Project in this Sector, Te Kawerau Iwi Tribal Authority identifies the following environmental and resource issues:

- That the mauri of all natural waterways is protected; and
- That heritage sites, water quality, the quality and availability of kaimoana (seafood) are protected.

Specific comment has been sought from Te Kawerau Iwi Tribal Authority. At the time of writing this AEE, no comment had been received.

16.4.2.2 Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua identifies the following environmental and resource issues:

- The mauri, amenity and ecological health of the coastal environment. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects. Ngati Whatua support the improvement of this environment through 'careful design and enhancement works', and believe that water must be managed holistically and nurtured as a living entity. Ngati Whatua believe that the improvement of this environment would provide benefits to tangata whenua (as kaitiaki, caretakers and advocates for this environment, and to make use of natural resources from the harbour); and

- The potential for SH16 widening works to impact on areas of cultural heritage value/known Maori archaeological sites.

Updated comment has been sought from Ngati Whatua. At the time of writing this AEE, no further comment had been received.

16.4.3 Mitigation of Cultural Effects

Cultural issues identified have influenced Project design and mitigation

The Project avoids sites of known archaeological/Maori heritage value in this Sector. Ngati Whatua o Orakei have made a series of recommendations relevant to the SH16 widening Project:

- Native planting on motorway verges: This has been incorporated in the Project landscape plans (refer to Part F.16 *Urban Design and Landscape Plans*);
- Stormwater treatment: The Project proposes treatment of all stormwater from new motorway surfaces, and some currently untreated areas along the existing SH16 (design is based on TP10); and
- Minimising visual impacts (eg. by minimising vertical structures): This has been incorporated into the Project design.

16.5 Landscape and Visual Effects

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides an assessment of the landscape and visual effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

16.5.1 Existing Environment

There is visual linkage between SH16 and the industrial properties

Those parts of the Rosebank Peninsula closer and visually exposed to SH16 are primarily industrial (activities range from car dismantling and repairs to bulk storage and goods distribution, printing, paint and chemical manufacture, and a wide range of servicing activities). Generally the residential properties, to the southern end of the Peninsula and more remote from the Project area, enjoy a much more remote sense of connection with both the main body of the Harbour and the current Northwestern Motorway. Those industrial properties overlooking the Waterview Inlet through to both the Rosebank Road and Patiki Road interchanges also tend to be located on coastal cliffs and escarpments that are more elevated relative to the motorway corridor. As a result, there is much more direct visual interaction between these industrial premises and SH16 than there is between SH16 and the residential properties.

For the wider visual catchment, the industrial premises form part of the reasonably immediate backdrop to SH16. (For example, when looking south from within the Waitemata Harbour, from the western Point Chevalier shoreline or from Te Atatu Peninsula).

The Auckland Regional Policy Statement (ARPS) proposes a new sightline in this area that extends from an origin point on the SH16 carriageway immediately west of the Te Atatu Interchange to the flanks of Mt Albert above the motorway.

16.5.2 Assessment – Operation

The visual catchment and related audiences potentially affected by the proposed redevelopment have been identified within Sector 3. Overall, 3 public realm viewpoints were assessed in this Sector (with 5 catchments identified). No private residential viewpoints were investigated. Technical Report G.20 *Assessment of Visual and Landscape Effects* assesses the nature of impacts that would be generated by the Project in order to describe and analyse effects in this environment, in terms of landscape, amenity and natural character values.

The visual effects are substantially absorbed by the surrounding industrial environment and intervening vegetation

Aside from local industrial premises, the existing motorway and cycleway, only Rosebank Park Domain and the Harbourview-Orangihina Park (Te Atatu Peninsula) offer clear views from public vantage points to the current motorway. Views from Harbourview-Orangihina Park are over and through mangroves, other coastal vegetation and the shell banks of Pollen Island. Widening of the current motorway (in conjunction with retention of the current Patiki Road and Rosebank Road ramps) would be substantially absorbed by these surrounding elements, to the point where any external effects would be minimal.

While the Project may be viewed more remotely from Point Chevalier and the Te Atatu Peninsula or the Waitemata Harbour, the effects are substantially absorbed by the surrounding industrial environment and intervening vegetation across Pollen and Traherne Islands (See F.16: *Urban Design and Landscape Plans)*. This is to the point where the visual effects of the Project are softened and any adverse effects will be low.

16.5.3 Assessment – Construction

The physical containment of the Project in this area and the coastal planting in Sector 4 will assist in screening the construction of the Project near the end of the Peninsula. However the environment will remain exposed to more external viewing points at Point Chevalier and Te Atatu Peninsula.

It is only after planted filter strips have covered over areas of reclamation, and rock armouring next to it is in place (as defined in the plans F.16 *Urban Design and Landscape Plans*), that the reclamation will fit into the existing environment. Therefore the temporary landscape impacts during construction on the Harbour environment and its margins are quite significant.

16.5.4 Mitigation – Operation

At Traherne Island a mixture of planting is proposed along the edge of the carriageway, designed to support the ecological enhancement of this feature (see plans F.16 *Urban Design and Landscape Plans*). Similar treatment is also proposed along the northern edge of

Rosebank Peninsula adjacent to Pollen Island, and from Patiki Road through to the Rosebank Park Domain[2]. This will result in the motorway corridor feeling partially enclosed and will contribute to the visual assessment conclusions.

16.5.5 Mitigation – Construction

It is recommended that where practicable, the construction of the Project is staged, so that replanting of vegetation is undertaken in a specific area once construction in that area is completed.

16.6 Archaeology

A full assessment of the effects on archaeology is provided in Technical Report G.2

The following provides a summary of the detailed assessment undertaken in Technical Report G.2 *Assessment of Archaeological Effects*.

16.6.1 Existing Environment

A number of archaeological sites have been recorded within or adjacent to the proposed designation, at the northern end of the Rosebank Peninsula (see Figure 16.2).

There are a number of existing archaeological sites

The sites comprise former settlement sites, middens, landings, tramway and limeworks on Pollen Island (scheduled in the Auckland Regional Plan: Coastal (ARP:C)) and the former house of Dr Daniel Pollen. Most of the recorded sites (including the house or Dr Pollen) have already been damaged or destroyed by urban development and motorway construction. These sites are therefore of limited archaeological value and significance. The exception to this is a recently recorded midden (site R11/2507) which is in relatively good condition.

16.6.2 Assessment – Construction

Most of the existing archaeological sites have been modified or destroyed

Works in this Sector will affect the locations of a number of recorded archaeological sites relating to both Maori and early European settlement. However, most of the previously recorded sites have been destroyed or severely modified through earlier motorway construction or erosion. There may still be surviving subsurface remains associated with some of these sites (in particular at sites R11/444 and 2216), which would be damaged or destroyed by the proposed works. If so, however, these would be of limited extent and significance and any effects would be less than minor.

The works will also affect the location of site R11/2508, the historic landing site associated with Dr Pollen's house. However, as there are no known archaeological remains of this site, the effects are considered likely to be less than minor.

[2] This contrasts with the more open causeway experienced further to the east.

Figure 16.2: Recorded Archaeological Sites in Sector 3

To the north of the motorway, sites R11/2506 (Landing) and R11/2507 (Midden) are within or partly within the designation. Sites R11/2504 (the historic tramway) and a third landing site (R11/2505) are just outside the designation. These sites should not be affected by the works if appropriate measures are put in place (as described below).

Overall, there will be minimal effects on known archaeological remains on the Rosebank Peninsula. However, monitoring and investigation of sites affected by the earlier construction of the motorway ramps at Patiki and Rosebank Roads did reveal the potential for further unrecorded subsurface remains to be exposed in any areas that have not already been modified by motorway construction. If such deposits are exposed, they are likely to be of limited significance.

16.6.3 Mitigation – Construction

The ASMP sets out avoidance, mitigation and monitoring measures

The Archaeological Site Management Plan (ASMP) (Appendix D of Technical Report G.2 *Assessment of Archaeological* effects), sets out avoidance, mitigation and monitoring measures that will be undertaken during construction. Of specific relevance to this Sector are the following:

- Protecting (e.g by fencing) sites R11/2506 (landing), R11/2507 (midden), R11/2504 (historic tramway) and R11/2505 (landing) during construction work; and

- Monitoring earthworks in areas previously unmodified by motorway construction by an archaeologist, so that any remains exposed are investigated and recorded.

16.7 Effects on Herpetofauna

A full assessment of effects on herpetofauna is provided in Technical Report G.8

The following provides a summary of the detailed assessment undertaken in Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*. The main potential effects relate to the copper skinks.

16.7.1 Existing Environment

Copper skinks were found on Rosebank Peninsula

The land within Sector 3 contains a variety of habitats, primarily comprising patches of mixed native and exotic scrubland, and stands of mature trees. Although large areas of short mown grass exist and are not considered suitable as a lizard habitat, the edge habitat, where the mown grass meets scrubland/bush habitats, is likely to provide suitable habitat for native lizards.

Two species of lizards (rainbow skinks and copper skinks) were detected in surveys of this area although only copper skinks are native to NZ[3]. Two copper skinks were found in the west bound tip of Rosebank Peninsula. Copper skink is widespread throughout the North Island and is not considered threatened fauna.

16.7.2 Assessment – Construction

Any potential effects in relation to copper skinks will be during construction, and the potential disturbance of their habitat. Construction activities that pose the greatest threat to the skink population include the clearance of vegetation and habitat features, potentially reducing the availability of habitat and resources. Noise and vibration created by construction activities are likely to have short term effects. However, these are considered to be no more than minor given the already close proximity of the skink population to existing highway traffic.

16.7.3 Mitigation – Construction

Mitigation by relocating the skink population

Potential adverse effects on the copper skink population can be mitigated by relocating the skink population in this area to sites or habitat outside of the construction footprint (e.g. beyond the construction areas in the designation or beyond the designation).

[3] The assessment has not considered impacts on Rainbow Skinks that are now considered a pest and not protected under the Wildlife Act.

The process for this mitigation is generally proposed to be managed through the implementation of a Ecological Management Plan (ECOMP) (relevant sections attached to Appendix A of Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*)[4].

This process provides for the collection of lizards from the construction areas prior to and throughout vegetation clearance, for identification of suitable habitats for relocation of lizards, including (if necessary) the planting of areas within the network and habitat enhancement, pest management and post release monitoring. Suitable habitat has been identified in reserve areas (e.g. at Harbutt Reserve and Heron Park, subject to Auckland Council Approval) and within the State highway network (e.g. SH20 south of Maioro Interchange). It is noted that, for Harbutt Reserve, additional habitat enhancement to account for the existing skink population would be warranted (again subject to agreement by the [Auckland Council]).

16.8 Other Ecological Effects

A full assessment of effects on vegetation is provided in Technical Report G.17 – No botanically notable or significant vegetation was identified

It is noted that full ecological assessments have been undertaken for the Project, including assessment on birds (avifauna), marine ecology, vegetation and freshwater. These are detailed further in the Technical Reports (see Chapter 12 for a summary of these).

The assessments of marine ecology, and freshwater are not considered relevant to this Sector. The assessment of Avifauna is part of Chapter 13, the regional overview. The assessment of vegetation (G.17 *Assessment of Vegetation Effects*), does consider vegetation in this area, report concludes that terrestrial vegetation within Sector 3 is dominated by weed species and common native species (which include plantings associated with the Motorway corridor). There is only limited development of lower fringe coastal species (marsh ribbonwood, *Muehlenbeckia complexa*, glasswort and jointed rush) identified and the areas of vegetation within this Sector are not considered to be either botanically notable or significant. As such, although the works may result in some loss of vegetation, any effect is considered to be less than minor. No further detail on this assessment is provided in this Chapter.

16.9 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.5 and G.12

The following provides a summary of the detailed assessment undertaken in Technical Reports G.5 *Assessment of Construction Noise* and G.12: *Assessment of Operational Noise Effects*. There are not considered to be any significant effects relating to operational noise within this Sector, therefore this has not been discussed further.

[4] A separate approval process will be required under the Wildlife Act for the lizard relocations.

16.9.1 Existing Environment

The existing noise environment is dominated by traffic noise from SH16, Rosebank and Patiki Roads. The only affected receivers are light-industrial businesses, which are not considered noise sensitive and are not classified as protected premises and facilities by NZS 6806: Acoustics – Road-traffic noise – New and altered roads 2010 (NZS 6806).

16.9.2 Assessment – Construction

The noise generated throughout this Sector of the Project will occur from the construction of four different elements:

- The Rosebank Road off ramps and road widening – It is anticipated that construction will result in up to 80 $L_{Aeq\ (T)}$ dBA due to pad footing construction, which will take place over a 24 hour period for approximately 6 months;
- The Patiki Road Cycle Bridge – It is anticipated that construction will result in up to 63 $L_{Aeq\ (T)}$ dB as a result of the earthworks and retaining wall construction.;
- The Rosebank Park Domain access road – It is anticipated that construction of the access road will result in up to 58 $L_{Aeq\ (T)}$ dB; and
- Construction Yard 2 (Patiki Road) - which will operate over a 24 hour period, and will produce up to 54 $L_{Aeq\ (T)}$ dB of noise.

Noise levels within this Sector will affect only industrial receivers which are generally less sensitive to noise than residential properties. Average noise levels from construction are predicted to generally comply with the noise guidelines from the New Zealand Standard for Construction Noise 1999 (NZS 6803) , however where construction occurs close to receivers, these noise levels may be marginally exceeded.

Night-time construction is preferential in this area, as activities within the Rosebank Industrial area which are more sensitive to noise (such as administration areas) are less likely to be in operation during the night-period. Only the pad footing preparation is likely to exceed the noise guidelines for industrial areas and only where this occurs close to receivers; the average level of noise will not exceed the guideline. It is recommended that good communication is maintained with surrounding businesses when pad footing is occurring close by and that issues are addressed on a case by case basis.

16.9.3 Mitigation – Construction

General noise mitigation measures are contained within the Construction Noise and Vibration Management Plan (CNVMP) (Appendix C of Technical Report G.5 *Assessment of Construction Noise Effects*). This includes consultation and general construction practices and general noise management and monitoring. In particular it is recommended that good communication is maintained with surrounding businesses when pad footing is occurring close by so that any issues are addressed on a case by case basis.

16.10 Vibration

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of vibration effects. The following is a summary from this report, as it relates to Sector 3.

A full assessment of vibration effects is provided in Technical Report G.19

16.10.1 Existing Environment

The existing environment is an urban environment, dominated by SH16 and the Rosebank business environment. While this Sector has no sensitive residential receivers, it is acknowledged that offices can also be sensitive to vibration. A representative commercial receiver at 702 Rosebank Road (located approximately 36m from SH16) was surveyed and achieved a mean ambient Peak Vector Sum (PVS) (mm/s) of 0.3 and a maximum PVS of 0.95mm/s. This ambient vibration level is considered to be low.

16.10.2 Assessment – Construction

The key vibration source for construction in this Sector is considered to be vibratory rollers used for road construction. In general, sensitive receivers (two properties) have been classified as having a low to medium risk of non-compliance with the German Standard Structural Vibration - Part 3: Effects of Vibration on Structures (DIN 4150-3:1999) project criterion based on their distance from the vibration source.

In respect of construction vibration, perception effects are primarily related to the concern that people may have over the potential for damage to their buildings. On this basis, the assessment of effects has focussed on standards or criteria that are intended to avoid superficial damage to buildings[5].

[5] It is noted that significantly greater vibration levels would required before vibration caused any structural damage to buildings.

16.10.3 Mitigation – Construction

Vibration during construction will be managed through the implementation of the CNVMP (Appendix K of Technical Report G.19 *Assessment of Vibration Effects*)[6]. This includes:

- Undertaking vibration monitoring, particularly during activities predicted to cause high levels of vibration; and
- Implementing the CEMP complaints procedure, including a 24 hour hotline.

It is considered that with the implementation of the CNVMP, the vibration effects of the Project during construction will be no more than minor.

A full assessment of effects of stormwater management is provided in Technical Report G.15

16.11 Stormwater

The following provides a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

16.11.1 Existing Environment

There is little if any effective quality treatment of stormwater from the existing motorway

The existing catchment within Sector 3 drains to the landward (southern) and seaward (northern) side of the tidal flats and channels and is mainly an industrial urban area.

The existing stormwater system includes:

- At the Rosebank Road Interchange, stormwater reticulation systems intercept surface runoff from the ramps. Stormwater is treated through four settlement tanks (one for each ramp), before being discharged into the tidal mangrove flats;
- On SH16 in the westbound direction, from Patiki Road to the western side of the Rosebank Park Domain, stormwater is collected by standard cesspits, connected to the reticulated network, before being discharged into the CMA on the eastern side of the Rosebank Park Domain Raceway. There is no evidence of any stormwater quality treatment; and
- Pavement drains are also located on the outer edge of both carriageway shoulders, discharging typically at 100m centres, either directly into the tidal streams and mangroves or to a stormwater cesspit.

Apart from the four existing settlement tanks at Rosebank and Patiki Interchanges, there is little if any effective quality treatment of stormwater from the existing motorway within this Sector.

[6] It is noted that pre-construction and post construction building condition surveys are also identified for 'at risk' buildings, services and structures (which are those identified to be of 'high' risk). This is not relevant to this Sector.

16.11.2 Assessment – Operation

Filter cartridge vaults proposed for treatment

In this Sector, space constraints adjacent to the proposed carriageway means that there is no appropriate location for a wetland, wet pond, filter strips or swales. Therefore, it is proposed that stormwater be collected by a combination of slot drains, dish channels and/or catchpits and piped to filter cartridge vaults for treatment, before being discharged into the CMA. Five cartridge vaults are proposed in this area. The outfalls will be concrete wingwalls, integrated into the rock armour revetment with an additional rock apron as necessary along the edge of the wingwall.

100% of the impervious area will be collected and treated

Following completion of the Project, 100% of the impervious area within this Sector will be collected and treated prior to discharge to the receiving environment. This treatment will be be up to 80% efficient (for the average annualised removal of total suspended solids).

As a result of this proposed treatment, the water quality effects of stormwater discharge on the receiving environment have been appropriately minimised. Further, notwithstanding that there will be a greater volume of stormwater discharged from impervious surfaces, the treatment proposed will result in a reduced effect (lower contaminant discharge or higher water quality levels) than the current discharges in this Sector given that there is currently little or no treatment. This is considered a beneficial environmental effect from the Project.

16.11.3 Assessment – Construction

A temporary stormwater pond will treat construction runoff

During construction, the four settlement tanks currently treating runoff from the four ramps will require demolition to provide for the widened road. In order to ensure that this runoff continues to be effectively treated throughout construction, it is proposed to intercept the piped system at the bridge abutments and route this to the temporary stormwater pond located on the southern side of the motorway. The temporary stormwater pond will be used until the permanent stormwater treatment devices are in place. The temporary stormwater pond will be modified from the erosion and sediment discharge control pond and will also treat runoff from Construction Yard 2 (Patiki). This pond will discharge to the tidal flats of the Whau River.

The Auckland Regional planning documents provide direction that water quality treatment design in construction should seek to remove at least 75% of the suspended solid loads for areas of runoff. During construction, areas of construction for the Project will be 100% treated in accordance with the standards of the Regional Plan (TP10 standards).

The proposed stormwater treatment during construction meets the requirements of the Auckland Regional planning documents (including the PARP: ALW). In this regard, it is considered that the effects of stormwater have been appropriately minimised (the residual effects of contaminant discharges are addressed further in the relevant ecological assessments).

16.11.4 Mitigation – Operation

Ongoing maintenance of stormwater systems proposed

The proposed treatment devices will increase the level of existing stormwater treatment from SH16 which is considered an enhancement of the Project[7].

In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (OSMP) (Appendix D of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

16.11.5 Mitigation – Construction

All temporary stormwater treatment devices will be implemented and maintained in accordance with the Temporary Stormwater Management Plan (Appendix E of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan*. (ESCP)

16.12 Land Contamination

The following provides a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. Given the nature of contaminated materials, this assessment only looks at construction effects.

16.12.1 Existing Environment

Land use in this area is predominantly commercial and industrial. Historically, the land use within this Sector (pre-1970s) was mostly horticulture. There are many sources of contamination from the adjacent industrial land use.

[7] These works are identified as an 'off-set' to other ecological effects associated with the Project.

The area includes historic refuse dumping and levels of heavy metals were identified

Intrusive investigations were undertaken to determine the existing quality of soils and groundwater, the potential for any existing contamination to be disturbed during construction activities, and the potential human health risks for workers and the wider public outside the construction footprint. The Stage 1 desk study identified an area of potential concern to the west of the Rosebank Road interchange. This area was marked on the geological map as "refuse" suggesting the area could contain waste materials of unknown origin or composition. Therefore, the intrusive investigation targeted this area. These investigations confirmed the following:

- The underlying geology includes fill (in places) overlying Tauranga Group alluvium. The fill consists of reworked natural materials with fragments of brick and concrete encountered at one location;
- Three samples had levels of heavy metals (nickel and zinc) above the 'permitted baseline' levels for land disturbing activities (as defined by Rules in the PARP:ALW); and
- No samples exceeded the human health criteria (commercial/ industrial).

Based on the analysis, approximately 43% of the material in this area is classified as potential 'cleanfill'. This means that it could potentially be reused on site (with the remainder 57% considered to be 'managed fill' requiring disposal offsite).

16.12.2 Assessment – Construction

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for the wider community and for workers on the site). The results of the survey indicate two areas where potential effects are considered to warrant specific management:

- Given the exceedance of the 'permitted baseline' levels for nickel and zinc at four locations, measures are required to be put in place to ensure control off-site migration of contaminants and minimise the exposure of construction workers to potentially contaminated soils; and
- Where materials excavated do not meet the criteria of 'clean fill', it is proposed that it be disposed of as managed fill.

With the above management measures in place, it is considered that the effects of construction works on contaminated land are appropriately managed so that adverse effects are avoided.

16.12.3 Mitigation – Construction

All construction activities to be undertaken in accordance with a Contaminated Soils Management Plan

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils to put at risk workers and the wider public and the environment.

In particular, it is proposed all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) (see Appendix O of Technical Report G.9: *Assessment of Land and Groundwater Contamination*) and a Site Health and Safety Plan. These Plans will form part of the overall Construction Environmental Management Plan (CEMP).

The CSMP has been developed for the Project and is provided in Appendix O of Technical Report G.9: *Assessment of Land and Groundwater Contamination*. It identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

If unexpected contamination is identified, then it is considered that the procedures set out in the CSMP, will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

17. Assessment of Effects – Sector 4

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 4. Works in this Sector are related to widening and raising the Causeway (including reclamation), widening the Causeway Bridges and construction of a new pedestrian/cycle way bridge. Stormwater treatment is also proposed.

The main receiving environment in this Sector is the Waitemata Harbour. Traherne Island and Pollen Island are important ecological areas located adjacent the Causeway. The proposed widening will result in reclamation of the coastal marine area (CMA), the permanent occupation of the CMA, temporary occupation of the CMA and subsequent remediation of the marine ecological habitat. Key environmental impacts in this area relate to the CMA as a receiving environment, and particularly the impact of the permanent loss of habitat associated with the works. These effects are off-set by the improved stormwater treatment, habitat remediation and other avoidance and mitigation proposed.

Other key impacts relate to other ecological values of the area. For example, rare vegetation (*Mimulus repens*) will require relocation and there are potential impacts on bird and lizard populations using the CMA surrounding the Causeway. Overall, through the remediation and mitigation proposed, it is considered that these effects can be avoided or adequately mitigated.

The potential impacts on the existing SH16 and its operation (as key regional/national infrastructure) is also identified as a key issue. Careful construction management is proposed to mitigate effects on this resource.

While the Causeway traverses an 'urban' environment, residential dwellings and communities are set back from the Project through this Sector (e.g. on the southern side by the Waterview Estuary). To this end, the effects of emissions on human receptors (e.g. noise) are not considered to be an issue.

17.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 4. As described in Chapters 4 and 5, the main elements of the Project that will be located within Sector 4 are:

- Realignment of channels to mitigate coastal process impacts associated with the proposed widening of SH16 (eg. within the Waterview Estuary and Oakley Inlet);
- Reclamation of the SH16 Causeway (raising and widening the Causeway); and
- Widening the Causeway Bridges and construction of new pedestrian/cycle way bridge.

Reclamation, Occupation, Disturbance and Vegetation removal required in the CMA

The Project includes: reclamation (≈4.2ha), permanent occupation (≈2.68 ha (0.41ha of total occupation is aerial occupation)), temporary occupation (≈5.66ha (0.11ha of total occupation is aerial occupation)) and remediation of marine ecological habitat (≈1.2ha) (disturbance) in the CMA. There is also a requirement to remove of vegetation (mostly for the works identified above, but also for mitigation to enable natural reformation of the Rosebank Channel). Specific details on scheme elements in this Sector are described in Sections 4.4.4.1 and 5.9.4.1 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans* (Sheets 4, 5, 6, 7 and 8 for this Sector). Details of the proposed construction of these elements are described in Sections 4.4.4.1 and 5.9.4.1 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheets 4, 5, 6, 7 and 8 for this Sector).

Key environmental impacts in this area relate to the CMA as a receiving environment and the operation of SH16 as existing key infrastructure.

As there are no residential properties in close proximity to the works, as such potential construction and operation 'emission' effects are not considered a significant issue. For example, local air quality (e.g. dust generation), lighting and noise[1].

Whilst there are no immediately adjacent sensitive receivers, operational traffic noise from the Causeway may affect noise sensitive locations in Waterview and Point Chevalier. This is discussed in conjunction with the operation of the GNR Interchange in Chapter 18.

This Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter.

17.2 Land Use

17.2.1 Existing Environment

Transport infrastructure is the main landuse in Sector 4

The existing land use environment is shown conceptually in Figure 17.1 The information within this figure has been extracted from the Operative Auckland City District Plan (Isthmus Section) 1999 (Auckland District Plan). The Plans in Part F.1 *Existing Designation,* in this AEE contain further detail on existing designations and other restrictions. Key land uses in this area are the transport infrastructure (SH16) and the adjacent business land.

17.2.2 Special Purpose 3 Land Use and Designations

The Special Purpose 3 Zone (Transportation) coincides with the SH16 designation (reference A07-01) and runs from the Central Motorway Junction (CMJ) in the east to the western extents of Auckland City. The Special Purpose 3 zoning is applied to significant current or future transport infrastructure on the Isthmus. Any facility designed primarily for the movement of people and goods is a permitted activity in this zone. It is noted that the Causeway Bridges are not zoned or designated as it is within the CMA.

SH16 bisects Traherne Island, Open Space 1

17.2.3 Open Space Zone Land Use

Pollen Island is located to the north of the Causeway and Traherne Island is bisected by the Causeway. Both are zoned Open Space 1, In the Auckland District Plan. See Figure 17.1.

17.2.4 Assessment – Operation

The Project is consistent with the purpose and activities envisaged within the Special Purpose 3 Zone and therefore the land use effects are neutral.

17.2.4.1 Impacts: Open Space Zone

Traherne Island will be physically affected by the proposed upgrading of SH16 and the widening of the pedestrian/cycle way. This take represents a widening for the activities that already exist on this land parcel. In respect of land use, the Project is therefore considered consistent with the current use of the land and consequentially the impacts are considered no more than minor (notwithstanding ecological issues associated with this land take discussed elsewhere in this Chapter).

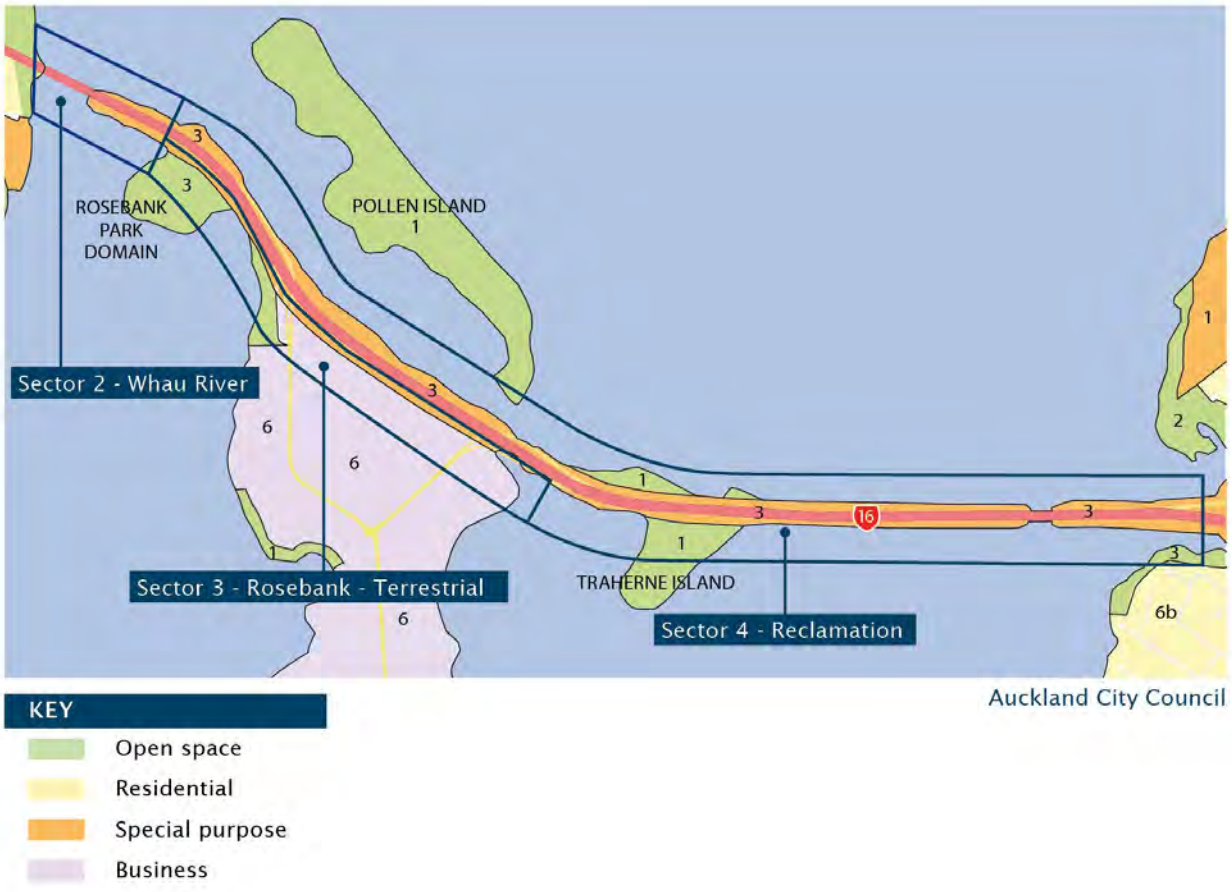


Figure 17.1 Land Use Zones Sectors 2-4 (Not to Scale)

17.2.5 Mitigation - Operation

Impacts on open space land have been minimised with the design of the interchange (e.g. retaining existing ramps at Patiki and Rosebank Roads). The majority of work on land in this Sector is already designated for motorway purposes.

17.3 Transport Effects (Sectors 3 and 4)

Technical Reports G.16 and G.18 provide further detail on the assessment of transport effects

Transport effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment Transport Effects*). The following is a summary from this assessment and includes effects relating to both Sectors 3 and 4. It is noted that many of the transport effects of the Project (including those in this Sector) are wider regional transportation effects. These are discussed in Chapter 13 of this AEE.

17.3.1 Existing Environment

17.3.1.1 Existing Road Environment

The existing environment of Sectors 3 and 4 generally comprises SH16, with the interchange at Patiki Road and Rosebank Road. The existing traffic flow patterns and volumes along SH16 are described in Chapter 13 (Assessment of Effects – Regional). SH16 carries in excess of 100,000 vehicles per day (vpd).

17.3.1.2 Pedestrian/Cycling Environment

An existing cycleway exists alongside the westbound carriageway of SH16. At some points along the Causeway, the cycleway and motorway are in close proximity and separated only by a wire link fence.

17.3.1.3 Passenger Transport

There are two bus routes which run along SH16 within this Sector (one of these routes runs straight along the motorway, the other enters/exits Rosebank Road On-ramp and Patiki Road on-ramp). Bus shoulders are provided intermittently along the length of SH16 in both eastbound and westbound directions between Te Atatu Interchange and GNR Interchange.

17.3.2 Assessment - Construction

Construction traffic is not a significant impact

Works within Sector 3 and 4 are planned to be constructed over four phases and include reclamation rising and the widening of the SH16 (and the existing Causeway bridges). This work will be undertaken under a combination of long term road realignments and night time closures. The Rosebank bridge works will take place in conjunction with the Causeway widening.

Construction works have the potential to impact on the transport network

The potential effects of construction traffic associated with the works in Sectors 3 and 4 are assessed in Technical Report G.18. While the absolute increase in traffic volume as a result of the Project (e.g. compared to the existing traffic volumes) is considered minor, the temporary traffic management measures associated with the construction works has potential for adverse effects on the transport network. These impacts include reduced capacity resulting from lane closures, restrictions in speeds and physical access restrictions. From a network perspective, these effects are represented in increased delays in travel times on SH16 and potentially the wider network.

17.3.2.1 Effects of Realignment and Narrowing of Lanes

During the works it is expected that the existing number of lanes on the motorway will remain operational throughout the works (though some night closures of lanes may be required, under managed conditions).

To accommodate the works, the carriageway will need to be narrowed to a minimum of 3.35m lanes and 0.3m (current lanes are 3.5m and shoulders are between 1-1.5m) and the motorway speed will be lowered to 80 kph during works. It is expected that SH16 will be realigned by re-marking lanes and installing safety barriers to open up work zones and allow off-line site construction. The four phases are summarised in Table 17.1 with the proposed realignment/narrowing noted during each phase.

Table 17.1: Realignment/Narrowing of Lanes during Construction Phases in Sector 3 and 4

Phase	Realignment/ Narrowing
1	Works occur to the north of SH16, with SH16 eastbound shifted to the median to provide working space. The work zone extends partly along Patiki off-ramp, and the off-ramp will be narrowed and a minor realignment installed to facilitate works between the mainline carriageway and the off-ramp.
2	Minor realignment of SH16 eastbound in the vicinity of the Whau River Bridge (Sector three) where the left hand lane is separated onto the newly constructed bridge segment (bull-run).
3	Works occur to the south of SH16, with SH16 westbound shifted to the median to provide working space. The work zone extends partly along Patiki on-ramp, and the off-ramp will be narrowed and a minor realignment installed to facilitate works in the area between the mainline carriageway and the on-ramp. The SH16 eastbound traffic over the Rosebank bridge will operate under a contra-flow arrangement.
4	Involves work in the median permitted by Phase 1 and Phase 3 works on the outside shoulders of SH16.

17.3.2.2 Effects arising from Temporary Closures

Some closures will be required to facilitate works

Some closures will be required to facilitate works (eg. lifting of bridge decks or road surfacing) to minimise impacts on traffic using SH16, it is proposed these works be done at night. The potential closures relate to the works on Patiki Road and Rosebank Road interchanges. Lane closures will be planned so that traffic demands can be accommodated by the remaining capacity. It is anticipated that any activity requiring closures will be able to be facilitated under two lane closures. Therefore, the effects are no more than minor.

17.3.2.3 Effects on Pedestrians and Cyclists

The existing pedestrian/cycle link will be maintained throughout works in this area until such a time that the new pedestrian/cycle way bridge is constructed. As access will be maintained, impacts to pedestrians and cyclists are expected to be negligible.

17.3.2.4 Effects arising from Construction Site and Work Site Access

The majority of the works will be undertaken adjacent to the motorway lanes. In order to minimise effects on traffic using SH16, the access points will not be in operation during peak hour times at Te Atatu Interchange.

The works in this area will primarily use Construction Yard 1 accessed from either Te Atatu Road (north of SH16) or SH16 Eastbound. It is recommended that access is located as far east as practicable so as to minimise interaction between site vehicles and the more sensitive areas to the west along the Whau River Bridge and Te Atatu Interchange. It is preferable that site accesses provided off SH16 are provided between the Patiki and Rosebank Interchanges, provided adequate sight distance can be provided.

17.3.2.5 Effects on Public Transport

Some effects on the operation and performance of buses during construction

It is expected there will be some effects on the operation and performance of buses during works within this area. The existing bus shoulders on SH16 eastbound will be removed during the first two phases of works, which will mean that buses will lose approximately 3km of free-flow speeds through the site during congested periods. This is approximately 75% of the bus priority facility provided through this Sector. Given the relatively short duration of the closure (e.g. in the order of six to 12 months), this is considered a moderate effect.

17.3.2.6 Effects on Property Access and Parking

The existing access road to the Rosebank Park Domain (in Sector 3) will be affected by the SH16 widening works, and the provision of a new separate cycleway. Therefore, a new two lane access road will be constructed for permanent operation (1 lane in each direction). This provides an improved vehicle access to the Rosebank Park Domain, whilst retaining the existing access arrangements for this road off Patiki Road.

17.3.3 Mitigation – Construction

Construction Traffic Management Plan

Traffic management methodologies will be employed during the construction period to manage the effects created by construction work sites and construction of the Project. Typical mitigation and management measures are outlined in the Construction Traffic Management Plan (CTMP) (as appended to Technical report G.16 *Assessment of Temporary Traffic Effects*). An overview of the CTMP is provided in Section 13.3.4 of this AEE).

Site Specific Traffic Management Plans

Traffic management for specific areas of the construction site will be formed and agreed within Site Specific Traffic Management Plans (SSTMP's). In particular, in this area, the following mitigation measures include:

- Construction planning over four phases, to allow works to be undertaken offline, and existing number of lanes to be maintained throughout the construction period for peak periods;

- Maintain pedestrian/ cycle way access throughout the construction period;
- The use of temporary lighting and safety barriers to separate traffic from the construction works;
- Limiting access to work zones on SH16 at Te Atatu Interchange to outside peak hours; and
- Controls for access to/from construction yards (eg. sight distances and access separations).

17.4 Cultural Impacts

17.4.1 Existing Environment – Iwi with Manawhenua

Te Kawerau a Maki and Ngati Whatua have manawhenua status

Te Kawerau a Maki and Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Auckland (west) and in this Sector. In this regard, these Iwi have a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

17.4.2 Assessment of Cultural Effects

17.4.3 Cultural Effects – Te Kawerau Iwi Tribal Authroity

Specific comment has been sought from Te Kawerau a Maki Iwi Tribal Authority. At the time of writing this AEE, comment had not been received.

17.4.4 Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua o Orakei identifies the mauri, amenity and ecological health of the coastal environment. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects. Ngati Whatua o Orakei support the improvement of this environment through 'careful design and enhancement works', and believe that water must be managed holistically and nurtured as a living entity. Ngati Whatua o Orakei believe that the improvement of this environment would provide benefits to tangata whenua (as kaitiaki, caretakers and advocates for this environment, and to make use of natural resources from the harbour).

Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE, no further comment had been received.

17.4.5 Mitigation of Cultural Effects

Cultural issues identified have influenced Project design and mitigation

Ngati Whatua o Orakei have made a series of recommendations relevant to the SH16 widening Project:

- Stormwater treatment: The Project proposes treatment of all stormwater from new motorway surfaces, and some currently untreated areas along the existing SH16 (design is based on ARC TP10);
- Minimising visual impacts (eg. by keeping the Causeway as close to sea level as possible and minimising vertical structures): This has been incorporated into the Project design; and
- Mitigation weed removal and replacement planting in the Motu Manawa (Pollen Island) Marine Reserve (MMMR) within the Project corridor: This has been incorporated into the Project, via the proposed restoration, weed control and revegetation measures within the marine reserve area (see Chapter 13 for an assessment of the regional marine environment).

17.5 Landscape and Visual Effects

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides an assessment of the landscape and visual effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

17.5.1 Existing Environment

17.5.1.1 Motorway Environment

There are expansive views from the Causeway

Presently, this Sector is dominated by two features: the Causeway and the coastal water either side of the Causeway. The Causeway is low-lying and currently accommodates three lanes of traffic in either direction. The structural profile of the Causeway is amplified by a concrete barrier running down the central median and a dedicated cycle lane running along its southern edge, separated from the motorway with security fencing. The motorway remains reasonably open within this Sector.

Expansive views are obtained across both the inner harbour and Waterview Estuary when travelling through this section of SH16, Rosebank, Te Atatu and Point Chevalier Peninsulas, and the Waitakere Ranges, adding more substance and diversity to these views. Rangitoto, Kauri Point and Auckland City also offer interest when travelling towards the Auckland Isthmus. These open views are counterbalanced by the experience of being more enclosed and contained by vegetation around Traherne and Pollen Islands, as well as the elevated Rosebank Domain.

Much less appealing and less natural, however, is the approach to the Rosebank Peninsula which is largely defined by the industrial and commercial activity running along the southern side of the highway corridor. This is reinforced very clearly by the signage, colouring of cladding and other 'branding' of such development, and the existing motorway structures within the area. The interchange ramps at Patiki Road are a strong built feature of this environment. However, those travelling on these structures have offered views over the inner harbour and CBD skyline, in a positive sense.

17.5.1.2 Landscape Environment

The MMMR is located near the mouth of the Whau River estuary, and is generally aligned in a north-south direction. It is one of the few unmodified estuarine areas (north of the Causeway) remaining in the Upper Waitemata Harbour, covering some 500ha of intertidal mudflats, tidal channels, mangrove swamp, saltmarsh and shell/chenier banks. Both Pollen Island and, to the east, Traherne Island comprise bird feeding ground and roosting habitats and their margins are identified as being an Outstanding Landscape (Rating) in the Auckland Regional Plan: Coastal (ARP:C) (see Appendix E.2: *Planning Maps*).

17.5.1.3 Volcanic Sightlines

Proposed Change 8 of the ARPS includes a sightline (reference A13) that extends from an origin point on the SH16 carriageway immediately west of the Te Atatu Interchange to the flanks of Mount Albert.

17.5.2 Assessment - Operation

Visual and landscape effects in relation to the proposed Causeway are considered to be low

The visual catchment and related audiences potentially affected by the Project have been identified for the assessment of landscape and visual effects. In this Sector, 14 public realm viewpoints and 4 private residential view points were assessed.

Visual and landscape effects in relation to the proposed Causeway are considered to be low. Although widening and elevation of the motorway Causeway will increase the magnitude of the Causeway, few locations (if any) investigated in close proximity to the motorway will be significantly affected by the Project. Most viewing points are typically high enough to prevent view obstructions without revealing the increased width of the Causeway.

Once filter strips and rock armouring is place, the reclamation will have a profile and appearance similar to that of the existing Causeway. The long term impact on landscape and visual values are minor. Proposed planting (see F.16 *Urban Design and Landscape Plans*) within Traherne Island, as well as other sections of the motorway will further reduce the profile of the Causeway and the wider motorway corridor.

17.5.3 Assessment - Construction

In the short term, the construction effects will be highly visible

The Causeway is located in a very exposed and visually sensitive part of the coastal environment. In the short term, the construction effects of reclamation, motorway reconfiguration and remediation will be highly visible to a number of residential and public receiving environments, until the process of rock armouring and filter strips are completed. Existing coastal planting and industrial land uses along Rosebank Peninsula will assist in screening parts of the motorway at the Rosebank Peninsula end of the motorway. However, construction effects in relation to visual and landscape are considered to be more than minor (though temporary in duration).

17.5.4 Mitigation Measures - Operation

F.16 Urban Design and Landscape Plans

It is recommended that the Causeway views and the general outlook be kept as open as possible to maximise exposure to, and the feeling of connection with, the Waitemata Harbour. The northern and southern edges of the Causeway will, however, be subject to differing treatments: the northern edge will be bound by a double layer of rock armour and kept free of planting (other than grass) in order not to compromise its wave dissipation function, whereas the Causeway's southern edge (bound by a single layer of rock armour) will be planted with marginal saltmarsh species (refer F.16 *Urban Design and Landscape Plans)*.

At Traherne Island a mixture of planting (refer F.16 *Urban Design and Landscape Plans)* is proposed along the edge of the carriageway, designed to support the ecological enhancement of this feature. This will result in the motorway corridor feeling partially enclosed – in contrast with the much more open Causeway experienced further to the east, when crossing the more open Waterview Estuary. Similar treatment is also proposed along the northern edge of Rosebank Peninsula adjacent to Pollen Island, and from Patiki Road through to the Rosebank Park Domain. The area immediately adjacent to industrial premises between Rosebank Road and Patiki Road cannot be planted due to space restrictions.

17.5.5 Mitigation Measures - Construction

The nature of works required for the reclamation limits the ability to mitigate the visual effects of the construction.

17.6 Coastal Processes

A full assessment of effects on coastal processes is provided in Technical Report G.4 and wider overview in Chapter 13

The following provides a summary of the detailed assessment undertaken in Technical Report G.4 *Assessment of Coastal Processes* (Chapter 4 in particular). The impacts of both construction and operation of the Project on wider coastal processes is provided in Chapter 13 of this AEE, which focuses on Region and Project-wide effects.

17.6.1 Existing Environment

The Causeway runs across the Waitemata Harbour from Great North Road Interchange to the Whau Bridge. The seabed material generally consists of sand and fine grained sediment (muds and silts). The Waterview Estuary and Oakley Inlet discharge into the Waitemata Harbour at the eastern extent of the Causeway. Both have been heavily modified by the original Causeway construction.

The CMA surrounding Pollen Island on the northern (seaward) side of the Causeway is largely unmodified. The upper-intertidal morphology and associated chenier (shell) ridges have been relatively stable throughout the last 60 years.

The soffit level of the existing Causeway bridges is low, such that there is no navigable span channel beneath the bridges, for other than small pleasure boats (e.g. kayaks).

17.6.2 Assessment – Operation

On completion of works in this Sector :

- The Causeway will be widened by an additional 20-25m;
- The Causeway bridges will be raised and widened, which will require additional piles in the CMA; and
- A new pedestrian/cycle way bridge will be provided to the south of the Causeway Bridges. This will have 4 additional piles in the CMA.

The extent of reclamation in this Sector is shown on Plan Set F.18 and the area of permanent occupation in the CMA is shown on Plan Set F.13(Part F of this AEE.). In this area, total reclamation is 4.2ha and the permanent occupation area is some 2.68ha (including the existing Causeway bridge (0.41 of this is aerial occupation)).

17.6.2.1 Reclamation

The proposed widened reclamation is not expected to change the flow regime of the Waitemata Harbour. Most of the reclamation will be located on elevated intertidal areas that are only inundated around high tide periods.

Proposed widened reclamation is not expected to change the flow regime of the Waitemata Harbour

It is anticipated that there will be only minor adjustments to the intertidal geomorphology, particularly on the northern Causeway toe-line. This will occur over a period of months as waves and tides re-work seabed sediments. Mitigation works are proposed to address the effects of these anticipated changes. These are set out in Section 7.6.5.

17.6.2.2 Causeway Bridges

The widened Causeway Bridges and the new pedestrian/cycleway bridge are not expected to have any significant effects on recreational boating (i.e. kayaks) as the flows are parallel with the pier groups. Because of low soffit levels under the existing bridges, passage by powered vessels is already limited.

The design and spacing of the additional piers will ameliorate any potential operational effects

The design and spacing of the additional piers within the CMA (parallel to the existing pier structures) will ameliorate any potential operational effects on physical coastal processes in Oakley Inlet. Although the pier groups are skewed to the tidal flow, the overall effect of these structures on hydrodynamics and geomorphology is expected to be no more than minor. This takes into account the effect of wakes, scour and tidal flushing.

17.6.3 Assessment – Construction

The construction activities require:

- Approximately 5.66ha of temporary occupation of the CMA adjacent to the Causeway and the Causeway bridges to provide sufficient working space;
- Temporary staging platforms will be used adjacent to the Causeway Bridges to enable the works to be undertaken offline. The temporary staging platforms will require 52 piers in the CMA;
- Realignment of three sections of channel within the Waterview Estuary and Oakley Inlet; and
- Temporary damming within the CMA for construction works (eg. coffer dams of the causeway).

Plan set F.18 shows the temporary occupation required in the CMA. The channel realignments are shown on Plan Set F.2 (see Part F of this AEE.)

17.6.4 Temporary staging platforms and occupation of the CMA

To enable construction of the widened Causeway Bridges and new pedestrian/cycleway bridge, temporary staging platforms on piles will be erected on both sides of the Bridges. There will be 22 temporary piles to support the northern staging platform and 30 piles to support the longer southern platform. These piles will occupy approximately 15m^2 of the sea floor area within the CMA.

The flow under the Causeway Bridges is essentially parallel to the orientation of the pairs of temporary piles, apart from the converging flows on the sides of the main channel through the piles adjacent to the abutments.

Overall, the flow volumes passing through the channel on ebb and flood tides would be much the same as present and any changes to tidal flushing of the Waterview Estuary and Oakley Inlet would be negligible. Most of the shoreline in the immediate vicinity of the bridges is

comprised of bridge abutments or causeway revetments so no additional bank erosion from installation of the temporary staging is expected. However, there may be some minor scouring of the inter-tidal mud banks to the south of the bridge abutments from the end groups of piles where the channels converge toward the outlet channel from Waterview Estuary and Oakley Inlet.

This is expected to be minor with flow velocities smaller on the edge of the channels and decreasing with the onset of high tide.

17.6.4.1 Channel realignment works

There will be a no more than minor change to the flow regime within the Waterview Estuary and Oakley Inlet

There will be a no more than minor change to the flow regime within the Waterview Estuary and Oakley Inlet as a result of new and widened structures compared to the existing environment. This takes into account the effects of wakes, backwater effects, scour and tidal flushing. The potential effects from discharge including potential discharges of sediments and contaminants sourced from Oakley Creek will be no more than minor due to the existing background water quality including turbidity.

Three separate channel realignments (2 in Oakley Inlet and 1 in the Waterview Estuary) are proposed to mitigate potential hydrodynamic and geomorphological effects of the existing channels being in-filled by reclamations to widen the Causeway, with these channel-realignment options the physical effects from construction or permanent occupation is assessed as no more than minor.

17.6.4.2 Disturbance

A temporary coffer dam will allow construction to be undertaken throughout all tides and create a dry working area

Over the majority of the length of the Causeway and other reclamation sites, ground improvement works will be required. It is proposed that this be undertaken using mudcrete, which is formed by injecting and mixing cement in situ into the existing fine sediment substrate of the CMA. This method avoids excavation of the contaminated sediment and reduces potential for adverse environmental effects from discharges. Any contaminants within the sediment are also 'locked up' within the mudcrete. There is however potential for some disturbance of sediment due to vehicle and plant movement and general works.

This construction methodology will require the use of a temporary coffer dam to allow construction to be undertaken throughout all tides. The coffer dam provides a dry working area and also serves as a sediment control measure. Installation and dismantling of these 'dam' elements, will be undertaken outside tidal inundation periods (eg. high tide) to minimise the discharge of suspended sediments to the receiving waters.

Works within the CMA will be undertaken in accordance with erosion and sediment control measures designed in accordance with TP90 (as set out in Technical Report G.22 *Erosion and Sediment Control Plan*).

In addition, any disturbances or discharges into the Waitemata Harbour will be rapidly naturally diluted, thus effects will be minimal outside a zone of reasonable mixing. Overall any disturbance of in-situ sediments and discharges of suspended sediments during construction are likely to be less than minor.

17.6.4.3 Chenier deposits

Small areas of chenier deposits are located in the area of permanent reclamation at the north western end of the causeway. These will be excavated, stockpiled and repositioned following completion of the works.

Chenier deposits will be stockpiled to be relocated

17.6.5 Mitigation – Construction

During construction, most of the potential effects will be able to be avoided through design, this includes:

- The implementation of erosion and sediment control measures, in accordance with ARC's TP90. With the implementation of these measures (and allowing for reasonable mixing of any discharges of like sediments (i.e. similar sediments to those already contributing to turbidity)), it is considered that the physical effects and aesthetic effects of discharges from disturbance activities are minor (Refer Technical Report G.22 *Erosion and Sediment Control Plan* (ESCP));
- Stormwater control measures designed in accordance with ARC's TP10 guidelines will manage the sediment and contaminant load entering into Oakley Creek and then ultimately discharged into the CMA (refer Technical Report G.15 *Assessment of* Stormwater *and Streamworks Effects*);
- The use of temporary coffer dams or sheet pilling will be used to maintain dry working areas over the construction period;
- Installation of coffer dams outside areas of tidal inundation;
- The layout and size of piles that are proposed to support the temporary staging platforms have been designed to minimise the number of piles and hence minimise the effects of piles on flow resistance;
- Given the importance of tidal-drainage channels for wetlands, encroachments and reclamations into these drainage channels have been avoided by adopting vertical retaining walls to support the widened carriageway;
- While the use of managed excavations for new by-pass channels will cause seabed disturbance and some sediment discharges, these would be much smaller and contained than the alternative of leaving natural erosion processes to form a new channel, generating substantial sediment discharges in the transition period;
- The use of steel casings for permanent piers will minimise discharges during excavations of the seabed sediment prior to in-situ casing; and

- Minimising the loss of chenier ridges (shell deposits) affected by the permanent reclamation. These areas will be excavated, temporarily stockpiled, and after completion of the revetment works, replaced on the beach in front of the new reclamation at the same geographical locations. Waves during high spring tides will eventually sort the shells back towards an equilibrium beach profile and re-build the chenier ridge.

A full assessment of effects on the marine ecology is provided in Technical Report G.6

17.7 Marine Ecology

The following provides a summary of the detailed assessment undertaken in Technical Report G.6 *Assessment of Marine Ecology Effects*. A description of the marine ecology from a regional and Project wide perspective is provided in Chapter 13.

17.7.1 Existing Environment

The marine ecological features contained within this Sector include mangrove forest, saltmarsh, shellbanks, intertidal mudflats and sandflats, subtidal soft muds and man-made rocky shore (existing rock revetment).

Ecological values on the northern side of the Causeway within Sector 4 are considered high to moderate

The ecological values on the northern side of the Causeway within Sector 4 are considered high to moderate. The interface between the mown grass edge seaward of the existing Causeway and the saline habitat comprises a mixture of native and exotic vegetation and an accumulation of rubbish and debris. Seaward of this interface area, dependent on the hydrology of the area and the sediment characteristics, the vegetation often grades into coastal marsh species and then into mangroves. On the western side of Pollen Island there are ecologically important drainage channels present that strongly influence the surrounding resident ecology. Chenier shellbanks are present on and around Traherne Island and the sandflats.

On the northern side of the Causeway there is higher diversity of marine invertebrates in the immediate estuarine environment due to the more diverse habitats in this area. Ecological values in this area are considered to be high to moderate.

The southern side of the Causeway, between the Whau River Bridge and eastern end of Traherne Island, has high to moderate ecological values. Vegetation in this area grades from grass (containing a mix of native saltmarsh and shrub species and exotic/weed species) to saltmarsh species at the base of the slope/rock armouring, through to low stature mangroves. Estuarine inverterbrates in this area comprise predominantly mud crabs, mud snails, polychaete and oligochaete worms.

Eastward of Traherne Island extending to the mouth of the Oakley Inlet, the sediment largely comprises soft deep mud flats, which supports a less diverse benthic fauna. This area has been extensively modified, particularly from the construction of the existing Causeway and bridges. In addition, sediments in this area have a higher concentration of contaminants. Ecological values in this area are considered to be moderate to low.

Overall, the ecological values within this Sector are variable

Overall, the ecological values within this Sector are variable, with a generalised trend of decreasing ecological value with increasing proximity to the Causeway and mouth of the Oakley Inlet.

17.7.2 Assessment Operation

The main potential effect during operation on marine ecology is considered to be as a result of stormwater discharges from SH16, which may contain elevated levels of suspended sediments and other contaminants and reclamation.

17.7.2.1 Stormwater Discharges

Stormwater treatment in this area is proposed to comprise a combination of cartridge filters and biofilter treatment devices (as discussed in Section 17.9 and in Technical Report G.15 *Assessment of Stormwater and Streamworks* Effects). All stormwater treatment devices have been designed in accordance with ARC TP10, with at least 80% treatment efficiency for both the removal of suspended solids and heavy metals[2]. Given the proposed treatment, the effects of the discharge on marine ecological values are considered to be less than the current situation as assessed in Chapter 13 – Regional Overview.

17.7.2.2 Disturbance Impacts

Road traffic will be closer to the marine environment in some sections of the alignment in the operational phase and therefore has the potential to increase disturbance to marine organisms, primarily from noise and vibration. However the adverse effects of this are considered negligible.

17.7.2.3 Loss of habitat – permanent

The completion of the works in this Sector will result in the permanent loss of approximately 1,400m^2 subtidal habitat and approximately 51,700m^2 intertidal habitat.

Adverse effects on marine ecological values considered to be moderate

The permanent loss of habitat will arise from:

- Reclamation and permanent occupation of the CMA for the widened Causeway, and the widened abutments of the Causeway bridges; and

[2] The efficiency of contaminant removal is based on the total suspended solids on an average annual basis.

- New piles required to support the widened Causeway bridges and the new pedestrian/cycleway bridges.

The adverse effects on marine ecological values arising from the permanent habitat loss are considered to be moderate.

17.7.3 Assessment - Construction

Sector 4 is the largest coastal sector and encompasses marine/estuarine habitats on both sides of the Causeway and the mouth of the Oakley Inlet.

The main construction activities within Sector 4 that have the potential to affect marine ecological values relate to:

- The realignment of three sections of low tide channel (two within Oakley Inlet and one within Waterview Estuary adjacent to the southern side of the Causeway Bridges);
- Raising and widening of the Causeway (reclamation);
- Widening the Causeway Bridges; and
- Constructing the new pedestrian/cycle way bridge.

These construction activities will not only disturb the marine habitat, but will also result in both permanent (discussed in section 17.7.2.2) and temporary loss of marine habitat (comprising intertidal and subtidal habitat).

17.7.3.1 Loss of Intertidal and Subtidal Habitat - temporary

A wider area of intertidal and subtidal habitat will be disturbed during construction. It is anticipated that this will be approximately 5,700m^2 of subtidal habitat and 50,000m^2 of intertidal habitat beyond the area detailed in Section 17.7.2.2 above.

The temporary loss of habitat will arise from:

- The works needed to construct the widened Causeway. These works can only be carried out while the work area is free of standing water. As such a coffer dam needs to be installed in each work area to keep out seawater. The area beneath each coffer dam, and contained within each dam that is outside of the permanent reclamation area, is considered as a temporary loss of habitat;
- Channel realignments of the Waterview Estuary and Oakley Inlet. This will involve the establishment of a temporary storage lagoon at each location to store excavated material and minimise the loss of suspended solids to the marine environment; and
- Temporary occupation of the CMA by piers to support the staging platforms.

17.7.3.2 Discharges of Stormwater

Potential for road runoff to be discharged into the marine environment

As construction progresses and greater areas of impervious surface are completed there is potential for road runoff to be discharged into the marine environment. However, temporary stormwater treatment has been designed for construction (as described in Section 17.9 and Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*). This will include a combination of sand filter trenches and grassed filter strips. It is considered that the adverse effects on marine organisms arising from the discharge of treated stormwater during construction are likely to be negligible.

17.7.3.3 Potential Discharge of Suspended Solids

Potential for construction to disturb the seabed and result in increased suspended solids in the water column

Construction activities in this Sector have the potential to disturb the seabed and result in increased suspended solids in the water column. In addition, contaminants that are bound to fine sediment particles may be disturbed during some construction activities, primarily by the channel excavation works and installation and removal of the coffer dams.

Construction activities that may generate suspended sediment include:

- Pile driving for both the temporary staging platforms and the permanent Causeway bridges;
- Ground improvement works to support the widened Causeway Bridges abutments. This will be undertaken using Marine Deposit Displacement (MDD), which includes the placement of rock onto the marine mud (with a geotextile separator) and tamping using an excavator. Tamping will be undertaken at low tide to minimise the generation of suspended sediment;
- Ground improvement works for the reclamation works. It is proposed to undertake this work within coffer dams, which will minimise the potential for suspended solids to be discharged to the environment;
- Installation and removal of the coffer dams. While the coffer dams will be used around the active work areas to allow works to be undertaken in the dry, their installation and removal may generate suspended sediment. Portable water filled temporary dams are the preferred option along most of Sector 4 as the depth of soft sediments excludes the use of sheet piling. The removal of the temporary dam will result in a temporary increase in suspended sediment. Interlocked sheet piles will be used as watertight coffer dams where the sediment does not comprise deep soft mud. On balance, it is considered that the adverse effects of the placement and removal of the coffer dams are likely to be negligible, given that they are to be used temporarily and mitigate potential discharge of sediment and cement that may cause significant adverse effects on marine ecological values; and

- Channel realignments of the Waterview Estuary and the Oakley Inlet. The realignments are required to move the low tide channels away from the permanent reclamation. It is proposed to use temporary storage lagoons at each location to contain the excavated material so that there is no loss of sediment or water from the area into the adjacent CMA.

Given the location of the works, it is anticipated that any suspended sediment generated during construction works will be readily diluted in the wider marine system, and unlikely to have any effect on marine ecology. As noted above, specific construction methods (such as the use of coffer dams and temporary storage lagoon) have been designed to minimise loss of suspended solids beyond the area of temporary occupation.

Contaminants that are bound to fine sediment particles may be disturbed during some construction activities, primarily by the channel excavation works and installation and removal of the coffer dams.

The potential to re-suspend contaminants such as heavy metals, during disturbance of the seabed is considered to be low, however, given the proposed construction methods, and the large dilution provided by the Waterview Estuary and wider harbour. As such it is considered that the adverse effects of mobilisation of existing sediment-bound contaminants from marine sediment disturbance are likely to be negligible.

Considered that the adverse effects of discharge of contaminants negligible

17.7.3.4 Potential Discharge of Cement

Several different ground improvement methods are proposed for the various parts of the widening of the embankment. The main method proposed is in-situ mudcrete, which involves reworking sediment with cement to strengthen the material. The use of cement within the marine environment poses a potential risk should cement be accidentally discharged during placement, causing an alteration the ambient pH levels.

However, the use of coffer dams around the work areas will mitigate the potential adverse effects from air borne and water borne cement. Any water contained within the coffer dams that is considered to be contaminated as a result of works will be removed by a suction truck, treated and disposed off-site.

17.7.3.5 Disturbance from Vibration and Noise

Bridge piling and vibratory rollers for road construction will be the primary source of vibration disturbance in this Sector. Given the temporary nature of bridge piling works, disturbance from vibration on marine organisms is considered to be negligible.

Noise disturbance within Sector 4 will occur during both night and day. Given that the marine organisms adjacent to the existing Causeway already tolerate a noisy motorway, it is considered that the effects of noise disturbance on marine organisms will be negligible.

17.7.3.6 Chenier Ridges

A number of dry shell banks (chenier ridges) are located on the northern side of the existing Causeway within the area of permanent reclamation. It is intended that these be removed, temporarily stockpiled and reinstated at the toe of the new Causeway embankment following completion of the works. It is predicted that wave action will reform the shell deposits into a natural profile in a relatively short period of time.

17.7.4 Avoidance and Mitigation

A range of mitigation measures are proposed to be implemented to protect the marine environment from potential sediment and contaminant discharges during construction and operation. These are set out in the Construction Environmental Management Plan (CEMP) (refer Technical Report G.21) and associated management plans.

This includes the installation of erosion and sediment control devices, temporary stormwater devices, long term permanent stormwater treatment devices, the use of practices such as suction trucks to remove contaminated water, removal and replacement of the shellbanks, and the timing of works (e.g. carrying out disturbance works during low tide to minimise sediment generation).

While temporary habitat loss is considered to be minor (and acceptable), permanent habitat loss is considered to have a potentially moderate adverse effect requiring avoidance or mitigation. While it is difficult to directly avoid or mitigate these effects, the following measures are considered to off-set these effects:

The moderate effect of permanent marine habitat loss will be offset by improved stormwater treatment and restoration of the coastal habitat along SH16

- Providing a habitat remediation zone on either side of the reclamation revetments. It is proposed to construct this area by remediating a 3m wide area of intertidal habitat by providing a 0.5m (approx) layer of marine mud above the ground improvement layer of the toe of the revetment (refer Coastal Works Report G.23). This will allow marine organisms to recolonise the remediation zone over time as the replaced sediment depth over 500mm is more than sufficient to support infaunal and burrowing organisms, as well as vegetation such as mangroves;
- Improving the efficiency of the removal of contaminants from the operational phase of stormwater discharge. The proposed stormwater treatment devices will meet and exceed ARC's TP10 requirement, and are considered to provide a positive effect of the Project (refer Section 17.9 and Technical Report No.G.15);
- Treating stormwater runoff from both the existing and proposed State highway pavement. The proposed stormwater treatment will remove in excess of 80% of suspended solids and heavy metals;
- Restoration of coastal fringe habitat (refer Plans F.16 *Urban Design and Landscape Plans* of the AEE for details); and
- Removal of litter and debris from within and adjacent to the CMA.

Monitoring of the marine environment is proposed to ensure that construction mitigation measures proposed are effective in protecting the marine ecological values. This will include suspended sediments, pH and benthic invertebrate community composition. Details of the proposed monitoring are set out in the Ecological Management Plan (ECOMP) (Appendix G of Technical Report G.11).

Monitoring will be undertaken during construction

17.8 Vegetation

A full assessment of effects on terrestrial vegetation provided in Technical Report G.17

Vegetation effects of the Project have been assessed in Technical Report G.17 *Assessment of Vegetation Ecological Effects*. The following is a summary from this assessment.

17.8.1 Existing Environment

The terrestrial environment within Sector 4 can generally be divided into two distinct locations, the southern landward side of the Causeway and the northern seaward side of the Causeway.

Vegetation on the southern landward side is generally confined to an outer strip between the cycle way and the CMA. This strip consists of trimmed grass and weeds, with some native plants also present. Including marsh ribbonwood.

Vegetation on the northern seaward side of the Causeway is limited. There are several mature crack willow, and further west the wetter areas are occupied mainly by flax and pampas grass. The drier areas are dominated by grass species but at the eastern end populated by shining privet and immature native species.

There are also some areas of restoration planting along the Causeway with numerous young cabbage trees and smaller manuka.

Mimulus repens *has been classified as being Naturally Uncommon and Regionally Endangered*

Traherne Island is vegetated by pioneer native species including manuka, karamu and karo, together with noxious weeds such as brush wattle, moth plant and woolly nightshade. Between the cycleway and the edge of the flax (on the southern landward side), the outer strip is partly grassed and partly covered in salt marsh species. Between the outer strip and the flax scrub there is a shallow 1.5m drain which contains *Samolus repens, Triglochin striatum, Cotula coronopifolia* and several square metres of the herb *Mimulus repens. Mimulus repens* has been classified as being Naturally Uncommon and Regionally Endangered (described further in to Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*).

On the northern seaward side of Traherne Island, the vegetation is a dense growth of tall and healthy flax, amongst which is a lesser amount of young karo, karamu, cabbage trees, manuka and brush wattle. There are also several individuals of coastal tree daisy.

17.8.2 Assessment – Construction

The majority of terrestrial vegetation in Sector 4 will not be affected. While there may be some small loss of vegetation, given that the vegetation is dominated by weed and exotic species, this loss if not considered to be significant.

With the proposed mitigation the effects on terrestrial vegetation are less than minor

Works within Traherne Island would affect two populations of *Mimulus repens*. This is considered to be an adverse effect, given its regionally important status. However, this effect can be avoided by the removal and relocation of the plants affected (as described below).

With the above avoidance and mitigation proposals in place the effects on terrestrial vegetation are less than minor.

17.8.3 Mitigation – Construction

During construction, measures will be implemented to minimise the extent of disturbance to vegetation and waterways and to protect existing areas of vegetation. These measures are set out in the ECOMP that is Appendix C to Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*. The following specific avoidance and mitigation measures are proposed for the works located within Sector 4:

- The *Mimulus repens* are physically removed and protected during the proposed works and rehabilitated afterwards by restoration planting; and
- The proposed native coastal fringe vegetation (to be planted into sheltered parts of the Causeway revetment) will replace some of the coastal margin habitat lost through the coastal works (discussed in Section 17.7).

17.9 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

17.9.1 Existing Environment

The main receiving environment for stormwater runoff in this Sector is the Waterview Estuary Inlet on the southern side and the Waitemata Harbour on the northern side of the Motorway. A full description of the marine environment is provided in Chapter 13 (Regional Overview.)

The existing stormwater infrastructure comprises:

- For the Causeway, between GNR Interchange and Traherne Island, the stormwater runoff discharges across a small area of grass (and paved cycleway - westbound only) into tidal mangrove flats. The passage of the runoff across the vegetated areas provides a limited level of water quality treatment, but not to ARC TP10 standards;

- An engineered stormwater treatment system was installed as part of the bus shoulder widening project from the GNR Interchange to the Rosebank Road Interchange. This comprises a hybrid treatment device, part filter strip, part grass swale, part sand filter and part infiltration;
- Westbound beyond Traherne Island and towards Rosebank Road, surface water runoff is directed towards cesspits and piped reticulation and discharges either across Traherne Island itself or direct into the Waitemata Harbour, by means of a number of individual outfall structures; and
- A slotted median drain, with interconnected cesspits, is also located on the sections of motorway where the eastbound lanes traverse the Rosebank peninsula, and (according to the as-built data) discharges directly into the CMA.

In summary, there is currently limited treatment for runoff from the pavement on this section of the motorway.

17.9.2 Assessment – Operation

The planted biofilter strips will discharge diffusely to the rock armour revetments along the Causeway edge

The stormwater treatment design for the causeway section of SH16 comprises 7m wide biofilters to be located along the side of the motorway to provide treatment for the respective adjacent pavement areas. The planted biofilter strips will discharge diffusely to the rock armour revetments along the Causeway edge, which in turn will discharge diffusely to the coast.

96.7% of the proposed and existing impervious area within Sector 4 will be collected and treated, in accordance with ARC's TP10, prior to discharge to the receiving environment.[3] The level of treatment proposed for these areas will remove in excess of 80% of suspended solids and heavy metals.

By providing treatment of both new and existing impervious area, the effects from stormwater discharge on water quality environment have been minimised and is considered a positive environmental effect from the Project.

17.9.3 Assessment - Construction

Stormwater management during construction is restricted because it is proposed to widen and raise the Causeway starting with the areas outside the existing motorway, so drainage paths will be blocked. Therefore, stormwater management for Sector 4 during construction focuses on draining the motorway of surface water and providing stormwater treatment to ensure that the current resource consents are complied with.

[3] Water quality assessed for Total Suspended Solids removed. Efficiency of system based on average annualised removal of total suspended solids.

It is proposed to use hybrid sand filter trenches with cesspits fitted with screening filters, and a limited width grassed filter strip, configured in different combinations during the different phases of construction. This is proposed as the BPO solution for temporary stormwater treatment within Sector 4, due to the envisaged efficient contaminant removal with flexibility and ease of construction.

100% of the new impervious area will be treated during the construction phase. The level of treatment of both new and existing impervious area to be treated within Sector 4, during construction, ranges between 35% to 100%.

17.9.4 Mitigation – Operation

The proposed treatment devices will increase the level of existing stormwater treatment from SH16 as described above and is thus considered to provide a positive outcome from the Project.

The OSMP sets out ongoing maintenance and management procedures during operation

In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (OSMP) (Appendix D of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

17.9.5 Mitigation – Construction

All temporary stormwater treatment devices will be implemented and maintained in accordance with the Temporary Stormwater Management Plan (TSMP) (Appendix E of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan* (ESCP).

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

17.10 Land Contamination

The following provides a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. Given the nature of contaminated materials, this assessment only looks at construction effects.

17.10.1 Existing Environment

Land use in this area comprises SH16 as it crosses the harbour on the Causeway. There are no historical land uses that have the potential to cause contamination as the area was previously harbour before the construction of the motorway.

Intrusive investigations were undertaken to determine the existing quality of soils and groundwater, the potential for any existing contamination to be disturbed during construction activities, and the potential human health risks for workers and the wider public outside the construction footprint. These investigations confirmed the following:

- The underlying geology includes fill overlying Tauranga Group alluvium. The fill consists of reworked natural materials with minor amounts of waste materials;
- One soil sample was found to have levels of Nickel that exceed the 'permitted baseline' level for land disturbing activities (as defined Rules in the PARP:ALW); and
- None of the samples exceeded the human health criteria (commercial/ industrial).

Based on the analysis, approximately 58% of the material in this area is considered potential 'cleanfill'. This means that it could potentially be reused on site (with the remaining 42% considered to be 'managed fill' requiring disposal offsite).

17.10.2 Assessment - Construction

There were two areas where potential effects are considered to warrant specific management

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for the wider community and for workers on the site). The levels of contamination identified in this area did not generally exceed standards and criteria considered as 'triggers' for adverse effects. However, there were two areas where potential effects are considered to warrant specific management:

- Given the exceedance of one of the samples for Nickel above 'permitted baseline' levels, measures are required to be put in place to ensure control off-site migration of contaminants; and
- Where materials excavated do not meet the criteria of 'clean fill' it, is proposed that it be disposed of as managed fill.

With the above management measures in place, it is considered that the effects of construction works on contaminated land are appropriately managed so that adverse effects are avoided.

17.10.3 Mitigation – Construction

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils to put at risk workers and the wider public and the environment.

In particular, it is proposed all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) and a Site Health and Safety Plan. These Plans will form part of the overall Construction Environmental Management Plan (CEMP).

The CSMP has been developed for the Project and is provided in Appendix A of Technical Report G.9 *Assessment of Land and Groundwater Contamination*. It identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume

and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

If unexpected contamination is identified, then it is considered that the procedures set out in the CSMP, will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

18. Assessment of Effects - Sector 5

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 5. The works within this Sector comprise a new interchange being built at the GNR Interchange to provide motorway to motorway connections for SH16 and SH20. Overall, the key environmental effects identified and considered in Sector 5 relate to the potential impacts on the existing established residential communities of Waterview and Point Chevalier, of both construction and operation and on the receiving coastal environment (the coastal marine area (CMA) of Oakley Inlet and the wider Waterview Estuary).

The construction and operation of the Project will be a significant change to the existing environment in this area, particularly south of the GNR Interchange (for the community of Waterview). Property take and the structures (including viaducts for the ramps and the northern tunnel portal), as well as the tunnel ventilation building and stack (which are addressed in Sector 7), will have adverse impacts on the community (land use, social, visual in particular). Emissions (noise, vibration, air and light) are not as significant a change in this environment (compared to Sector 9 in particular); given the impact of GNR as a Regional Arterial Road already traversing through this area. Structures are required over and in the Oakley Creek Inlet, and works will impact on the area identified as the 'Oakley Inlet Heritage Area'.

Through careful design and proposed mitigation in various areas, it is considered that these effects are adequately mitigated. In particular, the following key mitigation proposals are noted:

- The reinstatement of open space (in both quantity and quality) within and beyond the proposed designation boundaries and the ongoing development of this space through Open Space Restoration Plans with the [Auckland Council];
- The channel realignments within Oakley Inlet to minimise sediment discharge and disturbance from the reclamation of the CMA;
- The acoustic treatment of the GNR Interchange (with twin layered open graded porous asphalt (OGPA) surface) to reduce noise emissions from vehicles during operation;
- Landscaping and urban design of the Interchange, to provide visual screening and sense of scale to the Interchange structures;
- Enhanced community connectivity, and restoration works for the Oakley Inlet Heritage Area, to improve public access to and interpretation of the heritage area on the northern and southern sides of Oakley Inlet; and
- Careful management of construction activities in this area, primarily through the Construction Environmental Management Plan (CEMP) (to minimise disruption to the existing community).

While the above proposals will mitigate adverse effects, it is acknowledged that there will be residual impacts of the Project, at least in the short to medium term.

18.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of activities within Sector 5.

This Chapter assesses the effects of the Project in Sector 5

As described in Chapters 4 and 5, the main elements of the Project in this area are:

- Four new ramps within the GNR Interchange to provide motorway to motorway connection between SH16 and SH20; and
- Construction of the retaining wall approaches to the tunnel portal.

Specific details on scheme elements in this Sector are described in Section 4.4.5 of this AEE and the overview of the scheme is provided in plans F.2 *Operation Scheme Plans*, (Sheets 9, 10 and 13 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.5 of this AEE, with the construction areas and yards provided in the plans F.5 *Construction Scheme Plans* (Sheets 9, 10 and 13 for this Sector).

The works within this area are located within an urban environment dominated by the GNR Interchange. Residential areas are located to the north (Point Chevalier), and the south west (Waterview), with Unitec located to the south east. Receiving environments include Oakley Creek and the Oakley Inlet to the south and the Waitemata Harbour to the northwest. The Star Mill archaeological site, a site of regional significance, and a number of other archaeological sites (defined as the 'Oakley Inlet Heritage Area) are also located in this area.

Given the existing environment, the key issues identified in the assessment of environmental effects for the Project in Sector 5 relate to the potential impacts on the existing established residential communities of Waterview and Point Chevalier, for both construction and operation, construction impacts on transport networks and the receiving coastal environment (the CMA of Oakley Creek Inlet and the wider Waterview Estuary)[1].

Key issues relate to the existing residential environment and coastal marine area

This Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those specific environmental matters considered relevant to the environment in this Sector are reported in this Chapter. For example, as stormwater from the Great North Road Interchange area will not discharge to the freshwater environment, effects on freshwater ecology are not considered in this Chapter.

18.2 Land Use

18.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 18.1 below. The information within this figure has been extracted from the Operative Auckland City District Plan (Isthmus Section) 1999 (Auckland District Plan) (the district plan maps are provided in Appendix E.2 of this AEE which contain scaled maps and further detail on designations and other restrictions).

Land use is dominated by existing transport infrastructure (SH16), residential and open space

Land uses in the area include land currently zoned for transportation (Special Purpose 3), education (Special Purpose 2), open space (Open Space 1, 2 and 3) and residential (Residential 6a and 6b) purposes.

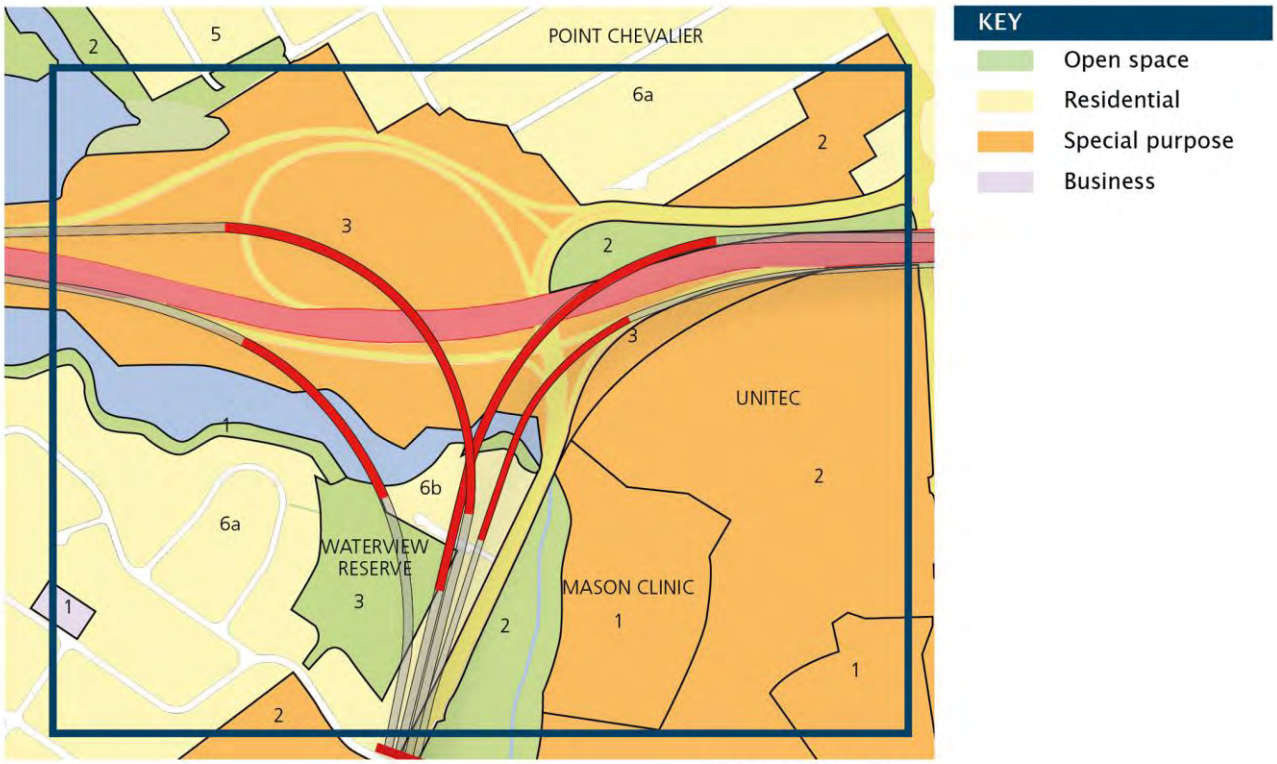


Figure 18.1: Land Use Zones within Sector 5 (Not to Scale)

18.2.1.1 *Special Purpose Land Use*

SH16 and the existing GNR Interchange occupy a large tract of land between Waterview and Point Chevalier. This land is zoned Special Purpose 3 (transportation). Within this land is the Northwestern Cycleway which crosses over GNR on an overbridge.

Special Purpose 3 Zone provides for significant current or future transport infrastructure

The Mason Clinic is zoned Special Purpose 1 and is surrounded by the Unitec Mt Albert Campus (zoned Special Purpose 2) to the north, east and south with Oakley Creek Reserve to the west. The Mason Clinic is an inpatient forensic psychiatric facility providing inpatient beds and community-based services as Auckland's regional forensic psychiatry service. The Clinic is run by the Waitemata District Health Board and provides care for people with intellectual disability who are convicted or charged with offences. Unitec occupies 55ha of land on the western side of Carrington Road. There are four existing access points to the Unitec campus on Carrington Road to the east of the site. The Mason Clinic and Unitec sites are both subject to Concept Plans in the Auckland City District Plan.

St Francis Primary School is located on the corner of Point Chevalier Road and Montrose Street and is zoned Special Purpose 2 (education purposes)[2].

[2] Waterview Primary School is located to the south of this area and effects on this land use activity are considered in the Assessment of Effects – Sector 7 (Chapter 20 of this AEE).

18.2.1.2 *Open Space Land Use*

There are five areas of open space in the Sector 5 Project area

There are a number of open space areas which exist within Sector 5. These include Eric Armishaw Reserve, Cowley Reserve, Waterview Reserve and Oakley Creek Esplanade Reserve.

Eric Armishaw Reserve is located at the western end of Walker Road abutting the Waitemata Harbour. The reserve is zoned Open Space 2 (for informal recreation) and adjoins the GNR Interchange to the south. The reserve has a medium sized playground and public toilet facilities.

An unnamed 1.58ha pocket of land exists between the SH16 and GNR in Point Chevalier. This open space is zoned Open Space 2 (for informal recreation). The Northwestern Cycleway parallel to GNR, runs through the middle of this open space.

Cowley Reserve is zoned Open Space 1 (for Conservation) and consists of 2400m² of land vested as local purpose (esplanade) reserve. There is currently no public access to this Reserve. Two residential properties (zoned Residential 6b) (13b and 15 Cowley Street) otherwise interrupt a contiguous coastal esplanade associated with Waterview Reserve. Cowley Reserve is subject to the Reserves Act 1977.

Waterview Reserve is located to the south of the GNR Interchange with frontage to Cowley and Herdman Streets. Waterview Reserve includes a sports field, picnic tables, public toilets, playground, disused basketball/tennis courts and volleyball area. Waterview Reserve is zoned Open Space 3 (for organised recreation) and has a connected esplanade which stretches along Oakley Creek between the main park area and the western end of Oakley Avenue (zoned Open Space 1). Pedestrian access to the Reserve, can be obtained from Cowley Street, Herdman Street and Waterbank Crescent and carparking is provided along Cowley Street. Overall the combined esplanade strip and Reserve have an area of 4.1ha. It is classified as a recreation reserve under the Reserves Act 1977.

To the east of the Project area, the Oakley Creek Esplanade Reserve is located between GNR and Unitec. The reserve is zoned Open Space 2 (for informal recreation) and includes both sides of the upper reaches of Oakley Creek. The Reserve contains a walkway which meanders across the creek. Access to the Reserve is provided from GNR.

18.2.1.3 *Residential Land Use*

Residential land use surrounds the Project

Properties west of GNR include those on Cowley Street, Herdman Street, Waterbank Crescent and properties north of the GNR Interchange (Point Chevalier). The residential areas are zoned Residential 6a and 6b (medium density housing). A pocket of Residential 6a zoned land, which interrupts the Oakley Creek Esplanade Reserve, is occupied by a petrol station (BP Waterview).

18.2.1.4 *Designations and Other District Plan Controls*

Designation A07-01 provides for SH16 and the GNR Interchange between the Central Motorway Junction (CMJ) and Auckland City's western boundary. The purpose of the designation is "Motorway". The District Plan does not list any specific conditions in relation to this designation.

Plans F.1 Designation Plans shows existing designations within the direct Project area

A public road network designation (Reference – B08-04) applies to all Auckland City Council (ACC) owned roads to enable the safe and efficient functioning and operation of the Council's road network. Within Sector 5, ACC owned roads include GNR, Cowley Street, Herdman Street and Waterbank Crescent.

Other designations and 'other District Plan controls' include:

- The Mason Clinic is located on land subject to Concept Plans and specific development controls (identified as site D04-14 on the Planning Maps);
- The Unitec Mt Albert Campus is subject to Concept Plans and specific development controls (identified as site D04-10 on the Planning Maps);
- The Microwave Transmission Corridor from TVNZ Transmission Centre in Auckland City traverses the GNR Interchange and is subject to designation B08-02; and
- A Coastal Management Overlay is included in the District Plan to the south of the Oakley Inlet which specifies further restrictions on vegetation removal and coastal protection.

18.2.1.5 *Auckland City Future Planning Framework*

The Auckland City Future Planning Framework 2008 (FPF) area plans set out a number of key medium and long-term outcomes that the Council wants to achieve by 2030, from a city planning point of view. Of particular significance to this area, the following are mapped aspirations:

- Single dwelling small site/townhouse residential development;
- Key development sites near the Waterview portal for future 'large-site comprehensive development';
- GNR and SH16 maintained as key road passenger transport routes;
- Cultural heritage values (including archaeological and Maori sites of significance) around the GNR interchange to be managed and maintained;
- Improved pedestrian/cycle environment along GNR up to SH16 and along the Waterview esplanade; and
- An urban forest/ecological corridor along Waterview esplanade, Oakley Creek, SH16 and the coastline along Eric Armishaw Reserve.

18.2.2 Assessment - Operation

Land use impacts associated with the operation of the Project relate to the scale of permanent land take from surrounding land use areas. In particular, effects include the loss of the land uses as a result of the Project and the potential loss of viability for the remaining surrounding land use areas (i.e. Whether the land take is of a sufficient scale that the viability of the remaining land use is jeopardised). The assessment relates to those areas outside of the existing designated transport areas.

18.2.2.1 *Impacts on Special Purpose Zoned Land and Existing Designations*

The majority of structures for the Project in this Sector are located within land already zoned for transportation (Special Purpose 3) and the existing designation for motorway purposes (Reference A07-01). As such the impact of the proposed GNR Interchange on existing land uses has been minimised through the design of the Project. There will be no adverse land use impact on the Special Purpose 3 zone as the Project is consistent with the purpose and activities envisaged within this zone.

There is no requirement for land occupied by the Mason Clinic (Special Purpose 1/Concept Plan D04-14), the Unitec Campus (Special Purpose 2/Concept Plan D04-10) or St Francis Primary School.

