



9 Assessment of Actual and Potential Environmental Effects

9.1 Overview

The actual and potential environmental effects of the Project and suggested methods for avoiding, remedying or mitigating these effects are addressed in detail in the suite of Technical Assessments contained in **Volume 3**. These effects are summarised below along with methods for mitigating any identified adverse effects that cannot be avoided or remedied in accordance with sections 5, 171, 104 and Schedule 4 of the RMA.

The assessments carried out for the Project do not apply a permitted baseline in order to discount the severity of adverse effects. A permitted baseline can be difficult to apply for a project of the scale and complexity of the Project. The NZ Transport Agency is not asking the consent authority to disregard any effects in accordance with section 104(2). However, in many instances existing or authorised activities will provide context for understanding the nature and acceptability of effects and the expectations of the community. For example, many of the activities carried out for the Project could (or already do) occur within the existing designations in the Project area. Because of this, the community surrounding the Project area in many ways already accommodates the effects of the proposal.

9.2 Positive Effects

There are a number of positive effects associated with the implementation of the Project. These positive effects are canvassed throughout the body of the AEE, with such effects being implicit in the nature and detail of the Project as described earlier and with particular benefits of the Project being addressed in **Section 2.4**.

A high level overview of the range and extent of the positive effects of the Project is set out below. The main thematic areas of positive effects are transport, social, and those associated with the natural environment.

9.2.1 Transport

The scale and extent of positive effects of the Project for traffic and transport are identified in

Figure 47 below and discussed further in **Section 9.3**. Along with a wide range of travel-time savings for both private vehicles and public transport, congestion on the local network will be reduced and the Project will be built to a higher safety standard. The establishment of the SUP for the full extent of the Project will positively affect the modal choice available.



Figure 47 Summary of Transport Benefits of the Project



Source: NZ Transport Agency

9.2.2 Social

The Project provides positive social effects at both a regional and localised level. Improved journey efficiency, network resilience and connectivity will have both a positive local and regional effect, whilst the increased mobility choice provided by the SUP and the provision of acoustic attenuation within the Project extent will provide positive localised social effects. Social effects are discussed further in **Section 9.10**.

9.2.3 Natural Environment

The Project includes the implementation of a stormwater management system that will improve both the quality and quantity of stormwater management compared to the existing situation. The Project addresses flow attenuation to improve flooding effects across the greater extent of the Project relative to the current situation. It also implements a wetlands focussed approach which will significantly improve existing water quality. The improvement of water quality discharge will have a positive effect on the receiving surface water environment and the freshwater ecology as a consequence of this.

In addition to the mitigation planting proposed as part of the Project (to soften the impact of the Project from a visual perspective), amenity planting will be undertaken which will contribute positively to the local natural environment.

The treatment or removal of contaminated soil as a consequence of earthworks is a further positive effect on the natural environment.



Effects on the natural environment are discussed further in **Sections 9.13 to 9.20**.

9.3 Transport Effects

A transport assessment has been prepared by Flow Transportation Specialists to assess the potential effects on the transport environment from the construction and operation of the Project and is included as the Assessment of Transport Effects (**Technical Assessment 14**). The assessments and predictions in this section are taken from that Technical Assessment.

The Assessment of Transport Effects assesses the potential effects of the Project on private and commercial vehicles, public transport, pedestrians and cyclists during both construction and operation. Positive and adverse effects have been predicted through use of the following traffic and transport models:

- The Upper Harbour SATURN model to identify the predicted performance of the road network and the road user benefits of the Project;
- The Auckland Regional Transport (ART) model to assess the likely public transport benefits of the Busway Extension and to identify the anticipated changes in traffic flows which have been fed through to the following traffic models; and
- Auckland Cycle Model to predict the cyclist and pedestrian demands on the proposed new SUPs.

9.3.1 Effects

9.3.1.1 Effects during Construction

Potential effects on the transport network resulting from the Project's construction will likely arise from the proposed traffic management measures which include:

- Temporary speed limit reductions along SH1 and SH18 for the majority of the construction period;
- Lane narrowing along SH1 and SH18, with the number of through traffic lanes and the location and extent of bus shoulder lanes along SH1 and bus priorities at the interchanges to be retained, as far as reasonably practicable. These restrictions are likely to be in place for the majority of the construction period;
- Rosedale Road would be kept open for traffic and pedestrians throughout the construction period, however one way traffic and signalised controls may be implemented; and
- Access between SH18 and Paul Matthews Road to be kept open for traffic throughout the construction period, however right turn bans to and from Paul Matthews Road may be implemented to allow the works to progress along SH18.

McClymonts Road is proposed to be kept open for two way traffic throughout the construction period, as far as reasonably practicable, by the construction of an off line bridge. This will allow eastbound buses from Albany Bus Station to reach the southbound bus only on ramp at McClymonts Road and to allow pedestrians from the east to reach the Albany Bus Station.

Overall, the proposed traffic management measures during construction will potentially adversely affect vehicles using motorways and the wider road network, as well as users of public transport, pedestrians and cyclists. This is further discussed below.

Effects along SH1, SH18 and wider Road Network

Speed reductions put in place along SH1 and SH18 are predicted to result in temporary increased travel times along SH1 and SH18 (Table 29 of the Assessment of Transport Effects). Journey times on SH1 and SH18 respectively are predicted to increase by approximately 20 seconds with further increases in journey time congestion in the morning peak southbound on SH1 and then northbound on SH1 and westbound on SH18 in the evening peak.



Construction activity is also predicted to result in an increase of traffic flows on the wider road network (Table 31 of the Assessment of Transport Effects). This is primarily due to the temporary restrictions to be put in place at Rosedale Road and Paul Matthews Road.

Effects on Public Transport

During construction bus services will be impacted by an increase in congestion on the wider road network, the temporary closure of the Rosedale Road bridge and through the elimination of right turns into Paul Matthews Road. Impacts on the Northern Express services and other bus services on the SH1 main line may also occur temporarily.

Effects on Pedestrians and Cyclists

The closure of Rosedale Road at any stage of the works may result in a significant detour for pedestrians and cyclists, depending on their origin and destination. However, surveys of pedestrians and cyclists activity at Rosedale Road show relatively few users, as outlined at Section 8.2.3 of the Assessment of Transport Effects.

Effects on Albany Park and Ride Parking

Construction of the busway link over the Northern Motorway to Albany Bus Station is likely to temporarily affect the capacity of the Park and Ride facility at Albany. Opportunities to provide temporary alternative parking spaces to those impacted have been identified (refer to Section 8.2.4 of the Assessment of Transport Effects) and include utilising the AT owned vacant land at 125 McClymonts Road, adjacent to the Albany Bus Station and through provision of additional parking at Silverdale Station.

9.3.1.2 Effects during Operation

Operational effects associated with the Project have been considered in respect of the following matters:

- Effects for vehicles using SH1 and SH18;
- Area-wide transportation effects of Project;
- Effects on pedestrians and cyclists;
- Effects on public transport;
- Effects on Freight; and
- Safety effects of Project.

Effects along SH1 and SH18

As discussed at section 7.2 of the Assessment of Transport Effects, the Project is expected to increase daily flows on the Northern Motorway (SH1) by up to 28,600 vehicles per day (two way in 2031, between the Greville interchange and the SH18 direct connections (a 21% increase)). Daily flows along the UHH (SH18), east of the Albany Highway interchange are expected to increase by 22,500 vehicles/day (two way, in 2031 (a 49% increase)).

The effects of these increases will be significantly reduced by:

- the provision of additional capacity along SH1, between the SH18 direct connections and Oteha Valley Interchange;
- the provision of the SH18 direct connections between SH18 and SH1 (north); and
- The upgrade of SH18, between the Albany Highway and SH1 direct connections, to motorway standard.

As a result, travel times are predicted to improve, even with these increases in flows, relative to the future scenario without the Project. These improvements in travel times will vary by route, direction



and time of day, but travel times are predicted to include decreases of over 10 minutes during the weekday morning and evening peaks¹⁶.

Area-wide Transportation Effects of Project

While the Project is predicted to result in an increase in flows along both SH1 and SH18, Section 7.2 of the Assessment of Transport Effects identifies that decreases in flows are forecast on a number of parallel routes (based on 2031 traffic forecasts). These routes include:

- Albany Highway (reductions of up to 5,600 vehicles per day predicted, or 22%);
- Rosedale Road (reductions of up to 4,800 vehicles per day predicted, or 19%);
- Bush Road (reductions of approximately 4,500 vehicles per day predicted, or 14%);
- William Pickering Drive (reductions of approximately 4,000 vehicles per day predicted, or 24%);
- Paul Matthews Road (reductions of approximately 3,300 vehicles per day predicted, or 13%);
- Apollo Drive (reductions of approximately 3,000 vehicles per day predicted, or 11%);
- East Coast Road (reductions of up to 2,900 vehicles per day predicted, or 8%); and
- Sunset Road (reductions of approximately 2,900 vehicles per day predicted, or 17%).

Conversely, traffic flows are predicted to increase on several arterial routes, particularly those that feed the Greville and Oteha Valley Interchanges. Most notable among these is Albany Expressway, which is predicted to increase by up to 4,400 vehicles per day west of SH1 (an 11% increase).

In general, the Project is predicted to result in a decrease in forecast traffic flows on local streets and roads, except for those closest to and that connect directly to Greville and Oteha Valley Interchanges. This will have corresponding effects on local property accesses. Access will, for example, be improved on local roads that experience reductions in traffic volumes.

Effects on Pedestrians and Cyclists

The Project's effects on pedestrians and cyclists are assessed in Section 7.4 of Assessment of Transport Effects.

The Project proposes SUPs parallel to SH1 from Oteha Valley Road to Constellation Bus Station and parallel to SH18 from Albany Highway to Constellation Bus Station. In general, the SUPs proposed will provide connections where presently there are none.

Connectivity for pedestrians and cyclists will be significantly improved both north-south along the SH1 corridor and east-west parallel to SH18 through the provision of continuous and safe SUPs along these corridors, bridging a significant gap in the existing walking and cycling network. It is also considered that by reducing traffic on existing arterial routes, this will indirectly benefit both pedestrians and cyclists.

The Project will also contribute to remedying severance caused by the existing motorway corridors through the provision of new pedestrian and cyclist connections across these corridors.

In summary, the Project's effects on pedestrians and cyclists will be positive and the Project will result in significantly improved safety and connectivity outcomes for active modes.

Effects on Public Transport

Section 7.5 of the Assessment of Transport Effects identifies a number of benefits for public transport in terms of providing quicker and more reliable journeys by bus through the extension of the Busway to Albany Bus Station. In particular, northbound buses will no longer need to travel with general traffic at the Upper Harbour Interchange as they leave the Constellation Bus Station. It is predicted in 2031 that the Project will result in a reduction of travel time from Albany Bus Station to Constellation Bus

¹⁶ Between SH1 at Oteha Valley Interchange and SH18 Albany Interchange southbound



Station of over 10 minutes Northbound and 4 minutes Southbound during the evening peak period compared to if the Project was not constructed. This reduction of travel times for buses will provide greater reliability and make bus patronage more attractive.

Reductions in general traffic volumes on several roads in the areas surrounding the Project are expected with the implementation of the Project. These reductions will provide indirect benefits to public transport operators and users by reducing congestion on these routes and improving bus travel times where bus priorities are not already in place. This includes East Coast Road, Bush Road, Rosedale Road, Apollo Drive, Paul Matthews Road, William Pickering Drive and Sunset Road, each of which are expected to experience reduced traffic.