The proposed designation boundary does overlap ACC roads which are designated (Reference – B08-04). The Project will require closure of Cowley Street permanently.

ACC has indicated that the Project design of the AEE is sufficient for it to provide the necessary s177 approval, as the primary designation. Discussions for this approval are progressing.

18.2.2.2 *Impacts on Open Space Zoned Land*

The Project proposes to occupy approximately 1.9ha of Waterview Reserve permanently for the operation of the Interchange. Reserve replacement of the open space and the active facilities which currently exist at Waterview Reserve is required to mitigate the effects of this loss of open space for the local community and in the case of the sportsfields for the wider District community.

The impact on open space land at Cowley Reserve during operation is minimal (e.g. ramp abutments only). It is considered that the effects on this Reserve overall are positive as the replacement mitigation (discussed in Section 18.2.4) will provide a continuous esplanade walkway through to the Waterview Esplanade.

The scale of open space land take is significant

The unnamed parcel of land between GNR and SH16 (approximately 1.6 ha) will continue to provide for the existing pedestrian/cycle way connection during operation of the Project and will only be impacted by the ramp abutments. This is considered a negligible land use impact (given the existing use of the area).

The Oakley Creek Esplanade Reserve is not required during operation of the Project.

Replacement land is proposed to mitigate this effect

Overall, the scale of open space land take is significant with approximately 1.9ha of Waterview Reserve and associated active facilities (e.g. the sportsfield, basketball court, playground) required for the operation of the Project. However, it is considered that the proposed replacement land and reinstatement of the active facilities within the local community (provided through the Open Space Restoration Plans developed with the [Auckland Council]) will offset the amenity and land use impacts (See Section 18.2.4 for further detail of the proposed reserve replacement mitigation). With mitigation in place, these effects are (from a land use perspective) considered moderate to minor (depending on the timeframes taken to implement the reserve replacement outside the designation area).

18.2.2.3 *Impacts on Residential Zoned Land*

Residential land take is a moderately adverse effect

The proposed GNR Interchange will require residential property take in Cowley Street, Herdman Street and Waterbank Crescent, Waterview. The number of residential properties to be taken for the Project is discussed further in the assessment of construction impacts (see Section 18.2.3.2).

It is anticipated that the majority of residential land required for construction of the Project will transition into other land uses in the future e.g. open space[3]. The overall property take is estimated to be around 6% of the total number of dwellings in the Waterview area (based on 2006 Census data)[4]. While this represents a moderate impact on the land use in the area, the adverse effects of the loss of the residential properties is not considered to be significant in the medium to long term. In particular, it is noted that the surrounding residential land is zoned Residential 6a and 6b (for medium density development) in the Auckland District Plan and that the FPF aspires for this area to have 'single dwelling small site/townhouse residential development' in the future. As the existing residential site configurations within the area are not yet developed to this potential, it is considered that the quantum of residential dwellings lost as a result of the Project can be absorbed or replaced into the remaining residential zone, in future.

---

3 The final land available for return to residential land use will be determined following construction.

4 It is noted that with Sector 7, the proportion of impact increases to around 8.5%, the above conclusions remain relevant.

18.2.2.4 *Impacts on Future Planning Framework*

The Project is not considered to provide a barrier to achieving ACCs future vision for communities (set out in the FPF). It is considered to enhance some outcomes related to the opportunity for local areas to develop, including urban intensification, through improved accessibility to transport links and passenger transport (bus) networks.

18.2.2.5 *Impacts on Coastal Management Area (District Plan)*

The Project will remove existing residential development on the northern side of Cowley Street, which is entirely within the Coastal Management Area. This will provide the opportunity post construction to match this overlay with land use (such as open space) that allows for the better maintenance and enhancement of the coastal margin. The Project will also provide increased public access to and along the CMA and bring the Star Mill archaeological site (and other features of the heritage area) into the public domain. While the replacement bridge proposed for restoration of the heritage area (see Section 18.8) will increase structures in the Coastal Management Area, this bridge will provide for public access to and along the CMA in these areas and provide a physical linkage between the Waterview Reserve and the Northwestern Cycleway (as another recreation area).

18.2.3 Assessment - Construction

As noted above, the majority of the Project within this area will be constructed within land already designated for Motorway Purposes (Designation A07-01) and zoned special purposes within the Auckland City District Plan.

There will however be land take required for construction from land zoned open space and residential to the southern side of the proposed GNR Interchange (as noted in Section 18.2.2 above).

18.2.3.1 *Impacts on Open Space Zoned Land*

It will be necessary to occupy 100% of Cowley Reserve and the un-named 1.6 ha open space zoned land between GNR and SH16 during construction. It is considered that this land take is minor as both areas are currently inaccessible and severed by transport infrastructure.

It will be necessary to occupy 100% of Waterview Reserve (approximately 2.5ha) (and a portion of the connected Waterview Esplanade (approximately 0.15 ha) during construction. Construction Yard 6 is located directly within this area, with associated construction sediment erosion and stormwater ponds.

The primary construction impact on open space within this Sector is the take for Waterview Reserve. This Reserve plays an important local role in providing for local community open space and active facilities including a sportsfield, playground and toilet block. Temporary reserve replacement area is therefore required to mitigate the effects of this Reserve take on the local community (see Section 18.2.4 for proposed reserve replacement).

Temporary reserve replacement is required to mitigate the effects

18.2.3.2 *Impacts on Residential Zoned Land*

During the construction period there will be a concentrated impact on the NZTA owned residential land in the northeast of the Waterview community. Table 18.1 identifies the total number of parcels and dwellings identified in this area. The full Schedule of Properties affected by the designation in this area is provided in NOR 4[5].

Table 18.1: Summary of Sector 5 Land Take from Residential Zoned Land (APPROXIMATE)

Impact	Due to	Zoning	Parcels	Dwellings
Cowley Street (northern side of Cowley Street)	Construction and Permanent Works (Construction Yard, Motorway Structures)	Residential 6b	17	23
Cowley Street (southern side) and GNR	Construction and Permanent Works (Construction Yards and Motorway Structures)	Residential 6a	18	25
Herdman Street	Construction and Permanent Works (Construction Yard and Motorway structures)	Residential 6b	8	8
Herdman Street/Waterbank Cres (western side of Waterview Reserve)	Construction and Permanent Works (Temporary/permanent reserve replacement)	Residential 6a	25	25

18.2.4 Mitigation - Operation

Land use effects have been minimised through design

18.2.4.1 *Avoiding Effects Through Design*

The potential adverse land use effects have been minimised on the Open Space and Residential Zones in design of the GNR Interchange. In particular, design has sought to locate the works within land already designated for motorway purposes and zoned Special Purpose 3 as far as practicable.

18.2.4.2 *Permanent Reserve Replacement*

Mitigation proposed includes the development of Open Space Restoration Plans with key stakeholders, including the [Auckland Council], to inform the restoration and reinstatement of open space and reserve areas affected by the Project. In particular, and in respect of this land use effects assessment, this would include replacement of the quantity of land lost at Waterview Reserve and the associated active reserve facilities.

[5] NOR 4 includes property impact from the proposed designation in both Sectors 5 and 7.

Mitigation includes permanent reserve replacement

The mitigation solution proposed is shown graphically in Appendix E.4 of the AEE, whereby open space is replaced locally within the designation by:

- Retaining some of the existing Waterview Reserve;
- Returning some 22 previously zoned residential properties along Waterbank Crescent as open space. This allows the opportunity for a senior playing field and other recreation facility replacement to be incorporated back into the Reserve. It also provides adequate street frontage for the Reserve. An approximately 5m high vegetated bund will be placed outside of this area to protect the amenity within the Reserve by providing a visual buffer between the Reserve and the motorway structures;
- Providing linkage from the Northwestern Cycleway to Waterview Reserve via the heritage mitigation proposed, and specifically the bridge crossing of the Oakley Inlet (see Section 18.8 and the plans in F.9 Oakley Inlet Heritage Plan); and
- Providing a continuous 20m wide esplanade reserve along the southern edge of Oakley Creek through the Interchange area (this includes the acquisition of two residential properties on Cowley Street to provide for this area[6]).

Further replacement open space area is proposed outside of the NZTA's proposed designation area (as practicable and with the agreement of [Auckland Council]) by:

- Expanding Saxon Reserve through the acquisition of four residential properties adjoining the existing reserve. This would offset the community function at Waterview Reserve; and
- Expanding the coastal walkway along the Waterview esplanade by acquiring a residential property at the end of Oakley Avenue. This would provide a continuous walking route from the coastal walkway onto the street network within this area.

Approximately 0.6ha of Waterview Reserve will be retained after construction and it is proposed that a further 2.5ha of replacement open space is provided within or in close proximity to the Waterview community. This will result in a surplus of 0.6 ha of open space in total. All existing active facilities will be able to be provided within the replacement reserve areas identified. However, it is noted that final configuration of reserve facilities is proposed to be developed with the [Auckland Council], being the final owner and manager of these resources.

6 It is noted that the properties affected are also required during construction of the Project.

18.2.4.3 *Other Mitigation*

In addition to the above, the following general mitigation proposals are made with respect to land use impacts:

- Once construction is complete the designation should be uplifted from surplus land to allow for reinstatement of open space/recreation areas; and
- Further development of the Urban Design and Landscape Framework Plan with key stakeholders to guide future land use development within this area.

18.2.5 Mitigation - Construction

18.2.5.1 *Temporary Reserve Replacement*

To mitigate the temporary use of Waterview Reserve during construction, it is proposed that reserve replacement occurs in the areas outlined in conceptual Figure 18.2. Within the designation, there is potential for the immediate installation of reserve facilities at the corner of Herdman Street and Waterbank Crescent (the proposed node shown in Figure 18.2 adjoining Waterview Reserve).

Temporary mitigation proposed includes:

- Early works occurring to provide for a temporary playing field area on the edge of the Waterview Reserve/ Waterbank Crescent. This playing area will be designed and adequately separated from the Construction Yard required for the Project;
- Early works to replace existing active facilities within Waterview Reserve at an alternative location; either within the temporary playing area (provided above), or within Saxon Reserve;
- As opportunity arises, acquire other areas of reserve replacement (for example, the size of Saxon Reserve could be increased). If the reserve quantity cannot be replaced in the vicinity of Saxon Reserve at the time of construction, there is potential for upgrading of facilities in the existing reserve to mitigate recreation facility impacts; and
- Early works occurring to extend the Waterview Esplanade by acquiring a property at the end of Oakley Avenue (if possible).

It is proposed that these works be confirmed with the [Auckland Council] as owner and manager of the City's reserve and recreation facilities. Discussions are underway and progressing.

Figure 18.2: Temporary Reserve Replacement Areas

18.3 Transport Effects

Technical Reports G.16 and G.18 provide further detail on the assessment of traffic effects

Transport effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment Transport Effects*). The following is a summary from this assessment.

18.3.1 Existing Environment

18.3.1.1 *Roading Environment*

This Sector comprises the GNR Interchange which has three lanes in each direction along SH16. The existing ramp arrangements are illustrated in Figure 18.3.

Both the eastbound and westbound on-ramps have ramp signals and a priority lane to allow truck, buses, motorbikes and High Occupancy Vehicles (HOVs) to bypass the ramp signals. After the two off-ramps diverge from the main carriageway, separate approaches are provided to GNR for vehicles either travelling north or south on GNR. The intersection of the eastbound

and westbound off-ramps with GNR for right turn movements at GNR are signal controlled. The westbound off-ramp has a single slip lane into its own lane on GNR and the left turn of the eastbound off ramp has a "Give Way" control, with the nearside lane continuing into a dedicated lane and the offside left turn lane merging with northbound traffic on GNR. A description of the existing traffic flow patterns and volumes along SH16 and GNR in this area are provided in Chapter 13.

Figure 18.3: Existing Ramp Arrangements at GNR Interchange

18.3.1.2 *Pedestrian/Cycling Environment*

The Northwestern Cycleway runs parallel to SH16 and then over GNR on a shared walking and cycling bridge (south of the Interchange and evident in the aerial photograph on Figure 18.3). From the bridge crossing, the pedestrian/cycle way continues along the northern side of the Unitec Campus. At Carrington Road there are shared walking and cycling paths from the cycleway along both sides of the road to the intersection with Point Chevalier Road/GNR.

18.3.1.3 *Passenger Transport*

There are three main bus service routes through the GNR Interchange. These services include routes operating along SH16 providing routes between West Auckland and the Auckland CBD; a route along GNR through the Interchange (e.g. from Waterview through to Point Chevalier); and routes operating between GNR onto and off SH16, through the Interchange.

18.3.2 Assessment – Operation

The overview of the transport assessment for the Project is provided in Chapter 13 of the AEE (Regional assessment). The assessment provides for the anticipated effects of the Project on the wider motorway network, arterial roads and the local roading network. Further detail on this assessment is provided in Technical Report G.18 *Assessment Transport Effects.*

18.3.2.1 *Effects on Property Access and Parking*

The land take associated with the completion of the new motorway to motorway connections results in all the properties on Cowley Street, as well as those along the western side of GNR between Cowley Street and Herdman Street being removed. In addition, the properties along the western side of Great South Road between Herdman Street and Oakley Avenue (Sector 7) are also required. Property access to these properties will no longer be required with the completion of the Project.

Cowley Street will be closed as a public road following construction of the Project. Alternative access to facilities retained within the Waterview Reserve will instead be provided via Herdman Street, which it is proposed to remain open following the completion of the Project.

The removal of these direct property accesses from the eastern side of GNR, (north of Herdman Street) will be of benefit for the proposed new shared pedestrian/cycle path along this side of GNR (to the existing cycleway bridge). As there is currently no parking along this Section of GNR, there will be no effects on parking in this area as a result of the Project.

18.3.3 Assessment – Construction

Works within this Sector are planned to be constructed over two years and include construction of the SH20-SH16 ramps. This work will be largely undertaken off-line and therefore is not anticipated to affect motorway or arterial movements. The works will be staged from the site compound accessed from GNR (Construction Yard 3). Technical Report G.16 *Assessment of Temporary Traffic Effects* provides detail on the construction works planned in each of the phases of construction.

The potential adverse effects of construction traffic on the road network include: reduced capacity on roads within the Project site, resulting travel time delays and diversions off these roads onto other roads in the network (increasing congestion and travel times on these routes) and potentially loss of access for users of the network through the construction site (e.g. if road closures etc are left unmanaged).

It is proposed that traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project.

The specific traffic management methodologies proposed within this Sector include:

- Mainline realignment and narrowing of the lanes on SH16 with installation of temporary barriers to open up work zones and allow off-line construction;
- An 80km/hour temporary speed limit installed for the length of the road affected by realignment/narrowing;
- Night time closure of lanes when work is required in the median and or structures over live carriageways;
- Construction sites and site access established; and
- A temporary cycle lane.

The Technical Report G.16 *Assessment of Temporary Traffic Effects* discusses the traffic management methodologies, their duration, timing and effects.

18.3.3.1 *Effects of Realignment and Narrowing of Lanes*

During the works it is expected that the existing number of lanes on SH16 (mainline) and on the ramps will remain operational throughout works (except for limited night closures). However, the carriageways will be narrowed to a minimum of 3.25m lanes and 0.3 shoulders during works. Wherever lane narrowing or realignments are installed to facilitate offline construction activities, temporary TL-3 barriers will be installed to isolate the work site from passing traffic with gaps provided for site access from the motorway and temporary lighting installed.

Table 18.2 provides a summary of the proposed realignment/narrowing in this Sector.

Table 18.2: Realignment/Narrowing of Lanes during Construction Phase

Area Affected	Proposed Realignment/ Narrowing on Ramps and Lanes of SH16
Motorway to Motorway Ramps	The realignment of the westbound off-ramp will be undertaken over two phases, with work completed on the southern shoulder of the ramp, followed by works in the area between the off-ramp and SH16 westbound carriageway. Construction of the new SH16 eastbound motorway to motorway on-ramp will be completed through implementation of lane and shoulder narrowing on SH16 westbound.
GNR Interchange Eastern Ramps	Under the first construction stage, the SH16 lanes and shoulders past the eastern ramps will be narrowed and shifted towards the median. The westbound off-ramp will be narrowed and shifted to the northern side of the carriageway. Under stage two, the SH16 lanes and shoulders past the eastern ramps will be marked in their final arrangement. The westbound off-ramp will also be shifted to the southern side of the carriageway.
GNR Interchange Western Ramps	Under the first construction stage, the SH16 lanes and shoulders past the western ramps will be narrowed and shifted towards the median. Both the existing ramps will also be narrowed and shifted toward the median. Under stage two, the westbound SH16 and on-ramp lanes past the western ramps will be marked in their final arrangement. The eastbound off-ramp will also be shifted to the northern side of the carriageway to allow construction to the south.
SH16 and Ramps	Under the first construction stage, the SH16 lanes and shoulders through the interchange will be narrowed and shifted away from the median to allow construction of the new median abutments. Under second construction stage, the SH16 lanes and shoulders through the interchange will be shifted toward the median to allow construction of the new abutments adjacent to SH16.

The realignment/narrowing of lanes will be coupled with installation of a temporary speed limit of 80kph. The long term work sites set up to facilitate works in Sector 5 are not expected to have significant impact on the capacity of SH16, and are of significantly shorter duration than those set up for Sectors 1 – 4. This is because:

- The duration of ramp construction over SH16 and adjacent to the ramps is expected to occur over a number months, as opposed to several years in the case of the Sectors to the west;
- Lane narrowing is not anticipated through the Interchange as these works will be undertaken under night closures, compared to daytime offline activities such as those in Sector 4; and
- Lane narrowing is anticipated for construction of the western and eastern ramps. However, for the purposes of this Chapter, the impacts of those activities have been assessed in the discussions about Sectors 4 and 7 (see Chapters 17 and 20).

Nevertheless a Regional assessment has been undertaken of the effect of these works (as summarised in Chapter 13 of this AEE). The assessment indicates that capacity reductions on SH16 are likely to divert traffic onto the arterial network across the Isthmus and extend out to North Shore in some instances. The Construction Traffic Management Plan (CTMP) (Appendix A of Technical Report G.16 *Assessment of Temporary Traffic Effects*) will be important in managing these effects.

18.3.3.2 *Effects arising from Temporary Closures*

Night time closures of On and Off Ramps

There will be a number of night time closures for construction works at the GNR Interchange. Technical Report G.16 *Assessment of Temporary Traffic Effects* discusses the closures in detail and the potential detour routes proposed. Potential closures include the ramps to and from SH16 to GNR and the connection through SH16 (between Point Chevalier and Waterview) on GNR itself. Motorists will be advised of off-ramp closures at the previous Interchange in advance of and during the closures. Details of the communication protocols to mitigate the effects of road closures are discussed in Section 18.4.1 below.

18.3.3.3 *Effects on Pedestrians and Cyclists*

During construction, pedestrians and cyclists will be diverted around the work zone south of the existing western on-ramp on a temporary footpath/cycle lane until the new footpath/ cycle lane is commissioned during works on the GNR Interchange western ramps. The existing cycleway link is therefore maintained throughout works, and as such the impacts to pedestrians and cyclists in this Sector are expected to be negligible.

18.3.3.4 *Effects arising from Construction Site and Work Site Access*

Managed site accesses proposed for Construction Yards

The construction site for the works at the GNR Interchange will be set up within the Interchange (Construction Yards 3 and 4) and Waterview Reserve (Construction Yard 6). Site access is nominated on the Construction Scheme Plans (see Part F.5 of this AEE). However it is proposed that the final locations be agreed with the [Auckland Council/Roading Authority] in a Site Specific Traffic Management Plan (SSTMP).

Site accesses will also be required for works on the Project. Each ramp and carriageway is likely to require site access from time to time. Further, it is proposed that the inside of the SH16 eastbound on-ramp loop be used as a laydown area for storage of materials and for staging of works. This site will be accessed from an entrance on the left hand side of the on-ramp, within the loop. Site accesses have the potential to result in traffic safety impacts if not appropriately managed.

Further site access points on SH16 will not generally be in operation during peak hour times. Site accesses will be located and managed so that sufficient sight distance is provided to the access and so that conflicts in speed differentials between site vehicles and on-ramp traffic are avoided. In cases where the location of site accesses means that acceleration and deceleration lanes cannot be provided, temporary lane closures are proposed (outside peak hour traffic periods) to provide a traffic lane for acceleration and deceleration lengths.

Site access points on the local road network will also be designed to provide adequate sight distances, acceleration and deceleration and to consider turning bays for vehicles entering the access. It is considered that the implementation of SSTMP's to confirm site access points (and management) are an appropriate measure to mitigate potential transport effects of these accesses during construction.

18.3.3.5 *Effects on Public Transport*

Given that most works on the State Highway[7] itself will be conducted at night, and that there are few public transport services in this period; works within this Sector are anticipated to have negligible impact on public transport.

18.3.4 Mitigation - Construction

A full suite of proposed mitigation and management options is proposed in the CTMP

Traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management to minimise the effects of construction traffic are outlined in the Construction Traffic Management Plan (CTMP) (appended to Technical Report G.16 *Assessment of Temporary Traffic Effects*). Given the regional nature of the effects of construction on the traffic network, the overview of the CTMP is provided in Section 13.3.4 of this AEE.

It is expected that mitigation and management for specific areas of the construction site will be formed and agreed with the SSTMP. In particular, it is proposed that the SSTMP address mitigation measures for this area as follows:

- Restrict construction site access to GNR, where practicable (e.g. to limit movements from the existing interchange ramps or SH16);
- Avoid site access on SH16 during peak periods. Any exceptional access or truck movements to/from SH16 or the Interchange ramps will require escorted entry/exit during peak periods (6am – 9am on SH16 Eastbound and 3pm – 6pm on SH16 Westbound). These exceptional requirements would be agreed with the relevant Road Controlling Authority in advance of works commencing on site;
- Maintain pedestrian access across this Sector (including the Northwestern Cycleway); and
- Where site access points on the local road network are required, planning shall demonstrate consideration of turning bays for vehicles entering the access and provision of appropriate visibility for users of the local road.

[7] This refers to the works on the existing State highway carriageways, not the majority of works (which will be 'off-line')

18.4 Social Impacts

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14 *Assessment of Social Effects*). This social assessment provides a holistic 'lens' on the potential effects of the Project on neighbourhoods and wider communities, including social, economic and cultural effects. The following is a summary from that assessment.

A social impact assessment is provided in Technical Report G.14

18.4.1 Existing Environment

This area covers the residential areas of southern Point Chevalier (north of SH16) and northern Waterview (south of SH16). These residents typically access local social/commercial services at Point Chevalier or Avondale. Few local shops/services are located in Waterview itself. Of these, the Waterview Superette on GNR (Sector 7) is well frequented. St Francis School (located just north of SH16) is a key educational facility in this Sector[8]. Figure 18.4 shows the location of key community sites and facilities of interest in the Sector 5 area.

Social effects of works in Sector 5 have the potential to impact on communities in Waterview and Point Chevalier

A number of demographic characteristics of the population in this area indicate that a high proportion of the community is economically and materially disadvantaged. In particular:

- Less than half of Waterview households own (or partly own) their own home;
- The Census Meshblocks that are affected by property acquisition for the Project have a high rate of deprivation compared with the Auckland Region as a whole (ratings of 9-10, indicating that representing the most deprived 10-20% of residents in the country); and
- There is a relatively high concentration of Housing New Zealand (HNZ) accommodation in northern Waterview (notably along Herdman Street, Daventry Street and Oakley Avenue).

As described in Section 18.2.1.2, the Waterview Reserve and Esplanade strip represent a significant recreation resource for local residents (particularly those residents living in the north of Waterview where access to other parks and reserves is more limited).

Important transport linkages include SH16, the local road/footpath network and the Northwestern Cycleway. The GNR overbridge provides a pedestrian connection over the busy GNR.

[8] The Waterview Primary School is another key education facility. Effects on this facility are discussed in Sector 7 (Chapter 20) of this AEE.

Figure 18.4: Community Infrastructure in Sector 5

18.4.2 Assessment - Operation[9]

Residential property acquisition is a key impact of the Project

18.4.2.1 *Effects from Property Acquisition*

As discussed in the land use assessment above, residential property acquisition will reduce population size in Waterview[10] by around 80 households in this Sector. The impact of residential land take will result in (at least initially) a high degree of change for these communities. The potential social effects of the loss of these dwellings include:

Social impacts relate to impacts on people's way of life, health and wellbeing, accessibility and connectivity and impacts on community infrastructure

- Potentially significant displacement/fragmentation of the current Waterview community, given the scale of property acquisition (the combined property acquisition in Sectors 5 and 7 affects 8.5% of households in Waterview);
- Potentially significant impacts on community cohesiveness, given that some residents may not be able to relocate within the same neighbourhood;
- Impacts on the ability of residents to participate in social/cultural activities (for example, attend community events or a local church); and
- A change to the composition of the community (a demographic impact from the population loss). This effect is noted as the Census Meshblocks affected by property acquisition have a higher proportion of Pacific Island residents and HNZ/lower socio-economic residents relative to the wider Waterview suburb.

Beyond the population loss resulting from the required property acquisition, it is also likely that some current residents will decide to move elsewhere as a result of the Project. This would result in a change to, rather than a loss of, residents from remaining areas in the local study area, and as such is considered to result in a neutral population effect overall.

It is acknowledged that this may result in a high degree of change for affected residents and that this initially is a significant impact at least in the short to medium term. Ameliorating factors for longer term impacts include the relatively high natural 'turnover' for housing rates in Waterview[11] and the ability for people join new facilities and adjust their living patterns and social networks. The existing arrangements between the NZTA and HNZ, related to the communication and provision for tenant relocation will provide mitigation for a large proportion of the community in respect of these effects. The advanced purchase strategy employed by the NZTA for the Project has also reduced the severity of these impacts enabling people to move on with their housing choices at timeframes of their choosing (prior to lodgement of the NORs).

---

9 It is recognised that social impacts have been occurring in the planning phase of the Project at the local level, mainly in terms of the uncertainty caused by the Project, particularly surrounding potential property acquisition. Further details are contained in Technical Report G.14 *Assessment of Social Effects* (not repeated in this AEE).

10 It is acknowledged that these impacts will occur from the construction phase, due to the timing of property acquisition.

11 Almost 60% of Waterview residents had resided at their current place of residence for less than 4 years at the time of the 2006 Census of Population and Dwellings.

These effects will be further offset by the Project providing improved accessibility within and between local communities for the wider study area (as discussed in Chapter 13). This will result in an increase in people's accessibility and consequently ability to participate in social/cultural activities. Furthermore, the longer term growth anticipated as a result of improved accessibility (e.g. the opportunities for urban intensification) is considered to (at least in part) off set the land requirement impacts.

18.4.2.2 *Effects from New Motorway Structures*

Operation noise, vibration, visual and air emissions have the potential to generate nuisance, amenity and health effects (which are discussed more specifically in terms of emissions, in later Sections of this Chapter). Specifically, for the social impact assessment, these effects have the potential to impact on people's wellbeing and quality of life.

For the new surface Section of SH20, the large scale of the motorway structures will bring about a notable change in community character as a result of visual impacts in the public domain (see Section 18.6). Overall, community character impacts are considered to be minor to moderately negative as a result of the new surface motorway structures and northern ventilation building and stacks[12]. It is considered that over time, people will gradually adjust to their new environment as it becomes a normal part of their day to day surroundings. By the time the Project is constructed, most residents can be expected to have factored the Project into their own expectations and aspirations about the future of their own lives and communities.

Overall, the Project will generate accessibility and connectivity improvements for local residents in this area. It is considered this will result in positive social impacts to people's patterns of daily living. These benefits are attributed to:

- Improved accessibility to and across the State highway network in turn, improving accessibility to areas of places of work, community facilities and facilities of regional importance in the wider area[13];
- A diversion of traffic (including heavy vehicle traffic) from local streets (e.g. GNR) which will improve travel times for local residents who use these routes, increase safety for pedestrians, cyclists and motorists, and also help to reduce travel times for public buses using local streets;
- Improved accessibility between the Northwestern Cycleway and the Waterview Reserve, via the proposed bridge over the Oakley Inlet (proposed as mitigation for the impacts on the Oakley Inlet Heritage Area); and

12 More specifically discussed in Sector 7, Chapter 20 of this AEE.

13 While there is no direct connection to/from Waterview to SH20 southbound, the improved capacity works on SH16 are considered an accessibility improvement for this community.

- Improved accessibility for users of the Northwestern Cycleway (overall making the user experience a more pleasant one with increased separation from vehicular traffic, route improvements and widening to 3m along most of the Project area).

It is acknowledged that the Project will continue the sense of severance between Waterview/Point Chevalier (already severed by SH16) and Unitec/Springleigh (already severed by GNR). However, actual connectivity will not change as a result of the Project's expanded GNR Interchange.

The improved public access to the Star Mill/tannery heritage area through the proposed walkway/cycleway is considered to be a moderately positive social effect on people's culture (given that a number of people indicated a particular interest in this site in Project consultation), in addition to the connectivity benefits provided by the pedestrian bridge over Oakley Creek (noted separately above).

18.4.2.3 *Effects on Community Infrastructure*

Once reserve reinstatement measures have been implemented, impacts on Waterview Reserve are considered to be neutral in the long-term. Usability and enjoyment of Waterview Reserve will be similar to the present situation today, given the 'like for like' replacement of reserve area and facilities. While proximity to the GNR Interchange structures will be greater than the existing impact of SH16, the improved street frontage of the reserve will provide the benefit of passive surveillance of the reserve (assisting in an appropriate Crime Prevention Through Environmental Design (CPTED) response). The proposed improvements to Saxon Reserve enable this reserve to be expanded to better serve as an alternative 'community reserve' in a central location in the Waterview community. No adverse air quality effects are expected on users of Waterview Reserve; however the visibility of the ventilation stack may (at least initially) deter some residents from using the reserve due to perceived health impacts. However, for most users this impact is likely to diminish with time as the ventilation stack gradually becomes an accepted part of the surrounding environment. Social impacts associated with impacts on other reserve areas are considered to be neutral.

Issues for St Francis School are largely related to nuisance effects that the School already experiences due to its proximity to SH16. Overall the School will experience an improvement in air quality, and noise impacts will be similar regardless of whether or not the Project goes ahead. No impacts are expected in relation to the School roll.

18.4.3 Assessment – Construction

18.4.3.1 *Effects on Residents*

Construction has potential adverse social impacts on the community and its residents

Overall, construction activities are considered to result in reduced 'liveability' for the community in this area affecting people's quality of life and wellbeing. In particular, these effects are associated with the emissions from construction (noise, vibration and air discharges). It is likely that some residents may experience stress and/or nuisance as a result of these emissions. Impacts are expected to range from minor to potentially significant impacts, varying according to proximity to construction areas and the duration of exposure.

Construction Yards 3, 4 and 6 are located within this Sector, and will be major construction yards throughout the construction period. The presence of construction yards will challenge some local resident's expectations of neighbourhood amenity, character and safety. This may affect people's pride in their neighbourhood but is considered to have little impact on wellbeing or way of life overall. In particular, these effects are associated with the physical impact of construction works and the changing visual character of the locality over the construction period (e.g. removal of trees and vegetation or the presence of buildings, stockpiling and machinery).

The traffic disruptions projected during construction may cause minor impacts in restricting people's accessibility to go about their normal living patterns and participate in social/cultural activities during construction. While these effects are considered in terms of travel times, the overall impact of such delays in terms of living patterns and connections are considered to be relatively minor and able to be countered by management measures. Likewise, while pedestrian access in some areas may be made somewhat more difficult, the overall impact is such that it is not considered to limit people's ability to go about their normal lives.

Potential that construction works will have positive socio-economic outcomes

Over the construction period, there is also potential that construction works will have positive socio-economic outcomes as the construction workforce will increase demand for retail and other services (e.g. food outlets, service stations and vehicle servicing). Given the duration of construction, potentially housing (particularly rental) demand may also increase. Experience in other major construction sites indicates that, if well managed, the construction site and the associated workforce can become a positive part of the community (involved in community services, such as education) and hosting community events (e.g. community planting days). The daily influx of temporary construction workers will increase the daytime population of the local community, and increase the associated sense of 'busy-ness' in the area. For some residents this will heighten the sense of impact/disruption to their daily lives during construction. For others, this is accepted as a necessary part of construction and is not seen as a negative impact and may even be positive (e.g. the socio-economic activity associated with this population).

Some residents have indicated that they will choose to voluntarily relocate from Waterview prior to construction, in anticipation of construction impacts expected in this area. Should this change be realised, there will be some change to the composition of residents living in the community. However, it is considered this voluntary movement would result in a change to, rather than a loss of, residents from the local study area. As such it is considered to result in a neutral population effect overall but may cause some effects on community cohesion and existing social networks. These impacts are expected to reduce over time as people adjust to their new neighbourhood. Overall impacts are unlikely to be widespread. In individual cases, it is acknowledged that a perceived reduction in house 'saleability' during the construction period could restrict (but not inhibit) people's future plans, however on balance impacts are considered to be minor and not widespread (particularly in the longer term).

18.4.3.2 *Effects on Community Infrastructure*

As outlined in Section 18.2.3.1, 100% of the 'active reserve' part of Waterview Reserve is required throughout construction. The loss of this open space will (without mitigation) result in a decrease in leisure and recreation opportunities for local residents, including both formal (e.g. sports fields, playgrounds) and informal (e.g. use of walkways/linkages and children playing) recreation opportunities. Measures to mitigate construction impacts are proposed as part of the reserve reinstatement package (see Section 18.2.4.2). Given the proposed temporary provision of playing areas/sportsfields, residents are not considered to experience more than minor impacts from the temporary loss of Waterview Reserve.

There will be impacts on St Francis School during construction, particularly associated with emissions from construction (e.g. noise) and from traffic delays. However, the mitigation measures proposed with respect of these matters are considered sufficient to address these social impacts.

18.4.4 Mitigation - Operation

18.4.4.1 *Avoidance of Impacts through Design*

Project design amendments have enabled property acquisition in Sector 5 to be minimised from previous designs. In order to minimise property acquisition impacts, proactive and early property purchase has played a role in reducing the uncertainty for individual households. The NZTA has worked closely with HNZ to provide advance warning regarding the purchase of properties from the national housing stock, to enable HNZ maximum time to facilitate the resettlement of the individuals and families affected.

A significant portion of the alignment in the vicinity of the GNR Interchange (which will connect SH16 with SH20) is located within land already designated for motorway purposes. Partial property acquisition has been minimised as far as practicable in order to avoid unacceptable residential amenity impacts (e.g. situations where residents would lose a significant part of their outdoor living area).

Reserve reinstatement is provided on a 'like for like' basis in terms of both size and usability (as set out in Section 18.2.4.2).

18.4.4.2 *Mitigation and Management Measures*

It is proposed that the NZTA continue and further develop the staged property purchase strategy currently implemented, to minimise uncertainty within the community and provide residents sufficient time to relocate.

A number of other mechanisms proposed to address the operational effects of the Project (particularly for noise and vibration emissions and visual/landscape effects) will assist in addressing adverse social impacts. In addition, the following specific measures are proposed:

- Provision of information to residents on the land acquisition process;
- Involvement of the community and stakeholders (including iwi) in the restoration of open space and recreation areas; and
- Measures to manage and remedy any graffiti (this was raised as an issue in consultation).

Beyond this, it is noted that a confirmed decision on the Project will assist in providing certainty for local study area residents and enabling people to move on with their lives and make decisions that may have been delayed as a result of the earlier uncertainty caused by the Project.

18.4.5 Mitigation - Construction

18.4.5.1 *Avoidance of Impacts through Design*

The establishment of temporary sportsfields during construction will mitigate access to open space/recreational opportunities during construction (see Section 18.2.5.1).

Buffer areas have been proposed within Construction Yard 6 to minimise adverse effects on neighbouring residents (e.g. from light spill and hazardous facilities).

18.4.5.2 *Mitigation and Management Measures*

Management and mitigation for the identified social effects includes:

- Development of an education programme for St Francis School students about the Project and its construction (including information/education about traffic safety and air quality impacts);

- Development of a communications strategy to keep the community and stakeholders informed about construction activities and the construction programme. This strategy would include information on the management of emissions from the Project (e.g. noise and vibration during construction) and as appropriate involvement in the construction works (e.g. community planting days);
- Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of the CEMP; and
- Implementation of a formal complaints/feedback process as part of the management of construction (e.g. through the CEMP).

18.5 Cultural Impacts

18.5.1 Existing Environment – Iwi with Manawhenua

Te Kawerau a Maki and Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Auckland (west) and in this Sector. In this regard, Ngati Whatua has a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

Te Kawerau a Maki and Ngati Whatua has manawhenua status

18.5.2 Assessment of Cultural Effects

18.5.2.1 *Cultural Effects – Te Kawerau Iwi Tribal Authority*

Of relevance to the Project in this Sector, Te Kawerau Iwi Tribal Authority identifies the following environmental and resource issues:

- That the mauri of all natural waterways is protected; and
- That heritage sites, water quality, the quality and availability of kaimoana (seafood) are protected.

Specific comment has been sought from Te Kawerau a Maki Trust. At the time of writing this AEE, no comment had been received.

18.5.2.2 *Cultural Effects – Ngati Whatua o Orakei*

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, they identify the following environmental and resource issues associated with the SH20 Section of the Project:

- Green space and reserves as important for ecological health and in providing social/cultural/health to local residents. Specifically, Ngati Whatua expressed concern over the loss of reserve area from Waterview Reserve. They also identified visual and acoustic impacts of the surface motorway as impacts. Ngati Whatua also identify that landscaping, planting and the provision of better pedestrian access through the park would improve their use/enjoyment as well as the biodiversity and ecological condition of the land and water. It is noted that reserve reinstatement is provided as mitigation for these impacts (see 8.5.3.1);
- The mauri, amenity and ecological health of Oakley Creek. Matters of concern include stormwater discharges to Oakley Creek, degradation of water quality and visual effects of the above ground motorway structures. Opportunities for the future improvement of Oakley Creek were also identified as important to Ngati Whatua. Ngati Whatua states that the protection/enhancement of Oakley Creek should not be seen as a 'cost' or impediment to the Project; and
- Archaeological/Maori heritage sites given the history of Oakley Creek as a Maori settlement area. Site R11/2203 (former Maori settlement area comprising terraces, pits, midden, stone mounds and karaka trees (see Figure 18.5)) in Sector 5 was identified as particularly important to Ngati Whatua. Impacts on this site are avoided by construction works. There may be possible minor impacts from the development of walkways (proposed as mitigation), but overall these walkways will enhance public access to and appreciation of this archaeological area.

Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE, no further comment had been received.

18.5.3 Mitigation of Cultural Effects

Cultural issues identified have influenced Project design and mitigation

The cultural issues identified have been taken into account in the technical assessments and are reflected in the design of the Project and in the scope and design of the mitigation measures proposed.

18.5.3.1 *Avoidance of Impacts through Design*

The following design elements are considered to have avoided potential adverse effects on tangata whenua values:

- Reserve reinstatement measures (including the replacement of open space land on a 'like for like' basis, landscaping and visual and acoustic screening, and landscaping) which serves as important mitigation for the replacement of open space impacted by the Project;
- Sites of archaeological importance have been avoided as far as practicable; and
- Stormwater treatment (see Section 18.17) is a further important measure in terms of the water quality and mauri of Oakley Creek and the coastal areas in this Sector.

18.6 Landscape and Visual Effects

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

18.6.1 Existing Environment

Within and in close proximity to this area, the landscape setting is dominated by residential development. This development is dominantly 1940s and 1950s State housing in the Waterview area, with a more varied mix of housing around Point Chevalier (including some relatively recent infill housing). The housing stock north of SH16 is afforded Harbour views to and over Eric Armishaw Park.

Oakley Creek and its esplanade reserve afford a significant physical separation between the current SH16/GNR Interchange and the Unitec campus. The landforms, mature trees and topographical changes that mark the edge of Oakley Creek, help to buffer these activities (e.g. the campus and Mason Clinic).

The existing GNR Interchange comprises two distinct areas:

- the current interchange which is totally dominated by the SH16 and GNR carriageways and bridge, on and off-ramps, the cycleway/walkway over GNR and limited vegetation; and
- the residential catchment of Waterview immediately west of GNR in the vicinity of Waterview Reserve.

The lower reaches of Oakley Creek remain essentially natural, flanked by mangroves and coastal regeneration, even if most of the taller canopy species, such as large amounts of privet, are exotic. Currently merging with Waterview Reserve, the Oakley Inlet environs and their planting[14] serve to screen much of the current Interchange from the Unitec campus, Mason Clinic and nearby housing, including that south to south-west of the current interchange. The rising terrain immediately east of Oakley Creek further helps to largely isolate the Interchange from much of the Unitec land, including the old Carrington Clinic building with its very distinctive architectural profile.

Along the northern margins of the current Interchange, planting is more sporadic and less deep or mature. Nevertheless, trees and pockets of bush on the left-over land between the Interchange and residential properties extending from Eric Armishaw Park through to St Francis School create sufficient screening that exposure to the motorway system is typically sporadic, even intermittent. Most properties which are one row of housing back from the motorway system are almost entirely screened from it at present.

The Waterview residential area almost entirely comprises single storey houses, with the majority of views confined to the immediate property and street environs. This only really changes closer to both the Oakley Inlet and Oakley Creek, with a walkway reserve along the coastline affording glimpses though to SH16. Views from the reserve itself are more open and expansive in places. The existing GNR corridor also accommodates views to and beyond the Oakley Esplanade Reserve for properties on the very edge of that road, although the BP service station and its planting limits such views for some. However, the high traffic volumes on GNR limit the overall amenity of such views.

18.6.2 Assessment - Operation

Specific catchments are identified in Technical Report G.20

The visual catchment and related audiences potentially affected by the Project have been identified within Sector 5 for the assessment of landscape and visual effects. Overall, 28 public realm and 1 private residential view points were assessed. The potential effects of the Project, in terms of landscape, amenity and natural character values are described in more detail in Technical Report *G.20 Assessment of Visual and Landscape Effects*.

The Project works compound the existing Interchange's appearance over the surrounding residential and coastal environment. While the viewpoints to the north and east of the Interchange are considered to be affected to a limited degree, the proposed works will create a significant impact to the area south of the Interchange, with the new SH20 tunnel portal, four ramps and associated infrastructure (e.g. light poles) occupying most of the existing Waterview Reserve and displacing adjacent housing along Waterbank Crescent, Herdman Street, Cowley Street and GNR. The removal of housing and the proposed clearing of weed and shrub species within and around the Star Mill Site will also increase exposure to the motorway structures and open up views to Waterview Reserve and the SH20 tunnel portal and

[14] Oaks, macrocarpa, poplar and pine.

ramps to residential areas which currently do not view the Interchange.

Over time, it is expected that proposed planting will soften the motorway's form (as defined in the plans F.16 *Urban Design and Landscape Plans*), however the residential character south of the Interchange will remain adversely affected by both the new motorway structures and their use. It is noted however, that the front tier of houses facing the new motorway are likely to absorb the bulk of the Project effects on Waterview's residential receiving environment and the properties beyond this will have surprisingly little direct visual contact with the motorway system and will not be significantly affected by it.

A clear contrast emerges between high effects on the area generally around Waterview Reserve, the Waterview Primary School and that part of GNR north of Oakley Avenue, and the moderate to low order effects that will be experienced from central Herdman Street (near Waterbank Crescent) westwards and from Oakley Street southwards. Other surrounds away from Waterview will generally have a low impact.

For motorists, pedestrians and cyclists approaching from the direction of Avondale and Blockhouse Bay Road on GNR, the transition of the new Interchange would be very marked, with a new series of fly-overs emerging from the ground and vegetation left of the road corridor, before following the line of GNR towards SH16. These elements would contrast with the residential and open space form. On the other hand, for those approaching from Point Chevalier or coming off SH16, the ramps and fly-overs would be somewhat more muted by pre-exposure to the Interchange.

In summary, it is considered that the visual effects within this Sector are significant

In summary, it is considered that the visual effects within this Sector are significant on particular areas within the Waterview community with a new dominant motorway structure imposed within a residential community. However it is noted that while the structural content of the current Interchange will increase so too will the vegetated area surrounding the motorway structures (e.g. re-vegetation will virtually in-fill all of the land between motorways and their connecting ramps). The proposed planting (as defined in the plans F.16: *Urban Design and Landscape Plans*) will enhance the screening already provided by planting around the northern perimeter of the motorway corridor and will also assist in softening the interface between the remaining residential catchment and the new recreational areas and car parking around Waterview Reserve and assist in screening the views from this receiving environment to the more distant ramps and other motorway structures. This is set out further in Section 18.6.4 below.

The proposed planting will enhance the screening and will also assist in softening the interface between the Project and surrounding environment

18.6.3 Assessment - Construction

Within Sector 5 it is expected that the removal of dwellings and the construction of the Project will significantly change the residential environment and generate significant visual effects on those people within the local Waterview community (particularly those residing within Herdman Street, Waterbank Crescent and GNR – together with the Waterview Primary School) and those commuting and travelling along GNR. Proposed planting and bunding will screen some of these effects, and temporary fencing may also assist in reducing such effects, but this cannot alleviate the loss of amenity associated with the construction period. It is

acknowledged that effects in relation to the Point Chevalier residential catchment, Unitec campus and even Eric Armishaw Park are much more limited in their scope and severity.

18.6.4 Mitigation - Operation

Enhancement planting along the length of the works is proposed, as defined in the plans F.16 *Urban Design and Landscape Plans* and includes:

- Replacement of vegetation to the south of the Interchange (bordering Oakley Inlet) with 'Coastal Forest' ecotype planting and removal of weed species existing;
- Low mixed planting between the ramps and the ramps and pedestrian/cycle way;
- A Pohutukawa Parkland Node (comprising Pohutukawa, native shrubs and screen planting) to be developed at GNR Interchange to create a buffer between the Motorway system and nearby housing ('A Basalt Rock Forest' ecotype); and
- Mass planting along the GNR and Herdman Road boundaries to screen emerging ramp structures, including 'coastal forest ecotype' planting.

18.6.5 Mitigation - Construction

The following mitigation is proposed:

- The installation of solid screen/safety fencing during the construction period to minimise views into the construction areas; and
- Early placement of bunding and planting to screen the construction area in Waterview Reserve.

18.7 Amenity Trees

A Schedule of Trees identified in the Project area is in Appendix E.7 of this AEE

A number of trees in this Sector appear to be in generally good health and form. While there were no trees 'scheduled' within the Auckland District Plan, several trees are considered valuable to the amenity and urban environment. A schedule of trees identified in and around the Project area is provided in Appendix E.7 of this AEE. This Schedule has been prepared by a qualified arborist.

18.7.1 Existing Trees

An array of exotic and native tree species of varying age, size and quality exist. A number of those trees are situated within Waterview Reserve and specifically at the northern end of the reserve near Cowley Street. Additional native and exotic trees are located within the residential lots surrounding Waterview Reserve. In particular the existence of several well-established native tree species upon the property of 23 Waterbank Crescent is noted. This includes a Kowhai tree, Kahikatea and a large Kawaka tree.

18.7.2 Assessment - Construction

Construction works may require the removal of some existing amenity trees within the Waterview Reserve as the area is a key construction site. In some instances relocation of particular trees could be considered. (e.g. Ash and Titoki trees at the northern periphery of the Reserve). Further investigation work would be required to determine the feasibility of relocating the better quality specimen trees (i.e. ground conditions).

The existing trees within the middle of Waterview Reserve (e.g. Poplar and Gum Trees) could potentially be retained and the area still utilized as a contractors working area. Specific tree protection measures would however need to be implemented to ensure the particular tree(s) and their growing environment is not adversely affected.

18.7.3 Mitigation Measures

It is proposed that detailed construction planning shall, where practicable, give consideration to retaining the above valued trees (i.e. where such trees are not required for the permanent works of the Project, consideration should be given to construction methods that avoid the need for tree removal). It is proposed that this planning and management can be provided through the CEMP and associated management plans (Technical Report G.21).

The loss of trees can be mitigated by appropriate landscape and specimen planting

Where removal of these trees is required appropriate mitigation and landscape planting can mitigate any effects, in accordance with the urban and landscape design plans proposed (see Plans in F.16 of this AEE).

18.8 Archaeology and Heritage

A full assessment of archaeological effects is provided in Technical Report G.2

The following provides an assessment of the archaeological effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.2 *Assessment of Archaeological Effects*.

18.8.1 Existing Environment

A number of archaeological sites have been recorded around the GNR Interchange (see Figure 18.5).

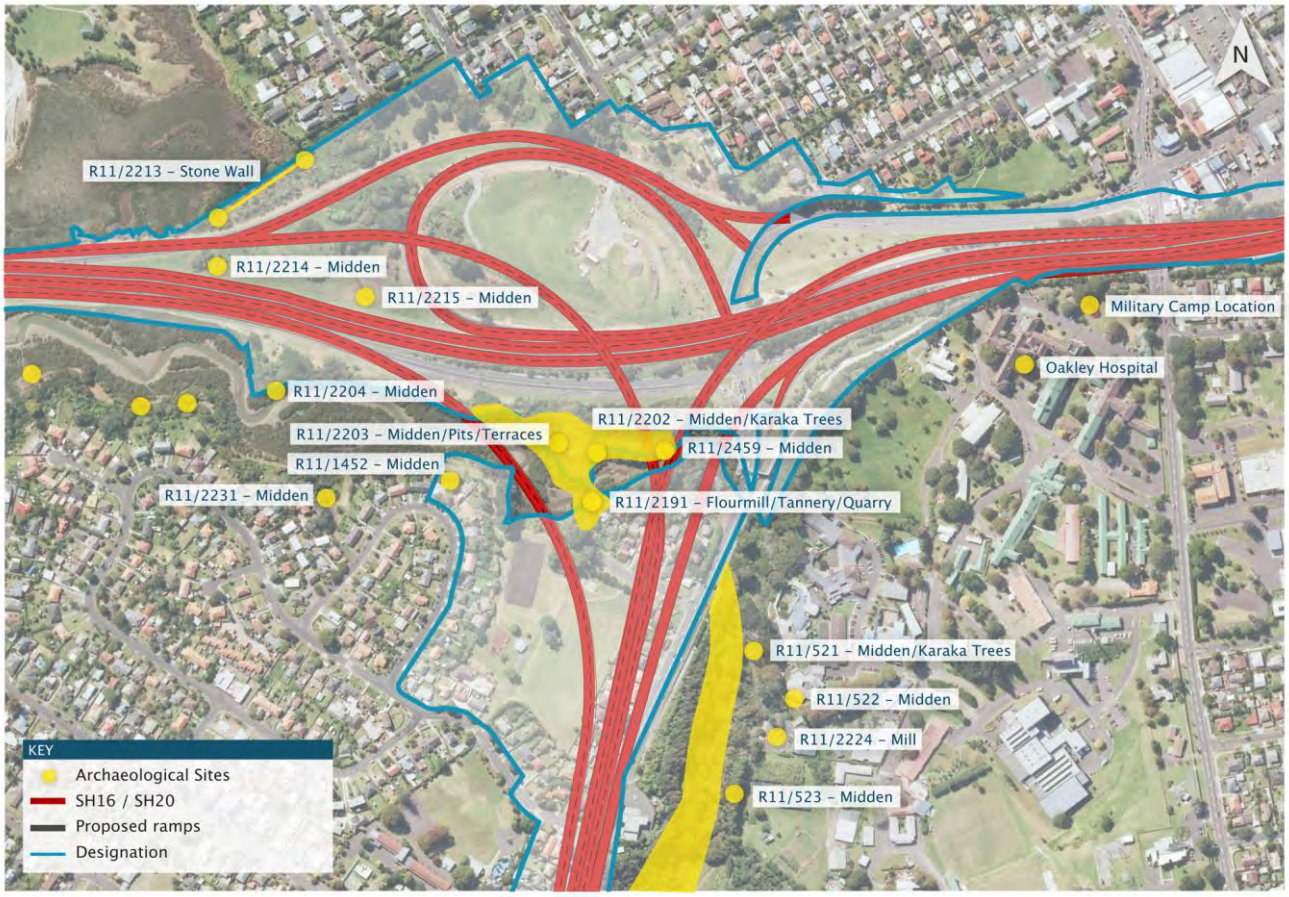


Figure 18.5: Recorded Archaeological Sites in Sector 5

The complex of sites located on the banks of the Waterview Inlet and Oakley Creek is considered a significant heritage landscape. Within this area, there are three sites of significance in terms of their archaeological/heritage landscape value:

- Star Mill/Garrett Tannery/Quarry site (site R11/2191);
- Remains of former Maori settlement (site R11/2203); and
- Early European stone wall (site R11/2213).

Other sites in the vicinity are middens, most of which have been either damaged or destroyed and are of limited archaeological value.

The seawall of Star Mill/Tannery/Quarry site is scheduled in the Auckland Regional Plan: Coastal (ARP:C). The former Carrington Hospital (now part of Unitec) is a significant historic building[15] in the vicinity of the Project, and the building and surrounds (extending to SH16) are scheduled in the Auckland District Plan (Isthmus Section). The cluster of Maori habitation sites along Oakley Creek is scheduled in the Auckland City District Plan.

18.8.2 Assessment - Construction

Works will impact to some extent on the significant Oakley Inlet heritage area

Works will impact to some extent on the significant Oakley Inlet heritage area, where sites R11/2191 (Star Mill/Garrett tannery/quarry), R11/2203 (Maori settlement), R11/2202 (midden) and 2459 (midden) are located[16]. The features of the site complex have been largely avoided by placing the supporting piers for Ramps 3 and 4 on the periphery of the site. However, there will be some damage to the eastern part of the site from ramp piers. Depending on machine access and construction methodology relating to the piers for Ramps 3 and 4, effects on the site should be minimal, although there will be some adverse visual effects from the presence of motorway ramps passing over and adjacent to the site. Overall, the effects of the Project on this heritage area will be more than minor, taking into account its heritage significance. The improved access to the site from the walkways and the bridge and improved vegetation management proposed as mitigation would be a positive effect of the Project. While the Project will have visual effects on this site, it will not prevent the heritage landscape from being read and understood.

The seawalls of the Star Mill site (R11/2191) identified in the ARP: C will be affected by the remedial works, however these are considered to be positive rather than adverse effects (subject to the mitigation identified in Section 18.9.4).

There is also some potential for effects on unrecorded subsurface archaeological remains in previously unmodified areas close to the north and south banks of the Oakley Inlet[17] (in particular, potential subsurface midden deposits). There is also some potential for unrecorded remains relating to the original mill workers houses adjacent to GNR, which should be investigated during and after removal of the modern houses to establish whether any remains are present.

The proposed SH16 widening and tie-in works near the GNR Interchange will impact on the western end of the stone wall (R11/2213), which is considered to be of moderate archaeological and heritage significance. The works will potentially destroy 30m of the 130m wall. There is also some potential for destabilisation of parts of the remaining wall as a result of machine movement unless care is taken to minimise impacts. Overall, impacts are considered to be minor and any indirect damage during construction can be remedied by reconstruction of the affected

15 An NZHPT Category I registered Historic Place.

16 It is noted that more information on the specific heritage features of these sites is available in Technical Report G.2 and that this report cites other investigative reports on the site. The site is referred to as the 'Waterview Inlet Heritage Area' in a number of these reports. For the purposes of this AEE, we have referred to the area as the Oakley Inlet (to distinguish from the inlet to the Waterview Estuary beneath the Causeway Bridges).

17 Along which a number of archaeological sites have been recorded.

parts of the wall. Effects on the wider heritage landscape are considered minor as the wall has previously lost its landscape context.

Works will also impact on the locations of two recorded midden sites (R11/2214 and 2215) within the GNR Interchange. However, these sites have no known intact deposits and are of limited archaeological significance. Effects on these sites are considered to be less than minor.

The works will not impact on the scheduled Carrington Hospital building, but will affect a part of its scheduled surrounds (which extend up to the motorway). There will be no effects on any known heritage values (the works are along the existing boundary of the Northwestern Motorway).

An approximate location of the 1861 artillery camp has been recorded in this general area (its precise location and whether any subsurface remains have survived are unknown). It is unlikely that there are any remains relating to the 19th century artillery camp in the area of the Project, however the potential for discovery is acknowledged.

18.8.3 Mitigation

The Archaeological Site Management Plan (ASMP) (Appendix D of Technical Report G.2 *Assessment of Archaeological* effects), sets out avoidance, mitigation and monitoring measures that will be undertaken during construction. The following sections describe mitigation measures for specific areas within this Sector.

18.8.3.1 *Oakley Inlet Heritage Area*

Mitigation is proposed for the Oakley Inlet Heritage Area

For the Oakley Inlet Heritage Area[18] (also referred to as the Waterview Inlet Heritage Area), to address the adverse effects of the pier and ramp construction and the longer term visual impacts of the ramps, it is proposed that the following mitigation be implemented:

- Monitoring of works by an archaeologist to investigate and record any affected archaeological remains (including vegetation removal);
- Planning and operation of machine access and works to minimise adverse effects on archaeological features;
- During and following removal of the houses north of Cowley Street and west of GNR (the area of the Mill workers' cottages), investigations should be carried out to establish if any archaeological remains have survived and (as appropriate) recording should be undertaken;
- Remedial or (limited) restoration works to the basalt walls, wheel pit and bridge abutment to ensure their long term preservation;

[18] Sites R11/2191, R11/2202, RR11/2203, R11/2459.

- Preparation and implementation of a vegetation management plan to remove vegetation that is damaging archaeological features and to protect and enhance features with appropriate vegetation cover;
- Improving public accessibility to this area post-construction, including provision for a bridge linking the northern and southern banks of the inlet (see plan F.9 *Oakley Inlet Heritage Plan* for details); and
- Provision of interpretative signage.

18.8.3.2 *Other Areas*

For the Stonewall[19] on the northern side of the Interchange, the following mitigation is proposed:

- Operation of heavy machinery as far away from the wall as possible, and demarcating the Section to be preserved with waratahs and an adequate buffer area prior to the commencement of earthworks;
- Use of any surplus stone for repairing the remainder of the wall (or to be offered to [Auckland Council] for repairing other historic stone walls within reserves, such as those along the Oakley Creek); and
- Clearing the remainder of the wall of vegetation growth and repairing the wall where necessary to a specification prepared by a heritage professional. The wall should be left exposed to view, and a vegetation management and maintenance plan developed.

For other archaeological sites, or in response to the potential to impact on unrecorded sites, the following mitigation is proposed:

- Monitoring of works in the vicinity of midden sites R11/2214 and 2215 and the previously unmodified areas near the banks of the Waterview Inlet by an archaeologist to record any intact remains (if present); and
- Follow the Accidental Discovery Protocols detailed in the Archaeological Management Plan will be followed.

[19] Site R11/2213.

A full assessment of effects on coastal processes is provided in Technical Report G.4

18.9 Coastal Processes

The following provides an assessment of the effects of the Project on coastal processes. This is a summary of the detailed assessment undertaken in Technical Report G.4 *Assessment of Coastal Processes*. More detail on the impacts of both construction and operation of the Project on coastal processes is provided in Chapter 13 of this AEE, which focuses on Region and district wide effects.

18.9.1 Existing Environment

A description of the coastal environment for the whole Project is set out in Chapter 4. The coastal works in Sector 5 are limited to the Oakley Inlet which feeds into the Waterview Estuary.

The Waterview Estuary and the Oakley Inlet are estuarine systems which have been extensively modified by the construction of the original Causeway and catchment runoff that has led to an accumulation of fine-grain sediments over the past six decades.

All regional and/or Project-wide effects on coastal processes are discussed in Chapter 13. More specific localised effects are set out below. The key works or activities in Sector 5 relevant to coastal processes are the installation and removal of temporary piers (construction platforms) and installation of permanent piers (ramps) for the SH16/SH20 ramps at the GNR Interchange[20].

18.9.2 Assessment of Effects - Operation

18.9.2.1 *Permanent Occupation within the CMA*

The proposed pier locations are detailed in F.12: CMA Permanent Occupation. The four on and off-ramps will be supported on single 1.8m cast in-situ piers. All of the piers are located outside the main sub-tidal channel of Oakley Inlet, apart from Pier 5 (of Ramp 2), which is located on the side of the channel. All the other piers are located well up the intertidal areas within mangrove areas. As such given the position of the piers outside the main sub-tidal channel, the effects on hydrodynamic flows, general scour and geomorphology of Oakley Inlet are likely to be small.

The location of the piers (mostly in the upper elevations of the inter-tidal zone), will have only minor effects on backwater effects upstream during Oakley Creek flooding. Local scour immediately around the piers could occur under Oakley Creek flood events, particularly for Pier 5 (Ramp 2) on the side of the sub-tidal channel, although the amount of scour would be tempered by flow retardation provided by the surrounding mangroves. Even if local scour were to occur, ongoing sedimentation processes would re-fill these localised scour depressions within weeks particularly during spring tides.

[20] It is noted that works proposed in the Oakley Inlet which are associated with the widening of the Causeway, are discussed in relation to Sector 4, Chapter 17 of this AEE.

18.9.2.2 *Operational Stormwater Discharge*

The operational traffic load and increase of impervious surface area has the potential to increase sediment and contaminant load entering into Oakley Creek and thereby discharging into the CMA on entering Oakley Inlet.

Although stormwater control measures will be used along the proposed motorway where sediment may enter Oakley Creek, there is still potential for some sediments and contaminants to be released into the Creek and ultimately discharged into the CMA.

Modelling has been undertaken to predict the sediment and contaminant load released from the new road area, the retention of sediments and contaminants using stormwater treatment measures and dispersal of the discharged sediments and contaminants throughout Oakley Inlet, Waterview Estuary and Central Waitemata Harbour by tidal processes.

The modelling predicted that after passing through the proposed stormwater treatment measures, the operational loads entering into Oakley Creek are not a significant increase over the existing base loads from the overall catchment. Furthermore, any sediment released into the CMA through Oakley Inlet gets rapidly dispersed through Waterview Estuary and the central Waitemata Harbour. As a result, levels of suspended sediment concentration, sediment deposition depths and contaminant accumulation, are low. The resulting environmental effect in terms of coastal physical processes is minimal and the effects are less than minor.

Effects in terms of coastal physical processes are less than minor

18.9.3 Assessment of Effects - Construction

18.9.3.1 *Occupation of the CMA by piles to support Temporary Staging Platforms*

Temporary staging platforms are required to be located partially or wholly within the CMA of Oakley Inlet. Overall 71 temporary piles of 0.6m diameter are to be temporarily installed to support staging platforms used for the construction of the on/off ramps for the GNR Interchange. The total area of temporary seafloor occupation is therefore estimated to be 42m^2, with the temporary occupation plans detailed in F.13: CMA Temporary Occupation.

Only 3 piles are to be located within the central portion of the main channel, with another 4-5 piles near the sides of the main subtidal channel and the remainder positioned higher up the inter-tidal banks within the mangroves. As a result the actual temporary loss of channel flow area will be small. Some disturbance of the upper-tidal vegetation will be required to drive the temporary piles.

18.9.3.2 *Disturbance from Temporary Building Platform Piles*

Metal piles of 0.6m diameter will be driven into the upper reaches of Oakley Inlet, in order to support a temporary building platform. Most of these piles are within the upper tidal vegetation areas and will require removal of vegetation within the immediate surroundings of piles. The total area of vegetation removal will be small in comparison to the total area of CMA in these upper reaches of Oakley Inlet.

Given the relatively high background suspended-sediment concentrations and that the sediments disturbed from the seabed of the channel are similar to the type and colour of sediments causing turbidity in the Oakley Inlet, the effects on colour, visual water clarity and aesthetics of the water appearance will be less than minor after allowing for reasonable mixing.

18.9.3.3 *Discharges from Earthworks and Construction*

There is potential for sediment to be released into Oakley Creek from construction works in Sectors 7-9. Although sediment control measures will be used along the proposed works where sediment may enter the Oakley Creek, there is still potential for some sediment to be released into the Creek and thereby discharged into the CMA.

Resulting environmental effects in terms of coastal processes are minimal

The proposed works include sediment control measures (see Technical Report G.22 *Erosion and Sediment Control Plan*) to reduce the sediment being discharged into Oakley Creek.

Modelling has been undertaken to assess the construction loads entering Oakley Creek. This assessment concludes that, providing erosion and sediment control measures are in place, the effects will be relatively low, in comparison to base loads from the overall catchment, and that any sediment that is released into the CMA through the Oakley Inlet gets rapidly dispersed throughout Waterview Estuary. From the estuary much of the sediment discharged is released to the Central Waitemata Harbour. The resulting levels of suspended-sediment concentration, sediment deposition depths and associated particulate contaminant accumulation are therefore low. The resulting environmental effects in terms of coastal processes are minimal; localised and of short duration, and therefore the effects are less than minor.

18.9.4 Mitigation

18.9.4.1 *Avoiding Impacts by Design*

The design of the Project has sought to avoid potential impacts, including:

- The location of piles to support the temporary staging platforms has minimised the number of piles within the main channel of Oakley Inlet; and
- The spacing of the piers for permanent occupation during the design process has ameliorated any potential effects on physical processes (avoiding piers in the main channel, with the exception of Pier 5 of Ramp 2).

18.9.4.2 *Construction Management*

Erosion and sediment control measures during construction activities in accordance the proposed G.22 *Erosion and Sediment Control Plan.* Implementation of this Plan will minimise the release of sediment into Oakley Creek.

18.9.4.3 *Operation Management*

Stormwater control measures in accordance with Operational Stormwater Management Plan (OSMP) (Appendix D to Technical Report F.14 *Streamworks and Stormwater Discharges*) will minimise the release of sediments and contaminants from operational stormwater runoff into Oakley Creek.

18.10 Marine Ecology

A full assessment of effects on the marine ecology is provided in Technical Report G.11

The following provides an assessment of the ecological effects of the Project on marine ecology. This is a summary of the detailed assessment undertaken in Technical Report G.11 *Assessment of Marine Ecology Effects*.

18.10.1 Existing Environment

A full description of the "regional" marine environment within which the Project is located is given in Chapter 13.

The estuarine ecological values are assessed as moderate to low

Mangroves inhabit the intertidal mudflats within the Oakley Creek and generally the coastal edge vegetation comprises a narrow bank of native shrub, saltmarsh and exotic weed species. Some areas of native vegetation are present, mainly on the northern side of Oakley Creek adjacent to the existing motorway. The estuarine ecological values are assessed as moderate to low in this area due to the high concentration of contaminants in sediment and limited diversity of benthic invertebrates.

18.10.2 Assessment – Operation

The Project proposes occupation of the CMA and long term operational discharges of treated stormwater, both to the CMA and to Oakley Creek (which discharges to the receiving environment of the Waterview Estuary).

18.10.2.1 *Habitat Impacts from Piers*

The area of permanent habitat loss is estimated to be 20m^2 from the intertidal zone (as per the plans in F.12: CMA Permanent Occupation Plan). Shading of saline vegetation beneath the new ramps may limit the recolonisation of disturbed intertidal mudflat areas by mangroves upon completion of construction. In addition, existing mangroves that will be shaded may be less thrifty.

The adverse effects of installation of the permanent piers and the consequential habitat loss are considered to be moderate.

18.10.2.2 *Contaminant Discharges*

The management of stormwater is detailed further in Section 18.17. The issue of cumulative impacts of contaminant discharges is discussed in Chapter 13.

18.10.3 Assessment - Construction

Potential construction effects on marine ecological values include temporary habitat loss and disturbance, noise and vibration and the discharge of construction phase stormwater.

18.10.3.1 *Temporary Habitat Loss and Disturbance*

The area of temporary subtidal habitat loss/disturbance is estimated to be around 15m^2, whereas subtidal habitat loss/disturbance is estimated to be approximately 5m^2.

The adverse effects on the marine ecological values of temporary habitat loss/disturbance will be negligible

Construction of the ramp viaduct structures requires temporary occupation and disturbance of the CMA primarily from temporarily piling to support 12 staging platforms. The staging platforms extend from the northern and southern side of Oakley Inlet, thereby minimising disturbance of the low tide channel (see the plans in F.13 CMA Temporary Occupation).

The adverse effects on marine ecological values associated with the temporary staging platforms include increased suspended sediment concentration, removal of vegetation (including mangroves), mortality of benthic invertebrates and temporary habitat loss.

The areas of intertidal and subtidal habitat temporarily disturbed during construction will be readily recolonised following completion of construction and removal of the staging structures. It is considered that the adverse effects on the marine ecological values of temporary habitat loss/disturbance will be negligible.

18.10.3.2 *Shading of Saline Vegetation*

Shading of saline vegetation may restrict growth during the estimated 18 months they are in place but it is expected that, upon removal of the staging structures, the vegetation will recover fully over time. Given that mangrove forest/vegetation is common in estuarine areas of Auckland, it is considered that any adverse effects resulting from the shading of mangroves will have negligible adverse effects on marine ecological values.

18.10.3.3 *Noise and Vibration Disturbance*

It is considered that during piling, fish and other mobile organisms will avoid the area, and sessile or infaunal marine invertebrates are likely to remain inactive, not feeding or foraging for example. Given the temporary nature of bridge piling works within Sector 5, disturbance from vibration on marine organisms is considered to be negligible.

18.10.3.4 *Contaminant Discharges During Construction*

Erosion and sediment control techniques within Sector 5 include super silt fences, decanting earth bunds and sediment retention ponds (see Technical Report G.22 *Sediment and Erosion Control Plan*).

The adverse effects arising from the discharge of construction phase stormwater are considered to be negligible

In addition, as detailed in the stormwater management (see Technical Report G.15 *Assessment of Stormwater and Streamworks*), sediment retention ponds will be used to treat 'dirty water' (including additional chemical treatment) and wet ponds will treat runoff from the contractor's working area. As a result of this treatment level[21], the adverse effects arising from the discharge of construction phase stormwater are considered to be negligible.

18.10.4 Mitigation – Operation and Construction

Mitigation of the key effects associated with the operation and construction phases of the Project (i.e. potential sediment and contaminant discharges, road runoff etc) will be managed through the installation of erosion and sediment control devices as per Technical Report G.22: *Erosion and Sediment Control Plan*, and temporary stormwater devices as per the mitigation proposed in Technical Report G.15 *Assessment of Stormwater and Streamworks*.

While the temporary habitat loss is considered to be negligible/minor and an acceptable adverse effect, the permanent habitat loss is considered to be a moderate adverse effect requiring mitigation. While it is difficult to directly mitigate these effects, opportunities exist to off-set these effects through:

- Improving the efficiency of the removal of contaminants from the operational phase of stormwater discharge (e.g. to 80% efficiency), which reduces the rate of accumulation of contaminants in the marine environment, and therefore has benefit to marine ecological values;
- Treating the runoff from the currently untreated existing State highway at the GNR Interchange (for the reasons identified above);
- Restoring coastal fringe habitat (e.g. as per the plans in F.16 Urban Design and Landscape Plans). Vegetating the faces of the ground improvement work areas provides an opportunity to increase ecological values at the interface of the terrestrial and coastal

[21] Provided the stormwater treatment and control devices are in place and working efficiently to proposed treatment levels.

habitats. Restoring the coastal fringe (weed control and revegetation with appropriate native species) along the alignment also provides benefit to the marine ecological values through increasing biodiversity; and

- Removal of gross litter and debris from within and adjacent to the CMA.

As outlined above, it is considered that the implementation of the mitigation opportunities identified above sufficiently offset the adverse effects on marine ecological values arising from permanent marine benthic habitat loss.

18.10.4.1 *Monitoring*

Ecological monitoring is proposed for pre, during and post construction. This is set out in the Ecological Management Plan (ECOMP) (Appendix G of Technical Report G.11 *Assessment of Marine Ecological Effects*). Monitoring of suspended sediments, pH and benthic invertebrate community composition are proposed as part of the Ecological Management Plan. This monitoring assists in ensuring that construction mitigation measures proposed are effective in protecting the marine ecological values.

A full assessment of effects on herpetofauna is provided in Technical Report G.8

18.11 Effects on Herpetofauna

The following provides an assessment of the ecological effects of the Project on herpetofauna (frog and reptile species). This is a summary of the detailed assessment undertaken in Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*.

18.11.1 Existing Environment

The land within Sector 5 contains a variety of habitats. Typical types range from rank grass and scrub, regenerating bush and older, established bush.

The vegetation in this area includes patches of mixed native and exotic scrubland and stands of mature trees. Although large areas of short mown grass exist and are not considered suitable as a lizard habitat, the edge habitat – where the mown grass meets scrubland/bush habitats – is likely to provide suitable habitat.

Two species of lizards (rainbow skinks and copper skinks) were detected within Sector 5 however only Copper skinks are native to NZ. Rainbow skinks are a pest and not protected. Copper skink breeding populations were found at the GNR Interchange on the side of the westbound on-ramp and the side of the Point Chevalier off-ramp. These populations of copper skinks make a contribution to local biodiversity and are of ecological significance, however the habitats are dominated by exotic species and have low ecological value (beyond the presence of the native skink population).

18.11.2 Assessment – Construction

The clearance of vegetation and habitat features may result in adverse effects to native herpetofauna as well as a reduction in the availability of habitat and resources.

Noise and vibrations created by construction activities are likely to have short term effects however these are considered to be no more than minor given the skink population presently lives in close proximity to the existing highway traffic.

Risks associated with habitat reduction for development can be reduced through the implementation of appropriate management; for example, re-locating populations into a more secure habitat. With this management, the effects on herpetofauna ecology are considered adequately mitigated.

18.11.3 Mitigation – Construction

Potential adverse effects on the copper skink population can be mitigated by relocating the skink population in this area to sites or habitat outside of the construction footprint (e.g. beyond the construction areas in the designation or beyond the designation).

The process for this mitigation is generally proposed to be managed through the implementation of an ECOMP (relevant sections attached to Appendix A of Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*)[22]. This process provides for the collection of lizards from the construction areas prior to and throughout vegetation clearance, for identification of suitable habitats for relocation of lizards, including (if necessary) the planting of areas within the network and habitat enhancement, pest management and post release monitoring. Suitable habitat has been identified in reserve areas (e.g. at Harbutt Reserve and Heron Park, subject to Auckland Council Approval) and within the State highway network (e.g. SH20 south of Maioro Interchange). It is noted that, for Harbutt Reserve, additional habitat enhancement to account for the existing skink population would be warranted (again subject to agreement by the [Auckland Council]).

18.12 Vegetation

A full assessment of effects on vegetation is provided in Technical Report G.17

The following provides an assessment of the ecological effects of the Project on ecology: vegetation. This is a summary of the detailed assessment undertaken in Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*.

[22] A separate approval process will be required under the Wildlife Act for the lizard relocations.

18.12.1 Existing Environment

There is a stand of valued vegetation: Karaka, in this Sector

The predominant character of the vegetation at the GNR Interchange is grassed open areas together with mature riparian vegetation growing along the margins of Oakley Creek including at its mouth, and mature specimen (amenity) trees. The majority of the vegetation is exotic, with the only notable indigenous element being semi-mature and younger karaka growing on basalt on the northern banks of the mouth of Oakley Creek. These are growing in a predominantly exotic forest. This vegetation is considered the most notable indigenous element in this Sector; representative of some of the historic rock forests of the Auckland Isthmus. These karaka (up to 8m in height) are growing on the basalt boulder substrate on the northern banks of the mouth of Oakley Creek.

To the east, bordering Unitec land, there is a sizeable stand of mature (large) oak trees. Alongside these are several mature Pohutukawa of similar size. This stand of vegetation appears to be the oldest within the Project area.

18.12.2 Assessment - Construction

The Project works in Sector 5 will affect some native amenity plantings within the GNR Interchange and potentially the valued karaka (discussed below). The mature trees that lie to the east on Unitec land will be unaffected.

On the western side of the GNR Interchange, the construction of the piers for the new ramps will result in the removal of some vegetation along the northern margins of the Oakley Creek. The terrestrial vegetation affected by these new structures is predominantly exotic, characterized by tree privet along with hawthorn, woolly nightshade, willow and poplar. Generally the stands of vegetation within Sector 5 that will be directly affected by the Project are ranked as having low botanical values. However, the exception to this is the karaka copse.

Detailed design may be able to avoid potentially significant impact, but this is a constrained environment

Ramps 1 and 2 avoid the key areas of botanical value (i.e. the Valued Vegetation) of the north bank bush, with the copses of karaka trees in particular being located in between these two ramps. However, it appears that Ramps 3 and 4 may potentially affect some of the key areas (although they appear to avoid the main concentrations of karaka). If at all practicable the key areas in this rock forest (especially the karaka groves) should be avoided via adjustments to the locations of piers, haul roads and crane platforms in this north bank bush[23]. If such avoidance cannot be achieved and some of these key areas need to be cleared, then their loss is considered to constitute an adverse effect, and as such will need to be mitigated. Even if such avoidance is achieved, potential damage to the wider rock forest at this locality (from construction activities) will still need to be mitigated.

[23] However, it is recognised that this needs to be balanced with other constraints in this area, including the Oakley Inlet Heritage Area and the coastal processes impacts of moving piers into the CMA and these matters have been considered in the design and assessment of alternatives as discussed in Chapter 11.

18.12.3 Mitigation - Construction

The management measures proposed for ecological impacts on vegetation area are generally provided in the ECOMP (an excerpt of which (for vegetation) is provided in Appendix C of Technical Report G.17: *Assessment of Terrestrial Vegetation Effects*). In addition to these, specific mitigation measures in this Sector include revegetation and restoration works at the GNR Interchange.

The ECOMP also proposes monitoring to ensure effectiveness of these mitigation and management measures, with remediation (e.g. additional planting) if the implementation of the mitigation measures are not effective.

Mitigation through revegetation and restoration

The GNR Interchange provides both a requirement for mitigation and an opportunity to enhance a degraded area of rock forest vegetation through weed control and appropriate planting. The proposed mitigation involves the restoration and enhancement of the remaining rock forest on the north bank. This proposal is given further detail Technical Report G.20 Assessment of *Visual and Landscape Effects* and more specifically in the plans F.16 Urban Design and Landscape Plans.

It is also noted that this mitigation will be integrated with the lizard management/mitigation proposals (see Section 18.11.3) and the mitigation for the Oakley Inlet Heritage Area (see Section 18.8.3.1). The enhancement of this volcanic rock forest (as detailed in the) mitigates the loss of vegetation in this area as a result of the construction of the new structures. The stormwater treatment devices to be provided in this Sector also provide an opportunity to include locally sourced and appropriate indigenous wetland species.

A full assessment of effects on air quality is provided in Technical Report G.1

18.13 Air Quality

Technical Report G.1 *Assessment of Air Quality Effects* provides an assessment of the potential impacts of the Project on air quality, both during construction and operation. The following assessment of the air quality effects of construction is summarised from that report. It is noted that, given the regional nature of air quality impacts, operation effects on air quality (which are overall positive) are discussed in Chapter 13 of this AEE.

18.13.1 Existing Environment

As noted previously, Sector 5 is located within an urban environment dominated by the GNR Interchange. Residential properties are located to the north and south west of the works. A number of 'key receptors' have been identified for the purpose of the Air Quality assessment, these sites include residential, education and medical facilities in proximity to the Project.

18.13.2 Assessment - Construction[24]

The main potential effect is as a result of dust generation and other air contaminant discharges

During construction, the main potential effect is as a result of dust generation and other air contaminant discharges which are liable to cause nuisance beyond the site boundary, and are generally considered to be localised effects. Dust may be generated during earthworks and construction activities, or as a result of vehicle movements around the site. Vehicle emissions may also arise from construction vehicles.

In addition, in this Sector, a concrete batching plant is proposed for the northern portal construction. This activity also has potential to generate adverse impacts on local air quality, associated with the discharge of cement and aggregates.

18.13.2.1 *General Construction Activities*

In assessing effects on air quality during construction, key receptors are considered to be residential areas, schools, preschools and healthcare facilities. Within Sector 5, sensitive receptors located within 100m of the work area include:

- Properties to the north in Pt Chevalier on Maryland Street, Smale Street, Miller Street, Alberta Street and Montrose Street;
- The Mason Clinic;
- Northern parts of Unitec;
- St Francis School; and
- Waterview School and Kindergarten[25].

The assessment for these receptors concludes that potential effects include dust from earthworks and construction, vehicle movements and spoil handling and stockpiles (as well as the concrete batching plant discussed below). It is concluded that these potentially significant effects can be mitigated with appropriate environmental management and mitigation in place.

It is also noted that the property take proposed by the designation avoids adverse impacts associated with emissions (e.g. for residential properties to the south west on Waterbank Crescent).

18.13.2.2 *Concrete Batching Plant*

In addition to the general construction activities described, a concrete batching plant will be located in this Sector within Construction Yard 6 (Waterview Reserve) (see the plans in F.6 Construction Yard Plans, for details). Concrete batching has the potential to generate dust from

---

[24] The assessment of operation air quality effects is recognized as a Regional and Project-wide matter and is discussed in Chapter 13 of this AEE.

[25] This receptor is discussed in more specific detail with respect to works in Sector 7, Chapter 20 of this AEE.

aggregates and cement powder. Aggregate dust is usually inert, only causing (amenity) effects. However, cement dust is highly alkaline when dissolved with water and can be corrosive to the skin.

Any potential adverse effect in relation to the operation of the concrete batching plant will be avoided

The nearest sensitive receptors to the concrete batching plant are the Mason Clinic located approximately 80m to the east, residential properties on Waterview Crescent, and Waterview School located approximately 150m to the south. It is anticipated that with appropriate controls in place (discussed below), any potential adverse effect in relation to the operation of the concrete batching plant will be avoided.

18.13.3 Mitigation - Construction

18.13.3.1 *Avoiding Impacts through Design*

The location of the concrete batching plant in Construction Yard 6 has sought to maximise separation distances for key receptors.

18.13.3.2 *Mitigation Measures*

Dust from general construction activities can be managed with a range of mitigation measures. A range of typical measures proposed are described in the Construction Air Quality Management Plan (CAQMP) (Appendix M of Technical Report G.1 *Assessment of Air Quality Effects*). These measures include the following key areas:

- Managing the surfaces of construction site areas (e.g. use of wind brakes, dampening of exposed and open areas, and covering tunnel spoil materials);
- Managing the handling of sediment and dust generating materials (e.g. stabilising works areas); and
- Managing vehicle operations in construction yards (metalling accessways, wheel washes).

The management of the concrete batching plant (is addressed in the Concrete Batching and Crushing Plant Management Plant (CBCMP) (Appendix N of Technical Report G.1 *Assessment of Air Quality Effects*). In relation to the concrete batching plant, the following mitigation measures are proposed:

- The plant will be located in the north eastern corner of Construction Yard 6 to provide the maximum possible separation from residential and sensitive receptors (80 – 100m);
- Supply of aggregate and cement will be managed (e.g. enclosure of load hoppers, conveyors and storage bays; enclosed tankers for cement delivery which will be pumped into silos; all handling of cement powder will be fully enclosed, with displaced air vented via filter units as required);

- Dust filter units will be installed on the cement silos, designed to comply with the relevant performance requirements of TP152[26]; and
- Pressure relief valves will also be fitted, with high fill alarms to avoid overfilling and spillages.

18.13.3.3 *Monitoring*

It is also proposed to monitor dust levels throughout the construction period using a range of methods including,

- Undertaking total suspended particulate (TSP) monitoring using continuous particulate monitors;
- Daily visual inspections of operational sites and surrounding areas for evidence of dust discharges; and
- Regular visual inspections of exposed surface areas and stockpiles to ensure either dampened down or covered appropriately.

Monitoring in relation to the concrete batching plant is also proposed to include:

- Visual inspections during delivery of bulk cement to the site and daily for discharges from the concrete batching plant;
- Automatic monitoring of filling the silos using the high fill alarms (audio and visual alarms);
- Monitoring hose connections between the tanker and silos by the tanker drivers during unloading of cement;
- Monthly inspections of the filter units fitted to the silos, cement weight hoppers and mixer drums; and
- Daily inspections of the water sprays to ensure they are working appropriately.

18.14 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.12 and G.5

The following provides an assessment of the effects of the Project within Sector 5 on noise emissions. This is a summary of the detailed assessment undertaken in Technical Report G.5 *Assessment of Construction Noise* and G.12 *Assessment of Operational Noise Effects*.

[26] ARC Technical Publication 152 – *Assessing Discharges of Contaminants into Air – (Draft).* Auckland Regional Council. 2002

18.14.1 Existing Environment

Existing traffic noise levels within this Sector are relatively high, emanating from traffic on GNR and SH16. A number of sensitive receptors are located within this Sector including residential properties to the north and south-west of the Interchange, and the Unitec tertiary education facility to the south east. Noise levels at 77 Herdman Street have been measured as 66dBL $_{Aeq(24h),}$ which is considered a moderately high ambient urban noise environment.

18.14.2 Assessment - Operation

Technical Report G.12 *Assessment of Operational Noise Effects* provides detail on the assessment of operation noise. In this Sector three distinct 'receiving environments' have been assessed; south of SH16 – including receivers in Waterview, north of SH16 – including receivers in Point Chevalier, and south east of proposed GNR Interchange – Unitec Tertiary Education Facility.

In undertaking the assessment, consideration has also been given to the operational traffic noise generated from SH16 along the reclamation in Sector 4 and the operational noise generated from GNR in Sector 7. The results are summarised in Table 18.3 and further details are provided in Technical Report G.12 *Assessment of Operational Noise Effects*.

Table18.3: Traffic Noise Effects within Sector 5

Receiving Environment	Potential Effect (without mitigation)
South of SH16 - Waterview Dwellings located to the south of SH16 and west of SH20/GNR Interchange in Waterview. 78 receivers were assessed including Waterview Primary School and Kindergarten.	Moderate effect – with noise increases of up to 5 decibels in some locations. Of the 78 positions assessed, 46 would exceed the Category A[27] criterion and 15 the Category B criterion without the implementation of noise mitigation measures.
North of SH16 – Point Chevalier Dwellings located north of SH16. Due to existing topography, dwellings are generally located above SH16, with sites sloping towards SH16. The established suburban settling results in 150 receivers being assessed.	Minor effect – with noise increases of up to 2 decibels in some locations. The existing noise in this area is already elevated due to the close proximity of SH16. Of the 150 positions assessed, 95 were predicted to exceed the Category A criterion and a further 19 positions would receive noise levels in excess of the Category B criteria.
South East of GNR Interchange Unitec is located within a high noise environment bound by SH16 to the north, GNR/new SH20 ramps to the west and Carrington Road to the east. Each facade facing SH16 or GNR/SH20 has been identified as a separate assessment point. 26 positions have been assessed.	Moderate Effects Of the 26 positions assessed, six were predicted to receive noise levels in excess of Category A, and an additional eight positions were in excess of Category B. An exceedance of the Category B criterion by up to 6 decibels is predicted.
From NZS6806, Category A = primary external noise criterion of 64 dBL$_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 dBL$_{Aeq(24hr)}$, Category C = internal noise criterion of 40 dBL$_{Aeq(24hr)}$).	

[27] The Criterion cited here are in accordance with the NZS6806, with the Primary and Secondary external noise criterion (A and B) and Category C a minimum internal noise criterion.

18.14.3 Assessment - Construction

Construction activities within this Sector will generally be undertaken during the day (off-line from SH16). Due to the close proximity of construction works, there is the potential for elevated construction noise levels for a short duration, in addition to longer term (yet at a greater distance) general construction noise impacts. It is noted that construction works are likely to occur in this Sector over an extended time period, thus potentially increasing the construction noise effects. Some night time works will be required in the vicinity of GNR and SH16, in order to avoid disruption of traffic on these major transport corridors.

The closest potentially affected receivers to the proposed works are the dwellings on Waterview Crescent (to the south-west of the Interchange) and Montrose Street (to the north east of the Interchange). These receivers are located close to Ramp 2 and Ramp 4 (respectively) but are some distance from the other ramps. There are two schools which may be potentially affected by construction noise in this Sector; St Francis School on Montrose Street and Waterview Primary School on Oakley Avenue. The school classrooms for these buildings are at least 250 metres from the ramp structures of Section 5, but are closer to this to the on-grade lanes.

Key conclusions for the construction noise assessment in this area, from Technical Report G.5 *Assessment of Construction Noise Effects*, include the following:

- Average noise levels will typically be below daytime construction noise guidelines as specified in Technical Report G.5;
- Where construction is occurring in close proximity to receivers, noise levels will be above the daytime guidelines for particular periods of time. Activities that will generate high noise levels are those that occur on or near ground level, such as the pad footing construction and piling;
- Construction Yards are, in general, located some distance from residential areas and noise impacts are likely to be low;
- The concrete batch plant proposed for Construction Yard 6 is required to operate 24 hours per day. The noise level from the batch plant will depend on the level of noise mitigation fitted; and
- Most of the construction activities occurring in this area have the potential to generate noise levels which would be above the night time guideline for noise limits (60 $dB_{LAeq(T)}$).

Given the exceedence of the noise guidelines, effects from construction in this Sector are expected to be more than minor and significant mitigation is required (see Section 18.14.5 below).

18.14.4 Mitigation - Operation

Technical Report G.12 *Assessment of Operational Noise Effects* discusses mitigation options considered for traffic noise from the Project. A summary of the preferred mitigation measures proposed for Sector 5 is set out in Table 18.4. The residual effect, with the mitigation proposed is noted for the affected receiving environments.

Table 18.4: Traffic Noise Effects with Mitigation

Receiving Environment	Preferred Mitigation	Residual Effect (with mitigation)
South of SH16 - Waterview	A combination of well performing low noise road surface such as twin layer OGPA and the 1.1m safety edge barrier on the SH20 to SH16 westbound ramp for an extended Section.	Noise increases by up to 3 decibels in some locations. However an overall average of 3 decibel reduction. Of the 78 receivers assessed, 58 would be within Category A and 20 would be within Category B.
	Overall with mitigation, considered to be a less than minor effect.	
North of SH16 – Point Chevalier	Option 4 – A combination of well performing low noise road surface such as twin layer OGPA and the 1.1m safety edge barrier on the ramps/bridges. One dwelling may require building modification mitigation (because it falls within the Category C criterion of NZS6806). This may include upgraded glazing and installation of alternative ventilation. Further investigation is required.	On average a 2 decibel reduction. Of the 150 receivers assessed, 114 would be within Category A and the remaining 35 would be within Category B. Only one dwelling is predicted within Category C (49 Montrose Street).
	Overall, with mitigation, the effects are considered to be less than minor and some dwellings achieve a positive outcome with betterment to the existing levels.	
South East of GNR Interchange	Option 4 – A combination of well performing low noise road surface such as twin layer OGPA and the 1.1m safety edge barrier on the ramps/bridges. Three positions were assessed to be within Category C criterion. Facades may require upgrades. This requires further investigation.	The majority of receivers receiving betterment to predicted existing noise levels in 2026. On average a 2 decibel reduction. Of the 26 positions assessed, 18 would be within Category A, 5 within Category B and 3 within Category C.
	Overall, with mitigation, the effects are considered to be generally positive.	
From NZS6806, Category A = primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, Category C = internal noise criterion of 40 $dBL_{Aeq(24hr)}$).		

In summary, the effects are considered to be generally positive because in the majority of locations the noise mitigation proposed provides betterment from the existing situation.

18.14.5 Mitigation – Construction

The general noise mitigation measures contained in the Construction Noise and Vibration Management Plan (CNVMP) (Appendix C of Technical Report G.5 *Assessment of Construction Noise Effects*). The following site specific noise mitigation measures are noted:

- Where equipment is operating at ground level during the night-period and can be screened using temporary noise barriers, these should be located around noisy plant such as drilling, jack hammering, noisy hand tools, concrete slumping areas, cranes, concrete pumping plant used for ramp construction;
- Once the ramps are constructed, consideration should be given to screening noise sensitive areas from sealing and finishing works using temporary noise barriers;
- Given that some ramps are a considerable distance from residential areas, it is proposed that daytime work be scheduled on ramp structures that are located close

to noise sensitive areas. Night-time construction can be scheduled on ramps located further from receivers (such as Ramps 1, 3 and 4);

- Where night construction must occur, some residents may need to be temporarily relocated. This should be considered on a case by case basis; and

- For a typical concrete batching plant (portable) with direct line of sight to receivers, noise levels of around 62 dB LAeq(t) are expected at receiver facades (assuming the batch plant is 150 metres away). However where noise mitigation measures are included around the batch plant, this noise level may significantly reduce. Noise mitigation for this plant may include but shall not be limited to the items listed on the following page.

As noted above in the air quality assessment, the location of the concrete batching plant within Construction Yard 6 has sought to maximise separation distances between the plant and receivers (see F.6 Construction Yard Plans for detail).

In addition, mitigation is proposed for the concrete batching plant. The details of construction management for this plant are set out in the CBCMP (Appendix E of Technical Report G.5 *Assessment of Construction Noise Effects*). In summary, mitigation proposed includes:

- Enclosure of equipment including but not limited to mixing vessels or dry mixing hoppers, conveyors and truck load out area;
- Truck slumping not at ground level where practicable;
- Daytime operation of equipment such as loaders. Conveying of material to be used in preference to driven loaders;
- Noise barriers located around concrete batching plant; and
- Batching plant designed and located to avoid or minimise reversing of trucks, and good driver and operator education regarding noise mitigation.

18.15 Vibration

A full assessment of vibration effects is provided in Technical Report G.19

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of operation and construction vibration effects. The following assessment of the vibration effects is summarised from that report.

18.15.1 Existing Environment

The existing environment is an urban environment, dominated by the existing SH16 Interchange and GNR. Residential areas are located adjacent to the Interchange and it is expected that people would experience day to day traffic related vibration. In order to establish the existing ambient noise environment within Sector 5, a representative receiver at 77 Herdman Street (located approximately 140m from SH16) was surveyed. The results indicate that the mean ambient levels of vibration are below the threshold for perceptibility of vibration effects in a residential environment.

18.15.2 Assessment - Operation

The effects of vibration from road traffic, in particular heavy vehicle movements is expected to be less than minor provided the Project road surface is monitored and maintained in accordance with the NZTA policy for road roughness.

18.15.3 Assessment – Construction

The key vibration sources for construction in this Sector are vibration rollers for road construction and piling. The closest dwellings to the construction works are located at Waterbank Crescent and Montrose Street.

In respect of construction vibration, perception effects are primarily related to the concern that people may have over the potential for damage to their buildings. On this basis, the assessment of effects has focussed on standards or criteria that are intended to avoid superficial damage to buildings[28]. A full assessment is provided in Technical Report G.19. However, in this Sector, it is noted that the assessment concludes that the only properties at low or medium risk are within the proposed designation. As these will not be occupied by residents during construction, further reporting is not provided in this AEE.

18.15.4 Mitigation - Construction

It is proposed that the construction vibration effects are managed through a management plan (the CNVMP, which is proposed in Appendix K of Technical Report G.19 *Assessment of Vibration Effects*). Mitigation measures within this Plan include[29]:

- Consultation with residents and 'sensitive receptors' and the implementation of the CEMP complaints procedure where by a 24 hour hotline is actively promoted and managed;
- The monitoring of vibration levels throughout the construction process to assess compliance with the Project criteria; and
- The appropriate mitigation of vibration effects if the monitoring indicates excessive vibration levels. Where practicable, this will include the cessation of the activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

It is considered that with the implementation of these measures, the vibration effects of the Project during construction will be no more than minor.

---

[28] It is noted that significantly greater vibration levels would required before vibration caused any structural damage to buildings.

[29] It is noted that pre-construction and post construction building condition surveys are also identified for 'at risk' buildings, services and structures (which are those identified to be of 'high' risk). This is not relevant to this Sector.

A full assessment of lighting effects is provided in Technical Report G.10

18.16 Light Emissions

Technical Report G.10 *Assessment of Lighting Effects* provides an assessment of operation and construction light effects. The following assessment of the light effects of construction is summarised from that report.

18.16.1 Existing Environment

The existing environment is an urban environment, dominated by GNR Interchange. Residential areas of Point Chevalier and Waterview are located to the north and south respectively. The current geography of the area means that the residential properties to the north are located on higher land, and receive minimum glare. The residential areas to the south are more remote and shielded by the heavily mangrove-covered Oakley Creek and Waterview Reserve.

The current lighting arrangement at GNR Interchange is provided by a series of single-armed 12m poles with 250W HPS semi-cut off luminaires. Residential areas are located to the north (Pt Chevalier) and south (Waterview) of the GNR intersection.

18.16.2 Assessment - Operation

The lighting arrangements for the enlarged intersection will be designed in accordance with relevant road lighting standards. Details of the lighting proposed are provided in Technical Report G.10.

It is anticipated that overall the lighting effects will not be significant. In addition, the use of taller poles proposed through the hub of the Interchange will reduce the overall lighting structures required to illuminate the Interchange to the required lighting levels.

18.16.3 Assessment - Construction

Two temporary construction yards (Construction Yards 4 and 5) will be located within the GNR Interchange. These will both require lighting so that they can be accessed at night. Night works will also be required at the Interchange to erect the ramps.

With management (mitigation measures proposed below), the effects of construction lighting are considered minor.

18.16.4 Mitigation - Operation

Road lighting is proposed to be designed to appropriate New Zealand lighting standards and in the form generally described in Technical Report G.10. The use of 'cut-off' luminaries on high mast poles will mitigate impacts of light spill.

18.16.5 Mitigation - Construction

Temporary lighting planning will avoid construction lighting effects

In order to manage temporary lighting during construction during night time activities, in particular works around the GNR Interchange and Construction Yards 4 and 5, a Temporary Construction Lighting Management Plan, to be prepared by the contractor, is proposed. This will demonstrate compliance with Auckland City Bylaws and be verified by an independent lighting specialist. In particular, the following specific mitigation measures are proposed:

- For general area lighting, it is proposed that asymmetrical floodlights are used with glass visors that are not raised more than 3 degrees above the horizontal plane; and
- A buffer of more than 10m will be provided between the construction area and adjacent residential properties.

With these measures, it is considered the effects of construction lighting will be no more than minor.

18.17 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

18.17.1 Existing Environment

The impervious area within Sector 5 discharges to the Oakley Inlet, Waterview Estuary Inlet and Waitemata Harbour. A full description of the marine receiving environment is provided in Chapter 13 of this AEE.

Within Sector 5 the existing motorway infrastructure includes SH16 in the easterly/westerly axis, and the existing GNR interchange on and off ramps. Currently some stormwater treatment is provided for a Section of the SH16 carriageway by a treatment swale located just to the north of the carriageway within the Interchange. In addition, there is an existing wet pond within the bounds of the GNR Interchange that is consented to treat runoff from some of the interchange carriageway.

18.17.2 Assessment - Operation

Treatment devices for the GNR Interchange catchments will discharge to the Oakley Creek estuarine area, Waterview Inlet and the Upper Waitemata harbour (north of causeway). As the stormwater discharge will be to estuarine areas where flooding is not of concern, it is considered that peak flow attenuation and extended detention are not required. Therefore treatment devices for this Sector are required to provide water quality treatment only, though energy dissipation and erosion protection will be provided at the discharge outlets.

In total eight treatment devices are proposed within Sector 5. These have been defined based mainly on elevation and reticulation restrictions to the catchments for each device. Detail on these devices is provided in Technical Report G.15 (Section 6.7 of that Report). Overall, 85% of the existing impervious area and 100% of the new impervious area (90% in total) will be treated as part of the Project, to 80% efficiency[30]. In this area, the increase in treated impervious surface is approximately 3ha, which is considered a benefit of the Project for the quality of water discharged to the receiving environment.

18.17.3 Assessment – Construction

There are three contractor's working areas, one located at the northern portal of the tunnel (Waterview Reserve) and two within the GNR Interchange area which create additional impervious areas and source areas for stormwater pollutants. Assessment of water quantity only is provided for these treatment devices, as flooding is not a concern where waters are discharging directly to the CMA.

Overall, during construction 100% of new impervious area will be treated.

Overall, during construction 100% of new impervious area will be treated. These areas will be treated in accordance with the standards of the Proposed Auckland Regional Plan: Air Land Water (PARP: ALW). Of the existing impervious area, some 30.3% will be treated during construction (that is those existing areas of SH16 that are currently treated will continue to be treated during construction). Other areas will be managed through the Technical Report G.22 *Erosion and Sediment Control Plan* (there is insufficient room for additional treatment of stormwater within the existing footprint during construction).

The proposed management of stormwater during construction is considered consistent with Regional Planning policy direction (particularly the PARP: ALW). The residual effects of contaminant discharges during construction have been discussed in the ecological effects assessments, particularly Section 18.10 above.

18.17.3.1 *Concrete Batching Plant*

Within this Sector, a concrete batching plant is proposed, to supply shotcrete for liner construction (of the driven tunnel). The runoff and waste water from the concrete batching plant will require extra treatment due to the high sediment loads and elevated pH; thus the runoff will need to be treated separately to that from the construction yards. The concrete batching yard will comprise the "at risk" or "dirty" areas of the site, whilst the remainder of the construction yard (including the aggregate storage area, any covered storage of additives and general vehicle movement areas) will be the "clean area[31]".

---

30 Efficiency is referring to the percentage of total suspended solids removed from stormwater through the treatment devices.

31 The runoff from the clean area will drain to the temporary stormwater treatment device for that particular construction yard for treatment.

"Dirty water" will be managed by reusing as much water as possible for concrete production. The waste water from the concrete batching plant (e.g. the truck washdown), and the runoff from the plant yard will be treated and stored onsite in a storage/reuse tank, before either being reused or routed through construction yard stormwater ponds for further water quality polishing prior to discharge. The storage/reuse tank will consist of a container modified for the removal of sediment and pH correction.

Full details of the concrete batching plant operations are described in the Appendix F of Technical Report G.15 (this is the CBCMP). Temporary stormwater details are provided in the Temporary Stormwater Management Plan (TSMP) (Appendix E of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

18.17.4 Mitigation - Operation

The proposed treatment devices will significantly increase the level of existing stormwater treatment from SH16. In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (Appendix D of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

Treatment devices increase the level of existing stormwater treatment from SH16

18.17.5 Mitigation - Construction

As noted above, the proposed erosion and sediment control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan*.

The proposed construction management of stormwater will include the implementation of the following management plans:

- The TSMP (Appendix E of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*);
- The CBCMP (Appendix F of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

It is considered that these management plans will provide effective mitigation of the adverse effects of the discharge of contaminants from stormwater during construction.

A full assessment of the effects of contamination is provided in Technical Report G.9

18.18 Land Contamination

The following provides an assessment of the potential effects of the Project on contaminated land and groundwater and contaminated materials. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. Given that construction activities will be the only period where contaminated materials are disturbed, this assessment only looks at construction effects.

18.18.1 Existing Environment

Land use in this area comprises road infrastructure (SH16, GNR and residential roads), playing fields in Waterview Reserve, bush on the banks of Oakley Creek and residential housing. Historically, there is evidence of earthworks within Waterview Reserve. A tannery historically occupied both banks of Oakley Creek and archaeological remains are still present. There is also evidence of a small basalt quarry within the area of bush on the north bank of Oakley Creek, together with Maori settlement features. It is also suspected that the mounded area in the centre of GNR Interchange is associated with the construction of SH16.

The investigations undertaken on land contamination (detailed in Technical Report G.9) confirmed:

- The underlying geology includes generally fill (silty sand or gravel) underlain by Tauranga Group (silty clay). The fill was predominantly reworked natural material with some granular base course materials;
- No waste was identified in any of the investigation locations within the Former Tannery and Basalt Quarry;
- A fragment of suspected cement bound asbestos was found in one of the soil samples taken from within the GNR Interchange;
- Perched groundwater from the Waitemata Group Aquifer was encountered in three locations within Waterview Reserve. No contaminants were identified above relevant guideline values;
- Exceedances of the 'permitted baseline' levels for land disturbing activities[32] were found in a number of soil samples at a range of locations within GNR Interchange. The exceedances were also found in relation to the human health criteria (parkland/ recreation); and
- No exceedances of the permitted baseline levels or human health criteria were recorded in the soil samples taken within Waterview Reserve, SH16 alignment, the former tannery and basalt quarry. As such no specific measures are required during excavation works in these areas, aside from good practice.

[32] As defined by Rules in the PARP: ALW.

Based on the analysis, approximately 34% of the material in this area is considered potential 'cleanfill'. This means that it could potentially be reused on site (with the remaining classified as 'managed fill' (42%) or contaminated fill (25%) requiring disposal offsite).

18.18.2 Assessment – Construction

Potential issues for land contamination can be adequately managed through appropriate mitigation measures

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for workers on site and the wider community). Based on the results of the baseline sampling, the following specific comment is made:

- Measures will be required within the GNR interchange to ensure that any runoff does not result in elevated heavy metals migrating off site to adjacent receiving environment and minimise the exposure of construction workers to potentially contaminated soils;

- Measures will be required to ensure that during construction, workers and the wider community are protected (in response to the small levels of asbestos reordered in the GNR Interchange); and

- Where material excavated does not meet the criteria of 'clean fill', it is proposed that it is disposed of off site as either 'managed fill' or contaminated fill'.

It is considered that these potential issues can be adequately managed through appropriate mitigation measures during construction as described below. With these measures in place, any potential effects are considered to be less than minor.

18.18.3 Mitigation – Construction

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils to put at risk workers, the wider public and the environment. In particular, it is proposed all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) (attached as Appendix O to Technical Report G.9) and a Site Health and Safety Plan.

Of particular note in this Sector, the following measures are identified from the CSMP:

- Specific measures will be employed for any material known to contain asbestos, in accordance with the Health and Safety in Employment (Asbestos) Regulations 1998 and the Department of Labour Guidelines for the Management and Removal of Asbestos (revised) 1999; and

- If unexpected contamination is identified, that the procedures set out in the CSMP, will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

19. Assessment of Effects – Sector 6

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 6. The works within this Sector include widening SH16 and providing an additional lane in each direction between the Great North Road Interchange and the St Lukes Interchange. Works are largely within the existing designation, and impacts associated with the works relate primarily to construction impacts (as a 'live motorway') and for adjoining activities, particularly where the Northwestern Motorway adjoins residential dwellings.

Through the Project design and the proposed mitigation, it is considered that the effects can be managed to be minor with some key benefits deriving from the works (particularly the improvement in the operational capacity of SH16 as a regional strategic route). Specific issues are addressed through mitigation proposed in this Sector, particularly with respect to construction impacts (vibration and traffic safety for the operation of SH16), and visual mitigation through landscaping. The treatment proposed for stormwater, which includes treatment of the existing stormwater runoff from SH16, is considered a betterment of the Project.

19.1 Introduction

This Chapter assesses the effects of the Project in Sector 6

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 6. As described in Chapter 4 and Chapter 5, the main element of the Project in this area is the widening of SH16 on the northern and southern side, with associated retaining walls and fill embankment widening. The noise barriers (while mitigation) are also a significant structural element in this Sector.

Specific details on scheme elements in this Sector are described in Section 4.4.6 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans*, (Sheets 10, 11 and 12 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.6 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheets 10, 11 and 12 for this Sector).

The works within this area are located within an urban environment already dominated by SH16. Western Springs Gardens is located to the north east and Chamberlain Park Golf Course is located to the south east of the motorway[1]. Other major urban land uses include Unitec and the Point Chevalier business area. There are also comparatively small pockets of residential land use around Parr Road (North and South).

Given the existing environment, the key issues identified in the assessment of environmental effects for the Project in Sector 6 relate to the potential impacts on existing established business, residential and open space activities. However, it is noted that these activities are already adjoining to the Northwestern Motorway.

This Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those specific environmental matters considered relevant to the environment in this Sector are reported in this Chapter. For example, there are no known archaeological sites affected by the Project in Sector 6 and therefore archaeological effects are not considered in this Chapter.

19.2 Land Use

19.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 19.1. The information within this figure has been extracted from the Auckland District Plan (Isthmus) (refer to Appendix E.2 for the District Plan maps).

Existing land use includes SH16, open space, residential and business uses

The existing land use environment in Sector 6 is primarily open space with SH16 bound by Chamberlain Park (Open Space 3) to the south and Western Springs Gardens (Open Space 4) to the north. Other land uses within the surrounding area include undeveloped land zoned for open space (Open Space 3), residential (Residential 5, 6a and 7b) and business (Business 2) purposes.

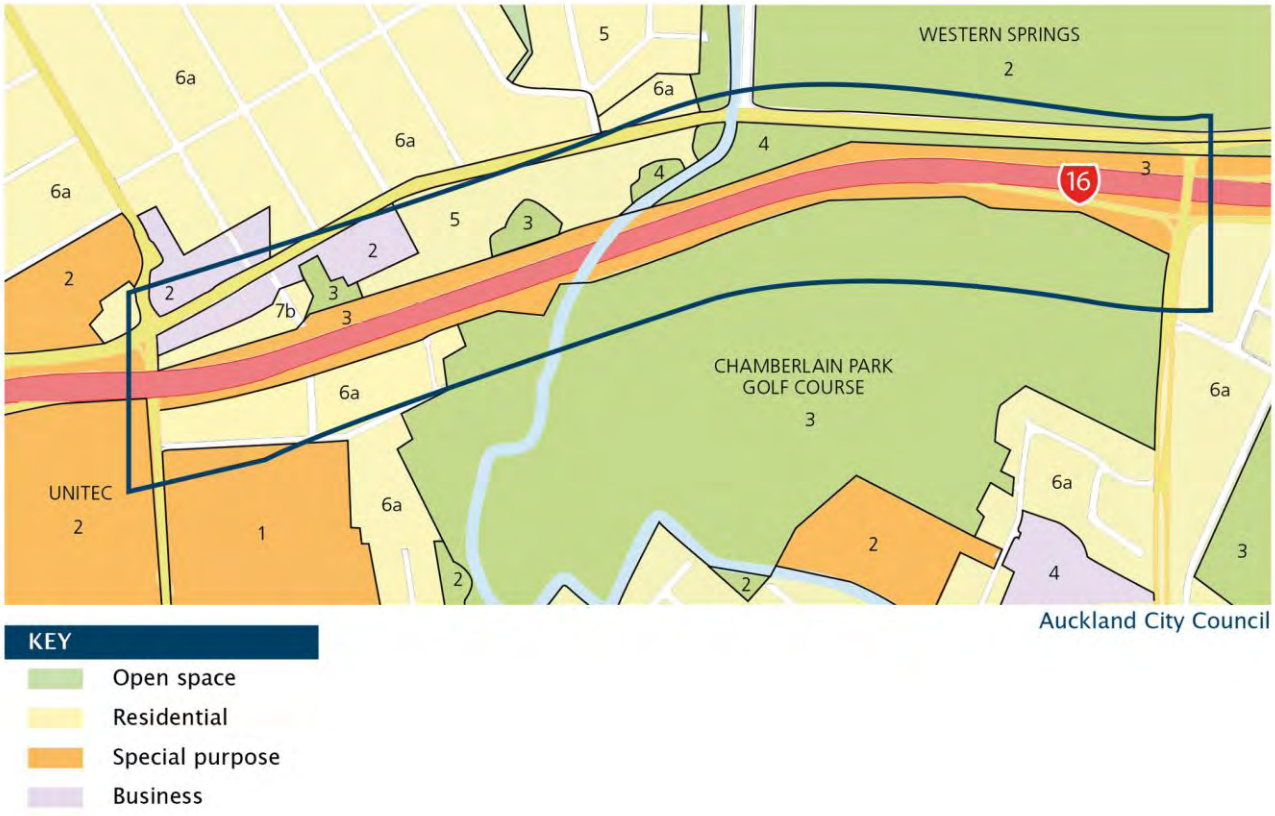


Figure 19.1: Land Use Zones within Sector 6 (Not to Scale)

19.2.1.1 *Special Purpose Land Use*

SH16 is zoned Special Purpose 3

This section of SH16 runs from the Great North Road Interchange to the St Lukes Road Interchange from west to east. The existing land occupied by SH16 is zoned Special Purpose 3 (for transportation). Within this land is the Northwestern Cycleway which is located on the southern side of SH16. The Special Purpose 3 zoning underlies an existing designation for motorway purposes (Reference - Designation A07-01).

19.2.1.2 *Business Land Use*

Land to the eastern side of Point Chevalier Road, including properties fronting Great North Road are zoned for business purposes (Business 2) and are occupied by a range of sub-urban retail and food outlets. The carpark serving this business area immediately adjoins SH16, south to Great North Road and the Point Chevalier shops (though it is zoned Residential 7b[2]).

19.2.1.3 *Residential Land Use*

Residential land use exists on either side of Great North Road and SH16 within this Sector. The residential areas are primarily zoned Residential 5 and Residential 6a.

19.2.1.4 *Open Space Land Use*

There are four key areas of open space in the Sector 6 Project area

An area of open space zoned Open Space 4 (for community recreation purposes) referred to as the Western Springs Gardens exists between SH16 and Great North Road. This open space zoned land currently contains business activities (including Cobb n' Co and the Auckland Horticultural Centre), the Western Springs Community Hall and a public carpark (designated as Council Carpark D05-03). Western Springs itself is located to the northern side of Great North Road outside of the Project area.

To the south of SH16 is Chamberlain Park, also known as the Chamberlain Park Golf Course. Chamberlain Park is zoned Open Space 3 (for organised recreation purposes).

Other areas of open space in Point Chevalier include the RSA Bowls Club (1136 Great North Road) and a parcel of vacant land at 1074 Great North Road. Both of these sites are zoned Open Space 3.

[2] This site is currently designated as the Point Chevalier Council Carpark (Reference – Designation D04-09).

19.2.1.5 *Existing Designations*

Plans provided in F.1 show the proposed designation in relation to the existing designations

Plans provided in F.1 of this AEE provide detail on the proposed designation of the Project in relation to existing designations. Designation A07-01 provides for SH16 between the CMJ and Auckland City's western boundary. The purpose of the designation is "Motorway". The District Plan does not list any specific conditions in relation to this designation.

A public road designation (Reference B08-04) applies to all Auckland City Council owned roads to enable the safe and efficient functioning and operation of the Council's road network. Within Sector 6, Auckland City Council owned roads include Carrington Road and St Lukes Road.

Other designations either adjoining or underlying the Project area include:

- St Lukes Road (identified as Designation D05-06, Proposed Regional Road);
- Council carparks:
    - St Lukes Road / Great North Road, designation D06-08
    - Point Chevalier / Parr Road, designation D04-09; and
    - Western Springs, designation D05-03.

19.2.1.6 *Future Planning Framework*

The Auckland City Future Planning Framework 2008 area plans set out a number of key medium and long-term outcomes that the council wants to achieve by 2030, from a city planning point of view. Of particular significance to Sector 6 of this Project, the following are mapped aspirations:

- Point Chevalier to remain a local centre, providing retail and small business services for the daily and weekly needs of the surrounding community, with future mixed use/business activities in Point Chevalier between SH16 and Great North Road at the eastern end of the existing business zoning[3];
- A mix of housing types for the area, including low rise apartments/terraces located along the lower end of Point Chevalier Road within convenient walking access from Point Chevalier local centre;
- Improved pedestrian cycle networks crossing SH16;

[3] This land is currently zoned Residential 5 in the District Plan.

- Chamberlain Park remaining open space;
- SH16, Great North Road, Carrington Road and St Lukes Road are key road passenger transport routes; and
- Improvements to Meola Creek.

19.2.2 Assessment - Operation

19.2.2.1 *Impact on Land Zoned as Special Purpose or Existing Designations*

The majority of works for the Project in this Sector are located within land already zoned for transportation (Special Purpose 3) purposes and the existing designation for motorway purposes. There will be no adverse land use impact on the Special Purpose 3 zone as the Project is consistent with the purpose and activities envisaged in this zone. As such the impact of the proposed works on other surrounding land uses has been minimised through the design of the Project (retaining works within the existing zone).

Separate approvals are required from Auckland City Council under s177 of the RMA for overlapping designations

The proposed designation boundary does overlap Auckland City Council roads which are designated (Reference B08-04[4]) and the Council designated carpark (Reference D04-09). For the car park area a separate approval will be required from Auckland City Council under Section 177 of the RMA (albeit that works in this area are for below ground 'tie backs' associated with the Carrington Road Bridge retaining wall structures and will not restrict future use of this carpark).

Auckland City Council has indicated that the Project design of the AEE is sufficient for it to provide the necessary s177 approval, as the primary designation. Discussions for this approval are progressing.

19.2.2.2 *Impact on Residential Land Use*

The proposed widening will require residential take on Great North Road and a property at Parr Road South, Point Chevalier. Around five residential land parcels are affected by the designation proposed for the Project. This is discussed further in the assessment of construction impacts (see Section 19.2.4.2 below). For a land use perspective, this is considered a minor land take, particularly given the potential opportunity for the removal of designation and redevelopment of these sites following construction. Furthermore, such development could facilitate the Council's Future Planning Framework, which identifies these properties as future business areas in their aspirational planning.

[4] However, in contrast to works in Sectors 5, 7, 8 and 9, works crossing local roads in this Sector are within the existing NZTA designation (A07-01) which is the primary designation.

19.2.2.3 *Impact on Open Space Land Use*

The Project proposes a minor take from open space zoned land for construction works (as outlined in Section 19.2.4.1 below). It is anticipated that this land will be reinstated as Open Space following construction of the Project. Therefore, it is considered that the impact on open space land use from operation of the Project is no more than minor.

19.2.2.4 *Impact on Future Planning Framework*

The Project is not inconsistent with Councils Future Planning Framework

The Project creates opportunity for the wider Future Planning Framework by developing a significant element of the strategic land transport network to enable regional economic and population growth. In addition, works may facilitate more local aspirational planning in this area, for example by creating an opportunity for land use changes (from residential to business with the uplifting of the construction designation in the future) and through the wetland development proposed for the Meola Creek, which will contribute to improvements to this waterway (this is discussed further in Section 19.15). In both cases, it is noted that the Project does not propose to undertake these development works.

19.2.3 Assessment - Construction

As noted above the majority of the Project within this area will be constructed within land designated for Motorway Purposes (Designation A07-01) and zoned special purposes within the Auckland City District Plan.

There will however be land take required from land zoned open space and residential to the northern and southern sides of SH16 (as noted in 19.2.3 above).

19.2.3.1 *Impact on Land Zoned as Open Space*

Approximately 0.1ha of open space at Western Springs Gardens is required for the widening of SH16. This area of open space is currently operating as Council carpark. It is considered that as the proposed land take is required for construction only; the impact is minor and temporary.

It will be necessary to occupy approximately 0.2ha of private open space zoned land at 1074 Great North Road (for Construction Yard 5). As the open space is currently inaccessible to the public, these land use impacts are considered negligible.

19.2.3.2 *Impact on Land Zoned as Residential*

Minor land take

During the construction period there will be an impact on residential land on either side of the motorway corridor. In total five parcels of land and approximately four dwellings are required in this Sector. The full schedule of properties affected by the designation in this area is provided in NOR 3.

Given the scale of impact and the extent of surrounding residential zone, the land take is considered minor (in terms of land use impact).

As noted above, construction works will impact on the existing Council designated carpark (Reference D04-09). Works in this area are for below ground 'tie backs' associated with the Carrington Road Bridge retaining wall structures and will not restrict future use of this carpark. Other than minor disruption during construction, this is considered a no more than minor land use impact.

19.2.4 Mitigation - Operation

19.2.4.1 *Avoiding Effects Through Design*

The Project design has sought to locate the works within land already designated for Motorway purposes and zoned Special Purpose 3 as far as practicable, thus minimising potential adverse impacts on other land uses.

Land use effects have been avoided in design

19.2.4.2 *Mitigation Proposed*

The following general mitigation proposals are made with respect to land use impacts:

- Once construction is complete the designation should be uplifted from surplus land to allow for reinstatement of other land uses (e.g. in the land surrounding the proposed wetland pond).

19.3 Transport Effects

Technical Reports G.16 and G.18 provide further detail on the assessment of traffic effects

Transport effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment Transport Effects*). The following is a summary from this assessment.

19.3.1 Existing Environment

19.3.1.1 *Roading Environment*

This Sector comprises SH16 which has three lanes in each direction between the Great North Road Interchange and St Lukes Interchange. The existing traffic flows and volume patterns along SH16 are illustrated in Chapter 13.

19.3.1.2 *Pedestrian/Cycling Environment*

The Northwestern Cycleway runs along local roads until it is provided as a dedicated cycle lane between SH16 and the Chamberlain Park Golf Course through to St Lukes Road

Interchange. There are currently on-road cycle lanes along both sides of the length of Carrington Road providing a direct link to the Unitec Campus from Point Chevalier.

19.3.1.3 *Passenger Transport*

There are bus routes operating along either Great North Road or SH16 between or through the Great North Road Interchange and the Auckland CBD. St Lukes Road is identified as a Quality Transport Network Route by ARTA in their network planning.

19.3.2 Assessment - Operation

The overview of the transport assessment for the operation of the Project is provided in Chapter 13 of the AEE (regional assessment). The assessment provides for the anticipated effects of the Project on the wider motorway network, arterial roads and the local roading network. Further detail on this assessment is provided in Technical Report G.18 *Assessment of Transport Effects.*

19.3.3 Assessment – Construction

Staging during construction

SH16 will be realigned through a number of phases within this Sector by re-marking lanes and installing safety barriers to open up work zones and allow off-line construction. The northern Carrington Road bridge abutment widening is envisaged to be carried out without significantly affecting Carrington Road or SH16. The works will be staged from the site compound accessed from Great North Road (Construction Yard 5). Technical Report G.16 *Assessment of Temporary Traffic Effects* provides detail on the construction works planned in each of the phases of construction.

The potential adverse effects of construction traffic on the road network include reduced capacity on roads within the Project site, resulting travel time delays and diversions from these roads onto other roads in the network (increasing congestion and travel times on these routes).

It is proposed that traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project.

Traffic management methodologies discussed in Technical Report G.16 Assessment of Temporary Traffic Effects

The specific traffic management methodologies proposed within this Sector include:

- Shoulder closures with minor mainline and ramp realignments and associated lane and shoulder narrowing;
- Potential night time lane closures; and
- Construction sites and site access established.

Technical Report G.16 *Assessment of Temporary Traffic Effects* discusses the traffic management methodologies, their duration and effects.

19.3.3.1 *Effects of Realignment and Narrowing of Lanes*

Minor mainline and ramp realignments and associated lane and shoulder narrowing will be required during construction within this Sector. The realignment/narrowing of lanes will be coupled with installation of a temporary speed limit of 80kph. Technical Report G.16 *Assessment of Temporary Traffic Effects* illustrates that capacity reductions are likely to affect the arterial network (particularly along Great North Road and New North Road and roads such as Jervois Road and Meola Road (the route through Herne Bay and Point Chevalier)), as traffic diverts off the State highway over construction. The Construction Traffic Management Plan (CTMP) (appended to Technical Report G.19 *Assessment of Temporary Traffic Effects*) will be important in managing these effects.

19.3.3.2 *Effects arising from Temporary Closures*

Night time closures are required for the Project along sH16 and St Lukes Interchange

There will be some temporary night time closures required for the Project along SH16, including this Sector. Section 12.2.2 of Technical Report G.16 *Assessment of Temporary Traffic Effects* discusses the impact of temporary closures on night time traffic flows and the potential detour routes proposed. Potential closures include closure of the Westbound St Lukes On-Ramp and closures of SH16 for works on Carrington Road bridge (diverting traffic off the State highway at Great North Road and St Lukes Road Interchanges).

The traffic assessment indicates that a significant number of trips that pass through this Sector originate from the northern and southern motorways and a high proportion of trips continue to Te Atatu Interchange and beyond. It also indicates that traffic patterns associated with St Lukes Interchange are closely linked to Great North Road and locations further west. Motorists will be advised of off-ramp closures at the previous interchange in advance of and during the closures. Details of the communication protocols to mitigate the effects of road closures are discussed in the CTMP.

The effects of these temporary closures can be managed through the CTMP and SSTMP (through communication for drivers and through traffic volume triggers which enable the timing of road closures such that the potential traffic impacts are minimised).

19.3.3.3 *Effects on Pedestrians and Cyclists*

During construction the existing pedestrian / cycle way on the southern side of SH16 will be unaffected by the works. As such the impacts on pedestrians and cyclists in this Sector are expected to be negligible.

19.3.3.4 *Effects arising from Construction Site and Work Site Access*

Managed site accesses proposed for Construction Yard 5

The construction site for works along SH16 will be set up within Construction Yard 5 off Great North Road. Access to the construction yard will be from Great North Road. Site access is indicated on the Construction Scheme Plans (see Part F.5 of this AEE).

Site access points will also be required for works on the Project. Site access will be undertaken from two main locations, from the access on Great North Road opposite Moa Road, and also from site accesses located on SH16.

Site access points on SH16 will not generally be in operation during peak times. Site accesses will be located and managed so that sufficient sight distance is provided to the access and so that conflicts in speed differentials between site vehicles and traffic are avoided. In cases where the location of site accesses mean that acceleration and deceleration lanes cannot be provided, temporary lane closures are proposed (outside peak hour traffic periods) to provide a traffic lane for acceleration and deceleration lengths.

19.3.3.5 *Effects on Public Transport*

There are no public transport priority measures through Sector 6. As such, the impacts on services (apart from any effect on the general stream of traffic) are expected to be negligible.

19.3.4 Mitigation - Construction

A full suite of mitigation and management options is proposed in the CTMP

Traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management to minimise the effects of construction traffic are outlined in the CTMP. Given the regional nature of the effects of construction traffic on the network[5], the overview of the CTMP is provided in Section 13.3.3 of this AEE.

It is expected that mitigation and management for the specific areas of the construction site (in this case, the mainline or SH16 and the Construction Yard 5), will be formed and agreed with Site Specific Traffic Management Plans (SSTMPs). In particular, in this area, mitigation measures addressed by the SSTMP will include:

- Restricting construction site access to Great North Road where practicable (e.g. to limit movements and traffic congestion on SH16);
- For any access or truck movements to/from SH16 during peak periods there will be escorted entry/exit (6am – 9am on SH16 Eastbound and 3pm – 6pm on SH16 Westbound)[6]; and

---

5 As most construction traffic will enter and exit directly onto the State highway network, rather than local roads.

6 It is noted that the CTMP seeks to avoid site access to and from SH16 during peak periods.

- Where site access points on the local road network are required planning shall demonstrate consideration of turning bays for vehicles entering the access and that appropriate visibility is provided for users of the local road (e.g. Great North Road).

19.4 Social Impacts

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14 *Assessment of Social Effects*). This social assessment provides a holistic 'lens' on the potential effects of the Project on neighbourhoods and wider communities, including social, economic and cultural effects. The following is a summary from that assessment.

A full social impact assessment is provided in G.14 Assessment of Social Effects

19.4.1 Existing Environment

This area covers the residential areas in Point Chevalier directly north and south of SH16. The Point Chevalier town centre on Great North Road serves local Point Chevalier residents as well as neighbouring communities including Waterview and Mt Albert. South of SH16, there are a number of specialised medical/rehabilitation services clustered on Carrington Road, many of which provide specialty services and are recognised as facilities of regional importance. These facilities are important to the wellbeing of people from across the Auckland region as a whole. Community infrastructure and areas of interest in Sector 6 are shown in Figure 19.2.

Social effects of works in Sector 6 have the potential to impact on communities in Point Chevalier

The predominant ethnic groups are European, Asian, Pacific Island and Maori. Just under half of residents own (or partly own) their own home.

Important transport linkages include SH16, the local road/footpath network and the Northwestern Cycleway. The pedestrian and cycle link across Carrington Bridge is an important link over SH16 which provides access between Point Chevalier and Unitec/Mt Albert/Waterview.

19.4.2 Assessment - Operation

19.4.2.1 *Effects from New Motorway Structures*

Operational noise, vibration, visual and air emissions have the potential to generate nuisance, amenity and health effects (which are discussed more specifically in terms of emissions, for example in Sections 19.12, 19.13, 19.6 and 19.11 of this Chapter). Specifically, for the social impact assessment, these effects have the potential to impact on people's wellbeing and quality of life. Given the effects of the existing State highway in this Sector, it is considered that these potential operational effects will be similar to those already experienced by residents and it is considered that over time, people will adjust to the new environment as it becomes a normal part of their day to day surroundings.

Social Impacts include people's way of life, health and wellbeing, accessibility and connectivity and impacts on community infrastructure

While the effects of emissions in this area are assessed in more detail later in this Chapter, and overall these effects are slightly positive (with mitigation for noise) is not considered to result in a substantial social benefit (or negative impact) for residents living adjacent to the Motorway as any alteration to local amenity/character will generally be fairly localised (affecting those residents directly bordering or overlooking Motorway infrastructure, with the exception of air emissions).

It is acknowledged for these same immediate residents, the benefits of the Project in relation to emissions (particularly noise) are somewhat off-set by the visual effects of the proposed noise barriers.

Overall, the Project will generate accessibility and connectivity improvements for residents (including those local to this Sector) and it is considered this will result in positive social impacts to people's patterns of daily living. These are discussed for the wider community in Chapter 13. Of particular relevance to the community in this Sector, the following conclusions are noted:

- Improved accessibility to and across the State highway network improving accessibility to areas of places of work, community facilities and facilities of regional importance in the wider area, particularly from this Sector to the south-west of the Region; and
- Reduced traffic on the local road network, including Point Chevalier Road and Great North Road, creating opportunities for other transport modes in this Sector.

19.4.2.2 Effects on Community Infrastructure

Community infrastructure in Sector 6 will benefit from improved accessibility from the new section of SH20, improvements to capacity of SH16 and a reduction in traffic flow on the local streets which provide access to the site (in particular, Carrington Road, Great North Road and Mt Albert Road).

In particular, this will benefit the following sites and facilities:

- Unitec: Accessibility improvements are considered beneficial in the context of the organization's regional student catchment and future plans to provide for future growth on the site; and
- The Mason Clinic and rehabilitation/addiction units around Carrington Road.

Potential impacts on recreation opportunities are considered neutral in this Sector.

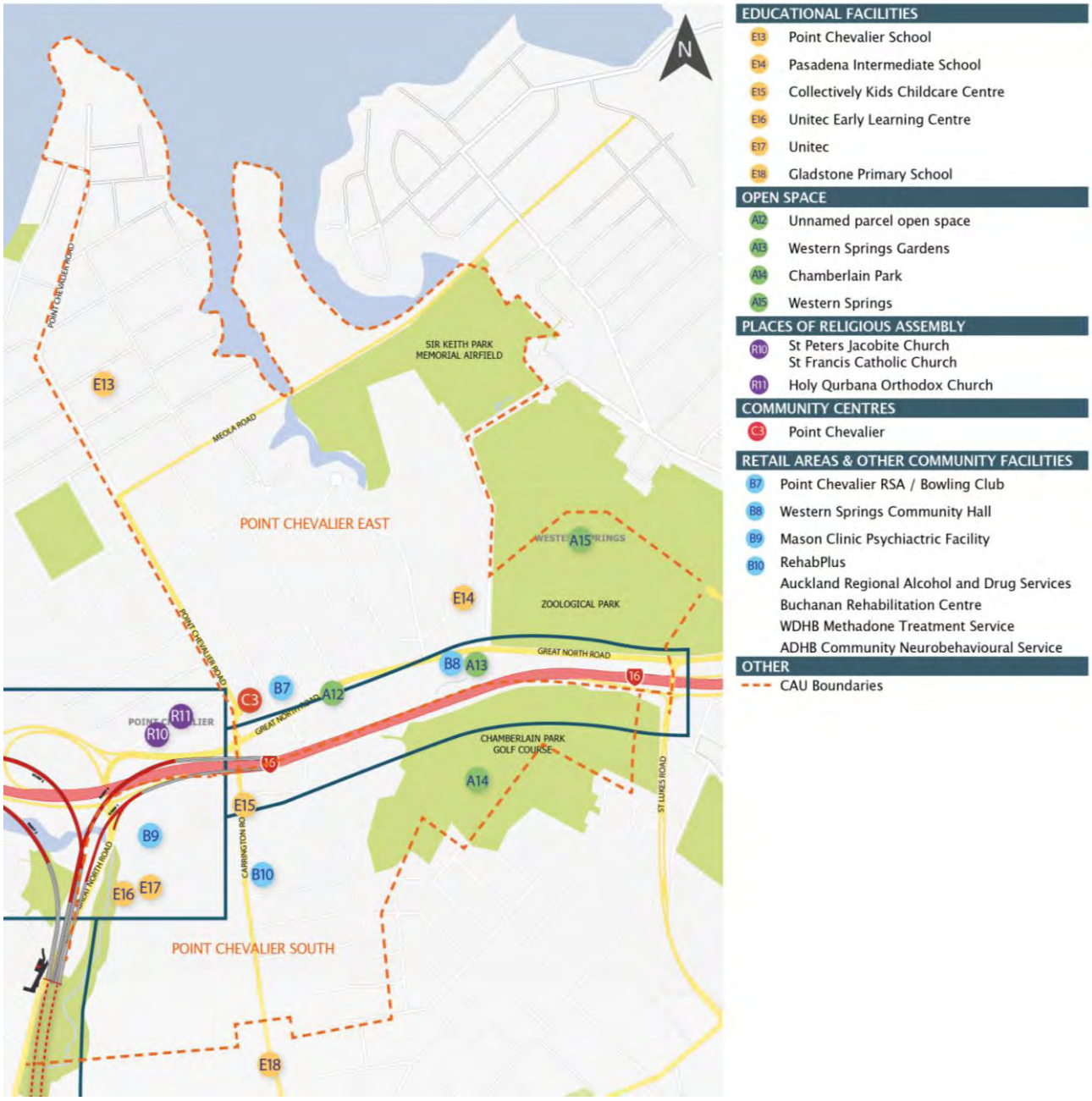


Figure 19.2: Community Facilities in Sector 6

19.4.3 Assessment - Construction

19.4.3.1 *Effects on Residents*

Given the existing SH16 and the effects of this facility for those residents immediately adjoining the Project, construction activities are considered less of a significant change to the existing urban environment for this community. Nevertheless, emissions from construction (noise, vibration and air discharges) have the potential to be a stress and/or nuisance to

Construction has potential adverse social impacts

residents in this area. However, with the construction environmental management planning proposed, it is considered these effects can be mitigated and managed.

The traffic disruptions projected during construction may also cause minor impacts in restricting people's accessibility to go about their normal living patterns and participate in social/cultural activities during construction (particularly when considered for the wider Project area). While these effects are considered in terms of travel times, the overall impact of such delays in terms of living patterns and connections are considered to be relatively minor and able to be countered through management measures (as discussed in the traffic effects assessment above).

The daily influx of temporary construction workers will increase the daytime population of the local community, and increase the associated sense of 'busy-ness' in the area. Given the existing business areas of Point Chevalier and St Lukes, this is generally considered a positive impact in this Sector (though it is acknowledged that some may perceive this as a disruptive and therefore negative change).

19.4.3.2 *Effects on Community Infrastructure*

There will also be impacts on community infrastructure during construction, particularly associated with emissions from construction (e.g. noise) and resulting from travel time delays. However, the mitigation measures proposed with respect of these matters are considered sufficient to address these social impacts.

Given that Unitec represents a major traffic generating activity in the area, traffic disruptions during construction will have a particular impact in terms of causing some delays for staff and students during peak travel periods, but overall it is expected that this can be countered by traffic management measures and forward planning.

Traffic management measures and forward planning will counter traffic disruptions

There will be some construction encroachment on the Western Springs Gardens site including areas where there is an existing NZTA designation over parts of the carparking area (which will need to be used during construction). The [Auckland Council] will need to find alternative parking arrangements (e.g. parking on local streets and in the Western Springs site on the northern side of Great North Road), which may affect operation of the site in a minor way during construction.

Recreation and open space impacts are considered minor, given that the unnamed parcel of open space land at 1074 Great North Road is not presently accessible to the public.

19.4.4 Mitigation - Operation

19.4.4.1 *Avoidance of Impacts through Design*

As for the land use impacts, the Project design being largely within the existing designation avoids potential adverse social impacts by reducing the scale of land take (as community and / or business disruption).

19.4.5 Mitigation - Construction

19.4.5.1 *Avoidance of Impacts through Design*

Where possible, construction yards have in the first instance been located as far as possible from sensitive land uses, particularly residential areas. Where this has not been possible, buffer areas have been proposed within the construction yards to minimise adverse effects from such things as light spill and hazardous facilities.

19.4.5.2 *Mitigation and Management Measures Proposed*

Management and mitigation proposed for the identified social effects include:

- Provision of information to residents on the land acquisition process;
- Development of a communications strategy to keep the community and stakeholders informed about construction activities and the construction programme;
- When particularly noisy works are proposed in close proximity to adjacent schools/childcare centres, these works where practicable are to be carried out outside of school hours or during school holidays; and
- Implementation of a formal complaints/feedback process as part of the management of construction (e.g. through the CEMP).

Communication with the community and residents throughout construction is key to mitigating adverse social effects

19.5 Cultural Impacts

19.5.1 Existing Environment – Iwi with Manawhenua

Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Auckland and in this Sector. In this regard, this Iwi has a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

Te Kawerau a Maki and Ngati Whatua have manawhenua status

19.5.2 Assessment of Cultural Effects

19.5.2.1 *Cultural Effects – Ngati Whatua o Orakei*

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua o Orakei identifies the following environmental and resource issues:

- The mauri, amenity and ecological health of waterways. Matters of concern include stormwater discharges, degradation of water quality and visual/amenity effects; and
- The potential for SH16 widening works to impact on areas of cultural heritage value/known Maori archaeological sites.

It is of note, that there are no known archaeological / Maori heritage sites in this Sector. Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE, no further comment had been received.

19.5.3 Mitigation of Cultural Effects

The cultural issues identified have been taken into account in the technical assessments and are reflected in the design of the Project and in the scope and design of the mitigation proposed.

- Stormwater treatment (see Section 19.15) is important in terms of the water quality and mauri of Meola Creek.

Cultural issues identified have influenced Project design and mitigation

19.6 Landscape and Visual Effects

The following provides an assessment of the landscape and visual effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

A full visual and landscape effects assessment is provided in Technical Report G.20

19.6.1 Existing Environment

Within this Sector the landscape setting for SH16 is dominated by a mix of state housing, bungalows and relatively recent infill around Point Chevalier. The Point Chevalier business area along Great North Road further 'breaks up' this residential area.

On the southern side of the motorway corridor, a small cluster of housing around Novar Place, Parr Road South and Sutherland Road adjoin SH16. However this housing is, for the most part, segregated from both the carriageway and its traffic by vegetation, fencing and, in particular, the deep cut through volcanic basalt that accommodates SH16's passage under Carrington Road.

At Motions Road, the open space of Western Springs Park/Western Springs Gardens and the Chamberlain Park Golf Course create a quite different urban landscape. The open space offers a secure, long term buffer between the motorway corridor and residential development within nearby parts of Mt Albert and Western Springs. Closer to St Lukes, the Northwestern Cycleway and fencing separates the carriageways from the fairways and trees of the Chamberlain Park Golf Course.

19.6.2 Assessment - Operation

Specific visual catchments are identified in Technical Report G.20

The visual catchment and related audiences potentially affected by the proposed redevelopment have been identified within Sector 6 for the assessment of landscape and visual effects. Overall, 6 public realm and 1 private residential viewpoints are assessed. The assessment methodology, in terms of landscape, amenity and natural character values are described in detail in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

The changes along this part of the Project are located close to the existing SH16 and therefore the landscape will retain a profile similar to that at present. The main changes to the external appearance and profile of the State highway will arise from the new noise barriers proposed north and south of the motorway, the removal of dwellings and the provision of the new stormwater pond. Bunding and planting (as defined in plans F.16 *Urban Design and Landscape Plans*) will help to soften the effects of these changes and should appreciably enhance much of the landscape north of the current motorway.

It is acknowledged that the noise barriers near Sutherland Road, Parr Road South and Novar Place may adversely affect the residential outlook from adjoining properties - at least in the short term. In particular, it is anticipated that vegetation clearance (to enable construction of these barriers) will heighten this impact. However, these same residents are already exposed to the existing motorway, with its mixture of infrastructure and vehicle traffic. Furthermore, the combination of residual existing vegetation and new proposed planting will assist in minimising these effects.

Between SH16 and Great North Rd, landscape and visual effects are expected to be positive, both in the short and longer terms, despite the removal of dwellings along Great North Road. In particular, the in-filling of much of the open space presently bordering SH16 with 'coastal forest' and other mixed native planting will enhance both that space and the motorway's margins (as defined in plans F.16 *Urban Design and Landscape Plans)*. This planting, assisted by the fact that the Project is in cut through the local ridges at St Lukes and Point Chevalier, and low profile in general, will further reduce its visual impact over time. This is set out further in Section 19.6.4 below.

Consequently, it is anticipated that the effects for this Sector as a whole will be limited and are typically low effects.

19.6.3 Assessment - Construction

Although the removal of some housing is required in this Sector, the proposed widening of SH16, erection of noise barriers and development of a stormwater pond (within what is currently an area of vacant land near Great North Road) would – as with the Te Atatu Interchange – be substantially confined to the existing motorway corridor. Notwithstanding this, it is noted that ground preparation, reconstruction, re-contouring, bunding and erection of the proposed noise barriers would be visible from surrounding residential properties, around both Sutherland Road and Great North Road.

The current motorway cuts through the local terrain and sinks down into it, which together with the presence of the Chamberlain Park Golf Course and substantial areas of vacant and undeveloped land north of the motorway will assist in buffering the effects. Although, it is inevitable that local residents would be exposed to the proposed construction of the Project, it is considered a modest impact in terms of visual and landscape effect. Nevertheless, as at those locations, such effects would still remain appreciable until the proposed bunding and planting are complete.

With mitigation, adverse visual and landscape effects are minor

19.6.4 Mitigation - Operation

Enhancement planting along the length of the works is proposed, as defined in the plans F.16 *Urban Design and Landscape Plans.* These plans include:

- Existing tree planting to be interspersed with planting of with native 'coastal forest' specimens;
- Bunds to be planted with 'coastal lowland' native species; and
- Low growing eco-sourced planting around stormwater pond to allow views from the motorway.

19.6.5 Mitigation - Construction

The following mitigation is proposed:

- The installation of solid screen / safety fencing during the construction period to minimise views into the construction areas; and
- Early placement of bunding and noise barriers to screen the construction area.

19.7 Amenity Trees

A Schedule of Trees identified in the Project area is in Appendix E.7 of this AEE

A number of trees in this Sector appear to be in generally good health and form. While there were no trees 'scheduled' within the District Plan several trees are considered valuable to the amenity and urban environment. A schedule of trees identified in and around the Project area is provided in Appendix E.7 of this AEE. This Schedule has been prepared by a qualified arborist.

19.7.1 Existing Environment

Large mature trees (Pohutukawa and Pinus species) exist at the edge of the Chamberlain Park Golf Course adjoining the Northwestern Pedestrian/cycle way. These trees are a strong visual feature within the Sector.

A group of vegetation consisting of native species such as Ngaio, Manuka, Lemonwood and Coprosma are situated near the commencement of the cycle way at St Lukes Road. The majority of the trees are deemed pioneer species and it is considered that these can be readily replaced.

On the northern side of SH16 a variety of trees have been identified on private land (1058 – 1060 Great North Rd[7]), and within the Council carpark area (within the Western Springs Gardens) including established Pohutukawa.

To the western side of the Western Springs Garden Community Hall and immediately adjacent the Horticultural Society building the existing vegetation is predominantly Ngaio species with Pittosporum, Pohutukawa and Melia trees growing amongst the Ngaio. This vegetation is of varying form and generally of average quality.

19.7.2 Assessment

The loss of trees can be mitigated by appropriate landscape and specimen planting

Construction works are likely to require the removal of some existing identified trees, though it is considered likely that the majority of trees highlighted above can be retained. It is noted that a number of trees identified in this Sector are considered 'pioneer species' and are not long lived. Removal and replacement of these specimens is not considered a significant effect.

[7] Sheoke, Poplar and a single Sweetgum

19.7.3 Mitigation Measures

It is proposed that detailed construction planning should, where practicable, give consideration to retaining identified trees (i.e. where such trees are not required for the permanent works of the Project, consideration should be given to construction methods that avoid the need for tree removal). It is proposed that this planning and management can be provided through the Construction Environmental Management Plan and associated management plans (Technical Report G.21).

Where such removal is deemed necessary, it is proposed that replacement trees are identified and incorporated in the planting proposed in F.16 *Urban Design and Landscape Plans.*

19.8 Effects on Herpetofauna

A full assessment of effects on herpetofauna is provided in Technical Report G.8

The following provides an assessment of the ecological effects of the Project on herpetofauna (frog and reptile species). This is a summary of the detailed assessment undertaken in Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*.

19.8.1 Existing Environment

The land within Sector 6 contains habitats suitable for lizards. This includes habitats from rank grass, flax and pampas bushes. Two species of lizards (rainbow skinks and copper skinks) were detected within Sector 6 however only copper skinks are native to New Zealand. It is noted that rainbow skink are considered a pest and are not protected. Seven copper skinks were found in survey areas opposite the Chamberlain Park Golf Course and two were found at the end of Parr Road.

These populations of copper skinks make a contribution to local biodiversity and therefore have ecological significance. However, it is noted that the skinks habitats are dominated by exotic species and have low ecological value beyond the presence of the native skink population and that the copper skink is widespread throughout the North Island and is not considered threatened.

19.8.2 Assessment - Construction

Potential adverse effects on copper skinks will be experienced during construction works, with the disturbance of their habitat. Construction activities posing the greatest threat to the skink population are: removal or clearance of vegetation and loss of food sources. Noise and vibration of construction may also have some short term effects. However, these are considered to be no more than minor give the already close proximity of the skink population to the high traffic volumes of the Northwestern Motorway.

19.8.3 Mitigation - Construction

Mitigation proposed to relocate the native skink population

Potential adverse effects on the copper skink population can be mitigated by relocating the skink population in this area to sites or habitat outside of the construction footprint (e.g. beyond the construction areas in the designation or beyond the designation).

The process for this mitigation is generally proposed to be managed through the implementation of a Ecological Management Plan (relevant sections attachted to Appendix A of Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*)[8]. This process provides for the collection of lizards from the construction areas prior to and throughout vegetation clearance, for identification of suitable habitats for relocation of lizards, including (if necessary) the planting of areas within the network and habitat enhancement, pest management and post release monitoring. Suitable habitat has been identified in reserve areas (e.g. at Harbutt Reserve and Heron Park, subject to Auckland Council Approval) and within the State highway network (e.g. SH20 south of Maioro Interchange). It is noted that, for Harbutt Reserve, additional habitat enhancement to account for the existing skink population would be warranted (again subject to agreement by the [Auckland Council]).

19.9 Freshwater Ecology

A full assessment of effects on freshwater ecology is provided in Technical Report G.6

The following provides an assessment of the ecological effects of the Project on freshwater ecology. This is a summary of the detailed assessment undertaken in Technical Report G.6 *Assessment of Freshwater Ecological Effects*.

19.9.1 Existing Environment

Meola Creek is an urban stream flowing through Sector 6

Meola Creek is a 2.6km stream with its headwaters entirely piped above the Chamberlain Park Golf Course. It flows alongside Western Springs Park on the western side of Motions Road, to its mouth at the Meola Reef Reserve, where it enters the Waitemata Harbour. It has a catchment area of 16.5km^2, with an estimated 94% impervious surface area (in other words, it is a highly urbanised stream).

Freshwater species include longfin eels, shortfin eels and common bullies and invertebrate fauna including amphipods and snails. Table 19.1 summarises the physical habitat of Meola Creek.

8 A separate approval process will be required under the Wildlife Act for the lizard relocations.

Potential effects of the Project on freshwater ecology relate to the changes in the physical habitat provided by the waterways and water quality within the stream. Shoulder widening along the SH16 does not require extensions to the Meola Creek culverts, and therefore there is no loss of stream habitat in this Sector.

Table 19.1: Physical Habitat of Meola Creek

Meola Creek		
Modification	Moderate (un-channelised)	
Riparian vegetation	Riparian trees and shrubs	
Overhead shade	Good, partial canopy	
Substrate	Bedrock and soft sediment	
Fish habitat	Moderate (in stream vegetation)	
Fish access	Good, no downstream barriers	
Water quality	Poor	

Meola Creek:

19.9.2 Assessment- Operation

As noted in Section 19.15, the proposed stormwater discharge from the Project represents a small increase in runoff from impervious surfaces (relative to the existing catchment). The treatment proposed (for both the existing (untreated) and proposed impervious surface of the State highway catchment), will be an enhancement on current stormwater treatment.

Notwithstanding that the biological communities within the Meola Creek are considered 'pollution-tolerant'[9]; the Project will enhance overall contaminant loads (through the improved treatment). As such, adverse effects on ecological communities are unlikely.

19.9.3 Assessment - Construction

The proposed construction works will discharge stormwater containing elevated levels of sediment to Meola Creek during and after rainfall events. The footprint of works in this Sector is relatively small within the context of the catchment of Meola Creek, and the actual area of exposed soils during any rainfall event will be further reduced by progressive stabilisation (see below). The sediment discharged to the Creek is expected to be a small percentage of background sediment loads from the upstream catchment.

Temporary stormwater and erosion and sediment controls will be used to minimise discharges during construction

[9] As they are currently exposed to a range of pollution levels, which fluctuate with rainfall.

The habitats and ecological communities downstream of the works have relatively low ecological values and low sensitivity to minor increases in sediment loads. While some localised effects are likely, such as decreases in abundance of macroinvertebrates in the vicinity of the decanting earth bund discharge points, it is considered that freshwater communities will recover after completion of the works.

No significant effects on fish communities or their spawning habitats are expected due to the relatively small volume of sediment and the flushing effect of flood flows, and the resilience of most New Zealand fish species to intermittent increases in suspended sediment.

In conclusion, effects on freshwater habitats and communities in Meola Creek are not ecologically significant.

19.9.4 Mitigation - Operation

As set out in Section 19.15, all stormwater from new motorway surfaces will be treated, and some currently untreated areas along SH16 will also be treated. This will provide enhanced water quality discharging from this catchment to the Meola Creek and will therefore avoid potential adverse effects on ecological communities in this waterway. Further details on stomrwater treatment are set out in the Technical Report No. G.15 *Assessment of Stormwater and Streamworks Effects*. Implementation of the Operational Stormwater Management Plan appended to the report will enable the proposed stormwater treatment devices to remain effective throughout operation.

19.9.5 Mitigation - Construction

19.9.5.1 *Mitigation and Management Measures*

Mitigation measures proposed for freshwater ecological effects during construction are set out in the management processes for erosion and sediment control: Technical Report G.22 *Erosion and Sediment Control Plan*. These measures include: additional sediment control measures in the vicinity of Meola Creek, such as silt fences, super silt fences and decanting earth bunds[10].

[10] As discussed in Section 19.15, the proposal in this Sector for temporary stormwater management is to retain the erosion and sediment control measures throughout the construction period.

19.9.5.2 *Monitoring*

In addition to the management proposed in the Erosion and Sediment Control Plan, monitoring is proposed in this plan to confirm that the measures of these plans are effective in removing contaminants from water discharging from the construction site. In addition, it is proposed that monitoring of the freshwater ecological habitat is undertaken (as per the relevant sections of the Ecological Management Plan, provided in Appendix C of Technical Report G.6). If the monitoring indicates adverse effects on freshwater habitat, the management plan also proposes remediation actions to address these impacts.

The Management Plans propose monitoring to ensure effectiveness of mitigation and management measures

19.10 Vegetation

A full assessment of effects on vegetation is provided in Technical Report G.17

The following provides an assessment of the ecological effects of the Project on ecology: vegetation. This is a summary of the detailed assessment undertaken in Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*.

19.10.1 Existing Environment

The terrestrial vegetation in Sector 6 is mainly comprised of exotic specimen trees. There is a small area of planted Pohutukawa on the southern side of the motorway by Chamberlain Park and all are located within the Project footprint. On the northern side of the motorway at Duncan MacLean Link, there is a band of young native trees (mainly Ngaios) that run between the motorway and the 'Valentines' site. There is also some natural vegetation here on the low basalt cliffs. The only notable exotic specimens identified were around 20 pine trees which form a conspicuous grouping the between the cycle track and the golf course.

Impacts of the Project relate to the removal of vegetation for construction and potentially 'edge' and 'fragmentation' effects on remaining vegetated areas.

19.10.2 Assessment – Construction

The loss of self seeded exotic vegetation is not considered to result in any adverse effects and will not require any additional mitigation. Loss of indigenous vegetation can be effectively mitigated by replanting. Therefore, the ecological effects on vegetation are no more than minor.

The weed control proposed by the Project along this Sector is considered to provide an ecological benefit to remaining and replanted vegetation.

19.10.3 Mitigation - Construction

The management measures proposed for ecological impacts on vegetation are generally provided in the Ecological Management Plan (an excerpt of which (for vegetation) is provided in Appendix C of Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*).

The replanting proposed (as detailed in the plans F.16 *Urban Design and Landscape Plans*) mitigates the loss of vegetation in this area as a result of the construction of the new structures. The stormwater treatment devices to be provided in this Sector also provide an opportunity to include locally sourced and appropriate indigenous wetland species.

Mitigation through revegetation and restoration

The Ecological Management Plan also proposes monitoring to ensure effectiveness of these mitigation and management measures, with remediation (e.g. additional planting) if the implementation of the mitigation measures are not effective.

19.11 Air Quality

A full assessment of effects on air quality is provided in Technical Report G.1

Technical Report G.1 *Assessment of Air Quality Effects* provides an assessment of the potential impacts of the Project on air quality, both during construction and operation. The following assessment of the air quality effects of construction is summarised from that report. It is noted that, given the regional nature of air quality impacts, operation effects on air quality (which are overall positive) are discussed in Chapter 13 of this AEE.

19.11.1 Existing Environment

As noted previously, Sector 6 is located within an urban environment dominated by SH16. While the proportion of residential development through this Sector is comparatively low (dominantly open space), there are a number of residential properties located to the north and south of SH16. These sites are considered 'sensitive receptors' for air emissions and are generally within 100m of the work area. To the north within Point Chevalier residential properties are located on Great North Road and Parr Road North, to the south residential properties are located on Parr Road South, Novar Place and Sutherland Road. Collectively Kids, an early learning childcare facility is also located within 100m of the works.

19.11.2 Assessment – Construction

During construction, the main potential effect of the Project on air quality in this Sector is as a result of dust generation and other air contaminant discharges which are liable to cause nuisance beyond the site boundary. These are generally considered to be localised effects (e.g. those areas adjoining the construction site). Dust may be generated during earthworks and construction activities, or as a result of vehicle movements around the site.

Construction management (including management plans for air emissions) are proposed in the Construction Environmental Management Plan. On the basis of this management (see below), effects on these key receptors are unlikely to result in any significant effects.

Construction management proposed in CEMP

19.11.3 Mitigation – Construction

Dust can be managed with a range of mitigation measures. The following describes typical measures that can be applied, as described in the Construction Air Quality Management Plan (Appendix N of Technical Report G.1). In summary, the following measures are proposed:

- Managing the surfaces of construction site areas (e.g. use of wind brakes, dampening of exposed and open areas, and covering tunnel spoil materials);
- Managing the handling of sediment and dust generating materials (e.g. stabilising works areas); and
- Managing vehicle operations in construction yards (metalling accessways, wheel washes).

The Construction Air Quality Management Plan also proposes monitoring over the construction period. This monitoring includes particulate monitoring and visual inspection monitoring of dust levels.

19.12 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.12 and G.5

The following provides an assessment of the effects of the Project on noise emissions. This is a summary of the detailed assessment undertaken in Technical Reports G.5 *Assessment of Construction Noise* and G.12 *Assessment of Operational Noise Effects*.

19.12.1 Existing Environment

The existing traffic noise within this Sector is relatively high due to the location of SH16 and Great North Road. A number of residential properties are in close proximity to SH16, with ambient noise levels in excess of 70 $dBL_{Aeq(24h)}$. A long duration traffic noise measurement at 1102G Great North Road indicates very high noise levels in the region of 75$dbL_{Aeq(24h)}$.

19.12.2 Assessment – Operation

Technical Report G.12 *Assessment of Operational Noise Effects* Provides detail on the assessment of operation noise (including the methodology and application of the national standard NZS6806). Within this Sector, there are two distinct receiving environments which have been assessed separately. These areas are the environments located to the north of SH16 – including receivers between Great North Road and SH16, and to the south of SH16.

The results are summarised in Table 19.2 below and further details are provided in Technical

Report G.12 *Assessment of Operational Noise Effects.*

Table 19.2: Sector 6 Operational Noise Levels

Receiving Environment	Potential Effect (without mitigation)
North of SH16 Dwellings located between Great North Road and SH16 (on Great North Road and Parr Road South). The terrain generally slopes towards SH16 resulting in dwellings not being shielded from traffic noise. 56 receivers were assessed.	Minor change in effect from existing noise levels– with noise increases of up to 3 decibels in all locations. Of the 56 assessment locations, 28[11] are predicted to receive noise levels above the Category B criterion. Noise levels would be up to 9 decibels above 67 dB, a considerable exceedance, which is difficult to mitigate, particularly given the elevation of the dwellings above SH16[12].
South of SH16 Dwellings located east of Carrington Road, south of SH16. 40 receivers were assessed.	Minor change in effect from existing noise levels – with noise increases up to 4 decibels in some locations (e.g. 10 Sutherland Crescent). Of the 40 assessment locations, half would receive noise levels above the Category B criterion. Exceedance of the Category B criterion is predicted to be up to ten decibels, which is a considerable exceedance.
The NZS6806 used for assessment of traffic noise identifies three categories for noise levels as 'receptors'. Category A is considered desirable, with a primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B is a secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, which is considered appropriate in certain circumstances. Category C is a minimum internal noise criterion of 40 $dBL_{Aeq(24hr)}$).	

19.12.3 Assessment – Construction

Key conclusions for the construction noise assessment in Sector 6, from Technical Report G.5 include the following:

- Average noise levels will typically be below daytime construction noise guidelines,
- Where construction is occurring in close proximity to receivers, noise levels will be above the daytime guidelines for particular periods of time. Activities that will generate high noise levels include retaining wall construction, noise barrier and bund construction;
- Construction Yards will be located at Great North Road and adjoining the existing Northwestern Motorway (both high noise generating activities); and
- Most of the construction activities occurring in this area have the potential to generate noise levels which would be above the night time guideline (60 $dB_{LAeq(T)}$) for noise limits.

Construction noise effects are expected to be more than minor at receivers where equipment is operating in close proximity to dwellings. However, it is considered that the average level of noise from the construction works will have a no more than minor effect, particularly given

11 The Criterion cited here are in accordance with the NZS6806, with the Primary and Secondary external noise criterion (A and B) and Category C a minimum internal noise criterion.

12 It is important to note that most of these dwellings presently have noise environments exceeding the 'Category B' noise criterion from NZS6806 irrespective of the Project.

the existing high ambient noise environment. Notwithstanding this, given the potential to exceed the construction noise guidelines, mitigation is proposed (see below).

19.12.4 Mitigation – Operation

Technical Report G.12 *Assessment of Operational Noise Effects* discusses mitigation options considered for traffic noise from the Project. A summary of the preferred mitigation measures proposed for Sector 5 is set out in Table 19.3. Where the mitigation proposed reduces the impact or effects assessment of the Project this is noted.

Table 19.3: Sector 6 Operational Noise Levels with Mitigation

Receiving Environment	Proposed Mitigation	Residual Effect
North of SH16	Option 5 - A noise barrier/bund of 2-6m in height on the northern side of SH16 and the use of OGPA Surface Paving[13].	Noise decreases by up to 11 decibels in some locations (1042A Great North Road). On average a 4 decibel reduction. Of the 56 receivers assessed, 36 would be within Category A, 6 would be within Category B and 14 would be within Category C (however with building modification the noise may be reduced further)[12]. More than two thirds of the receivers would be within Category A.
	Overall with mitigation, the change in effects is considered to be less than minor and some dwellings achieve a positive outcome with improvement to the existing levels.	
South of SH16	Option 6- A noise barrier ranging from 2 to 4m in height located on the southern side of SH16 and the use of OGPA Surface Paving[11].	Noise decreases up to 11 decibels in some locations (e.g. 8A Sutherland Road). On average a 6 decibel reduction. Of the 40 receivers assessed, 35 would be within Category A, 4 would be within Category B and 1 would be within Category C (26A Carrington Road).
	Overall with mitigation, the changes in effects are considered to be less than minor and some dwellings achieve a positive outcome with improvement to the existing levels.	
From NZS6806, Category A = primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, Category C = internal noise criterion of 40 $dBL_{Aeq(24hr)}$).		

In summary, the effects are considered to be generally positive because in the majority of locations the noise mitigation proposed provides an improvement from the existing situation. It is recognised that this conclusion is based on an assessment of the change in road traffic noise effects, rather than the absolute effects of the ambient noise environment for these receivers).

13 However, 14 dwellings may also require building modification mitigation (because they fall within Category C criterion of NZS6806, though it is noted this is 'with' and 'without' the Project).

19.12.5 Mitigation – Construction

General noise mitigation measures for construction activities are contained in the Noise and Vibration Management Plan (Appendix C of Technical Report G.16: *Assessment of Temporary Traffic Effects*). The following site specific noise mitigation measures are noted:

- Scheduling noisy activities relating to the construction of retaining walls to occur away from dwellings where practicable during the night period; and
- Site hoarding so that the western and northern edges of the construction yard can be screened from nearby receivers.

19.13 Vibration

A full assessment of vibration effects is provided in Technical Report G.19

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of operation and construction vibration effects. The following assessment of the vibration effects of construction is summarised from that report.

19.13.1 Existing Environment

The existing environment is an urban environment, dominated by SH16. The existing residential areas are located adjacent to SH16 and it is expected that residents experience day to day traffic related vibration. To establish the existing ambient vibration environment, a representative receiver located approximately 18m from SH16 was surveyed. The results indicate that the mean ambient levels of vibration might be just perceptible in the residential environment.

19.13.2 Assessment - Operation

The effects of vibration from road traffic, in particular heavy vehicle movements is expected to be less than minor (particularly given the existing environment), provided the Project road surface is monitored and maintained in accordance with the NZTA policy for road roughness.

19.13.3 Assessment - Construction

The key vibration sources for construction in this Sector are vibration rollers for road construction, piling for Carrington Road Bridge and any blasting activities. In respect of construction vibration, perception effects are primarily related to the concern that people may have over the potential for damage to their buildings. On this basis, the assessment of effects has focussed on standards or criteria that are intended to avoid superficial damage to buildings[14].

In general, sensitive receivers within this Sector have been classified as having a high to low risk of non-compliance with the DIN 4150-3:1999 project criterion. With 'high risk' receivers particularly associated with works with vibratory rollers (road construction) and piling for the Carrington Road Bridge (see Table 19.4 below). Therefore, specific measures will be required to manage potential vibration effects in these phases.

Table 19.4: Risk Assessment for Construction Activities in Sector 6

Source	Soil Class	Design safe distance (m)	Risk	Sensitive Receivers
Vibratory rollers for road construction	IV	30m	High	26 Carrington Road 6A, 8A, 10, 12A Sutherland Road 23, 25, 34 Parr Road South 12, 13 Novar Place 1054A, 1044, 1042A, 1036, 1036B, 1102E, 1102F, 1102G, 1102H, 1102J Great North Road
			Med	6 Carrington Road (shop) 8, 18 Sutherland Road 12 Parr Road North 27, 34A, 34B Parr Road South 10, 11 Novar Place 1042, 1054 Great North Road
			Low	29 Parr Road South 28 Carrington Road 1046 Great North Road 1216 – 1236 (even numbers only) Great North Road (shops)
Piling for Carrington Road Bridge	IV	25m	High	26 Carrington Road
			Med	6 Carrington Road (shop)
			Low	28 Carrington Road 1236, 1238, 1232 Great North Road (shops)

[14] These are the standards in DIN 4150-3:1999, as discussed in Technical Report G.19. This standard seeks to avoid superficial damage to buildings. Significantly greater vibration levels would be required before there was any risk of vibration causing any structural damage to buildings. It is noted that report G.19 concludes there is no real risk of structure damage from vibration.

Source	Soil Class	Design safe distance (m)	Risk	Sensitive Receivers
Blasting	IV	90m	High	Refer Aerial Photos in Appendix J

The potential impacts of blasting vibration have also been assessed and the risks of vibration for these activities are considered high. It has therefore been proposed that trial blasts are undertaken to assess the vibration effects of blasting before construction. The trial blasts will indicate safe distances required from sensitive receivers and establish safe levels of charge weight for the distances involved and whether further management and mitigation needs to be put in place for these activities.

19.13.4 Mitigation - Construction

It is proposed that the construction vibration effects are managed through management plans (in particular, the Construction Noise and Vibration Management Plan which is proposed in Appendix K of Technical Report G.19 *Assessment of Vibration Effects*). Mitigation measures within this Plan include:

- Confirming standards for vibration over the construction period and identifying management measures that will enable these standards to be complied with;
- Setting out best practice blasting methods i.e. limiting the number of blasts per day, decked charges, frequency control, pre-splitting the rock, blasting at fixed times targeted at least disturbance, pre-warning of sensitive receivers, careful selection of charge weight and effective use of detonator time delays, which can significantly mitigate both vibration and noise effects. It is proposed that blasting occur only between 9am and 5pm;
- Consultation with residents and 'sensitive receptors' and the implementation of a complaints procedure, whereby a 24-hour hotline is managed;
- Undertaking pre-construction and post construction building condition surveys of identified at risk buildings, services and structures. The surveys will record if there is any damage which has occurred to these features;
- The monitoring of vibration levels throughout the construction process to assess compliance with the Project criteria; and
- The appropriate mitigation of vibration effects if the monitoring indicates excessive vibration levels. Where practicable this will include the cessation of the activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

It is considered that with the implementation of the CNVMP, the adverse vibration effects of the Project during construction are appropriately mitigated.

19.14 Light Emissions

A full assessment of lighting effects is provided in Technical Report G.10

Technical Report G.10 *Assessment of Lighting Effects* provides an assessment of operation and construction lighting effects. The following assessment of the lighting effects of construction is summarised from that report.

19.14.1 Existing Environment

The current lighting arrangement on this section of SH16, between Great North Road interchange and St Lukes, comprises a double sided arrangement of 12m poles with 250W HPS light sources from semi-cut off luminaries. Residential areas are located adjacent the motorway both to the north (Point Chevalier) and south.

19.14.2 Assessment - Operation

The lighting arrangements for the enlarged intersection will be designed in accordance with relevant road lighting standards. Details of the lighting proposed are provided in Technical Report G.10 *Assessment of Lighting Effects*.

It is anticipated that overall the lighting effects will not be significant. In addition, the use of taller poles proposed through SH16 will reduce the overall number oflighting structures required to illuminate the motorway to the required lighting levels.

Overall there is expected to be an improvement to the current lighting environment.

19.14.3 Assessment – Construction

Night time works will require temporary lighting

A temporary construction yard (Construction Yard 5) will be located on the northern side of the motorway, and accessed from Great North Road. This will require lighting so that it can be accessed at night. Night works will also be required at times for some aspects of the widening works along SH16.

With management (mitigation measures proposed below), the effects of construction lighting are considered minor.

19.14.4 Mitigation - Operation

Road lighting is proposed to be designed to appropriate New Zealand lighting standards and in the form generally described in Technical Report G.10 *Assessment of Lighting Effects*.

19.14.5 Mitigation – Construction

In order to manage temporary lighting during construction, the contactor will be required to prepare a lighting plan. This will need to demonstrate compliance with Auckland City bylaws and be verified by an independent lighting specialist.

- For general area lighting, it is proposed that asymmetrical floodlights are used with glass visors that are not raised more than 3 degrees above the horizontal plane; and
- A buffer of more than 10m will be provided between the construction area and adjacent residential properties.

With these measures, it is considered the effects of construction lighting will be no more than minor.

19.15 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

19.15.1 Existing Environment

The impervious areas within Sector 6 discharge to Meola Creek. The existing SH16 carriageway in Sector 6 has no formal stormwater treatment. Runoff drains via catchpits and is discharged to ground or untreated to the Meola Creek.

19.15.2 Assessment – Operation

19.15.2.1 *Assessment of Water Quality*

The Project works propose to collect and treat stormwater from 100% of the proposed and some 70% of existing impervious areas in the State highway catchment[15]. Following completion of the Project, there will be approximately 5ha of impervious surface area in this Sector (approximately a 20% increase), however 75% of this will be collected and treated prior to discharge to the receiving environment.

[15] Treatment efficiency is calculated to be at least 75% removal of total suspended solids for stormwater through the proposed Meola wetland.

Notwithstanding that there will be a greater volume of stormwater discharged from impervious surfaces; the treatment proposed will result in a reduced effect (lower contaminant discharge or higher water quality levels) than the current discharges in this Sector. This is considered an enhanced environmental effect from the Project.

19.15.2.2 *Assessment of Water Quantity*

The effects of increased stormwater quantity include the potential effects of increased flooding and downstream channel erosion (as stormwater is discharged to a stream environment). The Project will increase the total impervious area of SH16 in this Sector by around 20% (from approximately 4ha to just over 5ha).

The treatment device for Sector 6 will discharge to the Meola Creek, downstream of the SH16 culvert. This location is at the downstream end of the Meola Creek catchment. Attenuation of motorway runoff flows in this area is not proposed[16]. However, as Meola Creek has problems with bank erosion, extended detention is proposed to protect the stream.

19.15.3 Assessment - Construction

Permanent wetland to treat runoff

It is considered that the best management option for stormwater over the construction period in this Sector is to leave the proposed erosion and sediment discharge control devices in place until the permanent stormwater treatment devices can be made operational.

The proposed construction yard within Sector 6 has a higher risk for pollution generation and stormwater treatment is desirable. In this area for the operational phase, a permanent wetland is proposed to treat runoff from Sector 6. For the construction phase it is proposed to construct the permanent stormwater device as an early activity and use it as a construction stormwater treatment device. A wet pond is proposed rather than a wetland due to the varying and potentially high sediment loading from construction yards, which can be detrimental to the effectiveness of a wetland. The most practical option for temporary stormwater treatment is to construct a wet pond, with the same geometry as that of the proposed permanent wetland.

19.15.3.1 *Assessment of Water Quality*

The Auckland Regional planning documents provide direction that water quality treatment design in construction should seek to remove at least 75% of the suspended solid loads for areas of runoff. During construction, all areas of construction for the Project (approximately 1ha) will be treated in accordance with these standards.

[16] Attenuating and therefore delaying the peak flows from the local motorway catchment would increase the peak flow in Meola Creek (due to coincidence with peak flows from further up the catchment).

The proposed stormwater treatment during construction meets the requirements of the Auckland Regional planning documents (including the ARP: ALW). In this regard, it is considered that the effects of stormwater have been appropriately minimised (the residual effects of contaminant discharges are addressed further in the relevant ecological assessments).

19.15.3.2 *Assessment of Water Quantity*

In considering erosion, the proposal is for all treatment device outfalls to have energy dissipation and erosion control measures. On this basis, it is considered the potential adverse effects from erosion or scour from discharge of stormwater during flood events has been avoided.

19.15.4 Mitigation – Operation

The proposed treatment devices will increase the level of existing stormwater treatment from SH16 which is considered an enhancement of the Project (and is identified as an 'off-set' to other ecological effects associated with the Project). Extended detention will assist in protecting the Meola Creek from bank erosion.

Ongoing operational management to ensure effective stormwater treatment

In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (Appendix D of Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*).

19.15.5 Mitigation - Construction

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan*.

19.16 Land Contamination

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

The following provides an assessment of the potential effects of the Project on contaminated land and groundwater and contaminated materials. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. Given the nature of contaminated materials, this assessment only looks at construction effects.

19.16.1 Existing Environment

Land use in this area comprises primarily road infrastructure (SH16), which is bounded by a mix of residential and parkland/recreation land (Western Springs and Chamberlain Park golf course). Historical land use is unknown in this Sector.

Existing levels of heavy metals and PAH compounds were found above 'permitted baseline' levels for land disturbing activities

The investigations undertaken on land contamination (detailed in Technical Report G.9) confirmed:

- The underlying geology comprises fill overlying Tauranga Group alluvium or basalt. The fill was predominantly reworked natural soils along the SH16 alignment, but comprised glass, wire, wood, ceramics and brick within the Meola stormwater pond area;
- No waste was identified;
- Exceedances of the 'permitted baseline' levels for land disturbing activities (as set by the ARP: ALW) were found in samples along the alignment of SH16[17] in soil samples taken for the proposed Meola Stormwater pond area[18].

Based on the analysis, approximately 48% of the material in this area is considered potential 'cleanfill'. This means that it could potentially be reused on site (with the remaining 46% classified as managed fill and 6% classified as contaminated fill, requiring disposal offsite).

19.16.2 Assessment – Construction

Management proposed to avoid off-site migration of potentially contaminated soils

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for the wider community and for workers on the site).

The levels of contamination identified were found to exceed standards and criteria considered as 'triggers' for adverse effects, both along SH16 alignment and in the location of the Meola Stormwater pond area. Therefore specific mitigation measures will be required to control off-site migration of contaminants and minimise the exposure of construction workers to potentially contaminated soils. It is anticipated that with these measures in place any potential effect in relation to contaminated soils will be able to be effectively managed.

17 Heavy metal levels and lead levels with respect of human health criteria.

18 With respect of lead, PAH and BaP levels.

19.16.3 Mitigation – Construction

Procedures will be implemented through the Contaminated Soils Management Plan

A range of mitigation measures will be used to manage the potential for contaminated soils to be encountered, and minimise potential risk to workers and the wider public.

In particular it is proposed that all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) and a Site Health and Safety Plan prior to work commencing. These will form part of the Construction Environmental Management Plan, (CEMP).The CSMP has been developed for the Project and is provided in Appendix A of Technical Report G.9: *Assessment of Land and Groundwater Contamination*. It identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

Specific measures will be employed for any material known to contain asbestos, in accordance with the Health and Safety in Employment (Asbestos) Regulations 1998 and the Department of Labour Guidelines for the Management and Removal of Asbestos (revised) 1999.

In addition, if unexpected contamination is identified, the procedures set out in the CSMP will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

20. Assessment of Effects – Sector 7

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 7. The works within this Sector comprise the 'cut and cover' section of tunnel. The Sector runs from the northern portal near Waterview Reserve to the excavated tunnel (Sector 8) in the vicinity of Waterview Downs. Overall, the key environmental effects identified and considered in Sector 7 relate to the potential impacts on the existing established residential communities of Waterview and Springleigh, for both construction and operation of the Project and the receiving environment (Oakley Creek which discharges to the Waterview Estuary).

The construction of the Project will be a significant change to the existing environment in this area, particularly for the community of Waterview. Following construction, the operation of the Project, and the structures particularly the ventilation building and stack, will have potential adverse impacts on the community (land use, social, visual in particular). Emissions (noise, vibration, air and light) are not as significant a change in this environment (compared to Sector 9 in particular); given the impact of Great North Road as a Regional Arterial traversing through this area. Impacts on the Oakley Creek as a receiving environment are primarily due to stormwater discharges, particularly during construction.