Overall, the Project will provide travel time and reliability benefits for public transport, which should lead to increased patronage.

Effects on Freight

An assessment of the effects of the Project on freight movements is provided at Section 5.6 of the Assessment of Transport Effects. The Project is predicted to provide direct benefits to through freight movements by reducing motorway travel times on both SH1 and SH18. In addition, provision of a ramp signal bypass lane for trucks at the SH18 to SH1 (north) will reduce travel times compared to general traffic.

Benefits will also be gained by freight movements on arterial roads that are predicted to experience reductions in traffic as a result of the Project. This includes Bush Road, Rosedale Road, Apollo Drive and William Pickering Drive.

Safety Effects of the Project

The Project is expected to result in increased traffic on the motorways and local arterials leading to the motorways, with corresponding reductions in traffic elsewhere on the local network. As discussed at Section 7.7 of the Assessment of Transport Effects, if all other factors are equal, the likelihood of a crash would be expected to increase where traffic volumes increase (as a result of increased exposure and speed), and decrease where traffic volumes reduce (as a result of reduced exposure).

However, the rate of crashes occurring on the motorway and its interchanges are expected to reduce, despite increases in traffic volumes and speed, as the Project will deliver a range of safety improvements, including:

- Removing motorway to motorway traffic from the local road network, especially with regards to freight;
- Removing right turn movements from SH18 at Paul Matthews Road and Caribbean Drive;
- Reducing congestion and queuing on SH1, thereby reducing the incidence of rear-end type crashes;
- Improving street lighting throughout the Project extent;
- Providing increased shoulder widths in some locations;
- Improving existing crash barriers;
- Provision of increased shoulder widths which will allow forward visibility to be improved in certain locations; and
- Providing safe, separated pedestrian and cyclist facilities.

Predictions of the crash rates for SH1 and SH18 in 2031 with and without the Project have been developed (refer to Table 25 of the Assessment of Transport Effects). Crash reductions are predicted through sections of motorway, particularly on SH18 east of Albany Highway. Increased crash rates are predicted on sections of motorway where increased traffic is expected but are not being improved by the Project, particularly on SH18 west of Albany Highway. It is acknowledged that an increase in



traffic flows and an increase in the number of lane change manoeuvres introduced by the Project along SH1 may lead to an adverse effect in terms of the number of crashes between the Greville and Upper Harbour Interchanges. In addition, the increase in forecast speeds in this area may lead to increases in the severity of crashes. In total however, a net reduction in annual injury crashes on the motorway network is expected, relative to 2031 predictions without the Project.

Therefore it is assessed that the Project will result in beneficial effects for the safety of traffic, pedestrians and cyclists within the Project area.

9.3.2 Mitigation

From an operations perspective the Project will improve the efficiency and effectiveness of travel along the strategically significant routes of SH1, SH18 and the Busway. These improvements will enhance the capacity and efficiency of movement for people and freight travelling within Auckland, and between Auckland and the north. As such, no mitigation of operational traffic effects is required as there is a net positive effect.

The temporary effects of construction will be mitigated through the implementation of the following (as far as practicable) as part of a Construction Traffic Management Plan (CTMP). These include:

- The retention of the existing number of through traffic lanes along SH1 and SH18;
- The retention of existing bus shoulder lanes along SH1 and bus priorities at interchanges;
- The retention of vehicle and pedestrian connectivity on McClymonts Road, over SH1; and
- The retention of at least one traffic lane on Rosedale Road, beneath SH1.

Construction effects could also be further mitigated through management of works to occur during periods of least traffic disruption such as outside of peak periods and providing information to travellers for their consideration of alternative transport arrangements.

9.3.3 Summary

The Project has been assessed to provide an overall net benefit by improving the efficiency and effectiveness of travel along the strategically significant routes of SH1, SH18 and the Busway. These improvements will enhance the capacity and efficiency of movement for people and freight travelling within Auckland, and between Auckland and the north. The Project will also provide improved connectivity and safety to pedestrians and cyclists.

Temporary adverse effects may arise to transportation modes during the construction programme. These effects are able to be appropriately mitigated through the implementation of a CTMP.

9.4 Construction Noise Effects

Marshall Day Acoustics has undertaken a risk assessment of the noise effects that may be generated during the construction phase of the Project and this assessment is contained in the Assessment of Construction Noise and Vibration Effects (**Technical Assessment 3**). The proximity of dwellings and businesses to the proposed works and the absence of existing attenuation means there is the potential for the adopted day-time and night-time noise criteria to be exceeded.

As discussed at Section 2 of the Assessment of Construction Noise and Vibration Effects, the appropriate standard for the construction noise assessment is NZS6803:1999 (Acoustics – Construction Noise). The Standard does not anticipate that full compliance with the applicable construction noise criteria will be achieved at all times and at all receivers, rather it focuses on the implementation of the BPO for construction noise management and mitigation.



The following activities have the potential to result in exceedances of the Project construction noise criteria:

- Piling, construction and demolition of bridges;
- The construction of retaining walls and noise barriers;
- Bulk earthworks; and,
- Construction of structures and pavements.

9.4.1 Effects

A detailed assessment of the Project's construction noise levels and effects is provided at Section 6 of the Assessment of Construction Noise and Vibration Effects. Two residential areas in close proximity to the proposed works, at Pinehill to the east of SH1 and Unsworth Heights to the south of SH18, are predicted to be adversely affected by the noise generated during construction. Some of the properties in these residential areas currently receive acoustic screening from cutting escarpments or noise barriers, however, there are some properties that will have a direct line of sight towards the proposed construction areas.

Areas with limited or no sensitivity are considered to be unaffected by noise levels above 75 dB L_{Aeq} regardless of the time. Other commercial or community activities such as the District Court, which is located off Don McKinnon Drive, may be affected to a greater extent when the noise levels exceed 70 dB L_{Aeq} due to the need for clear communication within these spaces during day-time hours. The primary effect at this location is likely to be the interference of communication as well as general annoyance when concentration is interrupted.

Specific commercial and residential properties likely to receive noise levels in excess of the Project noise criteria are detailed in Section 6.1 of the Assessment of Construction Noise and Vibration Effects and include the following locations:

- The townhouses to the west of McClymonts Road and Masons Road, where future dwellings are currently being constructed which are likely to be temporarily exposed to levels greater than 70 dB L_{Aeq} ;
- A significant number of dwellings around the McClymonts Road Bridge and Albany busway area / Oteha Valley Road bridge works may be temporarily exposed to night-time noise levels in excess of 45 dB L_{Aeq} ;
- Several of the commercial activities adjacent to the motorway are likely to be exposed to temporary noise levels in excess of 70 dB L_{Aeq} during the day-time;
- A residential area between Constellation Drive and Sunset Road where the works required will be modest in scale and the proposed noise standards will only be exceeded for the first row of dwellings facing the motorway. During night-works, the Project noise criteria may be exceeded at a number of dwellings in this area; and
- It is anticipated that many properties within Unsworth Heights, due to their proximity to the southern boundary of the Project area, are likely to be temporarily exposed to noise levels in excess of 70 dB L_{Aeq} during the day-time. There are no proposed night works for this area, however in the event these are required, a significant number of dwellings will be exposed to levels greater than 45 dB L_{Aeq} .

9.4.2 Mitigation

As stated at Section 8.1 of the Assessment of Construction Noise and Vibration Effects, the most appropriate and effective method of managing construction noise is through on-site management and communication between staff and managers. It is proposed that a Construction Noise and Vibration Management Plan (CNVMP) is prepared for each sector by the contractor in accordance with the guidelines produced by the NZ Transport Agency and recommendations within Section 8.2 of the Assessment of Construction Noise and Vibration Effects.



The CNVMP will require the following noise mitigation measures to be implemented throughout the duration of construction. General noise mitigation measures include:

- Training of personnel with regard to quiet operating procedures;
- Maintenance of equipment to ensure noise levels remain as low as possible;
- Noise barriers are to be erected where necessary. Where operational noise barriers are proposed, these are to be installed at the beginning of construction to reduce construction noise effects;
- Noisy stationary equipment should be enclosed if necessary and where practicable;
- Low noise plants should be selected wherever practical, and where not practical, noisy plants should have mitigation measures fitted (e.g. silencers or enclosures);
- Night-time construction works should only occur when Project criteria can be met or where alternative measures are implemented to reduce noise emissions such as limiting works prior to midnight or operating on non-consecutive days;
- Tonal reversing alarms should be deactivated or replaced with a suitable alternative for night-time works;
- Public liaison and communication to ensure potentially affected properties are reasonably informed; and
- Noise barrier screening and appropriate management of temporary construction yard compounds.

Where an exceedance of the Project construction noise criteria is identified to be likely due to a specific activity in a specific area and the general mitigation measures as discussed below are not sufficient to achieve full compliance with the Project criteria, further mitigation should be investigated and implemented where practicable, such as temporary resident relocation.

9.4.3 Summary

Actual and potential adverse effects from construction noise will be temporary and will be appropriately managed with noise mitigation measures implemented through the CNVMP. Noise associated with piling activities, while temporary, has the potential to be significant. Effective communication with stakeholders is critical in terms of this particular activity, along with the implementation of identified mitigation measures.

Overall, the noise assessment concludes the Project can be constructed in such a way that any adverse construction noise effects are either mitigated or specifically managed to reduce effects as far as practicable.

9.5 Operational Noise Effects

An operational noise assessment has been prepared by Marshall Day Acoustics to assess potential effects on noise from the operation of the Project (refer to the Assessment of Operational Noise and Vibration in **Technical Assessment 9**).

The operational noise assessment methodology is detailed at Section 3 of the Assessment of Operational Noise and Vibration. Ambient noise levels have been determined by undertaking both long and short distance noise surveys within the vicinity of the Project. Computer noise modelling of the measured data has enabled the prediction of operational noise effects across the assessment area being defined as 100m from the edges of the carriageway.

The assessment is based on NZS 6806:2010 (Acoustics – Road traffic noise – New and altered roads). The application of the BPO requires Category A criteria to be met (or bettered). If this is not achievable, Category B criteria are to be met. If Category B criteria are unable to be met with the BPO, then Category C criteria must be achieved. The standard also considers the potential subjective response of people to changes in noise level and the number of people likely to be highly annoyed by the traffic noise levels.



9.5.1 Effects

The Project area has been divided into eight assessment areas (refer to Section 5 and Appendix B of the Assessment of Operational Noise and Vibration) that have been defined by identifying protected premises and facilities in accordance (PPFs) with NZS 6806:2010 that are:

- Located on the same side of SH1 or UHH (i.e. either adjacent to northbound or southbound lanes only);
- In neighbourhood clusters; or
- Adjacent to a section of SH1 or SH18 with the same traffic volume (i.e. located between ramps and not crossing over ramps).

A detailed assessment of the noise effects from the Project to each of the described assessment areas is provided at Section 5 of Assessment of Operation Noise and Vibration, with a summary as follows:

9.5.1.1 Assessment Area 1 – SH1 north of McClymonts Road

Two dwellings along Masons Road are predicted to currently receive noise levels within Category C criteria. These dwellings are multi storey units and it is the upper floors that are mostly affected by traffic noise. With the Project in place, the number of PPFs in Category C may increase to 11.

The assessment indicates an increase of up to 4 decibels at some PPFs following the implementation of the Project due to the proximity of the Busway. Although the new Busway will take traffic closer to dwellings in this area, the assessment concludes that the number of people likely to be highly annoyed by traffic noise would increase slightly over time. The assessment states that the noise environment in this Assessment Area would be similar to that experienced without the Project with the noise character remaining unchanged.

Two noise barrier options were tested, however the proposed location of the Busway and stormwater management devices result in insufficient space to construct a barrier high enough to effectively mitigate noise levels. Consequently, building modification was selected as the preferred mitigation option for these Category C dwellings.

9.5.1.2 Assessment Area 2 - SH1 South of McClymonts Road

There are 24 PPFs located between the southbound lanes of SH1 and Spencer Road, which are generally three storey townhouses. These are all classified as Category A PPFs. The dwellings are reasonably new and would have been constructed under the requirements of the former ACDP:NS, which required residences near State highways to have high levels of noise insulation. Bunding and fencing are already installed and while these will be acoustically effective for lower floors, they would not provide shielding for upper floors.

As a result of the Project, four PPFs are predicted to receive noise levels within Category C and a further five PPFs receiving noise levels within Category B. Noise levels in this area are predicted to increase generally by 3 to 4 decibels due to the widening of SH1 and the introduction of the Busway. This change in noise level would be just noticeable, but given the character of the noise remains unchanged, it is unlikely that effects will be any more than slight.

Consideration of a 5 m high barrier was undertaken, however, structural mitigation is not considered to be the BPO solution for this area with only marginal noise attenuation benefits for dwellings achieved. Consequently, building modification was selected as the most practical mitigation option.

The number of people highly annoyed would increase slightly over time. The reason is that the busway and motorway widening will bring traffic closer to the PPFs. Even with the modelled 5m high barrier option, only a marginal reduction in the number of people highly annoyed is predicted.



9.5.1.3 Assessment Area 2A –SH1 Colliston Rise

There are currently no buildings in this assessment area, however applications for building consent have been lodged for some of the sites within the approved subdivision. Building consent documentation shows those dwellings are to be built in accordance with the High Noise Route provisions of the former ACDP:NS and will include mechanical ventilation for habitable rooms facing the State highway. It is anticipated that future dwellings can also be designed to mitigate the effects of the State highway noise.

9.5.1.4 Assessment Area 3 – SH1 south of SH18

There are 28 PPFs in this area, generally single and double storey dwellings, all but two of which are predicted to receive existing ambient noise levels within Category A, due to shielding provided by the surrounding terrain. The remaining two dwellings receive existing noise levels within Category B (59B and 63 Santiago Crescent) and are two storeys dwellings overlooking the partial bund shielding them from the State highway.

With the Project in place, those two Category B PPFs are predicted to change to noise levels within Category C, with the effects relating to the unshielded upper storeys. No other dwellings will experience a Category C noise level change. There are no changes to the State highway in the vicinity of these PPFs, however as they are within 100m of the Project assessment is required under NZS 6806. Noise levels, as a result of the Project, are expected to marginally change with a predicted increase of up to 2 decibels which is an unnoticeable audible change for most people.

Irrespective of this, a 3m barrier option was assessed but structural mitigation is not considered to be the BPO solution for this area with only marginal noise attenuation benefits for the predicted Category C dwellings achieved. Consequently, building modification was selected as the most practical mitigation option.

9.5.1.5 Assessment Area 4 – SH18 Cabello Place

There are 30 PPFs within this area which are generally single and double storey dwellings. All these dwellings, with the exception of 21 Cabello Place, are predicted to receive existing ambient noise levels within Category A. Existing noise levels for most dwellings are below 60 dB $L_{Aeq(24h)}$. This is likely to be partially attributed to the existing earth bund and residential fencing in place between SH18 and the PPFs. The dwelling at 21 Cabello Place is predicted to receive an existing ambient noise level within Category B.

Once the Project is implemented, noise levels are predicted to remain relatively unchanged, with the majority of PPFs predicted to experience noise level changes of no more than two decibels. It is noted that two properties may receive noise level increases of 3 decibels (12 Cabello Place and 53 Meadowood Drive). However, noise levels would not exceed the mid-50 decibel level, and the effect for most would be negligible and slight for the three sensitive properties. As a result of this assessment outcome, no attenuation is necessary.

9.5.1.6 Assessment Area 5 – SH18 Barbados Drive

With a total of 86 PPFs, this is the largest assessment area and is generally characterised by established single and double storey dwellings located between SH18/UHH and Barbados Drive.

With the exception of three dwellings, all are predicted to receive existing ambient noise levels within Category A. This is as a result of an existing earth bund located between UHH and Barbados Drive which provides shielding. For 1A Caribbean Drive, 9 and 11 Wren Place, ambient noise levels are just within Category B, at 65 dB $L_{Aeq(24h)}$.

Once the Project is implemented, four properties (9, 11, 13 and 14 Wren Place) are likely to receive noise levels within Category C due to their proximity to the new ramps and UHH connection.



The introduction of a 3m barrier was assessed which resulted in three of the four receiving noise levels within Category A and 14 Wren Place receiving Category B noise levels. Further barrier attenuation to 14 Wren Place was not deemed practicable.

The Project (with mitigation) is predicted to result in noise level changes of +/-5 decibels. However, the PPF with the highest noise level (14 Wren Place, at 65 dB $L_{Aeq(24h)}$) is predicted to receive a 1 decibel noise level increase, which is unnoticeable. Overall, for the majority of PPFs, the effects from the change in noise level are predicted to be slight.

9.5.1.7 Assessment Area 6 – SH18 Metlifecare

This Assessment Area relates to the new Metlifecare aged care facility and all dwellings are predicted to receive existing ambient noise levels within Category A. An existing acoustic barrier to the SH18 frontage provides noise attenuation to the adjacent villas. A change to noise levels within Category B is likely as a result of the Project due to the proximity of traffic lanes and associated volumes.

Two barrier options have been assessed and a provision of a 2m barrier on the frontage to the east of the site would achieve noise levels within Category A at all PPFs.

Noise level increases of up to 5 decibels for the majority of PPFs are likely with mitigation in place, which will be a noticeable change. The resultant noise levels will be up to 62 dB $L_{Aeq(24h)}$. The assessment states at section 5.7.2 that with the windows closed, this would equate to no more than 40 dB $L_{Aeq(24h)}$ inside the dwellings during daytime, and significantly less during night time. The assessment concludes that these noise levels are considered appropriate for residential use and provide good amenity.

9.5.1.8 Assessment Area 7 – SH18 Bluebird Crescent

Of the 13 PPFs in this assessment area which are generally one storey, eleven currently experience Category A noise levels while Category B noise levels are experienced by the two remaining dwellings. Most PPFs receive noise levels below 60 dB $L_{Aeq(24h)}$.

Traffic speed and volume, once the Project is implemented, are likely to result in two PPFs receiving noise levels within Category C, and one within Category B. A 2.4m high barrier was selected as the BPO for this location and eliminates Category C noise levels occurring.

The introduction of the Project, even with the above barrier in place, is predicted to result in an increase of up to 5 decibels for the majority of PPFs which is noticeable, however, the noise levels are predicted to remain below 65 dB $L_{Aeq(24h)}$ for all but two PPFs (94 and 102 Bluebird Crescent). The assessment confirms at section 5.8.2 that these two PPFs would receive less or the same noise level even without Project (do nothing scenario), and concludes that there will be no adverse noise effects at these properties.

9.5.1.9 Assessment Area 8 – SH18 Childcare Centres

Assessment Area 8 contains only two PPFs, being two storey childcare centres with play areas facing SH18 located at Saturn Place and Omega Street. Existing noise levels are predicted to be up to 60 dB $L_{Aeq(24h)}$ Category A noise level for the Saturn Place facility and 66 dB $L_{Aeq(24h)}$ Category B at the Omega Street centre.

Following implementation of the Project, noise levels up to 66 dB $L_{Aeq(24h)}$ are likely for the Saturn Place centre while at the Omega Street facility, a noise level within Category C (71 dB $L_{Aeq(24h)}$) is predicted.

A 2.4m barrier has been assessed which results in a noise level of 64 dB $L_{Aeq(24h)}$ Category A for the Saturn Place centre and 66 dB $L_{Aeq(24h)}$ Category B as likely for the Omega Street centre. The change in noise level at the Saturn Place centre is a slight change that may just be noticeable. However, the character of the noise will not change. At the Omega Street centre, a noise level reduction of 1



decibel is predicted with the preferred mitigation option in place compared to the do nothing scenario. This would be an unnoticeable noise level reduction and would maintain the current level of noise.

9.5.2 Mitigation

To mitigate noise effects, OGPA, a low noise generating road surface, will be used on the main alignment and a dense asphalt surface will be used on the ramps. In addition, where practicable, noise barriers of varying heights will be installed.

With mitigation in place as described in **Section 9.5.1** above, the noise level change due to the Project for dwellings will generally be small (less than 4 decibels). This resultant change is either unnoticeable or just perceptible. For most areas, noise levels would change by no more than 2 decibels. This change would be imperceptible, particularly as the noise source (i.e. traffic) does not change.

For some dwellings, noise levels are predicted to increase by more than 4 decibels. Generally, those dwellings will still receive noise levels within the most stringent noise criteria Category A, so resultant noise levels are considered to be appropriate for residential use. New dwellings, particularly those adjacent to SH1 and the new Metlifecare retirement village adjacent SH18, have been designed and constructed to take account of the existing high noise levels from the existing roads, and no further improvement will be required. Any houses where noise levels are predicted to remain within Category C will be assessed on a case by case basis to determine if building modification mitigation would be required to achieve internal noise levels of 40 dB $L_{Aeq(24h)}$.

9.5.3 Summary

With the implementation of the identified mitigation measures, noise levels are predicted to be generally within the same noise Category as would be the case without the Project (do-nothing scenario). For most areas, noise levels would change by no more than 2 decibels. This change would be imperceptible, particularly as the noise source (i.e. traffic) does not change. While noise level increases cannot be mitigated at all dwellings, the proposed mitigation will generally maintain noise levels within the same noise Category despite the increase in traffic volume and speed over time.

9.6 Construction Vibration Effects

A construction vibration assessment has been prepared by Marshall Day Acoustics to assess potential vibration effects during construction of the Project and this is included in the Assessment of Construction Noise and Vibration Effects (**Technical Assessment 3**).

Vibration generating construction activities along the Project alignment are likely to include vibrating roller compactors and vibropiling or impact piling rigs. Accordingly, the assessment of effects has focussed on these activities.

9.6.1 Effects

Section 7.3 of the Assessment of Construction Noise and Vibration Effects identifies that there is a medium to high level of risk that vibration guidelines will be exceeded for some residential and commercial buildings adjacent to the Project. This is due to buildings being located within 20m of the site works in some instances. Within such distances, vibration management will be required.

The main areas where dwellings are located adjacent to areas of works includes the northern end of the Project near McClymonts Road and along the length of SH18. At these locations, significant numbers of dwellings will be located within the high and medium risk zones as defined at Section 7.3 and at Appendix F of Assessment of Construction Noise and Vibration Effects.



Commercial buildings vary in their proximity to construction works, however, many are located close to retaining wall construction areas or near large cuts/fills. Several commercial buildings are located within the high risk zone.