Through the careful design and proposed mitigation many of these adverse effects are mitigated. Careful construction management of works is required in the vicinity of key receptors, particularly Waterview Primary School and Kindergarten but also other residents in Waterview. In particular for the following key mitigation measures are noted:

- Traffic management and operation of Great North Road and local access to Waterview;
- Noise and vibration emissions during construction of the cut-cover tunnel in Great North Road;
- Landscaping and urban design of the ventilation building and stack, to provide visual screening where practicable and sense of scale to the Interchange structures;
- Enhanced community connectivity, and restoration works for the Oakley Inlet Heritage Area, to improve public access to and interpretation of the heritage area on the northern and southern sides of Oakley Inlet; and
- Careful management of construction activities in this area, through the Construction Environmental Management Plan (to minimise disruption to the existing community).

20.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 7. As described in Chapters 4 and 5, the main elements of the Project in this Sector are the:

- Great North Road Underpass; and
- Northern ventilation building and stack.

Relevant Plans: F.2: Operation Scheme Plans and F.5: Construction Scheme Plans (Sheets 13 and 14, for this Sector)

Specific details on scheme elements in this Sector are described in Section 4.4.7 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans*, (Sheets 13 and 14 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.7 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheets 13 and 14 for this Sector).

The works located within this area are located within an urban environment dominated by Great North Road. Residential properties are located to the west (Waterview). Oakley Creek runs through this Sector, to the east of Great North Road, in a northerly direction.

Key issues relate to the existing urban environment and Oakley Creek

Given the existing environment, the key issues identified in the assessment of environmental effects for the Project, relate to impacts on the existing community, transport networks and the physical residential environment. Effects on the receiving environment, particularly the Oakley Creek have also been assessed [1]

This Chapter is set out as follows:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (eg. there is no reporting of effects on coastal processes and effects on herpetofauna).

20.2 Land Use

20.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 20.1. The information within this Figure has been extracted from the Auckland City District Plan (refer Appendix E.2 for the district plan maps). The Plans in Part F.1: *Designation Plans* contain further detail on designations and other restrictions.

The land uses in this area are currently zoned for education (Special Purpose 2), open space (Open Space 2 and 3), residential (Residential 6a and 6b) and business (Business 1) purposes.

20.2.1.1 *Special Purpose Land Use*

Waterview Primary School and Kindergarten front Herdman Street with access also obtained from Oakley Avenue and Great North Road. This land is zoned Special Purpose 2 (for education) and is located to the west of residential housing fronting Great North Road. A small access way from the School connects with Great North Road. The School and Kindergarten is subject to Designation D04-03 in the District Plan.

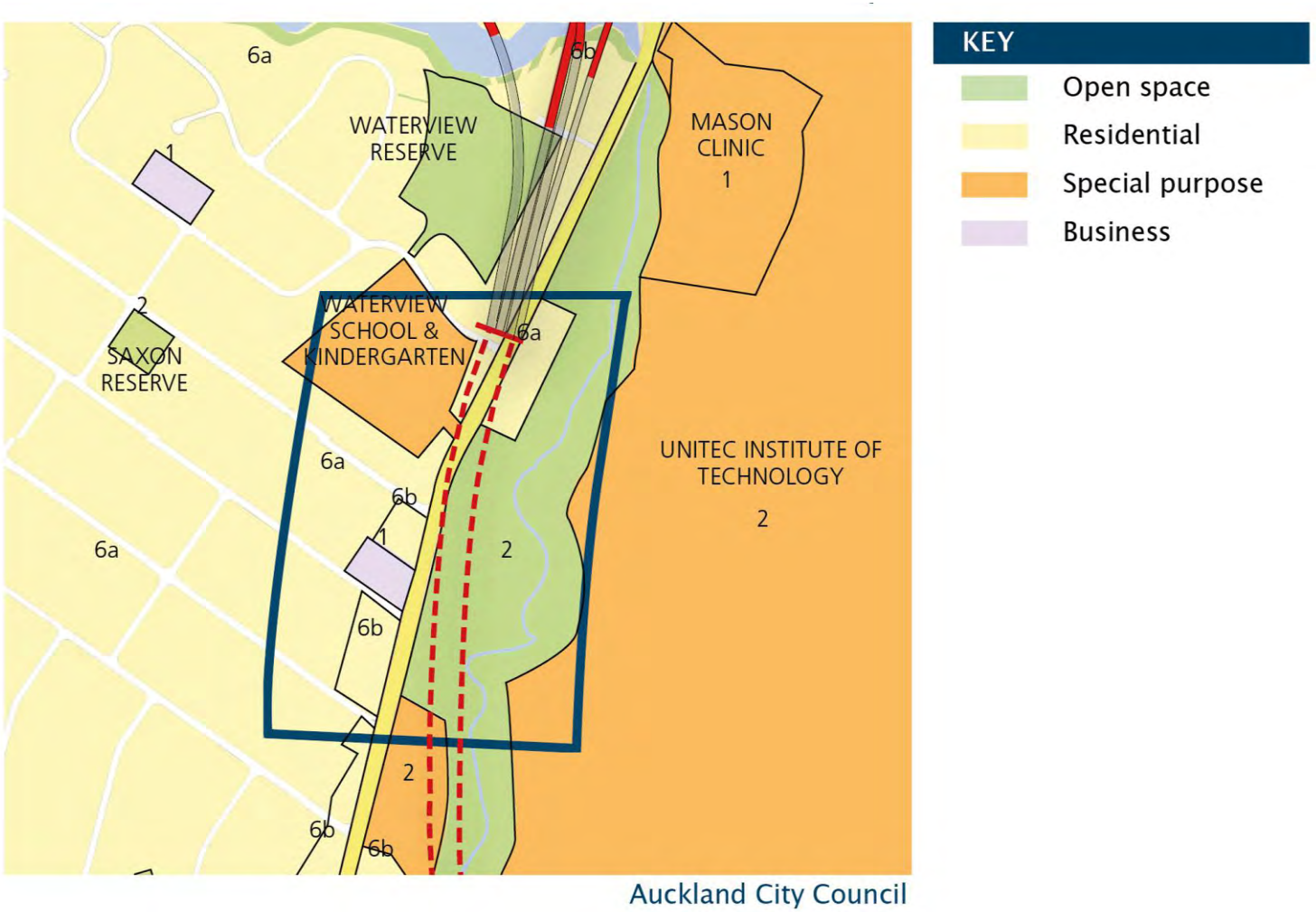


Figure 20.1: Land Use Zones Sector 7 (Not to Scale)

20.2.1.2 *Business Land Use*

There is a dairy (Waterview Superette) and adjoining businesses zoned Business 1 on the corner of Great North Road and Alford Street.

20.2.1.3 *Residential Land Use*

Properties west of Great North Road are zoned Residential 6a and 6b (medium density housing). A pocket of Residential 6a zoned land, which interrupts the Oakley Creek Esplanade Reserve, is occupied by a petrol station (BP Waterview).

Residential land use surrounds the Project

20.2.1.4 *Open Space Land Use*

Oakley Creek Esplanade Reserve is located in this area, between Great North Road and Unitec. The Reserve includes both the upper reaches of Oakley Creek and incorporates a walkway on its eastern side. A historic midden site and waterfall are located within the Reserve. The Reserve is zoned Open Space 2 (for informal recreation) purposes. The parcel of land within the Reserve located adjacent to Great North Road is classified as a Recreation Reserve and subject to the Reserves Act.

Oakley Creek Esplanade Reserve exists in this Sector

Saxon Reserve (a small neighbourhood Reserve) is located outside of the Project area within the Waterview community along Oakley Avenue (also discussed in reference to Sector 5 mitigation – Chapter 18).

20.2.1.5 *Other Designations*

In addition to the designation above for Waterview Primary School, a public road network designation (Reference – B08-04) applies to all Auckland City Council owned roads to enable the safe and efficient functioning and operation of the Council's road network. Within Sector 7, Auckland City Council owned roads include Great North Road, Oakley Avenue and Alford Street.

Plans in F.1 of this AEE provide detail on existing designations

20.2.1.6 *Auckland City Future Planning Framework*

The Auckland City Future Planning Framework 2008 area plans set out a number of key medium and long-term outcomes that the council wants to achieve by 2030, from a city planning point of view. Of particular significance to this Sector of this Project, are mapped aspirations for:

- Green ecological linkages along Oakley Creek;

- Single dwelling small site/townhouse residential housing types;
- Great North Road as a key road passenger transport route;
- Neighbourhood shops retained on Great North Road;
- The maintenance and management of cultural heritage values (including archaeological and Maori sites of significance) along Oakley creek; and
- Improved pedestrian/cycle environment along Great North Road and potentially crossing Oakley Creek.

20.2.2 Assessment - Operation

Land use impacts relate to the land take

Land use impacts associated with the operation of the Project relate to the scale of permanent land take from surrounding land use areas described below. In particular, effects include the loss of the land uses as a result of the Project and the potential loss of viability for the remaining surrounding land use areas.

20.2.2.1 *Impact on Special Purpose Land Use*

The majority of the Waterview School/Kindergarten sites are unaffected by the operation of the Project. However, the existing (unused) access to Waterview School located on Great North Road will be permanently closed, due to the location of the northern ventilation building. The access is understood to be currently unused and the effects of closing the access are less than minor.

20.2.2.2 *Impact on Residential Land Use*

The construction of the Great North Road underpass and associated ventilation building and stack will require a number of residential properties to be taken along Great North Road. The overall property take is estimated to be around 2.5% of the total number of dwellings in the Waterview area (based on 2006 Census data)[2]. While this represents a moderate impact on the land use in the area, the adverse effects of the loss of the residential properties is not considered to be significant in the medium to long term. In particular, the following observations are noted:

- The surrounding residential land is zoned Residential 6a and 6b (for medium density development) in the Auckland City District Plan and the Auckland City Future Planning Framework aspires for this area to have 'single dwelling small site/townhouse residential development' in the future; and
- It is considered that the existing residential site configurations with the area are not developed to this potential so therefore the quantum of residential dwellings lost due to the Project can be absorbed or replaced into the remaining residential zone.

[2] It is noted that with Sector 5 included, the proportion of impact increases to around 8.5%, however the above conclusions remain relevant.

Further, it is anticipated that some sites may be available for residential development following construction works. This would reduce the total impact on the residential zone as a result of the Project.

On balance, and given the extent of the residential zone in the wider area surrounding the Project, the adverse effects of the loss of a small proportion of this land use are not considered significant.

20.2.2.3 *Impact on Other Existing Designations*

Auckland City has a designation for their public roads

The Project requires designation over land currently designated by the Council for their public roads (Reference B08-04) such as Great North Road. In this Sector, the Project has retained all local road connections following construction of the Project. Auckland City has indicated that the Project design is sufficient for them to provide the necessary s177 approval, as the primary designation. Discussions in regard to this approval are progressing. Given the above assessment, the operation effects of the Project on existing designations are considered minor during operation of the Project.

20.2.2.4 *Impact on Business Land Use*

No businesses are directly impacted by the operation of the Project. Access will be maintained to existing businesses in this Sector including BP and the Waterview Superette and therefore there are no effects on business land use.

20.2.2.5 *Impact on Open Space*

No open space is directly impacted by the operation of the Project within Sector 7 and therefore there are no operational effects on the open space land use environment within this Sector. While some open space land is required during construction as discussed in Section 20.2.4.2 below, this land will be reinstated for use after construction.

20.2.2.6 *Impact on Future Planning Framework*

The Project is not considered to provide a barrier to achieving Auckland City's future vision for communities (set out in the Auckland City Future Planning Framework) and is considered to enhance some outcomes related to the opportunity for local areas to develop, including urban intensification, through improved accessibility to transport links and passenger transport (bus) networks.

20.2.3 Assessment - Construction

Some land take will be required to construct the Great North Road Underpass. These properties are for the most part zoned for residential purposes and open space purposes.

20.2.3.1 *Impact on Residential Land Use*

During the construction period there will be a concentrated impact on NZTA owned residential land in the northeast of the Waterview community. In total approximately 15 parcels of land (approximately 22 dwellings) are identified for take in this area. The full schedule of properties affected by the designation in this area is provided in NOR 4[3]. Access to a rear residential properties (at 1469A and 1469B Great North Road) outside of the designation footprint located on Great North Road will be maintained during the construction period.

Some residential land will be required during construction

20.2.3.2 *Impact on Open Space Land Use*

It will be necessary to occupy approximately 2.7ha of open space zoned land at Oakley Creek Esplanade Reserve. This is to provide for Construction Yard 7. Pedestrian / cycle way access through the Reserve will be maintained during the construction period. It is considered that the impact is temporary and providing the Reserve is restored following construction, these temporary construction land use effects are no more than minor.

20.2.3.3 *Impact on Business Land Use*

The dairy on Great North Road has been identified within the proposed designation. As discussed in Section 20.4, the site has been designated due to the potential risks associated with settlement. However, it is anticipated that the dairy will be able to remain fully operational throughout construction; and any effects on the dairy will be managed so that this occurs.

20.2.4 Mitigation - Operation

20.2.4.1 *Avoiding Effects through Design*

The potential adverse land use effects have been minimised on open space and residential land use in this Sector due to the construction methodology of the cut and cover tunnel.

20.2.4.2 *General Mitigation*

Once construction is complete, the designation should be uplifted from surplus land within the designation to allow for reinstatement of residential and open space areas where practicable for the safe and efficient operation of the Project.

Land use effects have been minimised through design

[3] This NOR includes property impact from the designation in Sectors 5 and 7.

20.3 Transport Effects

Traffic effects have been assessed for the Project and this assessment is reported in Part G (Technical Reports G.16 *Assessment of Temporary Traffic Effects* and G.18 *Assessment Transport Effects*). The following is a summary from this assessment.

Technical Reports G.16 and G.18 provide further detail on the assessment of traffic effects

20.3.1 Existing Environment

20.3.1.1 *Roading Environment*

This Sector comprises Great North Road which has four lanes through this area. Great North Road is defined as a strategic route in the Auckland District Plan and a regional arterial road in the Auckland Regional Arterial Road Plan.

20.3.1.2 *Pedestrian/Cycling Environment*

A shared walking and cycling path runs alongside Great North Road on the section between Great North Road interchange and the intersection with Blockhouse Bay Road. There are also pedestrian walkways through Oakley Creek Esplanade Reserve which can be accessed from Great North Road through a number of locations.

20.3.1.3 *Passenger Transport*

Through this Sector the main bus services of interest are those operating along Great North Road. There are a number of bus services which run north and south along Great North Road.

20.3.1.4 *Parking and Access*

On street parking is restricted for the length of Great North Road. Some of the properties surrounding Great North Road have direct access onto Great North Road and a hatched median is provided within this area.

20.3.2 Assessment - Operation

The overview of the transport assessment for the operation of the Project is provided in Chapter 13 of the AEE (regional assessment). The assessment provides for the anticipated effects of the Project on the wider motorway network, arterial roads and the local roading network. Further detail on this assessment is provided in Technical Report No. G.18 *Assessment Transport Effects.*

The regional assessment (Chapter 13) includes an assessment of operational transport effects

The particular effects relating to property access and parking in relation to this Sector during the operation of the Project are outlined below.

20.3.2.1 *Effects on Property Access and Parking*

Following completion of the Project, access to Herdman Street, Oakley Avenue and Alford Street properties and any temporary rearrangement of access to the BP service station will be reinstated along with the existing facilities (footpaths, bus stops, street lighting etc) on this section of Great North Road. There is presently no parking on Great North Road in this area to be affected by the Project following completion.

There is currently no parking on Great North Road in this area

With regard to Herdman Street, the existing vehicle accessway to the Waterview Primary School and existing parking provision on Herdman Street could be retained following completion of the Project. For operation of the School and Kindergarten in this area, the continued use of the controlled intersection at Herdman Street is considered preferable to the combination of traffic using an uncontrolled intersection (e.g. at Oakley Avenue) and routing through the Waterview residential area. Similarly the signalised pedestrian crossing at the Herdman Street is also proposed to be retained.

A new accessway is proposed off Great North Road, just north of Oakley Avenue, providing access to the vent building at the northern portal of the tunnel. The anticipated traffic using this accessway would be negligible, particularly when it is considered that along this side of Great North Road approximately 20 existing private driveways will be removed by the Project.

20.3.3 Assessment - Construction

Works within this Sector are planned to be constructed over two phases (for construction of the cut and cover tunnel). Each phase is expected to realign Great North Road. The construction site (Construction Yard 7) will be established at Oakley Creek Esplanade Reserve. Chapter 14 of *Technical Report No G.16 Assessment of Temporary Traffic Effects* details the construction works planned in each phase of construction, the traffic management methodologies proposed within this Sector, their duration and their effects.

Technical Report G.16 details the temporary traffic management planned in this sector

The potential adverse effects of construction traffic on the road network include: reduced capacity on roads within the Project site, resulting travel time delays and diversions from these roads onto other roads in the network (increasing congestion and travel times on these routes). There is also the potential for reduced access for users of the road network through the construction site (e.g. if road closures etc are left unmanaged).

It is proposed that traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project.

The specific traffic management methodologies proposed within this Sector include:

- Realignment of Great North Road with narrowed lanes and shoulders implemented throughout the site to maximise the construction zone – with temporary safety barriers installed;

- Local road connections to Great North Road closed and traffic diverted (e.g. either Oakley Avenue or Herdman Street accesses may be closed, though not simultaneously);
- A 30kph speed limit implemented throughout the works;
- Diversions of pedestrian and cycle access;
- Temporary bus stops; and
- Construction sites and site access established.

20.3.3.1 *Effects of Realignment and Narrowing of Lanes*

The existing number of lanes on Great North Road will remain operational

During construction it is expected that the existing number of lanes on Great North Road will remain operational in the temporary alignment, however they will be narrowed to a minimum width of 3m and 300mm shoulders.

The first stage of the construction of the Great North Road Underpass, Great North Road will be narrowed and shifted to the west to allow the construction of temporary pavement to the east of Great North Road. Once the temporary pavement is complete, traffic will be shifted to the east on to the new temporary pavement. Once the tunnel and final pavement works are complete, Great North Road will be returned to its existing alignment.

It is anticipated that traffic impacts arising from the long term work site will primarily arise from installation of temporary signals for site access along Great North Road. The traffic model indicates the highest travel time impact anticipated along Great North Road northbound from Blockhouse Bay Road to Point Chevalier Road to be approximately 2 minutes 30 seconds additional travel time in the AM Peak.

A strategy will be put in place throughout construction on Great North Road to reduce the volume of traffic on that road, advise of alternative routes to minimise traffic volumes and optimise the signal phasing to prioritise traffic on Great North Road to mitigate these effects.

20.3.3.2 *Effects arising from Temporary Closures*

There will be some night time closures required in this Sector

There will be some temporary night closures required for the Project in this Sector. Section 14.2.2 of Technical Report No G.16 *Assessment of Temporary Traffic Effects* discusses the impact of temporary closures on night time traffic flows. Potential Closures in this area include:

- Work in the "live lanes" of Great North Road; and
- Cowley Street to be removed as part of the Project, and the connections of Great North Road to Herdman Street and Oakley Avenue will be temporarily closed and traffic diverted south to Alford Street.

A Site Specific Traffic Management Plan (SSTMP) is proposed to manage lane closures. In particular, the following measures are proposed:

- Lane closures will occur over night and both directions of traffic will be maintained unless alternative methodologies cannot be developed;
- If full closures are necessary, road users will be advised of the closures in advance of the closed section, before and during the closures. Traffic will be directed to an appropriate diversion route (see Section 14.2.2 of Technical Report No *G.16 Assessment of Temporary Traffic Effects* for information on the location of these diversions). Due to the length of some of the detour routes required, it is desirable to minimise the closure duration and the number of road users that are affected by the closure. As such, extensive pre-conditioning and advertising campaigns would be expected if Great North Road was to be closed during works.

20.3.3.3 *Effects on Pedestrians and Cyclists*

During the construction activities on Great North Road, there will be some accessibility effects for pedestrians and cyclists through the work site. This is because the eastern pedestrian / cycle way will be closed during works. The footpath and cycleway will be diverted onto the western side of Great North Road at the signalised intersections to the north and south of the site in order to minimise the hazards of closing such a busy arterial. A review of the pedestrian provisions at these intersections will be undertaken during development of the proposed site specific management plans (see Section 20.3.4 below).

20.3.3.4 *Effects arising from Construction Site and Work Site Access*

The Great North Road Underpass site compound (Construction Yard 7) will be accessed from a temporary signalised intersection on Great North Road, which shall be located at either the Herdman Street intersection or immediately to the north. The intersection will be installed over night using lane closures. Temporary TL-3 barriers will be installed to isolate the work site from passing traffic

The design and operation of signals will be developed to minimise delays for traffic on Great North Road

The additional phase at the signalised intersection is expected to generate some additional delay for vehicles passing along Great North Road. The design and operation of the signals will be developed to minimise delays for vehicles on Great North Road, and consideration will be given to closing the site access during peak periods if significant delays or queues are observed.

20.3.3.5 *Effects on Public Transport*

A number of buses pass through Sector 7 and these services are expected to be affected by the works. This will primarily result from the relocation of bus stops through the site in order to minimise delays to through-traffic arising from the site layout. Bus stops will be relocated at either end of the site in locations that provide a safer route for pedestrians. The bus stop relocations will take into account the closure of the eastern footpath on Great North Road, and the presence of the School on Herdman Street.

Bus stops will be relocated to provide a safer route for pedestrians

There are no bus priority measures situated along Great North Road within Sector 7, and as such there are not anticipated to be any travel time impact over and above those experienced by the general stream of traffic.

20.3.4 Mitigation - Construction

Traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management to minimise the effects of construction traffic are outlined in the Construction Traffic Management Plan (CTMP) (appended to Technical Report G.16 *Assessment of Temporary Traffic Effects*)). Given the regional nature of the effects of construction on the traffic network, the overview of the CTMP is provided in Section 13.3.2.2 of this report.

It is expected that mitigation and management for specific areas of the construction site will be formed and agreed within a SSTMP. In particular, in this area, it is proposed that mitigation measures for the SSTMP address:

Site Specific Traffic Management Plans will be developed to manage specific traffic effects during construction

- Phasing of intersections to minimise travel delays;
- Diversion and maintenance of safe footpath and pedestrian access;
- Restricted times on when lane closures are implemented i.e. after 9pm at night and lifted before 5.30am; and
- Consideration of turning bays for vehicles entering the access points on Great North Road.

20.4 Ground Settlement

A full assessment of ground settlement effects is provided in Technical Report G.13

Technical Report G.13: *Assessment of Ground Settlement Effects* provides a detailed assessment of the expected settlement from the Project, including detail on the methodology for assessment of ground settlement effects. The following is a summary from that report.

20.4.1 Existing Environment

The existing environment within Sector 7 is predominantly residential in nature with the Unitec campus and a few commercial buildings at the northern end. The buildings are of an older style and form and there are some historic structures located within the Unitec campus.

Dwelling types are varied but can generally by summarised into two construction types – masonry construction and timber construction.

Of the larger buildings in this Sector, a limited number of sensitive buildings have been identified which warrant special consideration as a result of their unusual construction or particular status including Unitec Building 76.

The tunnel alignment will run beneath an extensive service network associated with these residential areas. These service networks primarily run along arterial roads such as Great North Road.

20.4.2 Assessment – Construction

Settlement effects relate to movement of buildings

Settlement effects during construction in this Sector relate to potential movement of buildings associated with the excavated tunnelling and movements associated with construction of the retaining walls for the cut-cover underpass of Great North Road.

20.4.2.1 *Excavated Tunnel Settlements*[4]

Effects on residential dwellings in the area as a result of tunnel construction are considered to be less than minor. However, an inspection prior to construction is proposed to identify any pre-existing defects or sensitive features. Periodic inspections during critical phases of construction are also proposed.

[4] Further assessment of other buildings above the excavated tunnel is reported in Chapter 21 of this AEE.

In acknowledgement of the sensitivity of the existing heritage buildings on the Unitec Building 76, an assessment has also been undertaken for this building. The assessment undertaken as part of the settlement analysis predicted some form of ground settlement in the vicinity of this building, however, generally the settlement is considered to be relatively uniform across the Building 76 site. There will be a low level of movement and negligible effects are anticipated. However, due to the substantial size of the building and historic nature, a monitoring programme is proposed (see Section 20.4.3 below).

20.4.2.2 *Underpass / Retaining Wall Settlements*

Effects on services are summarised as follows:

- Metrowater 550mm x 900mm (ch 3740) – Effects from settlement are anticipated to be minor comprising slight cracking and slight damage to the mortar;
- Great North Road services (including sewer, water, stormwater, gas, power and communications) (ch 3900) – Effects are expected to be negligible as the services run perpendicular to the settlement gradients;
- Watercare Orakei No. 9 Trunk Sewer (around ch 3500) – in the vicinity of 1510 Great North Road, the gradients of this service line may result in settlement having minor effects on the sewer (e.g. slight cracking of concrete and mortar). It is not anticipated that this will disrupt operation; and
- Local roads - Only minor changes are expected as a result of settlement to road gradients. These changes are expected to occur as a smooth profile over the existing roads with no sharp changes in grade.

Settlement effects with more than 'negligible' impacts on buildings are anticipated in association with the retaining walls for the Great North Road underpass. In particular, properties on the 'odd numbers' from 1467 though to 1481 Great North Road are identified (excluding 1471), with effects ranging up to 'severe'[5]. While the assessment of settlement has been considered 'conservative' or worse case, these properties have been included in the designation for the Project (to enable repair or re-construction of any damage to buildings without undue disruption to residents). It is proposed that monitoring and remedial works (rather than purchase) is appropriate for one of these buildings (the Waterview Superette), to allow for ongoing business operation on this site.

[5] Effects in this category can include damage requiring extensive repair work, distortion of windows and doors, noticeable sloping of floors.

20.4.3 Mitigation - Construction

Settlement monitoring will be undertaken

While overall the effects of settlement on buildings and services (outside the designation) are considered minor, the uncertainty of modelling and the risk of effect indicates the monitoring over the construction period is appropriate. Appendix H of Technical Report G.13, provides a proposed Settlement Effects Management Plan (SEMP). Of particular relevance to this Sector, this monitoring and mitigation includes:

- Individual structural condition assessments to be carried out on buildings within the subsurface designation and in any area where the buildings are assessed to have greater than 'negligible' risk of damage, including the following specific buildings:
    - Unitec Building 76;
    - Waterview Primary School and
    - the BP Service Station at 1380 Great North Road;

  Monthly visual assessments are proposed during the critical construction phases, and if damage is found, repainting, redecorating and repairs undertaken as required;
- Monitoring of all retaining walls in this Sector for movement, using inclinometers and surface survey to determine actual displacements during and post construction;
- Grouting between and behind secant pile walls, sealing and fracturing/jointing of rock at base of excavation, and reinjecting water through boreholes back into surrounding ground or basalt aquifer to mitigate change in groundwater levels;
- For transport infrastructure, overlaying road surface to raise it, reconstructing kerb and channels and additional stormwater catch pits and associated piping if ponding found; and
- For services, CCTV inspections are to be used to provide a baseline for assessing future change to these over construction. In the case of the Watercare Orakei No. 9 sewer, regular CCTV inspections are proposed.

20.5 Social Impacts

A full social impact assessment is provided in G.14: Assessment of Social Effects

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14: *Assessment of Social Effects). This social assessment provides a holistic 'lens' on the potential effects of the* Project on neighbourhoods and wider communities, including social, economic and cultural effects. The following is a summary from that assessment.

20.5.1 Existing Environment

Social effects in Sector 7 have the potential to impact on the Waterview community

This area covers the residential areas of Waterview and the Unitec residential village on Great North Road. Few local shops/services are located in Waterview itself: the Waterview Superette, BP petrol station and small block of shops on Daventry Street. Community facilities and sites of interest in Sector 7 are shown in Figure 20.2.

A number of demographic characteristics of the population in this area indicate that a high proportion of the community is economically and materially disadvantaged. In particular:

- Less than half of Waterview households own (or partly own) their own home;
- The Census Meshblocks that are affected by property acquisition for the Project have a high rate of deprivation compared with the Auckland region as a whole (ratings of 9-10, indicating the most deprived 10-20% of residents in the country); and
- There is a relatively high concentration of Housing New Zealand accommodation in northern Waterview (notably along Herdman Street, Daventry Street and Oakley Avenue).

Waterview Primary School and Kindergarten are located in Sector 7. Waterview Primary School had a roll of 144 students in 2010, and Waterview Kindergarten had a roll of approximately 62 students in 2009. The School and Kindergarten are important community facilities for Waterview, as they provide a focal point for interaction and the School hall is rented out to community groups and organisations outside of School hours.

As described in Section 20.2.1.4, Saxon Reserve (a small neighbourhood Reserve) and the Oakley Creek Esplanade Reserve (identified in consultation as highly valued by the local community) are important recreation areas for local residents. Heron Park in the south of Waterview also provides for the recreation needs of local residents.

Important transport linkages in Sector 7 include SH16, the local road/footpath network and the Northwestern Pedestrian/cycle way. The Oakley Creek Walkway provides a pedestrian link from the Oakley Creek Esplanade Reserve, connecting Waterview with Springleigh and providing access to Unitec and Phyllis Reserve (crossing Oakley Creek via a footbridge).

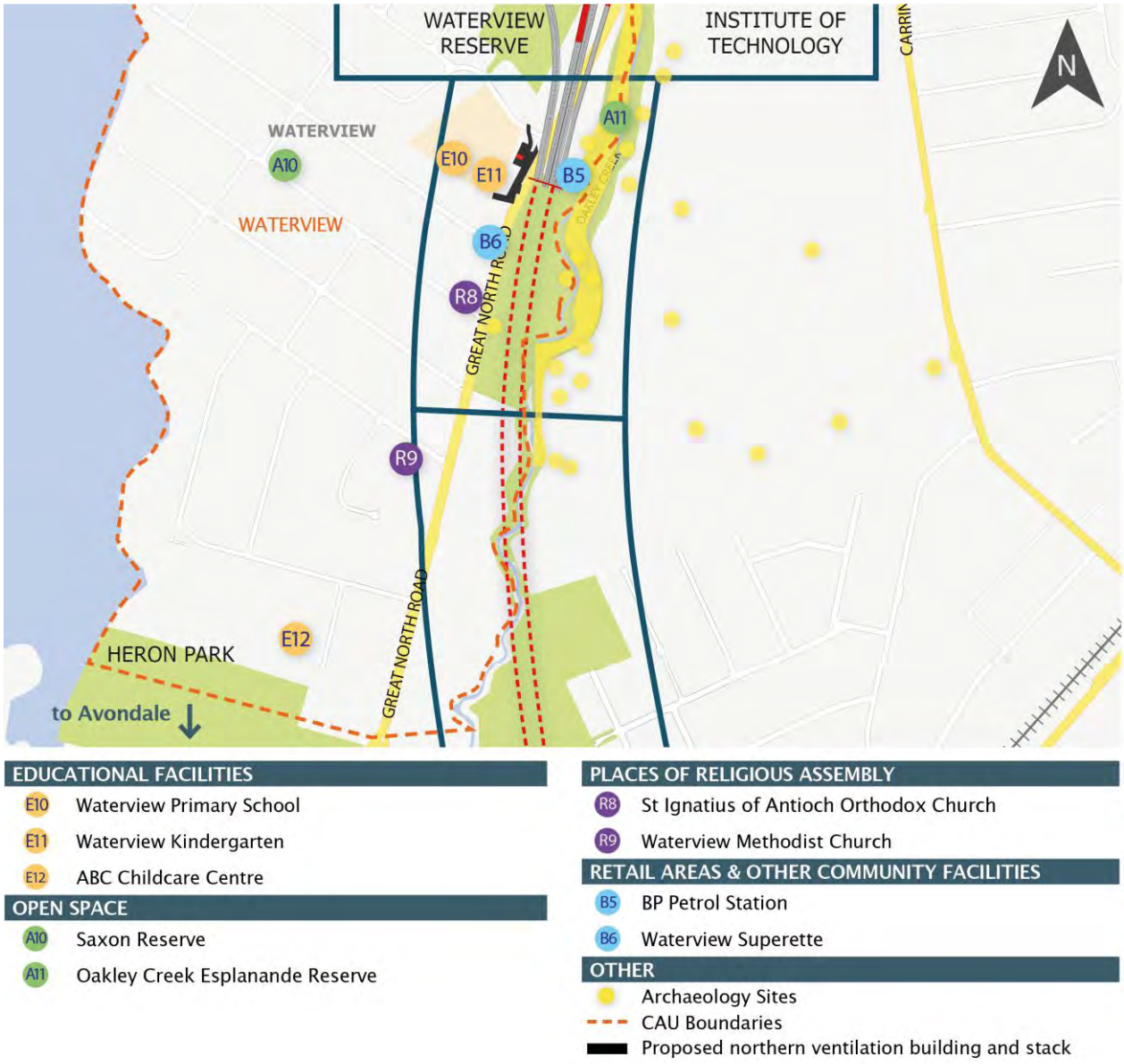


Figure 20.2: Community Infrastructure in Sector 7

20.5.2 Assessment - Operation[6]

20.5.2.1 *Effects from Property Acquisition*

Social impacts relate to impacts on people's way of life, health and wellbeing, accessibility and connectivity and impacts on community infrastructure

As discussed in the land use assessment above, residential property acquisition will reduce the population size in Waterview by 22 households in Sector 7[7]. The impact of residential land take will result in (at least initially) a high degree of change for this community. As discussed in Chapter 18, the potential social effects of the loss of these dwellings include:

- Potentially significant displacement/fragmentation of the current Waterview community, given the scale of property acquisition (the combined property acquisition in Sectors 5 and 7 affects 8.5% of households in Waterview);
- Potentially significant impacts on community cohesiveness, given that some residents may not be able to relocate within the same neighbourhood;
- Impacts on the ability of residents to participate in social/cultural activities (for example, attend community events or a local church); and
- A small demographic impact from the population loss, and given that the Census Meshblocks affected by property acquisition have a higher proportion of Pacific Island residents and Housing New Zealand/lower socio-economic residents relative to the wider Waterview suburb.

Beyond the population loss of the required property acquisition, it is also likely that some current residents will decide to move elsewhere as a result of the Project. This would result in a change to, rather than a loss of, residents from remaining areas in the local study area, and as such is considered to result in a neutral population effect overall.

It is acknowledged that the residential land take may result in an initially high degree of change for affected residents and that this is a significant impact at least in the short to medium term. Ameliorating factors for longer term impacts include the relatively high natural 'turnover' for housing rates in Waterview[8] and the ability for people join new facilities and adjust their living patterns and social networks. The existing arrangements between the NZTA and Housing New Zealand, relating to the communication and provision for tenant relocation, provide mitigation for a large proportion of the community in respect of these effects. The advanced purchase strategy employed by the NZTA for the Project has also reduced the severity of these impacts (enabling people to move on with their housing choices at timeframes of their choosing (prior to lodgement of the Notices of Requirement).

---

6 It is recognised that social impacts have been occurring in the planning phase of the Project at the local level, mainly in terms of the uncertainty caused by the Project, particularly surrounding potential property acquisition. Further details are contained in Technical Report G.14 *Assessment of Social Effects*, and are not repeated in this AEE.

7 It is acknowledged that these impacts will occur from the construction phase, due to the timing of property acquisition.

8 Almost 60% of Waterview residents had resided at their current place of residence for less than 4 years at the time of the 2006 Census of Population and Dwellings.

20.5.2.2 *Effects from New Motorway Structures*

Adverse impacts from the changing form and amenity of the area

Operation noise, vibration, visual and air emissions have the potential to generate nuisance, amenity and health effects (which are discussed more specifically in terms of emissions, in later sections of this Chapter). Specifically, for the social impact assessment, these effects have the potential to impact on people's wellbeing and quality of life.

For the new section of SH20, the large scale of the motorway structures will bring about a notable change in community character as a result of visual impacts in the public domain (see Section 18.6). Overall, community character impacts are considered to be minor to moderately negative as a result of the new motorway structures e.g. the ventilation building and stacks within Sector 7. While the ventilation building and stack represent a notable change to the character of this area (more fully discussed in Section 20.7), the building will also assist in screening the Primary School and Kindergarten from traffic noise (Great North Road). Part F.16: Urban Design and Landscape Plans have identified planting mitigation to better integrate the form of this building with surrounding residential and business built form.

It is considered that over time, people will gradually adjust to their new environment as it becomes a normal part of their day to day surroundings. By the time the Project is constructed, most residents can be expected to have factored the Project into their own expectations and aspirations about the future of their own lives and communities.

Accessibility and connectivity improvements for residents

Overall, the Project will generate accessibility and connectivity improvements for local residents in this area. It is considered this will result in positive social impacts to people's patterns of daily living. These benefits (of particular relevance to this Sector) are attributed to:

- A diversion of traffic (including heavy vehicle traffic) from local streets (eg. Great North Road). This will improve travel times for local residents who use these routes, increase safety for pedestrians, cyclists and motorists, and also help to reduce travel times for public buses using local streets; and
- Improved accessibility between the Northwestern Cycle way and the Waterview Reserve, via the proposed bridge over the Oakley Inlet (proposed as mitigation for the impacts on the Oakley Inlet Heritage Area).

Wider social benefits of the Project are set out in Chapter 13 of this AEE.

20.5.2.3 *Effects on Community Infrastructure*

The Project has the potential to impact on Waterview Primary School and

Projected actual operational impacts on the School and Kindergarten (discussed later in this Chapter) are not expected to be adverse. Of particular note, both air quality and noise impacts will be very similar regardless of whether or not the Project goes ahead. The key adverse impact is associated with the northern ventilation stack, which will be located approximately 30-100m from the School and Kindergarten. It is expected that there will be a perception of significant adverse impacts on the School in terms of potential health impacts,

Kindergarten

given the visual prominence of the ventilation stack[9]. Overall, impacts as compared to the discharges itself are considered to be potentially more significant. These effects will require careful management of communication and dissemination of air quality monitoring results (see the proposed mitigation discussed in Section 20.5.5) to avoid impacts on the School roll and students/parents.

Concern has been expressed that the extent of residential property acquisition in Waterview and negative perceptions of the ventilation stack could adversely impact the Primary School and Kindergarten rolls. Should the rolls drop further as a result of the Project, there are implications for funding/staff levels and potentially the viability of the School/Kindergarten. However, it is noted that the improved accessibility (and the increased certainty of the Project) are considered to create opportunity for further urban intensification in this area, which in the longer term is considered to create opportunity to off-set the loss of households required by the Project (though it is acknowledged that this outcome is by no means certain). Recognising the high level of uncertainty over the scale of this potential impact, post-construction monitoring of the School and Kindergarten rolls is proposed (see Section 20.5.4.3 below).

20.5.3 Assessment - Construction

20.5.3.1 *Effects on Residents*

Construction has potential adverse social impacts on the community and its residents

Overall, construction activities are considered to result in reduced 'liveability' for the community in this area affecting people's quality of life and wellbeing. In particular, these effects are associated with the emissions from construction (noise, vibration and air discharges). It is likely that some residents may experience stress and/or nuisance as a result of these emissions. Impacts are expected to range from minor to potentially significant impacts, varying according to proximity to construction areas and the duration of exposure.

Construction Yard 7 is located within this Sector, and will be a major construction yard through the construction period. The presence of construction yards will challenge some local resident's expectations of neighbourhood amenity, character and safety. This may affect people's pride in their neighbourhood but is considered to have little impact on wellbeing or way of life overall. In particular, these effects are associated with the physical impact of construction works and the changing visual character of the locality over the construction period (eg. removal of trees and vegetation or the presence of buildings, stockpiling and machinery).

The traffic disruptions Projected during construction may cause minor impacts in restricting people's accessibility to go about their normal living patterns and participate in social/cultural activities during construction. While these effects are considered in terms of travel times, the overall impact of such delays in terms of living patterns and connections are considered to be relatively minor and able to be countered by management measures.

[9] It is noted that this concern is not borne out in the modelling results for air quality (see section 20.12). However, the issue of community concern is recognised.

Likewise, while pedestrian access in some areas may be made somewhat more difficult, the overall impact is such that it is not considered to limit people's ability to go about their normal lives. Construction of the Great North Road Underpass is not considered to physically severe Waterview from local amenities, given that pedestrian access will be maintained along all key routes on at least one side of the road in parts of the Project area affected by construction works.

Over the construction period, there is also potential that construction works will have positive socio-economic outcomes as the construction workforce will increase demand for retail and other services (e.g. food outlets, service stations and vehicle servicing) and, given the duration of construction, potentially housing (particularly rental) demand. Experience in other major construction sites indicates that, if well managed, the construction site and the associated workforce can become a positive part of the community (involved in community services, such as education) and hosting community events (eg. community planting days). The daily influx of temporary construction workers will increase the daytime population of the local community, and increase the associated sense of 'busy-ness' in the area. For some residents this may heighten the sense of impact/disruption to their daily lives during construction. For others, this is accepted as a necessary part of construction and may even be seen as positive (eg. the socio-economic activity associated with this population).

Some residents have indicated that they will choose to voluntarily relocate from Waterview prior to construction, in anticipation of construction impacts expected in this area. Should this change be realised, there will be some change to the composition of residents living in the Waterview community. This voluntary movement would result in a change to, rather than a loss of, residents from the local study area, and as such is considered to result in a neutral population effect overall. This may cause some effects on community cohesion and existing social networks, however impacts are expected to reduce over time as people adjust to their new neighbourhood. Overall impacts are unlikely to be widespread. In individual cases, it is acknowledged that a perceived reduction in house 'saleability' during the construction period could restrict (but not inhibit) people's future plans, however on balance impacts are considered to be minor and not widespread.

The commencement of construction will put an end to the uncertainty surrounding the SH20 Project during the long planning phase, providing a benefit in enabling people to move forward with their lives and future plans. It is acknowledged that this has been causing a degree of stress and uncertainty for residents potentially affected by property acquisition in the planning phase.

20.5.3.2 *Effects on Community Infrastructure*

There will be impacts on Waterview Primary School and Kindergarten during construction, particularly associated with emissions from construction (eg. noise, vibration and dust) and from traffic impacts. A small number of parents have indicated that they may remove their children from the School/Kindergarten if the Project is confirmed, in anticipation of significant construction disruption and perceived pollution from the ventilation stack.

Construction has potential adverse social impacts on Waterview Primary School and Kindergarten

It is recognised that there is a high degree of uncertainty associated with the likely scale of this impact, and that the perception of anticipated construction impacts is one of the biggest issues in relation to potential roll loss (rather than actual impacts experience, given the effects assessment and stringent level of management measures proposed).

Overall, it is anticipated that while construction impacts can be managed in accordance with the CEMP, there will still be some potentially significant impacts on Waterview Primary School and Kindergarten, associated with potential roll loss during construction. The School and Kindergarten have raised concern over implications for funding/staff levels and the viability of the School/Kindergarten, should rolls drop further as a result of the Project. As such, monitoring of the rolls is proposed (see Section 20.5.4.3 below).

Given that Construction Yard 7 is relatively small and confined and that walkways will be maintained during construction, limited restriction to usability and enjoyment is envisaged. Overall, impacts during the construction period are considered to be minor.

20.5.4 Mitigation - Operation

20.5.4.1 *Avoidance of Impacts through Design*

The Great North Road Underpass provides significant mitigation for a transport corridor through an urban environment, and reduces local social impacts including loss of residential housing, reserves and avoidance of major sites of community infrastructure (such as Unitec) in Sector 7. As set out in Chapter 11 of this AEE, earlier design alternatives in this location have been revised in response to consultation feedback and social concerns[10].

The NZTA has worked closely with Housing New Zealand to provide advance warning regarding the purchase of properties from the national housing stock, to enable Housing New Zealand maximum time to facilitate the resettlement of the individuals and families affected.

20.5.4.2 *Mitigation and Management Measures*

It is proposed that the NZTA continue and further develop the staged property purchase strategy currently implemented, to minimise uncertainty within the community and provide residents sufficient time to relocate.

[10] As examples, the earlier open road option parallel to Great North Road and the option which had a 'gap' of open road between the excavated tunnel and cut-cover tunnel (underpass) sections of the Project.

A number of other mechanisms proposed to address the operational effects of the Project (particularly for air emissions and visual/landscape effects) address adverse social impacts. In addition, the following specific measures are proposed:

- Provision of information to residents on the land acquisition process; and
- Measures to manage and remedy any graffiti (this was raised as an issue in consultation).

Communication is an important component of mitigating social impacts

Communication of the results of ambient air quality monitoring (via the Project website or more targeted mechanisms) to Waterview Primary School/Kindergarten and Waterview residents will be an important management mechanism concerning the perceived health impacts of the ventilation stack. Continuing to make the results of Project technical assessments available to the public will be important in helping to increase understanding of the actual risk associated with the ventilation stacks and air emissions.

It is proposed that the NZTA undertake the following with respect to wider community reinstatement, though it is acknowledged that these works may be limited to involvement in processes undertaken by others (such as the [Auckland Council]):

- Where practicable, uplift the designation over surplus land in Sector 7 once construction of the Project has been completed;
- Contribute to design solutions for any surplus land in Sector 7; and
- Give consideration to the amalgamation of residential titles (if possible) to enable more comprehensive residential redevelopment following construction.

Beyond this, it is noted that a confirmed decision on the Project will assist in providing certainty for local study area residents and enabling people to move on with their lives and make decisions that may have been delayed as a result of the uncertainty caused by the Project.

20.5.4.3 *Monitoring*

Monitoring the school roll is important to confirm social impacts

Development and implementation of a programme to monitor the School roll and specific concerns of teachers/parents/children at Waterview Primary School and Kindergarten. Should monitoring confirm social impacts beyond those envisaged in developing the initial mitigation strategy, the mitigation strategy should be updated accordingly in consultation with the Ministry of Education, e.g. this may include additional consultation with the community over the Project's operational effects (discussed further below).

20.5.5 Mitigation - Construction

20.5.5.1 *Avoidance of Impacts through Design*

Construction Yard 7 will be located within Oakley Creek Esplanade Reserve, away from residential areas in this Sector.

20.5.5.2 *Mitigation and Management Measures*

Mitigation and management for the identified social effects includes:

- Temporary relocation of Waterview Kindergarten during construction, in order to avoid circumstances where noise or other impacts may result in the reduced operational ability of Kindergarten facilities;
- Development of an education programme for Waterview Primary School and Kindergarten students about the Project and its construction (including information/education about traffic safety and air quality impacts);
- Development of a communications strategy to keep the community and stakeholders (including Waterview Primary School and Kindergarten) informed about construction activities and the construction programme. This strategy would include information on the management of emissions from the Project (e.g. noise and vibration during construction) and as appropriate involvement in the construction works (e.g. community planting days); Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of the CEMP;
- Implementation of a formal complaints/feedback process as part of the management of construction (eg. through the CEMP). Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of the CEMP; and
- Maintenance of a safe crossing option over Great North Road (close to Herdman Street) to enable children to continue to walk safety to Waterview Primary School/Kindergarten; and
- Monitoring of the school roll over the construction period to identify whether additional support is required for the School (e.g. if roll numbers drop through the construction period).

20.6 Cultural Impacts

20.6.1 Existing Environment – Iwi with Manawhenua

Ngati Whatua has manawhenua status

Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Auckland (west) and in this Sector. In this regard, Ngati Whatua has a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

20.6.2 Assessment of Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Sector, Ngati Whatua identifies the mauri, amenity and ecological health of Oakley Creek. Matters of concern include stormwater discharges to Oakley Creek, degradation of water quality and visual effects of the above ground motorway structures. Opportunities for the future improvement of Oakley Creek were also identified as

important to Ngati Whatua. Ngati Whatua states that the protection/enhancement of Oakley Creek should not be seen as a 'cost' or impediment to the Project. Ngati Whatua have indicated support for the tunnelled sections of SH20.

Updated comment has been sought from Ngati Whatua. At the time of writing this AEE, no further comment had been received.

20.6.3 Mitigation of Cultural Effects

Cultural issues identified have influenced Project design and mitigation

These issues have been taken into account in the Technical Assessments and are reflected in the design of the Project and in the scope and design of the mitigation measures *proposed*. Stormwater treatment (see Section 20.17) is a particularly important measure in terms of the water quality and mauri of Oakley Creek in this Sector.

20.7 Landscape and Visual

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

20.7.1 Existing Environment

The existing landscape includes residential and open space land use

The existing suburban environment of Waterview within this Sector is defined in terms of its character and amenity values of state housing. Most of this housing comprises single storey units on individual lots, although a few duplex units are also located in the area. Great North Rd, with its traffic flows and service station, acts as a point of division between the residential environment and the open space and mature trees lining Oakley Creek (Oakley Creek Esplanade Reserve).

Specific catchments are identified in Technical Report G.20

The Waterview Primary School and Kindergarten are located behind the residential housing along Great North Road with access along Herdman Street.

20.7.2 Assessment - Operation

Effects on the Waterview Primary School and Kindergarten are moderate

The visual catchment and related audiences potentially affected by the proposed redevelopment have been identified within Sector 7 for the assessment of landscape and visual effects. Overall, 8 public realm and 2 private residential viewpoints are assessed.

The housing along Great North Road within this Sector will be removed to provide for the proposed tunnel portal building and ventilation stack. Together the combination of structures and landscape modification within the northern end of Waterview will have a major impact. Viewed from locations that are not directly exposed to the motorway corridor, the buildings will appear to have an industrial quality along the margin of Waterview acting as a local landmark signalising the presence of the tunnel portal. The effects on the Waterview

Primary School and Kindergarten are moderate with the School directly abutting the portal building site, establishing a buffer between the development and other residential properties along Oakley Avenue and Herdman Streets. Exposure to the buildings within the residential catchment south of Oakley Avenue, the Primary School and Waterbank Crescent rapidly diminishes so that such effects will be largely restricted to those properties and parts of the Oakley Creek Reserve in close proximity the buildings.

The ventilation stack and building will have a significant impact on local residential catchment

The placement of the structures and landscape modification within this Sector will have a significant impact on the local residential catchment and on the wider public perception of the suburb. Tree planting and architectural treatment of the proposed buildings (as defined in the plans F.16: *Urban Design and Landscape Plans*) will assist in limiting the long term impacts to a moderate level.

20.7.3 Assessment - Construction

The construction works will have significant landscape and visual effects for the duration of the construction phase. Significant impacts will occur on local amenity values due to the removal of dwellings (included in the land use component), site preparation and the development of the motorway infrastructure.

20.7.4 Mitigation Measures - Operation

Landscape and urban design mitigation

Enhancement planting along the length of the works is proposed as defined in the plans F.16: *Urban Design and Landscape Plans*. The Plans include:

- Canopy tree planting and low-mid height native understorey planting on the eastern side of Waterview Primary School;
- A 2m high solid boundary fence partially blocking views towards building from School;
- Mature established tree specimens potentially transplanted from other Sectors; and
- Planting of native species fronting Great North Road to soften the edge of the northern Portal building.

20.7.5 Mitigation Measures - Construction

The installation of solid screen / safety fencing during the construction period to minimise views into the construction areas.

20.8 Amenity Trees

A number of trees in this Sector appear to be in generally good health and form. While there were no trees 'scheduled' within the District Plan, several trees are considered to contribute to the amenity and urban environment. A schedule of trees identified in and around the Project area is provided in Appendix E.7 of this AEE. This Schedule has been prepared by a qualified arborist.

20.8.1 Existing Environment

A Schedule of Trees identified in the Project area is in Appendix E.7 of this AEE

There are a number of existing exotic and native trees within this Sector including large pine trees (eastern side of Great North Road), juvenile Pohutukawa, Oak and Liquidamber trees. In the vicinity of the Oakley Creek Esplanade Reserve, there are established Manuka trees and a large group of Chinese Poplar trees.

20.8.2 Assessment

Trees along the alignment will require removal

To facilitate the works within this Sector beneath Great North Road, all established vegetation within the immediate vicinity of the alignment will need to be removed. The large Pine trees, situated on the eastern side of Great North Road, though located outside the proposed sub-surface footprint, will have an extensive root zone and given the post-mature status, their general health and stability could be compromised by potential root severance. The removal of the Pine trees is deemed the most practical option with replacement planting undertaken with more appropriate specimen trees.

There are a number of juvenile Pohutukawa, Oak and Liquidambar trees that are relatively good specimens and consideration should be given to relocating several of the aforementioned trees.

In the vicinity of the southern end of the Sector there are groves of established native regenerating species (predominantly Manuka). Several small juvenile Puriri and Kahikatea exist amongst the Manuka. It should be noted a very recent mass planting of native pioneer species has been undertaken in the immediate region. Retention of the established Manuka groves and understorey vegetation should be considered in detailed construction planning, if practicable.

A group of large Chinese poplar trees also exist near the southern end of the Sector. An existing pedestrian footpath dissects the group of Poplar trees.

20.8.3 Mitigation Measures

The loss of trees can be mitigated by appropriate

It is proposed through the Construction Environmental Management Plan (CEMP) that construction planning should, where practicable, give consideration to retaining the above valued trees (i.e. where removal of such trees is not required for the permanent works of the

Project, consideration should be given to construction methods that avoid the need for tree removal). This planning and management is provided for through the CEMP and associated management plans (Technical Report G.21).

landscape and specimen planting

Where removal of these trees is required, landscape planting can mitigate these effects (e.g. planting in accordance with the urban and landscape design plans proposed (see Plans in F.16 of this AEE)).

20.9 Archaeology

A full assessment of effects is provided in Technical Report G.2

The following provides an assessment of the archaeological effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.2 *Assessment of Archaeological Effects*.

20.9.1 Existing Environment

There are a number of archaeological sites along the banks of Oakley Creek in Sector 7, mainly along the eastern bank of the creek (see Figure 20.3). Along or close to the creek (in most cases on the eastern bank) there are many sites relating to Maori occupation, including midden, pits and terraces (most of which have been damaged). There are also sites relating to early European industry and farming, including a possible mill site and drystone walls (generally in good condition).

The complex of sites located on the banks of Oakley Creek is considered a significant heritage landscape and is scheduled in the Auckland City District Plan (Isthmus Section).

20.9.2 Assessment – Construction

No recorded sites will be affected during construction

The Project will not affect any of the recorded sites, which are predominantly located east of the proposed works. The cut and cover tunnel has little potential for exposing unrecorded sites, but the proposed construction yard in the Oakley Creek Esplanade Reserve has slightly more potential. Although no sites have been observed in this area, almost all having been recorded on the eastern bank of the creek, it is possible that unrecorded archaeological deposits or features may still be present close to the creek.

20.9.3 Mitigation - Construction

Monitoring of ground disturbance will occur

Works involving ground disturbance in the construction yard will be monitored by an archaeologist (to establish whether any subsurface remains are present, and to record any that may be exposed). The Accidental Discovery Protocols detailed in the Archaeological Site Management Plan in the CEMP will be followed.

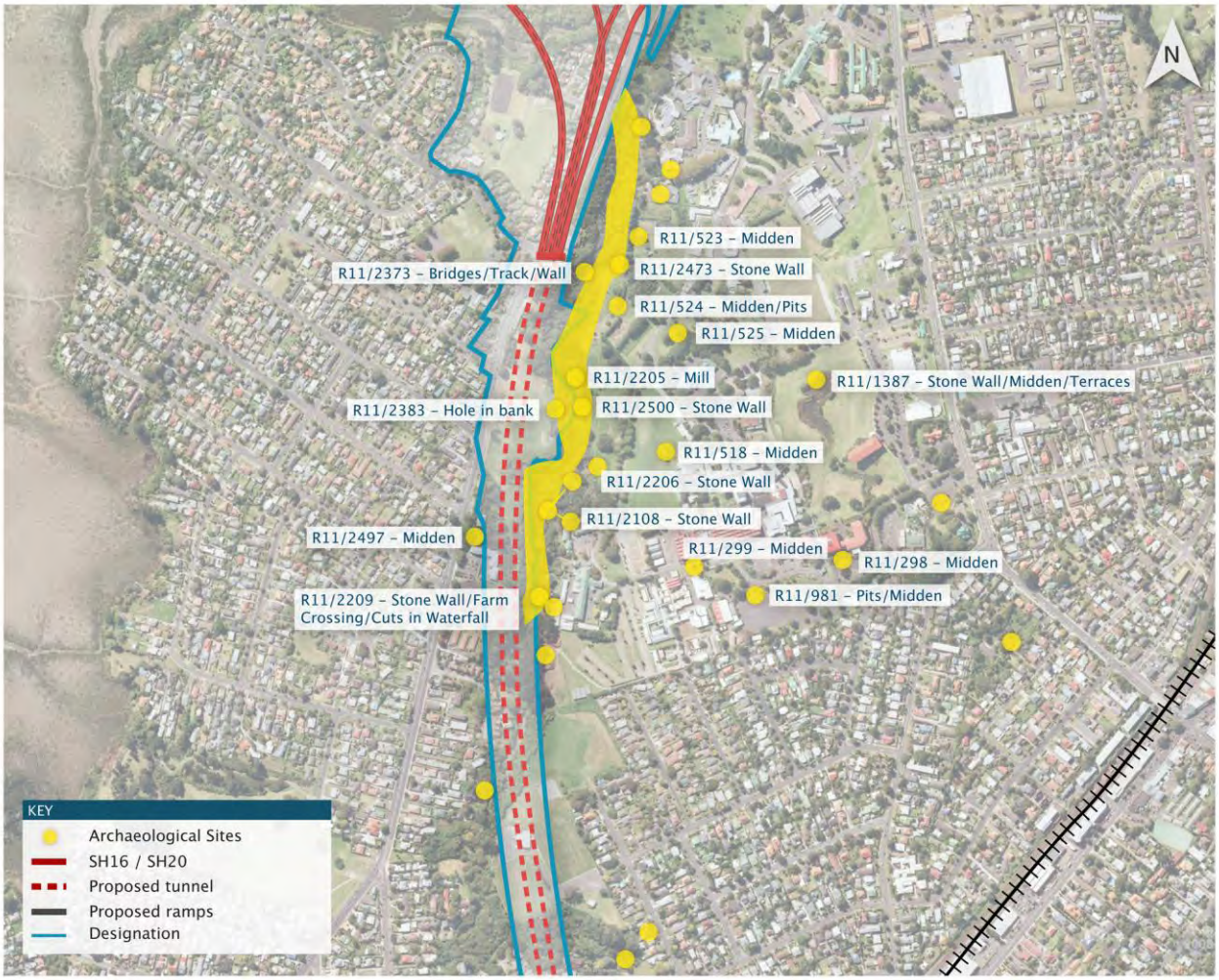


Figure 20.3: Recorded Archaeological Sites in Sector 7

20.10 Groundwater

A full assessment is provided in Technical Report G.9

The following provides an assessment of the groundwater effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Groundwater Effects*.

20.10.1 Existing Environment

The following description of the existing environment covers the alignment of the tunnels, which extend to the northern portals in Sector 7. A long section showing the geology along the tunnel alignment is provided in Plan Set F.10 Geological Profile. This indicates that there are five hydrogeological units along the alignment of the tunnels through Sector 7.

Recorded groundwater levels indicate a northerly gradient to groundwater flows, with groundwater levels falling to close to sea-level at the coast (e.g. Oakley Inlet).

Oakley Creek runs through this Sector

Oakley Creek runs through Sectors 7, 8 and 9. Oakley Creek can be described as a 'flashy river'; with significant flow variations and a low base flow component. The majority of the flow in the stream is sourced from quick flow (e.g. rainfall runoff, stormwater discharges etc.). Approximately a third of the stream flow is sourced from stored sources, and groundwater recharge into the Creek is estimated to be only a small portion of this (approximately 30% of the groundwater recharge).

20.10.2 Assessment

Taking of groundwater has a number of potential effects on the environment. Some of these relate to the built environment (addressed through the ground settlement effects that occur from groundwater drawdowns), while others relate to effects on receiving environments; for example, the potential effects on flows of Oakley Creek and the potential for contaminants in groundwater to be released (e.g. groundwater flows from landfills).

In order to assess potential groundwater effects, 2-D and 3-D groundwater models have been developed. This is described in detail in Technical Report No.G.7 *Assessment of Groundwater Effects*.

Within Sector 7, the key issues are the potential effect of the drained northern cut and cover tunnel on Oakley Creek, and the amount and extent of groundwater drawdown that might induce ground settlement.

20.10.2.1 *Northern cut and cover tunnel*

Potential settlement effects are considered to be minor

The proposed construction method for the northern cut and cover tunnel uses diaphragm walls, with the base of the tunnel being unsealed (drained) in the long term. The difference in effects between short term and permanent drainage at the northern portal is relatively small, and therefore there is not considered to be a significant advantage in permanently sealing the base slab. Groundwater modelling indicates that the permanently drained (unsealed) northern portal would have a maximum long-term drawdown of 5m to 10m in compressible soils immediately adjacent to the tunnel walls, reducing to less than 5m at a distance of 50m. Measurable drawdown could extend some 200m from the cut and cover tunnel walls.

Potential settlement effects associated with this level of drawdown, as detailed in Technical report no. G.13 *Assessment of Ground Settlement Effects*, are considered to be minor.

20.10.2.2 *Oakley Creek*

Modelling suggests that in both the short and long term, potential effects on Oakley Creek will be less than minor with groundwater inflow to the Creek expected to reduce by around 2%. Because inflow from groundwater makes up only a proportion of the 30% Creek base flow, the actual reduction in Creek flows will be rather less than 2%.

20.10.3 Mitigation Measures

Potential effects associated with groundwater drawdown are predicted to be minor within Sector 7. However, as with any modelling, there is a degree of uncertainty regarding the results. Therefore, it is proposed that a comprehensive groundwater monitoring programme be established prior to, during and post construction to monitor potential effects on groundwater and demonstrate that the assessed effects are realised.

In addition, if groundwater drawdown occurs (as an advance to ground settlement and building effects), the monitoring can be used as a trigger to initiate more comprehensive settlement monitoring and/ or implementation of mitigation measures, if necessary.

The proposed groundwater monitoring programme is set out in detail in the Groundwater Management Plan (GWMP) Appendix H of the *Assessment of Groundwater Effects.* Monitoring includes:

- Establishing a series of groundwater monitoring bores along the alignment of the tunnel;
- Monitoring the groundwater bores regularly at least 12 months prior to, during and up to 3 years post construction; and
- Comparing the results against trigger levels that have been established based on the pre-construction monitoring results.

The groundwater monitoring will be undertaken in conjunction with the settlement monitoring proposed in Technical report no. G.13 *Assessment of Ground Settlement Effects* and described in Section 20.4.

The results of the groundwater monitoring would be assessed monthly against the trigger levels. Where a trigger level is exceeded, a course of action would be put in place. Where an alert trigger is exceeded, this would initiate additional monitoring of settlement marks, or in the event that an alarm trigger exceeded, cessation of construction activities that have resulted in the drawdown until groundwater levels have returned to sub-alarm levels.

It is also proposed to establish 3 continuous monitoring locations along the Oakley Creek (Sectors 7, 8 and 9), to monitor baseflows and the potential effects of groundwater drawdown. Monitoring would be undertaken at least 12 months prior to, during and up to 12 months following completion of the lining of the tunnel.

20.11 Freshwater Ecology

A full assessment of effects on freshwater ecology is provided in Technical Report G.6

The following provides an assessment of the ecological effects of the Project on ecology: vegetation. This is a summary of the detailed assessment undertaken in Technical Report G.6 *Assessment of Freshwater Ecological Effects*.

20.11.1 Existing Environment

A waterfall within Oakley Creek prevents passage of most native fish species

Oakley Creek runs through Sector 7 in non-channelised sections, with a low level of human modification. A 6m high natural waterfall in Sector 7 (approximately 900m from the mouth of the creek) prevents passage of most native fish species. The Creek currently receives urban stormwater runoff from the surrounding catchment. Water quality is considered to be low and similar to other urban catchments in terms of physical habitat modification and diversity and sensitivity of macroinvertebrates.

Below the waterfall, freshwater species include the inanga, common bully, longfin eel, shortfin eel, smelt, redfin bully, torrentfish, giant bully and yellow eyed mullet. Above the waterfall, the only native fish with permanent populations are shortfin and longfin eels, which are tolerant of a wide range of adverse environmental variables, including elevated levels of suspended sediment. There are also two introduced pest fish (mosquito fish and goldfish). The physical habitat of this section of the Creek is shown in Table 20.1.

Table 20.1: Physical Habitat of Oakley Creek in Sector 7

Oakley Creek: Great North Road to Waterfall	
Modification	Low (unchannelised)
Riparian vegetation	Riparian trees and shrubs
Overhead shade	Good, partial canopy
Substrate	Soft sediment
Fish habitat	Good (undercut banks, pools)
Fish access	Good, no downstream barriers
Water quality	Poor (stormwater, CSO's)

20.11.2 Assessment - Construction

Sediment discharges will occur to Oakley Creek during construction

Sediment discharges to Oakley Creek will occur during construction, however the sensitivity of freshwater biological communities to the predicted increases in suspended sediment is relatively low. Effects are likely to be limited to localised decreases in abundance of some species, but there are not expected to be any significant decreases in taxonomic richness or changes in characteristic fauna within Oakley Creek. The existing biological communities in the creek are adapted to fluctuating flows and water quality, and are expected to have a high resilience or capacity to recover from the predicted (and 'worse case scenario') increases in suspended sediment. Investigations of contaminated land suggest that such areas are limited in extent and are not considered to pose a significant threat to ecological receptors. Overall, Project works can be managed to ensure no significant contamination of stream water occurs.

While temporary and localised adverse ecological effects are expected in the receiving environments, overall it is concluded that mitigation measures (below) will ensure that these effects are less than minor.

Drawdown of groundwater at the tunnels will result in a cone of depression of the groundwater table(s) that extends outwards from the tunnels. Modelling indicates that the associated change in average velocity will be less than 0.1m/s, which is a minor change within the context of natural variation in water velocity within a stream section. Overall, it is expected that the resident biota are already adapted to a range of velocity conditions, and that effects of this magnitude would not significantly alter instream environmental conditions (eg. additional erosion or deposition) and therefore would not have significant effects on stream ecology.

Drawdown of groundwater might also alter the contribution of groundwater that naturally flows towards Oakley Creek. This may result in changes to the base flows in Oakley Creek and increases the volume of water that naturally discharges through the floor of the Creek to recharge the underlying groundwater system. Technical Report G.7 *Assessment of Groundwater Effects* recommends that the northern portal and approaches be undrained, that the tunnel be sealed, and that a permanent drain be placed in the basalt at the southern portal (to relieve pressure on the retaining walls here). The report concludes that with adoption of these recommendations the potential effects of dewatering will be less than minor. On the basis of this recommendation, freshwater ecological effects range from negligible (at the northern portal) to minor (at the southern portal) effects.

20.11.3 Assessment - Operation

The limited quantities of contaminated water generated from the tunnel (mainly from groundwater seepage into the tunnel lining) will be collected and pumped to the northern portal wetland for treatment prior to discharge into the mouth of Oakley Creek (with contingency for removal by tanker trucks for off-site treatment if it is found to be highly contaminated). The predicted minor increase in contaminant concentrations as a result of the Project is unlikely to significantly affect water quality in Oakley Creek.

20.11.4 Mitigation - Construction

20.11.4.1 *Mitigation*

Temporary sediment retention ponds will be constructed along the SH20 alignment, in Sectors 5 and 7. These ponds will discharge treated stormwater into the stream (see Technical Report G.15 Assessment of Stormwater and Streamworks Effects and particularly the Temporary Stormwater Management Plan, Appendix E of that report) for details.

Temporary sediment retention ponds will be constructed

Mitigation measures for freshwater ecological effects are set out in Technical Report G.22 *Erosion and Sediment Control Plan*. These measures include: additional sediment control measures in the vicinity of Oakley Creek, such as silt fences, super silt fences, decanting earth bunds, clean and dirty water diversion bunds, progressive stabilisation of the earth-worked areas (to minimise the exposure period of disturbed soils and therefore the potential areas for sediment discharge).

Excavation strategies will be employed to minimise the extent of groundwater drawdown during construction of the tunnels (which will minimise associated effects on freshwater ecology).

20.11.4.2 *Monitoring*

Monitoring measures for freshwater ecological effects include:

- Groundwater monitoring of the Creek (see Section 20.10.3);
- Monitoring of avoidance/mitigative devices for sediment discharges during construction, as per the Erosion and Sediment Control Plan (Technical Report G.22 *Erosion and Sediment Control Plan*) and Temporary Stormwater Management Plan (Appendix E of Technical Report G.15 Assessment of Stormwater and Streamworks Effects);
- Monitoring of discharges from construction-phase stormwater treatment ponds to streams, also as per the Temporary Stormwater Management Plan;
- Management of potential spills of hazardous substances, as per the Hazardous Substances Management Plan (see Technical Report G.21: *Construction Environmental Management Plan*); and
- Freshwater ecological habitat monitoring, as per the Ecological Management Plan (excerpts of which are provided in Appendix C of the Technical Report G.6).

Corrective measures will be identified and applied in event of adverse ecological effects arising from the construction of the motorway.

20.11.5 Mitigation - Operation

20.11.5.1 *Mitigation by Design*

The tunnel alignment minimises impermeable surface area in the Oakley Creek catchment, significantly reducing stormwater generation and therefore potential effects on the ecological values of Oakley Creek.

20.11.5.2 *Management Measures*

The limited quantities of contaminated water generated from the tunnels will be collected and pumped to the northern portal wetland for treatment prior to discharge into the mouth of Oakley Creek (with contingency for removal by tanker trucks for off-site treatment if it is found to be highly contaminated). The management process for operational stormwater management is provided in the Operational Stormwater Plan, Appendix D of Technical Report G.15: *Assessment of Stormwater and Streamworks Effects*.

20.12 Air Quality

A full assessment of effects on air quality is provided in Technical Report G.1

Technical Report G.1 *Assessment of Air Quality Effects* provides an assessment of the potential impacts of the Project on air quality, both during construction and operation. The following assessment of the air quality effects of construction is summarised from that report. Given the regional nature of air quality impacts, operation effects on air quality (which are overall positive) are discussed in Chapter 13 of this AEE.

20.12.1 Existing Environment

As noted previously, Sector 7 is located within an urban environment with residential properties located to the west of Waterview. Residential properties are located to the north and south west of the works. A number of 'key or sensitive receptors' have been identified for the purpose of the Air Quality assessment, these sites include residential properties (along Great North Road between Herdman Street and Alverston Street) and education and medical facilities in proximity to the Project (e.g. Waterview Primary School and Kindergarten).;

20.12.2 Assessment - Construction[11]

During construction, the main potential effect is as a result of dust generation and other air contaminant discharges which are liable to cause nuisance beyond the site boundary, and are generally considered to be localised effects. Dust may be generated during earthworks and construction activities, or as a result of vehicle movements around the site. Vehicle emissions may also arise from construction vehicles.

Effects on these properties are unlikely to result in any significant effects with appropriate environmental management and mitigation in place.

[11] The assessment of operation air quality effects is recognised as a Project-wide and regional matter and is discussed in Chapter 13 of this AEE.

20.12.3 Mitigation - Construction

Dust from general construction activities can be managed with a range of mitigation measures. A range of typical measures that are proposed are described in the Construction Air Quality Management Plan (Appendix N of Technical Report G.1 *Assessment of Air Quality Effects*). These measures include the following key area particularly relevant to this Sector:

- Managing the surfaces of construction site areas (e.g. use of wind brakes, dampening of exposed and open areas, and covering tunnel spoil materials); and
- Managing the handling of sediment and dust generating materials (e.g. stabilising works areas).

20.12.3.1 *Monitoring*

It is also proposed to monitor dust levels throughout the construction period using a range of methods including:

- Undertaking total suspended particulate (TSP) monitoring using continuous particulate monitors;
- Daily visual inspections of operational sites and surrounding areas for evidence of dust discharges; and
- Regular visual inspections of exposed surface areas and stockpiles to ensure either dampened down or covered appropriately.

20.13 Noise Emissions

The following provides an assessment of the effects of the Project on noise emissions. This is a summary of the detailed assessment undertaken in Technical Report G.5 *Assessment of Construction Noise* and G.12: *Assessment of Operational Noise Effects*.

20.13.1 Existing Environment

The main land use elements within this Sector include Great North Road, residential areas to the west and Oakley Creek to the east. The majority of current ambient noise is generated by Great North Road.

20.13.2 Assessment - Operation

From the Great North Road Interchange, the alignment will comprise two cut-cover tunnels beneath Great North Road to connect to the excavated tunnel. Although there may be a degree of screening in this case, there may be some localised increases in noise level where the tunnel portal is located.

In addition, the tunnel services building and ventilation stack will be located in this Sector.

Noise associated with this building and stack will be controlled to meet the underlying District Plan zone noise limits, as they are stationary noise sources. Generally, noise is generated by the stack outlet airflow, the associated fans and transformer. Standard noise control measures, such as attenuators, can be applied to all of these noise sources to achieve compliance with relevant noise limits to provide no more than minor effects.

20.13.3 Assessment – Construction

In this Sector, noisy activities will occur close to receivers at some locations (dwellings within Waterview and the Waterview Primary School and Kindergarten). Where this occurs, it is predicted that the construction noise guidelines outlined in Technical Report G.5 *Assessment of Construction Noise Effects* may exceed both the daytime and night time Project noise criteria due to the limited separation distance between the activities and the receivers. For above ground construction, day time operation is recommended wherever possible as night time operation would cause excessive noise levels at nearby dwellings. Temporary noise barriers will be required for noisy operation.

Specific activities that will generate high noise levels within this Sector include:

- Realignment of Great North Road;
- Vibropiling/rammed piling;
- Rock excavation (if necessary);
- Road construction near receivers; and
- Vent building construction.

All of the above have the potential to generate significant noise levels if sufficient mitigation is not implemented. However it is acknowledged that even with mitigation, achieving the Project night time criterion of 60 dB $L_{Aeq(T)}$ will be difficult and that daytime noise limits may still be high for some receivers (e.g. the Kindergarten, see below).

Once the cut and cover tunnel roofing is constructed, excavation below ground will result in lower noise levels at nearby receivers from Sector 7 activities.

20.13.3.1 *Waterview Primary School and Kindergarten*

Noise level predictions for the closest dwellings approximately 50 metres from Construction Yard 6 in Sector 5 show that noise levels up to 68 dB $L_{Aeq(T)}$ are predicted. Waterview Primary School and Kindergarten are approximately 150 metres from Construction Yard 6, therefore, noise levels from the Construction Yard as received by the School are predicted to be at least 7 decibels lower due to increased distance. With acoustic fencing installed along Herdman Street, the resultant noise level reduction for classrooms will be in the order of 6 decibels, thus reducing the noise level at the facade of the closest classrooms to 55 dB $L_{Aeq(T).}$

During construction of Sector 7, Waterview Primary School will be within 100 metres of the construction site, though partially shielded by intervening dwellings. When these dwellings are removed as part of the Project, alternative mitigation in the form of a substantial temporary acoustic barrier of approximately four metres in height will be installed along the southern School property boundary to provide an alternative for the shielding lost from the dwellings.

Nevertheless, for some construction activities that are required to be undertaken at grade (i.e. not below ground level in the cut), noise levels are predicted to be up to 60 dBA at the closest School buildings. These noise levels would occur only during limited times (e.g. during specific construction works and once the cover was over Great North Road, construction noise in this area would be reduced). It is proposed that these activities should be scheduled during School holidays, where practicable.

Where these measures will not be able to be implemented fully, there will be some times when external doors and windows will need to be kept shut in order to reduce internal noise levels to a reasonable level. If this is required for an extended period, alternative mitigation, such as mechanical ventilation, will be considered for the most affected classrooms to enable windows to remain shut.

Overall, with suitable mitigation, the noise effects on the School can be managed. Ongoing consultation and communication with the School will be important and required throughout the construction period.

Kindergartens are required to provide sleeping facilities for the children attending and internal noise criteria for sleeping areas (for houses near major roads) are 30 dB $L_{Aeq(T)}$ (satisfactory) and 40 dB $L_{Aeq(T)}$ (maximum). Construction noise in the vicinity of the Waterview Kindergarten is likely to exceed the internal noise criteria for sleeping areas at times, even with the implementation of the general mitigation measures noted above. Specific mitigation measures including the installation of mechanical ventilation in sleeping areas and barriers will be required. Nevertheless, at times, the proposed noise criteria may still be exceeded. From a noise perspective relocation of the Kindergarten will be considered as an alternative mitigation measure, if other measures are not practicable (this is also supported by the mitigation proposals for social impacts, see Section 20.5.5).

20.13.4 Mitigation – Operation

Following construction, the SH20 road will be below ground in a cut-cover underpass of Great North Road through this Sector. As such no specific operational mitigation for noise is required for these elements. However, it is proposed that design and management of the ventilation building is provided (e.g. acoustic insulation) so that noise from the operation of this building complies with the District Plan noise standards for the surrounding residential zone.

20.13.5 Mitigation – Construction

In addition to the general noise mitigation measures contained in the Noise and Vibration Management Plan (Appendix C of Technical Report G.5), the following site specific noise mitigation measures are required:

- For cut and cover construction, where practicable, use a top-down construction (where the tunnel capping is constructed early in the programme) which will result in subsequent below ground night-time operation generally complying with the Project criteria;
- In order to provide mitigation for the School to achieve suitable internal noise levels in classrooms, a 2.5m high temporary barrier should be installed along the Herdman St boundary on top of the existing retaining wall. A 4 to 5 metre high barrier along the southern School boundary in the vicinity of teaching areas should be installed following the removal of the dwellings in Great North Road;
- Where noisy construction techniques are critical and must occur during the night period and noise effects are shown to be significant (i.e high levels of sleep disturbance will result), residents in the vicinity may need to be temporarily relocated to quiet accommodation. This should be considered on a case by case basis. Such a measure should only be considered after all other practicable noise control options such as mechanical ventilation have been considered; and
- The installation of mechanical ventilation in sleeping areas and barriers will be required at the Kindergarten. Nevertheless, at times, the proposed noise criteria may be exceeded. Relocation of the Kindergarten should be considered as an alternative mitigation measure if other measures are not practicable.

20.14 Vibration

A full assessment of vibration effects is provided in Technical Report G.19

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of operation and construction vibration effects. The following assessment of the vibration effects of construction is summarised from that report.

20.14.1 Existing Environment

The existing environment is an urban environment, dominated by Great North Road. Residential areas are located adjacent to Great North Road and it is expected that people would experience day to day traffic related vibration. To establish the ambient existing environment, a representative receiver (Waterview Primary School) located approximately 87m from Great North Road was surveyed. The results indicate that the mean ambient levels of vibration are below the threshold for perceptibility of vibration effects in a residential environment[12].

20.14.2 Assessment - Operation

The effects of vibration from road traffic, in particular heavy vehicle movements is expected to be less than minor provided the Project road surface is monitored and maintained in accordance with the NZTA policy for road roughness.

Case studies of existing tunnels have been investigated

In order to provide an understanding of potential vibration effects that may result during operation of the tunnel, two case studies were undertaken to provide information on existing vibration levels of residential buildings above existing buildings. The surveys were undertaken at Lyttleton Tunnel in Lyttleton and the Terrace Tunnel in Wellington (A full description of the surveys is provided in Technical Report No. G.19 *Assessment of Vibration Effects*). The study concluded that the existing vibration levels in both locations are slightly lower than the level measured at Auckland dwellings located near the existing SH16. The occupants were also questioned about their perceived vibration effects, and indicated that they had no concern in relation to traffic vibration.

Based on the results of the case studies, the operational effects of the tunnels within this Sector are considered to be minor. No specific mitigation is considered necessary at this stage.

20.14.3 Assessment - Construction

Key vibration sources are vibration rollers and piling

The key vibration sources for construction in this Sector are vibration rollers for road construction and piling for secant pile and diaphragm walls. The closest dwellings to the construction works are located at Oakley Avenue and on Great North Road.

[12] The survey results recorded a mean ambient Peak Vector Sum (PVS) (mm/s) of 0.27. In accordance with BS 5228-2:2009 the ambient level is just below the threshold for perceptibility of vibration effects in a residential environment (PVS of 0.3 (mm/s)).

In respect of construction vibration, perception effects are primarily related to the concern that people may have over the potential for damage to their buildings. On this basis, the assessment of effects has focussed on standards or criteria that are intended to avoid superficial damage to buildings[13]. This assessment is summarised in Table 20.3.

Table 20.2 Assessment for Construction Activities in Sector 7

Source	Soil Class	Design safe distance	Risk	Sensitive Receivers
Vibratory rollers for road construction	IV	30m	High	2, 4 Oakley Avenue 1467, 1471, 1479, 1481 Great North Road Waterview Kindergarten
			Med	1469, 1487 Great North Road
			Low	6 Oakley Avenue 1A, 1C, 3 Alford Street
Piling for secant pile and diaphragm walls	IV	25m	High	2 Oakley Avenue 1467, 1471, 1481 Great North Road
			Med	1479 Great North Road Waterview Kindergarten
			Low	1469, 1487 Great North Road

20.14.4 Mitigation - Construction

It is proposed that the construction vibration effects are managed through a management plan (the Construction Noise and Vibration Management Plan, which is proposed in Appendix K of Technical Report G.19 *Assessment of Vibration Effects*). Mitigation measures within this Plan include[14]:

- Consultation with residents and 'sensitive receptors' and the implementation of the CEMP complaints procedure where by a 24 hour hotline is actively promoted and managed;
- The monitoring of vibration levels throughout the construction process to assess compliance with the Project criteria; and
- The appropriate mitigation of vibration effects if the monitoring indicates excessive vibration levels. Where practicable this will include the cessation of the activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

Vibration levels will be monitored

[13] The Project criterion is intended to avoid superficial damage. Significantly greater vibration levels would need to occur before any structural damage to buildings could result.

[14] It is noted that pre-construction and post construction building condition surveys are also identified for 'at risk' buildings, services and structures (which are those structures identified to be of 'high' risk). This is not relevant to this Sector.

It is considered that with the implementation of these measures, the vibration effects of the Project during construction will be no more than minor.

20.15 Light Emissions

A full assessment of lighting effects is provided in Technical Report G.10

Technical Report G.10 *Assessment of Lighting Effects* provides an assessment of operation and construction light effects. The following assessment of the light effects of construction is summarised from that report.

20.15.1 Existing Environment

The existing environment is an urban environment. Great North Road is located adjacent the western boundary of the alignment. Residential areas are located to the west in Waterview. UNITEC is located to the east.

20.15.2 Assessment - Construction

A temporary construction yard (Construction Yard 7) will be located within this Sector. This will require lighting so it can be accessed at night. Night works will also be required at times for some aspects of the underpass, specifically where traffic connections are required to the existing roads.

Any lighting required during night time construction activities is required to meet Auckland City Bylaws, which permit no more than 100 lux (horizontal and vertical) over a residential boundary before 10pm and 10 lux thereafter. Provided these requirements are met, there is not considered to be any issues in relation to lighting. Residences are set well back from the construction area. A minimum 10m buffer will be implemented between any construction equipment and residential boundaries.

20.15.3 Mitigation – Construction

Effects of construction lighting will be no more than minor

In order to manage temporary lighting during night time construction activities, in particular works around Construction Yards 6 and 7, a Temporary Construction Lighting Management Plan, to be prepared by the contractor, is proposed. This will demonstrate compliance with Auckland City Bylaws and be verified by an independent lighting specialist. In particular, the following specific mitigation measures are proposed:

- For general area lighting, it is proposed that asymmetrical floodlights are used with glass visors that are not raised more than 3 degrees above the horizontal plane; and
- A buffer of more than 10m will be provided between the construction area and adjacent residential properties.

With these measures, it is considered the effects of construction lighting will be no more than minor.

20.16 Stormwater

A full assessment of effects of stormwater management is provided in Technical Report G.15

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and overland flows. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

20.16.1 Existing Environment

There will be limited streamworks and no stormwater discharges into the Oakley Creek in the Sector 7: Great North Road (refer to Figure 2.1) for the operational phase of the Project. However, during the construction phase stormwater will be discharged to Oakley Creek.

The downstream reaches of Oakley Creek run through reserve land in the vicinity of Sector 7. The Stream in this reach is in relatively good condition compared to the upstream reaches in Sector 9, being mostly natural channel with riparian vegetation. However the culvert under Great North Road provides a barrier to fish passage at the downstream end, and the level of metals in the stream such as zinc copper and lead are high as is typical for highly urbanised catchments. There is no existing motorway infrastructure in Sector 7.

20.16.2 Assessment - Operation

As the Sector 7 and 8 alignment is below ground surface, no stormwater runoff is generated from the motorway carriageway. However, drainage within the tunnel is necessary for the small amount of groundwater infiltration into the tunnel, rainwater carried into the tunnel by vehicles during rainfall events, flows generated by tunnel washdown procedures, and deluge flows activated during emergencies, such as fires.

The tunnel surface water collection system includes grated channels, and pits that incorporate flames traps and hold down covers for explosive protection. The pits create a water seal to prevent fire from entering the conveyance system and spreading to other parts of the tunnel.

Captured flows are conveyed to the tunnel low point through a piped network located in the centre of the lowest traffic lane.

The flow is collected in a sump located at the low point. The water is then pumped to the northern portal and discharged to either the wetland (clean water), the trade sewer (mildly contaminated water), or tanker trucks for offsite treatment and disposal (heavily contaminated water).

20.16.3 Assessment – Construction

The construction works for Sector 7, the Great North Road Underpass Tunnel, occur below ground and within the proposed construction yards. The catchment for temporary stormwater treatment in Sector 7 consists of the proposed Construction Yard 7, in the vicinity of the tunnel northern portal.

Treatment devices for the Sector 7 temporary catchments will discharge to the downstream reach of Oakley Creek. The runoff from the diverted Great North Road section will be collected and conveyed to one point using a traditional kerb and channel system and cartridge filters. The discharge would then flow into the existing Great North Road stormwater system from that point.

A wetland will treat runoff from the construction yard in Sector 7. A wetland was selected as the BPO because the vegetation and organic content of the wetland will act as a pH buffer and provide polishing for the already treated tunnel water.

20.16.4 Mitigation – Operation

Ongoing maintenance and management procedures during operation

The proposed treatment devices will provide for separation of clean, mildly contaminated and heavily contaminated water. This system will ensure that the treatment of water from within the tunnels is managed for appropriate discharge, avoiding the impacts of contaminant discharges. In order to ensure that the proposed stormwater treatment devices remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (Appendix D of Technical Report No. G.15 *Assessment of Stormwater and Streamworks Effects*).

20.16.5 Mitigation – Construction

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report No. G.22 *Erosion and Sediment Control Plan*.

The proposed construction management of stormwater will include the implementation of the Temporary Stormwater Management Plan (Appendix E of Technical Report G.15 Assessment of Stormwater and Streamworks Effects). It is considered that these management plans provide effective mitigation of the adverse effects of the discharge of contaminants from stormwater during construction.

20.17 Land Contamination

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

The following provides an assessment of the potential effects of the Project on contaminated land and groundwater and contaminated materials. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*.

20.17.1 Existing Environment

Land use in this area currently comprises a mix of residential and parkland, separated by Great North Road. A petrol filling station is located to the east of the northern portal area on the south bound carriageway of Great North Road. Historically the land use in this area was green field.

The previous Phase 1 desk top study did not identify any significant potentially contaminating activities within the area. A review of the boreholes drilled during both the parallel and previous geotechnical investigations did not identify any potential contamination or encounter any non natural fill. The generalised geological sequence in the area is expected to comprise Tauranga Group alluvium overlying Waitemata Group sandstone and siltstones.