9.6.2 Mitigation

As outlined at Section 8.3 of Assessment of Construction Noise and Vibration Effects, in order to manage and mitigate adverse effects of vibration on affected properties, detailed management and mitigation options for construction vibration will be contained in a CNVMP. Management will include:

- Liaison with affected parties;
- Monitoring of building condition prior to construction and in response to complaints;
- Monitoring of vibration levels received by buildings during the first use of high-vibration activities in their vicinity and in response to complaints;
- Using low-vibration techniques and managing the timing of activities where practicable to avoid disturbance; and
- Remedying any vibration-induced damage.

9.6.3 Summary

Overall, the construction vibration assessment concludes that the Project can be constructed in such a way that any potential adverse construction vibration effects are either mitigated or remedied (see Proposed Condition CNV 8).

9.7 Operational Vibration Effects

An operational vibration assessment has been prepared by Marshall Day Acoustics to assess the potential effects of vibration during the operation of the Project and this is included as the Assessment of Operational Noise and Vibration Effects (**Technical Assessment 9**).

The Project vibration risk has been assessed by reviewing data of heavy commercial vehicles travelling on existing roads and by applying a range of surfaces (scenarios). This data has been compared against suitable traffic vibration criteria (Class C of the Norwegian Standard NS 8176.E:2005) which indicates that compliance with the criteria can be achieved at 25 metres from the road edge (even for roads in a degraded state). For newly sealed OGPA, the risk contour may be as small as 2m from the road edge.

Complaints data for the Project area has also been requested from the AMA which is responsible for the maintenance of the Auckland State highway network. In response, it is understood that no complaints have been received in regards to traffic vibration, which indicates that the current level of traffic vibration is likely acceptable and is expected.

9.7.1 Effects

As no receivers are identified to be within 2m from the traffic lane edge, it is assessed that the operational vibration effects will be negligible.

9.7.2 Mitigation

No mitigation is proposed as it is not warranted.

9.7.3 Summary

As referred to above, it is assessed that the operation vibration effects will be negligible.



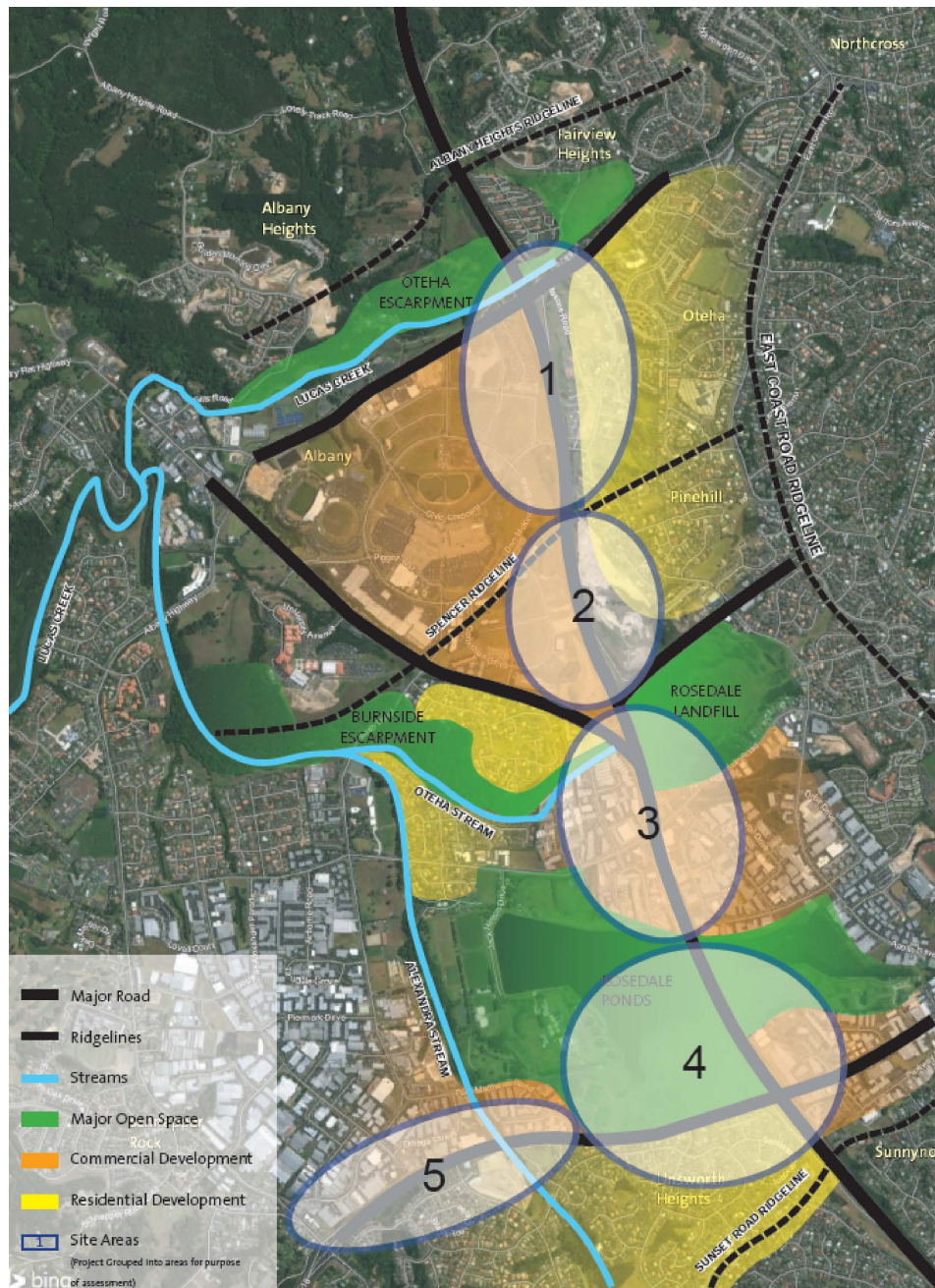
9.8 Landscape and Visual Effects

A landscape and visual assessment has been prepared by Boffa Miskell to assess the effects from the construction and operation of the Project and is included as the Assessment of Landscape and Visual Effects (**Technical Assessment 8**).

The assessment has been undertaken with regard to the New Zealand Institute of Landscape Architect's Assessment Guidelines and the UK guidelines for landscape and visual impact assessment.

The Project area has been divided into five areas for landscape and visual analysis as depicted in **Figure 48**.

Figure 48 Site areas for Landscape Analysis



Source: Boffa Miskell



9.8.1 Effects

9.8.1.1 Temporary effects during construction

The predominant visual effects during construction will be experienced by the residential viewing audiences to the east of SH1, namely Fairview Heights and Oteha, and Unsworth Heights to the south of SH18. The temporary landscape and landscape character effects would primarily be a result of bulk earthworks and the removal of vegetation within stream embankments and associated with the construction of the carriageway, Busway and SUP, in addition to the cut and fill of modified slopes along SH1 and SH18.

Site Area 1

The residential areas of Fairview Heights and Oteha are the viewing audiences most likely to experience visual effects during the construction phase within Site Area 1. While hoarding is proposed, existing views will be interrupted by the Project and due to the proximity of the works to residential properties, overall moderate – low adverse visual effects during construction are anticipated. The landscape effects will be low during construction in this area since the removal of vegetation and earthworks are primarily alongside the existing road corridor which is highly modified.

Site Area 2

Within Site Area 2, grass occupying the State highway verges would be removed, as would some isolated trees within the proposed Greville Road construction yard. These effects will be most apparent to residential audiences to the east of SH1. Adverse visual effects from the west are anticipated to be limited due to the audience's transient nature. Overall, both the landscape and visual effects within Site Area 2 during construction of the Project are considered to be low.

Site Area 3

The general landscape of Site Area 3 is already highly modified and therefore the landscape and character effects during construction are considered to be low for most viewing audiences in this area. For those within close proximity to the proposed Busway and SUP across Rosedale Road, there will be a higher magnitude of visual change, but overall, adverse visual effects will be low.

The Rosedale Closed Landfill will be impacted due to the location of the SUP and Busway proposed along the eastern edge of SH1. While the works require the removal of part of the western face of the Rosedale Closed Landfill, requiring earthworks and removal of some vegetation, the works represent the option with the least physical landscape effects and associated visual impacts on the surrounding viewing audiences. The landscape effects upon the site area are determined to be low in significance. The adverse visual effects during construction would range from very low to low for the majority of viewing audiences. However, moderate-low adverse visual effects are anticipated for viewing audiences located at 9 Arrenway Drive and 121 Rosedale Road, who are in close proximity to the proposed Rosedale Road Busway and SUP bridge.

Site Area 4

Temporary landscape effects will be moderate as a consequence of the loss of grassed open space in Constellation Reserve.

It is considered that the temporary adverse visual effects resulting from the reduction in open space for viewing surrounding Constellation Reserve would be high. The elevated landform of Unsworth Heights will allow residents to view a wide area of construction. Therefore, it is considered that the adverse visual effects for residential viewing audiences facing north, during construction would be moderate (depending on their position relative to the works). Unsworth Heights residents who have views of the works along SH1 and at the existing Northern Busway are expected to experience low adverse effects during construction. It is considered that viewing audiences from these relatively close proximity locations are to some degree, desensitised to the proposed infrastructure works given the presence of the existing transport corridor of SH1, and views towards Constellation Bus Station.



Therefore, overall the adverse visual amenity effects during construction upon viewing audiences within this site area are considered to be moderate.

Site Area 5

Temporary adverse effects within Site Area 5 will primarily be generated by earthworks in relation to the construction of the SUP, the cut and fill of modified slopes along SH18 and the formation of a wetland. Vegetation removal will be required which will consist of grass in highway verges and some isolated trees. Some tree removal will be required within the vicinity of the Alexandra Stream embankment. These areas are mainly alongside the existing road corridor in a highly modified environment. The overall landscape and landscape character effects during construction are considered to be moderate to low.

While residential audiences will be affected during the construction phase, the works will be viewed in the context of a commercial environment. Transient visual audiences (road users and pedestrians) would experience a moderate level of visual change when viewing the Project from within the existing road environment. This change will result in some adverse visual effects albeit for only a short duration within the road corridor. Therefore, the resultant overall adverse visual effects during construction will be low.

9.8.1.2 Effects during operation

The principal elements of the Project that will give rise to permanent landscape and visual effects include:

- The extent of the proposed road widening, new ramps between SH18 to SH1, SUP and Busway;
- Ancillary structures, including signage, bridges and lighting;
- Existing vegetation (to be retained and removed) and proposed new vegetation; and
- Physical changes to watercourses and stormwater ponds and other landscape features.

Site Area 1

The existing modified environment at Site Area 1 is not considered to be particularly sensitive or of high value. The permanent visual effects would be the highest for some residents immediately to the east of SH1 and the Project area. In some cases, the visibility of SH1 would be increased and would be in closer proximity to the eastern viewing audiences. The addition of the SUP would bring in some beneficial visual amenity effects and improve the amenity value of the view for some close proximity viewing audiences, particularly along Masons Road. The assessment considers that road users and residents would experience low adverse effects with the inclusion of the new Busway bridge to the Albany Bus Station, as bridge structures within road corridors are a common built feature in transport oriented environments. Overall, the permanent adverse visual effects will be low and landscape effects very low.

Site Area 2 and 3

There may be some permanent adverse effects at Site Area 2 and Site Area 3 through the inclusion of the Busway and SUP, particularly given the volume of earthworks and the loss of some areas of isolated grass and vegetation. However, the landscape and visual effects of the loss of small areas of vegetation will be low to very low.

Site Area 4

The permanent landscape effects at Site Area 4 will include the loss of open space at Rosedale South Park and NHHS, and vegetated areas within close proximity to the Project. The inclusion of the Busway, a larger Constellation Bus Station and the SUP will have some permanent landscape impacts as a result of the earthworks and loss of isolated areas of grass and vegetation. The permanent landscape, and landscape character effects are considered to be moderate to low. Consequently, the



level of adverse visual amenity effects will be moderate at the completion of the Project, with some beneficial visual effects resulting from mitigation planting.

Site Area 5

The permanent adverse effects at Site Area 5 are likely to include a slight reduction of vegetation along the northern edge of SH18 and some impacts from earthworks and a loss of isolated areas of grass and vegetation, with the most sensitive viewing audience being the Unsworth Heights residential area. The permanent landscape, landscape character and natural character effects are considered to be very low in this area. The permanent visual amenity effects will be low after mitigation measures have been implemented.

9.8.2 Mitigation

Section 5.1 of the Assessment of Landscape and Visual Effects sets out a number of mitigation measures to address temporary effects during construction and permanent effects during operation. A Landscape Management Plan will be required under the conditions of the NoRs. The landscape plan will be developed using the guiding principles in the draft UDLF. The draft UDLF has been developed to guide the detailed design and, in part to mitigate the permanent visual effects of the Project where these are considered to be necessary.

Mitigation planting and additional planting (including street trees) will be included as permanent features of the Project. The mitigation planting shown in the proposed planting plans is proposed to be over 30ha. An additional 5.9ha of planting and street trees is also shown in the proposed planting plans.

The mitigation outlined at **Table 36** identifies those elements proposed in relation to built elements of the Project:

Table 36 Proposed Mitigation of Visual Effects

Item	Description
Elevated ramps, bridges and other structures	Use visually recessive colours and materials Ensure height of structures is as low as practicable Consider earth mounding with vegetation to provide visual relief of elevated structures Vegetate with tall species where public are in close proximity to the back of buildings to avoid vandalism to properties
MSE Block Wall, L-Shape Gravity Wall, Board Pile Wall	Use visually recessive colours and materials Ensure overall height of structures is as low as practicable Consider mounding or vegetating in front of walls particularly where the wall meets adjacent properties to screen structures
Wetland / stormwater ponds / dry basins and swales	Provide native vegetation around wetland and pond surroundings Consider vegetating swale with plant species suitable for roadside swale planting
Steel UC Wall with concrete panels	Use visually recessive colours and materials Ensure overall height of structures is as low as practicable Consider visually aesthetic designs or graphics to make walls less visually intrusive
Stormwater drainage outflow	Recontour embankments to provide an environment for planting Vegetate disturbed areas with appropriate plant species



Item	Description
1V:3H Earthworks slope with rip rap armour	Rising slope of armour should be as steep as practicable to avoid greater visibility of structure extending into pond environment
Noise walls	Refer to the NZ Transport Agency State Highway Noise Barrier Design Guide Version 1 2010 Consider visually aesthetic designs or graphics to make walls less visually intrusive

9.8.3 Summary

The construction of the Project is anticipated to be staged over a period of time and therefore visual effects will occur progressively. The resulting corridor will result in some low adverse visual effects from an increased prominence of structures within the road corridor associated with the Project. Contextually appropriate noise walls, extensive mitigation planting, and views towards new pedestrianised features will provide an acceptable level of visual change. In addition, the introduction of over 35ha of additional vegetation coupled with improved connectivity for road users, and provision of new walking and cycling facilities, will provide an improved journey experience for these users.

It is therefore considered that potential permanent adverse landscape and visual effects can be managed and mitigated to the extent that they will be no more than minor.

9.9 Effects on Public Reserves

As set out in **Sections 3 and 5** above, the Project will require land from public reserves, both temporarily for construction purposes and in some instances permanently, for structures associated with the Project. The reserves in question range from recreation reserves with no public access to the NHHS sporting complex. On-going consultation with AC Parks is continuing as described in **Section 8**.

9.9.1 Effects

It is acknowledged that the Project will affect a number of reserves which provide for both passive and active sports recreation activities for the local and wider community. The Project will impact on the following public reserves:

- Tawa Reserve;
- Arrenway Reserve;
- Centorian Reserve;
- Rosedale Park South;
- Constellation Park;
- Meadowood Reserve;
- Omega Reserve;
- Alexandra Stream Reserve;
- Rook Reserve; and
- Bluebird Reserve.

Tawa Reserve has no public access but provides a grassed buffer between SH1 and the adjacent industrial uses. The Project requires encroachment into the reserve for the purposes of construction and the provision of a permanent stormwater wetland and retaining walls. As indicated in the Assessment of Landscape and Visual Effects (**Technical Assessment 8**), additional planting is



proposed in this area. The direct effect of the Project is the loss of this area as public reserve as part of AC Parks' overall land asset. As no loss of public active space will result and the buffer function of the reserve will be maintained through the Project, the overall effect is considered to be negligible.

The proposed route of the SUP encroaches on Arrenway Reserve and it is also proposed to provide a link from the SUP to the local network on Arrenway Drive. While the whole of the reserve is indicated as being required within the NoR, this is for construction purposes only. The Project will result in a reduction of grassed open space which acts as a buffer between SH1, the adjacent industrial uses and the RWWTP. This area is not currently used by the public but as a consequence of the Project it will be activated by means of the SUP link. This is considered to be a positive local effect. Post construction, the designation will be drawn back to an agreed position.

Centorian Reserve currently has no passive or recreation function and is another reserve providing a buffer area between SH1, the warehousing on Holder Place and the RWWTP. With the development of the SUP, the Busway extension and associated retaining wall, the area of the reserve will be reduced. However, with the proposed planting of the batter slope and the westerly location of the proposed structures, the reserve will continue to provide its current function and therefore, the effect on this reserve is considered to be no more than minor.

Rosedale Park South will be required in full in order to provide the SH18/1 interchange. This area of open space is currently used for grazing and is not formally accessible to the public. AC Parks has indicated that the proposed long term use for this site is sports playing fields. As a result of the Project, this land-banked area for future active recreation use will be lost.

While a number of options for the SH18/SH1 interchange and Paul Matthews Interchange have been considered (see **Section 7**), land is required at Constellation Park to facilitate the Project. The land requirement at this reserve is limited to the southern portion. The area includes a marginal strip located between SH1 and the RWWTP that has no public access, however, it also includes Turf 3 and the adjacent grassed sports field which form part of the NHHS complex. Hockey and its tenant North Harbour Hockey have indicated that this land requirement will compromise its existing operations NHHS that occupies this reserve as well as its intended upgrade plans previously noted in **Section 8**. Therefore, without mitigation, the Project generates a potential significant adverse effect without mitigation for the operator and all users of the facility. Consideration of the Project effects with respect to the wider community use of the NHHS is provided in **Section 9.10** (Social Effects).

Upgrades to Caribbean Drive are required as part of the Project and result in the need for a minor encroachment of up to 3m along the western boundary of Meadowood Reserve for construction access, vegetation clearance and footpath realignment. The area of reserve subject to the proposed works is boundary planting and boundary fencing. The Project will result in a very minor reduction in public reserve land which will be less than minor. Consideration of the Project effects with respect to the occupiers and users of this reserve is provided in **Section 9.10** (Social Effects).

Omega Reserve and Alexandra Stream Reserve provide a riparian reserve to the Alexandra Stream to either side of SH18. Both contain a pedestrian/cycle way as well as riparian planting. The Project land requirement relates to the provision of a retaining wall associated with the SH18 widening at Alexandra Stream Reserve with an extension to the existing embankment and to the roof of the existing underpass. It is proposed to provide a link from the SUP to the existing SUP located within Omega Reserve. New rip rap aprons to the existing culverts in both Reserves are proposed which will require construction access and vegetation removal. While construction work will have an adverse impact on the immediate works areas this will be short term and very localised. Any permanent land requirement will be minimal. As such the effects on these public reserves are considered to be minor localised effects only. The SUP link is considered to provide a net-benefit with further activation of the reserve through increased accessibility.



A permanent stormwater management device is necessary along the SH18 section of the Project and a wetland device is the best practicable option with the preferred location at Rook Reserve and an alternative area identified within Bluebird Reserve for the reasons explained at **Section 7**. The size of treatment necessitates a large wetland area at either location which will reduce the grassed area of reserve currently available for use by the surrounding residential properties for passive recreation purposes (dog walking, children's play). This may result in the increased use of adjacent parks within the neighbourhood (e.g. Barbados Reserve). While the Project will reduce the overall availability of passive recreation space along this section of the Project area, this will be a localised adverse effect requiring mitigation with respect to the final design of the stormwater wetland. A proprietary device will also be installed on what is currently the berm located between the off-ramp to the Z Energy service station and the UHH.

The Project also necessitates a requirement for land at Bluebird Reserve for the purposes of improved sight lines which will result in the removal of vegetation and the provision of a retaining wall. This area of Bluebird Reserve is bush covered with no formal access. Planting of a suitable species mix is proposed in this area to replace the removed bush vegetation while maintaining the required line of sight for the motorway. The Project will result in a localised minor reduction in public reserve land.

9.9.2 Mitigation

With respect to reserves land affected by the Project in public use, measures to mitigate construction impacts will be agreed as part of a reserve reinstatement package with AC Parks to ensure remediation and return to public use in an effective and efficient manner. These discussions are progressing with AC Parks.

The design of the stormwater management wetland at Rook Reserve (currently preferred) will be progressed in agreement with AC Parks so that the Project provides an additional amenity area within the reserve, subject to meeting public safety requirements.

The NZ Transport Agency is progressing a mitigation package with AC Parks addressing the Project's effect on Rosedale Park South. A joint working group has been convened to consider a number of options for compensatory land for future sports playing fields, the outcome of which is awaited. Options being explored include the provision of an alternative site for the proposed sports fields.

A specific mitigation package with AC and Hockey that addresses the Project's effect on the NHHS is being progressed by the NZ Transport Agency. AC, Hockey and the NZ Transport Agency have agreed to temporary upgrades of the existing NHHS, to ensure training and international events can still occur during construction. The construction timetable also allows Hockey to remain on the existing NHHS until after the events scheduled for November 2017 have concluded. With respect to a permanent mitigation solution, a site in the western corner of Rosedale Park West has been identified as the preferred option for the full relocation of hockey facilities. This option has the support of the joint working group including Hockey, AC and Watercare. It has also received support from the Upper Harbour Local Board, subject to details being worked through with the incumbent tenants located on the site that is the preferred option (Rosedale Pony Club and North Harbour BMX). Any resource consents required for the permanent reconfiguration or relocation of the facility will be sought separately from those required for the Project. At the time of writing, the resource consent application for the relocation of the hockey facility to Rosedale Park West was being prepared and is due to be lodged in late December 2016.

Where land is required, the NZ Transport Agency will engage in a separate statutory process under the PWA to acquire the land, which shall include appropriate compensation. Separate statutory processes under the RA will be progressed by the NZ Transport Agency with respect to the revocation of reserve status where permanent occupation is required.



9.9.3 Summary

Effects on public reserves will range from temporary to permanent. Effects on public reserves are considered to be greatest at Rosedale Park South which is required to provide for the SH18/SH1 interchange and to Constellation Park which compromises the use of the park, currently used by the NHHS. Planning for an alternative facility for NHHS is well advanced. While the loss of Rosedale Park South will not be offset by an alternative area of reserve land, and discussions are taking place with AC Parks regarding this matter, the Project area does contain an extent of open space.