Intrusive investigations were not undertaken on Great North Road to confirm existing conditions, as this would have caused significant disruption on the busy commuter road.

20.17.2 Assessment – Construction

Aound 280,000m^3 of material will be excavated from the underpass

Approximately 280,000m^3 of material will be excavated from the underpass. This will either be stockpiled on site, if space permits, or directly disposed of off-site. As noted above, no intrusive investigations were undertaken on Great North Road given the significant disruption that this would have caused. Groundwater and soil testing therefore will be undertaken prior to and during the construction of the underpass.

Based on the desk top study, and the existing land use within the Sector, there is no indication of potential contamination concerns aside from the petrol station.

20.17.3 Mitigation – Construction

As noted above, groundwater and soil testing will be undertaken prior to and during construction of the underpass to determine the nature of the material to be excavated, to identify any specific management requirements, and to assess whether the material could be reused on site (as cleanfill) or requires disposal offsite (as managed fill or contaminated fill).

A range of management measures will be employed to avoid and mitigate the potential for contaminated soils to put at risk workers and the wider public and the environment. In particular, it is proposed all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) (attached as Appendix O to Technical Report G.9) and a Site Health and Safety Plan.

The CSMP identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

If unexpected contamination is identified, then it is considered that the procedures set out in the CSMP, will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated

21. Assessment of Effects – Sector 8

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 8. The works in this Sector comprise the motorway continuing from the cut and cover tunnel section in Sector 7 into two deep tunnels with an approximately maximum depth of 50m in a southerly direction through to Alan Wood Reserve, passing beneath Avondale Heights and Springleigh. Overall, the key environmental effects identified and considered in Sector 8 relate to the effects on residential areas (e.g. settlement) and groundwater take from tunnel construction. Through Project design and the proposed mitigation, it is considered that effects can be managed to be minor. Monitoring will provide an appropriate mechanism to identify any change in effects from those expected and 'trigger' the need for further mitigation (if required).

A surface designation is also proposed for the construction, maintenance and operation (in the event of an emergency) of an emergency exhaust, proposed at 36 Cradock Street. This exhaust does not form part of the operational ventilation system of the tunnels and will not have an operational discharge of air. The facility is provided so that, in the event of a fire or similar emergency, this can be exhausted from the mid-point of the tunnels. This facility will only need to operate when called to do so in the event of an emergency (fire). The location of this structure is on the edge of a residential area and will be screened by existing and proposed vegetation (through the Urban Design and Landscape Plans). Further detail on the design and appearance of this structure is proposed.

21.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 8.

This Chapter assesses the deep tunnels

As described in Chapters 4 and 5, the main elements of the Project in this area are:

- Two 2km long tunnels; and
- Tunnel ventilation systems (including the emergency ventilation systems) and tunnel operation buildings.

Specific details on scheme elements in this Sector are described in Section 4.4.8 of this AEE and the overview of the scheme is provided in plans F.2 *Operation Scheme Plans*, (Sheets 15, 16, 17, and 18 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.8 of this AEE, with the construction areas and yards provided in the plans F.5 *Construction Scheme Plans* (Sheets 15, 16, 17 and 18 for this Sector).

The works located within this area are located within an urban environment, with residential areas to the east and west. Much of the alignment of the tunnel runs beneath open space reserve (Phyllis Reserve and Harbutt Reserve). Oakley Creek runs along the alignment in a northerly direction.

Given the existing environment, the key issues[1] identified in the assessment of environmental effects for the Project, relate to impacts on the existing community, transport networks and the physical residential environment. As construction activities within this Sector will be underground, potential construction effects will be minimised, particularly in relation to air quality (e.g. dust generation), lighting, and construction traffic (given that access will be through Sector 7 and Sector 9). No issues have been identified in relation to archaeology, and no specific cultural issues have been identified by Ngati Whatua (iwi with manawhenua status in Auckland City) who have indicated their support for the tunnelled section of SH20.

The landscape and visual effects of the northern and southern ventilation buildings and associated stacks have been considered in the Sector 7 and 9 assessments.

There is no stormwater runoff or treatment required within Sector 8 as all works are underground.

This Chapter is set out in the following way:

[1] Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (e.g. there is no reporting of effects on transport, landscape and visual effects, archaeology or coastal processes). It is also noted that the discharge to air from the ventilation stacks (from vehicles travelling through this Sector) are discussed in Chapter 13.

21.2 Land Use

21.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 21.1 below. The information within this figure has been extracted from the Operative Auckland City District Plan (Isthmus Section) 1999 (Auckland District Plan) (refer Appendix E.2 for the district plan maps). The Plans in Part F.1: Designation Plans contain further detail on designations.

Relevant District Planning Maps are provided in Appendix E.2

Key land uses in this area include land for open space (Open Space 2, 3 and 4 zones), residential (Residential 1, 5, 6a and 7a zones), business (Business 2) and special purpose (Special Purpose 3 zone for the North Auckland Railway line and Avondale Station) activities.

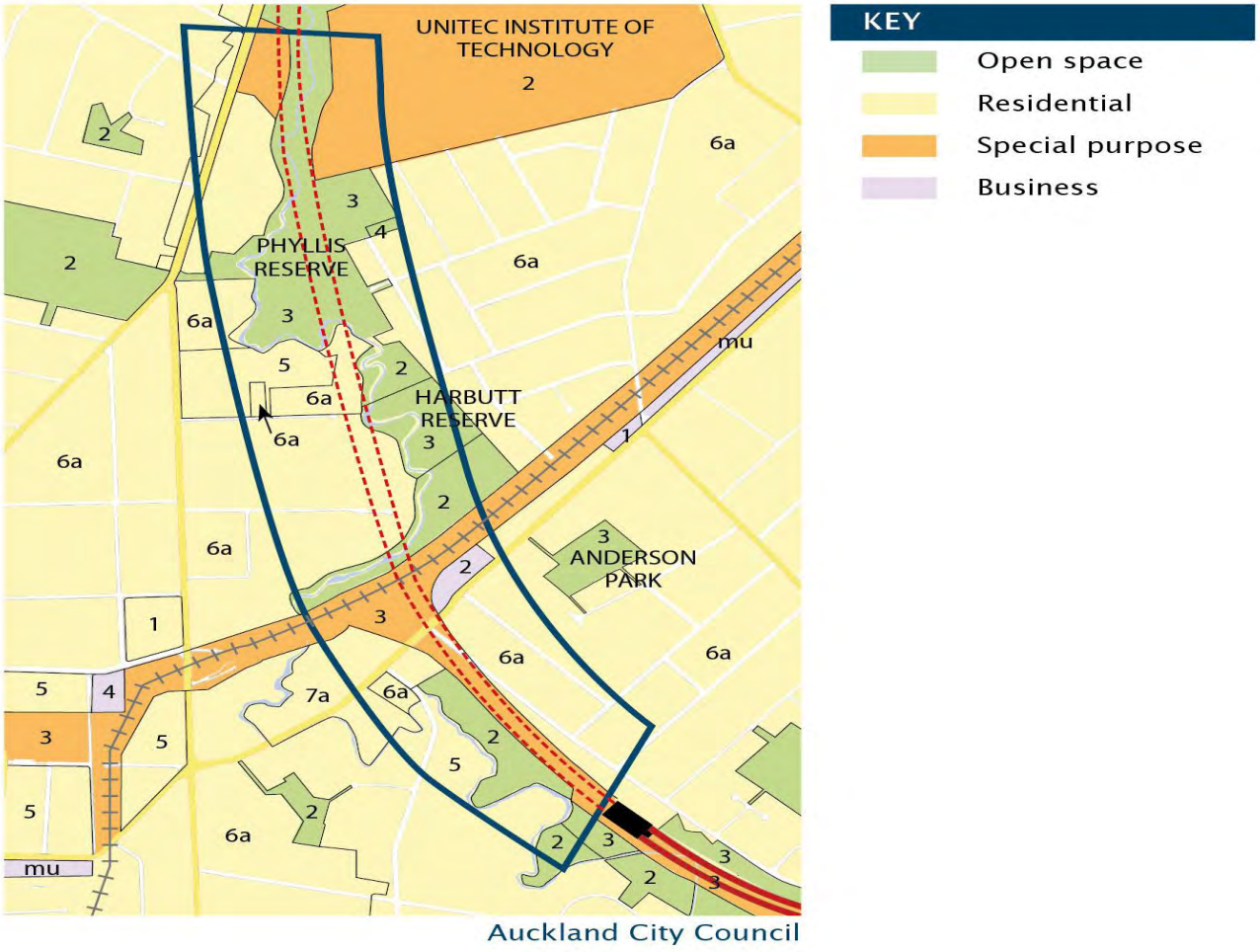


Figure 21.1: Land Use Zones within Sector 8 (not to scale)

21.2.1.1 Open Space Land Use

There are large areas of open space within this Sector

Oakley Creek Esplanade Reserve, Phyllis Reserve, Harbutt Reserve and the northern end of Alan Wood Reserve are the main areas of open space within this Sector.

The southern end of Oakley Creek Esplanade Reserve is accessed from 1628 Great North Road (GNR). Oakley Creek Esplanade Reserve is zoned Open Space 2 (for informal recreation).

Phyllis Reserve is located to the southern end of Oakley Creek Reserve, on the eastern side of Oakley Creek. The reserve is made up of a number of parcels and accessed from Phyllis Street and a walkway from GNR.

Harbutt Reserve is located to the eastern side of Oakley Creek. The Reserve is zoned for both organised (Open Space 3) and informal recreation (Open Space 2) and accessed from Harbutt Avenue. Harbutt Reserve has an associated reserve management plan. Two of the parcels which make up this reserve are classified as recreation reserves under the Reserves Act 1977.

The northern end of Alan Wood Reserve is located within Sector 8 and zoned for informal recreation (Open Space 2). This portion of the reserve is not subject to the Reserves Act 1977. This area of Alan Wood Reserve includes a training field which is leased from New Zealand Railways Corporation.

21.2.1.2 Residential Land Use

There are four different residential zones located within this area. The majority of residential land is zoned Residential 6a and 6b. There is a portion of Residential 5 zoned properties located off Blockhouse Bay Road and Cradock Street. More intensive residential zoning (Residential 7a) is located on those sites which front New North Road.

21.2.1.3 Special Purpose Land Use

Special Purpose land use includes land zoned for transportation purposes (Special Purpose 3). This is specifically for the North Auckland Railway (Western) line which runs east – west parallel to New North Road and the land zoned for the Avondale-Onehunga Southdown Railway Line (yet to be developed) which runs north-west to south east, from the North Auckland Rail Line bisecting Alan Wood Reserve.

21.2.1.4 Volcanic View Shafts

As shown in Planning Map No 3 F04 in Appendix E.2, this Sector passes beneath the E05-29 View Protection Shaft from the Auckland District Plan – Isthmus Overlays.

Plans F.1 Designation Plans shows existing designations

21.2.1.5 Designations

The existing designations within this area include:

- Designation for Railway Purposes – North Auckland Railway (Reference-H13-09);
- Designation for Railway Purposes – Avondale South Railway Line (ASLR) (Reference – G08-05);
- Designation for the reserve and access way located at 1628 GNR to Oakley Creek (Reference E04-08); and
- Designation for the public road network which applies to all Auckland City Council owned roads (Reference B08-04).

21.2.1.6 Auckland City Future Planning Framework

Council has a future spatial plan for this area

The Auckland City Future Planning Framework 2008 (FPF) area plans set out a number of key medium and long-term outcomes that the Council wants to achieve by 2030, from a city planning point of view. Of particular significance to Sector 8 of this Project, are mapped aspirations for:

- A variety of housing types (consisting primarily of a mix of single dwelling/small sites and single dwelling traditional site development with some low rise apartments and terraces) located on either side of New North Road by the rail line;
- An employment node where Pak n'Save is located;
- Providing green linkages along Oakley Creek around the Avondale to Southdown rail corridor within Alan Wood Reserve and up to Phyllis, Harbutt and Oakley Creek reserves;
- Owairaka – Mt Albert heritage values are protected;
- A future rail line within the Avondale to Southdown rail corridor;
- Open spaces within Owairaka are developed as safer, more accessible and welcoming open spaces, and are developed as part of nearby transport infrastructure projects (including work on SH20); and
- Improved connectivity and pedestrian/cycle environments through Alan Wood Reserve adjacent to the railway line, along New North Road, and up to Phyllis and Harbutt Reserves.

21.2.2 Assessment – Operation

Land use impacts associated with the operation of the Project have been minimised due to the driven tunnel construction methodology employed throughout this Sector. While a number of properties will be affected by sub-strata (i.e. underground) designations, the impacts on land use are significantly reduced.

The only impact at surface level within this area is a residential site at 36 Cradock Street which is required for the placement of an emergency exhaust stack, necessary for the safe operation of the tunnel. This is discussed further in Section 21.10 below.

Separate assessment of 36 Cradock Street

The Project is not considered to provide a barrier to achieving Auckland City Council's future vision for communities as set out in the FPF (discussed in Section 6 above). It is considered to enhance some outcomes related to the opportunity for local areas to develop, including urban intensification, through improved accessibility to transport links and passenger transport (bus) networks.

21.2.3 Assessment – Construction

The construction works require some land (zoned for special purpose and residential land use) to the northern side of the southern portal to be used during the construction of the northern portal, which would result in the temporary loss of sportsfields in Alan Wood Reserve. This is discussed in conjunction with the construction land use assessment for Sector 9.

21.2.4 Mitigation

21.2.4.1 Avoiding effects through design

The potential impacts on all land uses within this Sector have been significantly minimised as the road will be in tunnels, which will be constructed using a driven tunnel methodology thus minimising surface affects.

21.2.4.2 Mitigation

Once construction is complete the designation should be uplifted from surplus land to minimise the impact on surrounding land use

Mitigation includes planned withdrawal of designation following construction

During construction, there will be the temporary loss of sportsfield impact during construction at Alan Wood Reserve. It is proposed that two playing fields are provided at the northern end of Alan Wood Reserve within this Sector on land leased from the New Zealand Railways Corporation. This is discussed in further detail in relation to Sector 9, Chapter 22 of the AEE.

21.3 Social Impacts

A full social impact assessment is provided in G.14 Assessment of Social Effects

A full Social Impact Assessment has been undertaken for the Project and is reported in Technical Report G.14 *Assessment of Social Effects*. This social assessment provides a holistic 'lens' on the potential effects of the Project on neighbourhoods and wider communities, including social, economic and cultural effects. The following is a summary from that assessment.

21.3.1 Existing Environment

Communities in this Sector include Waterview, Mt Albert, Avondale Heights and Springleigh

Residential activity is the predominant land use within Sector 8, covering the residential areas in southern Waterview, Mt Albert, Avondale Heights and Springleigh. There are two town centres in the vicinity: Avondale (to the west) and Mt Albert (to the east). Odyssey House, an adult rehabilitation centre with residential facilities, is located on Bollard Avenue. The Avondale Motor Park on Bollard Avenue (overlooking Alan Wood Reserve) appears to provide a home to a number of 'long-term' residents. Community sites and facilities of interest in Sector 8 are shown in Figure 21.2.

The predominant ethnic groups in Sector 8 are European, Asian, Pacific Island and Maori.

As described in the land use assessment (above), reserves and recreation areas in Sector 8 include Phyllis Reserve (which caters for active recreation and organised sporting activities), Harbutt Reserve (which provides passive recreation opportunities) and Alan Wood Reserve (which provides passive and active recreation opportunities).

Important transport linkages in Sector 8 include the local road/footpath network and pedestrian linkages between the Avondale commercial centre to the Pak'n Save site (along New North Road), to Phyllis Reserve (along GNR/Blockhouse Bay Road) and to a lesser extent to the Springleigh area (along Woodward Road).

21.3.2 Assessment – Operation[2]

Potential social impacts relate to impacts on people's accessibility and connectivity

The tunnel section underneath Waterview and Mt Albert (comprising approximately two thirds of the new section of SH20 motorway being constructed) decreases the extent of new physical barriers between communities, and is not considered to result in any community impacts in this respect. The only visible structure associated with the Project in Sector 8 will be the emergency exhaust stack at 36 Cradock Street, and community character impacts are considered to be neutral. This is described in further detail in Section 21.10.

[2] It is recognised that social impacts have been occurring in the planning phase of the Project at the local level, mainly in terms of the uncertainty caused by the Project, particularly surrounding potential property acquisition. Further details are contained in Technical Report G.14 Assessment of Social Effects, and are not repeated in this AEE.

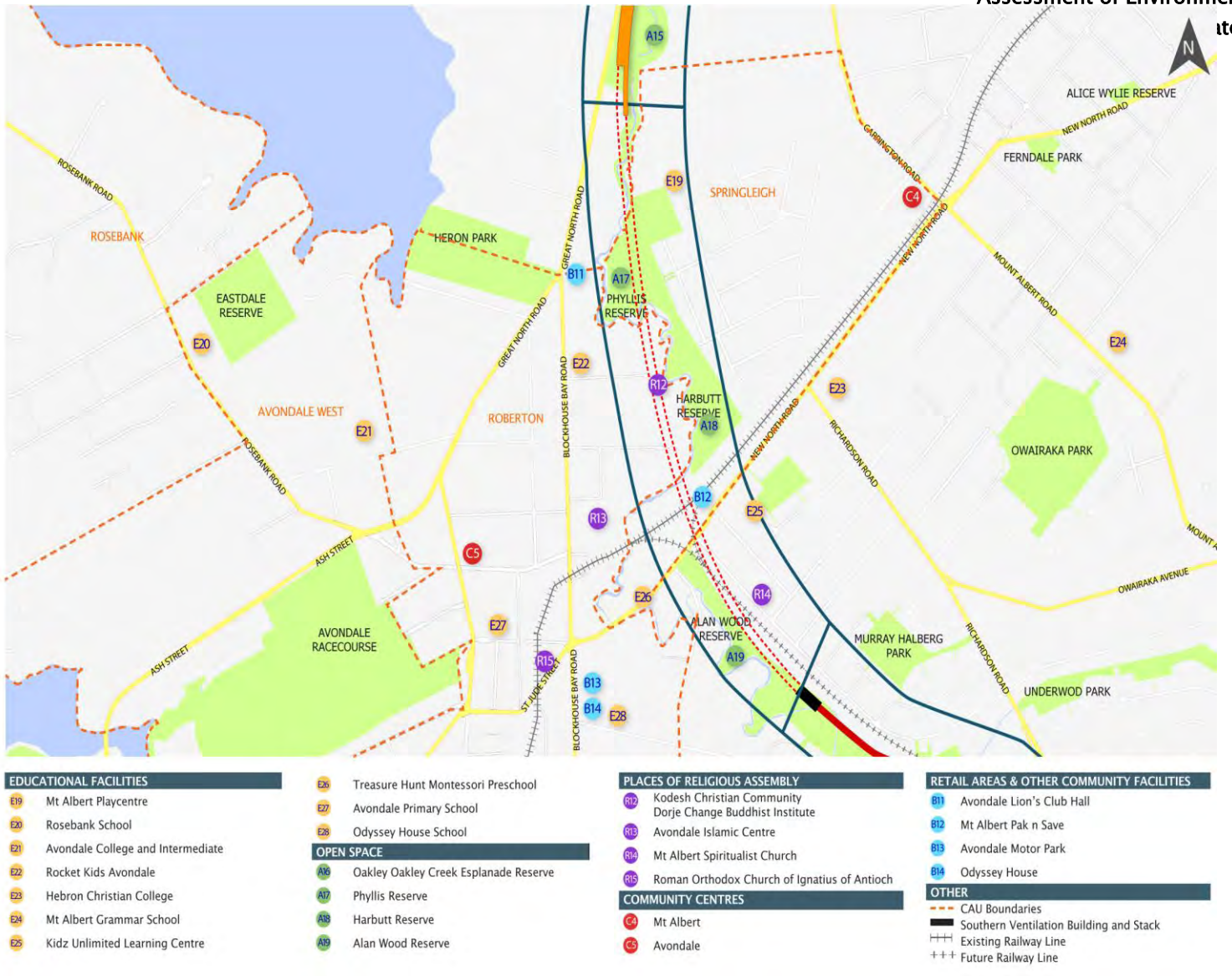


Figure 21.2: Community Site and Facilities in Sector 8

Overall, the Project will generate accessibility and connectivity improvements for local residents in this area. It is considered this will result in positive social impacts to people's patterns of daily living. Benefits of particular relevance to residents in this Sector include the diversion of traffic (including heavy vehicle traffic) from local streets (e.g. GNR). This will improve travel times for local residents who use these routes, increase safety for pedestrians, cyclists and motorists, and also help to reduce travel times for public buses using local streets.

Some residents may perceive the sub strata designation to impact on their property rights, though this concern was not generally expressed in consultation.

21.3.3 Assessment – Construction

Construction has potential adverse social impacts on the community and its residents

Overall, construction activities are considered to result in reduced 'liveability' for the community in this area affecting people's quality of life and wellbeing. In particular, these effects are associated with the emissions from construction vibration. It is likely that some residents may experience stress and/or nuisance as a result of these emissions. Fear of subsidence (associated with the tunnelling works) could cause some worry and concern among residents living directly above the proposed tunnel though effects on residential dwellings in the area as a result of tunnel construction are considered to be less than minor or negligible, as set out in Section 21.6).

The traffic disruptions projected during construction within this Sector may cause minor impacts in restricting people's accessibility to go about their normal living patterns and participate in social/cultural activities during construction. While these effects are considered in terms of travel times, the overall impact of such delays in terms of living patterns and connections is considered to be relatively minor and able to be countered through management measures (as discussed in the traffic effects assessment above).

Potential socio-economic effects may arise during construction due to increased demand on for retail and other services

Over the construction period, there is also potential that construction works will have positive socio-economic outcomes as the construction workforce will increase demand for retail and other services (e.g. food outlets, service stations and vehicle servicing) and, given the duration of construction, potentially housing (particularly rental) demand. Experience in other major construction sites indicates that, if well managed, the construction site and the associated workforce can become a positive part of the community (involved in community services, such as education) and hosting community events (e.g. community planting days).

The commencement of construction will put an end to the uncertainty surrounding the SH20 Project during the long planning phase, providing a benefit in enabling people to move forward with their lives and future plans. It is acknowledged that this has been causing a degree of stress and uncertainty for residents potentially affected by property acquisition in the planning phase.

21.3.4 Mitigation – Operation

21.3.4.1 Avoidance of Impacts through Design

Adverse social impacts in are avoided through Project design

The tunnel provide significant mitigation for a transport corridor through an urban environment, and reduces local social impacts including loss of residential housing and reserves in the Sector 8 area.

21.3.5 Mitigation – Construction

21.3.5.1 Mitigation and Management Measures

Communication with the community and residents throughout construction is key to mitigating adverse social effects

The following general mitigation will be undertaken to manage potential social effects:

- Provision of information to residents on the strata acquisition process;
- Development of a communications strategy to keep the community and stakeholders informed about construction activities and the construction programme;
- Management and monitoring of vibration and traffic effects as part of the CEMP (refer Technical Report G.21); and
- Implementation of a formal complaints/feedback process as part of the management of construction (e.g. through the CEMP, Technical Report G.21).

Beyond this, it is noted that a confirmed decision on the Project will assist in providing certainty for local study area residents and enabling people to move on with their lives and make decisions that may have been delayed as a result of the uncertainty caused by the Project.

21.4 Groundwater

The following provides an assessment of the groundwater effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Effects*.

21.4.1 Existing Environment

The following description of the existing environment covers the alignment of the tunnels, which runs through Sector 8. A long section showing the geology along the tunnel alignment is provided in Plan Set F.10 *Geological Profile*. This indicates that there are seven hydrogeological units along the alignment of the tunnels through Sector 8.

Recorded groundwater levels indicate a northerly gradient to groundwater flows, with groundwater levels falling to close to sea-level at the coast (e.g. Oakley Inlet).

Oakley Creek runs through Sectors 7, 8 and 9. Oakley Creek can be described as a 'flashy river'; with significant flow variations and a low base flow component. The majority of the flow in the stream is sourced from quick flow (e.g. rainfall runoff, stormwater discharges etc.). Approximately a third of the stream flow is sourced from stored sources, and groundwater recharge into the Creek is likely to be only a small portion of this.

21.4.2 Assessment

Taking of groundwater has a number of potential effects

The taking of groundwater has a number of potential effects on the environment. Some of these relate to the built environment (addressed through the ground settlement effects that occur from groundwater drawdowns), while others relate to effects on receiving environments; for example, the potential effects on flows of Oakley Creek and the potential for contaminants in groundwater to be released (e.g. groundwater flows from landfills).

In order to assess potential groundwater effects, 2-D and 3-D groundwater models have been developed. This is described in detail in Technical Report G.7 *Assessment of Groundwater Effects*.

Within Sector 8, the key issues are the potential for construction of the DTsto result in contaminant migration from existing landfills or negative impacts on Oakley Creek, and the potential for groundwater drawdown to result in ground settlements (in particular associated with cross-passages).

21.4.2.1 Driven Tunnel

The maximum drawdowns will occur during the construction phase

As the driven tunnels (DTs) will be fully lined (sealed) on completion, the maximum drawdown will occur during the construction phase. The groundwater modelling indicates that when the tunnel is driven through the East Coast Bays Formation (ECBF) sandstones and siltstones, maximum drawdown in the Tauranga Group Alluvium (TGA) is expected to be between 0.5m and 8m adjacent to the tunnel. Where the tunnel is driven through more permeable Parnell Grit (PG), a greater magnitude and extent of groundwater drawdown is expected to occur, however this could be mitigated by pre-grouting, reducing drawdown in the TGA to between 8m and 15m.

Drawdown in the TGA rapidly reduces to less than 4m within 50m to 100m from the tunnels. Measurable drawdown (0.5m) is predicted to extend no more than 90m from the tunnels within the TGA. Where the tunnels are driven through PG, measurable drawdown in the overlying weathered Parnell Grit (WPG) is expected to reach some 250m from the tunnels.

In the long term, as the tunnels are fully lined, the modelling indicates negligible drawdown in TGA and WPG adjacent to the tunnel, with measurable drawdown extending no more than 80m from the tunnels.

Potential settlement effects associated with this level of drawdown, as detailed in Technical Report G.13 *Assessment of Ground Settlement Effects* are considered to be less than minor.

21.4.2.2 Potential for Contaminant Migration

The alignment of the tunnels run beneath a number of former landfills

The alignment of the tunnels run beneath a number of former landfills in Sector 8. Beneath Phyllis Reserve the tunnel is at least partially driven through the more permeable PG, which could potentially under drain the fill and result in downward movement of groundwater and contaminants. However, a thick (up to 21m) layer of low permeability residual soils (WPG) and TGA separates the fill from the more permeable PG. These thick, low permeability soils behave like an aquitard reducing the potential risk of contaminants reaching the tunnel excavation or migrating into the deeper rock aquifer.

Additionally, groundwater monitoring in boreholes screened through the fill in 2009/2010 indicates that there is almost no water residing within the fill in this area. Therefore the potential for contaminants to migrate is considered to be negligible.

21.4.2.3 Oakley Creek

Potential effects on Oakley Creek from the DTsare expected to be less than minor, both during construction and operation. During construction, groundwater inflows to the Creek are mostly unaffected, except that when the tunnel is driven through the higher permeability PG, groundwater inflows to the Creek could reduce by about 4%. Long term, the sealed tunnels are expected to result in a negligible reduction in groundwater inflows of <2%. As groundwater inflows make up only a proportion of the Creek base flow (approximately 30%), the actual reduction in Creek flows will be even less than 2% to 4%.

21.4.3 Mitigation Measures

Effects of groundwater drawdown are predicted to be less than minor

Potential effects associated with groundwater drawdown are predicted to be less than minor within Sector 8. However, as with any modelling, there is a degree of uncertainty regarding the results. Therefore, it is recommended that a comprehensive groundwater monitoring programme be established prior to, during and post construction to monitor potential effects on groundwater and demonstrate that the assessed effects are realised.

In addition, if groundwater drawdown occurs (as an advance to ground settlement and building effects), the monitoring can be used as a trigger to initiate more comprehensive settlement monitoring and/ or implementation of mitigation measures, if necessary.

The proposed groundwater monitoring programme is set out in detail in the Groundwater Management Plan in Appendix H of the Technical Report *G.7 Assessment of Groundwater Effects.* Monitoring includes:

- Establishing a series of groundwater monitoring bores along the alignment of the tunnel;
- Monitoring the groundwater bores regularly at least 12 months prior to, during and up to 3 years post construction; and
- Comparing the results against trigger levels that have been established based on the pre-construction monitoring results.

The groundwater monitoring will be undertaken in conjunction with the settlement monitoring proposed in Technical Report G.13 *Assessment of Ground Settlement Effects*.

The results of the groundwater monitoring would be assessed monthly against the trigger levels. Where a trigger level is exceeded, a course of action would be put in place. Where an alert trigger is exceeded, this would initiate additional monitoring of settlement marks. In the event that an alarm trigger exceeded, this could result in the ceasation of construction activities that have resulted in the drawdown until groundwater levels have returned to sub-alarm levels.

It is also proposed to establish 3 continuous monitoring locations along the Oakley Creek, to monitor baseflows and the potential effects of groundwater drawdown. Monitoring would be undertaken at least 12 months prior to, during and up to 12 months following completion of the lining of the tunnel.

21.5 Freshwater Ecology

A full assessment of effects on freshwater ecology is provided in Technical Report G.6

The following provides an assessment of the ecological effects of the Project on freshwater ecology in Sector 8. This is a summary of the detailed assessment undertaken in Technical Report G.6 *Assessment of Freshwater Ecological Effects*.

21.5.1 Existing Environment

Oakley Creek runs through Sector 8 in channelised and non-channelised sections. The Creek currently receives urban stormwater runoff from the surrounding catchment. Water quality is considered to be low and similar to other urban catchments in terms of physical habitat modification and diversity and sensitivity of macroinvertebrates. The only native fish with permanent populations are shortfin and longfin eels, which are tolerant of a wide range of adverse environmental variables, including elevated levels of suspended sediment. Two introduced pest fish (mosquito fish and goldfish) are also present. The physical habitat of this section of the Creek is shown in Table 21.1.

Table 21.1: Physical Habitat of Oakley Creek in Sector 8

Oakley Creek: Waterfall to New North Road		Sector 8
Modification	Moderate (unchannelised)	
Riparian vegetation	Riparian trees and shrubs	
Overhead shade	Good, partial canopy	
Substrate	Soft sediment, boulder sections	
Fish habitat	Good (undercut banks, pools)	
Fish access	Poor (downstream waterfall)	
Water quality	Poor (stormwater, CSO's)	

Oakley Creek: New North Road to Richardson Road		Sectors 9
Modification	Moderate (channelised sections)	
Riparian vegetation	Grass with some riparian trees/shrubs	
Overhead shade	Poor, no canopy	
Substrate	Soft sediment, boulder sections	
Fish habitat	Moderate (substrate, bank vegetation)	
Fish access	Poor (downstream waterfall)	
Water quality	Poor (stormwater, CSO's)	

21.5.2 Assessment – Operation

Potential effects in relation to Oakley Creek may arise in this Sector as a result of:

- Groundwater drawdown arising from the tunnels affecting the groundwater flows and velocity of Oakley Creek; and
- Inflow of contaminated groundwater into the tunnels being subsequently collected and disposed of into Oakley Creek.

Drawdown of groundwater at the tunnels will result in a cone of depression of the groundwater table(s) that extends outwards from the tunnels. Modelling indicates that the associated change in average velocity will be less than 0.1m/s, which is a minor change within the context of natural variation in water velocity within a stream section. Overall, it is expected that the resident biota are already adapted to a range of velocity conditions, and that effects of this magnitude would not significantly alter in-stream environmental conditions (e.g. additional erosion or deposition) and therefore would not have significant effects on stream ecology.

Drawdown of groundwater might also alter the contribution of groundwater that naturally flows towards Oakley Creek. This may result in changes to the base flows in Oakley Creek and increase the volume of water that naturally discharges through the floor of the Creek to recharge the underlying groundwater system. Technical Report G.7 *Assessment of Groundwater Effects* recommends that the northern portal and approaches be undrained, that the tunnel be sealed, and that a permanent drain be placed in the basalt at the southern portal (to relieve pressure on the retaining walls here). The report concludes that with adoption of these recommendations, the potential effects of dewatering will be less than minor. On the basis of this recommendation, freshwater ecological effects range from negligible (at the northern portal) to minor (at the southern portal) effects.

Limited quantities of contaminated water may be generated from the tunnels during operation, mainly from groundwater seepage into the tunnel lining. This will be collected and pumped to the northern portal wetland for treatment prior to discharge into the mouth of Oakley Creek (with contingency for removal by tanker trucks for off-site treatment if it is found to be highly contaminated). The predicted minor increase in contaminant concentrations as a result of the Project is unlikely to significantly affect water quality in Oakley Creek.

21.5.3 Assessment – Construction

Construction groundwater will discharge to treatment at the portals

During construction tunnel water will be treated at both portals (refer to the Technical Report G.22 *Erosion and Sediment Control Plan*) and discharged through temporary stormwater systems. The volume of the stormwater retention ponds and other detention structures have been sized and are sufficient to treat both surface runoff and groundwater flows. The freshwater ecological effects of this stormwater discharge are considered in the relevant chapters of this AEE with respect to all construction stormwater and sediment erosion control management during construction.

21.5.4 Mitigation – Operation

The tunnel alignment minimises impermeable surface area in the Oakley Creek catchment, significantly reducing stormwater generation and therefore potential effects on the ecological values of Oakley Creek

The limited quantities of contaminated water that may inflow into the tunnels will be collected and pumped to the northern portal wetland for treatment prior to discharge into the mouth of Oakley Creek (with contingency for removal by tanker trucks for off-site treatment if it is found to be highly contaminated). This is discussed further in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects.*

21.5.5 Mitigation – Construction

During construction, the following mitigation measures include:

- Excavation strategies will be employed to minimise the extent of groundwater drawdown during construction of the tunnels (which will minimise associated effects on freshwater ecology);
- Monitoring the flows in Oakley Creek flow and associated groundwater monitoring as per the Groundwater Management Plan contained within Appendix H of Technical Report G.7 *Assessment of Groundwater Effects*; and
- Appropriate management and treatment of groundwater flows from tunnelling through treatment devices at the portals, in accordance with Technical Report G.22: *Erosion and Sediment Control Plan*.

21.6 Ground Settlement

A full assessment of effects on ground settlement is provided in Technical Reports G.13

Technical Report G.13 *Assessment of Ground Settlement Effects* provides an assessment of settlement effects, including detail on the methodology for assessment of ground settlement effects. The following is a summary from this report.

21.6.1 Existing Environment

The existing environment within Sector 8 is predominantly residential and urban in nature. Two closed landfills are located at Phyllis Reserve and Harbutt Reserve. There is also an extensive service network associated with these residential areas. These networks primarily located on arterial roads such as GNR and New North Road.

Dwelling types in this Sector are generally summarised in two residential types: masonary (e.g. brick, block/brick or stucco clad) and timber (e.g. weatherboard, board/batten or fibre cement buildings). In addition to these general residential building types, specific buildings have been identified, which include the Pak'n Save building (due to the complex component nature of this building, the foundations and basement carparking), and 1510 GNR (the 'Unitec Residential Flats') (due to the unique foundations of this building).

In this Sector, the tunnels also path beneath the North Auckland rail line (at around Chainage 2500, see the plans in F.2 *Operation Scheme Plans*, Sheet 16 for location). This line comprises twin rail tracks running approximately parallel to New North Road

21.6.2 Assessment – Construction

Potential settlement effects have been derived using computer modelling and predicted groundwater drawdowns

Within this Sector, settlement may occur by two separate sources: the mechanical settlement of the ground due to the physical excavation of material for the driven tunnel, and the consolidation of the ground due to the extraction of groundwater.

The area in which settlement is likely to occur is above the tunnel alignments extending out several hundred metres either side of the tunnels. Predicted settlements have been derived from computer analysis and the predicted groundwater drawdowns described in Technical Report G.7 *Assessment of Groundwater Effects*. The analysis concludes:

- It is anticipated there will be only negligible effects for residential dwellings in the area;
- The Pak n'Save building is founded on shallow footings and hence the building complex is expected to generally follow the ground profile. No significant visible effects are expected, and a negligible damage risk classification has been assessed on the basis of the masonry construction type;
- The Unitec Residential Flats may experience some differential settlement, however, any damage occurring is likely to be non-structural in nature and repairable;
- Only minor changes are expected as a result of settlement to road gradients. These changes are expected to occur as a smooth profile over the existing roads with no sharp changes in grade;
- Likely minor effects on the Watercare Orakei No. 2 Trunk Sewer which are not expected to cause a disruption to operations; and
- No damage is expected to the stormwater and sewer networks that discharge to Oakley Creek and the Watercare Orakei No. 9 sewer.

21.6.3 Mitigation – Construction

Monitoring of settlement marks, buildings surveys and services will be undertaken prior to, during and following construction

Overall, any potential settlement effects are considered to be negligible. However, a monitoring programme will be put in place prior to, during and following construction to confirm predicted effects and identify the need for any specific mitigation should it be required. This is set out in the Settlement Effects Management Plan (SEMP) (refer Appendix H of Technical Report G.13 *Assessment of Ground Settlement Effects*), and includes:

- Monitoring settlement marks along the alignment of the tunnel;
- Undertaking building surveys of sensitive buildings and features prior to, during and following construction; and
- Monitoring services in the vicinity of the tunnel alignment.

The settlement monitoring will be undertaken in conjunction with the groundwater monitoring programme set out in the Groundwater Management Plan (GWMP) (refer Appendix H of Technical Report G.7 *Assessment of Groundwater Effects*).

Should the monitoring indicate that there is a risk of damage to occur, then a range of mitigation measures have been identified that could be put in place. These are set out in the CEMP.

21.7 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.12 and G.5

The following provides an assessment of the effects of the Project on noise emissions. This is a summary of the detailed assessment undertaken in Technical Report G.5 *Assessment of Construction Noise Effects* and G.12 *Assessment of Operational Noise Effects*. There are not anticipated to be any operational noise effects associated with SH20 through this Sector (excluding that associated with 36 Cradock Street addressed in Section 21.10 below). Traffic noise will be mitigated effectively by enclosing the State Highway in a tunnel, and therefore no adverse noise effects are anticipated. The following summary therefore only describes potential construction effects.

21.7.1 Existing Environment

Ambient noise environment is dominated by road and railway noise

This Sector crosses GNR, Phyllis, Harbutt and Alan Wood Reserves, the North Auckland Rail Line, New North Road, Oakley Creek and residential areas. Ambient noise levels in the Sector are primarily generated from traffic noise from the nearby GNR and New North Road, and railway noise from the rail line.

21.7.2 Assessment – Construction

The main element of the Project in this Sector is the driven tunnel. The underground nature of the tunnel means that construction noise effects are largely mitigated through the design of the Project and are anticipated to be low.

The closest receivers will be those located above the construction works, mainly residential dwellings to the east of Great North and Blockhouse Bay roads. The level of noise transmitted to receivers above the tunnels will be dependent on the ground conditions between the works and receivers. Some of the noise experienced by receivers will be reradiated noise as a result of vibration. Noise levels resulting from works within the tunnels are anticipated to be around 30 – 40 dB $L_{Aeq(t)}$ (assuming a radiation efficiency of building elements of 0.4 – 0.5).

Internal noise levels in some receivers during night time construction may exceed WHO guidelines for internal noise

This indicates:

- During daytime works, noise levels are likely comply with the construction noise guideline level of 70 dB LAeq(T) for construction activities occurring at the tunnel face.
- Reradiated noise levels are likely to exceed the World Health Organisation (WHO) guidelines for internal noise during the night-period (30 dB LAeq(8 hour)). During the daytime, noise levels will either just exceed or just comply with the WHO Guideline (35 dB LAeq(16 hour)).

- As the noise predications are very sensitive to ground conditions and the radiation efficiency of dwellings, the actual level of reradiated noise and vibration may vary on site and between dwelling to dwelling. It is therefore important that noise and vibration monitoring is undertaken during tunnelling to determine if internal noise limits/vibration limits are exceeded and what mitigation/management must be undertaken.

Noise received by residential areas near the tunnel portals will reduce as works progress further into the tunnel. A conveyor will operate outside on a 24 hour, 7 days per week basis; however this can be enclosed to achieve compliance with the night time noise-criteria.

21.7.3 Mitigation – Construction

Monitoring will be undertaken during construction and some residents temporarily relocated during tunnelling if necessary

A range of mitigation measures to manage noise during construction have been developed for the Project. These are detailed in the Construction Noise and Vibration Management Plan (CNVMP) (in Appendix C of the Technical Report G.5 *Assessment of Construction Noise Effects*) and include: erecting temporary noise barriers around noisy construction activities and programming noisy activities to occur during the daytime where possible.

Noise monitoring will be undertaken throughout the construction period to ensure compliance with the Project noise criteria. If the monitoring indicates that internal noise levels are unreasonable, consideration will be given to temporary relocation of residents. It is expected that this relocation may be required for around 7 days at worst affected locations, as the tunnel face moves forward.

21.8 Vibration

A full assessment of vibration effects is provided in Technical Report G.19

Technical Report G.19 *Assessment of Vibration E*ffects provides an assessment of vibration effects. The following is a summary from this report.

21.8.1 Existing Environment

The ambient vibration environment within this Sector is well below the threshold for perceptibility in residential environments. The majority of the residential sites are located a sufficient distance from arterial roads, and it is likely that the majority of ambient vibration occurring at sensitive receivers in this Sector is due to human activity within the residences, rather than vibration from traffic sources.

21.8.2 Assessment – Operation

In order to provide an understanding of potential vibration effects that may result during operation of the tunnels, two case studies were undertaken to provide information on existing vibration levels of residential buildings above existing buildings. The surveys were undertaken at Lyttleton Tunnel in Lyttleton and the Terrace Tunnel in Wellington. (A full description of the surveys is provided in Technical Report G.19 *Assessment of Vibration*

Effects). The study concluded that the existing vibration levels in both locations are slightly lower than the level measured at Auckland dwellings located near the existing SH16. The occupants were also questioned about their perceived vibration effects, and indicated that they had no concern in relation to traffic vibration.

Based on the results of the case studies, the operational effects of the tunnels within this Sector are considered to be minor. No specific mitigation is considered necessary.

21.8.3 Assessment – Construction

Potential vibration effects associated with construction have been assessed for the 'open face excavation' tunnelling methodology, which may be undertaken either by road header or excavators. Vibration levels from both tunnelling methods have been considered in Technical Report G.19 *Assessment of Vibration Effects*.

Consideration has been given to the key vibration sources and the appropriate design distance which is expected to comply with the DIN 4150-3:1999 project criterion for construction and the closest receivers to the vibration source. No receivers within this Sector are considered to be high risk of non-compliance with the DIN 4150-3:1999 Project criterion.

21.8.4 Mitigation Measures

Vibration during construction will be managed through the implementation of the CNVMP (Appendix K of Technical Report G.19 *Assessment of Vibration Effects*). This includes:

- Undertaking pre-construction and post construction building condition surveys of identified at risk buildings, services and structures. These surveys will identify if there is any damage as a consequence of construction activities;
- Undertaking vibration monitoring; and
- Implementing the CEMP complaints procedure, including a 24 hour hotline.

Vibration effects will be managed through the implementation of the CNVMP such that effects will be no more than minor

If the proposed monitoring indicates that elevated vibration levels from construction have or will result in damage, then appropriate procedures will be put in place. This may include stopping the particular activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

It is considered that with the implementation of the CNVMP, the vibration effects of the Project during construction will be no more than minor.

21.9 Land Contamination

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

The following provides an assessment of the potential effects of the Project on contaminated land and groundwater and contaminated materials. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination*.

21.9.1 Existing Environment

Existing landuse in this Sector includes historic landfilling areas within Phyllis and Harbutt Reserves

Land use in this area comprises residential and parkland (Harbutt and Phyllis Street reserves) with some roading infrastructure. Oakley Creek flows through and around the reserves. Previous environmental investigations have identified historical land-filling activities within both Phyllis and Harbutt Reserves.

Intrusive investigations[3] were undertaken to determine the existing quality of soils and groundwater within the alignment, and the potential for any existing groundwater contamination to affect the operation of the twin tunnels given its location below the historical landfills located in Phyllis and Harbutt reserves. These investigations confirmed the following:

- The most significant deposits of waste were confirmed to be in the northern area of Phyllis Street Reserve, known as "Albie Turner Field". The waste varied in thickness to a maximum of 11m, and was generally classified as cleanfill, green waste and household waste. Other parts of the Reserve contained mainly construction and demolition waste;
- Perched groundwater was identified, but this was found to be discontinuous and in some cases ephemeral; and
- Groundwater sampling indicated initially elevated concentrations of lead, copper and volatile hydrocarbons. Later sampling rounds indicated levels of contaminants to have dissipated, with significant reductions in hydrocarbons, copper, and lead no longer at elevated concentrations. Therefore there are no specific issues in relation to contaminated groundwater.

21.9.2 Assessment – Operation

As groundwater in this area was found to be perched and discontinuous, the assessment (both investigation and numerical modelling) has shown that the potential likelihood for contaminated groundwater to enter the twin tunnels during operation to be small. Moreover, the groundwater quality programme indicates that there are not considered to be any significant levels of contaminants in groundwater.

---

3 Refer Technical Report G.9 *Assessment of Land and Groundwater Contamination,* for a description of the methodology of this assessment of the existing environment.

21.9.3 Assessment – Construction

The proposed tunnelling method will not disturb historic landfill areas

The construction activities in this area are all below ground associated with the deep tunnel and will not disturb the surface of the Reserves. Therefore, the intrusive investigation was specifically designed to understand the potential contamination associated with the historical filling activities within the Phyllis and Harbutt Reserves, and any associated leachate and contaminated groundwater that may affect the construction activities underneath. The findings from these investigations indicate:

- The main areas of waste were confirmed to be in the northern area of Phyllis Street Reserve, known as "Albie Turner Field", with a maximum thickness of 11m. The depth of the tunnel construction (up to 50m) indicates that this waste material will not be disturbed during construction activities.

As indicated above any potential impacts in relation to groundwater are considered to be small. Perched groundwater was identified in the investigations, but this was found to be discontinuous and in some cases ephemeral. Assessment (both investigation and numerical modelling) of the potential for contaminated groundwater to enter the twin tunnels during construction has shown the likelihood to be small. Notwithstanding this, the groundwater quality programme indicates that there are not any significant levels of contaminants in groundwater.

21.9.4 Mitigation

No specific mitigation measures are required during tunnelling aside from good practice. Given the depth of the tunnel (up to 50m deep), it is considered unlikely that contaminated material will be encountered. In addition, the assessment has shown that construction activities are unlikely to be affected by contaminated groundwater.

21.10 36 Cradock Street – Emergency Exhaust

The emergency exhaust will only operate in the event of fire

As described in Chapter 4 of this AEE, it is proposed to locate an emergency exhaust and building at 36 Cradock Street, approximately mid way along the tunnel alignment. The emergency smoke exhaust will be approximately 12m high, and associated building approximately 5m in height and 10m by 10m in area. This exhaust does not form part of the operational ventilation system of the tunnels and will not have an operational discharge of air. The facility is provided so that, in the event of a fire or similar emergency, smoke can be exhausted from the mid-point of the tunnels.The emergency exhaust will only operate in the event of fire (or similar emergency). For this reason, no assessment has been undertaken of the air quality effects of this facility. However, to ensure the fans/power supply for the emergency exhaust is fully operational, periodic maintenance/testing will be required and undertaken.

21.10.1 Existing Environment

36 Cradock Street is zoned residential (Residential 6a), and is located at the northern extent of a group of residential properties (28 to 48) accessed from Cradock Street. There are two legal accesses to the site, an unformed access along the eastern boundary of the site, and a well formed right of way over various other residential parcels of land. The site is large in area (over 0.6ha) and comprises a residential dwelling and swimming pool. The site is bounded by Oakley Creek and Phyllis Reserve on its northern boundary.

A schedule of Trees for the Project area is in Appendix E.7

The expansive site has an array of native tree species, including Kauri, Karaka, Pohutukawa Totara, Titiko, large Kanuka and Rimu trees. Many of these are good species with heights up to 11m. There are also groves of Cabbage trees and Tree Ferns on the site. The property also has a vast selection of exotic trees and shrubs including Magnolia, Liquidambar (up to 17m) and Silver Birch to name a few.

The subject site has a number of established trees of good form and health

The subject property is considered distinctive due to the extensive number of established trees located within an urban environment. It is considered many of the existing established trees are of relatively good form and appear in good health.

21.10.2 Landuse and Access

21.10.2.1 Assessment

As NZTA already owns 36 Cradock Street, there will be no land take required during the construction or operation of the emergency exhaust. The location of the proposed emergency exhaust stack on the site at 36 Craddock Street is detailed in Figure 21.3.

Figure 21.3: Emergency Exhaust Building and Stack Location (Excerpt from Plan F.16 Sheet 225 *Urban Design and Landscape Plans)*

It is proposed that access to the construction and operation of the emergency exhaust will be via the formed right of way (notated by number 1 in Figure 21.3). This will require heavy vehicles to access the site. Depending on the amount or type of heavy vehicles accessing the site, there may be some effect on the right of way in terms of its integrity. Therefore this will need to be monitored and maintained to ensure there are no effects on the other users of the right of way.

During both construction and operation, it will be important to ensure that access to the other properties using the right of way is not compromised. The site is considered large enough to manage the potential amount of construction traffic and plant that may be required during construction activities. With appropriate measures in place, this is not considered to be an issue.

The proposed building and emergency exhaust location (noted by number 5 in Figure 21.3) is situated near the existing building platform on the site to minimise the land disturbance and retain as much existing vegetation on the site as possible for immediate screening potential. The building with a height of approximately 5m complies with the District Plan height limits for the Residential 6a zone (however the 12m exhaust stack exceeds the 8m height limit). The building will be located a sufficient separation distance (approximately 25m) away from the nearest residential dwelling and will be partially screened by existing vegetation, proposed native canopy planting and riparian planting along Oakley Creek.

The building is located a sufficient separation distance from nearby residential dwellings

21.10.2.2 Mitigation

Impacts have been minimised through the design with the building and emergency exhaust located a sufficient separation distance from the property boundary and adjoining residential buildings.

Through the CEMP (refer Technical report G.21), measures will be put in place to minimise disruption to the adjacent residential properties and maintain access to their properties.

As noted above, heavy vehicles will utilise the formal right of way to access the site, and therefore the integrity of the right of way will need to be monitored, and maintained during and following the construction period as required.

In addition, it is noted that the proposed reserve replacement (identified in Appendix E.4) provides for an esplanade reserve to be created between this site and the Oakley Creek. This work will provide incidental mitigation, protecting the screening of the facility (as discussed in Section 21.10.4).

21.10.3 Social Impacts

21.10.3.1 Assessment

The emergency smoke exhaust stack is for use only in rare emergency events, to discharge smoke in the rare case of a fire within one of the tunnels. Air quality/health impacts of an emergency discharge will be similar to any other emergency fire event (for example, a house or car fire within the local community). Given the exceptional use of this facility and the similar effects to a domestic emergency situation, it is not considered to have any particular impacts.

Emergency smoke exhaust for rare emergency events only

The main potential social impacts, therefore, are considered to be during construction and local to the adjacent residential properties. Potential effects are likely to result from noise, dust, and construction traffic as discussed below. These effects are considered to be able to be readily managed.

21.10.3.2 Mitigation Measures

As noted previously, potential construction effects will be managed through the implementation of the CEMP (refer Technical Report G.21).

21.10.4 Landscape and Visual

21.10.4.1 Assessment

Sheet 25 of plans in F.16 show planting around the emergency exhaust stack

The emergency exhaust stack will sit within the very edge of a heavily vegetated gully that contains Oakley Creek, directly opposite Phyllis St Reserve. Two car parks would also be located adjacent to it (noted by number 3 in Figure 21-3). An existing dwelling and swimming pool would be removed to facilitate the construction of the emergency vent and, even though its architectural configuration is uncertain at this stage, it is intended that it be heavily planted around, so as to reduce its exposure to nearby residential properties and the Phyllis St Reserve (see Figure 21-3 and the plans in F.16 *Urban Design and Landscape Plans*, particularly Sheet 225 for further detail).

However visually, the 12m height of the structure, together with its utilitarian form will be apparent at the interface between the Oakley Creek margins and the residential environment. The stack is likely to rise above surrounding vegetation, both existing and proposed and be apparent from neighbouring properties. Viewed from this residential environment, it will be visible to at least 5 dwellings (and their inhabitants) immediately south to west of the stack, and approximately 8 – 10 properties along the western side of Phyllis Street. There is likely to be visibility over a greater area though more sporadically, because of intervening bush around the creek and reserve margins.

The new buffer planting will soften the profile of the exhaust stack but it has residual visual impacts

Visual effects will be particularly apparent when the stack is viewed from the vicinity of Cradock Street. When viewed from Phyllis Street and the adjoining reserve it will remain clearly apparent in places, but will also be partially screened by intervening vegetation and viewed against a backdrop of suburban development.

Over time, both the creek-side vegetation and new buffer planting will soften the profile of the exhaust stack and further isolate it from surrounding properties; however, it is likely to remain a discordant feature at the interface of Cradock St with Oakley Creek in the foreseeable future.

21.10.4.2 Mitigation Measures

It is proposed that appropriate screen planting be implemented to soften the profile of the emergency exhaust stack and associated control building. As illustrated on Plan F.16 Sheet 225, this includes:

- Exotic garden species cleared from the site and the planting of native coastal forest species;
- Riparian planting along Oakley Creek; and
- Retention of existing trees where possible.

It is also proposed that the appearance of the building is further consulted with the [Auckland Council] to minimise visual effects where possible.

21.10.5 Amenity Trees

21.10.5.1 Assessment

There is an array of native tree species located on the property, including Kauri, Karaka, Pohutukawa, Totara, Titiko, Whiteywood, Kohekohe, large Kanuka, Rimu and many groves of Cabbage trees and Tree Ferns. The property also has a vast selection of exotic tree species and shrubs. Many of the existing established trees are of relatively good form and appear in good health.

The proposed building and stack will be approximately 10m by 10m in extent. It is proposed to locate the building to take into consideration the presence of the better established tree species and restrict the construction area(s) to avoid the need to fell and remove significant areas of the existing vegetation where practicable. For example, the building could be situated in the immediate vicinity of the existing residential dwelling.

21.10.5.2 Mitigation

Planning and management in relation to the protection of vegetation will be implemented through the CEMP and associated management plans (Technical Report G.21). Specific consideration should be given to:

Planting and management implemented through the CEMP and associated management plans

- Locating the building so as to minimise the amount of established vegetation loss;
- Minimising the extent of construction areas, and retaining trees where possible; and
- Undertaking appropriate mitigation and landscape planting in accordance with the Urban Design and Landscape Plans (see Plans in F.16 of this AEE).

21.10.6 Air Quality Assessment

21.10.6.1 Assessment

As the emergency exhaust stack is for fire use only, due to its rare operation, the effects are not considered against the Air Quality National Environmental Standards (AQNES) for air quality. The dimensions of the stack have been determined by the tunnel design team.

During construction there may be some localised effects associated with dust on the adjacent residential properties. However, this is not considered significant, and would be able to be readily managed through appropriate construction procedures.

21.10.6.2 Mitigation

Operational effects in relation to air quality have been avoided through design, in relation to the height of the exhaust.

Dust generated from construction activities will be managed through the Construction Air Quality Management Plan (CAQMP) (refer Appendix M of Technical Report G.1 *Assessment of Air Quality Effects*).

21.10.7 Noise Emissions

21.10.7.1 Assessment – Operation

Emergency exhaust will comprise a plant room and a 12m high stack

The emergency exhaust will comprise a plant room and stack. The plant room will be at ground level and house large centrifugal fans which will draw the smoke exhaust from the tunnel via a 50m deep shaft (e.g. through the ground). The exhaust stack will be approximately 12 metres in height and located adjacent to the plant room.

This system is not part of the general ventilation system and will only operate during emergencies and during maintenance tests. However attenuation will be required to both the intake and discharge sides of the fan. Attenuation is required to the discharge side of the fan to prevent exceedance of boundary noise conditions during testing periods. Attenuation will be required to the intake side of the fan to reduce noise levels inside the tunnel sufficiently to enable voice alarms to be intelligible.

The plant room will be constructed from heavy materials, such as block work, to minimise noise breakout from the building itself. It is understood that the smoke extract fans require monthly tests in order to ensure they work effectively. The testing will be undertaken during daytime only, and will require full speed operation of the fans.

In the event of an emergency, the fans would be operating at any time of the day or night. As the required rate of smoke extraction would limit the mitigation that can be applied to the fans, it is would be impracticable to achieve the recommended noise limits for emergency operations and during the short duration testing during daytime.

Therefore, a higher noise criterion of 65 dB LAeq(15 min) is proposed for the operation and testing of the emergency smoke extract system, subject to a restriction on the hours of testing.

21.10.7.2 Assessment – Construction

Some delivery of materials by helicopter

The construction of the emergency ventilation building and stack will potentially require delivery of some materials by helicopter to an area in the vicinity of Cradock Street (the alternative is vehicle access). As the closest dwellings are within 50m of the site and shielding helicopters is not practicable, deliveries will need to be notified in writing in advance to adjoining residents.

21.10.7.3 Mitigation – Operation

As noted above, attenuation will be required as part of the design of the buildings and around the fans. Other mitigation includes:

- Undertaking maintenance testing during the daytime only, and timed during the middle of the day if possible; and
- Notification of adjacent residents of when maintenance testing of fans will be occurring.

21.10.7.4 Mitigation – Construction

It is recommended that the following mitigation is imposed, for construction of this structure (should delivery by helicopter be required):

- Restrict the number of helicopter deliveries of materials;
- Notify adjoining residents in advance of helicopter deliveries; and
- Implement the CEMP complaints procedure, including the 24hour phone line.

22. Assessment of Effects – Sector 9

Overview

This Chapter assesses the actual and potential effects of the Project within Sector 9. The works within this Sector comprise construction of a new carriageway through Alan Wood Reserve, from the southern tunnel portals, under the proposed Richardson Road bridge to join up with the existing SH20 motorway section at Maioro Street Interchange. Within Sector 9 the works include the approaches to the tunnel. Overall, the key environmental effects of the Project within Sector 9 that are identified and considered in this AEE are the potential impacts of both construction and operation of the Project on: the existing established residential communities of Owairaka and New Windsor, the Oakley Creek stream and its floodplain which covers parts of Alan Wood Reserve / Hendon Park. Much of this land area has historically been set aside for the Avondale to Southdown rail line, which is not developed.

Given the relatively low level of existing development in the area (the amount of open space) and the degree of change that will occur, the Project represents a significant change to the local environment, particularly for the community. Property take and the presence of the Project (carriageway and associated ventilation building and stack) will have an adverse impact on the social and community wellbeing, particularly over the construction period. The built form of the Project will have significant visual impacts. Effects from emissions (noise, vibration, air and light) are generally minor or low, except in the case of noise impact which is considered severe.

The Project proposes measures and design elements that mitigate these impacts including proposed open space reinstatement/replacement, stream restoration, landscaping, noise walls and restored community connectivity (Hendon Park Bridge). However, there are residual adverse impacts of the Project (at least in the short and medium term) which will reduce over time as people become accustomed to this substantially different environment.

Through the Project design and management many adverse effects can be more fully mitigated and remedied or are off-set by other works. In particular, it is noted that:

- The reinstatement of open space within the designation replaces recreation and reserve facilities on a “like for like” basis (in both quantity and quality);
- The realignment of Oakley Creek will provide an overall, long term benefit for this waterway, creating opportunities to ‘re-naturalise’ the form of the waterway and for restoration planting;
- The Project has only minor impacts on downstream flooding and has retained flood plain storage (e.g. within the Oakley Creek). Furthermore the Project, creates the opportunity to reduce upstream flooding issues by reinstating open space (25 Valonia Street), which is consented for residential development; and
- The proposed stormwater treatment system will collect and treat stormwater from both new and existing (untreated) impervious areas. Combined with the proposed rehabilitation and restoration of this steam, it is considered the Project will result in improved water quality.

22.1 Introduction

This Chapter provides an assessment of the actual and potential effects on the environment of the Project within Sector 9. As described in Chapters 4 and 5, the main physical elements of the Project located within Sector 9 are:

- Southern portal and southern ventilation building;
- New carriageway (SH20) from the tunnel portals to Maioro Street Interchange;
- Richardson Road Bridge;
- Hendon Avenue cycle / pedestrian way and bridge; and
- Construction of the northern half of the Maioro Street Interchange.

Relevant Plans: F.2: Operation Scheme Plans and F.5: Construction Scheme Plans (Sheets 17, 18 and 19, for this Sector)

Specific details on scheme elements in this Sector are described in Section 4.4.9 of this AEE and the overview of the scheme is provided in plans F.2: *Operation Scheme Plans* (Sheets 17, 18 and 19 for this Sector). Details of the proposed construction of these elements are described in Section 5.9.9 of this AEE, with the construction areas and yards provided in the plans F.5: *Construction Scheme Plans* (Sheets 17, 18 and 19 for this Sector).

Key issues relate to existing residential development, the natural environment of Oakley Creek and emissions from the Project

The works are located within an urban environment. The predominant land use is open space (comprising 'Alan Wood Reserve'[1] and Hendon Park), bounded by residential areas to the east (Owairaka) and west (New Windsor). There is a business/commercial land use node to the east, around Richardson Road / Stoddard Road. Key natural features include Owairaka (Mount Albert) to the east of the Project area and Oakley Creek, running through the Alan Wood Reserve, along the same general alignment as the Project.

Given the existing environment, the key issues identified for the assessment of environmental effects for the Project include[2]:

- Effects on the human environment, effects on neighbourhood (land use and transport) and socio-economic effects;
- Impacts on the physical locality, particularly relating to the visual and amenity effects;
- Effects on the natural environment of Oakley Creek including the ecosystem effects for this waterway; and
- Effects associated with the discharge of emissions (in particular noise) associated with the construction and operation of the Project.

---

1 This area comprises land owned and managed as reserve and land owned by the Crown for the Avondale-Southdown Rail Line. The wider area of 'open space' also includes a residentially zoned property currently undeveloped (25 Valonia Street).

2 Chapter 12 provides a summary of all matters considered in the assessment of environmental effects for the Project. Only those matters considered relevant to the environment in this area are reported on in this Chapter (e.g. there is no reporting of effects on archaeology or coastal processes).

This Chapter is set out as follows:

22.2 Land Use

22.2.1 Existing Environment

The existing land use environment within this Sector is shown conceptually in Figure 22.1. The information within this Figure has been extracted from the Auckland District Plan (refer Appendix E.2 for the district plan maps). The Plans in Part F.1: *Designation Plans* contain further detail on existing designations and other sites subject to concept plans.

Existing zones in the area include: land currently zoned for transportation (Special Purpose 3), education (Special Purpose 2), open space (Open Space 2 and Open Space 3), residential (Residential 7a, Residential 6a and Residential 5) and business (Business 1, Business 2, Business 4, Business 8 and Mixed Use).

Auckland City Council

Figure 22.1: Land Use Zones within Sector 9 (Not to Scale)

22.2.1.1 *Special Purpose Land Use*

Special Purpose 3 Zone provides for significant current or future transport

The Special Purpose 3 Zone (Transportation) matches the Avondale to Southdown Rail Designation (reference G08-05 in the Auckland District Plan) (discussed in Section 22.2.1.6) and runs in a northwest/southeast line through Alan Wood Reserve/Hendon Park south to the Richardson Road Industrial area. This zoning also relates to land at 222 Richardson Road, which has previously been used for 22 pensioner dwellings; however these were demolished in 2009 and the land is now vacant.

The Special Purpose 3 zoning is applied to significant current or future transport infrastructure on the Isthmus. Any facility designed primarily for the movement of people and goods is a permitted activity in this zone. In this area, the zoning extends to land north of New North Road (containing the North Auckland Rail Line[3]).

Christ the King School is located at the southern extent of the Sector and is zoned Special Purpose 2 for education purposes. It is subject to additional controls in the District Plan.

22.2.1.2 *Open Space Land Use*

There are large areas of open space in this Sector

Hendon Park and Alan Wood Reserve (Council-owned) and other land (private and NZTA owned) surrounding the special purpose zone are the main areas of land zoned for open space in this area. These areas are used for formal and informal recreation. The Special Purpose 3 Zone described above, bisects much of the open space area.

[3] Also referred to as the 'Western Line'.

Hendon Park comprises approximately 1.7ha of irregularly shaped land with access from Richardson Road. Oakley Creek (coming from Underwood Park) and a tributary (coming from the Stoddard Road industrial area) converge within the Park. This land is subject to a floodplain overlay in the District Plan for a 100 year flood event. Hendon Park adjoins residential land to the north and east, and privately owned open space to the northwest (of which approximately 2ha is owned by the NZTA) and the south (approximately 0.2ha of which is owned by Portage Licensing Trust) and New Zealand Rail Corporation land to the south[4].

The above open space parcels (Alan Wood Reserve and Hendon Park) are not subject to the Reserves Act 1977.

Further north west, Alan Wood Reserve is bisected by land designated for the Avondale-Onehunga-Southdown rail line and zoned for transportation. Within this area, the reserve has two playing fields, one basketball practice area, toilet facilities and picnic tables. Only one of the existing playing fields is located entirely on Open Space 3 zoned land. The other playing field straddles the Special Purpose 3 zoned land (rail designation). To the north of Sector 9 there is an additional training field (located within Sector 8).

From a land use perspective, Alan Wood Reserve consists of:

- Open Space 3 zoned land. This land lies generally to the east of the Special Purpose 3 Zone. Part of this land is subject to the Alan Wood (Hendon Avenue) Reserve Management Plan (RMP) which was prepared in 1981. This land is not generally subject to the Reserves Act 1977, with the exception of a small parcel of land (approximately 0.2 ha) which is classified as Recreation Reserve; and
- Open Space 2 zoned land. This land lies generally to the west of the Special Purpose 3 Zone and was added to Alan Wood Reserve in 1992. This land is subject to the Reserves Act 1977.

22.2.1.3 *Residential Land Use*

The majority of residential zoned land in Sector 9 is zoned Residential 6a, including those located along Hendon Avenue and Richardson Road. The Residential 6a zone in the Auckland City District Plan (Isthmus) provides for a standard residential zone, with medium to high density residential development compared to the rest of the District (e.g. 1 lot per 350m^2).

The majority of residential zoned land in Sector 9 is zoned Residential 6a

Properties in New Windsor including those fronting Valonia Street are zoned Residential 5, indicating a lower density of suburban residential development (e.g. 1 lot per 500m^2). A resource consent granted in 2005 for 83 residential units at 25-31 Valonia Street has not yet been implemented and the site remains undeveloped. This site is also zoned Residential 5.

22.2.1.4 *Business Land Use*

On the northern side of Richardson Road (opposite the Stoddard Road shopping area) is land

[4] As noted above, the residential zoned, but undeveloped site at 25 Valonia Street, also currently contributes to the wider 'open space' of this area (as residential zoned land, this is discussed in Section 22.2.1.3)

zoned Business 8. Land zoned Business 8 provides for large-scale business development, although the current use of the site does not reflect the intention of the plan for this zone. This land is currently occupied by the Richardson Tavern, bottle store and car park. The Richardson Road Industrial area and the Stoddard Road shops, further to the south, are zoned for Business 2, Business 4 and Mixed Use Purposes.

22.2.1.5 *Auckland City Future Planning Framework*

The Auckland City Future Planning Framework (FPF) 2008 area plans set out a number of key medium and long-term outcomes that the Council wants to achieve, from a city planning point of view (by 2030). The FPF provides direction on the land use aspirations for Council.

Of particular significance to Sector 9, mapped aspirations in this area include:

Protecting and enhancing (where possible) the Oakley Creek cultural heritage values and water quality

- Providing green linkages along Oakley Creek around the Avondale-Southdown rail corridor located within Alan Wood Reserve and the Stoddard shops;
- Protecting and enhancing (where possible) the Oakley Creek cultural heritage values and water quality;
- Developing Stoddard Road as a town centre catering for business, office, retail, residential, open space, community and recreation uses;
- Redeveloping Housing New Zealand-owned land within the Stoddard Road area to provide for a range of housing types (including single dwellings, townhouses and apartments);
- Developing mixed use activities along Stoddard Road and a mix of housing types (including low-rise apartments of two to four storeys);
- Integrating with roads, pedestrian and cycling environments within the Mt Roskill/Hillsborough area (completed as part of earlier State Highway 20 Project and the development around Stoddard Road); and
- Establishing SH20 and the Maioro Street Interchange as a major transport network improvement that integrates with Richardson Road and Maioro Street as key road passenger transport routes.

22.2.1.6 *Designations*

Plans in F.1 of this AEE provide detail on existing designations

Plans provided in F.1 of this AEE provide detail on the proposed designation of the Project in relation to existing designations. As noted above in Section 22.2.1.1, the Avondale-Southdown Rail Designation is designation G08-05 in the Auckland District Plan.

A public road network designation: B08-04, applies to all Auckland City Council owned roads to enable the safe and efficient functioning and operation of the Council's road network. Within Sector 9, Auckland City Council public roads include Valonia Street, Richardson Road and Hendon Avenue.

The Project also overlaps with the following existing designations/notices of requirement (where the NZTA is the Requiring Authority):

- Designation for proposed road, motorway and railway from Hayr Road to Richardson

Road (Reference F05-05); and

- Designations providing for the extension of SH20 from Hillsborough Road to Maioro Street (Reference H08-06 and H08-07).

22.2.2 Assessment – Operation

Land use impacts relate to the land take

Land use impacts associated with the operation of the Project relate to the scale of permanent land take from surrounding land use areas described below. In particular, effects include the loss of the existing land uses and the loss of potential or viability for the remaining, surrounding land use areas. The assessment relates to those areas outside of the existing designated transport areas.

22.2.2.1 *Impacts: Special Purpose Land Use*

The surface road and southern tunnel portal building are generally designed to be located within land zoned for transportation (Special Purpose 3) and designated for rail purposes, which has minimised impacts on adjoining land uses. The Project retains an approximately 20m wide strip of land to enable land to be retained for future rail development. This combined corridor means that the land footprint of the Project extends beyond the current Special Purposes 3 zone in the vicinity of Hendon Avenue.

22.2.2.2 *Impacts: Open Space Land Use*

Loss of open space will be replaced as part of the mitigation proposals

The Project will permanently occupy approximately 3.2 ha of open space zoned land at Alan Wood Reserve/Hendon Park. This represents a significant take from the open space land in this area. Appropriate reserve replacement is proposed to mitigate this and to provide permanent replacement facilities to the local community (see mitigation proposed in Section 22.2.4 below). The land use impacts are considered to be minor with the replacement land provided.

22.2.2.3 *Impact: Residential Land Use*

The proposed Project will impact on residential property in Valonia Street and Hendon Avenue. The number of residential properties required for the Project is discussed further in the assessment of construction impacts (Section 22.2.3 below). While a number of these properties are required for the construction of the Project, it is anticipated that some sites may become available for residential re-development following construction works. This would reduce the total impact on the residential zone as a result of the Project [5].

While impact on residential property has significance for the residents in the area, given the extent of the residential zone in the wider area surrounding the Project, the adverse effects of the loss of this land in terms of the integrity of the residential zone is not considered significant.

[5] The final land available for return to residential land use will be determined following construction

22.2.2.4 *Impact: Business Land Use*

The proposed motorway corridor through the Stoddard Road business area will impact on business properties. The number of business properties required for the Project is discussed further in the assessment of construction impacts (see Section 22.2.3.3 below). While a minimal number of these properties are required for the construction of the Project, the land take is partial in most circumstances and it is considered that the businesses will be able to remain operational during construction. In the long term, the viability of this business zone is not considered significantly affected by the Project.

22.2.2.5 *Other Impacts on Existing Designations*

The Project does not preclude the future Avondale-Southdown Rail

As noted above, the Project requires land from the area currently designated for the Avondale-Southdown Rail. However, the Project design has retained an approximately 20m wide strip of land which provides a corridor for future rail development. The NZTA is involved in ongoing consultation with KiwiRail with respect to the Project to ensure that the Project does not preclude the ability to provide a land corridor for a future rail line.

Auckland City has a designation for their public roads.

As noted above, the Project designates land already designated by the Auckland City Council for its public roads. In these areas, the Project retains all local road connections following construction (including reinstatement of a realigned Valonia Street). Auckland City Council has indicated that the Project design of the AEE is sufficient for it to provide the necessary s177 approval, as the original designation. Discussions for this approval are progressing.

Given the above assessment, the operational effects of the Project on existing designations are considered minor.

22.2.3 Assessment - Construction

22.2.3.1 *Impact: Open Space Land Use*

It will be necessary to occupy 7.7 ha of open space zoned land at Alan Wood Reserve/Hendon Park during construction. This provides for Construction Yards 8, 9 and 10 for the Project and the construction of the surface motorway and southern tunnel portal. This represents a significant land take from the open space land in this area. Appropriate reserve replacement is proposed to mitigate these and to provide permanent replacement facilities to the local community (see Section 22.2.4).

22.2.3.2 *Impact: Residential Land Use*

Some residential land will be required during construction

The location and quantity of residential zoned land physically affected by the proposal during construction is summarised in Table 22.1 below. Of the land parcels affected approximately 16 parcels of partial land take, with a total of 30 dwellings are estimated to be taken for construction.

Undeveloped residential land on Valonia Street is required for the stormwater management, realignment of Oakley Creek, provision of flood retention and provision of both temporary and permanent open space replacement. Additional land is also required for the realignment of Valonia Street (to maintain safe access between Valonia Street and Richardson Road, following construction of the Richardson Road bridge over SH20).

Residential land on Hendon Avenue is required for construction, installation of the grout wall (which is proposed for the mitigation of groundwater flows at the cut of the tunnel), stormwater management and treatment (swales), and for noise and visual/landscape mitigation. As discussed in Chapter 11, inclusion of some properties on Hendon Avenue within the designation is due to the scale of land use impact of a 'partial take' of these properties. In particular, the loss of private open space and the fragmentation of land parcels are significant, with complete purchase of the property being a more appropriate approach to manage adverse effects of the Project.

Notwithstanding the social impacts of land take on the residents in this area (which are discussed in Section 22.5 of this Chapter), given the extent of the residential zone in the wider area surrounding the Project, the adverse effects of the loss of a small proportion of residential land use on the integrity of the residential zone are considered to be minor.

Table 22.1 – Summary of Approximate Land Take from Residential Zone Sector 9

Impact	Residential Zoning	Parcels	Dwellings
Valonia Street	Residential 5	10	9
Valonia Street	Residential 6a	2	4
Valonia Street (Goldstar Site)	Residential 5	1	0[6]
Hendon Avenue	Residential 6a	30 (16 of these are partial take)	16

[6] Note however that 83 residential dwellings are provided for on this site, by an unimplemented resource consent.

22.2.3.3 *Impact: Business Land Use*

The location and quantity of business zoned sites impacted by the Project during construction is summarised in Table 22.2. None of the business buildings will require removal for construction of the Project and it is considered probable that many will be able to operate during the construction period, particularly as none have been identified as 'sensitive' to construction activities[7]. It is acknowledged that specific impacts on these businesses will be confirmed in consultation with respective business operators. On this basis, it is considered that the impacts on the integrity of the wider business zone are minor.

Table 22.2 – Summary of Approximate Land Take from Business Land Use Sector 9

Impact	Take Requirement	Business Zoning	Parcels
Richardson Road Tavern	Partial take - Carpark to be used for construction	Business 8	1
Richardson Road	Construction works associated with Richardson Road bridge.	Mixed Use	1
Stoddard Road	Construction works include stream realignment, retaining and rock anchors for retaining wall.	Mixed Use	5

22.2.3.4 *Other Impacts on Existing Designations*

As the works provided for under the designation for the Avondale-Southdown Rail have not been implemented, the Project construction will not affect any activity within that designation. Although land will be impacted for construction and operation this does not preclude future rail construction or operation discussed in Section 22.2.2 above.

As noted above, the Project also requires designation over land currently designated by the Council for its public roads. Construction impacts on the transport network have been assessed and management and mitigation measures identified as appropriate. These are discussed in Section 22.3. The assessment concluded (subject to the implementation of mitigation and management identified) that the construction effects of the Project on the existing public road designation will be minor.

22.2.4 Mitigation - Operation

22.2.4.1 *Avoiding Effects through Design*

The potential adverse effects on the land zoned for Open Space and Residential use have been minimised through the design of the surface motorway. Furthermore the design has sought to avoid adverse effects by locating the works within land already zoned Special Purpose 3 (as far as practicable).

Land use effects have been reduced through design

[7] Further it is noted that some areas designated in this zone, are for the provision of a future rail corridor and therefore will not be directly affected beyond construction works (for this Project).

22.2.4.2 *Mitigation*

Permanent Reserve Replacement

Open Space Restoration Plans will be developed with key stakeholders, including the [Auckland Council] to inform the restoration and reinstatement of open space and reserve areas affected by the Project. In particular and in respect of the land use effects assessment, this would include replacement of the quantity of land lost at Alan Wood Reserve/Hendon Park and the associated active recreation facilities.

The mitigation proposed is graphically shown in Appendix E.4 of the AEE. This identifies opportunities for replacement open space land (largely) within the designation by:

The Open Space Reinstatement Option is shown in Appendix E.4 of this AEE

- Retaining some of the existing Alan Wood/Hendon Park (7.75ha);
- Returning an additional 3.7ha of open space land around the existing open space areas following construction; and
- Providing two new playing fields at 25 Valonia Street.

In total, this mitigation proposes that approximately 3.7ha of new land be provided as open space within or in close proximity to the Owairaka community. When combined with the retained open space, this provides a surplus of 0.5 ha of open space for the reserve network in this area. In addition, the loss of sportsfields generated by the Project can be accommodated within the land provided. It is appropriate that further work is undertaken with the managers of the reserve and open space (e.g. the [Auckland Council]) to confirm the reinstatement of these reserve and recreation facilities. It is noted that the reinstatement can be undertaken over the construction period.

General Mitigation

Once construction is completed it is likely that the designation will be uplifted or withdrawn from surplus land within the designation, to allow for reinstatement of open space / recreation areas and residential land use. Uplifting of the designation from the replacement rail corridor will be undertaken in consultation with KiwiRail.

22.2.5 Mitigation - Construction

22.2.5.1 *Temporary Reserve Replacement*

To mitigate the temporary loss of the use of reserve land at Alan Wood Reserve/Hendon Park during construction it is proposed that temporary open space replacement occurs within the area. Figure 22.2 identifies the potential location of this temporary open space replacement.

Temporary open space replacement

It is proposed to provide three temporary playing fields to replace the three fields which currently exist. These will be a combination of playing fields located either: to the northern end of Alan Wood Reserve (leased from the New Zealand Railways Corporation) or at 25 Valonia Street.

in the northern end of the Sector, one proposed sportsfield will only be available until such time as Construction Yard 8 is established. At that time, it is proposed that the temporary field be relocated (within the designation footprint) to 25 Valonia Street. it is proposed that

this field be developed as a permanent replacement field (subject to confirmation with the [Auckland Council] in the Open Space Restoration Plans).

22.3 Transport Effects

Technical Reports G.16 and G.18 provide further detail on the assessment of transport effects

Transport effects have been assessed for the Project and are reported in Part G (Technical Reports G.16: *Assessment of Temporary Traffic Effects* and G.18: *Assessment of Transport Effects*). The following is a summary from this assessment.

22.3.1 Existing Environment

22.3.1.1 *Roading Environment*

The existing roads within this Sector that are relevant to the Project are Richardson Road, Hendon Avenue and Valonia Street. Richardson Road is classified as a District Arterial Road in the Auckland City District Plan, while Hendon Avenue and Valonia Street are classified as Local Roads. As a District Arterial Road, Richardson Road is a major route in Auckland.

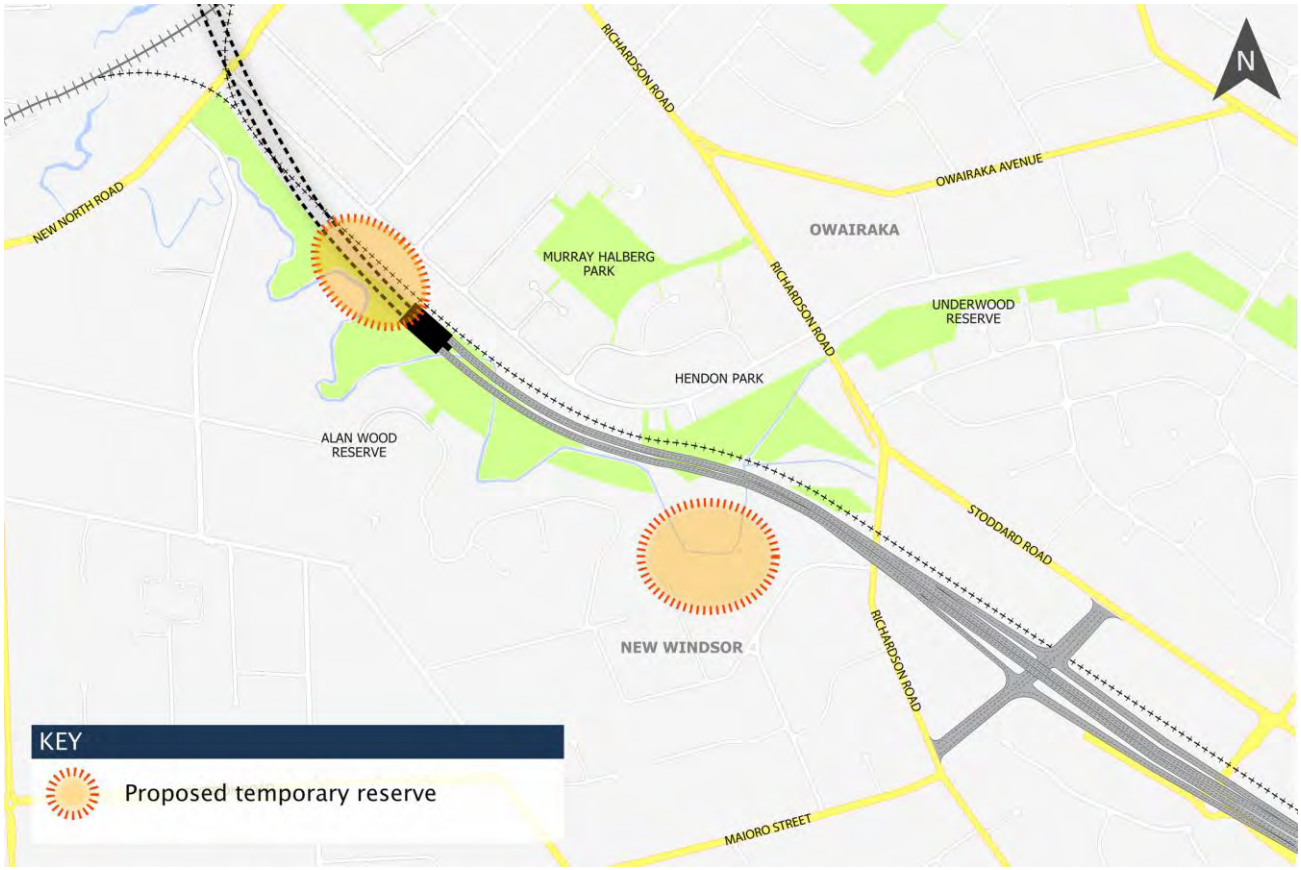


Figure 22.2: Temporary Reserve Replacement Areas

22.3.1.2 *Pedestrian / Cycling Environment*

There is currently a cycle lane along Richardson Road. There are pedestrian walkways through Alan Wood Reserve and Hendon Park. At the end of the walkway through Hendon Park, a shared pedestrian and cycle path continues through Underwood Park and Walmsley Park. In the vicinity of the existing SH20 termination at Maioro Street, a segregated shared pedestrian/cycle way is provided alongside the southern side of SH20. Shared pedestrian / cycle ways are also provided between Maioro Street and Stoddard Road via the SH20 roundabout termination and a bridge over SH20 between Sandringham Road Extension and Ernie Pinches Street.

22.3.1.3 *Passenger Transport*

There are two bus services which run along Richardson Road and Hendon Avenue.

22.3.1.4 *Parking and Access*

Parking is permitted on both sides of the local roads in this Sector. Parking is also provided for on Richardson Road.

22.3.2 Assessment – Operation

Given the local and regional effects on transport, the assessment on operation is provided in Chapter 13 of the AEE (regional assessment). The assessment provides for the anticipated effects of the Project on the wider motorway network, arterial roads and the local roading network. Further detail is provided in Technical Report G.18: *Assessment of Transport Effects*. In addition to this overall assessment, the following considers the operational transport effects within Sector 9 (specifically this relates to the operation of Richardson Road and Valonia Street).

The regional assessment (Chapter 13) includes an assessment of operational transport effects

22.3.2.1 *Effects on Local Access and Parking*

Following completion of the Project access to those properties remaining along Richardson Road and Valonia Street will continue to be provided, as will the existing facilities (such as footpaths, lighting etc), on both these roads.

Existing local road connections will be maintained

The realignment of Valonia Street will create a new intersection (Valonia Street / Richardson Road), slightly to the south of the existing intersection. This will maintain all traffic movements to and from Richardson Road (in a similar form as is currently provided). The realignment of the intersection will have a minor effect, in the loss of some on-street parking, on both sides of Richardson Road.

Following the realignment, the existing parking arrangements on Valonia Street will be reinstated. While the open space development at 25 Valonia Street will require off-street parking there is room for this to be provided within the land taken by the Project (as detailed in the Urban Design and Landscape Plans provided in Part F.16 of this AEE). Consequently, in combination, it is considered that the effects of the Project in this area on the existing on-street parking will be negligible.

22.3.3 Assessment – Construction

The construction of the Project in this Sector is expected to take place over a number of phases. Works include construction of the southern portal, the carriageways, Richardson Road bridge, and pedestrian bridges. With the exception of the Richardson Road bridge, construction of the majority of works can be conducted 'off-line' and will not impact on the existing road network. Access to the work site will be established off SH20 and Richardson Road, at the location of the future Richardson Road bridge.

The potential adverse effects of construction traffic on the road network include: reduced capacity on roads within the Project site, resulting travel time delays and diversions off these roads onto other roads in the network (increasing congestion and travel times on these routes) and potentially loss of access for users of the network through the construction site (e.g. if road closures etc are left unmanaged).

It is proposed that traffic management methodologies will be employed during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project.

The specific traffic management methodologies employed within this Sector include:

- Temporary realignment of Richardson Road to allow the construction of the Richardson Road bridge and narrowing of the lanes on SH16 with installation of temporary barriers to open up work zones and allow off-line construction;
- Temporary relocation of bus stops;
- Night time closure of lanes on Richardson Road where required to allow work to be undertaken to Richardson Road Bridge;
- Establishing controlled construction sites and site access points separated from live traffic; and
- Provision of a temporary cycle lane/pedestrian path.

Chapter 16 of Technical Report G.16 *Assessment of Temporary Traffic Effects* discusses the traffic management methodologies employed within this Sector and their effects.