Overall, while the Project will result in the reduction of public reserve land (much of which is not currently used for active recreation), considering the range of reserves affected and their uses, as well as the mitigation measures being progressed through ongoing discussions with AC and the strategy to relocate hockey and associated other users, it is concluded that any potential effects on public reserves and associated active and passive recreation values will be minor.

9.10 Social Effects

An Assessment of Social Effects (**Technical Assessment 10**) has been prepared by Aurecon NZ Limited which considers the actual or potential social impacts that may as a result of the Project during its construction and operational phases. The assessment focuses on the experiences (actual or anticipated, direct or indirect) of individuals, families / households, or communities in response to changes introduced by the Project. Social impacts are often the 'human' experiences of other impacts, and it is not the actual or potential effect of these impacts that is assessed below as this assessment has taken place above with respect to the relevant individual technical area (air quality, noise, traffic and visual).

9.10.1 Effects

Social effects have the potential to occur during both the construction and the operation of the Project. The potential effects from each phase are different and have, therefore, been considered separately. Social impacts are often the 'human' experiences of other impacts, and it is not the actual or potential effect of these impacts that is assessed below.

9.10.1.1 Temporary effects during construction

Recognising the Project's timeframes and scale of the works, it is a major construction project with the potential for adverse social effects, if not well managed. Potential effects associated with the Project during the construction phase include:

- Annoyance and disruption from unmanaged construction effects such as noise, vibration and dust and general disturbance;
- Stress or anxiety from unmanaged construction effects such as noise, vibration and dust and general disturbance;
- Traffic disruptions associated with construction restricting people's accessibility to go about their normal living patterns and participation in social/cultural activities when compared to the current situation;
- Construction effects challenging local residents' expectations of neighbourhood amenity, character and safety (such as the CSA between Paul Matthews Road and SH1);
- Construction activities restricting people's accessibility to pedestrian routes (e.g. Rosedale Road during road lowering, Paul Matthews Road and McClymonts Road during the switch from the existing alignments, and the Alexandra Stream underpass during SH18 widening); and



- Access to passive recreation reserves (e.g. the development of the proposed stormwater wetland at either Rook Reserve or Bluebird Reserve will result in the temporary loss of access to the wider reserve area).

Overall, there is the potential for reduced “liveability” for the local community varying according to proximity to construction activities and the duration of exposure.

The construction works within Meadowood Reserve have the potential to disrupt the play area and passive recreation space located in its south-western corner. Noise and disturbance effects may also arise for the Community House and Crèche if unmanaged.

It is acknowledged that the Project area contains a well-established business community providing services to the local and wider community. The following potential social impact issues for businesses which have road frontage access and which will be disrupted by the construction works (e.g. Paul Matthews Road, Rosedale Road, Constellation Drive) or by way of construction access through lots (e.g. Rosedale Road, Arrenway Drive, Cowley Place, Saturn Place, Bush Road) include:

- Partial severance / restriction for access to operations;
- Potential loss of business vitality/ viability if disruption is for extended periods (e.g. reduced customer visibility, reduced customer access, reduced servicing area); and
- Potential loss of staff or viability of operations due to staff / employment pressures (e.g. loss of car parking, accessibility issues, annoyance and disruption from unmanaged construction effects).

In addition, some business premises which are directly affected by the Project will need to relocate as the building in which they are currently accommodated will be demolished (e.g. at 121 Rosedale Road, 9-15 Arrenway Drive, 78-80 Paul Matthews Road). The NZ Transport Agency has implemented a Property Strategy and is working with these businesses and land owners in respect of specific contingency/ mitigation packages which best suit them.

9.10.1.2 Effects during operation

Once the Project is operational, it will generate accessibility and connectivity improvements for local residents in this area. It is considered this will result in positive effects on people’s patterns of daily living and wellbeing. These benefits are attributed to the following Project outcomes:

- A direct link between SH1 and SH18 which will reduce the reliance on local roads, resulting in improved travel times for local residents who use these routes;
- Dedicated local road to local road connection between Unsworth Heights and North Harbour East;
- Dedicated pedestrian/cycle facilities along both SH1 and SH18 as well as improved linkages to local reserves and community areas;
- Improved east-west connectivity with the upgrades to McClymonts overbridge, Rosedale Road and Constellation Drive including pedestrian/cycle provision; and
- Better access to public transport with the extension to the Busway.

It is acknowledged that the Project will affect a number of reserves which provide both passive and sports recreation to the local and wider community. The Project requirements in relation to these areas are discussed at **Section 9.9** and is not repeated here. While Rosedale Park South is currently not a publically accessible reserve, it has potential to contribute to the local community’s sports and recreation requirements is noted. The mitigation to be between AC and the NZ Transport Agency should ensure a commensurate level of future service.

The NHHS is recognised as a regional and local sports recreation facility. Its community function relates to school use for training and games as well as local club activities and summer programmes. The loss of this facility would be a significant adverse effect in respect of its community uses. The strategy with respect to this facility is discussed above at **Section 9.9**.



The Project's preferred option for a stormwater wetland within Rook Reserve will reduce the area available for passive recreation purposes at this location as currently enjoyed (open sloping grassed area) by the local community. The location of the wetland in the north-eastern corner of the reserve and the ability to adopt a "safety in design" approach to its layout, provide opportunities for the wetland to be an amenity feature within the reserve and part of its passive recreation function in conjunction with the wider reserve. The alternative location for this wetland is Bluebird Reserve at a grassed area identified in the north-eastern corner. Similar to the Rook Reserve design, the wetland would provide an amenity feature but the balance of passive recreation land would be much reduced, being limited to the small play area adjacent Bluebird Crescent.

As noted above, a number of businesses will be displaced permanently from their current location. Acquisition of properties or the takeover of tenancies will allow the owners/tenants to be compensated and move on or relocate, and in that way mitigates the effects on affected landowners or tenancies. However, it is recognised that effects of displacement and relocation may remain.

The two off-ramps (Z service station and Unsworth Drive) from the west bound carriage way of the UHH will be permanently closed as a consequence of the Project. Neither access can be maintained for safety reasons as one of the key purposes of the Project is to upgrade UHH to motorway standard. Improved access at Caribbean Drive forms part of the Project design with traffic modelling predicting better travelling time for users of the Unsworth Drive off-ramp as reported in the Assessment of Transport Effects. The owners and tenants of Z service station and the Greenwich Shops have raised concerns that the ramp closures will result in their businesses failing, as there will no longer be passing trade. This group is of the view that tenants will need to relocate while owners will be unable to either attract new tenants or on-sell the properties, as a consequence. Additionally, without an income, they would be unable to keep the properties leading to blight.

9.10.2 Mitigation

A key element in addressing the actual and potential social effects will be liaison and interaction with the local community ensuring they are aware of the Project's construction programme and when works will commence in their area so they can plan and prepare in advance. Therefore, it is proposed that a Stakeholder and Communications Plan to keep the community and stakeholders informed about construction activities and the construction programme be developed. In more detail, this Plan would include:

- The appointment of a Community Liaison Manager providing a key contact for the resident and business community within the Project area with a community reference group;
- A communication strategy detailing how/when construction management information will be communicated to directly affected landowners, neighbours, stakeholders and the wider community;
- Community involvement in the construction works (e.g. community planting days);
- Measures to maximise opportunities for customer and service access to businesses that will be maintained during construction;
- Measures to mitigate potential severance and loss of business visibility issues by way-finding and supporting signage for pedestrian detours required during construction;
- Other measures to assist businesses to maintain client/customer accessibility, including but not limited to client/customer information on temporary parking or parking options for access and delivery;
- Management and monitoring of key environmental issues such as noise, vibration, dust and traffic effects as part of the CEMP; and
- Implementation of a formal complaints/feedback process as part of the Stakeholder and Communications Plan.



With respect to reserves land affected by the Project, measures to mitigate construction impacts will be agreed as part of a reserve reinstatement package with AC to ensure remediation and return to public use (where possible) in an effective and efficient manner. The design of the stormwater management wetland at either Bluebird Reserve or Rook Reserve will be progressed in agreement with AC such that it provides an additional amenity area within the reserve, and subject to meeting public safety requirements.

The NZ Transport Agency is progressing a specific mitigation package with AC and Hockey addressing the Project's effect on the NHHS. The mitigation measures outlined at **Section 9.9**, will ensure that the community use of the facility will continue at the current site until all uses transfer to the intended new facility. Retention of the NHHS in the immediate local area is an important community outcome.

A number of businesses are directly affected by the Project and premises will be acquired. It is recommended that the NZ Transport Agency continue progressing its property strategy which includes a business resettlement assistance strategy that has been implemented through the planning phase. With respect to the Greenwich Shops and Z service station, it is recommended that the NZ Transport Agency specifically work with these businesses in respect of signage and advertising.

9.10.3 Summary

The Project will generate a variety of social effects of which some are adverse in nature while others are beneficial. Taken as a whole, the Project will not result in significant adverse social effects and any such effects are able to be managed through the management of construction effects and disturbance as well as stakeholder engagement and communications.

Overall, the proposed social effects are expected to be positive. The proposed works are considered essential for Auckland's transport network. Although there are potential adverse effects on the immediately adjacent community and surrounding environment, various mitigation measures will be employed to manage these effects and ensure a positive outcome for directly affected parties and the wider community.

The NZ Transport Agency will continue to engage with those landowners whose properties are directly affected by the NoRs and establish mitigation measures. Where land is required, the NZ Transport Agency will engage in a separate statutory process under the PWA to acquire the land where required, which shall include appropriate compensation.

9.11 Cultural Heritage and Tangata Whenua Values Effects

Engagement with nine Mana Whenua groups who have self-identified an interest in the Project (outlined in **Section 4 and 8** above) has been on going through the Central – North Area IIG and targeted Project hui. The extent of this consultation with Mana Whenua is recorded in **Section 8** and in the Consultation Report at **Appendix E**. Three CVAs have been prepared by Ti Ākitai Waiohua, Ngāti Manuhiri and Ngāi Tai Ki Tāmaki and these are provided at **Appendix F**.

9.11.1 Effects

Through the Project hui described in **Section 8**, the actual or potential effects of the Project which are of concern to Mana Whenua have been identified. Having regard to the CVAs provided, matters of importance from a Mana Whenua perspective for each interested group are summarised below.

9.11.1.1 Ti Ākitai Waihoua

For Ti Ākitai Waihoua cultural values reflect their traditional importance and association with the land and water. As such they wish to assert their kaitiakitanga obligations, to ensure that the impact of the development on the terrestrial and aquatic environment is managed.



9.11.1.2 Ngāti Manuhiri

There are no wāhi tapu or archaeological sites of significance to Ngāti Manuhiri recorded within the Oteha area. Living taonga within the Project area such as plants, birds and reptiles, are likely to be impacted by varying degrees of development. Ngāti Manuhiri support all initiatives that will protect or enhance their continued presence and environment.

9.11.1.3 Ngāi Tai Ki Tāmaki

Ngāi Tai Ki Tāmaki have expressed the importance of upholding their responsibility as kaitiaki particularly where species within the Project area are to be relocated or managed. Iwi support the use of low impact and water sensitive design in the Project as well as water quality management and stormwater treatment responses.

9.11.1.4 Other Mana Whenua

While CVAs as yet have not been received from others with an interest in the Project area, the matters raised by Ti Ākitai Waihoua, Ngāti Manuhiri and Ngāi Tai Ki Tāmaki have been reflected in Project hui discussions.

9.11.1.5 Discussion

Mana Whenua concerns have centred on maintaining or enhancing environmental values. These largely relate to the protection of waterways and vegetated areas, with Lucas Creek (in particular the western reach) being identified as a culturally significant area. The protection of the stream environments from contaminants such as stormwater and improved water quality outcomes in the Project catchments are a preferred outcome. Mana Whenua have also identified the risk of leachate migration from the excavation work at the Rosedale Closed Landfill as being of concern due to the potential to impact downstream water quality. Additionally, Mana Whenua have sought to have built elements of the Project express the historical connection that they have with the locality.

9.11.2 Mitigation

Mitigation planting is proposed as part of the Project. This planting seeks to remediate any adverse visual effects generated by the Project and restore ecological values to fragmented areas of vegetation. Where practicable planting will be sourced from local native stock.

Stormwater treatment has been provided throughout the Project to comply with the hydrology mitigation requirements outlined within the AUP and the matters of concern expressed by Mana Whenua throughout the design of the Project. These measures include the use of swales as conveyance mechanisms for runoff to the proposed stormwater ponds for treatment prior to discharge into the receiving environment. The design has mitigated water quality and quantity effects to the greatest extent possible by treatment, detention, attenuation and outlet protection.

The construction water management approach adopted for the Project will ensure a high level of erosion and sediment control avoiding untreated loads reaching the freshwater environment and adversely affecting water quality and aquatic habitat.

The freshwater ecology technical assessment outlines the measures for mitigation for the direct and indirect effects of the Project on freshwater bodies. This includes the installation of culverts to provide for fish passage in waterways. It also includes retaining as much riparian vegetation as possible at Lucas Creek and Alexandra Stream, due to the importance of the vegetation in providing habitat and reducing stream erosion.

Measures adopted in the Project design for works within the Rosedale Closed Landfill will ensure no leachate migration will occur during construction.



The proposed designation and consent conditions include the following measures to involve Mana Whenua in Project design and construction:

- Feedback must be sought from the NZ Transport Agency Northern IIG on the draft CEMP;
- The CEMP is to require cultural and environmental monitoring by Mana Whenua representatives, where this is requested by the above group;
- There must be an opportunity for an Mana Whenua representative to be present during any native fish recovery and relocation;
- The NZ Transport Agency Northern IIG is a key stakeholder to be specifically identified in the Stakeholder and Communications Plan; and
- A requirement for the Urban Design and Landscape Plans to be prepared together with the NZ Transport Agency Northern IIG.

9.11.3 Summary

Overall it is assessed that the design of the Project responds positively to the matters raised by Mana Whenua and is consistent with iwi values identified.

9.12 Archaeology and Historic Heritage Effects

An archaeological assessment has been prepared by Clough & Associates Ltd to assess potential effects on identified locations of potential archaeological significance from the construction and operation of the Project in the Assessment of Archaeological Effects (**Technical Assessment 2**).

To determine whether any archaeological or other cultural heritage sites had previously been recorded on or in the immediate vicinity of the Project area, an initial literature review was completed followed by field surveys of higher risk areas as detailed in Section 3 of the Assessment of Archaeological Effects.

9.12.1 Effects

As outlined at Section 4.2 of the Assessment of Archaeological Effects, no heritage sites are recorded within the Project corridor, and subsequent field surveys and assessment did not indicate any areas with archaeological or heritage potential. This is primarily due to the majority of the assessment area having undergone previous development. The proposed works are unlikely to have an impact on land that has not been modified in the recent past. Previous earthworks throughout the Project area would have destroyed any archaeological features or deposits that may have been present.

The potential for both the construction works and the operational works to impact on any unrecorded archaeological or heritage site is considered to be low to nil within the Project area.

Three reserves within the assessment area were identified having the potential to contain archaeological deposits: Bluebird Reserve, Rook Reserve, and Constellation Reserve. However, aerial photographs illustrated that the Bluebird Reserve and the western part of the Constellation Reserve had undergone past modifications which would have directly impacted on any archaeological resources present. No archaeological features or deposits were identified during the site visit at either Rook Reserve or Constellation Reserve. In addition, there were no other areas of archaeological sensitivity or areas of archaeological potential identified that could be affected by the Project.

Overall, any potential effects on unrecorded archaeological values are considered likely to be less than minor.



9.12.2 Mitigation

The Project archaeologist considers that site-specific mitigation measures are not required. Where any sites are encountered, accidental discovery protocols will be adhered to in order to avoid any damage or irreversible effects. The proposed Project conditions include a requirement for a contractor's briefing by the Project Archaeologist, and set out steps to take should any unrecorded historic heritage sites be exposed.

9.12.3 Summary

Overall, with the implementation of the mitigation proposed, it is assessed that the effect of the Project on archaeological and heritage values will be less than minor.

9.13 Construction Water Effects

An Assessment of Construction Water Management (**Technical Assessment 4**) has been prepared by Ridley Dunphy Environmental Ltd to assess the potential effects of earthworks and management sediment on waterways generated through the construction of the Project. This assessment informs and should be read in conjunction with the Assessment of Freshwater Ecology and Assessment of Surface Water Quality.

As outlined in **Section 5.9.4**, the total area of earthworks for the Project equate to approximately 61ha. The earthworks areas are predominantly within a narrow corridor and include works associated with pavement repair and replacement. The most significant bulk earthworks activity is proposed at the SH18/SH1 tie-in (north and west bound ramps) as well as the Paul Matthews Road Link.

Works are also proposed within stream systems located to the south of RWWTP Pond 1 (including filling). In addition, works are proposed within the banks of the Alexandra Stream, Oteha Stream and Lucas Creek associated with the construction of outfall structures. A number of artificial watercourses (stormwater drains) are also affected by the Project including the stormwater discharge channel from the Masons Road stormwater pond and the channels adjacent to the Moro Pond. These artificial watercourses drain to the Auckland Council stormwater network. The Project works also involve the widening of the crest of the existing SH1 causeway on both the eastern and western side of the existing motorway.

The assessment identifies the erosion and sediment control philosophy and the principles to be applied on the Project, along with a series of risk mitigation tools. This includes compliance with both the Technical Publication No. 90 Erosion and Sediment Control: Guidelines for Land Disturbing Activities (TP90), Auckland Council and the NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure, Construction Stormwater Management (dated September 2014) (NZ Transport Agency Guideline) in the design of all erosion and sediment control measures.

One of the key principles of construction water management for the Project is the future submission to Auckland Council of Construction Erosion and Sediment Control Plans (CESCPs) prior to works commencing. These plans will be developed for each specific area of works or activity and will be undertaken in accordance with the key principles outlined within the Assessment of Construction Water Management.

9.13.1 Effects

While the assessment notes that the Project is essentially a road widening exercise, exposing land surfaces through earthwork activities has the potential to result in soil mobilisation and an increase sediment loads above the normal levels that are discharged to waterbodies. This can result in the potential for adverse effects on the receiving environment and habitats. An increased sediment load discharged to a watercourse can affect water quality and the ability of aquatic organisms to survive and/or migrate.



The effects of increased sediment loads discharged to waterbodies will vary, as different waterbodies and habitats have varied capacities to manage elevated levels of sediment. Without appropriate management, the adverse effects of sediment-laden runoff has the potential to be significant, with long-term effects on freshwater systems, estuaries and harbours into which the catchment discharges.

9.13.2 Mitigation

CESCPs are proposed to be developed, and which will follow the principles outlined in Section 6 of the Assessment of Construction Water Management. These plans form part of the wider CEMP framework which is recommended as part of the Project. In order to minimise sediment from escaping the works area and entering waterways, a series of controls are proposed to be installed, depending on the specific environment. These will be designed, constructed and maintained in accordance with recognised guidelines and will at all times achieve, as a minimum, the requirements of the NZ Transport Agency Guideline and TP90. A detailed management approach has also been identified to ensure that erosion and sediment control measures are fit for purpose, monitored and well maintained. Monitoring will ensure a process of continuous improvement for construction water management methodologies and specific measures can be implemented (i.e. adaptive management).

The erosion and sediment control measures that have been developed for the different construction activities are detailed in the following subsections.

9.13.2.1 Erosion and sediment control devices

Sediment Retention Ponds (SRP) are proposed primarily for the SH1/SH18 works and will be designed with a length to width ratio of 3:1, side slopes of 2:1 and a depth of 1.5m. The SRP depth can be amended to ensure effective operation if required. SRPs will also be utilised in Construction Support Areas. Proposed new stormwater management wetlands, or the footprint of these wetlands, will be utilised as SRPs where possible.

Cleanwater diversion channels required for the Project works will use a hot mix bund, to be established on the edge of the existing sealed carriageway in order to divert flows away from the works locations. Within the Project area, there are a wide range of catchment sizes and characteristics that will require specific cleanwater diversion channel designs. However, for the existing motorway surface the cleanwater diversions will be sized for the 1% annual exceedance probability (AEP) storm event with discharge locations for every 100m lineal length of motorway.

Dirty water diversion channels will be utilised in a few places to allow surface flow to be diverted to treatment devices. These will be based on NZ Transport Agency standard of 1% AEP storm event with adequate room assessed within the necessary catchment areas to install such devices.

9.13.2.2 Culverts and outfalls

Replacement culverts are proposed to be installed in sections and fully completed and stabilised within the day works programme. All culvert works are to be established in dry environments. This will be achieved by undertaking the works either during a period of no flow, or if flow occurs, during the works period using pumping. This pumping will temporarily divert upstream flows around the work area to discharge back downstream of the culvert works. Once the culvert is installed, rip-rap erosion control is required to be installed at the inlet and outlet of the culvert. Any rip-rap work or associated concrete works are to be undertaken in a dry environment to minimise likelihood of sediment-laden runoff. A silt fence is required to be erected during the culvert backfilling process, until the area has been fully stabilised. Processes to manage effects during high-rainfall events are also proposed.

9.13.2.3 Retaining wall construction

Retaining wall works are to be constructed from hard stand areas with machinery on stabilised platforms. Where this cannot occur, a silt fence is to be placed around the lower area of the works to



ensure any sediment generated is fully captured and treated. Any spoil from the construction of the walls is to be loaded immediately onto a truck or equivalent, and removed from the area to a location that has been approved in the CЕССР.

Any cement contaminated water will require treatment prior to discharge. This is to be conducted on-site using treatment tanks with water pH tested prior to discharge, or the water removed from the site and treated elsewhere through the use of sucker trucks.

9.13.2.4 Drainage/utility installation

When placing pipe networks for stormwater or other utilities, the nature of the environment is an important consideration. For works outside streams or overland flow paths, cesspit protection is to be provided for all adjacent cesspits. Where the works are adjacent to a watercourse, a silt fence or filter sock is to be erected between the watercourse and the works area. This is to be maintained to ensure functionality remains and can be moved with the works as they progress. The excavation works, placement of pipes and any backfilling are to be fully stabilised on a daily basis.

Where works are to be undertaken within a swale or overland flow path, temporary cofferdams may be used within swales with connected solid novacoil pipes to take any swale water around the works area on a temporary basis. The cofferdams are to be removed upon completion and the surface stabilised.

9.13.2.5 Bridge construction and demolition

Bridge construction will involve piling operations and reinforced concrete column and crosshead construction. This is proposed to occur in various locations throughout the Project. Specific erosion and sediment control measures are to be applied to these areas.