22.3.3.1 *Effects Arising from Realignment and Narrowing of Lanes*

The functioning of Richardson Road will be maintained throughout the construction period

Work on the Richardson Road bridge will be undertaken over two phases of realignment, with lane and shoulder narrowing. In the first stage, Richardson Road will be realigned to the west to allow completion of the new bridge. In stage two, Richardson Road will be transferred to the new bridge. The existing number of lanes on Richardson Road will remain operational throughout works. However, lanes on Richardson Road will be narrowed to a minimum width of 3.0m (with 300mm shoulders). Work in the live lanes of Richardson Road will be conducted during night closures. The effects of these works on the local road network can be managed through operation of an approved site specific traffic management plan (developed for site specific works). The installation of lane narrowing and a temporary speed limit on Richardson Road is anticipated to have little impact on travel times throughout this Sector.

22.3.3.2 *Effects Arising from Temporary Lane Closures*

Temporary closures will be necessary on Richardson Road during bridge construction works and for the realignment of the road between each stage of works. Closures will be programmed to minimise disruption on daytime traffic with closures programmed after 8pm and the road re-opened by 6am (seven days a week). Detour routes for closures will be provided – proposed detour routes are shown within Section 16.1 of Technical Report G.16 *Assessment of Temporary Traffic Effects*. These closures and proposed detour routes would be confirmed through site specific traffic management plans (SSTMPs) (Refer Section 22.3.4).

Limited night time closures will be required to enable works on Richardson Road Bridge

22.3.3.3 *Effects Arising from Site Access*

There will be site accesses to both the western and eastern sides of Richardson Road during works on the Richardson Road bridge and surrounds. As noted previously, it is anticipated that the main access to the construction site in Sector 9 (and to Sector 8) will be provided from Richardson Road, until such time that the Richardson Road bridge is completed. From that point it is anticipated that construction traffic access will be directly on and off SH20, north of the Maioro St Interchange.

Site access movements will be managed to minimise the effect on the local network and on Richardson Road operations, and if necessary restrictions will be made on the movements or hours of operation of particular movements of the accesses. For example, subject to detailed assessment, right hand turns may be restricted during peak periods (e.g. to address safety concerns or if the construction movements generate queues or delays to the local road network). Appropriate management of construction traffic will be confirmed through Site Specific Traffic Management Plans, developed at the time of works and confirmed with the local network operator (e.g. the [Auckland Council]) (Refer Section 22.3.4).

Site access points will be carefully managed to minimise effects on Richardson Road and other local roads

22.3.3.4 *Effects on Cyclists and Pedestrians*

During construction on Richardson Road, existing pedestrian footpaths will be narrowed and diverted around the work sites. It is also noted that footpaths (on one side of the road or the other) may be required to be closed during works (however, at this time it is planned that both sides will be able to remain open throughout works). These activities may have some impact on accessibility and convenience for pedestrians and cyclists.

The effects of such works can be managed during construction, e.g. through diversions installed to direct pedestrians to the alternative side of Richardson Road and via installation of pedestrian refuges and signage to provide safe road crossing points (refer Section 22.5.3)

22.3.3.5 *Effects on Public Transport*

A number of bus services run along Richardson Road. These services will be affected by the works as bus stops will require temporary relocation to minimise delays to through traffic. Bus stops will be relocated to either end of the construction site to locations that provide a safe route for pedestrians. The bus stop relocations will take into account the location of pedestrian attractors / generators in the area and will be located in consultation with service providers. As such, the effects of construction on public transport can be managed.

Bus stops on Richardson Road will be temporarily relocated during construction

22.3.4 Mitigation - Construction

Traffic management methodologies will be implemented during the construction period to manage the effects created by increased construction traffic, work sites and construction of the Project. Typical mitigation and management measures to minimise the effects of construction traffic are outlined in the Construction Traffic Management Plan (CTMP) (as Appendix A to Technical Report G.19 *Assessment of Temporary Traffic Effects*)). Given the nature of the effects of construction on the regional traffic network, the overview of the CTMP is provided in Section 13.2 of this report.

Site specific traffic management plans will be developed to manage specific traffic effects during construction

It is expected that mitigation and management measures for specific areas of the construction site will be formed and agreed through Site Specific Traffic Management Plans (SSTMPs) which will be prepared in accordance with the CTMP. In particular, in this Sector, mitigation measures include:

- Traffic reduction strategies through-out the construction period, to divert traffic from Richardson Road and advise users of alternative routes;
- Site access restrictions to provide for safe access and safety of surrounding road network. The site access to work zones will be positioned on the local road network where possible;
- Site access restrictions if appropriate at Richardson Road site access (e.g. banning right turn movements into the site over peak periods to minimise impacts to Richardson Road traffic capacities);
- Maintaining pedestrian access along Richardson Road throughout the construction period, including identification of detorus and safe crossing points if footpaths on one side of Richardson Road require closure;
- Liaison with passenger transport service providers to confirm relocation of bus stops on Richardson Road over the construction period.

22.4 Ground Settlement

A full assessment of ground settlement effects is provided in Technical Report G.13

A full assessment of the ground settlement effects of the Project is provided in Technical Report G.13 *Ground Settlement Effects*. The following provides a summary of the potential settlement effects in relation to buildings, service networks and utilities.

22.4.1 Existing Environment

The existing environment within Sector 9 is predominantly residential and urban in nature with services, including a Watercare watermain crossing through the Alan Wood Reserve (in the vicinity of 25 Valonia Street). One closed landfill is located in Alan Wood Reserve. South of Richardson Road, there is a small area of business land use.

22.4.2 Assessment – Construction

Ground settlement occurs as a result of groundwater drawdowns and from the mechanical settlement (relaxation of the ground) during construction.

Settlement may occur as a result of groundwater drawdowns and from 'mechanical settlement'

In this Sector, potential settlement effects relate to construction of the trench (retaining walls) and tunnel portals in Alan Wood Reserve and the retaining walls close to business activities at Richardson Road / Stoddard Road. Vertical and horizontal ground displacements have been predicted on the basis of ground conditions and the construction methodology. The predicted settlements have then been considered alongside building and service plans.

In the vicinity of the southern portal retaining walls, relatively minor settlements are predicted. Given the distance from the proposed works to residential dwellings in this area, only negligible effects are expected as a result of retaining wall and tunnel portal construction.

Estimates of maximum displacements for the retaining walls beneath Richardson Road show approximately 5mm horizontal movement and less than 5mm vertical movement in the land area behind the proposed retaining wall (this reduces to zero movement at a distance of approximately 20m from the retaining wall). Effects on buildings in proximity to these retaining walls are expected to be minor.

Services in the vicinity of the southern portal include water, stormwater and sewer. The majority of these services will be relocated as part of the Project works, therefore there are no adverse effects for these services.

Settlement of land around the Alan Wood Reserve landfill is expected to be relatively uniform and not considered to have any detrimental effects, particularly given the discrete nature of the landfill material.

22.4.3 Mitigation – Construction

Settlement monitoring will be undertaken pre, during and post-construction

While the effects of settlement are considered minor or negligible, it is recognised that these effects are assessed on the basis of predicted settlements. While of low probability it is acknowledged that there is a high impact from any settlement. As a consequence, monitoring is proposed to be undertaken. Full details of settlement monitoring is set out in the Settlement Effects Management Plan (SEMP) (Appendix H of Technical Report G.13). Further, if the monitoring indicates effects of settlement different (and worse) from those predicted, the SEMP identifies mitigation measures.

in order for the monitoring to confirm that the effects of construction works are 'as predicted' the following key measures are proposed:

- Specific building condition assessment for the 'Modern Chairs Building' on Richardson Road, including an initial condition assessment for baseline condition assessment prior to construction of the Richardson Road retaining walls;

- Monthly visual assessments, level and/or wall inclination surveys for critical construction phases, for 'Type 1 and Type 2' buildings where 'more than negligible' or 'slight' effects or greater have been predicted; and
- Specific monitoring of retaining walls for movement using inclinometers and surface survey to determine actual displacements during and post construction.

In the unlikely event that damage occurs to buildings or services as a result of settlement during the construction a range of mitigation and remediation measures can be implemented. This may include building repairs, service diversions or relocations and similar remediation measures. This is discussed in detail in the SEMP (Appendix H of Technical Report G.13).

22.5 Social Impacts

A full assessment of social effects is provided in Technical Report G.14

A full Social Impact Assessment has been undertaken for the Project and is reported in Part G (Technical Report G.14 *Assessment of Social Effects*). This social assessment provides a holistic 'lens' on the potential effects of the Project on the neighbourhood and wider community, including social, economic and cultural effects. The following is a summary from that assessment.

22.5.1 Existing Environment

The Project affects residential areas of Owairaka and Walmsley

This area includes the residential areas of Owairaka and Walmsley (to the north of Oakley Creek) and New Windsor (to the south of Oakley Creek). At the intersection of Stoddard Road and Richardson Road, there are a number of retail shops and community outlets. This retail area provides an employment source for study area residents and is envisaged by ACC as a future growth node. Local residents also travel to Avondale or Mt Roskill for shopping. There is a small group of shops on the corner of Hendon Avenue and Hargest Terrace in Owairaka. The Richardson Road industrial area is a small area of mixed use zoning along Richardson Road, which is currently occupied by a range of light industrial activities.

Figure 22.3 shows community infrastructure and sites of interest in and around Sector 9.

A number of demographic factors of the community in this area indicate that a high proportion of the community is economically or materially disadvantaged.

Education facilities in this area include Christ the King School (state-integrated), Wesley Intermediate School, Owairaka District School, New Windsor School, Wesley Primary School and a number of early childhood facilities (as shown in Figure 22.3).

Alan Wood Reserve/Hendon Park is a key reserve in the local area

Alan Wood Reserve/Hendon Park is a key reserve in the local area providing active and passive recreation opportunities for local residents. As the rail designation is vacant and has been leased by Council for open space, many people consider that this is part of the Alan Wood Reserve. Similarly, the undeveloped residential land at 25 Valonia Street contributes to the wider open space area. There is limited pedestrian connectivity between New Windsor and Owairaka other than the informal use of pipes/drains across Oakley Creek. Murray Halberg Park (located further east in Owairaka) provides both passive and active recreation

opportunities. The park is well used compared with Alan Wood Reserve/Hendon Park, mainly due to its good level of facilities and amenities. On the southern side of Oakley Creek, there is a small local reserve just off Methuen Avenue in New Windsor.

Important transport linkages in this area include the local road/footpath network and the Alan Wood Reserve walkway, which connects New North Road with Hendon Park. The pedestrian crossing on Owairaka Avenue is an important connection, which is particularly used by students at Owairaka District School. Most people living in this area work in the Auckland isthmus (including Auckland CBD).

22.5.2 Assessment - Operation[8]

22.5.2.1 *Effects of Property Acquisition*

Permanent residential property acquisition will have social impacts

As described in Section 22.2, permanent residential property acquisition will be required facilitate the project. This will reduce population size in Owairaka[9] by between 25 and 30 households. Overall, the net population loss in Owairaka may have some short term adverse impact on the ability of residents to participate in social/cultural activities, but in the long term is not expected to generate any significant impact as people join new facilities and adjust their living patterns accordingly.

Other social impacts identified in the assessment include:

- The loss of dwellings may impact adversely on community cohesiveness, given that some residents may not be able to relocate within the same neighbourhood;
- The degree of impact will be felt more by lower socio-economic demographics - as Housing New Zealand properties form a relatively large proportion of the properties required (around 50%) and resettlement tends to be a greater issue for these groups
- There are a small number of people for whom relocation may have added concern (e.g. those who have indicated that they live where they do because of people they know or because they have limited mobility and it is close to their work).

22.5.2.2 *Effects of New Motorway Structures*

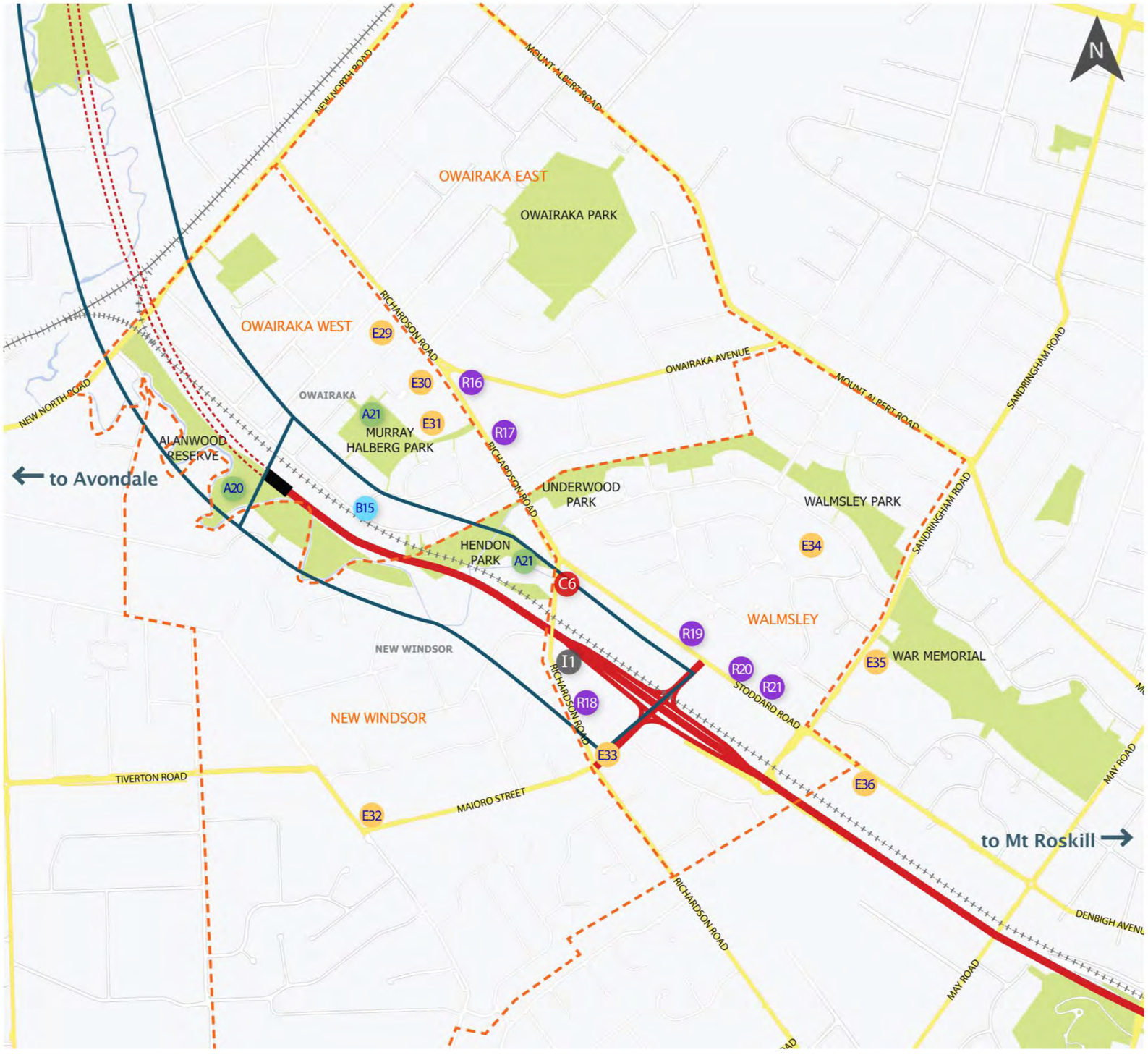
Adverse impacts from the changing form and amenity of the area

Compared to other Sectors of the Projects, residents and the community in this area will experience the greatest change in the environment as a result of emissions from the Project (this particularly relates to noise and air emissions, but is also relevant for light and vibration, see Sections 22.15 through to 22.18). Furthermore, in the consultation, one of the biggest issues of concern in this area related to perceptions and concerns of the health impacts from air discharges.

---

8 It is recognised that social impacts have been occurring in the planning phase of the Project at the local level, mainly in terms of the uncertainty caused by the Project. Further details are contained in Technical Report G.14 *Assessment of Social Effects*, and are not repeated in this AEE.

9 It is acknowledged that these impacts will occur from the construction phase, due to the timing of property acquisition.



EDUCATIONAL FACILITIES

- E29 Little Dudes Childcare Centre
- E30 Owairaka Kindergarten
- E31 Owairaka District School
- E32 New Windsor School
- E33 Christ the King School
- E34 Wesley Primary School
  Wesley Kindergarten
- E35 Wesley Intermediate School
- E36 Edukids

OPEN SPACE

- A19 Alan Wood Reserve
- A20 Murray Halberg Park
- A21 Hendon Park

PLACES OF RELIGIOUS ASSEMBLY

- R16 Hosana World Harvest Church
- R17 Sandringham - Owairaka Baptist Church
- R18 Christ The King Church
- R19 Presbyterian Church St Enoch / Owairaka Pacific Islanders Church
- R20 Samoan Assembly of God
- R21 Masjid-e-Umar Islamic Centre

COMMUNITY CENTRES

- C6 Stoddard Road

INDUSTRIAL AREAS

- I1 Richardson Road Industrial Area

RETAIL AREAS & OTHER COMMUNITY FACILITIES

- B15 Hendon Avenue Shops

OTHER

- CAU Boundaries
- Southern Ventilation Building and Stack
- Existing Railway Line
- Future Railway Line

Figure 22.3: Community Infrastructure in Sector 9

The scale of change; from the existing environment to the proposed environment with the Project, is such that it is considered there will be effects on people's way of life (particularly for those residents living in close proximity to the Project or for users of facilities, such as the open space or education sites (Christ the King School)). For example, noise emissions, while within the New Zealand Standards, still represents a significant change compared to the existing environment. However, the community will adjust to this change over time, and recognising the scale or extent of effects[10], the impacts are likely to be minor to moderately negative on people's long term wellbeing and way of life.

Changes to community character are considered to be minor to moderately negative as a result of the Project (particularly associated with the new surface motorway structures and ventilation building/stack). In the longer term, residents are generally expected to adjust to these impacts.

Positive impacts from the Oakley Creek restoration

While the form of the Project does impact the locality of this area, the amenity of Oakley Creek is expected to improve. This is considered to have an overall positive impact on the cultural values held by a number of people across the study area (e.g. those community groups who are actively involved in the management and riparian planting of Oakley Creek).

The Project will generate accessibility and connectivity improvements for local residents, which will result in positive social impacts to people's patterns of daily living. In particular, the following are noted:

Improved accessibility for residents

- Improved access to the State highway network is anticipated to benefit people by improving accessibility generally to other areas in Auckland, including places of work, community facilities and facilities of regional importance.
- The Project will divert traffic from local streets, improving travel times on local roads, increasing safety for pedestrians, cyclists and motorists, and creating the opportunity to improve public transport opportunities.
- Additional accessibility benefits are also expected for pedestrians and cyclists, as a result of the new pedestrian/cycle way parallel to SH20 in this Sector and as a result of the Hendon Bridge.

22.5.2.3 *Effects on Community Infrastructure*

Impacts on the seven business sites at Stoddard Road/Richardson Road are considered minor from a social perspective (as the business activities are expected to remain following construction of the Project). Furthermore, once operational, the accessibility benefits cited above will have moderately to significantly positive impacts with respect to the economic benefits for the Richardson Road industrial area.

Minor impacts to community infrastructure

Community education and social facilities are not directly affected by the Project and the viability of these services (e.g. school rolls) are not expected to be adversely affected by the

[10] It is noted that the adverse noise effects diminish rapidly for those residents shielded by the Project by one or more dwellings.

relatively low portion of residential land take in this area (relative to the wider community).

Given the land requirements for the Samoan Assembly of God site are limited to construction and potentially longer term for loss of carparking (at such time as the rail land corridor is developed); impacts on this facility are considered to be negative, associated with increased noise and other nuisance effects of having the motorway closer.

Potential impacts on recreation opportunities are considered to be neutral in the long-term. There is likely to be a public perception that the Project will decrease the quantity of open space in Alan Wood Reserve. However, as discussed in Section 22.2.2.2, the actual quantity of open space land available for replacement provides for a slight increase in the total open space in this area, subject to agreement with the [Auckland Council]). On this basis, the usability and enjoyment of these open space areas will be similar to the present situation today.

22.5.3 Assessment - Construction

22.5.3.1 *Effects on Residents*

Construction activities result in reduced 'liveability' for local residents

Overall, construction activities are considered to result in temporarily reduced 'liveability' for local residents. Impacts on people's quality of life and wellbeing are expected to range from minor to potentially significant negative impacts, varying according to proximity to construction areas and the duration of exposure. In particular, emissions are likely to result in some residents experiencing anxiety and/or nuisance (e.g. as a result of construction noise, dust or vibration). The following specific effects are noted:

- Some people in the community (e.g. those who stay at home during day including those that work from home, are sick or who work night shifts) could be disproportionally affected by long periods of noisy day time construction works;
- Particularly disruptive construction activities may impact on people's enjoyment of outdoor living areas, such as use of barbeque's or outdoor play areas;
- Nightworks may disrupt sleeping patterns and may cause annoyance/general disturbance among local residents (mainly those directly adjacent to construction areas);
- The proximity of some particularly 'sensitive' sites such as the Avondale Motor Park (where residents have particularly low levels of acoustic insulation), means that where the noise effects arising from night works, could include general annoyance and potentially sleep disturbance effects; and
- Vibration effects may result in anxiety or concern, particularly in relation to fears of housing or building damage.

A number of temporary Construction Yards are located in Sector 9 (Construction Yards 8 – 12). The presence of construction yards will also challenge some local resident's expectations of neighbourhood amenity, character and safety, associated with 'annoyances' such as noise, vibration, amenity impacts, perceptions of impacts from air quality and the potential for crime associated with construction of the motorway.

This may affect people's pride in the neighbourhood but is considered to have little impact on wellbeing or way of life overall, because such effects are temporary. In individual cases, it is acknowledged that a perceived reduction in house 'saleability' could restrict (but not inhibit) people's more immediate plans, however on balance impacts are considered to be minor and not widespread and are likely to be limited to the construction period[11].

Traffic disruptions during construction may cause minor impacts; restricting people's ability to go about their normal living patterns and participate in social/cultural activities during construction. However, the overall impact of such delays will be relatively minor, and able to be countered by appropriate forward planning in traffic management (see Section 22.3.4). Likewise, while pedestrian access in some areas may be more difficult, the overall impact on people's mobility is not considered to limit people's ability to go about their normal lives.

Construction will put an end to the uncertainty surrounding the Project

The commencement of construction will put an end to the uncertainty surrounding the Project during the long planning phase, providing a benefit in enabling people to move forward with their lives and future plans. It is acknowledged that the planning phase has caused a degree of anxiety and uncertainty for residents potentially affected by property acquisition.

The daily influx of temporary construction workers will also have social impacts:

- Increasing the sense of 'busy-ness' in the area;
- The construction workforce will increase demand for retail and other services (e.g. food outlets, service stations and vehicle servicing etc) and, given the duration of construction, potentially housing (particularly rental) demand.

22.5.3.2 *Effects on Community Infrastructure*

Positive and negative impacts on community infrastructure

Impacts on employment structures in Sector 9 are expected to range from minor negative to minor positive impacts during construction. Negatively, these may include a reduction in accessibility and disruptions to business areas (e.g. Richardson Road). Positively there is likely to be increased demand for retail and service business in the local area (from construction workers).

During construction the impacts on open space and recreation areas will be greater than once the Project is operational. Approximately 75% of Alan Wood Reserve/Hendon Park is required throughout construction. The loss of this open space (without mitigation) would result in a decrease in leisure and recreation opportunities for local residents. The reserve also performs an important community function in providing meeting areas and social spaces for Owairaka and New Windsor residents. Measures to mitigate construction impacts are proposed as part of the reserve reinstatement package (as discussed in Section 22.2.5).

[11] Empirical studies of valuation effects of major infrastructure projects over time have identified little relationship between Projects and the long term overall resale values (though there is some evidence that the time taken to sell can be attributed to these projects).

The usability and enjoyment of Alan Wood Reserve is expected to reduce during construction with noise, potential dust/odour and amenity impacts. As such, some reduction in recreation opportunities and enjoyment is also expected for residents in Sector 9, resulting in a minor negative social impact for these communities.

22.5.4 Mitigation – Operation

22.5.4.1 *Avoiding Effects through Design*

Project design amendments have enabled property impacts to be minimised in this Sector (compared to earlier designs). The designation footprint has avoided in the as far as practicable partial property take, in order to avoid adverse residential amenity impacts (e.g. situations where residents would lose a significant part of their outdoor living area or amenity outdoor space). The Project design has also sought to include reserve and open space replacement on a 'like for like' basis in terms of both size (quantity) and usability (quality).

In Sector 9 the design has provided the opportunity for an integrated transport corridor (with the future Avondale-Southdown Rail line) while also providing opportunities to maintain open spaces. In Alan Wood Reserve, the layout of the new motorway and reserve gives back the maximum area of linked and usable open space. The tunnel portal has been extended as far east as possible under the constraints of the Project, maximising open space in the western end of the Park.

22.5.4.2 *Mitigation and Management Measures*

The NZTA has worked closely with Housing New Zealand to provide advance warning regarding the purchase of properties from the national housing stock. This approach has enabled Housing New Zealand time to facilitate the resettlement of the individuals and families affected. This has reduced the potential scale of community disruption in advance of construction. The NZTA will continue and further develop the staged property purchase strategy, in order to minimise uncertainty within the community and to facilitate relocation of residents where appropriate.

Other proposed mitigation includes:

Communication is an important component of mitigating social impacts

- The provision of information and/or development of an education programme about the Project for the school and kindergarten communities regarding actual air quality impacts of the Project, including communicating the results of ambient air quality monitoring (via the Project website) to local schools and residents;
- Where practicable, uplift the designation over surplus land in Sector 9 once construction of the Project has been completed, where it is not otherwise required for open space mitigation or rail corridor protection;
- Contribute to a design solution for surplus land in Sector 9 (e.g. ongoing work with the community and stakeholders on urban design and open space restoration); and

- Give consideration to the amalgamation of residential titles (as practicable) to enable more comprehensive residential redevelopment following construction of remnant residential areas.

As noted a confirmed decision on the Project will assist in providing certainty for local residents and enable people to move on with their lives and make decisions that may have been delayed as a result of the uncertainty caused by the Project to date.

22.5.5 Mitigation - Construction

22.5.5.1 *Avoiding Effects through Design*

Buffer areas have been proposed within the construction yards to minimise adverse effects on adjoining sensitive uses (eg. from light spill, dust and hazardous facilities).

22.5.5.2 *Mitigation and Management Measures*

Management and mitigation measures for social construction effects include:

- The establishment of temporary sportsfields and early investment in reserve replacement;
- Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of the construction management;
- Development and implementation of a consultation and communications strategy for ongoing engagement with residents and community stakeholders during the construction period;
- As far as practicable, avoidance of construction activities in times and periods that have the potential to adversely affect the operation of education facilities; and
- Implementation of a formal complaints/feedback process as part of the CEMP.

22.6 Cultural Impacts

22.6.1 Existing Environment – Iwi with Manawhenua

Ngati Whatua are recognised manawhenua (Iwi with customary authority) within Auckland (west) and in this Sector. In this regard, Ngati Whatua has a role in managing the environment and the way it is cared for. Further information is provided in the regional assessment in Chapter 13 of this AEE.

Ngati Whatua has manawhenua status

22.6.2 Assessment of Cultural Effects – Ngati Whatua o Orakei

Project specific assessment was provided by Ngati Whatua o Orakei in 2009 (refer to Appendix E.6). Of relevance to the Project, Ngati Whatua identifies the following environmental and resource issues associated with the SH20 section of the Project:

- Green space and reserves as important for ecological health and in providing social/cultural/health to local residents. Specifically, Ngati Whatua expressed concern over the loss of reserve area from Alan Wood Reserve/Hendon Park, and the potential fragmentation of remaining land in this reserve area. Other concerns relate to visual and acoustic impacts and the importance of landscaping, planting and the improved pedestrian access;
- The mauri, amenity and ecological health of Oakley Creek are matters of concern for Ngati Whatua and effects from stormwater discharges to Oakley Creek, degradation of water quality and visual effects of the above ground motorway structures are issues they have identified. Opportunities for the future improvement of Oakley Creek were also identified as important to Ngati Whatua. Ngati Whatua states that the protection/enhancement of Oakley Creek should not be seen as a 'cost' or impediment to the Project. This is reflected in the proposal to carry out restoration/enhancement of Oakley Creek as part of the Project; and
- The creation of a physical and visual barrier between the New Windsor and Owairaka communities was identified as a concern. It is noted that the Hendon Bridge will enhance physical connectivity between these areas, although there will be a greater sense of perceived disconnection between these two areas given the visual prominence of the motorway.

Updated comment has been sought from Ngati Whatua o Orakei. At the time of writing this AEE no additional comment has been received.

22.6.3 Mitigation of Cultural Effects

These issues have been taken into account in the technical assessments and are reflected in the design of the Project and in the scope and design of the mitigation measures proposed.

Cultural issues identified have influenced Project design and mitigation

Reserve reinstatement measures (including the replacement of open space land on a 'like for like' basis, landscaping and visual and acoustic screening, and landscaping) serves as important mitigation for the replacement of open space impacted by the Project.

The proposed restoration/rehabilitation of Oakley Creek (see Section 22.13.5.2) seeks to mitigate (and in some areas, enhance) environmental, ecological and amenity/landscape effects. This will be managed through the Oakley Creek Re-alignment and Rehabilitation Guidelines prepared for the Project. Stormwater treatment (see Section 22.10) is a further important measure in terms of protecting the water quality and mauri of Oakley Creek.

The Hendon Bridge (connecting Owairaka and New Windsor, over SH20 and the future Avondale Southdown rail line) will enhance physical connectivity between New Windsor and Owairaka (given that there is currently no formal connection between these two areas in Alan Wood Reserve).

22.7 Landscape and Visual

A full visual and landscape effects assessment is provided in Technical Report G.20

The following provides an assessment of the landscape and visual effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.20 *Assessment of Visual and Landscape Effects*.

22.7.1 Existing Environment

The existing landscape is dominated by open space

The existing landscape is dominated by open space (Alan Wood Reserve and Hendon Park) surrounded primarily by residential areas. As Alan Wood Reserve extends southwards and merges with Hendon Park it becomes much wider, more open and is more exposed to surrounding residential areas. Oakley Creek runs through the open space, and as it moves through the southern part of the open space area it becomes increasingly more modified, effectively becoming a drainage channel.

In addition, the catchment is 'widened' by the increasing elevation of housing development e.g. on the ridges around Methuen Road, New Windsor Road and north of Maioro Road. The visual catchment north of the Project remains largely contained by residential dwellings along Hendon Avenue adjacent to both open space areas. Further to the south-east (from the Richardson Road / Stoddard Road intersection) the catchment is increasingly confined to the shops abutting the intersection and the adjoining Stoddard Road/Richardson Road Industrial Area.

On the more elevated slopes generally south of the Project, the 'layering' of housing is very pronounced through to Whittle Place and Valonia Street, although the 'overlapping' of houses, garages, fencing and planting on those slopes also limits the degree of exposure to both Alan Wood Reserve and Hendon Park from most individual properties.

Christ the King Catholic Church and Primary School delineates the western side of the Project catchment to the south. Occupying the north side of Richardson Road between the new bridge and the Maioro Street Interchange, the Church and Primary School also mediate between the State highway corridor and the bulk of the residential area south of Richardson Road.

22.7.2 Assessment - Operation

Catchments are identified in Technical Report G.20

The visual catchment and related audiences potentially affected by the Project have been identified within Sector 9 for the assessment of landscape and visual effects. In this Sector 45 public realm viewpoints were investigated and 6 private residential view points were assessed.

In summary, the potential landscape, amenity and natural character effects of the Project, on the outlook of many residents, include significant adverse visual and landscape impacts. The presence of the ventilation stack and portal building will exacerbate perceived effects. However, it is acknowledged that exposure to direct effects of the motorway will be concentrated around the immediate catchment.

The removal of housing along Hendon Avenue will be a significant visual effect in its own right, creating a new visual sub-catchment along Hendon Avenue to Alan Wood Reserve and the new motorway structures. The direct impacts on residential areas one back from Alan Wood Reserve would be quite low. Bunding, noise walls and planting around the periphery of the motorway (as proposed in F.16 *Urban Design and Landscape Plans*) will also isolate the infrastructure and in the long term, soften the landscape.

Although buffered by a layering of planting and existing trees, the occupation of this open space by the Project (more specifically the ventilation building) will have a significant impact on the perception of the residual reserve (visible from residents including those along Hendon Avenue, Avondale Motor Park and other properties overlooking the reserve on more elevated parts of Methuen Road).

In the short to medium term the combination of stack and portal building will have a significant effect

In the short to medium term at least, the combination of stack and portal building will have a significant effect on the character of both the motorway corridor and Alan Wood Reserve for users of the open space and for residents in the area (e.g. both public and private residential views). In the long term it is likely that the building (and stack) will remain visually prominent on the local landscape due to its size and the limited opportunities for this to be fully screened by planting.

The motorway corridor between Richardson Road and Maioro Road passes through a linear area of vacant space flanked by a line of commercial and industrial uses. As a result the effects in this area are minor at worst, with existing businesses effectively isolating the motorway and planting softening and improving the existing situation.

22.7.3 Assessment - Construction

The construction works will have significant landscape and visual effects for the duration of the construction phase. Impacts on local amenity values occur due to the removal of dwellings (included in the land use component) and the development of the motorway infrastructure. The landscape effects on Alan Wood Reserve will be particularly significant. This outcome is a consequence of the Project in this sector.

As noted in the social assessment (section 22.5.3.2), a large part of Alan Wood reserve will not be accessible during construction. Inevitably, the period of initial transformation from a 'public open space' into a motorway corridor will have significant effects on local landscape and amenity values (regardless of screening as mitigation). The location of work compounds and site offices, together with vehicle access points and the staging of works, will impact on some residents more than others and, as such, add a another layer of magnitude for a smaller number of residents, for the duration of construction activities.

22.7.4 Mitigation - Operation

Landscape and urban design for mitigation

Enhancement planting along the length of the works is proposed. Bunding, noise walls and planting around the periphery of the motorway (as proposed in F.16 *Urban Design and Landscape Plans*) will provide the means to isolate the Project infrastructure from viewing catchments and in the longer term, soften the landscape and as far as practicable mitigate the adverse effects. In particular, the proposed 'basalt rock forest ecotype' and 'mature canopy species' planting are considered important visual mitigation.

Further design work (architectural treatment) on the appearance of the ventilation building and stack may also assist to integrate these structures into their wider suburban settings.

22.7.5 Mitigation - Construction

Early works and screening

The following mitigation is proposed:

- The installation of solid screen / safety fencing during the construction period to minimise views into the construction areas; and
- Early placement of bunding and noise walls to screen the construction area in Alan Wood Reserve.

22.8 Amenity Trees

22.8.1 Existing Environment

A Schedule of Trees for the Project area is in Appendix E.7

The majority of existing trees in this Sector are located within Alan Wood Reserve. This includes juvenile native species which are establishing well and some significant mature trees. There are no "scheduled trees" identified within the District Plan within this sector. A Schedule of Trees for the Project area is in Appendix E.7 of this AEE.

22.8.2 Assessment - Construction

Trees along the alignment will require removal

The majority of existing trees located within Alan Wood Reserve within the alignment of the proposed 'at-surface' carriageway will require removal. This includes several large groups of trees such as mature Flowering Cherry trees and a stand of large mature Gum trees, which are situated immediately adjacent to the toilet block in Alan Wood Reserve.

These Gum trees are considered to be some of the most significant specimen trees in the Project area, in terms of their overall volume, form and contribution to the locality (However, these trees are required by the alignment and the effect of their removal considered in the overall landscape and visual assessment, see Section 22.7). Additionally a large Macrocarpa tree and Pine located on the southern side of Alan Wood Reserve will require removal due to the intention to realign the existing stream.

Consideration has been given to existing trees in locating the proposed Construction Yards (e.g. to avoid significant areas of trees). In this regard, those trees bordering Oakley Creek have been avoided in the location of Construction Yard 9. It is noted that some trees within the Construction Yards in Alan Wood Reserve area may require removal and a management plan approach is proposed to address this.

Within the area of proposed Construction Yard 12 (at the Richardson Tavern) there are a number of trees which currently exist. These trees are of relatively poor to average examples of the species and not of a particular good status (as such their removal is not significant)[12]. Vegetation situated immediately north - northwest of the Tavern carpark area consists of weeds species[13] and Willow trees. Again, removal of these trees is not significant.

22.8.3 Mitigation Measures

It is proposed that detailed construction planning shall, where practicable, give consideration to retaining valued trees (i.e. where such trees are not required for the permanent works of the Project, consideration will be given to construction methods that avoid the need for tree removal). It is proposed that this planning and management can be provided through the Construction Environmental Management Plan and associated management plans (Technical Report G.21).

The loss of trees can be mitigated by appropriate landscape and specimen planting

Where removal of these trees is required appropriate mitigation and landscape planting can mitigate any effects, in accordance with the urban and landscape design plans proposed (see Plans in F.16 of this AEE). Specifically, this area proposes planting with 'basal rock forest ecotype'.

22.9 Streams

Technical Report G.15 provides a more detailed assessment of effects on stream flows

The following provides an assessment of the effects on streams as a result of the Project, particularly in relation to the proposed stream diversions. This is a summary of the detailed assessment undertaken in Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*. Stream works for the Project include stream realignment and rehabilitation and structures over the stream.

12 Specimens include a Lemonwood, Pohutukawa, Kohuhu, Bottlebrush and three Willow myrtle trees.

13 Privet, Woolly Nightshade

22.9.1 Existing Environment

22.9.1.1 *Existing Catchment*

Oakley Creek is the biggest stream in Auckland City. It has a substantial waterfall (approximately 6m high) in its downstream section approximately 900m above its mouth (see also the description of this feature in Chapter 8 of this AEE).

Oakley Creek is an open channel within Sector 9. In this area the alignment of the stream follows the edge of the basalt geology which forms sections of the eastern banks. This is also the boundary of a volcanic aquifer and there are groundwater inflows into the stream.

22.9.2 Assessment - Operation

22.9.2.1 *Streamworks Assessment*

In-stream works will be undertaken in Sector 9. Effects of streamworks relate to:

Oakley Creek will be permanently realigned

- Changes to stream length;
- Changes to stream morphology;
- Changes to flow.

The proposed stream realignments are shown in the Plans in Part F.14 (Streamworks and Stormwater Discharges) in this AEE. A total of (approximately) 220m of the Stoddard Road tributary and 790m of Oakley Creek will be realigned (with a combined overall length of approximately 1km). These realignments will result in the waterway being shorter than existing, resulting in a total loss of stream length estimated at approximately 137m, though with rehabilitation works there is proposal to increase some areas of stream by introducing meanders (reducing the total stream length lost to around 130m). The rehabilitation works will occur in sections of the stream beyond the immediate area of realignment. This is shown in Table 22.4.

In these areas the existing stream is channelised in many portions with manmade basalt rock walls. The proposed steam realignments and rehabilitations are based on a naturalised channel form, and will increase and enhance the aquatic and terrestrial habitat, and make the stream more amenable and accessible to the public. In addition, the proposed Project structures interact with the 100 year ARI flood plain. Hydraulic design will mitigate effects of flooding.

In undertaking the proposed stream realignments the following design features will be included:

Stream realignment is not expected to have adverse effects on morphology

- A cross sectional profile that provides for a natural staged channel form (e.g. between normal and high flows);
- Cobble materials will be used for bed materials;
- Naturally sourced silt material will be deposited in pool areas;
- Planting of stream banks and floodplain (to provide shading and 'roughness'); and

- Riffles will be formed with basalt rock across the base of the stream.

The approach to undertaking these streamworks is outlined in the *Oakley Creek Realignment and Rehabilitation Guidelines* included as Appendix C to Technical Report G.6. Figure 22.4 summarises the areas of proposed stream realignments (this plan also identifies areas of rehabilitation, discussed further in Section 22.13).

The change to a natural channel type for the stream morphology (discussed above) is likely to be beneficial to the flow hydraulics. The proposed meander pattern and riffle-run-pool sequences will add complexity to the flow hydraulics, particularly compared to the existing basalt rock wall channels (which provides for faster flowing water). In addition, the proposed riparian planting (see the plans in F.16 of this AEE) will increase the 'roughness' of the channel, which will also slow flows. These changes will have a positive effect on flow hydraulics (and will be beneficial to aquatic fauna, see Section 22.13)[14].

The flow hydraulics will be improved b works

This approach to the realignment will create a variable bed type. Therefore, the stream morphology is not expected to change significantly from the 'natural form' and there are not expected to be any adverse environmental effects. The ecological effects of the changing stream morphology, including stream length, are discussed in Section 22.13 of this AEE.

Table 22.3: Oakley Creek Realignments and Calculated Loss of Stream Bed Area (approx)

Stream Realignment	Existing Length (m)	Proposed Length (m)	Net length lost (m)	Stream width (m)	Streambed area lost (m^2)
Stoddard Rd Tributary Realignment	138	127	11	1.7	19
Stoddard Road Tributary Realignment II	79	71	8	1.8	14
Oakley Creek Realignment under SH20 Bridge	125	124	1	2.5	2
Oakley Creek Realignment @ 25 Valonia Street	148	114	34	2.1	71
Oakley Creek Realignment @ Methuen Road	230	214	16	2.1	34
Oakley Creek Realignment @ Alan Wood Reserve	287	220	67	2.1	141
Total	1,007	870	137	-	281
Rehabilitation length added	135	141	6		
Revised Total	1,142	1,011	131		

22.9.2.2 *Structures in Watercourses*

In addition to the realignment works, the Project requires crossing of Oakley Creek (Oakley Creek bridge (SH20)). The bridge span would require a road bridge of some 40m with a span of 12m. The channel for the stream below the bridge would be approximately 4m wide and 1m high (with a high flow channel of 12m).

Sediment discharge and erosion are avoided by Project design

[14] This is considered to provide an overall improvement for freshwater aquatic habitat, which is discussed further in more specific reference to the freshwater ecology assessment, see Section 22.13.2.

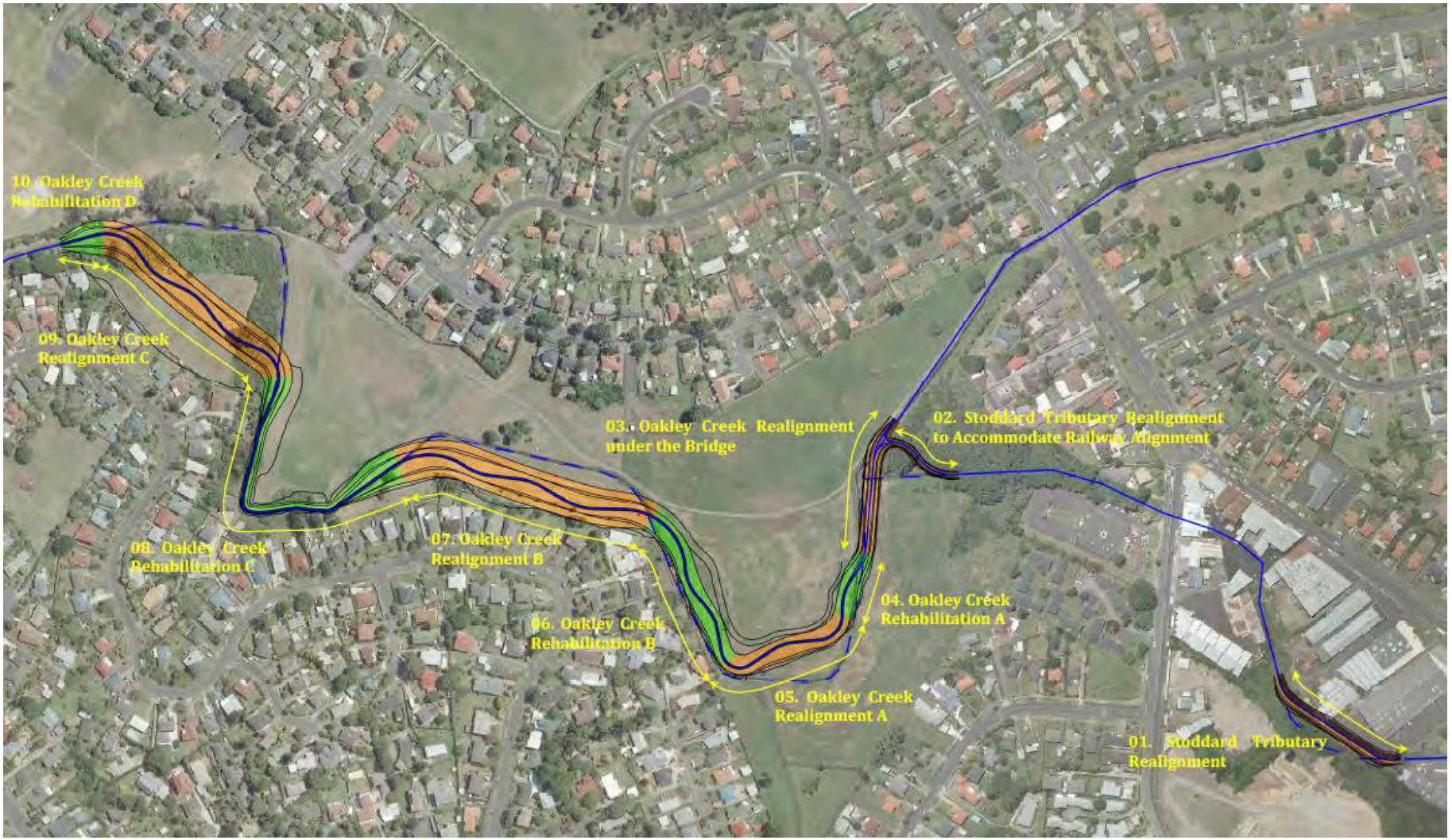


Figure 22.4 Proposed Realignment and Rehabilitation Areas of Oakley Creek and Stoddard Road Tributary

Options were considered for the stream crossing and a bridge option was selected as the 'best practicable option' (see Technical Report G.15 for detail, Section 8.2). In particular, the following environmental effects of the bridge crossing were identified:

- Hydraulic efficiency - Clear span under bridge allows greater hydraulic efficiency, avoiding potential head losses;
- Blockage – The risk of blockage of the channel is considered low due to the wider span;
- Habitat / Riparian Planting - the opportunity for planting vegetation on the banks of the stream channel is low (due to shading), the habitat within the stream is less affected than by culverting.

22.9.3 Assessment – Construction

22.9.3.1 *Sediment*

It is noted that the natural channel in the lower Oakley Creek is mostly free of erosion; in those areas where vegetation has been re-established. The measures proposed above will avoid potential erosion in the realigned stream areas (and resulting sediment generation) as a result of the works.

Sediment discharge and erosion are avoided by Project design

Potential effects on the stream during construction relate to sediment contamination (and particularly the visual and ecological effects of sediment contamination, which are further discussed in respect of freshwater ecology in Section 22.13).

22.9.4 Mitigation – Operation

22.9.4.1 *Avoiding Effects by Design*

The bridging (rather than culverting) of Oakley Creek was considered to avoid potential adverse effects associated with hydraulic efficiency, risk of blockage, and environmental benefits (ecological).

22.9.4.2 *Mitigation*

Key principles to mitigating and avoiding potential adverse effects on the stream as a result of streamworks include the following:

Implementation of the Restoration and Rehabilitation Guidelines will manage the effects of the proposed Streamworks

- Restoring channelized sections of the stream with an appropriate natural bank profile, in accordance with the *Oakley Creek Realignment and Rehabilitation Guidelines* included as Appendix C to Technical Report G.6. This includes:
    - Allowing for a cross sectional profile that resembles a natural staged channel, including a permanent flow channel (e.g. berms to hold the 100 year event);

  - Applying erosion and sediment control measures using an adapted stream profile and biotechnical construction techniques; and
  - Designing for a no 'net loss' of functional stream value following mitigation;
- Retaining the existing stream profiles that are unmodified to the extent practicable;
- Limiting works within the watercourse to stream bank slumping and "nuisance" areas of superficial erosion;
- Rehabilitating some 343m of the Oakley Creek within the Project Area, in accordance with the *Oakley Creek Realignment and Rehabilitation Guidelines* to improve the morphology and flow hydraulics of the waterway throughout the length of the waterway in the Project area (1.3km);
- Provide for increased functional values of re-aligned streams; and
- Operational sediment and erosion control (e.g. following construction works), are proposed:
  - The riffles within the new stream bed to provide grade control, preventing bed erosion.
  - As set out in the realignment and rehabilitation guidelines, it is proposed that basalt lining materials will be re-used in any areas considered to be susceptible to erosion, for example the toe of banks.
  - Stablising the banks of the stream with geotextiles and planting.

22.9.5 Mitigation – Construction

Sediment during construction will be managed in accordance with the *Erosion and Sediment Control Plan* (Technical Report G.22). In summary the following measures are proposed to manage sediment disturbance or erosion:

- The new stream alignment will be formed and fully stabilised prior to diversion of Oakley Creek into these realignment areas.

22.10 Stormwater

Technical Report G.15 provides a more detailed assessment of effects on stormwater

The following provides an assessment of the stormwater effects of the Project on existing stormwater systems and flows. This is a summary of the detailed assessment undertaken in Technical Report G.15: *Assessment of Stormwater and Streamworks Effects.*

22.10.1 Existing Environment and Proposed Works

22.10.1.1 *Catchments*

The existing catchment includes Oakley Creek which is an 11.3km stream with its headwaters in the vicinity of Keith Hay Park in Hillsborough. It flows through Mt Roskill, Wesley and Owairaka. It has a catchment area of 12.9km^2, and has an estimated 84% of its catchment urbanised.

Oakley Creek is a major urban stream

There are a number of major culverts upstream and downstream of Alan Wood Reserve; overall in this area there is some 400m of culverting (e.g under Richardson Road to the south and New North Road, railway and Bollard Ave to the north). There are also culverts off the Stoddard Road Tributary[15].

Notable lengths of the stream are culverted in the area

22.10.1.2 *Drainage of the Proposed State Highway*

Sector 9 has been broken into two catchments for the purposes of operational stormwater treatment devices, based mainly on elevation and reticulation restrictions. These are the 'Alan Wood Wetland Catchment' and the 'Valonia Wetland' (see sheet 109 of the plans in F.2 *Operation Scheme Plans* for the location of these proposed wetlands), and the plans in F.14 *Streamworks and Stormwater Discharges* for further detail.

Two catchments for stormwater treatment

The catchment for the Alan Wood Wetland consists of the impervious SH20 carriageway surface (extending from the southern tunnel portal to just north of the proposed Oakley Creek bridge (SH20)). Approximately half of this catchment is below the surrounding ground level in the motorway trench as it approaches the tunnel portal, and runoff from this area will be pumped to the treatment device location.

The catchment for the Valonia Street Wetland includes the SH20 carriageway surface, from just north of the proposed Oakley Creek Bridge (SH20) to the Maioro Interchange. It includes the school site (Christ the King) and the Maioro Street Interchange overbridge and ramps.

Most of the new alignment will run approximately parallel to Oakley Creek in Alan Wood Reserve. The existing catchment draining to Oakley Creek in Alan Wood Reserve, is a mixed urban use area suffering from water quality issues common to residential catchments, including high levels of suspended solids, metals, hydrocarbons and elevated temperatures, BOD and faecal contaminants (from combined sewer overflows). In addition there are dense weed and algae blooms (periodically) as well as floatable litter.

Oakley Creek Stream includes culverts at Bollard Avenue, New North Road and the North Auckland Railway Line

At the downstream end of Alan Wood Reserve, the stream is culverted under Bollard Avenue, New North Road and the North Auckland Railway Line ('Western Line'), with open channel sections in between. At the Bollard Inlet there is a high flow culvert that runs directly under New North Road and the railway line and discharges back to Oakley Creek.

---

15 The Stoddard Road Tributary is culverted under the Mt Roskill section of SH20 and there are consented works for culverting under the Maioro Interchange.

22.10.2 Assessment – Operation

Two stormwater wetlands are proposed in this area. The catchment area for the Alan Wood Wetland is 2.94 ha and the catchment area for the Valonia Wetland is 11.59ha and will treat stormwater from both the new and existing impervious areas. The potential effects of the wetlands are water quality and changes to water quantity (in the receiving environments; Oakley Creek).

22.10.2.1 *Assessment of Water Quality*

The stormwater from motorways contains pollutants, such as heavy metals, suspended solids and hydrocarbons. There is currently 1.04ha of untreated 'impervious area' (particularly surrounding local roads) within Sector 9. It is proposed to treat 100% of this area as part of the Project, as well as 100% of the new impervious area created by the State highway carriageway and associated works (9.56ha). The total area of stormwater treatment is a catchment of 10.60ha.

These wetlands will provide: quality treatment (removing 75% of the total suspended solids[16]), extended detention and flood attenuation. The wetlands are considered to be the 'best practicable option' for the two catchments (for example, they provide superior water quality treatment to wet ponds).

Provided that the treatment systems (wetland ponds) are developed in the manner proposed by the Project, and taking into account proposals to treat existing untreated impervious areas, the effects of stormwater on water quality will be no more than minor. Specific effects of these residual contaminants and changes to water quality are considered in the ecological effects assessment (refer to Section 22.13).

22.10.2.2 *Assessment of Water Quantity*

The conversion of existing pervious surfaces to impervious area within a catchment increases the volume of runoff and peak flow rates. The volume of stormwater runoff for the operational phase has been minimised as far as practicable by limiting impervious catchment sizes for the Project[17].

Attenuation of peak flows has been provided for within the treatment devices which will discharge to Oakley Creek once the Project is operational. The stormwater attenuation proposed will include extended detention to protect the stream and peak flow attention for flooding events up to the 100 year ARI event. The design provides for peak flows to be reduced from the predevelopment level (see Section 6.11.3 for more detail on the specific design level for water quantity treatment).

---

16 This is based on an average annual removal of total suspended solids.

17 It is noted that the adoption of the tunnel alignment, with trench cutting and below ground road surface, has minimised the impervious area of the Project.

Assessment has also been undertaken to consider the potential effects of scour (erosion) of the outfalls from the stormwater treatment devices. In this Sector, the outlet pipes will include a wingwall and rip-rap rock apron (from the swales (2) and the wetlands (2))[18]. These devices will appropriately avoid potential adverse effects of erosion within the receiving environment (the Oakley Creek).

22.10.3 Assessment - Construction

The catchment for temporary stormwater includes the area requiring permanent stormwater treatment, with the addition of the proposed construction yards (See Plans F.6). In addition, provision has been made for treated water from the tunnel construction.

22.10.3.1 *Assessment of Water Quality*

In accordance with the ARC's guidance, the construction planning has sought that water quality treatment during construction will seek to remove at least 75% of suspended solids, from runoff. During construction, stormwater from 100% of areas of construction for the Project (approximately 4.99ha) will be treated in accordance with TP10.

22.10.3.2 *Assessment of Water Quantity*

Attenuation within the wetlands is proposed by providing storage and detailing outlet configurations. Extended detention has been provided for all stormwater discharges to stream environments within the Project, minimising the potential for erosion of the downstream channel during construction.

22.10.3.3 *Concrete Batching Plant*

Within this Sector, a concrete batching plant is proposed, to supply shotcrete for the liner construction of the driven tunnel. The runoff and waste water from the concrete batching plant will require specific treatment due to the high sediment loads and elevated pH; thus the runoff will need to be treated separately to that from the construction yards. The concrete batching yard will comprise the "at risk" or "dirty" areas of the site whilst the remainder of the construction yard including the aggregate storage area, any covered storage of additives and general vehicle movement areas will be the "clean area[19]".

---

18 The general structure and design for outfall structures is provided in F.14: *Streamworks and Stormwater Discharges*.

19 The runoff from the clean area will drain to the temporary stormwater treatment device for that particular construction yard for treatment.

"Dirty water" will be managed by reusing as much water as possible for concrete production. The waste water from the concrete batching plant, e.g. the truck washdown, and the runoff from the plant yard will be treated and stored onsite in a storage/reuse tank, before either being reused or routed through construction yard stormwater ponds for further water quality polishing prior to discharge. The storage/reuse tank will consist of a container modified for the removal of sediment and pH correction.

Details of the concrete batching plant operation are described in Technical Report G.22 *Erosion and Sediment Control Plan*. Full details of the concrete batching plant operations are described in Appendix F of Technical Report G.15 (the Concrete Batching and Crushing Plant Management Plan). Temporary stormwater details are provided in the Temporary Stormwater Management Plan (Appendix E of Technical Report G.15).

22.10.4 Mitigation – Operation

The proposed treatment devices will increase the level of existing stormwater treatment. To enable the proposed stormwater treatment devices to remain effective, there will be ongoing maintenance and management required. These measures are set out in the Operational Stormwater Management Plan (Appendix D of Technical Report No. G.15 *Assessment of Stormwater and Streamworks Effects*).

22.10.5 Mitigation – Construction

As noted above, the proposed erosion and control measures implemented during construction will be used to manage stormwater until the permanent stormwater treatment devices are in place. The erosion and sediment control measures will be undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan*.

22.11 Groundwater

Technical Report G.7 provides further detailed assessment of groundwater effects

The following provides an assessment of groundwater effects of the Project, including consideration of the impacts of groundwater flows during and following construction. This is a summary of more detailed assessment undertaken in Technical Report G.7: *Assessment of Groundwater Effects.*

22.11.1 Existing Environment

The following description of the existing environment covers the alignment of the tunnels, which commence (up to the tunnel portals) in Sector 9. A long section showing the geology along the tunnel alignment is provided in Plan Set F.10 *Geological Profile*. This indicates that there are seven hydrogeological units along the alignment of the tunnels (this extendes from Sectors 7 through to 9). Recorded groundwater levels indicate a northerly gradient to groundwater flows.

Oakley Creek runs through Sectors 7, 8 and 9. Oakley Creek can be described as a 'flashy river'; with significant flow variations and a low base flow component. The majority of the flow in the stream is sourced from quick flow (e.g. rainfall runoff, stormwater discharges etc.). Approximately a third of the stream flow is sourced from stored sources, and groundwater recharge into the Creek is likely to be only a small portion of this (approximately 30%).

22.11.2 Assessment

Taking of groundwater has a number of potential effects on the environment. Some of these relate to the built environment (addressed through the ground settlement effects that occur from groundwater drawdowns), while others relate to effects on receiving environments; for example, the potential effects on flows of Oakley Creek and the potential for contaminants in groundwater to be released (e.g. groundwater flows from landfills)[20].

2-D and 3-D modelling has been undertaken to assess potential groundwater effects

Within Sector 9, the key potential issues or environmental effects of groundwater relate to changes to groundwater flows in the construction and operation of the southern portals, and the resulting impacts on Oakley Creek.

22.11.2.1 *Southern Portal*

Due to the higher groundwater table within the basalt at the southern extent of the tunnels, a permanent drain is proposed at the Southern portal to reduce pressure on the walls. A grout curtain (at approximately 20m distance from the walls) will be used to cut off groundwater in the basalt. This will result in a further reduction in water pressure and limit groundwater inflows to the portal area.

A grout curtain will be installed in the underlying basalt to limit groundwater inflows to the southern portal

As the southern portal and approaches will be fully drained, the greatest drawdown will occur when long term steady state conditions are achieved. The modelling results suggest drawdown of between 2m and 15m immediately adjacent to the walls of the portal can be expected, with measureable drawdown extending no more than 100m. The magnitude and extent of drawdown is a function of the basalt permeability which will vary according to the degree of fracturing and inter-connection between fractures. Therefore there may be locations where drawdown could extend a lesser or further distance. Potential settlement effects associated with this level of drawdown are considered to be minor.

22.11.2.2 *Oakley Creek*

Potential effects on Oakley Creek from the drained southern portal are expected to be less than minor. Modelling of the long term situation suggests that groundwater inflows to the Creek could reduce by up to 6%, however as groundwater inflows make up only a small proportion of the Creek base flow (estimated to be around 30%), the actual reduction in Creek flows will be only a fraction of this.

---

[20] In order to assess potential groundwater effects, 2-D and 3-D groundwater models have been developed. This is described in detail in Technical Report No.G.7 Assessment of Groundwater Effects.

22.11.3 Mitigation Measures

Potential effects associated with groundwater drawdown are predicted to be less than minor. It is proposed that a comprehensive groundwater monitoring programme be established prior to, during and post construction to monitor potential effects on groundwater and demonstrate that the assessed effects are realised.

Groundwater monitoring will be undertaken pre-construction, during and post construction to monitor groundwater levels along the alignment of the tunnel

If groundwater drawdown occurs (as an advance to ground settlement and building effects), the monitoring can be used as a trigger to initiate more comprehensive settlement monitoring and/ or implementation of mitigation measures, if necessary.

The proposed groundwater monitoring programme is set out in detail in Appendix H (Groundwater Management Plan) of the Technical Report G.7 *Assessment of Groundwater Effects.* Monitoring includes:

- Establishing a series of groundwater monitoring bores along the alignment of the tunnel (1 in Sector 9).
- Monitoring the groundwater bores regularly at least 12 months prior to, during and up to 3 years post construction.
- Comparing the results against trigger levels that have been established based on the pre-construction monitoring results.

The groundwater monitoring will be undertaken in conjunction with the settlement monitoring proposed in Technical Report G.13 *Assessment of Ground Settlement Effects*.

The results of the groundwater monitoring would be assessed monthly against the trigger levels. Where a trigger level is exceeded, a course of action would be put in place. Where an alert trigger is exceeded, this would initiate additional monitoring of settlement marks, or in the event that an alarm trigger is exceeded, cessation of construction activities that have resulted in the drawdown until groundwater levels have returned to sub-alarm levels.

It is also proposed to establish continuous monitoring locations along Oakley Creek, to monitor baseflows and the potential effects of groundwater drawdown (1 of these will be in Sector 9). Monitoring would be undertaken at least 12 months prior to, during and up to 12 months following completion of the lining of the tunnel.

22.12 Effects on Herpetofauna

A full assessment of effects on herpetofauna is provided in Technical Report G.8

The following provides an assessment of the ecological effects of the Project on herpetofauna (frog and reptile species). This is a summary of the detailed assessment undertaken in Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*.

22.12.1 Existing Environment

The land around Sector 9 contains a variety of habitats. Typical types range from rank grass and scrub, regenerating bush and older, established bush. The vegetation in this area includes patches of mixed native and exotic scrubland and stands of mature trees. Although large areas of short mown grass exist and are not considered suitable as a lizard habitat, the edge habitat where the mown grass meets scrubland/bush habitats, is likely to provide suitable habitat for native lizards.

Two species of lizards (rainbow skinks and copper skinks) were detected within this area however only Copper skinks are native to NZ. Copper skink breeding populations were found at Hendon Park.

22.12.2 Assessment – Construction

The main potential effect on copper skinks is likely to be during construction, and the potential disturbance to their habitat.

The clearance of vegetation and habitat features may result in adverse effects to native herpetofauna (e.g. direct injury or mortality) as well as a reduction in the availability of habitat and resources (i.e. food and shelter). Such habitat clearance may also result in indirect mortality if displaced lizards fail to establish in adjacent areas (due to habitat competition).

Noise and vibrations created by construction activities are likely to have short term effects however these are considered to be no more than minor given that the Project assessment identified populations adjacent to existing SH16 traffic (e.g. in Sectors 1 through 6).

The magnitude of adverse effects is considered significant for the resident skink populations in this Sector, as the extent of vegetation clearance (habitat clearance) in this area is estimated to be between 60% and 100% of the current habitat.

22.12.3 Mitigation - Construction

Potential adverse effects on the copper skink population can be mitigated by relocating the skink population in this area to sites or habitat outside of the construction footprint (e.g. beyond the construction areas in the designation or beyond the designation).

The process for this mitigation is generally proposed to be managed through the implementation of the Ecological Management Plan (Relevant sections contained within Appendix A of Technical Report G.8 *Assessment of Herpetofauna Ecological Effects*)[21].

This process provides for the collection of lizards from the construction areas prior to and throughout vegetation clearance, for identification of suitable habitats for relocation of

[21] A separate approval process will be required under the Wildlife Act for the copper lizard relocations.

lizards, including (if necessary) the planting of areas within the network and habitat enhancement, pest management and post release monitoring. Suitable habitat has been identified in reserve areas (e.g. at Harbutt Reserve and Heron Park) and within the State highway network (e.g. SH20 south of Maioro Interchange). It is noted that, for Harbutt Reserve, additional habitat enhancement to account for the existing skink population would be warranted (subject to agreement with Council).

22.13 Freshwater Ecology

A full assessment of effects on freshwater ecology is provided in Technical Report G.6

The following provides an assessment of the ecological effects of the Project on freshwater ecology. This is a summary of the detailed assessment undertaken in Technical Report G.6 *Assessment of Freshwater Ecological Effects*.

22.13.1 Existing Environment

Oakley Creek has relatively low ecological health

The ecological values of Oakley Creek are considered to be low and similar to other urban catchments in terms of physical habitat modification and diversity and sensitivity of macroinvertebrates. The only native fish with permanent populations are short-fin and long-fin eels, which are tolerant to a wide range of adverse environmental variables, including elevated levels of suspended sediment. Two introduced pest fish (mosquito fish and goldfish) are also present.

Overall, within the Project area Oakley Creek has relatively low ecological health in terms of physical habitat modification and diversity and sensitivity of macroinvertebrates. Water quality is low but is similar to other urban catchments. The Stream Ecological Valuation (SEV)[22] scores in the parts of the stream directly affected by the realignment required in Sector 9 (Stoddard Road and Hendon Park) are generally low (0.39 and 0.34 respectively)[23]. The physical habitat of this section of the Creek is shown in Table 22.3.

Table 22.4: Physical Habitat of Oakley Creek in Sector 9

Variable	New North Road to Richardson Road
Modification	Moderate (channelised sections)
Riparian Vegetation	Grass with some riparian trees/shrubs
Overhead Shade	Poor, no canopy
Substrate	Soft sediment, boulder sections
Fish habitat	Moderate (substrate and bank vegetation)
Fish access	Poor (natural waterfall downstream)
Water Quality	Poor (stormwater, CSOs)

[22] Calculated in accordance with the protocols described in ARC TP302.

[23] Sites scoring less than 0.4 are considered to have low functional values, while those scoring above 0.8 have high values.

22.13.2 Assessment - Operation

The adverse effects on freshwater ecology relate primarily to the works proposed on the streams and waterways of the Project. In particular, these effects include discharge of contaminants to these waterways and the physical changes in habitat within the waterways (e.g. resulting from realignment and from shading or change from structures).

22.13.3 Sediment and Contaminant Discharges

Oakley Creek is considered to be a high-risk area in terms of potential adverse freshwater effects, as the stream is a contained environment (in that there is no lateral dispersal of sediment, with all sediment discharged increasing the stream's base load and potentially affecting the downstream environment all the way to the stream mouth). While the stream is a contained environment, the sensitivity of freshwater biological communities to the predicted increases in suspended sediment is relatively low.

During operation, all stormwater discharges to Oakley Creek will be treated. The Project will represent approximately a 1% increase in the total impervious surface stormwater discharge to Oakley Creek. While it will have relatively high contaminant load (being stormwater runoff from a road) it will be treated. Overall, it is expected that the future load of contaminants from the Project in Sector 9 will represent some 6% of the total load[24].

As noted earlier, the sensitivity of biological communities in Oakley Creek is relatively low and therefore this small percentage increase of contaminant loads is considered unlikely to have any significant adverse effects on biological communities.

22.13.3.1 *Habitat Loss*

As noted in Section 22.9, sections of Oakley Creek will be realigned to allow for the construction of the Project. Overall, approximately 137m of the stream will be lost[25]. As with the bridging which reduces the impact of culverting from the waterway (discussed in Section **Error! Reference source not found.**), the proposed realignments also provide for the Project while avoiding the need for piping or culverting works.

As noted in Section 22.9.2.1, the design of the realignments has been undertaken in some detail, in accordance with the *Oakley Creek Realignment and Rehabilitation Guidelines*, which are Appendix C of Technical Report G.6. It is considered that, the habitat development proposed with the realignment will mean that the waterway will be in better condition than it is at present. It is acknowledged that the works will not address other

---

[24] It is estimated that the current contaminant load is around 729kg of zinc and 87kg of copper.

[25] It is noted that while the total impact on stream length from the realignment is 137m, there is opportunity to increase the stream by around 7m in the rehabilitation works by the introduction of meanders (shown on Figure 22.4).

factors that limit the freshwater ecological values (such as water quality and fish access[26] and that there will be a residual impact of habitat loss associated with the realignment. It is considered that the development of these ecological functions in the stream rehabilitation off-set impacts from construction works. An example of the proposed concept for habitat restoration, through in-stream habitat heterogeneity is provided in Figure 22.5, which is an extract from the *Oakley Creek Realignment and Rehabilitation Guidelines*, detailing concept design for the development of 'pool-run-ripple' sequences in the stream).

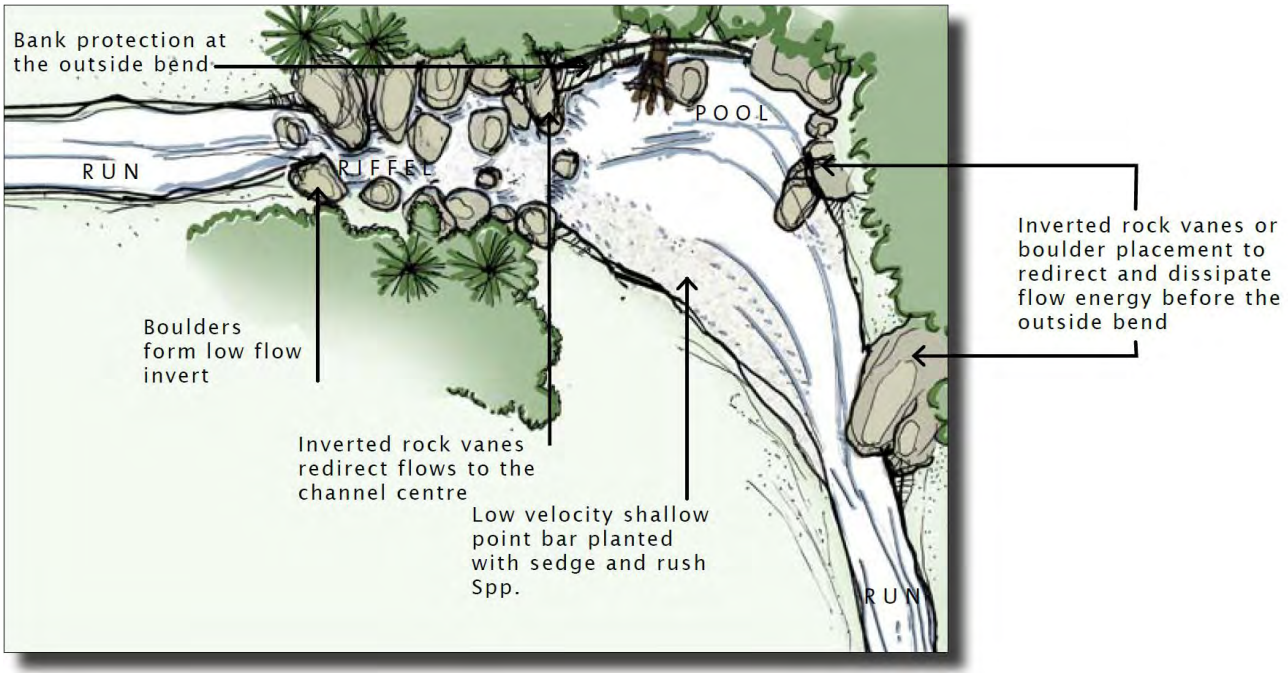


Figure 22.5 Concept for Pool-Riffle-Run Sequence in Oakley Creek (*source:* Appendix C, Technical Report G.6)

An assessment has been undertaken on the principle of 'no net loss' to mitigate the effects of stream realignment. For the purpose of assessment, it was assumed that the 'compensatory rehabilitation' (to off-set the loss of habitat from realignment), would consist of riparian vegetation. The amount of rehabilitation, using the methodology from the Auckland Regional Council, indicated that appropriate length of the stream rehabilitation works is around 343m. As indicated in Figure 22.4 (which highlights the proposed rehabilitation areas in the Project Area), this is a smaller amount than the total length of stream that has been identified as available for rehabilitation[27].

---

[26] Fish access is limited by natural physical constraints (the waterfall downstream). Improvements to water quality can be progressed in the longer term. However, beyond the additional impervious catchment treated by the Project, further such works are beyond the scope of this Project (nor are they the NZTA's responsibility).

[27] In addition to the rehabilitation works proposed for the realignment in Sector 9, there is opportunity for other works to be assigned to this area (on the basis of the Environmental Compensation Ratio). This includes the works associated with culverting of the Stoddard Road Tributary (Maioro Street), which is a separate project. This waterway feeds directly into the Oakley Creek. Furthermore, as part of this Project, the works and loss of habitat associated with piping of Pixie Stream (not within this catchment). These works could be undertaken within the 1.8km length

22.13.4 Assessment - Construction

22.13.4.1 *Sediment and Contaminant discharges*

Given the topology of the catchments in this area, low gradients and generally flat, the sediments generated during construction will be relatively low volumes, which can be effectively contained and treated. This is discussed further in the assessment of stormwater for the Project (see Section 22.10).

Due to the low gradient of the Oakley Creek in this Sector, sediment generation will be low and be able to be effectively managed

Effects are likely to be limited to localised decreases in abundance of some species. There are not expected to be any significant decreases in taxonomic richness or changes in characteristic fauna within Oakley Creek. The existing biological communities in the stream are adapted to fluctuating flows and water quality, and are expected to have a high resilience or capacity to recover from predicted increases in suspended sediment.

Investigations of contaminated land suggest that such areas are limited in extent in Sector 9, and that while several areas were identified where ecological guidelines were exceeded by specific heavy metals, all were within 'background concentrations' found elsewhere in the Auckland Region and so are not considered to pose a significant threat to freshwater ecology (refer to Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects)*.

While temporary and localised adverse ecological effects are expected in the receiving environments, overall it is concluded that with mitigation measures in place (as discussed in Section 22.13.5), these effects are less than minor.

22.13.4.2 *Stream Realignment*

Potential effects during stream diversion have been described under operation effects above (Section 22.13.2), and in Section 22.9 (Streams). While the stream realignments are considered to be high risk areas in terms of sediment generating potential, a methodology for construction outside of the stream channel will minimise sediment mobilisation.

Stream realignment will be undertaken offline

22.13.5 Mitigation - Operation

22.13.5.1 *Avoidance of Impacts by Design*

Instream works/realignments in Sector 9 avoid the need for any new culverts within Oakley Creek. Works have been designed to minimise loss of stream length, to maintain fish passage and to enhance instream habitat quality (for example, by allowing for variation in stream width, depth and velocity, and by planting riparian vegetation).

Effects on Oakley Creek have been reduced through design

---

of stream available for rehabilitation (as indicated on Figure 22.4 of this report). The combined length of rehabilitation proposed to offset impacts on the Oakley Creek (ARC Permit No's 37342, 37607) is 1.1km

The piers that will support Hendon Bridge will be set back from the stream banks and there should be no requirement for instream works.

22.13.5.2 *Stream Rehabilitation and Ecological Mitigation*

Loss of stream length in Sector 9 will be compensated for by stream rehabilitation to ensure no net loss of ecological values. The proposed rehabilitation is further described in the *Oakley Creek Realignment and Rehabilitation Guidelines,* Appended to Technical Report G.6 *Assessment of Freshwater Ecological Effects*. The purpose of this rehabilitation is to enhance stream ecological functional values[28].

Oakley Creek Realignment and Rehabilitation Guidelines Technical Report No. G.31

22.13.5.3 *Stormwater Treatment*

All stormwater from new motorway surfaces will be treated, as discussed in Section 22.10.

22.13.6 Mitigation - Construction

22.13.6.1 *Construction Management*

Specific erosion and sediment controls are also proposed during construction to minimise potential sediment runoff into Oakley Creek. These are set out in Technical Report G.22: *Erosion and Sediment Control Plan*.

Erosion and sediment controls will be implemented to minimise potential contaminant discharges into Oakley Creek

Mitigation measures of relevance to freshwater ecology include: additional sediment control measures in the vicinity of Oakley Creek, such as silt fences, super silt fences, decanting earth bunds, and clean and dirty water diversion bunds, progressive stabilisation of the earth-worked areas (to minimise the exposure period of disturbed soils and therefore the potential areas for sediment discharge).

22.13.6.2 *Construction Monitoring*

A comprehensive ecological monitoring programme will be implemented during construction to monitor potential adverse effects on freshwater ecology. This is set out in the Ecological Management Plan Excerpt Appended to Technical Report G.6.

A full assessment of effects on freshwater ecology is provided in Technical Report G.17

22.14 Vegetation

The following provides an assessment of the ecological effects of the Project on ecology: vegetation. This is a summary of the detailed assessment undertaken in Technical Report G.17 *Assessment of Terrestrial Vegetation Ecological Effects*.

[28] Included within these proposed works is the environmental compensation committed to by the NZTA in the ARC Consent Conditions associated with the recently consented Maioro Street Interchange Project.

22.14.1 Existing Environment

Vegetation within Sector 9 is largely exotic and introduced

Alan Wood Reserve/Hendon Park is at the southern end of Sector 9 and is predominantly grassed open space and includes the confluence of the main stem of Oakley Creek with its tributary coming from the Maioro Interchange. The locality is dominated by a mix of rank grass (Kikuyu), weed fields and exotic bush. The stream margins are characterised by willows with the occasional macrocarpa and eucalypt.

A small amount of a nationally endangered aquatic moss (*Fissidens berteroi)* has previously been reported growing amongst the willow roots but has not been rediscovered during the Project assessment survey.

A few notable specimens exist of a regionally uncommon fern (*Doodia squarrosa)* (identified as naturally uncommon and regionally sparse), however these exist outside of the Project footprint. A type of taprooted geranium (*Geranium add retrorsum)* is abundant within this Sector and its taxonomic and rarity status are currently unknown. However this plant is plentiful and easily cultivated.

The occasional indigenous species are present, however only as scattered individuals including cabbage tree, ponga and karamu. A single large Pohutukawa tree is in close proximity to the Project footprint.

22.14.2 Assessment – Construction

The vegetation to be cleared within Section 9 is almost completely comprised of exotic trees, woody and herbaceous weeds and grass. The indigenous species present are extremely few in terms of number and diversity. The mature Pohutukawa will be unaffected by the Project and the botanical conservation values of the vegetation that will be cleared is negligible.

The small population of notable fern (*Doodia squarrosa*) presently growing in the blockwork of the channel wall in Oakley Creek will remain undisturbed by the Project construction works. However, there is potential that it will be affected by works for rehabilitation of the banks of Oakley Creek in this area, (discussed in the mitigation proposed, see Section 22.13.5.2).

As the taprooted geranium is heavily prevalent and easily propagated, even if rare, it is considered that any effects are less than minor, provided that further assessment and mitigation (relocation) is provided if necessary.

Any edge effects, in terms of new edges being created within areas of existing habitat, are considered to be negligible as the works will be in a location of very low botanical conservation value and wholly characterised by edge conditions and processes already. The Project will reduce the extent of the weed-fields in this area.

As a portion of the Project in Sector 9 will be below ground level (cut trench towards the tunnel portals), there is the potential for it to affect the local groundwater regime in particular by causing a draw down effect within the immediately adjacent soils. There is potential, therefore, for the main SH20 alignment within Sector 9 to create an influence on soil moisture that results in water related stress to vegetation alongside the actual motorway where it runs above ground. However, as almost all the vegetation in Sector 9 is exotic and introduced, even if there is any die-back of vegetation along the margins of the trench cut for the Project (as a result of changes to soil moisture, the loss of such vegetation would not constitute a significant ecological effect.

22.14.3 Mitigation – Construction

Vegetation removal will be minimised through construction planning

Whilst the vegetation affected by the Project is largely exotic and introduced, a range of mitigation measures will be implemented during construction to minimise potential effects on vegetation. These are set out in the excerpt from the Ecological Management Plan (Appendix C of Technical Report G.17 *Assessment of Terrestrial Vegetation Effects*) and include*:*

- Minimising vegetation clearance and scrub vegetation within the construction footprint.
- Where construction activities can avoid amenity trees, providing protection with temporary fencing.
- Undertake replacement planting as soon as practicable following completion of the Project, in accordance with the landscape plans (refer Plan set F.16 Urban Design and Landscape Plans).
- Undertaking further assessment of the *Geranium* to confirm its status. If it is concluded to be a rare specimen or its taxonomic status cannot be confirmed, then the Management Plan provisions will provide for collection and relocation.

22.15 Air Quality

A full assessment of effects on air quality is provided in Technical Report G.1

Techncial Report G.1 *Assessment of Air Quality Effects* provides an assessment of the potential impacts of the Project on air quality, both during construction and operation. The following assessment of the air quality effects of construction is summarised from this report. Given the regional nature of air quality impacts, operational effects on air quality are discussed in Chapter 13 of this AEE.

22.15.1 Existing Environment

As noted previously, Sector 9 is located within an urban environment, although a large part of the areas is open space reserve. Residential properties are located to the north and south west of the works.

22.15.2 Assessment – Construction

During construction, the main potential effect on air quality is as a result of dust generation and other air contaminant discharges which are liable to cause nuisance beyond the site boundary. These are generally considered to be localised effects. Dust may be generated during earthworks and construction activities, or as a result of vehicle movements around the site. Vehicle emissions may also arise from construction vehicles and from the concrete batching plant proposed in this Sector.

In assessing effects on air quality during construction, key receptors are considered to be residential areas, schools, preschools and healthcare facilities. Within Sector 9, a number of residential properties are located within 100m of the work area, specifically those on Hendon Avenue to the north and Methuen Road and Valonia Street to the south. Other sensitive receptors include Christ the King School and Avondale motor park. Effects on these properties are unlikely to result in any significant effects with appropriate environmental management and mitigation in place.

In addition, a concrete batching plant and a rock crusher will be located in this sector. The concrete batching plant will be located within Construction Yard 10 (Alan Wood Park), whilst the crusher will be located in the eastern end of Hendon Park.

Concrete batching has the potential to generate dust from aggregates and cement powder. Aggregate dust is usually inert, only causing (amenity) effects. However, cement dust is highly alkaline when dissolved with water and can be corrosive to the skin. The proposed location of the concrete batching plant is within 30-40m of residential properties on Methuen Road (to the south east and south west of the construction yard site) and approximately 80m from residential properties on Hendon Avenue (to the north). While there are potential adverse effects associated with the operation of this activity, it is anticipated that with appropriate controls in place (discussed below), any potential effect in relation to the operation of the concrete batching plant will be avoided.

The rock crusher is required to break up basalt from the southern end of the tunnel, which may result in potential dust discharges. Dust from crushing basalt is usually inert only causing nuisance (amenity) effects. The proposed location of the crusher is approximately 70m from the nearest residential properties on Hendon Avenue. Due to the requirement to mitigate noise, the crusher will be fully enclosed. Effective dust control will therefore be managed through the use of one or more bag filter units.

22.15.3 Mitigation - Construction

22.15.3.1 *General Mitigation and Monitoring*

A range of measures will be put in place to manage dust and road construction activities

Dust can be managed with a range of mitigation measures. The following describes typical measures that can be applied, as described in the Construction Air Quality Management Plan (refer Appendix N of Technical Report G.1 *Assessment of Air Quality Effects*):

- Managing the surfaces of the construction site area (e.g. use of wind breaks, damping down exposed/open areas from water sprinklers or water trucks, covering tunnel spoil (e.g. using covered buildings));
- Managing the handling of sediment and other dust generating materials (e.g. managing and unloading of vehicles, stabilising earthworks areas, minimising drop heights for spoil stockpiling); and
- Managing vehicles operating within and exiting construction areas (e.g. stabilising haul roads and construction yards with metal, installing wheel wash facilities at the egress/exit points of construction yards, speed limits for construction vehicles and managing loading of trucks for spoil transport).

Monitoring will be undertaken to assess air quality effects of construction methods

In addition, to ensure that the effects of construction on air quality are being effectively managed, it is also proposed to monitor dust levels throughout the construction period. For example,

- Undertaking total suspended particulate (TSP) monitoring using continuous particulate monitors;
- Daily visual inspections of operational sites and surrounding areas for evidence of dust discharges;
- Regular visual inspections of exposed surface areas and stockpiles to ensure either dampened down or covered appropriately; and
- Should such monitoring indicate that there are adverse effects to air quality during construction; remedial action (e.g. changes to construction methods) can be implemented to manage these effects.

22.15.3.2 *Mitigation and Monitoring – Concrete Batching Plant and Rock Crusher*

Air discharges from the concrete batching plant and the rock crusher will be managed

Specific measures will be put in place to manage air discharges from the concrete batching plant and the rock crusher. These are described in detail in the Concrete Batching and Crushing Plant Management Plan (refer Appendix O of Technical Report G.1: *Assessment of Air Quality Effects*).

Due to the need for the concrete batching plant to be located near the tunnel entrance during construction, this means that is will be located in close proximity of residential properties (within 30 - 40m). Therefore, dust suppression measures will need to be carefully managed to avoid the potential for dust nuisance to those areas, including the following:

- Load hoppers, conveyors and storage bays for aggregates will be partially enclosed to minimise potential for dust discharges;
- Water sprays and regular sweeping of sealed yard areas will be undertaken.;
- Cement powder will be delivered to site in enclosed tankers, and pumped into silos. All handling of cement powder will be fully enclosed, with displaced air vented via filter units as required;
- Dust filter units will be installed on the cement silos; and
- Pressure relief valves will also be fitted, with high fill alarms to avoid overfilling and spillages.

The rock crusher will be fully enclosed to mitigate noise affects. This will have the additional benefit of capturing fugitive dust. Other measures include installing one or more bag filter units to the crusher, designed to discharge within the building, and fitting water sprays to the end of the conveyor from the crusher, to minimise discharges of dust at the transfer point.

In addition to the routine monitoring described in Section 22.15.3.1, regular inspections will be undertaken of the concrete batching plant and the rock crusher to ensure they are working effectively, and that any potential emissions are minimised.

22.16 Noise Emissions

A full assessment of effects on noise are provided in Technical Reports G.12 and G.5

The following provides an assessment of the effects of the Project on noise emissions. This is a summary of the detailed assessment undertaken in Technical Report G.5 *Assessment of Construction Noise* and G.12: *Assessment of Operational Noise Effects*.

22.16.1 Existing Environment

The existing noise environment in this Sector is low, as landuse is primarily open space

The existing noise environment within this Sector is low due to the majority of the land use being unoccupied open space containing no major roads. Richardson Road is the only arterial road located within proximity to sensitive receivers. The Avondale-Southdown rail designation (undeveloped) extends through Alan Wood Reserve adjoining Hendon Avenue. Existing noise levels measured in Hendon and Methuen Avenues were measured as a low urban noise environment[29].

[29] Technical Report G.12 provides further detail on the results of the noise measurements undertaken in this area.

22.16.2 Assessment - Operation

The construction of the new surface road within this Sector to connect to the existing SH20 Mt Roskill section is considered to be a "new road" and has been assessed accordingly[30]. This Sector contains three distinct receiving environments which have been assessed separately:

- Residential environment located to the north of the proposed alignment;
- Residential environment located to the south of the proposed alignment; and
- The site of Christ the King School located to the south of the alignment, incorporating a small number of residential sites.

The traffic noise impacts and potential effects of the Project have been assessed for these three receiving environments. The results are summarised in Table 22.5 below and further details are provided in Technical Report G.12: *Assessment of Operational Noise Effects.*

Table 22.5: Traffic Noise Impacts

Receiving Environment	Potential Effect (without mitigation)
North of Proposed SH20 Alignment Dwellings located between New North Road and Richardson Road, generally located along Hendon Avenue. 63 receivers were assessed.	Severe effect – with noise increases of up to 21 decibels in some locations (e.g. 129 and 129A Hendon Avenue). This is due to the new road being located in unoccupied open space. Traffic noise from the new road is predicted to generate noise levels which, without mitigation, would exceed the Category A criterion by up to 8 decibels, and the Category B criterion by up to 5 decibels. These levels are high, and their reduction to acceptable levels would require the implementation of extensive mitigation measures.
South of Proposed SH20 Alignment Dwellings located between Bollard Avenue and Richardson Road, generally located along Methuen Avenue and Valonia Street. 69 receivers were assessed.	Severe effect – with noise increases up to 21 decibels in some locations (194A Methuen Avenue). This is due to the new road being located in unoccupied open space. Traffic noise from the new road is predicted to generate noise levels which, without mitigation, would exceed the Category A criterion by up to 8 decibels, and the Category B criterion by up to 5 decibels. These levels are high, and their reduction to acceptable levels would require the implementation of extensive mitigation measures. It is noted that even with the implementation of mitigation measures, resultant traffic noise levels will be higher than are currently being experienced by residents in the area. Due to the considerable increase in noise level which will occur with the Project, mitigation design has been undertaken with the view of reducing noise levels to the greatest extent practicable, to below the Category A criterion, if this can be demonstrated to be reasonable and feasible.
Christ the King School The Christ the King School site, incorporating a small number of residential sites. 12 receivers were assessed.	Severe effect – with noise increases up to 15 decibels in some locations (284D Richardson Road). This is due to the new road being located in unoccupied open space.
From NZS6806, Category A = primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, Category C = internal noise criterion of 40 $dBL_{Aeq(24hr)}$).	

22.16.3 Assessment – Construction

Construction activities within this Sector will occur mainly during the daytime. Activities likely to involve noisy construction include:

The construction of the southern tunnel portal, including the ventilation building;

- The Richardson Road underpass and bridge;
- Roading construction along the route;
- Construction of the Hendon Avenue pedestrian bridge; and
- Construction yards including crushing and concrete batching.

Of the above activities, the concrete batch plant located in Construction Yard 10 is likely to require the most significant noise mitigation and management as this plant will be required to operate as necessary both day and night. It is also proposed to crush basalt to enable it to be carted offsite. The rock crusher will be located in Hendon Reserve and is likely to generate high levels of noise; however crushing will occur during the daytime only.

The predicted noise levels for activities within Sector 9 will generally comply with the daytime construction noise criterion. However, for certain activities there is potential for daytime activity to exceed the criteria without adequate noise mitigation where noisy activities are carried out at ground level. In particular, it is noted that works around the construction of the grout curtain are expected to significantly exceed the criterion for receivers closest to the works, without mitigation.

Night-time operation in this Sector is confined to the construction of Richardson Road overbridge and the operation of Construction Yards 9 and 10. As stated above, the concrete batch plant required in Construction Yard 10 will require 24 hour per day operation, as the availability of concrete is critical to the safety of workers in the tunnels. With the implementation of noise mitigation measures (described below) noise levels can be reduced significantly. However, for the Project to meet the noise criteria for night time work a full suite of mitigation measures are likely to be required (see below in section 22.16.5).

Night time activities occurring in this Sector have the potential to generate elevated noise levels

The basalt crusher is also likely to generate high levels of noise, but this will only be operated during the daytime. Without mitigation, noise levels are likely to exceed the construction guidelines for daytime activities. Specific noise mitigation measures will therefore also be required for the basalt crushing.

Similarly, blasting is also likely to be required in this Sector. This work will also only be undertaken during the daytime. Due to the significantly shorter duration of works, controlled blasting, though likely to generate higher noise and vibration levels than other construction techniques, offers a less intrusive impact to surrounding premises[31]. Detailed calculation of peak noise levels will be required before blasting occurs to determine if and how receivers are

[31] For example, compared to construction alternatives such as rock-breaking.

affected and, as appropriate specific measures are proposed to manage noise from blasting (see section 22.16.5 below).

22.16.4 Mitigation – Operation

A number of mitigation options were developed for each of the receiving environments affected by the "new road". A multi-disciplinary approach to determine the best practicable mitigation option (as discussed in Section 11.7 of this AEE). The 'best practicable mitigation options' determined as part of this process are set out in Table 22.6. The full range of mitigation measures considered is described in detail in *Technical Report No G.12 Assessment of Operational Noise Effects.*

Table 22.6: Summary of Mitigation Measures Operational Noise

Receiving Environment	Best Practicable Mitigation Option	Residual Effect (with mitigation)
North of Proposed SH20 Alignment	Option 4 - A noise barrier of 2-2.5m in height located on the northern side of the proposed designation area.	On average a 3 decibel reduction. Of the 63 receivers assessed, all 63 will be within Category A. Overall, with mitigation, the increase in noise levels is considered to be severe – with noise increases up to 17 decibels in some locations (4 Barrymore Place). This is due to the relatively low noise existing environment into which a major transportation corridor is introduced. However, notwithstanding this, all assessed properties have (with mitigation) met the Category A noise criteria.
South of Proposed SH20 Alignment	Option 4 - A noise barrier ranging from 2 to 5m in height located on the southern side of the proposed designation.	On average a 4 decibel reduction. Of the 69 receivers assessed, 66 dwellings predicted to be in Category A and 3 in Category B. Overall, with mitigation, the increase in noise levels is considered to be severe with noise increases up to 13 decibels in some locations (e.g. 194A Methuen Avenue). This is due to the relatively low noise existing environment. Notwithstanding this, all but three of these dwellings met the Category A noise criteria and all met or better Category B.
Christ the King School	Option 3 – Noise barriers ranging from 3 to 4m in height along Maioro Street and SH20 and OGPA Surface Paving.	On average a 3 decibel reduction. Of the 12 receivers assessed, 11 would be in Category A and one of the school buildings in Category B. However, NZS 6806 does not apply to the Christ the King School which is assessed based on a private Property Agreement which sets out alternative noise criteria. Overall, with mitigation, the increase in noise levels is considered to be severe – with noise increases up to 10 decibels in some locations (e.g. 284D Richardson Road). However, notwithstanding this, all assessed residential properties have (with mitigation) met the Category A noise criteria.
From NZS6806, Category A = primary external noise criterion of 64 $dBL_{Aeq(24hr)}$, Category B = secondary external noise criterion of 67 $dBL_{Aeq(24hr)}$, Category C = internal noise criterion of 40 $dBL_{Aeq(24hr)}$).		

In summary, the increase in noise levels is considered to be severe because the new road is located within an existing low noise environment, primarily made up of unoccupied open space.

The mitigation will mean all receivers achieve either compliance with criteria in the NZ Standard

The proposed mitigation will however result in receivers (residential properties) achieving Category A and Category B compliance, which is considered to be appropriate noise mitigation under the New Zealand Standard 6806.

22.16.5 Mitigation – Construction

A range of mitigation measures to manage noise during construction have been developed for the Project. These are detailed in the Construction Noise and Vibration Management Plan (CNVMP) (in Appendix C of the Technical Report G.5 *Assessment of Construction Noise Effects*) and include: erecting temporary noise barriers around noisy construction activities and programming noisy activities (such as works on Richardson Road overbridge) to occur during the daytime where possible. Noise monitoring will be undertaken throughout the construction period to ensure compliance with the Project noise criteria.

Construction noise will be managed through the Construction Noise and Vibration Management Plan

Specific measures will be required for the concrete batching plant given that it is required to operate 24 hours a day, its potential to generate elevated noise levels and its proximity to residential properties. Such measures include:

Specific mitigation measures will be required for the concrete batching plant, the rock crusher and blasting operations

- Enclosing the concrete batching plant and providing additional noise barriers.
- Enclosing the truck loadout area, or alternatively, it may be possible to construct the batch plant so that trucks remain inside the tunnel cutting and are loaded out from above;
- Ensuring that truck slumping occurs in the tunnel cutting and not at ground level, where practicable;
- Undertaking daytime operation of noisy activities, such as loaders, where practicable;
- Designing the batching plant so that reversing of trucks is not required; and
- Good driver and operator education regarding noise mitigation.

Even with the above measures in place, it is possible that dwellings within 150 metres of the batching plant will experience noise levels of above 45 dB $L_{Aeq\ (t)}$ during the night period. The number of dwellings affected will depend on the successfulness of above measures. Noise monitoring will be undertaken during the operation of the concrete batching plant, and if noise levels from the batch plant exceed this criterion, mechanical ventilation/air conditioning may need to be provided to allow these residents to sleep with their windows closed.

The rock crusher also has the potential to generate elevated noise, although this will only be required to operate during the day. Mitigation measures include locating the crusher within a well sealed enclosure, and operating the crusher only for short periods during the daytime. Noise monitoring will be undertaken during the operation of the rock crusher to determine whether any further measures are required. Further detail of construction noise mitigation and monitoring specific to the concrete batching plant and rock crushers is detailed in the Concrete Batching and Crushing Plant Management Plan (CBCPMP) appended to Technical Report G.5.

Blasting is also required for the works within this sector. The blasting operation will need to be carefully managed, in accordance with the following:

- Blasting to occur only during the daytime between the hours of 9am and 5pm, but ideally around noon. Predictions of blast overpressure will be performed before any blasting and charge sizes selected to ensure that the limits in Table 5-3 are complied with.
- Good communication with residents is essential and residents will be notified prior to blasting. Noise and vibration monitoring blasting is proposed to ensure noise and vibration limits are in compliance with criteria.

Where noisy construction techniques are critical and must occur regardless of exceeding the Project noise criteria (45 dB $L_{Aeq(t)}$ during the night) affected residents may require temporary relocation (short term accommodation). This would be on a case by case basis. Where residents are unwilling to relocate or the construction period is sufficiently long as to make relocation not practicable, other measures will be considered, for example ventilation (to enable windows to be closed) or potentially, the improvement of the sound insulation of dwelling façades (to provide appropriate internal noise levels). Such a measure should only be considered after all other practicable noise control options have been considered.

22.17 Vibration

A full assessment of vibration effects is provided in Technical Report G. 19

Technical Report G.19 *Assessment of Vibration Effects* provides an assessment of vibration effects. The following is a summary from this report.

22.17.1 Existing Environment

The existing environment is an urban environment, dominated by local roads and residential development. In order to establish the existing ambient noise environment within this sector, representative receivers at 204 Methuen Road (approximately 630m from Blockhouse Bay Road) and Christ the King School (approximately 22m from Maioro Street) were surveyed. Both of the receivers achieved a mean ambient Peak Vector Sum (PVS) (mm/s) of 0.13. In accordance with BS 5228-2:2009 the ambient vibration level is considered to be low. It is likely that the majority of vibration measured within this Sector is due to human activity within the residences, rather than vibration from traffic sources given that the residential properties are located a sufficient distance from arterial roads.

22.17.2 Assessment – Operation

There are two aspects of vibration that are considered an 'effect'. The first of these is the potential for vibration to cause actual 'damage' to properties. The second relates to the perception from residents and occupants of buildings (i.e. if the vibration can be felt and can raise concerns of damage to buildings).

There is not anticipated to be any vibration effects from heavy vehicles using SH20

It is considered highly unlikely that there will be any building damage due to operational vibration because research suggests levels produced by traffic, even on dilapidated road surfaces is relatively low[32].

The operational effects of the motorway are anticipated to be minor. The existing ambient surveys of properties (dwellings) within 20m of SH16 did not identify vibration issues (it is noted that these residents did not express concern about traffic vibration). The main risk within this Sector is the change in vibration exposure because the dwellings are not currently located adjacent to a motorway.

Measured ambient vibration levels were also taken at the recently opened SH20 Mt Roskill alignment (south of Sector 9), 10m away from the State highway carriageway. The survey indicated vibration levels were much lower than the level expected for a human response (ie. perception response).

It is expected that the vibration from road traffic, in particular heavy vehicle movements, will be less than minor provided that the Project road surface is monitored and maintained to appropriate standards.

22.17.3 Assessment - Construction

The key vibration sources for construction in this Sector are vibration rollers for road construction, drilling for grout curtain and secant piles, piling, rockbreakers and blasting.

During construction vibration may occur particularly in relation to construction of the grout curtain and during blasting operations

In general, sensitive receivers within this Sector have been classified as having a low to medium risk of non-compliance with the DIN 4150-3:1999 Project criterion. This is with the exception of some receivers in close proximity to drilling for the grout curtain and secant piles which have a high risk of non-compliance. Therefore, specific measures will be required to manage potential vibration effects, in particular whilst constructing the grout curtain.

It has not been possible to assess potential blasting vibration effects at this stage. This is because models which predict vibration effects for blasting require key inputs such as distance, ground conditions and explosive charge weight and this information is currently unavailable. It has therefore been proposed that trial blasts are undertaken to assess the vibration effects of blasting before construction commences. The trial blasts will indicate safe

[32] The NZTA currently follows a framework to provide for pavement surfaces that do not degrade below a certain level of roughness.

distances required from sensitive receivers and establish safe levels of charge weight, for the distances involved.

22.17.4 Mitigation - Operation

The potential for vibration effects from heavy vehicle movements on SH20 are considered to be less than minor with appropriate mitigation. This mitigation will include:

- The road surface to be monitored and maintained according to the NZTA policy for road roughness; and
- Further traffic vibration monitoring prior to construction and upon completion of the Project in order to obtain objective accurate data (the findings of this data should be utilised, in conjunction with sensitive receivers to assess any long term vibration effects).

22.17.5 Mitigation – Construction

Vibration during construction will be managed through the implementation of the Construction Noise and Vibration Management Plan (CNVMP) (Appendix K of Technical Report No.G.19 *Assessment of Vibration Effects*). This includes:

Vibration effects will be managed through the implementation of the CNVMP such that effects will be no more than minor

- Undertaking pre-construction and post construction building condition surveys of identified at risk buildings, services and structures. These surveys will identify if there is any damage as a consequence of construction activities;
- Undertaking vibration monitoring, particularly during activities predicted to cause high levels of vibration; and
- Implementing the CEMP complaints procedure, including a 24 hour hotline.

If the proposed monitoring indicates that elevated vibration levels from construction have or will result in damage, then appropriate procedures will be put in place. This may include stopping the particular activity until appropriate mitigation or alternative low-vibration construction techniques have been employed.

It is considered that with the implementation of the CNVMP, the vibration effects of the Project during construction will be no more than minor.

22.18 Light Emissions

A full assessment of lighting effects is provided in Technical Report G.10

Technical Report G.10 *Assessment f Lighting Effects* provides an assessment of operation and construction effects. The following assessment of the light effects is summarised from that report.

22.18.1 Existing Environment

The existing environment is an urban environment, which is currently largely open space with residential properties located to the north and south of the reserves.

At present there is no road through this area, which comprises primarily Alan Wood Reserve and Hendon Park. The existing lighting environment is relatively dark with some amenity lighting at the reserve access parking areas. Residential areas bound the reserves both to northwest and southeast.

At the southern end of the Sector, the new road will join onto the existing Maioro Street Interchange. At present there is a temporary double sided lighting pole arrangement of 250M HPS luminaries on 12m poles south of the Interchange.

22.18.2 Assessment - Operation

The lighting arrangement for the new section of SH20 will comprise central median lighting from 20m single columns. Near the tunnel portal where the median is very wide, there will be a single staggered pole arrangement with one 400W luminaries mounted within the median area. As the median narrows, the arrangement will revert to the standard 20m single column arrangement of two 400W HPS luminaries. The temporary lighting at Maioro Street Interchange will be changed to a permanent single sided arrangement along the new ramp. Fully cut off luminaries will be used to minimise light spill in this area.

The new motorway will be visible in a previously dark environment

The new lighting in this area will have a significant effect on the visual environment. Where previously this was a relatively dark environment, the new motorway will be visible at night. The closest residents will look down on the motorway from either side of the carriageway, and will see the lit carriageway after dark. This effect will be lessened by tree planting. More distant residents will be able to see the motorway at night as a result of the lighting. However, it will be seen as an illuminated object and will not impinge on these properties as light spill.

A cycle way will be provided to the west of the motorway which will have its own amenity lighting provided by fully cut-off luminaries with horizontal glass and stone guards to minimise vandalism.

22.18.3 Assessment - Construction

While construction in this Sector will typically occur during the day, some aspects will require night time works, specifically in relation to the tie-in of Richardson Road to the Richardson Road bridge. Temporary lighting will therefore be required to support night time works. Any temporary lighting at night will need to be carefully managed.

In addition, a number of construction yards (Construction Yards 8 – 12) are located in Sector 9, within Alan Wood Reserve and Hendon Park. These yards will need to be accessed on occasions at night (e.g. the concrete batching plant requires access 24 hours a day for seven days a week), therefore lighting will be required. Spill lighting is not considered to be an

issue as the residential properties located near these construction yards are set wellback (at least 10m).

22.18.4 Mitigation - Operation

It is recognised that there will be a significant change to the existing lighting environment in this sector. This is unavoidable, with the lighting required to meet the minimum standards and safety requirements.

Fully cut-off luminaries will be used to reduce light spill

The proposed lighting arrangements will be designed in accordance with AS/NZS 1158 and Auckland City Bylaws. In order to minimise lighting effects as much as possible, fully cut-off luminaries (as opposed to semi-cut off luminaries that will be used elsewhere on the Project) will be used in this area. These will significantly reduce light spill as they allow no light above the horizontal plane. Whilst these luminaires have the benefit of reducing light spill, nearly a third more poles will be required in order to provide adequate uniformity.

22.18.5 Mitigation - Construction

In order to manage temporary lighting during construction, for night time activities the contactor will be required to prepare a lighting plan. This will need to demonstrate compliance with Auckland City Bylaw and be verified by an independent lighting specialist.

For general area lighting, it is proposed that asymmetrical floodlights are used with glass visors that are not raised more than 3 degrees above the horizontal plane.

22.19 Land Contamination

A full assessment of the effects of construction on land contamination is provided in Technical Report G.9

The following provides an assessment of the potential effects of the Project on contaminated land and groundwater and contaminated materials. This is a summary of the detailed assessment undertaken in Technical Report G.9 *Assessment of Land and Groundwater Contamination Effects*. Given the nature of contaminated materials, this assessment only looks at construction effects.

22.19.1 Existing Environment

Land use in this area comprises parkland (open space and playing fields) within Alan Wood Reserve, surrounded by residential housing. At the southern end of Alan Wood Reserve, land use changes to commercial and light industrial up to the Maioro Street Interchange. Historically, landfilling was undertaken within Alan Wood Reserve between the 1940s to the 1970s, and is listed as a Priority 2 Landfill in the ACC *Closed Landfills Asset Management Plan 2005/2006*. Priority 2 landfills are described in the document as "present a minor actual risk and/or significant potential risk to human health and/or the environment".

Intrusive investigations were undertaken to determine the existing quality of soils and groundwater, the potential for any existing contamination to be disturbed during construction activities and the potential human health risks for workers and the wider public outside the construction footprint. These investigations confirmed:

- The underlying geology within Alan Wood Reserve comprises fill or basalt overlying Tauranga Group Alluvium. Much of the fill comprises reworked natural soils (silt and clay) though at some locations waste was encountered (to a maximum thickness of 2.4m), comprising plastic bags, glass, basalt boulders, reinforced and unreinforced concrete, fibre board, metal, brick and timber in a sandy silty matrix. In addition, fragments of possible cement bound asbestos were identified at two locations.
- Further south, the underlying geology around the Maioro Street Interchange comprises fill or basalt overlying weathered Waitemata Group (clayey silt and sand). Much of the fill comprised reworked natural soils (silt and clay) though at some locations waste was encountered (to a maximum thickness of 3.5m) comprising plastic, glass, metal, brick, wire, textile and timber in a sandy silty matrix. Groundwater was encountered at 1.6m and 2.6m below ground level.
- None of the soil samples taken in the vicinity of Alan Wood Reserve had contaminant levels that exceeded 'permitted baseline' levels for land disturbing activities (as defined in Rules of the PARP:ALW) or the human health criteria (parkland/ recreation) (as defined by Auckland City Council Soil Screening Criteria – Human Health 2007).
- Of the soil samples taken around Maioro Street Interchange, no exceedances were identified in relation to human health (commercial/industrial) criteria, however levels of copper, zinc, lead and nickel were found at four locations to exceed the 'permitted baseline' criteria for land disturbing activities (as defined by Rules in the PARP:ALW).
- Asbestos fibres (chrysotile) was identified in soil samples from five locations around Maioro Street Interchange, at depths between surface and 0.6m.
- None of the groundwater analysis exceeded the ANZECC water quality guidelines.

Some heavy metals and asbestos samples were identified in surveys

Based on the intrusive sampling, approximately 48% of the material in this area is considered potential 'cleanfill'. This means that it could potentially be reused on site, with the remaining classified as either 'managed fill' (19%) or 'contaminated fill' (33%) requiring disposal offsite.

22.19.2 Assessment – Construction

Contaminants have the potential to generate adverse effects for receiving environments, on human health (for workers on site and the wider community). Based on the results of the baseline sampling, the following specific comment is made:

- There are elevated levels of some heavy metals in Maioro Street Interchange. Measures will be required to ensure that during any land disturbing activities, any runoff does not result in elevated heavy metals migrating off site to adjacent receiving environment.
- Levels of asbestos were also recorded in some of the samples taken around Maioro Street Interchange. Measures will be required to ensure that during construction, workers and the wider community are protected.

- Where materials excavated do not meet the criteria of 'clean fill' it is proposed that it is disposed of off-site as either 'managed fill' or contaminated fill'.

It is considered that any potential issues can be adequately managed through appropriate mitigation measures during construction as described below. With these measures in place, and potential effects are considered to be less than minor.

22.19.3 Mitigation – Construction

A range of mitigation measures will be used to manage the potential for contaminated soils to be encountered, and minimise potential risk to workers and the wider public.

In particular it is proposed that all construction activities be undertaken in accordance with a Contaminated Soils Management Plan (CSMP) and a Site Health and Safety Plan prior to work commencing. These will form part of the Construction Environmental Management Plan, (CEMP).The CSMP has been developed for the Project and is provided in Appendix A of Technical Report G.9: *Assessment of Land and Groundwater Contamination*. It identifies a number of specific mitigation measures for contamination, including management and training for personnel undertaking construction work, maintaining records of excavated material, volume and type, and where the material has been disposed of, stored or stockpiled, management methods for erosion and sediment control, stockpiling of material, assessment of material (e.g. to confirm it is 'clean fill', and management of any contaminated material.

Specific measures will be employed for any material known to contain asbestos, in accordance with the Health and Safety in Employment (Asbestos) Regulations 1998 and the Department of Labour Guidelines for the Management and Removal of Asbestos (revised) 1999.

In addition, if unexpected contamination is identified, the procedures set out in the CSMP will effectively manage works such that the adverse effects of disturbing this material can be avoided, remedied or mitigated.

22.20 Flooding

The following provides an assessment of the flooding effects of the Project. This is a summary of the detailed assessment undertaken in Technical Report G.15: *Assessment of Stormwater and Streamworks Effects.*

22.20.1 Existing Environment

In Sector 9 overland flow paths for the 100 year ARI rainfall event intersect the proposed SH20 motorway alignment.

22.20.2 Assessment – Operation

Works in Sector 9 have potential impacts on flooding, associated with the bridging works (potential to exacerbate flooding by blockage of the stream) and from construction works on the floodplain.

22.20.2.1 *Streamworks Impacts on Flooding*

The proposed streamworks including the 'SH20 bridge' (this is the bridge of Oakley Creek by the SH20 carriageway itself) do not increase upstream flood levels, so there is no adverse effect on upstream flooding. The lowering of flood levels through the proposed stream works will be beneficial to neighbouring properties and local drainage systems in the area.

22.20.2.2 *Works in the Floodplain*

As a result of improved stream flood storage within the Project area (the channel storage increases from 18,400m^3 to 27,200m^3), the Project slightly reduces flood extents upstream of the Project, and more significantly reduces flood extents through the streamworks reach. In general, more of the peak flow is contained within the channel extents, and less overflows to surrounding reserve land and properties, resulting in an overall positive environmental effect of the Project on flood extents.

A number of habitable floors have been identified as at risk of flooding in the Project area. The Project has a small impact on the flood levels in relation to habitable floors. Works are expected to reduce the flood risk for two houses, and leaves it unchanged for four other houses. No additional habitable floor levels are put at risk due to the Project. In terms of property effects, the extent of flooding reduces for properties along Valonia Street, Whittle Place, Methuen Road (large improvement) and Hendon Avenue. However, there is one property (Bollard Avenue) where the expected maximum depth of flooding for 100 year ARI event will increase to a minor degree (e.g. from 1.2m to 1.3m)[33]. This effect is considered minor because flooding of the garage on this property already exists.

A comparison has been made of the flood storage in the Alan Wood Reserve area. The existing flood storage is 79,400m^3 compared to 47,600m^3 for with the Project. This indicates a net decrease in flood storage of 31,800m^3. The reduction in net storage occurs mostly from reduction in flood water level. It is noted that 25 Valonia Street provides some 8,000 m^3 of storage, which will be maintained by the Project (and would otherwise have been lost as a result of the consented development of this site). This is considered partial mitigation for loss of flood storage.

[33] This is based on floods inclusive of maximum probable development and climate change (to 2090), so water depths will be less for current situation.

22.20.3 Mitigation

The proposed design includes improved stream flood storage in the channel design. There is also an opportunity to increase flood storage at 25 Valonia Street (compared to the consented residential development on this site). The former is considered appropriate mitigation for the potential adverse effects and the latter a positive environmental effect.

It is further noted that management of the Oakley Creek Bridge (SH20) to keep it clear of blockage will be necessary to maintain flood flows. With these mitigation measures, it is considered the effects have been appropriately managed.

23. Planning Assessment

Overview

The purpose of this Chapter is to provide analysis of the Project against the relevant policy framework within which the designations and resource consents are sought.

As a result of the 'bundling' of consents (which themselves have different consent status, as set out in Chapter 7 of this AEE), the most restrictive activity status for the consents sought is applied to the application. In this regard, the Waterview Connection is a Non-Complying Activity. The NZTA also seeks designation and alterations to designation through seven (7) Notices of Requirement.

There are a large number of consent applications, and a large number of objectives and policies relevant to the Project (from national, regional and district planning documents). An analysis of the relevant objectives and policies is provided It is concluded that the Project is generally consistent with these:

- The strategic importance of the WRR is to provide an alternative route through the Region to reduce dependency on SH1, particularly through the Auckland Central Business District (CBD) and across the Auckland Harbour Bridge, improving resilience of the strategic transport network.
- The WRR will also provide for economic growth, unlocking potential for development along its length by improving trip reliability and access from the west to the south of the Region, and from the CBD to the southern Auckland isthmus and airport.
- The Project will sustain the potential of natural and physical resources for future generations. It is intended to meet the growing transportation needs of the Region and does not preclude future opportunities for other land transport development, such as the Avondale to Southdown Rail Line;
- The Project safe-guards the life supporting capacity of air, soils, water and ecosystems.
- The Project avoids, remedies and mitigates the adverse effects of the Project on the environment (as set out in Chapter 24 of this AEE).
- The Project recognises and provides for the matters of Section 6 of the RMA.
- The Project has also had particular regard to and as appropriate has responded to those matters in Sections 7 and 8 of the RMA.

On balance of the matters considered and assessed in this Chapter, it is considered that the benefits of this Project alongside the proposed measures to avoid, remedy and mitigate the adverse effects, leads to the conclusion that the Project satisfies the definition of sustainable management and is consistent with the purpose and principles of the Act. To this end, it is considered that the purpose of the RMA will be achieved more by confirming the designations and granting the consents sought.

23.1 Introduction

This Chapter assesses the Project against relevant planning matters

The purpose of this Chapter is to provide analysis of the Project against the relevant policy framework within which the designations and resource consents are sought. Chapter 7 of the AEE identifies the resource consents that are required and the status of these activities. However, as a result of 'bundling' the consents, the most restricted activity classification is required. On this basis, the Project is a Non-Complying Activity in terms of the resource consent applications that are to be lodged (within the administrative jurisdiction of the Auckland Regional Council). Chapter 7 also identifies the designations and alterations to designations being sought through 7 NOR's.

Chapter 6 of the AEE identifies the relevant provisions of the Resource Management Act 1991 (RMA) in relation to the Project. In addition, under Section 104 of the RMA (consideration of resource consents by the ARC) and under Section 171 of the RMA (consideration of NORs for new designations and alterations to existing designations by the relevant consent authority), regard must be had to the relevant provisions of a national policy statement, national environmental standard, regional and district planning documents when considering the application.

A number of planning documents are relevant to the Project

There are a large number of planning documents prepared under the RMA that are relevant to the Project. As an overview these include:

- National Environmental Standard – Air Quality;
- The Hauraki Gulf Marine Park Act 2000;
- New Zealand Coastal Policy Statement 1994;
- Auckland Regional Policy Statement 1999;
- Auckland Regional Plan: Coastal 2004;
- Auckland Regional Plan: Sediment Control 1993;
- Proposed Auckland Regional Plan: Air, Land and Water 2001;
- Transitional Regional Plan 1991;
- Operative Auckland City District Plan (Isthmus Section) 1999;
- Operative Waitakere City District Plan 1995.

This Chapter concludes with an assessment of Part 2 of the RMA

The remainder of this Chapter considers objectives, policies and regulations within these documents and provides an assessment of Project against these provisions.

This Chapter concludes with an assessment of the purpose of the RMA (Part 2 Assessment) as the overriding consideration for the Project.

23.2 National Environmental Standard – Air Quality 2004 (AQNES)

The AQNES are designed to protect public health and the environment of New Zealand by, among other things, setting concentration limits for criteria air pollutants. The standards are mandatory and have the force of regulation. There are five ambient air quality standards, with three considered relevant to the Project (those air pollutants from vehicles).

23.2.1 Assessment

Technical Report G.1: *Assessment of Air Quality Effects* provides an assessment of the air quality effects of the Project against the air pollutants of the AQNES that are relevant to road transport emissions. The potential effects of the Project have been assessed by comparing predictions against the AQNES (and where relevant other guidelines and targets). In all areas, this report concludes that for all the modeled emission scenarios, predicted pollutant concentrations will be less than the levels set in the AQNES.

All the modeled emission scenarios predict pollutant concentrations will be less than the levels set in the AQNES

In terms of regional effects, the Project is expected to have negligible effects on air quality. In 2016 and 2026 (the modeled years of assessment) the pollutant concentrations arising from motor vehicles across the Region are expected to be less, irrespective of the Project (due to improvements in vehicle emissions and reduced congestion).

23.3 New Zealand Coastal Policy Statement 1994

The New Zealand Coastal Policy Statement (NZCPS) provides guidance on management of the coastal environment. Policy statements and plans produced by the regional and territorial authorities are required not to be inconsistent with the NZCPS. Matters addressed in the NZCPS include:

- Preservation of the natural environment;
- Protection of those characteristics of the coastal environment of special value to tangata whenua;
- Provision of appropriate subdivision, use and development of the coastal environment; and
- Crown's interest in the land of the Crown in the CMA.

These matters are addressed within the objectives, policies, rules and other provisions of the Auckland Regional Policy (RPS) Statement and the Auckland Regional Plan: Coastal (ARCPC) (which is discussed separately below). However, in summary the following planning assessment is provided for relevant objectives and policies of the NZCPS.

23.3.1 Assessment

23.3.1.1 National Priorities for the Preservation of Natural Character

The Project is not inconsistent with the National Priorities for Preservation of Natural Character

The Project has responded to the policy direction of this Chapter in the following ways:

- Assessments have been undertaken to consider the effects of the Project on coastal processes, marine ecology, avian ecology, freshwater ecology and terrestrial ecology (see Technical Reports G.3, G.4, G.6, G.11. and G.17). While in some areas not all adverse effects of the coastal environment can be avoided, the following specific assessment is concluded:
    - No area or habitat important to the continued survival of any indigenous species of nationally vulnerable or outstanding examples of community types are adversely affected by the Project;
    - The effects on regionally endangered species, such as the *Mimulus repens* (on the Causeway), will be mitigated through proposals to relocate the population identified and re-establish appropriate habitat for it (detailed further in Chapter 17 of this AEE);
    - Works in the Waterview Estuary and intertidal areas, associated with the Causeway works, and structures associated with the Great North Road Interchange (Oakley Inlet) have been designed and mitigated to avoid impacts on the ecosystems of this environment (see 23.1.6.6);
    - Construction methodologies have been designed to avoid effects on marine indigenous vegetation (e.g. mangrove areas and in particular the vegetation areas of Pollen Island and Traherne Island). Where such avoidance is not practicable, mitigation includes re-establishment of coastal vegetation areas (e.g. saltmarsh and estuarine fringe species planting) (detailed further in Chapters 14, 17 and 18 of this AEE and on the plans in F.16: *Urban Design & Landscape Plans*).
- The assessment and design for the Project has considered the natural character of the coastal environment, both in terms of the visual/landform, cultural and historic values and in terms of the dynamic processes of the physical environment (in particular, see Chapter 13 of this AEE and Technical Reports G.20: *Assessment of Visual and Landscape Effects* and G.4: *Coastal Processes*). Recognising the existing degree of modification of the coastal environment in the Project area, the specific elements which contribute to the natural character in this area are not considered to be adversely affected by the Project;
- Further specific detail with respect to the preservation of natural character where appropriate is provided in consideration of the Regional Policy Statement and Regional Plans (as regional instruments that are founded on the NZCPS).

23.3.1.2 Protection of Characteristics of Special Value to Tangata Whenua

Consultation has been undertaken with tangata whenua

The Project has responded to the policy direction of this Chapter in the following ways:

- Consultation has been undertaken and the views of Kawerau a Maki and Ngati Whatua (Iwi with manawhenua in respect of the coastal environment in the Project area[1]) have been sought in the Project design and in the assessment of environmental effects (discussed in Chapter 10 of this AEE). At the time of writing this AEE, a report had been provided by Ngati Whatua o Orakei, which is provided in Appendix E.6 of this AEE, but further input had not been received); and
- Those aspects of the environment identified as being of special value to Kawerau a Maki and Ngati Whatua have been recognized in the Project design (as documented in Chapters 12 through to 22); and
- Further specific detail with respect to the protection of characteristics of special value to tangata whenua is provided in consideration of the Regional Policy Statement and Regional Plans (as regional instruments founded on the NZCPS).

23.3.1.3 Use or Development of areas of the Coastal Environment

The NZCPS recognises that use and development of the CMA can be appropriate

The Project has responded to the policy direction of this Chapter and the following specific comments are made:

- On balance, and in recognition of the existing significant physical resource of SH16, the proposed widening of the Causeway is considered an appropriate use of the CMA (further it is noted that, as discussed in Section 23.5 below this use is anticipated in the ARP: C as works on the State highways in the Coastal Marine Area are provided for);
- Where appropriate, public access to and along the CMA has been provided for by the Project, including the extension and upgrading of the Northwestern Cycleway (SH16), the extension of the esplanade reserve along Waterview (Sector 5) and the enhanced pedestrian/cycle way between the Great North Road Interchange and Waterview Reserve (Sector 5). While no public access restrictions to the CMA are proposed, it is acknowledged that the future Motorway classification of the State highway will restrict pedestrian access. This is considered appropriate for public health and safety and is off-set by the maintained and enhanced pedestrian / cycle way proposed (the Northwestern Cycleway);

[1] The consultation summary in Appendix E.5 of this AEE details consultation with other iwi and tangata whenua groups.

- The Project has considered the collection, management and treatment of contaminant laden stormwater discharged from the Project as well as the existing impermeable surfaces of the State highway corridor. The assessment of these discharges on the coastal environment (marine ecology and coastal processes) has been considered and these assessments conclude that the adverse effects will be minor and, in the case of stormwater contamination, improved from the existing situation. As such, the disposal of wastes from the Project and the effects of such disposal have been considered and the effects have been appropriately managed;

- The Project design has had specific regard to hazards and climate change, particularly with respect to the stormwater wetland reclamation (Sector 1) and the design of the Causeway reclamation (Sector 4) (this is further detailed in Technical Report G.23: *Coastal Works Report*). While the need for hazard protection works has not been avoided, the Project has sought to respond to the need for such works for the existing physical infrastructure and minimise potential for works in the future; and

- A precautionary approach has been taken in the construction design and design for works in the CMA, particularly for the Causeway, bridges and reclamation (this is further detailed in Technical Report G.23: *Coastal Works Report*).

23.3.1.4 Crown's Interests in Land of the Crown in the CMA

Reclamation is identified as the best practicable option for the widening and raising of the Causeway

The Project has responded to the policy direction of this Chapter and the following specific comments are made:

- Management processes have been proposed in the construction methodology to ensure that material used to create and form the reclamation of the Project will not include contaminants which may adversely impact on the CMA, as detailed in Technical Report G.23: *Coastal Works Report*, and provided for in the Construction Environmental Management Plan, more specifically the management plans relating to earthworks and contaminated materials (see Appendix O of Technical Report G.9: *Assessment of Land and Groundwater Contamination* and Technical Report G.22: *Erosion and Sediment Control Plan*).

- Consideration has been given to alternatives for the proposed reclamations, as set out in Chapter 11 of this AEE where reasons for reclamation being the best practicable option for the Project are provided (see Section 11.5.5 of this AEE);

- Recognising the physical constraints of the land transport network in Auckland and the existing physical resources (including SH16 along the coastal margins and crossing the CMA), consideration has been given to alternatives for occupation of the CMA. In particular:
    - The Project has sought to minimise occupation of the CMA for piers associated with the Great North Road Interchange (see Section 11.5.6) and where complete avoidance is not considered practicable, provided the reasoning for the proposed Occupation in this area;
    - The Project has considered alternatives for temporary occupation of the CMA for construction management. On balance, it is considered that the potential effects of temporary occupation for the overhead conveyor in the CMA is appropriate given the opportunity this creates to reduce traffic movements and the impacts associated with these (see Section 11.5 for further discussion).

23.4 Hauraki Gulf Marine Park Act 2000

The HGMPA has the status of a national policy statement

The Hauraki Gulf Marine Park Act 2000 requires that all persons carrying out functions for the Gulf must have particular regard to sections 7 and 8 of that Act, and that it has the status as a national Policy Statement, with respect to the Hauraki Gulf. A number of matters in sections 7 and 8 of this Act have been considered in response to the policy matters of the NZCPS. However, the following additional comments are made:

- As a matter of national significance, the interrelationship between the Project and wider Hauraki Gulf (particularly the Waitemata Harbour) has been recognised in the assessment of effects, particularly with respect to coastal processes and marine ecology;

- The use of the Hauraki Gulf by the Auckland community for economic activities and for recreation has been recognised, for example through the maintained navigation channel in the Whau River (particularly used by Te Atatu Boat Club for access to the Hauraki Gulf);

- The treatment of stormwater and design of the Causeway in the CMA have had particular regard in the assessment of effects to maintaining the air, water and ecosystems of the CMA (part of the Hauraki Gulf) and, the discharge of contaminants from SH16 is considered to be improved from the existing situation (which provides for enhancement of the life-supporting capacity of the CMA and Hauraki Gulf);

- The Project proposes habitat restoration to the coastal margins of the Project, including works on Traherne and Pollen Islands (particularly with respect to marine ecology mitigation and vegetation ecology mitigation), which contributes to the enhancement of natural and physical resources of islands of the Hauraki Gulf; and

- Through restoration of the Oakley Inlet Heritage area, the Project proposes protection of cultural and historic associations of the community with historic resources and further seeks to integrate these with recreation opportunities. In particular this relates to the commercial history of the Waterview Estuary / Oakley Inlet area (e.g. the Star Mill and Garrett Tannery sites).

23.5 Auckland Regional Policy Statement 1999

The Auckland Regional Policy Statement 1999 (RPS) aims to achieve integrated, consistent and coordinated management of the Region's resources and provide greater certainty over the ways that natural and physical resources are managed. The objectives and policies of the RPS considered relevant to the Project are summarised in Chapter 6 (Section 6.4) and full reference is provided in Appendix E.3 of this AEE. It is noted that there are two Proposed Changes, which are discussed in the assessment below.

While a full assessment of the Project has been undertaken against the objectives and policies of the RPS, the most relevant are considered to be those relating to the regional overview and strategic direction and transport.

23.5.1 Assessment

23.5.1.1 Regional Overview and Strategic Direction

The RPS sets regional direction

The Objectives against which the Project has been assessed are all those in 2.5.1 (and as Proposed, Objectives 6.1.1) and the Policies are 2.5.2-1, 2.5.2-2, 2.5.2-6, 2.5.2-6, 2.5.2-7, 2.5.2-7 and 2.6.1-1, 2.6.1-2 and 2.6.7 (and as Proposed 2.6.8, 2.6.11, 2.6.14)

In consideration of this Chapter of the RPS, the following conclusions are made:

Project assists in accommodating the Region's growth

- As demonstrated in the regional assessment of effects discussed in Section 13.2 of this AEE and in Technical Report G.18: *Assessment of Transport Effects*, the following transport benefits of the Project are identified and demonstrate that the Project is necessary for the social and economic wellbeing of the Region's population:
    - The Project assists in accommodating the Region's growth in a manner consistent with the RPS and its strategic objectives, by improving accessibility and efficiency of the transport network between centres of economic development and growth. This gives effect to the principles of the RMA and

the LGAAA 2004, which specifically seeks to integrate land use and transport provisions in the planning for the Region and provides for the growth of these economic centres;

- The Project provides for improved use of existing transport facilities (e.g. the existing components of the WRR that the Project unites as a completed strategic route);
- The Project promotes an efficient land transport system by completing the strategic transport network in this part of the Auckland Region (the WRR), removing through traffic from the local road network and reducing congestion, improving travel times, trip reliability and connectivity between economic growth areas of the Region;
- The Project increases the carrying capacity and provision for passenger transport along SH16 and therefore progresses integration of transport modes. The Project creates an improved opportunity for passenger transport on the local/arterial road network by completing the SH20 strategic network (though it is recognised that this opportunity will be progressed by others);
- The Project includes an integrated pedestrian / cycle facility for those areas where the proposed State highway road development is 'at-surface' (e.g. SH20 from the Maioro Street Interchange to Alan Wood Reserve, and SH16);
- The Project maintains the opportunity for the future strategic route of the Avondale-Southdown Rail Line (facilitating its future development where practicable);
- Connectivity or 'permeability' is maintained across the Project, for local traffic (e.g. via the proposed interchanges and by constructing the Project beneath local roads such as Richardson Road, New North Road and Great North Road) and for pedestrians (e.g. through the subway and crossings proposed at Te Atatu Interchange, at crossings below the Great North Road Interchange viaduct structures, through tunnelling and at Hendon Park); and
- Connectivity to and along waterways and the CMA within the Project area is maintained and enhanced, particularly the coastal margins of SH16, Waterview / Oakley Inlet and Oakley Creek south of New North Road (where the Project is 'at surface').

The Project provides for improved use of transport facilities and has transport benefits for the Region

- In this way, the Project facilitates the urban intensification and growth in a manner consistent with the Regional Growth Strategy (as reflected by the inclusion of this Project in the Strategic Network of the ARLTS) and therefore reflects the integrated land and transport planning of the RGS and ARLTS;

The Project facilitates the urban intensification and growth

- The NZTA has, in development of the Project, undertaken, with other stakeholders, an Urban and Landscape Design Framework (June 2010). This Framework sets out an overall 'urban design vision', for the Project and the wider surrounding area in which the Project sits (e.g. incorporating aspirations from the Council and community). Where practicable, the urban design and landscaping proposed for the Project (see the plans in F.16: *Urban Design and Landscape Plans*) has drawn from the relevant concepts of the Framework to maintain and enhance urban landscape and to contribute to a pleasant environment for users and those resident around the Project;

- The Project promotes transport efficiency in a way that does not compromise the intrinsic values of the Region's natural resources or the quality of the immediate environment.

  The does not compromise the intrinsic values of natural resources or quality of the environment

  - Although it involves widening of the existing SH16, including works within the CMA; the effects on the natural environment can be managed and measures implemented to avoid and mitigate adverse effects, as discussed in Chapters 13 and 17 of this AEE;
  - Works on waterways have been designed to avoid, remedy and mitigate potential adverse effects and there is long term opportunity for environmental enhancement from the Project through the restoration and rehabilitation of Oakley Creek (see Chapter 22);
  - The impacts on groundwater are no more than minor (see Chapter 21 in particular, but also Technical Report G.7: *Assessment of Groundwater Effects*).

- The proposed landscaping and built form of the Project (see the Plans in Section F.16: *Urban and Landscape Design Plans*) has specifically sought to recognise the volcanic heritage and maritime locality of the Project;

- The Project design has sought to minimise impacts on the Region's heritage and has identified opportunities to off-set these impacts by enhancement and development of access to and interpretation of the Oakley Inlet Heritage Area (see F.9: *Oakley Inlet Heritage Plan* and Technical Report G.2: *Assessment of Archaeological Effects*, for detail);

  The Project design has sought to minimise impacts on the Region's heritage

- The Project provides nationally significant infrastructure that utilises existing physical resources in the coastal marine area (the existing SH16 Causeway). An assessment of the impacts on natural character of the coastal environment (see in particular Technical Reports G.4: *Coastal Processes* and G.20: *Assessment of Visual and Landscape Effects*) has been undertaken and generally concluded that these are no more than minor;

- Assessment of the Project has included consideration of the emissions of the Project (e.g. noise, air, vibration and contaminants (including sediment) on the health of the environment and the community. In the case of air, the regional effects of the Project are negligible. For noise effects, the local adverse effects have been mitigated by the proposed noise walls, road surfacing and other noise attenuation. For contaminants discharged to water the effects have been mitigated and in the case of SH16 discharging to the CMA, the adverse effects are improved from the current situation;

- An assessment has been undertaken on the impacts of the Project on intrinsic values of the Region's natural resource base, including:

  - Natural features (e.g. waterways and the coastal marine area);
  - Landscapes; and
  - Areas of indigenous vegetation or habitat for indigenous fauna

  (See particularly Technical Reports G.3: *Assessment of Avian Ecological Effects*, G.6: *Assessment of Freshwater Ecological Effects*, G.8: *Assessment of Herpetofauna Ecological Effects*, G.11: *Assessment of Marine Ecological Effects* and G.17: *Assessment of Terrestrial Vegetation Effects*).

  Where practicable, the design has sought to avoid impacts on these resources. In order to balance the potential effects with the regional significance of the Project, where avoidance of impacts is not practicable, measures have been taken to remedy and mitigate potential adverse effects. For marine ecological impacts this has included off-setting mitigation (eg. enhanced stormwater treatment, to acknowledge the ecological effects of reclamation);

The design has sought to avoid impacts on natural resources

- Consultation has been undertaken and input has been sought from Kawerau a Maki and Ngati Whatua (Iwi with manawhenua in respect of the Project area) to recognise their role as kaitiaki of natural resources (at the time of writing this AEE, two reports have been provided by Ngati Whatua in respect of the SH16 and SH20 elements of the Project, see Appendix E.6 of this AEE);

- Consideration has been given to cumulative effects of the Project. In particular, the cumulative effects to the natural character of the coastal marine area have been considered. Once the filter strips and rock armouring of the Causeway is 'bedded in', it is considered it will have a profile and appearance very similar to the current Causeway and that its long term impact on natural character is therefore likely to be low;

Consideration has been given to cumulative effects of the Project

- Consideration of the alternatives in the design of the Project (both for construction and operation) has been provided in such a way as to:
    - Avoid adverse effects on the environment, including impacts on archaeological sites, natural features and social impacts (in particular, the decision to include a significant component of tunnelling for the Project avoids potential adverse social effects); and
    - Not preclude opportunities for other projects, including the future Avondale-Southdown rail, and identified as a future strategic transport route (for freight and passenger transport) and an option for accommodating future growth in the existing urban areas of the Region.

Opportunities for other projects not precluded

23.5.1.2 Matters of Significance to Iwi

The Objectives against which the Project has been assessed are 3.3.1 through to 3.3.3 and the relevant Policies include 3.4.1, 3.4.4 and 3.4.10. The following conclusions from assessment against these are made:

- As noted above in Section 23.5, consultation has been undertaken with Iwi and tangata whenua. Specifically, Kawerau a Maki and Ngati Whatua o Orakai (Iwi with manawhenua in respect of the Project area) have been consulted and reference has been made to cultural impact reports and management plans they have prepared. At the time of writing this AEE, two reports specifically on the Project have been received from Ngati Whatua o Orakei, see Appendix E.6 and these have been responded to in the Project design;

Consultation has been undertaken with Iwi Kawerau a Maki and Ngati Whatua

- Specific comment has been sought from Kawerau a Maki and Ngati Whatua on those environmental assessments of specific concern or interest to them (e.g. archaeology assessment, and ecological reports (as requested) and the *Oakley Creek Restoration and Rehabilitation Guidelines* in particular;

- The Project proposes further consultation with Ngati Whatua o Orakei in the Open Space Restoration Plans, particularly Waterview Reserve area, following comments received and interests expressed by Ngati Whatua o Orakei in their reports on the Project (Appendix E.6);

- The Project proposes protocols for accidental discovery of archaeological sites during construction (detailed further in Technical Report G.2: *Assessment of Archaeological Effects*) in recognition that such discovery may be waahi tapu or represent ancestral taonga of special value to tangata whenua and provides for necessary response in accordance with tikanga Maori;

Protocols for accidental discovery proposed

- The opportunities identified for a future Marae (identified by Waitakere City Council at Harbourview - Orangihina Park) are not affected by the Project; and
- There are opportunities identified for customary activities in harvesting of harakeke identified in the landscaping planning for the Project (see F.16: *Urban and Landscape Design Plans*). However, it is noted that this land area is also the future rail corridor land (discussed in 23.4.1.3 below).

23.5.1.3 Transport

The Objectives against which the Project is assessed are 4.3-1 through to 4.3-4. The relevant Policies include 4.4.1, 4.4.4, 4.4.7 and 4.4.10 (and Proposed Objectives 4.3.1 through to 4.3.9 and the proposed revision to those policies identified). It is noted that some policy direction of this Chapter is also recognised in the overall strategic direction (discussed in Section 23.5.1.1 above) and is not repeated here. In assessing the Project against these matters, the following conclusions are made:

At a strategic level the environmental effects of the WRR have considered in the confirmation of the strategic option in the ARLTS

- The Project is a recognised component of the Region's strategic transport option (as set out in the ARLTS 2010 – 2040). The option assessment for the development of the ARLTS sought to identify a suite of projects and policies that combined will provide for a sustainable transport system that meets the outcomes sought for the Region. The environmental effects of these options have been considered in the confirmation of the strategic option of the ARLTS (see also Section 11.3;

The deep tunnels avoid potential environmental effects and impacts on amenities

- In developing the Project, in particular the options assessment for the Project (see Chapter 11) consideration has been given to those options that reduce the environmental effects of transport and avoid the modification of landscapes and natural habitats. A key factor in selecting tunnelling was the opportunity that deep tunnels provided to avoid potential environmental impacts and impacts on amenities (see also the discussion in 23.6.1.1 above);
- A social impact assessment has been undertaken which considers the 'well-being' of residents (both within the Project area and for the wider Region) (see Technical Report G.14: *Assessment of Social Effects*). This assessment considers the health of the community, including the opportunities created by the Project for more 'active' transport modes (cycling and walking) and for accessibility to health facilities;
- A key objective for the Project is to improve accessibility for individuals and businesses and support regional economic growth and productivity. In developing the Project, specific assessment of how the Project delivers on this objective is provided (see Section 13.2 and 13.3 of this AEE and Technical Report G.18: *Assessment of Transport Effects*.) These assessments demonstrate that the Project improves accessibility between important economic centres and growth areas;

- The Project is recognised in the ARLTS 2010 – 2030, and as such, supports the Region's strategic land use and transport planning, including the compact and intensified urban form of Auckland;

- The development of the Project has demonstrated (see Section 13.2 and Technical Report G.18: *Assessment of Transport Effects*) that the Project provides for better use of the existing transport network by relieving congested routes and providing more capacity in sections of the strategic network that improve the operation of that strategic network, including improvements to routes for freight;

- The Project design has been considered within the context of the NZTA's purpose and objectives (e.g. for safety and efficiency). The designs have been taken through the NZTA's safety audit process and the imperative for safe designs have been included in the evaluation of design options (as discussed in Chapter 11 of this AEE);

- In developing specific design for the Project, the management and treatment of stormwater has been identified as an opportunity to manage the effects of the Project on water quality and enhance the water quality discharged from the existing network.

- The Project improves opportunities for passenger transport on the existing SH16, by increasing the length of bus shoulder lanes along the Causeway. The Project also facilitates opportunities for development of identified Quality Transport Networks, by reducing traffic flows on the local network (it is acknowledged that this is an 'opportunity created' rather than specifically delivering on this passenger transport development). As noted above, the Project also maintains the opportunity in the future for provision of the Avondale-Southdown Rail Line and Project design has been based on consultation with KiwiRail.

23.5.1.4 Energy

Chapter 5 of the RPS contains objectives and policies that relate to the sustainable use of energy resources. Objective 5.3.1 seeks the efficient use and development of energy resources and Policy 5.4.1-3 seeks an urban form that is supported by transportation systems. It is considered that the Project is consistent with this policy direction as it completes the regional strategic transport corridor, providing for efficient through traffic routes and separating these from the local road network.

The Project completes a regional strategic transport corridor

23.5.1.5 Heritage

Chapter 6 of the RPS contains objectives and policies that are related to the protection of Auckland's natural and physical heritage resources. Objectives considered relevant to this Project include 6.3.1 through to 6.3.4 and the Policies of 6.4.1, 6.4.4, 6.4.7, 6.4.10, 6.4.13, 6.4.16 and 6.4.19 as well as Proposed Objectives 6.3.6 through to 6.3.8 and the associated policy amendments to 6.4.19. While policy direction for heritage has been generally discussed in Section 23.6.6.1 above, the following more specific assessments are made in respect of this Chapter:

- Public access to the Region's heritage resources are maintained and enhanced by the Project, with the opportunity for public access and interpretive signage of the Starr Mill site in the Oakley Inlet Heritage area identified as a benefit of the Project (including off-setting impacts of the Project on that heritage area). This area is identified as being of regional heritage value, contributing to places and events important in the Region's history and identified and valued by the community. (see F.9: *Oakley Inlet Heritage Plan* and Technical Report G.2: *Assessment of Archaeological Effects*, for detail);

Public access to the Region's heritage resources are maintained and enhanced

- The Project protects and restores ecosystems in particular:
    - The rehabilitation and restoration of Oakley Creek, proposed in response to the stream diversions and freshwater ecology (see Chapter 22 and Technical Report G.15: *Assessment of Stormwater and Streamworks Effects* and Technical Report G.6: *Assessment of Freshwater Ecological Effects*). Overall, the mitigation proposals seek to protect and restore the ecological values of this waterway and provide improved habitat opportunities; seeking to maintain a 'no net loss' approach[2], with proposals for the ongoing management and protection of the ecological restoration and enhancements to the public access to these areas;
    - As noted earlier, the improved stormwater treatment proposed from the Project off-sets the ecological impacts of reclamation on the CMA (by improving stormwater discharge quality from the existing SH16 carriageway) and mitigates the effects of stormwater discharge from the new transport elements of the Project;
    - The design of the Causeway (ground improvements) avoids potential adverse effects on marine ecology (discussed in more detail in Section 23.6.6.6 below);

The Project protects and restores ecosystems

[2] This is encapsulated in the approach where the length of stream lost is compensated by the length of proposed stream restoration, discussed in Technical Report G.6: *Assessment of Freshwater Ecological Effects*.

- The re-establishment of habitat for the threatened *Mimulus repens* on the Causeway provides mitigation for the potential adverse impacts on this ecological heritage, in an environment where the ongoing viability of the restoration can be managed (e.g. it is retained within land owned by the NZTA) (see Section 17.8 and Technical Report G.17: *Assessment of Vegetation Effects* for details); and
- Taking a precautionary approach, the population of potentially significant *Geranium* spp identified in Sector 9 will be further assessed and mitigation will include relocation of this population, should it be confirmed to be significant (see Chapter 22.14 and Technical Report G.17: *Assessment of Vegetation Effects* for details).

- An assessment of the visual and landscape effects of the Project has been undertaken and the following assessment is made:

Tunneling avoids potential effects on landscapes

  - The proposed tunneling of significant elements of the work avoids potential effects on the quality and character of the landscapes in this area (this includes a volcanic view shaft area), see Chapter 21 and the Chapter 11, where the alternatives to tunneling are discussed;

Landscape impacts in the CMA are not significant

  - As discussed earlier, the form of works proposed on the reclamation will not have any significant impact (or cumulative effect) on the coastal marine environment, given the existing Causeway in this area.

The Project will change the landscape in Sector 9 and at the Great North Road Interchange

  - It is acknowledged that there are visual and landscape impacts of the Project, particularly at the Great North Road Interchange and in Sector 9. These are not outstanding landscape areas, but do represent a significant impact (in the short and medium term). While the planting and mitigation proposed will mitigate these effects in the long term, it is acknowledged that the Project represents a permanent and considerable change to this visual catchment.
  - The views of Volcanic Cones, as mapped by the Regional Council, have informed the landscape and visual assessment and the Project avoids intrusion into these view shafts (see discussion for Sector 1, Chapter 14, and Sector 9, Chapter 22 in particular).

- The tunneling avoids potential impacts of the Project on other heritage values of the area, including the Oakley Creek waterfall which is an unusual natural feature (in the Auckland waterway context), with high community and public association of value (as discussed in Chapter 11. This area was identified as a constraint for the Project, and options that avoided this area, including tunneling and potential effects on this constraint were considered in the option evaluation process.

- The plans in F.16: *Urban Design and Landscape Plans*, provide landscaping proposals that maximise the opportunity for use of indigenous plants and where appropriate eco-sourcing of stock (e.g. particularly for wetland and riparian vegetation).

23.5.1.6 Coastal Environment

Chapter 7 of the RPS includes objectives and policies related to the coastal environment, reflecting and implementing the national direction of the NZCPS. The Objectives of 7.3 and Policies of 7.4.4, 7.4.7, 7.4.10 7.4.13, 7.4.22 and 7.4.28 are considered particularly relevant to the Project.

The use of the coastal environment is considered appropriate

It is noted that many of the objective and policy matters identified in this Chapter have been discussed and responded to in the discussion on the NZCP (section 23.5 above). The intention is not to repeat that assessment, but rather to highlight the regional and additional considerations from the above objectives and policies with respect of the Project. On this basis, the following conclusions from the planning assessment are made:

- Given the existing physical infrastructure of SH16, and the discussions in Section 23.5 above, the use of the coastal environment is considered appropriate (as provided for in Objective 7.3-4);

- The impact of the Project on coastal processes has been considered, and the conclusion is that the effects on processes will be minor;

- Public access to and along the CMA is maintained, with enhancement around the Waterview / Oakley Inlet area;

- The recreation opportunities of the CMA in this area are already limited (e.g. due to the constrained access beneath the existing Causeway bridges). In other areas, such as the Whau River, recreation access is important (navigation and boat access for Te Atatu Boat Club). This access might need to be closed for short times through the Project construction, in consultation with the Boat Club, but will be managed to avoid disruption to passage of recreation craft (see sections 15.3 and 17.3);

- The management of materials disturbed in the coastal marine area, particularly associated with channel realignment (Waterview estuary and Oakley Inlet), piling (bridge construction) and the deposition of materials for the reclamation, will be undertaken in such a way as to minimise the potential for adverse effects on the CMA, including visual and ecological impacts (see discussion in Chapters 15, 17 and 18 and relevant technical reports related to coastal works, coastal processes, sediment control and construction management).

- In considering the effects of the Project in the CMA, consideration has been given to the potential impacts on the wider Waitemata Harbour and Hauraki Gulf. This assessment concludes that these impacts are minor or negligible (see Chapter 13 and Technical Report G.4: *Coastal Processes*).

- Specific consideration has been given to the sub tidal areas of the Project, particularly in recognition of the Coastal Protection Area 1 status of the Waterview Estuary and area surrounding the Pollen Island. The marine ecological features of this environment include mangrove forest, saltmarsh, shellbanks, intertidal mudflats and sand flats, sub tidal soft muds and man-made rocky shore (existing rock revetment). In summary the following conclusions are made:

  Impacts on the CMA have been minimised and mitigated and where appropriate offset mitigation has been proposed

  - While the greater area is recognised as an important area for wading birds, the area of the Project was considered to have relatively low use for intertidal feeding though a slightly higher value for roosting (e.g. high tide roosting on the Causeway rock revetments were noted). Temporary provision of roosting areas (during construction) with re-establishment of these areas following construction, were considered appropriate measures to mitigate these effects, as discussed in Chapter 13 of this AEE and in Technical Report G: 3: *Assessment of Avian Ecological Effects*.
  - The ecological values of the marine environment on the northern side of SH16 are high to moderate and similarly the southern side around Traherne Island. Other areas are considered to be of lower value. In most cases, works and occupation of the CMA are considered to have minor effects of the sub tidal areas, with the exception of the permanent loss of the CMA to reclamation. As noted in the ecological assessment, it is difficult to mitigate the adverse effects of permanent habitat loss.

    However, opportunities to reduce this impact (through habitat restoration) and to off-set these adverse effects have been proposed, e.g. remediation of the mudflat adjacent to the Causeway Embankment and improving treatment of stormwater, restoration of the coastal fringe habitat along the alignment, removal of gross litter and debris from within and adjacent to the CMA and restoration works (weed control and revegetation) within Pollen Island are proposed (as discussed in Chapter 13 of this AEE and in Technical Report G: 11: *Assessment of Marine Ecological Effects*).

23.5.1.7 Water Quality

Chapter 8 of the RPS includes objectives and policies related to the water quality. The Objective of 8.3.1 and Policies 8.4.1, 8.4.4, 8.4.7, 8.4.21 and 8.4.24 are considered particularly relevant to the Project.

It is noted that many of the objective and policy matters identified in this Chapter have been discussed and responded to in the discussion on the regional strategic direction (section 23.6.1.1 above). The intention is not to repeat that assessment, but rather to highlight the regional and additional considerations from the above objectives and policies with respect of the Project. On this basis, the following conclusions from the planning assessment are made:

- The assessment of the Project has considered the impacts of the Project on water quality for the coastal waterways, streams and groundwater (Technical Reports G.6: *Assessment of Freshwater Ecological Effects*, G.11: *Assessment of Marine Ecological Effects*, G.7: *Assessment of Groundwater Effects,* and G.15: *Assessment of Stormwater and Streamworks Effects*).

- The effects on the quality of groundwater from the proposed take of groundwater are considered no more than minor (see Section 22.11 of this AEE);

Effects on the quality of groundwater are considered no more than minor

- The Project design has sought to maintain and enhance water quality discharged to the coastal receiving waters in the design of stormwater management and treatment systems (see Technical Report: G.15 *Assessment of Stormwater and Streamworks Effects*;

- The Project design for stormwater treatment and the proposed restoration and rehabilitation will mitigate the effects of contaminants discharged into Oakley Creek and enhance the overall water quality and the health (balancing the effects of current unmanaged stormwater discharges and the form and vegetation of the current riparian margins to this stream with the Project works);

restoration and rehabilitation will mitigate the effects of contaminants discharged into Oakley Creek

- The Project design will not adversely impact on the water quality of other waterways affected by the Project (Pixie Stream and Meola Creek (see Chapters 14 and 19);

- The discharge of wash-water from within the tunnels will be managed (depending on the quality of water it will either be discharged for treatment to the stormwater system, discharged to sewer, or tanked off-site for appropriate treatment) to avoid potential adverse effects on receiving environments;

- Construction management will be carried out in a way that appropriately manages sediment discharge over construction (with regard to both sediment and erosion control and temporary stormwater management, see Technical Reports G.15 *Assessment of Stormwater and Streamworks Effects* and G.22: *Erosion and Sediment Control Plan*. In particular, the level of treatment proposed (including flocculation of all detention ponds and decanting earth bunds) is considered to contribute to this policy direction.

23.5.1.8 Water Conservation and Allocation

Chapter 9 of the RPS includes objectives and policies related to the water conservation and allocation. The Objective of 9.3.1 and Policies 9.4.1, 9.4.4, 9.4.7 and 9.4.10 are considered particularly relevant to the Project.

The impacts of the Project on water quantity and flooding have been considered and can be managed and mitigated to be minor

It is noted that some of the objective and policy matters identified in this Chapter have been discussed and responded to in the discussion on the regional strategic direction (section 23.6.1.1). The intention is not to repeat that assessment, but rather to highlight the regional and additional considerations from the above objectives and policies with respect of the Project. On this basis, the following conclusions from the planning assessment are made:

- The potential effects of the flow of water in the Oakley Creek have been considered, both with respect of the stream works and with respect to the taking of groundwater. Overall, the effects on flows are considered minor (see sections 22.9 and 22.11 Technical Reports G.15 *Assessment of Stormwater and Streamworks Effects* and G.7: *Assessment of Groundwater Effects*).
- The potential effects of the Project on flooding, associated both with the proposed diversions of Oakley Creek and works in the floodplain, have been assessed (see sections 22.20 with respect to flooding). The assessment concludes that the Project avoids increases to the existing flooding issues with the proposed establishment of open space at 25 Valonia Street, which will provide additional flood storage[3] and creates an opportunity to remedy existing flooding issues upstream of the Creek (see also Technical Reports G.15: *Assessment of Stormwater and Streamworks Effects* and G.22: *Erosion and Sediment Control Plan*);
- The potential effects of discharges to waterways have been assessed and it is considered that the design of these discharges is appropriate to avoid erosion (see Technical Report G.15: *Assessment of Stormwater and Streamworks Effects*);
- While the construction methodology for the construction of the Causeway constitutes 'damming', this is not associated with permanent abstraction or take of water, but rather as a measure to mitigate other potential adverse effects associated with construction activities. As such, it is considered that adverse effects are minor for this work (see Technical Report G.4: *Assessment of Coastal Processes* and G.23: *Coastal Works* for detail);
- The restoration and rehabilitation of the Oakley Creek and the realignment of the Creek has sought to minimise the extent of diversion and acknowledge the values expressed by Ngati Whatua with respect to this waterway.

[3] Compared to the 'permitted baseline' consented project for residential development of this site.

23.5.1.9 Air Quality

Chapter 10 of the RPS contains objectives and policies relating to air quality. The Objectives of 10.3.1, 103.3.2, and 10.3.3 and Policies 10.4.1and 10.4.4 are considered particularly relevant to the Project.

Potential effects on air quality (both locally and regionally) have been assessed

The following conclusions from the planning assessment of the objectives and policies of this Chapter include:

- The potential effects of the Project on air quality (both locally and regionally) have been assessed, for both the construction and operation impacts, this assessment is provided in Technical Report G.1: *Assessment of Air Quality Effects* and is discussed in the assessment Chapters of the AEE (particularly Chapter 13 for regional effects).
- The assessment of effects on air quality concludes that, while the Project provides a new road in the regional network, it has a negligible effect on the Region's air quality and that air quality is expected to improve over the next two decades (as the vehicle fleet improves);
- The Project provides improved facilities for passenger transport and for pedestrian and cycling activities (on SH16 and along open road sections of SH20);
- The discharge of contaminants to air via vent stacks results in a local air quality improvement (by dispersing contaminants above the local environment into the atmosphere) (though it is noted this does not reflect a change to the regional air shed); and
- Within the Project area, receptors near busy arterial roads experience improved air quality (due to the relief on these roads provided by the Project), though it is recognised that there are areas where local air quality is reduced by the Project (by the introduction of a road into an environment where there wasn't previously one). In these cases, contaminants to air from the Project are not expected to result in any exceedance to the AQNES.

23.5.1.10 Natural Hazards

The Causeway works have addressed coastal hazards and works in Sector 9 have considered flooding hazards

Chapter 11 of the RPS contains objectives and policies relating to avoiding, remedying or mitigating the effects of natural hazards. The Objective 11.3 and Policies of 11.4.1 are considered relevant. It is noted that coastal hazards and climate change issues have been discussed in the assessment of the NZCPS above.

In addition to this, assessment has been undertaken of the potential of the Project (terrestrial works) to impact on flood hazards associated with the floodplain of Oakley Creek. As concluded in Chapter 22, the Project design mitigates the loss of the length of Oakley Creek, and of flood plain storage through the Project design.

Further it is noted that the retention of 25 Valonia Street as open space creates an opportunity for flood storage to be retained in the area, which provides greater opportunity for reduction of upstream flooding issues and generally mitigates downstream flooding issues.

23.5.1.11 Soil Conservation

The management of soil degradation and potential impacts of sediment discharges to receiving environments is provided in Chapter 12 of the RPS. In particular, the Policies of 12.4.4 are noted for the Project.

Stormwater management and erosion and sediment control are proposed to address issues of soil conservation

The assessment of the Project has considered the potential effects of earthworks proposed for the Project and identified measures in the Project design to avoid, remedy and mitigate potential effects. The Project design, including the stormwater design (see Technical Report G.27: *Stormwater Design Philosophy Statement*) and the management of erosion and sediment control in construction (see Technical Report G.22: *Erosion and Sediment Control Plan*) identify appropriate land use practices for the management of soil degradation and the adverse effects on water quality of discharges of sediment laden water. The ecological assessments, particularly in relation to the receiving environments (freshwater and coastal) have considered the potential impacts of sediment laden discharges to these environments. Subject to the management measures proposed, the effects of the Project are considered no more than minor.

23.5.1.12 Contaminated Sites

Chapter 17 of the RPS considered the potential impacts of the use and development of contaminated sites. The objectives and policies of this Chapter have been considered, particularly in the assessment documented in Technical Report G.9: *Assessment of Land and Groundwater Contamination*. In summary, the following comments are made in consideration of the objectives and policies:

Monitoring of contamination is proposed throughout construction

- Contaminated sites investigation has been undertaken to confirm the scale and extent of contaminated material potentially affected by the Project. Further monitoring of contamination is proposed throughout construction;
- Site management, including removal of contaminated material is proposed to ensure that the Project remedies and mitigates the adverse effects of existing contaminated areas;
- Management measures are proposed to ensure that the Project does not introduce contaminated material into the environment, particularly sensitive receiving environments (e.g. the management of hazardous substances and the screening of fill materials prior to their use on site).

23.5.1.13 Esplanade Reserves and Strips

Extensions to esplanade reserve areas propsoed

Chapter 18 of the RPS recognises the importance of esplanade reserves and strips in providing access to and along the CMA and in protection of conservation values. The Project proposes to extend the existing esplanade reserves in areas along the Oakley Inlet and Oakley Creek, where this can be provided for by land required for the Project. In other areas, the NZTA commits to working with the Auckland Council to extend the esplanade reserve as an 'off-set' to open space lost from the Project (in particular around the Waterview area).

23.6 Auckland Regional Plan: Coastal 2004

The Auckland Regional Plan (ARP:C) provides a framework to promote the integrated and sustainable management of Auckland's coastal environment. The ARP: C contains objectives and policies that apply to the broader coastal environment and rules that have effect over the CMA. A number of consents are sought for the Project for coastal permits, relating to reclamation, use and occupation of the CMA, activities in the CMA, discharges to the CMA, and the taking, use and diversion of coastal waters (as set out in Chapter 7 of this AEE). This Section includes an assessment of works against the relevant objectives and policies for these consents. Matters of relevance to the Project are summarised in Chapter 6 of this AEE and the relevant objectives and policies are provided in Appendix E.3.

The ARP: C is operative with the exception of provisions subject to Variations and proposed Plan Changes: Variation 1 and Change 4, discussed in Chapter 6 of this AEE.

It is noted that a number of the objective and policy matters identified in the Coastal Plan are consistent with and similar to those identified in the NZCPS, Haurakei Gulf Marine Park Act, and the Regional Policy Statement. In such cases, the assessment of objectives and policies has been discussed and responded to in the discussions previous (e.g. sections 23.3, 23.4 and 23.5). The intention is not to repeat that assessment, but rather to highlight the regional and additional considerations from the objectives and policies of the ARP: C, with respect to the Project.

23.6.1 Assessment

23.6.1.1 Natural Character

Chapter 3 of the ARP: C sets out objectives and policies for recognising and protecting natural character in the coastal environment. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 3.3.1 and 3.3.2 and Policies 3.4.1, 3.4.2, 3.4.3, and 3.4.4.

Given the national priority of protection of natural character, there is consistent direction in the objectives and policies of the NZCPS and RPS. The assessment of these objectives and policies is not repeated here. However, on those objectives and policies with more specific regional direction, the following assessment summary is provided:

The impacts on natural character of CPA1 and CPA2 areas are minor

- Particular regard has been had to the natural character and values of the CPA1 and CPA2 areas within the Project area, in the assessment of effects in the CMA. In particular, the marine ecological assessment and coastal processes assessments have considered the specific values identified with those areas of the CPA1 (Motu Manawa (Pollen Island) Marine Reserve) and CPA2 (Henderson Creek) areas (as defined in Schedule 3 of the ARP: C), and the specific values identified within the environments of the Project. Overall the assessments conclude that the impacts on natural character of these areas, as a result of the Project are minor (see Chapter 13 (in particular) for the summary of this assessment).

Restoration of the coastal fringe habitat proposed

- The Project proposes restoration of the coastal fringe habitat along the Causeway and other areas of reclamation (e.g. Whau bridge abutments and wetland at Jack Colvin Park) as well as revegetation within Pollen Island area (as discussed in Chapter 13 of this AEE and in Technical Report G: 11: *Assessment of Marine Ecological Effects*). This replanting is indicated on the plans in F.16: *Urban Design & Landscape Plans*, which stipulates that saltmarsh and wetland habitat plantings will give preference from local genetic plant stock.

23.6.1.2 Landscape

Chapter 4 of the ARP: C sets out objectives and policies for recognising and protecting landscape in the coastal environment. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 4.3.1 and 4.3.2 and Policies 4.3.1, 4.4.2, 4.4.3, and 4.4.4, 4.4.5 and 4.4.6. Technical Report G.20: *Assessment of Visual and Landscape Effects* provides a detailed assessment of the visual and landscape effects of the Project, and this assessment is summarised in Chapters 14, 15, 17 and 18 of this AEE.

There is some overlap in the direction of the objectives and policies of the NZCPS and RPS with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, on those objectives and policies with more specific regional direction and direction with respect of management of the coastal environment, the following assessment summary is provided:

- The Whau River, Traherne Island and Rosebank Peninsula within the Project area are identified as an Outstanding Landscape in the ARP:C (Ranking 6). The scale and design of the widened Whau River bridge has sought to maintain a consistent visual appearance (including location of piers) to the existing bridge structure. Although the CMA and Peninsula are significant landscape features, the environment is already highly modified and the design of the Project will not be a noticeable change, from the majority of viewing locations (further the proposed planting will provide enhancement to the coastal margins in this area);
- The scale and design of the Causeway has sought to reduce and mitigate adverse effects of landscape elements, features and patterns (for example, retaining the low form of the Causeway which enables views of the CMA beyond the Causeway to be maintained) and retaining the visual linkages that exist for adjacent land;
- The Great North Road Interchange and viaducts within the CMA will have a more than minor effect, with a new dominant motorway structure imposed. However the vegetated area surrounding the motorway structures will virtually in-fill the land between these structures and the CMA.
- The proposed planting, as indicated on the plans in F.16: *Urban Design & Landscape Plans*, reintroduces appropriate vegetation patterns, with Pohutukawa (*Mestrosideros excelsus*) and saltmarsh vegetation planting;
- The natural variations in the foreshore and seabed, in particular the shell cheniers north of SH16 will be re-established in areas where these are disturbed by the Causeway construction (as discussed in Technical Report G.23: *Coastal Works Report*).

The scale and design of the Causeway has sought to reduce and mitigate adverse effects of landscape elements

Natural variations in the foreshore will be re-established

23.6.1.3 Natural Features and Ecosystems

Chapter 5 of the ARP:C sets out objectives and policies for recognising and protecting natural features and ecosystems in the coastal environment. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 5.3.1, 5.3.2 and 5.3.3 and Policies 5.4.1, through to 5.4.7.

There is some overlap in the direction of the objectives and policies of the NZCPS and RPS with this Chapter (particularly the Heritage Chapter of the RPS, discussed in Section 23.5.1.5). However, for those objectives and policies with more specific regional direction and direction with respect of management of the coastal environment, the following assessment summary is provided:

Particular regard has been had to the ecological values of the CPA1 and CPA2 areas within the Project area

- Particular regard has been had to the ecological values of the CPA1 and CPA2 areas within the Project area. In particular, the marine ecological and avian ecological assessments have considered the specific ecological values identified with those areas of the CPA1 and CPA2 areas (as defined in Schedule 3 of the ARP: C). Overall the assessments conclude:
    - That the ecological functioning of the CPA1 is (as a whole) maintained by the Project and that the effect of structures and works in the CMA can be managed and mitigated so that the effects are minor.
    - It is acknowledged that the permanent loss of benthic habitat from reclamation cannot easily be avoided or mitigated. While this is not considered a significant effect given the size, quality and habitat diversity of the CPA1 area overall, it is recognised as a permanent effect. Improving the quality of stormwater discharge from the existing SH16 (in terms of contaminants discharged to the CMA) off-sets this impact. Other mitigation measures are proposed to remedy this impact, including the restoration of coastal fringe habitat, removal of gross litter form the corridor and design of the Causeway structure to enable re-establishment of benthic habitat on the toe of the reclamation (see Chapter 13);
    - The effects on the functioning and values of ecological processes in the CPA2 area of the Project are considered minor (see Chapter 13 and Chapter 14 for specific discussion);

- The maintenance of the natural substrate composition has been considered and provided for in the design of the reclamation and the management of construction works, as described in Chapter 5 and assessed in Chapter 17 of this AEE;

- The restoration planting and works in the Oakley Inlet (as indicated on the plans in F.16: *Urban Design & Landscape Plans*) seeks to ensure that the linkages between the functioning of the CMA and those environments landward of the CMA are maintained.

23.6.1.4 Coastal Matters of Significance to Tangata Whenua

Chapter 6 of the ARP: C sets out objectives and policies for recognising and protecting coastal matters of significance to tangata whenua. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 6.3.1 and 6.3.2 and policies 6.4.1 and 6.4.4.

Given the national priority to recognise the relationship of Maori and their culture and traditions with their ancestral land, water, sites waahi tapu and other taonga, there is consistent direction in the objectives and policies of the NZCPS and RPS. Where this is the case, the assessment of these objectives and policies are not repeated here. Policy 6.4.1 provides specific direction to the use of Map Series 3, Sheet 1, for the identification of areas of value to tangata whenua. However, there are no areas of special value to tangata whenua mapped in the Project area.

23.6.1.5 Public Access

Chapter 7 of the ARP: C sets out objectives and policies for the provision of public access to, along and within the CMA. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 7.3.1 and 7.3.2 and Policies 7.4.1, 7.4.2 and 7.4.3.

Given the national priority of providing public access to and along the CMA, there is consistent direction in the objectives and policies of the NZCPS and RPS. This is considered to be the case for all objectives and policies relevant in this Chapter.

23.6.1.6 Coastal Heritage

Chapter 8 of the ARP: C sets out objectives and policies for recognising and protecting cultural heritage. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 8.3.1 and 8.3.2 and policies 8.4.3, through to 8.4.6.

The Project recognises and protects the Thomas's Mill Seawall

Given the national priority to recognise and protect heritage, there is consistent direction in the objectives and policies of the NZCPS and RPS (particularly with respect of the Heritage Chapter, see Section 23.5.1.5 above). However, the Plan specifically identifies and schedules regional heritage resources and this direction has been considered. The Thomas's Mill Seawall (Oakley Inlet Heritage area) is scheduled in the ARP: C and this has been considered and included in the definition and mitigation management for the Oakley Inlet Heritage area (identified for remedial works), discussed in 23.6.1.5 above.

23.6.1.7 Subdivision, Use and Development

Chapter 9 of the ARP: C sets out objectives and policies for managing subdivision, use and development of the CMA. In summary, objectives and policies considered particularly relevant to the Project in this Chapter include Objectives 9.3.1 and 9.3.2 and policy 9.4.1.

These objectives and policies seek to provide for the subdivision, use and development of the CMA, where these activities depend on the natural and physical resources of the CMA and where the adverse effects are avoided, remedied or mitigated. Given the existing physical resource of SH16, the Project is considered consistent with this policy direction.

23.6.1.8 General

Chapter 10 sets out objectives and policies which apply to all subdivision, used and development of the CMA that requires a resource consent. In summary, objectives and policies of particular relevance to the Project in this Chapter include Objectives 10.3.1 – 10.3.3 and policies, 10.4.1 - 10.4.16.

There is some overlap in the direction of the objectives and policies of the NZCPS and RPS with this Chapter. Where this is the case, the assessment of policy direction is not repeated. However, for those objectives and policies with more specific regional direction and direction, the following assessment summary is provided:

- The CMA is already highly modified by human activities, most notably the existing reclamation for SH16 and bridge crossing of the Whau River;
- The Project has positive effects for the wider environment and the occupation of the CMA is considered reasonable necessary for the activity (improving capacity of the existing State highway and connecting SH20 to SH16). These benefits need to be considered against the potential adverse effects of the Project (which have been designed and mitigated);
- Construction works in the CMA will be managed so that installation of the coffer dams are undertaken at such times and in a manner that minimises the potential for such activities to discharge sediments to sensitive receiving environments;
- Provision has been made in the temporary construction footprint for high tide bird roosting (that will be disturbed during construction);
- The design for the Whau River bridge provides for the maintenance of the navigation channel for the efficient passage of vessels (travelling to and from Te Atau Boat Club) and up-stream mooring areas;
- Management plans, particularly the Construction Environment Management Plan (see Technical Report G.23: *Construction Environmental Management Plan*), provides controls and processes for construction works to ensure that nuisance effects from construction activities in the CMA are avoided, remedied and mitigated; and
- The discharge of stormwater via outfall structures in the CMA is considered the best practicable option for the management and treatment of stormwater (as concluded in Technical Report G.15: *Assessment of Stormwater and Streamworks Effects*).

The occupation of the CMA is considered reasonable necessary

23.6.1.9 Activities

Chapter 11 sets out objectives and policies for the management of activities in the CMA of the Auckland Region. In summary, objectives and policies of particular relevance to the Project in this Chapter include Objectives 11.3.1 – 11.3.3 and policies, 11.4.1 - 10.4.5.

There is some overlap in the direction of the objectives and policies of the NZCPS and RPS with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, for those objectives and policies with more specific regional direction and direction with respect of management of the CMA, the following assessment summary is provided:

The Project is considered an appropriate use of the CMA, particularly given the existing significant physical infrastructure

- This Chapter recognises that there is a wide range of appropriate activities in the CMA. Given the existing significant physical infrastructure, particularly the existing corridor of SH16, the location of the Project within the CMA is considered the best practicable option. This is considered further in the assessment of options for the Project (set out in Chapter 11 of this AEE);
- The proposed pedestrian bridge on the Oakley Inlet is considered an appropriate activity in the CMA, as it restores and maintains the intrinsic heritage values associated with the regionally significant Star Mill heritage site and heritage area.

23.6.1.10 Structures

Chapter 12 sets out objectives and policies for the management of structures in the CMA. In summary, objectives and policies of particular relevance to the Project in this Chapter include Objective 12.3.1 (which provides for appropriate structures in the CMA) and policies, 12.4.1 through to 12.4.14 (excluding 12.4.6, and 12.4.11).

There is some overlap in the direction of the objectives and policies of the NZCPS, RPS and other Chapters of the ARP: C with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, for those objectives and policies with more specific regional direction (including particularly direction on the management of structures in the CMA) the following assessment summary is provided with respect of the Project:

- The design of structures in the CMA has sought to retain form with existing structures (e.g. Whau Bridge and the Causeway Bridge(s)). Where the structures represent new features within in the CMA (e.g. Great North Road Interchange) the design has sought to minimise footprint on the foreshore and seabed, and to minimise their visual dominance in adjoining open space and CMA areas. The proposed vegetation will also provide screening, in-filling much of the visual catchment between these structures and the CMA);

- The ARP:C recognises that structures may be appropriate in the CMA where they are of benefit to the regional and national community and there are no reasonable or practicable alternatives. As discussed, Chapter 11 provides a summary of the assessment of alternatives for the Project. As concluded in this assessment, given the existing significant physical resource in the CMA (SH16), which is a strategic route of regional and national significance, the structures associated with the Project are considered appropriate. The Project is a public work and provides significant regional benefits to the community (improving accessibility and connectivity). As such, it is considered that this policy direction is met; and

The Structures benefit the regional community

- The design of structures, including the coastal bridges and reclamation, have included consideration of the possibility of sea level rise and have used appropriate data from the ICCP (see Technical Report G.23: *Coastal Works*).

23.6.1.11 Reclamation and Drainage

Chapter 13 sets out objectives and policies for the management of works requiring reclamation and drainage of the CMA. In summary, objectives and policies of particular relevance to the Project in this Chapter include Objective 13.3.1 and 13.3.2 and policies, 13.4.1 through to 13.4.9 (excluding 13.4.6).

There is some overlap in the direction of the objectives and policies of the NZCPS, RPS and other Chapters of the ARP: C with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, for those objectives and policies with more specific regional direction the following assessment summary is provided:

- Given the existing physical resource of the SH16 Causeway, an alternative method (to reclamation) is not considered the best practicable option, nor is a land based site;
- The design of the reclamation has sought to minimise the area of the CMA necessary for the reclamation (having regard to the proposed use of the area for traffic, pedestrian / cycle movement, stormwater treatment and safety), as discussed in Technical Report G.23: *Coastal Works* and in the assessment of alternatives summarised in Chapter 11 of this AEE;
- The design of the reclamation has sought as far as practicable to be compatible with the existing environment, while providing the additional capacity on SH16 and the height required to address future sea level rise predictions;
- Public access to the CMA is maintained and provided for in the reclamation (via the pedestrian / cycle way);
- While public access is maintained across the CMA from the proposed reclamation, the setting aside of an esplanade reserve or strip is not considered appropriate given the ongoing operational requirements of a motorway;

- The materials proposed for use in the reclamation will not result in contaminants being discharged to the CMA and management measures proposed for the Project will provide appropriate screening and testing to confirm that materials are sufficiently free from contaminants.
- The loss of saline vegetation in the construction and reclamation works will be mitigated by restoration planting from appropriately eco-sourced material (as detailed in the plans F.16: *Urban Design and Landscape Plans*.
- While construction activities proposed will require temporary drainage of part of the CMA, this methodology provides an approach to avoid potential adverse effects and can be reinstated to the CMA following construction activities, as detailed in Technical Report G.23: *Coastal Works*.

Materials proposed for use in the reclamation will not result in contaminants being discharged

23.6.1.12 Disturbance of the Foreshore and Seabed III (Other than Dredging or Extraction)

Chapter 16 sets out objectives and policies for the management of works requiring disturbance of the foreshore and seabed for activities other than dredging or extraction of materials of the CMA. These activities are proposed by the Project and in summary, objectives and policies of particular relevance Objective 16.3.1 and policies, 16.4.1 through to 16.4.12.

There is some overlap in the direction of the objectives and policies of the NZCPS, RPS and other Chapters of the ARP: C with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, for those objectives and policies with more specific regional direction the following assessment summary is provided:

Activities for construction, that require disturbance of the foreshore and seabed will not result in the permanent loss of habitat for any threatened, endangered or rare species in the CMA

- The ARP: C indicates that activities including vegetation removal and disturbance of the foreshore and seabed are generally considered inappropriate. However, the Plan goes on to recognise that the provision, operation and maintenance of infrastructure such as roads and walkways and drainage systems, where there is no practicable alternative location outside the CMA, may mean that such activities are appropriate. For the reasons set out, particularly in Chapter 13 of this AEE, the use of the CMA for SH16, including the pedestrian / cycle way and stormwater management system, is considered an appropriate use of the CMA and the disturbance activities proposed provide for the effective construction of these activities. In addition, the following conclusions are noted from the assessment of effects and the Project design:
    - The activities for construction, that require disturbance of the foreshore and seabed will not result in the permanent loss of habitat for any threatened, endangered or rare species in the CMA;
    - The activities will have only minor or negligible impacts on coastal processes;
    - Consultation with Kawerau a Maki and Ngati Whatua has not identified any significant values in the Project area that will be adversely affected by these works;

- The disturbance of the foreshore and seabed will not result in adverse effects on natural features and ecosystems. The proposed diversion of the coastal channel in the Waterview estuary and Oakley Inlet are considered appropriate to avoid adverse effects on coastal processes;
- The disturbance will not result in cumulative effects; and
- The removal of vegetation from the CMA will generally be limited to the extent necessary for the construction of the Project, including the State highway and associated drainage systems. One exception to this is the removal of mangroves at Rosebank. This work is proposed to enable the natural realignment of the channel in this location and therefore is consistent with the policy direction for the operation of drainage systems and will contribute to the functioning of the CMA;

- Motor Vehicle use in the CMA will be limited to the immediate construction site (e.g. accessed from the existing State highway), and the proposed management (through the Construction Environment Management Plan) will establish a process for the identification and avoidance of sensitive environments in the CMA during construction activities.

23.6.1.13 Planting and Introduction of Plants

Chapter 18 sets out objectives and policies for the management of planting and introduction of plants in the CMA. These activities are limited with respect to the proposed Project (however, some revegetation of saltmarsh and on the rock revetments of the Causeway may border Mean High Water Spring). The Project is generally considered consistent with the objectives and policies of this Chapter as the proposed planting identifies the importance of eco-sourcing plant materials, particularly for saltmarsh and wetland planting along the CMA boundaries and is identified as a potential benefit of the Project, to mitigate (by off-set mitigation) the loss of habitat associated with the reclamation activities.

As such, it is considered that the proposed planting will provide opportunities to enhance existing indigenous plant communities in the Project area. The proposed planting will generally be in those areas already disturbed by the Project (e.g. the rock revetments of the reclamation) and will therefore not result in additional disturbance to the foreshore and seabed. In other areas, coastal planting will be managed through the Construction Environmental Management Plan, which defines processes to minimise the disturbance to the foreshore and seabed associated with vegetation works.

23.6.1.14 Taking, Use, Damming and Diverting

Taking, use, damming and diverting proposed as construction to mitigate potential adverse effects

Chapter 19 sets out objectives and policies for the management of works requiring taking, use, dam and divert water in the CMA. These activities are proposed by the Project for construction activities, in particular for the construction of a coffer dam to create a stable environment for construction works. This construction methodology (as detailed in Technical Report G.23: *Coastal Works*) is proposed to minimise potential adverse effects associated with construction, particularly the effects associated with sediment discharges during construction. The Project is generally not inconsistent with the objectives and policies of this Chapter as the works only involve temporary taking, damming and diversion, with positive effects on the environment (compared to the alternative construction methods considered).

23.6.1.15 Discharge of Contaminants

Chapter 20 sets out objectives and policies for the management of works requiring the discharge of contaminants to the CMA. These activities are proposed by the Project (particularly associated with the discharge of sediment during construction and the discharge of stormwater for the operation of the Project). In summary, objectives and policies of particular relevance include Objective 20.3.1 and policies, 20.4.1 – 20.4.3, 20.4.5, 20.4.7, 20.4.9 – 20.4.11, 20.4.13 and 20.4.14.

Recognition has been given to the best practicable options for stormwater discharges to the CMA

There is some overlap in the direction of the objectives and policies of the NZCPS, RPS and other Chapters of the ARP: C with this Chapter. Where this is the case, the assessment of the objectives and policies is not repeated here. However, for those objectives and policies with more specific regional direction the following assessment summary is provided:

- The Project proposes mitigation measures for the collecting of gross litter from the CMA within the State highway corridor; and

- Appropriate recognition has been given to the best practicable option framework for the identification and management of stormwater discharges to the CMA, including consideration of the practicality of the options and balancing these costs with the environmental and public good outcomes. On balance, the treatment levels proposed for stormwater discharges to the CMA are in excess of 80%[4] (and in some cases as high as 90% treatment). This is considered a high level of treatment, which in part provides off-set mitigation for the loss of habitat from the reclamation, but also represents a benefit of the Project (particularly given that many areas of the existing State highway discharging to the CMA in this area have only rudimentary or no stormwater treatment).

[4] This refers to 80% removal of total suspended solids on a long term average basis.

23.6.1.16 Natural Coastal Hazards

Chapter 21 sets out objectives and policies for the avoidance and mitigation of natural hazards. This policy direction is consistent with that proposed by the NZCPS and the ARPS, and the assessment of these matters is not repeated here (including those in relation to climate change, which have been discussed above). However, the following comments are made with regard to the specific regional policy direction provided in the ARP:C:

- Given the existing Causeway form and location, structural hazard mitigation (in the form of rock revetment) is considered appropriate. This structure will provide protection to the State highway (from hazards such as erosion), while limiting the size and scale of reclamation.

23.7 Auckland Regional Plan: Sediment Control 2001

The Auckland Regional Plan: Sediment Control (ARP: SC) manages land disturbing activities in the Region to maintain the quality of receiving water. Consents are sought for the Project under this Plan, relating to earthworks and land disturbance (as set out in Chapter 7 of this AEE). This Section includes an assessment of these proposed works against the relevant objectives and policies for these consents. Matters of relevance to the Project are summarised in Chapter 6 of this AEE and the relevant objectives and policies are provided in Appendix E.3.

As with the assessment above, is noted that many of the objective and policy matters identified in the ARP: SC are similar to those identified in the Regional Policy Statement. In such cases, the assessment of objectives and policies has been discussed and responded to in those discussions (sections 23.5 above). The intention of this Section is not to repeat that assessment, but rather to highlight the additional considerations from the objectives and policies of the ARP:SC, with respect of the Project.

23.7.1 Assessment

Specific management measures proposed to reduce the risk of surface erosion during construction

The objectives and policies of sections 5 and 7 of the ARP:SC are considered relevant to the Project. Consideration of the Project against the intent of Objectives 5.1.1 and 5.1.2 and 7.1.2 and Policies 5.2.1, 5.2.1 and 7.2.2 have been discussed in the assessment of the Project above, particularly in sections 23.5.1.6 and 23.5.1.7 for the RPS and sections 23.6.1.15 for the ARP: C. For the remaining objectives and policies (with more specific management direction) the following assessment summary is provided:

- The Project has prepared a Sediment and Erosion Control Plan (see Technical Report G.22), which identifies specific management measures proposed to reduce the risk of surface erosion during construction (which could result in sediment generation). Management measures include stabilisation or covering of sediment stock piles and use of geotextiles to stabilise exposed surfaces of the Project, management of vegetation removal and early revegetation of areas as construction progresses;

- The construction activities will be managed so that the proportion of the overall construction area, and particular catchments, is minimized; and

- While it is proposed that winter earthworks are provided for by the Project, the nature of activity over these months will be limited. For example, major winter earthworks will include the proposed tunneling works. However, the management of spoil material from the tunneling can be undertaken to avoid impacts (for example, via enclosure or covering of stockpiles).

23.8 Proposed Auckland Regional Plan: Air, Land and Water 2001

The Auckland Regional Plan (ARP: ALW) provides a framework to promote the integrated and sustainable management of Auckland's air, land and water resources. The ARP: ALW was notified in 2001 and Chapter 6 provides further commentary on the status of this Plan and various matters contained within this Plan.

The ARP: ALW contains objectives and policies that apply to those activities requiring regional consents under sections 13, 14 and 15 of the RMA. A number of consents are sought for the Project from this Plan, relating to works on the floodplain, uses of the beds of waterways (particularly Oakley Creek), the taking, use and diversion of water (including surface water and groundwater), and the discharge of contaminants to water and onto land) (as set out in Chapter 7 of this AEE).

This Section includes an assessment of works against the relevant objectives and policies for these consents. Matters from the ARP: ALW, of relevant to the Project are summarised in Chapter 6 of this AEE and the relevant objectives and policies are provided in Appendix E.3.

It is noted that many of the objective and policy matters identified in the ARP: ALW are consistent with and reflect those identified in the NZCPS and Regional Policy Statement. In such cases, the assessment of objectives and policies has been discussed and responded to in the relevant sections above (sections 23.5 and 23.6 above). The intention is not to repeat that assessment, but rather to highlight the regional and additional considerations from the objectives and policies of the ARP: ALW, with respect to the Project.

23.8.1 Assessment

23.8.1.1 Natural Values

Chapter 2 of the ARP: ALW provides management direction (objectives and policies) for the protection and management of the Region's natural values. A number of objectives and policies in this Chapter are considered appropriate (see Appendix E.3 for detail).

A number of the objective and policy matters of this Chapter are considered to be reflected in the consideration of the assessment against planning matters in the RPS (particularly Section 23.5.1.5 above). In addition to these conclusions, the following specific assessment conclusions are made in regard to the Project:

The Project has sought to maintain and enhance the quality of the Region's streams

- The Project has sought to maintain and enhance the quality of the Region's streams, particularly the Oakley Creek and Meola Creek, through the management of stormwater for discharges (see in particular Sections 19.15 and 22.10) and through the design and restoration of waterways where the Project requires diversions (see in particular Section 22.9); In particular, the Project design provides for the following with respect to the natural character of waterways:
    - Setting aside of esplanade reserve areas where practicable within the Project designation, where vegetation contributes to natural character of waterways (e.g. along the Oakley Creek in the vicinity of Cowley Street and 36 Craddock Street, see Section 21.2 of this AEE);
    - Restoration and rehabilitation of the Oakley Creek, in accordance with the Oakley Creek Restoration and Rehabilitation Plan prepared for the Project (see Technical Report G.31);
    - Ecological planting and habitat development around wetlands (with appropriate eco-sourcing of plant stock), within the Project footprint, as identified on the proposed plans in F.16: *Urban Design and Landscape Plans*;

Habitat development and restoration proposed

- The Project provides for the restoration of ecological values of waterways through the following:
    - Habitat development and restoration through planting of the corridor, particularly around wetland features and riparian margins of the Oakley Creek (as referred to above);
    - The implementation of specific design principles to establish and restore freshwater habitat within the Oakley Creek through the Oakley Creek Restoration and Rehabilitation Plan (as discussed in Technical Report G.6: *Assessment of Freshwater Ecological Effects* and in the discussion in Section 22.9 of this AEE);
    - Through the design of the Project to avoid culverting in the works proposed for the Oakley Creek (as discussed in Section 22.9 of this AEE and Technical Report G.15: *Assessment of Stormwater and Streamworks Effects*), where this stream is an urban stream with large areas of soft-bottom substrate and habitat potential;
    - In other areas the existing culverting and piping of streams (e.g. Pixie Stream) is considered to have already compromised these waterways as freshwater habitat. Notwithstanding this, the realignment proposed for the Pixie Stream inlet (following reclamation) will re-establish fish spawning habitat (in the CMA).

- In assessing the effects of the Project on the terrestrial and aquatic habitats of waterways, consideration has been given to the best practicable options for the discharge of contaminants (stormwater), during both construction and operation. These discharges are considered in Technical Report G.15: *Assessment of Stormwater and Streamworks Effects* and the effects of the proposed stormwater systems (both temporary and operational) in the ecological effects assessments (particularly Technical Reports G.6 and G.17, which summarise the assessment of freshwater and vegetation ecological assessments);

- In considering the Project design for Streamworks, particularly for the Oakley Creek, consideration has been given to the form of the stream channel, the aquatic habitat (both existing and potential), the flow regimes of the waterway, erosion, its natural substrate composition, the physical characteristics of the floodplain and the water quality of the waterway, and the rehabilitation and restoration proposed for the Creek, proposes to maintain and enhance these natural character values (see Section 22.9 and Technical Reports G.15: *Assessment of Stormwater and Streamworks Effects* and G.6: *Assessment of Freshwater Ecological Effects* in particular); and

- Where impacts on waterways are considered the best practicable option for the Project (e.g. culverting of a small part of Pixie Stream and reducing the length of Oakley Creek in the diversion of the waterway), off-set mitigation has sought to remedy and mitigate effects being caused, at least in part by the activity being granted consent. For example, the restoration and rehabilitation of Oakley Creek seeks to off-set impacts from loss of in-stream habitat within the same waterway and provides for enhanced habitat areas (in other words, while the length of the waterway has been reduced, the habitat enhancement and restoration compensates for this impact).

23.8.1.2 Use and Development

Chapter 2 of the ARP: ALW provides for the appropriate use and development of air, land and freshwater resources in the Region, but sets out the specific management directions that are considered necessary to recognise the characteristics, constraints and availability of these resources. A number of objectives and policies in this Chapter are considered appropriate (see Appendix E.3 for detail).

A number of the objective and policy matters of this Chapter have been considered in the assessment of the RPS planning matters (particularly in the discussion in sections 23.5.1.1, 23.5.1.5 and 23.5.1.7 above), the following specific assessment conclusions are made in regard to the Project:

- The Project is considered an appropriate use of land, air and freshwater resources recognising the aspirations of the Region to accommodate population and economic growth (as defined in the Auckland Regional Growth Strategy) and the need for land transport infrastructure to support this growth, which is facilitated by the Project. These wider social and economic benefits provided by the Project, discussed particularly in Section 13.2 and 13.4 of this AEE, have been balanced with the effects on air, land and water resources to provide for sustainable development;

The Project is considered an appropriate use of land, air and freshwater resources

- The construction and operation of the Project requires works that will result in change to the Region's air, land and freshwater resources. This AEE has considered these impacts and identified appropriate mechanisms to avoid (in the assessment of alternatives), mitigate and remedy these impacts, including in some cases off-set mitigation in recognition of residual effects associated with the loss of freshwater stream length (e.g. from culverting and stream diversion);

The Project maintains and enhances access to and along waterways

- The Project maintains and enhances access to and along waterways in the Region, particularly the Oakley Creek, through the integrated rehabilitation and restoration of this waterway with open space and the proposed pedestrian / cycle way and through provision of esplanade reserve areas (e.g. Cowley Street);

- The Project protects and enhances significant cultural heritage sites, and places, particularly around the Oakley Inlet (as discussed in Section 23.5.1.5 above), (see also Section 18 and Technical Report G.2: *Assessment of Archaeological Effects* of this AEE). In undertaking the assessment and planning of mitigation for this area, the following specific considerations have been made (consistent with Policy 22.4.17):

  The Project protects and enhances significant cultural heritage sites

  - The significance of the heritage site and area has been considered;
  - The integrity of the site, and the potential for enhancement of this integrity, through limited and strategic restoration of the site (including re-establishment of a pedestrian bridge connecting the heritage area across the Oakley Inlet and other limited replacement of basalt boulders);
  - The ability for ongoing maintenance of the heritage area; and
  - The ability for improved identification and understanding of the site, through interpretive signage in management of this area.

- Where there is uncertainty about the potential effects of the Project on air, land and water resources (e.g. where the effects identified have been assessed through modeling, as is the case with groundwater, stream works, coastal processes and air discharges), the Project proposes monitoring to ensure that the effects of the activity are of the scale assessed in this AEE and (as appropriate) further measures can be implemented to avoid, remedy or mitigate effects;

  Monitoring is proposed to ensure that the effects of the activity are of the scale assessed

- Mitigation measures proposed for the construction works, particularly those in the Ecological Management Plan, include appropriate management of works to avoid adverse effects on the feeding and breeding patterns of avifauna (see Technical Report G.31: *Ecological Management Plan*); and

- In the AEE (Chapters 13 through to 22) and in Technical ReportG.20: *Assessment of Visual and Landscape Effects*, the effects of the Project on amenity, including amenity values of air, land and water bodies are considered and where appropriate mitigation measures are proposed, including urban design and landscape planning (see F.16: *Urban Design and Landscape Plans*).

23.8.1.3 Tangata Whenua

Chapter 2.3 of the ARP: ALW sets out objectives and policies for recognising and protecting matters of significance to tangata whenua in the management of land, water and air resources. In summary, objectives and policies of this Chapter considered particularly relevant to the Project include Objectives 2.3.3.1 to 2.3.3.3 and policies 2.3.4.1 though to 2.3.4.4.

Given the national priority of the matters in this Chapter, a number of the objective and policy matters of this Chapter are reflective of those in the RPS. In such cases, it is not the intention to repeat the planning assessment here. However, the ARP: ALW provides further specific management direction and in response to these policies, the following assessment conclusions are made in regard to the Project:

- At the time of preparing this AEE, Schedule 8 of the ARP: ALW was not completed and therefore the specific assessment against this sites could not be undertaken. However, consideration of sites, including review and consultation with tangata whenua has been undertaken in accordance with Policy 2.3.4.2.

23.8.1.4 Management Areas

Chapter 3 of the ARP: ALW sets out objectives and policies for managing identified for specific management areas, including urban streams. In summary, objectives and policies of this Chapter considered particularly relevant to the Project include Objective 3.5.3.1 and policies from 3.5.4.4 through to 3.5.4.7.

Again it is considered that a number of the objective and policy matters of this Chapter are reflective of those in other sections of the ARP: ALW and the RPS. In such cases, it is not the intention to repeat the planning assessment here. However, this Chapter also provides further specific management direction and in response to these policies for urban streams and the following assessment conclusions are made in regard to the Project:

- The Plan recognises the importance of urban rivers and streams for the conveyance of stormwater, which is consistent with the management approach of the Project;

- The Project has taken consideration of the categorisation of rivers and streams undertaken in the ARP: ALW and provided for the appropriate recognition of those matters identified in Policy 3.5.4.4[5], including (amongst other things already considered) the avoidance, remediation and mitigation of the adverse effects of erosion on the banks and stream beds (as provided for in the Oakley Creek Rehabilitation and Restoration Plan), as discussed particularly in Section 22.9 of this AEE.

Consideration has been given to the categories of rivers and streams in the ARP: ALW

5 The Oakley Creek is classified as a Permanent Stream in an Urban Stream Management Area under Section 3.5 of the ARP:ALW. This provides for stream reaches to be classified, primarily by the percentage of impervious surface area and the percentage of artificial streambed material (such as concrete). For the Project the areas of potentially affected stream are primarily Type 4 (Highly Disturbed Urban Stream).

23.8.1.5 Air Quality

Chapter 4 of the ARP: ALW sets out objectives and policies for managing discharges to air. While transport and mobile sources are recognised as sources of contaminants to air, there are no Rules in the ARP: ALW that relate to these. However, the Project does seek resource consents for discharge to air for construction. Relevant Objectives include 4.3.1 through to 4.3.6 and Policies 4.4.1 through to 4.4.10 and 4.4.1.4 through to 4.4.18 and 4.4.24.

As with the sections of the ARP: ALW above, it is considered that a number of the objective and policy matters of this Chapter are reflective of those in the RPS. In such cases, it is not the intention to repeat the planning assessment here (see Section 23.5.1.9). However, this Chapter also provides further specific management direction and in response to these objectives and policies for the Project. Assessment of the air quality effects of the Project have been considered for both construction and operation (see Technical Report G.1: *Assessment of Air Quality Effects*, including consideration of the National Environmental Standards (see Section 23.2) and relevant regional targets.

In this assessment, the following matters have been considered, consistent with the planning direction in the objectives and policies of this Chapter:

Management of discharges to air during construction seek to minimise impacts on urban air quality management areas

- The amenity levels of Urban Air Quality Management Areas have been considered in the evaluation of air quality impacts and in the development of mitigation planning (for construction). In particular, while it is acknowledged that the proposed concrete batching plants have potential to generate adverse air quality impacts, it is considered that these effects can be managed through mitigation and that the benefits of the activity within the construction site (particularly for the safe and efficient construction of the tunnels) warrants their inclusion in the construction designation footprint (as the best practicable option for overall effects on the environment). This assessment and discussion is provided in more detail in Sections 18.16 and Sections 22.15 of this AEE;

- The management of construction activities, including the construction of the road, can be managed to avoid noxious, dangerous, offensive or objectionable emissions and mitigation measures proposed reflect this (set out in mitigation measures proposed in Sections 18.13.3 and Sections 22.15.3 of this AEE;

- In determining the location and extent of the construction yards, and the location of particular construction activities (e.g. sediment generating activities and the concrete batching plants) consideration has been given to appropriate distances between these activities and adjoining land uses (e.g. open space, residential and education). These distances are reflected in the proposed management of construction yards (see F.6: *Construction Yard Plans* and the detailed description of construction management in the AEE);

- While a full assessment of air quality has been undertaken, it is recognised that this is based on modelling data and expected environmental results. In recognition of the inevitable uncertainty of this assessment, monitoring is proposed both during construction and operation, for the discharge of contaminants to air (for example, see Section 13.10.3 and 22.15.3 of this AEE);

- In designing the stacks for operation of the Project, consideration has been given to the potential for these stacks to provide dispersion of contaminants to air. This dispersion provides an effective method to separate emissions from sensitive receptors (e.g. residential and schools), and in the case of the northern portal, the Project improves local air quality by reducing emissions at road level (e.g. Great North Road) and disperses vehicle emissions in a more effective and efficient manner (see Chapter 22 for discussion).

Ventilation stacks design for dispersal of contaminants to air

23.8.1.6 Discharges to Land and Water and Land Management

The objectives and policies in Chapter 5 address discharges to land or water, and acknowledge that vehicle use is a major cause of stormwater contamination. The objectives and policies provide for the appropriate management of adverse effects of stormwater discharges and the management of land containing elevated levels of contaminants including contaminated land[6]. Assessments for the AEE have provided specific consideration of discharges proposed by the Project, in particular the following Technical Reports: G.7: *Assessment of Groundwater Effects*, G.9: *Assessment of Land and Ground Contamination*, G.15: *Assessment of Stormwater and Streamworks Effects*, and G.22: *Erosion and Sediment Control Plan*.

As with the sections of the ARP: ALW above, a number of the objective and policy matters of this Chapter are reflective of those in the RPS. In such cases, it is not the intention to repeat the planning assessment here (see, in particular, Sections 23.5.1.7 and 23.5.1.12). However, this Chapter also provides further specific management direction and in response to these objectives and policies for the Project and the following provides a summary with respect of those matters. In conclusion, this includes the following:

- The Plan recognises the importance of urban streams for carrying stormwater and, as discussed in Section 23.8.1.4 above, has undertaken assessment in terms of the Council's Urban Stream Management Framework;

[6] Objectives of relevance in this Chapter are identified in Appendix E.3: *Statutory References.*

- The Project assessment has considered the potential impacts of the Project on flood storage and in particular, sought to ensure that the Project does not reduce storage (and even enhances storage in the area, beyond that which is currently provided by consented development);

- An holistic approach has been taken to the stormwater management, improving collection and treatment from the Project and existing impervious surfaces as well as collection from residential areas (where this is a practicable solution), and integrating this with the open space and wider environment of the Project (in particular this is demonstrated in the Oakley Creek Restoration and Rehabilitation Plan, Appendix of Technical Report G.6: *Assessment of Freshwater Ecological Effects*, where the community priorities for this waterway have been included in the design solutions proposed);

An holistic approach has been taken to the stormwater management

- An assessment has been undertaken of the potential disturbance of contaminated materials during construction and the effects of this on the environment and risk for human health. The assessment concludes that the risks of discharging contaminants is low and that contaminated material encountered during construction can be managed to remedy and mitigate adverse effects; and

- Assessment has been undertaken regarding the quantity of water discharged in the streams affected by the Project (as well as quantity) to minimise as far as practicable changes to the volumes in this waterways and as a result the potential erosion of streams. In particular, this issue has been considered and addressed for Sector 9, see Section 22.9 of this AEE, where mitigation proposed includes providing meanders and a form of the Oakley Creek to address both existing areas of erosion and future flow regimes (following the diversion of the watercourse).

23.8.1.7 Water Allocation

The objectives and policies in Chapter 6 address water allocation. The objectives and policies provide for the appropriate management of adverse effects of the take and use of water, with many of these addresses issues associated with water resource use. The Project requires the take of water, particularly associated with groundwater extraction during construction. While long term water is not extracted for use, Objective 6.3.8 and Policy 6.4.4.7 of this Chapter are relevant. Technical Report: G.7: *Assessment of Groundwater Effects* considers the effects of the groundwater diversion and take from the Project. Of relevance to the planning assessment, as summarised in Chapter 21.10[7] of this AEE concludes that:

[7] See also 20.10 and 22.10 for groundwater assessment at the tunnel portals.

- There is short term dewatering associated with construction of the tunnel and tunnel portals, with the potential effects on flows in the Oakley Creek considered to be less than minor;

Dewatering from the Project is less than minor

- The effects of groundwater take on settlement have also been assessed (Technical Report G.13: *Assessment of Ground Settlement Effects*), and these have also been concluded to be minor, with opportunities for appropriate management and mitigation of these effects. A monitoring programme is proposed to be established prior to construction to record groundwater levels and ground levels. This monitoring will allow appropriate responses to be triggered should actual effects differ from those predicted. Overall the effects of the proposal on settlement are considered to be less than minor, with a large number of potential mitigation options available to manage unexpected effects, should these occur;

Monitoring of groundwater is proposed

- In the longer term, the driven tunnels will be sealed to limit the inflow of groundwater, with the portals and approaches will remain drained. Combined, the potential effects associated with this dewatering are considered to be less than minor (relating more specifically to settlement effects associated with groundwater, which are addressed above).

23.8.1.8 Beds of Lakes and Rivers and Diversion of Surface Water

The objectives and policies in Chapter 7 address works that require occupation of the beds of lakes and rivers and the diversion of surface water. The Project requires consent for the diversion of Oakley Creek and construction within the flood plain of the Stream, particularly in Sector 9 (assessed in Chapter 22 of this AEE).

The relevant objectives and policies of this Chapter are provided in summary in Appendix E.3: *Statutory References*. As noted earlier, a number of the matters in this Chapter have been assessed in consideration of the RPS. The intention is not to repeat that assessment, but rather to highlight specific policy matters relevant to this Chapter. In summary, these include the following:

- The Plan seeks to maintain and where practicable enhance the natural characteristics of streams. This has been provided through mitigation and remediation proposed in the realignment of the Oakley Creek, including the restoration and rehabilitation proposed, so that it will be compatible with the environment within which it is located (see Chapter 22.9);

The Project proposes mitigation and remediation of the Oakley Creek

- The Plan recognises that structures on, in and under and the excavation and disturbance of the beds of streams (and reclamation and drainage) may be appropriate for regionally significant infrastructure, where it is the best practicable option. The assessment of the best practicable option is provided in Technical Report G.15: *Assessment of Stormwater and Streamworks* and concludes that the realignment of the Oakley Creek, and the bridging proposed over the stream is appropriate;

- The effects, including the cumulative effect, of works on Oakley Creek and within the floodplain have been considered and addressed and it is considered that the Project will not reduce flood storage outside the Project area, and will not have adverse environmental effects on the health or functioning of the Oakley Stream;

The Project will retains flood storage

- The proposed Oakley Creek restoration and rehabilitation, and the establishment of wetlands associated with stormwater treatment, provide an opportunity to enhance the ecological values and overall health of this waterway;

- Technical Report G.15: *Assessment of Stormwater and Streamworks* has assessed the applications for works on, in, under and over the Oakley Creek Stream and confirmed that the Project (including proposed mitigation of the Project), will not result in significant changes to the flow hydraulics of this waterway, will maintain the quantity and enhance the quality of water within the stream, will not exacerbate flooding and can be managed to remediate existing stream erosion and avoid erosion of this waterway in the future;

- The assessment also provides for the relocation of habitat and the presence of the *Geranium spp* identified, should it be confirmed to be rare and significant fauna;

- The loss of significant lengths of streams and waterways have been avoided by the Project design, including avoiding use of culverting in Sector 9 (with bridging proposed), and through the design of the realignment of Oakley Creek to increase meanders in the stream to (as practicable) retain length in this waterway;

- Notwithstanding the existing barrier to fish passage (Oakley Creek Waterfall) the Project maintains the substrate (soft bottomed stream) environment and avoids works that would limit the passage of fish and other aquatic organisms downstream;

- Disturbance of the stream bed, associated with the realignment of Oakley Creek, can be managed through the environmental management measures proposed, to ensure that the works to do result in contaminants being discharged to the stream during construction (see the environmental management plan measures proposed in Appendix of Technical Report G.15: *Assessment of Stormwater and Streamworks* and Technical Report G.9: *Assessment of Land and Groundwater Contamination*; and

- The finished works of Oakley Creek provide for maintained public access to and along the waterway.

23.9 Auckland District Plan 1999

The Auckland District Plan provides a framework to promote sustainable management of the City's land resources. The District Plan contains objectives and policies that apply to land use within the District. As well as the designations sought, land use consents are also sought under the District Plan (for land use on the land reclaimed from the CMA).

This Section includes an assessment of those provisions of the District Plan relevant to a consideration of the NOR and these land use consents (it is noted that the Section 89(2) land use consents are for land not currently within the District). Chapter 6 of this AEE and the relevant objectives and policies are provided in Appendix E.3. The Auckland District Plan is relevant to Sectors 2 through to 9 of the Project.

It is noted that many of the objective and policy matters identified in the District Plan are consistent with and reflect those identified in the NZCPS, RPS and Regional Plans discussed above. In such cases, the assessment of objectives and policies has been discussed and responded to in the relevant sections above and it is not the intention to repeat that assessment, but rather to highlight the additional considerations from the objectives and policies, with respect of the Project.

23.9.1 Assessment

23.9.1.1 Part 5B Coastal

The policy direction of Part 5B is consistent with, and generally reflected in the assessment of the NZCPS and RPS set out above. However, the following District Plan specific comments are made from the planning assessment of the Project:

Consideration of scenic values and an assessment contributing to the natural character has been made

- The assessment of visual and landscape assessment has included consideration of scenic values and an assessment has been undertaken for trees contributing to the natural character of the coastal environment;
- The Project requires work in the Council's Coastal Management Area and the design of mitigation and planting has sought revegetation of these areas in suitable indigenous species;
- The Project has assessed the need for reclamation of the CMA and confirmed that reclamation is the best practicable options for the Causeway widening and works associated with the Whau River Bridge abutments;

- The Project identifies areas where, following construction, esplanade reserves can be provided to protect and provide shade to the Oakley Inlet and improve access to and along the foreshore (further expansion of this reserve network is also identified for the open space replacement in the Waterview area, subject to confirmation with the Auckland Council).

23.9.1.2 Part 5B: Heritage

The policy direction of Part 5C is consistent with and generally reflected in the assessment of the RPS set out above (particularly discussion in Section 23.5.1.5). However, the following District Plan specific comments are made from the planning assessment of the Project:

Consideration has been given to the heritage sites and features

- A review and consideration has been given to the heritage sites and features identified in the District Plan, including the Category C archaeological feature identified along the Oakley Creek (parallel to Great North Road), though this area is not affected by the Project;
- Awareness of the City's existing heritage is encouraged by the proposed mitigation for the Oakley Inlet Heritage Area, including interpretive signage and improved accessibility to the area;

23.9.1.3 Residential Activity

There is a significant impact on the amenity (visual) of residential activity in the area (in the short and medium term) for Sectors 5 and 9

While the Project does not constitute residential activity, the objectives and policies of this Chapter are considered relevant as the District Plan seeks to provide opportunities for residential growth and maintain and enhance residential character and amenity. In particular, the assessment of design alternatives (see Chapter 11) and consideration for different construction options has considered the potential impacts of the Project on residential character and the ability for growth. Furthermore, the plans in F.16: *Urban Design and Landscape Plans* provides the measures proposed for the form of the Project to better place it in the urban environment.

It is acknowledged that there are amenity impacts for residential areas of the Project, particularly at the Great North Road Interchange and in Sector 9. In these areas, the Project represents a significant impact on the amenity (e.g. visual and noise emissions) of residential activity in the area (in the short and medium term). While the planting and mitigation proposed will mitigate these effects in the long term, the Project represents a permanent and considerable change to the character (amenity) of these residential areas.

23.9.1.4 Open Space and Recreation Activity

The potentially significant land use impacts of the Project on areas of open space and recreation activity are recognised. In particular, the loss during construction and longer term loss and severance of open space represents a significant potential adverse effect. The mitigation proposed by the Project has sought to recognise and maintain (albeit through mitigation and replacement) open space and recreation resources, and encouraging development of open space that provides for the active recreation needs and walkways and linkages for the community.

23.9.1.5 Transportation

The District Plan seeks to manage the use and development of the City's transportation resources to promote the City's environment. In particular, the Project provides for this in the following ways:

The Project is consistent with the Transport objectives and policies of the Auckland District Plan

- The Project encourages efficient use of roading infrastructure by improving capacity of the strategic transport network commensurate with the demand and traffic growth expected and completing the 'links' in this network to provide the WRR;
- While the proposed tunnel requires ongoing operation and ventilation (e.g. is not as efficient as a conventional open road, in terms of energy use), the completion of the WRR provides significant travel time savings and congestion relief which will reduce energy use by motor vehicles using the network;
- The Project significantly increases the length of bus shoulder lanes on SH16 promoting a more efficient public transport network, while not directly provided by the Project, the improved capacity on the local road network (e.g. Great North Road and Mt Albert / Carrington Roads) provides the opportunity for improved passenger transport and Quality Transport Network developments (though this would be led by others);

Increases the length of bus should lanes on SH16 are proposed

- The Project also seeks to provide pedestrian and cycle facilities within the transport corridor, where the State highway is at surface. In these cases, the design of the pedestrian and cycle facilities have given specific recognition to the importance of the safety of users, both in terms of physical safety and through Crime Prevention Through Environmental Design principles.

23.10 Waitakere District Plan 2003

The Waitakere District Plan provides a framework to promote sustainable management of the City's land resources. The District Plan contains objectives and policies that apply to land use within the District. While no land use consents are sought under the District Plan, designations are sought and this Section provides an assessment of those provisions of the District Plan relevant to a consideration of the NOR. Chapter 6 of this AEE and the relevant objectives and policies are provided in Appendix E.3.

The Waitakere District Plan is relevant in consideration of Sector 1 of the Project

It is noted that many of the objective and policy matters identified in the District Plan are consistent with and reflect those identified in the NZCPS, RPS and Regional Plans discussed above. In such cases, the assessment of objectives and policies has been discussed and responded to in the relevant sections above and it is not the intention to repeat that assessment, but rather to highlight the additional considerations from the objectives and policies, with respect of the Project. It is also noted that the Waitakere District Plan is relevant to consideration of Sector 1 of the Project.

23.10.1 Assessment

23.10.1.1 Managing Growth

Chapter 5.0 sets out the issue, objectives, policies and methods to manage growth in way that will achieve a sustainable compact urban form. The Project has been assessed against Objective 0, and the relevant policies (e.g. 0.5 and 0.6).

The Project is supports the current urban form

The Project is considered to support the current urban form as the proposed works enhance the existing State highway network and provide the final links in the WRR, which serve established areas within the MUL of the Region, and increasing connectivity and accessibility between the south, west and CBD.

The Project also supports these policies providing improved access to sustainable modes of transport (particularly the pedestrian / cycle way) and passenger transport, with incorporation of bus shoulders and pedestrian and cycle facilities.

23.10.1.2 Effects on Water Quality and Quantity

Chapter 5.1 sets out the issue, objectives, policies and methods to manage the City's waterways. The Project has been assessed against Objective 1 and the relevant Policies (see Appendix E.3). As noted above, a number of policy directions in this Chapter are considered consistent with the RPS and Regional Plans and the assessment of these matters is not repeated in this section. The following key considerations are made with respect of the remaining policy directions of this Chapter:

- Where the clearance and damage to native vegetation has not been avoided, the Project proposes revegetation and establishment of coastal and riparian margins. This includes the use of eco-source plant stock;

- The effects of works on the Pixie Stream have been cognisant of the existing piping of this stream. Where downstream areas are affected by the Project, re-channelling of the inlet (CMA) is proposed to promote re-establishment of fish spawning areas;

- The management and treatment of stormwater (discussed above) will improve the level of treatment from the existing State highway (treating both proposed and existing impermeable surfaces).

23.10.1.3 Effects on Native Vegetation and Fauna Habitat

Chapter 5.2 sets out the issue, objectives, policies and methods to protect the City's native vegetation and fauna habitat. The Project has been assessed against Objective 2 and the relevant Policies (see Appendix E.3). As noted above, a number of policy directions in this Chapter are considered consistent with the RPS and Regional Plans and the assessment of these matters is not repeated in this section. The following key considerations are made with respect of the remaining policy directions of this Chapter:

- The Project area is largely populated by exotic species, with indigenous mangrove and saltmarsh communities confined to the riparian margins and a recently revegetated area in Jack Colvin Park. Planting of native species as detailed in the plans F.16: *Urban Design and Landscape Plans* and considered in the Technical Reports on vegetation and marine ecology (G.6 and G.11) will facilitate restoration of the coastline and riparian margins and support ecological enhancement of the intertidal habitat likely to be affected by the Project.

23.10.1.4 Effects on Land (including soils)

Chapter 5.3 sets out the issue, objectives, policies and methods to maintain the life-supporting capacity of the City's land resources. Earthworks are essential to the construction of the Project. While this will result in the disturbance of land, management and mitigation measures have been proposed (see Technical Report G.22: *Erosion and Sediment Control Plan*).

23.10.1.5 Effects on Air Quality/Atmospheric Quality

The District Plan sets out the issue (5.4), objectives, policies and methods to manage the effects of land use and maintain air quality. The policy direction of this Chapter is considered consistent with the RPS, and the planning assessment in Section 23.5.1.9 is considered relevant for this Chapter.

23.10.1.6 Ecosystem Stability

The District Plan sets out the issue (5.5), objectives, policies and methods to manage the effects of land use and protect native vegetation and fauna habitat. The policy direction of this Chapter is considered consistent with the RPS, and the planning assessment in Section 23.5.1.5 is considered relevant for this Chapter.

23.10.1.7 Effects on Natural Character of the Coast and Margins of Lakes, Rivers and Wetlands

The District Plan sets out the issue (5.7), objectives, policies and methods to preserve and enhance the natural character of the City's coastal environment, rivers wetlands and margins. The policy direction of this Chapter is considered consistent with the NZCPS (see Section 23.3.1.1 above), the RPS, (see the planning assessment in Section 23.5.1.6) and the Regional Plans (e.g. as discussed in sections 23.6.1.1and 23.8.1.1). The assessment of this policy direction is not repeated here, but rather reference is made back to those Sections.

23.10.1.8 Effects on the Spiritual Dimension (Mauri)

The District Plan sets out the issue (5.8), objectives, policies and methods to protect and maintain those aspects of the environment of significance to tangata whenua. The policy direction of this Chapter is considered consistent with the RPS, see particularly the planning assessment in Section 23.5.1.2. This assessment is relevant and is not repeated here.

23.10.1.9 Effects on Amenity Values: Health and Safety

Chapter 5.10 sets out the issue, objectives, policies and methods to maintain and enhance the amenity values that contribute to the wellbeing of residents and workers. In particular, the Project has been assessed against Objective 10 and Policy 10.8.

The Project upgrades have been designed to improve the overall safety for users of the strategic transport corridor, improving capacity, and relieving traffic congestion (which in turn will improve fuel efficiency). Furthermore increased provision for alternative modes of transport by way of bus shoulders and in particular the shared-use pedestrian cycleway has the ability to improve the health of users and reduce the level of discharges to the environment. Further detail on the assessment of amenity impacts from emissions of the Project is provided, particularly in Chapter 14 of this AEE (of relevance to Sector 1).

23.10.1.10 Effects on Amenity Values – Landscapes, Local Areas and Neighbourhood Character

Chapter 5.11 sets out the issues, objectives, policies and methods to achieve a quality of built development (residential settlement) and associated activities which is sympathetic to, and protects and enhances, the dominant natural and physical features which contribute to the amenity value and character of an area. The Project has been assessed against Objective 11 and particularly Policies are 11.4, 11.6 and 11.7.

The Project has been assessed to identify potential adverse effects on local amenity values including visual and landscape impacts (Technical Report G.20), air quality (Technical Report G.1), operational noise (Technical Report G.12), construction noise (Technical Report G.5) and vibration effects (Technical Report G.19). In particular, the assessment for Sector 1 (Chapter 14) is considered relevant to the Waitakere District Plan assessment.

These assessments concluded that the design and mitigation measures proposed for the Project (Sector 1) are appropriate in this location and the effects can be mitigated through the suite of measures set out in Chapter 24 of this AEE.

23.11 Part 2 of the RMA

Section 104(1)(b) of the RMA sets out the principal planning documents which an authority shall have regard to (and other matters it must disregard) when considering an application for resource consent and any submissions received. Similarly Section 171(1)(a) of the RMA sets out these matters when a territorial authority is considering a notice of requirement. This Chapter has provided an assessment against those planning matters. In both cases, the considerations of sections 104 and 171 are subject to Part 2 of the RMA, which sets out the purpose and principles of the Act and which are central to determining the appropriateness of the notices of requirement and resource consent applications being sought for this Project.

The overarching intent of the consenting and designation processes, as defined in the RMA, is to manage the use, development, and protection of natural and physical resources in a manner that promotes sustainable management. The RMA goes on to provide definition of sustainable management, and further direction on the matters of national importance (section 6), other matters (section 7) and the principles of the Treaty of Waitangi (section 8) which should be responded to. The definition of sustainable management is provided in Section 5(2):

> *In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*
>
> > *(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
> >
> > *(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
> >
> > *(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

Sustainable management, includes balancing competing resource values

In providing for sustainable management, there is often the requirement to balance consideration of the sometimes competing resource values and the 'benefits and 'disbenefits' (or adverse effects) of a Project. In particular, for the designation of a public work, this balance involves considering the scale of often regional or national benefits for the wider community with the more localised adverse effects on the community through which or upon which a project impacts.

Completion of the WRR will enable people and communities to provide for their social, economic and cultural wellbeing

In terms of Section 5 of the RMA, the completion of the WRR, which will be achieved by the construction of the Waterview Connection Project, will enable people and communities to provide for their social, economic and cultural wellbeing, by:

- Providing for the economic and population growth of the Region;
- Improving accessibility and connectivity, particularly between economic centres; and
- Providing resilience in the transport network, completing an alternative strategic transport corridor to SH1 through the City.

It is acknowledged that careful mitigation and planning will be required in communities affected by the Project, particularly in the Waterview and Owairaka areas, in recognition of the physical scale and extent of impact the Project has on these existing communities. In particular, mitigation is proposed for this community's social and cultural well-being. It is considered that these impacts relate largely to the construction period, which needs to be balanced with the longer term operational benefits.

The completion of the WRR is consistent with the Region's Land Transport Strategy, and is therefore one component of the strategic land transport solution for the Region's economic prosperity and sustainable growth.

In balancing these considerations with the matters in Section 5(2) (a) through to (c) of the RMA, the following conclusions from the above planning assessment are made:

- In terms of sustaining the potential of natural and physical resources for future generations, the Project is intended to meet the growing transportation needs of the Region and does not preclude future opportunities for other land transport development, such as the Avondale to Southdown Rail Line.

- The Project safeguards the life supporting capacity:
    - Of air - by reducing congestion and through the ongoing improvements to the transport fleet, emissions to air are reducing, albeit that this is occurring with or without the Project);
    - Of water – by improving the treatment of stormwater from existing and proposed impermeable surfaces of the Project and by restoring and rehabilitating the Oakley Creek;
    - Of ecosystems – by avoiding, remedying and mitigating the adverse effects on ecological values of the Project, including freshwater, herpetofauna, avian and vegetation ecology and through avoidance of and off-set mitigation for the permanent loss of marine ecology through reclamation; and
    - Of soils – by the management of construction works (to control erosion and land disturbance) and remediation of sites of land contamination.

- The Project avoids, remedies and mitigates the adverse effects of the Project on the environment, including identification of measures and conditions to the consent applications and designations (as set out in Chapter 24 of this AEE).

The Project recognises and provides for the matters of Section 6 of the RMA, particularly:

The Project recognises and provides for the matters of Section 6 of the RMA

- While the Project requires reclamation of the CMA, it is not considered 'inappropriate' given the objectives and policies of the RPS and ARP: C and acknowledging the existing modification of the natural character of the coastal environment in the Project area;
- The Project provides and protects other areas of natural character, particularly the margins of wetlands and rivers (e.g. Oakley Creek);
- The Project does not adversely effect any outstanding landscapes nor adversely effect any outstanding natural features;
- Assessment has been undertaken of the ecology of the Project area and areas of significant indigenous vegetation (*Mimulus repens* and potentially a *Geranium spp*) can be re-established (and the effects therefore mitigated) and does not compromise significant habitats of indigenous fauna;
- The maintenance and enhancement of public access to and along the coastal marine area and streams is provided for;
- The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga has been provided for through the implementation of protocols for engagement of tangata whenua established by the NZTA;
- The protection of historic heritage has been provided for particularly through the Oakley Inlet Heritage Area mitigation plan; and
- The Project does not impact on any recognised customary activities.

The Project has also had particular regard and as appropriate responded to matters in Sections 7 and 8 of the RMA. While not exhaustive, the following are considered particularly relevant:

The Project has also had particular regard and as appropriate responded to matters in Section 7 and 8 of the RMA

- The kaitiakitanga of tangata whenua has been recognised in seeking specific cultural impact statements from mana whenua in the Project area and this process has recognised the principles of the Treaty of Waitangi (the partnership between Iwi and the NZTA as a Crown agency, and the retention by Maori of rangatiratanga over their resources and taonga in particular);

- The ethic of stewardship has been recognised in engagement with and participation of the community with respect to environmental and heritage issues (e.g. groups associated with the maintenance and enhancement of the Oakley Creek and residents who have specific interest and expressed stewardship of the heritage resources such as the Star Mill / Garrett Tannery site at Waterview);
- The efficient use and development of natural and physical resources has been provided for, by recognising the existing significant physical resource of SH16 and the importance of effective and efficient use of this resource;
- The efficient use and development of the rest of the existing State highway network and the potential to improve the use of the network, has also been recognised in the extension of SH20 to connect to SH16, which will improve the functioning and use of the wider SH20 and WRR network;
- Recognition has been given to the maintenance and enhancement of amenity values, particularly in the residential community in the assessment of emissions from the Project, in the landscape and visual assessment (and the resulting planning for landscape and urban design mitigation) and in the assessment of options (particularly the tunneling options which avoid many adverse amenity impacts of the Project);
- It is acknowledged that there are amenity impacts of the Project, particularly at the Great North Road Interchange and in Sector 9. While these are not outstanding landscape areas, the works do represent a significant impact (in the short and medium term), e.g. on the visual catchments and with respect to noise and emissions for residents (e.g. amenity). While the planting and mitigation proposed will mitigate these effects in the long term, the Project represents a permanent and considerable change to this amenity; and
- The Project has taken into account and responded to the effects of climate change in the design of the Causeway on SH16.

While it is acknowledged that the proposed tunnelling Project is not as efficient in the end use of energy (given the ongoing operational requirements of the tunnel), this effect is balanced against the benefits (amenity, natural environment, quality of the environment and protection of ecosystems) provided through tunnelling. In particular, tunnelling avoids impacts on the lower reaches of the Oakley Creek (an area of higher ecological and amenity value), and avoids severance impacts for existing established residential communities (Avondale Heights and Springleigh), with the resulting amenity impacts.

The Project achieves sustainable management

On balance, it is considered that the benefits of this Project alongside the proposed measures to avoid, remedy and mitigate the adverse effects of the Project, leads to the conclusion that the Project achieves sustainable management of natural and physical resources and is consistent with the purpose and principles of the Act. To this end, it is considered that the purpose of the RMA is achieved by the granting the designations and consents sought.

24 Summary of Measures to Avoid, Remedy or Mitigate Effects

Overview

This Chapter provides a summary of the measures that have been identified to avoid, remedy or mitigate the actual and potential adverse effects of the Project, as identified and described in Chapters 13 through to 22 and assessed (with respect to the relevant planning matters) in Chapter 23. In summary, the following conclusions are made with respect to these measures:

- Where practicable, potential adverse operational effects have been avoided or reduced through the iterative design process (e.g. reducing the designation footprint and through tunnelling) (Chapters 4 and 11);
- Potential effects will be appropriately managed and mitigated during operation. For example, noise walls, stormwater treatment measures for treatment of stormwater from new and existing roads, significant landscaping across the Project area, and environmental enhancement of Oakley Creek (Chapters 13 – 22);
- The construction methodology has been developed through an iterative process to avoid, remedy and mitigate potential adverse environmental effects where practicable (Chapter 5 and 11);
- The residual adverse effects of construction activities will be managed through the measures proposed in this AEE and provided for in the Construction Environmental Management Plan (Technical Report G.21);
- Environmental monitoring will be undertaken prior to, during and following construction to monitor potential effects, and provide a mechanism through which additional mitigation measures can be put in place during construction and operation if necessary (Chapters 12 – 22);
- The monitoring and management measures proposed are consistent with the policy directions of relevant policy and planning documents, particularly the Regional Plans; and
- An appropriate comprehensive suite of conditions for the designations and resource consents is being sought for the Project (Appendix E.1).

Subject to the mitigation proposed, which can be delivered as conditions of the consents and designations, it is considered that the potential adverse effects of the Project will be adequately and appropriately avoided, remedied and mitigated.

24.1 Introduction

This Chapter provides a summary of the mitigation, management and monitoring measures proposed to be implemented pre, during and post construction, in order to avoid, remedy or mitigate potential environmental effects of the Project. This Chapter responds to the environmental effects (as identified in Chapters 13 through to 22) and the consideration and response to the planning matters (as summarised in Chapter 23). It is proposed that the suite of mitigation, remediation and monitoring measures be provided and confirmed in conditions to the designations and resource consents.

As detailed in Chapter 13, the Project has the potential to create some significant benefits to the Region, by improving regional transportation links across Auckland (both for motor vehicles and passenger transport) and for other modes, e.g. pedestrian / cycle ways, therefore providing for economic growth and meeting the community's aspirations for social and economic wellbeing. The design of the Project also provides for improving the treatment of stormwater discharging to the CMA and improving local air quality in proximity to regional arterial roads (by reducing traffic flows on these roads in the Project area).

The Project has significant benefits for the Region. However, there are impacts on the environment that need to be remedied and mitigated

It is acknowledged that the Project will have adverse effects during both operation and construction. Given the size, scope and location of the Project within an urban environment, most of these effects arise in relation to the built environment and the community. The Project also has potential to affect the adjacent CMA and a number of freshwater systems including Oakley Creek. A range of mitigation, remediation, management and monitoring measures has therefore been developed for the Project, in order to avoid, remedy or mitigate potential adverse effects. These measures are summarised in Table 24.1.

24.2 Mitigation Measures – Operational

24.2.1 Key Operational Issues

In summary, the following issues have been identified through the various environmental assessments as requiring particular remediation, mitigation, management and / or monitoring for the operation of the Project:

- Land Use – Once construction is completed, it is recommended that the designation be uplifted or withdrawn from surplus land areas within the designation where practicable to minimise the potential impacts of land take from land uses surrounding the Project.

- Traffic Noise – The Project will bring some sections of SH16 closer to residential properties, and the new sections of SH20 will affect new residential receivers[1]. Permanent noise mitigation is proposed in areas adjoining 'sensitive receivers' (such as residential dwellings and schools within 100m of the Project), in order to mitigate the adverse impacts of noise on residents and users of these facilities. These 'structural mitigation measures' (e.g. pavement type and noise walls / bunding) result in the effects of the Project being acceptable for most assessed receivers. However, there are a small number of properties that are likely to require additional mitigation (e.g. acoustic treatment of buildings) and an investigation process is proposed to address this (by confirming the properties at issue and the treatment required to address this). Specific mitigation is shown on the Plans provided in Part F.17: *Noise Walls* of this AEE.

- Reserve Restoration and Management – construction and operation of the Project requires land from existing open space areas. The need for replacement open space and remediation of open space used for construction is identified as an important component of the mitigation/remediation works. An Open Space Mitigation proposal has been developed for the Project (Refer Appendix E. 4 of this AEE) setting out how the open space areas affected by the Project are proposed to be replaced (with the majority of these works proposed within the designation). It is appropriate that further work is undertaken with the managers of these reserve, open space and recreation facilities (the [Auckland Council]) as the long term owners and managers of these facilities. On this basis, it is proposed that a number of Open Space Restoration Plans be developed in conjunction with the [Auckland Council]. In particular, Restoration Plans are proposed for Jack Colvin Park, Waterview Reserve, Oakley Creek Esplanade Reserve and 'Alan Wood Reserve' (including the area proposed for 25 Valonia Street as mitigation). It is noted that this planning process can be undertaken over the construction period.

- Visual and Landscape – the Project is a significant infrastructure development within an existing and established urban environment. It is recognised that, particularly in areas where there is currently no State highway, the Project will represent a marked impact on the landscape and visual amenity. While the design of the Project, particularly tunnelling through Sectors 7 and 8, has removed this impact from the majority of the Project area, there are residual impacts associated with the open carriageway and the structures required to operate the tunnels. The landscaping and urban design proposed for the Project and set out in Part F.16: *Urban and Landscape Design Plans* of this AEE, respond to these potential effects and seek to mitigate these effects. There is also further opportunity for the appearance and detailed design of some structures associated with the tunnel ventilation system to be further developed over the construction period.

[1] It is noted that the tunnels avoid exposure of a number of 'sensitive receivers' to traffic noise from the Project.

- Stormwater Management – the Project will result in an increase in impervious area; given the widened SH16 and the new section of SH20, with the resulting runoff requiring stormwater treatment and management. Some potential adverse effects of contaminant laden stormwater have been avoided by the design of SH20 below ground (the tunnels), and in other areas there are environmental enhancements from the Project (with improved levels of treatment on the existing SH16 in particular). In remaining areas, the Project proposes to mitigate the impacts of contaminant discharges through the proposed stormwater treatment systems.

  These systems meet the Regional planning policy direction, with at least 75% efficiency[2] and in cases where stormwater is discharged to the CMA this in increased to 80%. Furthermore, the Project stormwater treatment system has been designed to treat both the new and existing impervious areas of the motorway (and in some cases wider catchment). This is considered to be an enhancement of the Project.

- Oakley Creek – the Project requires the realignment of Oakley Creek. Potential adverse effects (to the natural resource and to its ecological values) of this work have been avoided through the Project design, which has sought to undertake works to maintain the 'natural form' of the stream (as opposed to culverting or piping). It is recognised however, that even with the diversion works, there is a net reduction in stream length. In other areas, such as the Pixie Stream, permanent piping is proposed. To remediate and mitigate the potential adverse impacts of this work, the Project team has developed the *Oakley Creek Restoration and Rehabilitation Guidelines* (provided in Technical Report G.6: *Assessment of Freshwater Ecological Effects*). Replanting/ enhancement/ riparian planting will be undertaken in accordance with these Guidelines.

- Reclamation – widening of the Causeway and other Project work requires reclamation of some 4.7ha of the CMA. While the impacts of this work are considered minor in terms of coastal processes and natural character / landscape impacts, it is recognised that the work (along with other structures for the Project) represents a permanent loss of marine habitat, particularly from the intertidal area. Overall, the ecological values of this habitat range from low to high and this impact is considered moderately adverse. Mitigation measures are proposed to remedy and mitigate these effects, including habitat restoration (with a mudflat remediation zone on either side of the Causeway), improving the efficiency of stormwater treatment (effectively off-setting the impact of habitat loss), undertaking restoration of coastal fringe habitat and removal of litter from this area and the CMA along the Project corridor.

[2] This efficiency ratio is determined by the percentage of total suspended solids expected to be removed from stormwater through the proposed treatment system, on an average annualised basis.

24.2.2 Operational Management Plans

The NZTA has a number of existing procedures to ensure ongoing operation and maintenance of its assets. This includes, for example, ensuring landscaping is maintained, graffiti is removed, and the road surface is maintained.

In addition to these procedures, and to ensure that specific aspects of this Project are managed and maintained, the following specific operational management plans have been prepared:

- An Operational Stormwater Management Plan (Appendix D of Technical Report No. G.15 *Assessment of Stormwater and Stream works Effects*). This sets out specific management and maintenance aspects required to be undertaken for the proposed stormwater ponds; and
- An Operational Air Quality Management Procedure (Appendix O of Technical Report G.1 *Assessment of Air Quality Effects*). This sets out the ongoing monitoring proposed in relation to the tunnel operation.

As noted above, it is also proposed to prepare a number of Open Space Restoration Management Plans. These will be prepared in conjunction with the [Auckland Council].

24.3 Mitigation Measures – Construction

24.3.1 Summary of potential issues during construction

During construction, there will be a number of potential adverse effects, particularly given the location of the Project in close proximity to residential properties and given the adjacent receiving environment. Key issues relate to:

- Disturbance of the existing roading network from both construction activities (e.g. at Te Atatu and Great North Road Interchanges) and from construction traffic;
- Disturbance from construction effects such as noise and dust for sensitive receptors in close proximity to the construction areas, particularly in relation to works in Sectors 1, 5, 7 and 9;
- Permanent and temporary loss of marine habitats (Sectors 1 – 5);
- Permanent loss of freshwater habitats (Sectors 1 and 9);
- Discharges of elevated suspended solids and contaminants from construction activities into the receiving environment (marine and freshwater);
- Disturbance of archaeological sites, particularly in Sector 5 in relation to the Oakley Inlet Heritage Area;

- Potential settlement effects from tunnelling beneath buildings and other sensitive structures (Sector 7 – 9); and
- Temporary land take required from open space and community facilities. Particular impacts in Sectors 1, 5, 7 and 9.

24.3.2 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared for the Project (Refer Technical Report G.21 *Construction Environmental Management Plan*). This sets out the methods and tools to be implemented by the construction contractors to manage, remedy and mitigate potential adverse environmental effects in order to meet the resource consents and designation conditions, relevant legislation and the NZTA's environmental objectives.

The CEMP sets out the principles and general approach to managing the environmental effects. The management of specific effects (e.g. construction air quality, noise, vibrations etc) are further detailed within a suite of environmental management plans that form the appendices to the CEMP. The suite of management plans are:

- Construction Noise and Vibration Management Plan (Appendix C of Technical Report No. G.5 Assessment of Construction Noise Effects and Appendix L of Technical Report G.19 Assessment of Vibration Effects);
- Construction Air Quality Management Plan (Appendix M of Technical Report G.1 Assessment of Air Quality Effects);
- Erosion and Sediment Control Plan (Technical Report G.22);
- Temporary Stormwater Management Plan (Appendix E of Technical Report No. G.15 Assessment of Stormwater and Streamworks Effects);
- Ecological Management Plan (Appendix H of Technical Report G.21 Construction Environmental Management Plan), which includes management measures proposed for avian, herpetofauna (lizard), vegetation, freshwater and marine ecological effects;
- Groundwater Management Plan (Appendix H of Technical Report No. G.7 Assessment of Groundwater Effects);
- Settlement Effects Management Plan (Appendix H of Technical Report No. G.13 Assessment of Ground Settlements Effects);
- Contaminated Soils Management Plan (Appendix 0 of Technical Report No. G.9 Assessment of Land and Groundwater Contamination);
- Hazardous Substances Management Plan (Appendix L of Technical Report G.21 Construction Environmental Management Plan);
- Archaeological Site Management Plan (Appendix D of Technical Report G.2 Assessment of Archaeological Effects);
- Construction Traffic Management plan (Appendix A of Technical Report No. G.16 Assessment of Temporary Traffic Effects); and

- Concrete Batching and Crushing Plant Management Plan (Appendix N of Technical Report G.1 Assessment of Air Quality Effects, Appendix E of Technical Report G.5 Assessment of Construction Noise Effects and Appendix F of Technical Report G.15 Assessment of Stormwater and Streamworks Effects).

24.4 Summary of Mitigation Proposed

Table 24.1 overleaf provides a summary of the key mitigation proposed for the Project. Where relevant, reference is made in Table 24.1 to the Conditions proposed for the designation(s) and resource consent(s) sought for the Project (refer Part E.1 of Assessment of Environmental Effects (Appendices)). Subject to the mitigation proposed, which the NZTA proposes can be delivered as conditions of the consents and designations, it is considered that the potential adverse effects of the Project can be been appropriately avoided, remedied and mitigated.

Table 24.1: Summary of the Key Mitigation Proposed for the Project

Environmental Aspect	Potential and Actual Environmental Effects[3]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[4]
Land Use	**Operation**		
	• Loss of land uses. • Potential loss of viability for the remaining surrounding land use areas.	• Once construction is complete uplifting the designation from surplus land to allow for reinstatement of land uses. • Development of Open Space Restoration Plans to restore and reinstate open space and reserve areas affected by the Project. • Providing esplanade reserve.	 SO.1, SO.2, SO.3 SO.1, S0.2
	Construction		
	• Loss of land for construction works and in particular construction yards including on land zoned for residential and open space purposes.	• Liaison with affected parties to advise of construction works and programmes to minimise potential disruption. • Temporary provision of recreation facilities (e.g. sportsfields).	PI.1, PI.2, PI.3, PI.4, PI.5 SO.4
Transport	**Operation**		
	• Realising opportunity to optimise the wider network performance with the Project (e.g. optimisation of the Te Atatu Interchange) • Potential impacts of congestion in the tunnels	• Network Integration Plan. • Tunnels Operation Management Plan to set in place management structures for planned maintenance, closure or travel demand management within the tunnels.	OT.1 OT.2
	Construction		
	• Reduced capacity on roads within Project area. • Travel time delays, congestions. • Diversions onto local roads. • Potential loss of access for users of network through construction site. • Temporary lane/road closures. • Closure of bus shoulders on SH16 resulting in potential impacts on bus services. • Alternative/ restricted access maybe provided to community facilities. • Temporary changes to pedestrian/cycle ways through the Project area during construction. • Narrowing and realignment of lanes. • Removal of some direct property access (in Sectors 1 and 5). • Relocation of existing bus stops (in Sectors 7 and 9)	• All works to be undertaken in accordance with the Construction Traffic Management Plan. • Temporary pedestrian/cycle way and bridge provided to maintain ongoing access throughout construction period. • Use of temporary signals and safety barriers to separate traffic from construction works. • Any temporary lane closures on SH16 undertaken outside of peak hour traffic periods. • Early liaison with passenger transport agencies and operators. • Road user education campaigns/warnings and targeted communication in relation to temporary closures. • Clearly demarcated detour routes. • Use of overhead VMS messaging on SH1 north and southbound, SH16 east and westbound in advance of significant changes to road layout or capacity. • Letter drops and information provision to affected residences. • Scheduling of work at low demand periods. • Construction and work site access strictly controlled to provide for safe access and safety of surrounding road network. • Monitoring programme to monitor effectiveness of mitigation measures. • Site Specific Traffic Management Plans (SSTMPs) to be prepared for areas of work, setting out more specific details on road closures, lane narrowing, access arrangements, speed limits, intersection phasing etc.	TT.1 TT.3(h), TT.6 TT.2 TT.1, TT.2, TT.3(a) TT.4, TT.5 PI.3 TT.2, TT.3(b), (c) TT.1 TT.2 TT.3(a) TT.3(e), (f) TT.9, TT.10 TT.2, TT.3, TT.9

[3] It is noted that this table is a summary of actual and potential adverse effects and as such a number of Project design elements which have sought to avoid adverse effects are not specifically referenced. These are discussed in the assessment Chapters of this AEE (Chapters 13 through to 22) and in the discussion on the assessment of alternatives (Chapter 11).

[4] See Appendix E.1 of this AEE

Environmental Aspect	Potential and Actual Environmental Effects[3]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[4]
Settlement	**Construction**		
	Potential settlement during tunnelling (Sectors 7 – 9 only) could result in, • Damage to buildings. • Cracking of kerb and seals. • Effects of services. • Effects on closed landfill (Alan Wood Reserve).	• Construction activities undertaken in accordance with the Settlement Environmental Management Plan • Surveys of buildings and other sensitive structures, prior to during and following completion of tunnelling. • Implementation of settlement monitoring programme prior to, during and following completion of tunnelling. • Remedial works undertaken if required. • Monitoring services in the vicinity of the tunnel alignment. • Monitoring at retaining walls (inclinometers and surface) at portals and cut-cover tunnels	S.1 S.7 – S.13 S.2 – S.6 S.1 S.15 S.14
Social Impacts	**Operation**		
	• Impacts on community cohesiveness. • Impacts on ability of residents to participate in social/cultural traditions. • Impact on resident's sense of wellbeing and satisfaction. • Reduction in population size due to permanent loss of houses (residential property acquisition). • Change in community character / amenity • Severance between Owairaka / New Windsor and Waterview / Point Chevalier • Community concerns relating to air quality impacts from air discharges. • Visual impacts of motorway and ventilation stack on education facilities. • Impacts on community infrastructure.	• Replacement of 'like for like' open space (quantity and quality). • Involvement of the community and stakeholders (including iwi) in the restoration of open space and recreation areas. • Provision of public access to and along the CMA and waterways • Provision of key pedestrian/ cycle way linkages (upgrades to the Northwestern Cycleway, SH20 Cycleway, Hendon Park Bridge and Oakley Inlet Bridge). • Maintaining the navigation channel on the Whau River • Establishment of a Community Liaison Group to provide forum for information, prior to, during and following completion of Project. • Landscaping around northern and southern portals, and in areas where houses have been lost to minimise visual impacts. • Ongoing air quality monitoring and provision of information to educational facilities in close proximity to northern portal (Sector 7).	SO.1-S0.4 SO.1 SO.2 SO.2 C.2, C.11 PI.5 LV.1, LV.3 SO.5, AQ.10-14
	Construction		
	• General construction disruption, including increased travel times on local roads, noise, dust, vibration, air discharges resulting in reduced liveability and stress/nuisance. • Removal of some valued amenity trees. • Construction yards will challenge some local resident's expectations of neighbourhood amenity, character and safety. • Impacts on community infrastructure such as recreation and open space, including loss of part of Harbourview-Orangihina Park in Sector 1. • Loss of "active reserve" space of Waterview and Alan Wood Reserves. • Temporary noise and traffic effects on childcare facilities in Sector 5 (St Francis School) and 7 (Waterview Primary School and Kindergarten). • Impact on enjoyment of outdoor living areas, sleeping patterns, general annoyance/disturbance as a result of construction in Sector 7. • Impacts on access due to road closures, increased traffic and construction of the emergency exhaust at 36 Craddock Street.	• Establishment of a Community Liaison Group to provide forum for information, prior to, during and following completion of Project. • Location of construction yards away from sensitive land uses, with a minimum buffer area between residential land use and the yards. • Management and monitoring of noise, vibration, air quality/dust and traffic effects as part of Construction Environmental Management Plan (CEMP). • Where practicable, undertaking noisy construction activities outside of school hours or during school holidays. • Implementation of formal complaints/feedback process. • Temporary noise attenuation for education facilities and possible relocation of Waterview Kindergarten during construction if other noise measures are not practicable. • Communication of results of air monitoring. • Uplifting of designations on surplus land following construction. • Development of a communications strategy to keep the community and stakeholders informed about construction activities. • Maintenance of a safe crossing option over Great North Road to enable children to walk to Waterview Primary School and Kindergarten. • Creation of temporary playing fields in Sector 5 and 9.	PI.5 C3(n) CEMP 1-13 SO6 CEMP 2, PI.4 SO.7 S05 PI.2 TT3 SO4

Environmental Aspect	Potential and Actual Environmental Effects[3]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[4]
Cultural Impacts	**Operation**		
	• Degradation of water quality. • Availability of kaimoana. • Loss of reserve and open space areas • Mauri, amenity and ecological effects on Oakley Creek. • Degradation of amenity and ecological health of the coastal environment.	• Native planting on motorway verges and ecosourcing of plant stock. • Stormwater treatment from new motorway surfaces and some existing motorway surfaces • Design/artwork reflecting Maori heritage and West Auckland identity and culture. • Reserve reinstatement measures – 'like for like' and wider stakeholder (including Iwi) involvement in restoration planning.	V6 & V10 SW.1, SW 11 LV.1, LV.3 SO1, SO2
	Construction		
	• Potential impact on areas of cultural heritage value/known archaeological sites. • Mauri, amenity and ecological effects on Oakley Creek. • Degradation of amenity and ecological health of the coastal environment.	• Stormwater treatment from new motorway surfaces and some existing motorway surfaces • Accidental discovery protocols (including ko iwi protocols)	SW.3 ARCH 1 & ARCH 3 & CEMP.7
Landscape and Visual Impacts	**Operation**		
	• Change to local environment and outlook for many residents due to removal of existing vegetation, dwellings and proposed changes to motorway infrastructure. • Increased exposure of reclamation and motorway reconfiguration of the causeway within a visually sensitive part of the coastal environment. • Removal of vegetation within Sector 1 will have impacts on appearance of Jack Colvin Park. • Increased exposure to new structures (particularly 5 – Great North Road Interchange, and Sectors 7 and 9 – tunnel portal). • Significant change in landscape in Sector 9 from 'public open space' of Alan Wood Reserve to motorway corridor.	• Planting in accordance with the Urban and Landscape Plans (Plan Set F.16 of the AEE) • Specific treatment of planting areas, including use of specimen trees as identified on Plan Set F.16 of the AEE • Architectural treatments to new structures within close proximity to 'sensitive receptors' (particularly ventilation buildings and emergency exhaust). • Development of Restoration Management Plans in conjunction with the [Auckland Council] for Waterview Reserve, Jack Colvin Park, Alan Wood Reserve, and Oakley Creek Esplanade in general accordance with Urban and Landscape Plans.	LV.1 LV.1 LV.1 SO1
	Construction		
	• Particular effects on dwellings located in close proximity to construction works eg. Increased exposure to widened motorway corridor, loss of vegetation. • Impacts from removal of dwellings and creation of new structures. • High visibility of construction works, reclamation and rock armour on Causeway given the open nature of the coastal environment.	• Use of solid hoardings around construction sites to minimise views into the construction areas. • Early placement of permanent bunding and noise walls where practicable to screen construction areas. • Staging of construction so that planting can occur in a specific area once construction is complete.	CEMP 7 CEMP 7 LV5
Amenity Trees	**Construction**		
	• Removal of trees identified as contributing to the locality.	• Works to be undertaken in accordance with the Construction Environmental Management Plan (tree management). • Protection of identified trees where possible. • Landscape planting where trees cannot be retained in accordance with the Urban and Landscape Plans (Plan Set F.16 of AEE).	CEMP1 V7 L4
	Operation		
	• Impacts on the regionally significant Oakley Inlet Heritage Area	• Reinstatement of a bridge (pedestrian) across the Oakley Inlet • Interpretive signage of the archaeological site (as part of the Waterview Reserve Open Space Restoration plan)	ARCH.5 ARCH.5
Archaeology and Heritage	**Construction**		
	• Potential to affect known and unknown archaeological sites. • Particular affects identified in Sector 5 on Oakley Inlet Heritage Area and dry stone wall.	• Construction activities to be undertaken in accordance with ASMP (Appendix D of Technical Report G.2: *Assessment of Archaeological Effects*). • Remediation/restoration works to dry stone wall in Sector 5, and preparation and implementation of a Vegetation Management Plan. • Development of Restoration Plan for Oakley Inlet Heritage Area following completion of works, to include improved public access and interpretative signage.	ARCH1 ARCH7 SO1, ARCH6

Environmental Aspect	Potential and Actual Environmental Effects[3]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[4]
		• Monitoring of works in the vicinity of known archaeological sites during excavation works. • Use of Accidental Discovery Protocols in the event of unknown archaeological site being affected.	ARCH2 ARCH1 & ARCH3
Stormwater	**Operation**		
	• Potential for discharge of motorway runoff containing pollutants from vehicles such as heavy metals, suspended solids and hydrocarbons. • Increased impervious area resulting in increased volume of runoff from the catchment, and potential for downstream flooding impacts.	• Stormwater treatment devices and systems undertaken in accordance with BPO (and ARC's TP10 to treat at least 75% efficiency in Oakley Creek and Meola Creek and 80% where discharge is to the CMA). • Stormwater treatment devices and systems to be maintained and managed in accordance with the Operational Stormwater Management Plan (OSMP). • Energy dissipation and erosion protection will be provided at discharge outlets.	SW.11 SW.16 SW.20
	Construction		
	• Stormwater generated from impervious construction areas and pavement for proposed motorway has the potential to discharge suspended solids and other contaminants into adjacent receiving environment. • Methods for stormwater treatment during construction of the causeway are particularly restricted as drainage paths will be blocked.	• Temporary stormwater treatment devices and systems undertaken in accordance with BPO (and ARC's TP10 to treat at least 75% efficiency) designed for construction. • Temporary stormwater treatment devices maintained and managed in accordance with the Temporary Stormwater Management Plan (Appendix E of Technical Report G.15: *Assessment of Stormwater and Streamworks Effects*). • Erosion and sediment control measures to be implemented during construction, undertaken in accordance with Technical Report G.22 *Erosion and Sediment Control Plan.*	SW.3 SW.5, SW.7 E3
Streamworks	**Operation**		
	• Stream length loss (Oakley Creek and Pixie Stream).	• Enhancement and restoration in accordance with Oakley Creek Restoration and Rehabilitation Guidelines, for a length of 343m	STW.2
	Construction		
	• Disturbance of the streambed, and natural flow. • Stream bank erosion from construction activities. • Affect on fish passage.	• Streamworks to be undertaken in accordance with the erosion and sediment control measures set out in Technical Report G.22 *Erosion and Sediment Control Plan.* • Works to be undertaken offline to allow continued run of water, and fish passage through construction.	STW.8 STW.25
Groundwater	**Construction**		
	• Potential groundwater drawdown effects from tunnelling (Sectors 7-9) which may lead to settlement and damage to buildings • Groundwater drawdown leading to migration of contaminants through the groundwater, and potential impacts on Oakley Creek baseflow.	• Groundwater monitoring in accordance with the Groundwater Management Plan (see Appendix H of Technical Report G.7: Assessment of Groundwater Effects), prior to, during and following construction. • Continuous flow monitoring of Oakley Creek baseflows prior to, during and following construction. • Remediation action as required, in accordance with the Management Plan.	G1, G3, G4, G6, G9 G1, G10, G11 G1, G7, G8
Coastal Processes	**Operation**		
	• Potential changes to flow and drainage. • Contaminants to CMA. • Potential scouring. • Potential localised erosion and slumping associated with reclamation.	• Project design in general accordance with the Plans (pier locations) • Stormwater control measures in accordance with TP10. As treating both new and existing sections of SH16, considered to be an enhancement. • Spacing of piers to maintain navigable channel and minimise change to coastal hydrology.	C2 SW11 C11
	Construction		
	• Changes to tidal flushing within Waterview Estuary and Oakley Inlet. • Potential bank erosion and scouring. • Increased disturbance of seabed resulting in increased levels of suspended solids and any associated contaminants. • Channel bank instabilities or slumping and associated backwater effects. • Burial of chenier shell banks.	• Temporary stormwater treatment devices and systems undertaken in general accordance the Temporary Stormwater Management Plan (see Appendix E of Technical Report G.15: Assessment of Stormwater and Streamworks Effects). • Erosion and sediment control measures in accordance with Technical Report G.22 *Erosion and Sediment Control Plan.* • Managed excavations for new by-pass channels.	SW.1 E3, C2 C2(b), (c)

Environmental Aspect	Potential and Actual Environmental Effects[3]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[4]
	• Potential sediment loss associated with construction of permanent piers.	• Temporary stockpiling of chenier shell deposits and repositioning after completion of works. • Removal of mangroves to facilitate natural channel migration associated with reclamation. • Use of steel casings in the construction of permanent piers to minimise discharges during excavation of sediment. • Use of temporary coffer dams or sheet pilling to create dry working area and minimise potential for tidal inundation and generation of suspended solids	C.12 C2, C.7 C2 C2(a)
Marine Ecology	**Operation**		
	• Stormwater discharges from motorway, potentially discharging contaminants (suspended solids, hydrocarbons, heavy metals) into the receiving environment. • Shading from structures affecting coastal plant growth and colonisation. • Permanent habitat loss associated with reclamation of the CMA.	• Stormwater treatment devices to treat at least 80% efficiency where discharging to the CMA. • Stormwater treatment devices and systems to be maintained and managed in accordance with the OSMP (see Appendix D of Technical Report G.15: Assessment of Stormwater and Streamworks Effects). • Restoration of coastal fringe habitat. • Removal of gross litter and debris from within and adjacent to the CMA.	SW11 SW16 M.9 M.10
	Construction		
	• Temporary habitat loss. • Temporary habitat disturbance. • Discharges of suspended solids and other contaminants (e.g. cement) during construction. • Vegetation removal from CMA. • Direct mortality of benthic invertebrates.	• Temporary stormwater treatment devices and systems undertaken to treat at least 75% efficiency, designed for construction, and maintained and managed in accordance with the TSMP (see Appendix E of Technical Report G.15: Assessment of Stormwater and Streamworks Effects). • Erosion and sediment control measures in accordance with Technical Report G.22 *Erosion and Sediment Control Plan.* • Temporary removal, stockpiling and replacement of shell deposits. • Carrying out of disturbance works during low tide to minimise sediment generation. • Monitoring of suspended sediments, pH and benthic invertebrate community composition are proposed as part of the ECOMP (see Appendix G of Technical Report G.11: Assessment of Marine Ecological Effects). • Mudflat remediation zone on either side of the Causeway embankment to create benthic habitat. • Vegetating faces of ground improvement works and restoration of coastal fringe habitat. • Removal of gross litter and debris from within and adjacent to the CMA. • Restoration works on Traherne Island (comprising revegetation and weed control).	SW.1 E3, C2 C.12 C2(d) M1–7, E19 C18 M9 M10 V.11
Ecological Effects on Herpetofauna	**Construction**		
	• Potential disturbance and loss of habitat of copper skinks.	• Management in accordance with the ECOMP (see Appendix A of Technical Report G.8: Assessment of Herpetofauna Ecological Effects), including relocation and installing siltfences around construction areas where skinks are recorded. • Following construction, restoration of some lizard habitats through planting and provision of lizard refuges. • If significant populations of lizards are found requiring relocation, monitoring of habitat relocation.	H1 H1 H1

Environmental Aspect	Potential and Actual Environmental Effects[5]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[6]
Avian	**Construction**		
	• Clearance of vegetation disturbing bird roosting, breeding and feeding areas. • Direct mortality of birds from construction activities. • Loss of intertidal habitat disturbing bird roosting, breeding and feeding areas. • Displacement of birds as a result of a combination of habitat loss and Motorway. moving closer to preferred heading areas.	• Construction activities to be undertaken in accordance with the ECOMP (see Appendix J of Technical Report G.3: Assessment of Avian Ecological Effects). • Any substantial vegetation clearance to outside of the main breeding season where practicable • Temporary roosting structures to be provided in the vicinity of the Causeway during construction. • Monitoring roosting in Orangihina Park and temporary roosting areas with remediation where practicable	A1 A1 A2 A3
Freshwater Ecology	**Operation**		
	• Generation of additional stormwater discharge from increased impervious surface. • Permanent loss of in-stream habitat. • Discharge of contaminants from road runoff into freshwater receiving environments.	• Enhancement and restoration in accordance with Oakley Creek Restoration and Rehabilitation Guidelines. • Riparian planting. • Stormwater treatment devices and systems undertaken in accordance with BPO (and ARC's TP10 to treat at least 75% efficiency), and maintained and managed in accordance with the OSMP (see Appendix D of Technical Report G.15: Assessment of Stormwater and Streamworks Effects).	F12, STW21 STW20 SW11, SW16
	Construction		
	• Discharge stormwater containment elevated levels of sediment into waterways • Potential groundwater drawdown affecting Oakley Creek baseflow. • Localised decreases in abundance of some species within Pixie Stream in Sector 1 and Oakley Creek in Sector 9. • Works in the watercourse (e.g. stream realignments, culvert works) resulting in increased sediment generation and other potential contaminant discharge.	• Temporary stormwater treatment devices and systems undertaken in accordance with the BPO (and ARC's TP10 to treat at least 75% efficiency) designed for construction, and maintained and managed in accordance with the TSMP (see Appendix E of Technical Report G.15: Assessment of Stormwater and Streamworks Effects). • Freshwater ecological monitoring in accordance with the Ecological Construction Management Plan (see Appendix D of Technical Report G.6: Assessment of Freshwater Ecological Effects). • Erosion and sediment control measures in accordance with Technical Report G.22 *Erosion and Sediment Control Plan* e.g. Sediment retention ponds, silt fences and decanting earth bunds. • Management of potential spills of hazardous substances, as per the Hazardous Substances Management Plan. • Oakley Creek flow and groundwater monitoring in accordance with the Groundwater Monitoring Plan (see Appendix L of Technical Report G.21: CEMP).	SW11, SW16 F1 – F6 E3 CEMP10 G9-11
Vegetation	**Construction**		
	• Edge effects within areas of existing habitat. • Could specifically affect population of *Mimulus repens* (classified as naturally uncommon and regionally endangered) in Sector 4, and geranium sp. in Sector 9. • Loss of saltmarsh community on the upstream side of Henderson Creek (Sector 1). • Loss of vegetation at Jack Colvin Park for construction of the wetland (Sector 1).	• Works to be undertaken in accordance with the ECOMP (see Appendix C of Technical Report G.17: Assessment of Terrestrial Vegetation Effects). • Specific measures identified in relation to *Mimulus repens* and any Traherne Island flax that is affected (Sector 4), including translocation and replanting in appropriate areas. • Specific measures identified in relation to geranium sp. In Sector 9, including fencing off the area and translocation if necessary. • Replanting with locally sourced and appropriate indigenous species, in accordance with the Urban Design and Landscape Plans. • Replanting programmes for affected areas with appropriate species.	V1 V11 V12 V6, V10 V6

[5] It is noted that this table is a summary of actual and potential adverse effects and as such a number of Project design elements which have sought to avoid adverse effects are not specifically referenced. These are discussed in the assessment Chapters of this AEE (Chapters 13 through to 22) and in the discussion on the assessment of alternatives (Chapter 11).

[6] See Appendix E.1 of this AEE

Environmental Aspect	Potential and Actual Environmental Effects[5]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[6]
Air	**Operation**		
		• Monitoring of emissions of tunnel stacks	QA1
	Construction		
	• Dust generation from excavations, tunnel works and site clearance. • Vehicle emissions from construction vehicles. • Dust generation from use of aggregates and cement powder from Concrete. Batching Plant. • Dust generation from rock crusher. • Particularly sensitive receptors include schools, residential properties and healthcare facilities.	• Construction activities to be undertaken in accordance with the Construction Air Quality Management Plan (CAQMP), the Concrete Batching Plant and Rock Crusher Management Plan (CBPRCMP), for construction and concrete batching. • Air quality monitoring programme to be implemented throughout construction in accordance with the CAQMP and the CBPRCMP. • Buffer zones where possible between residential properties and construction activities/ yards. • Use of air filter bags for the concrete batching plan and rock crusher.	AQ1, AQ5, AQ10 AQ10-14 AQ4 AQ5 & AQ8
Noise Emissions	**Operation**		
	• Increase in traffic noise levels for some residential properties.	• Noise barriers and bunding of varying heights around sensitive receptors. • Low noise surface paving at Great North Road Interchange (double layer OGPA) • Additional monitoring required for Category C properties to identify the need for any additional mitigation. • There may be the need for building modification to severely adversely affected buildings (eg. upgraded glazing).	ON2 – ON3 ON3 ON7 & ON8 ON9 – ON11
	Construction		
	• Elevated noise levels during construction activities, particularly for those residents in close proximity to the works (particularly Sectors 1, 5, 7 and 9). • Elevated noise levels during construction activities for noise sensitive Waterview Primary School and Kindergarten (Sector 7). • Elevated noise levels during night time construction activities required in some Sectors. • Elevated noise levels to less sensitive industrial noise receivers.	• Construction activities to be undertaken in accordance with the Construction Noise and Vibration Management Plan. • Noise monitoring to be undertaken throughout construction to ensure compliance with Project noise criteria, and identify where additional measure maybe required. • Temporary noise barriers to be erected around construction yards and noisy construction activities. • Temporary relocation of Waterview Kindergarten away from construction noise activities. • Where monitoring has shown addition mitigation required this may be in the form of building modifications (e.g. glazing and insulation) or temporary relocation. • Implementation of a communications strategy with residents, and a 24 hour complaints line. • Undertaking noisy activities during the day, with quieter activities at night. • Where possible locating noisy activities in Construction Yards as far from residential areas as possible. • Temporary resident relocation as required.	CNV1 CNV1(viii) SO7 CNV1(i) PI(2) & CNV(xii) CNV5 & CNV2 CEMP7(n) CNV1(ix)
Vibration	**Operation**		
	• Vibration from road traffic.	• Monitoring and maintenance of road surfaces in accordance with NZTA standard policy.	V1
	Construction		
	• Potential damage to buildings and other sensitive structures from particular construction activities (notably rollers, piling and blasting). • Tunnelling may result in elevated internal vibration levels during night time works.	• Construction activities to be undertaken in accordance with the CNVMP. • Consultation with residents and 'sensitive receptors' and implementation of a complaints procedure with a 24hr hot line. • Vibration monitoring prior to, during and post construction. • Building surveys prior to, during and post construction. • Management or rescheduling of specific activities where possible. • Installation of vibration mitigation measures such as "vibration barriers" where necessary, or potential temporary relocation of residents.	CNV1 PI(4) CNV1(viii), CNV4 CNV1(v) CNV1 CNV1(ix)

Environmental Aspect	Potential and Actual Environmental Effects[5]	Proposed Mitigation and Monitoring (*note the colouring of the text in this Table for specific reference to each of these*)	Proposed Condition[6]
Light	**Operation**		
	• Light spill onto adjoining residential properties. • Change in lighting on new motorway in Sector 9.	• Road lighting designed to NZ Standards (Technical Report G.10) and Council District Plan and Bylaw standards.	L1
	Construction		
	• Temporary night time lighting required for night time works, and potential for light spill to adjacent residential properties.	• Development of Temporary Construction Lighting Management Plans for night time work with specific mitigation measures proposed.	L2
		• Buffer zones created between residential properties and construction yards.	L2
		• For night works, shielded lighting (no more than 3° from the horizontal plane)	L3
Land Contamination	**Construction**		
	• Potential for adverse effects for receiving environments on human health where there is high detection of contaminants. • Discharge of contaminants during land disturbance.	• Construction activities be undertaken in accordance with a CSMP (see Appendix O Technical Report G.9: Assessment of Land and Groundwater Contamination) and a Site Health and Safety Plan.	CL1
		• Specific additional sampling required within Jack Colvin Park, Meola Creek and Great North Road prior to construction activities, to confirm nature of material and management requirements.	CL2
		• Screening of all fill and excavated material and any soil classified as 'contaminated' or 'managed fill' to be disposed of offsite.	CL3, CL5
Flooding	**Operation**		
	• Reductions in flood storage availability in Sector 9 resulting in increased downstream flooding.	• Mitigation by design of increased capacity within stream and with the open space reinstatement area at 25 Valonia Street.	STW.26