Machinery is to be utilised on a fully stabilised surface, to ensure the machinery does not generate sediment. Stockpiled material is to be removed from the site on sealed truck units. Below any earthworks or drilling activities, a super silt fence is to be established in a horseshoe configuration around the perimeter of the activity which will capture any sediment in runoff from this activity. As an alternative, or backup to the super silt fence, bark or mulch filled filter socks may be appropriate to assist with filtering sediment and in reducing the pH of concrete discharge.

Concrete slurry is to be minimised through good site management. A dedicated concrete wash area is proposed for relevant construction support areas. Any concrete slurry generated is to be removed from the site via sucker trucks or discharged through a filter sock and the pH levels checked.

9.13.2.6 Pumping

Pumping may be necessary for some parts of the Project. Sediment retention ponds are to be installed and fitted with floating decants with a mechanism to control outflow.

9.13.2.7 Rosedale Wastewater Treatment Plant ponds

In addition to the basic erosion and sediment controls identified, a hot mix bund is to be established along the edge of the existing sealed carriageway between the RWWTP ponds in order to divert surface runoff from the carriageway away from the earthworks area. A cofferdam or groyne is to be established, after which the earthworks area is to be dewatered and contaminants removed. Clean hardfill is to be utilised to ensure that sediment generation is minimised. The construction works in this area are to be staged to limit sediment yield. Only the area needed for the immediate activity should be exposed, with no more than 0.25ha exposed to erosion during each phase.

9.13.2.8 Flocculation

Flocculation treatment is proposed for various sediment retention devices as well as specific activities such as pumping. A flocculation management approach will be detailed within the CEMP and implemented through the CЕССР. As the soil type differs throughout the Project area, the flocculent



will be effective in different dosages. On-going testing will be required to confirm particular details to be outlined in the CЕССР.

9.13.2.9 Construction support areas

Construction support areas are required to have adequate erosion and sediment control and due to the temporary nature of the exposed area, will typically be based upon runoff diversion channel and sediment retention ponds followed by a progressive cover of hard fill material. Where necessary silt fences are to be installed around the yard establishment phase of works until the yard area has been stabilised with clean hard fill material.

In order to manage construction water during the operation of the construction support areas, vehicle movements are only to occur within designated areas of hardstand, non-sediment contaminant products are to be stored within bunds, contaminated material is to be managed within self-contained locations, sealed hardstand is to be regularly cleared, and stockpiles of material within the yard are to be treated through sediment control measures.

9.13.2.10 Stormwater wetland establishment

The proposed stormwater wetlands are to be constructed in an isolated manner. The perimeter of the excavation area is to be marked with a topsoil bund to prevent machinery from disturbing unnecessary areas, whilst acting as an impoundment area with decanting devices installed if necessary.

The proposed stormwater wetlands are to be formed and fully stabilised with the permanent planting and mulching programme installed prior to removal of any erosion and sediment controls. The outlet structure device for the sediment retention ponds is to be the same as that of the permanent wetland with the outlet changed after construction to reflect operational requirements and flocculation may not be necessary any longer.

9.13.2.11 Adaptive management framework

As previously discussed, CЕССР(s) are a key tool for mitigating potential adverse effects. Monitoring will also be required as part of the CЕССР, and is a key tool for the success of the Project. Monitoring outcomes will be implemented in an adaptive management framework whereby there is a continuous improvement process at all times for construction water management methodologies and specific measures. This approach enables flexibility and innovation while still ensuring the potential adverse effects are managed appropriately, in accordance with best practice.

9.13.3 Summary

A range of construction activities that will be undertaken as part of the Project have the potential to impact on the ecological values of the receiving environments. While the report is based on a conceptual approach and provides a suite of methodologies for certain activities, it provides certainty that the construction activities can occur with minimal discharges and associated construction related effects. An adaptive management regime is a key part of the methodology proposed. Subject to the development of detailed CЕССРs (as required under the proposed conditions), and which are developed in accordance with the principles, management processes and the erosion and sediment control measures outlined, it is considered that the actual and/ or potential effects associated with erosion, soil mobilisation and sedimentation to receiving water bodies and stormwater discharges will be temporary in duration and appropriately avoided or mitigated.

9.14 Land Contamination Effects

An Assessment of Land Contamination Effects (**Technical Assessment 6**) and PSI has been undertaken by Aurecon to identify a range of on-site sources of contaminated land (HAIL activities), as a result of both historic and existing activities. These assessments also determine potential



contamination pathways in order to assess the potential effects arising from construction and operation of the Project on contaminated land.

9.14.1 Effects

Twelve sites have been identified as posing a greater risk due to potential land contamination and their proximity to the Project corridor. These include; Constellation Drive sub-station (pre-1970s), Z Energy service station (SH18), Caltex service station (SH18/Paul Matthews Road), Gull service station (Albany Highway), Rosedale Closed Landfill, scrap metal dealer and electroplater, RWWTP, channel at CH14300, channel at CH14700, and the stream near the Rosedale Closed Landfill (CH14000).

Adverse effects are likely to occur where there are linkages between the source, pathway and receptor. This is described in Section 3.7.2 of the Assessment of Land Contamination Effects. During construction, there is the potential for linkages to be created through soil disturbance and surface seal removal. Adverse effects that may arise as a result of pathways being created during construction include:

- Inhalation exposure to works on site and members of the public;
- Ingestion and dermal contact exposure to works and neighbouring site users;
- Discharge to stormwater;
- Passive discharge to groundwater or air;
- Accumulation in impacted sediment;
- Loss of amenity values (e.g. odour); and
- Vegetation impacts.

The potential adverse effects of works within each of these sites are summarised in **Table 37**.

Table 37 Summary of Potential Adverse Effects of concern from works within HAIL Sites

Location	Contaminants	Effects
Uncontrolled Fill		
Watercare Causeway	Asbestos containing material Metals Hydrocarbons Semi volatile organic compounds	Inhalation exposure to workers and neighbouring site users
Infilling of gully (CH14700)		Discharge to stormwater
Infilling of gully (CH14300)		Passive discharge to groundwater Accumulation of sediment
Infilling of stream (CH14000)		Amenity values
Power Substation		
Constellation Drive	Polychlorinated biphenyls	Dermal contact, ingestion of onsite workers Passive discharge to groundwater
Petrol Station		
Caltex service station SH18	Hydrocarbons Metals	Dermal contact, ingestion, inhalation to onsite workers and neighbouring site users Passive discharge to groundwater Amenity values
Z service station SH18	Hydrocarbons	



Location	Contaminants	Effects
Gull service station SH18		Dermal contact, ingestion, inhalation to onsite workers and neighbouring site users Passive discharge to groundwater Amenity values
Rosedale Closed Landfill		
SH1 CH1370-14200	Metal Methane Hydrocarbons Semi volatile organics Pathogens	Inhalation exposure to workers and neighbouring site users Discharge to stormwater Passive discharge to groundwater Accumulation of sediment Amenity values
Rosedale Wastewater Treatment Plant		
SH1 CH15000-15500	Pathogens Metals Methane	Inhalation exposure to workers and neighbouring site users Discharge to stormwater Passive discharge to groundwater Accumulation of sediment Amenity values
Scrap Metal Dealer/ Electroplater		
SH18 - CH1990	Hydrocarbons PFC's Metals	Inhalation exposure to workers and neighbouring site users Passive discharge to groundwater Amenity values

The Assessment of Land Contamination Effects states that all potential adverse effects generated during construction will be transient, however some contaminants such as asbestos, lead and benzene can lead to irreversible impact from additional exposure. However, this is considered to be highly unlikely and that well managed contaminated sites should not result in a significant increase to human health risk.

During operation of the Project, any residual contamination will be sealed beneath the State highway, or landscaped over, to ensure that no migration of contaminants occurs whilst the site remains undisturbed. The migration of contamination may occur during routine maintenance where soil is disturbed. Examples of such activities include trenching for installation of underground services, drilling for small scale civil works or alterations, and earthworks for landscaping. Adverse effects of such works during operation are likely to generate the same set of adverse effects as during construction.

Section 4.1.1 of the Assessment of Land Contamination Effects notes that there are some positive effects from the proposed works within these sites. These include:

- Characterisation of areas of potentially contaminated land which would have not otherwise have been assessed;
- Identification of areas of historical contamination previously unknown allowing controls to be implemented to protect human health and the environment;
- Possible removal of the contaminated material from the proposed development areas within the Project area; and



- Removal of some contaminated soils.

9.14.2 Mitigation

Section 6 of the Assessment of Land Contamination Effects outlines the proposed mitigation measures to address land contamination effects. In order to manage the adverse effects from earthworks in contaminated sites along the alignment, a draft Contaminated Site Management Plan (CSMP) has been prepared. The CSMP details the specific measures to be put in place to control and manage potential hazards from working with contaminated soils. Measures include:

- Any soil or recycled aggregate imported to the Project corridor shall be sourced from a site for which a PSI or DSI has been produced demonstrating the site is not a HAIL site and that the soil is likely to be representative of background concentrations for non-volcanic soils. In addition, any soil or recycled aggregate being imported for the Project is to be sampled and tested at a minimum rate of one sample for every 500m³;
- Any material not demonstrated to be imported from virgin ground shall be tested at a minimum rate of one sample per 250m³ of fill, but not less than three samples, for an appropriate suite of contaminants to demonstrate that it is acceptable for reuse within the Project corridor as cleanfill;
- Soil and surface stability is to be maintained at all times in accordance with AC's TP90;
- Soil stockpiles are to be located in designated stockpile areas which will be established prior to generation of waste soil. Stockpiled soil will be managed to control contamination of underlying soil and erosion. Sediment control measures will be used to minimise siltation of any surface and water or blockage of any existing drainage channels;
- Daily records of where excavation of contaminated or suspected material has occurred, including the type and volume of any contaminated material excavated, and where the material has been stockpiled or disposed of;
- Contaminated waste is to be disposed of off-site at a facility authorised to accept such material and a record is to be kept of such activities;
- Maintaining a register of landfill soil disposal and liquid disposal activities, and recording the location of contaminated soil excavations, disposal location quantity of contaminated material and off-site weighbridge documents;
- Maintaining a register of deposition/disposal of excavated contaminated soil that qualifies as waste soil. If material is transported off-site, it will be done using appropriately authorised waste transporters for disposal at an appropriately licensed landfill;
- Upon completion of soil excavation, all plant and equipment shall be cleansed and decontaminated in an appropriate manner;
- General uncontaminated fill material generated within the Project corridor should be separated from areas of potentially contaminated fill;
- Any groundwater encountered is to be sampled and if found to be contaminated should be pumped and collected in drums or tanks on-site for removal to an appropriate facility;
- Minimising dust by dampening the surface of the site, protecting stockpiles within sealed waste skips or wetting down the surface of the stockpile;
- Ceasing works in strong winds;
- Undertaking the loading or unloading of dry soil at the source to prevent the spread of loose material within and outside the Project corridor;
- Spill response kits are to be located at the site with contractors operating within the Project corridor are to adhere to an emergency spill response plan;
- Stockpiled materials with the potential to produce leachate or contaminated runoff are to be stored in a sealed and bunded area to divert stormwater away from the waste; and



- Liquid levels within the bunds shall be monitored and if exceeding more than 10% of the bund volume shall either be resprayed onto the stockpile or be removed from the site as hazardous liquid waste by an approved waste handler.

A DSI is currently being undertaken to assess the actual site conditions within areas of potential contamination. This is required to better understand the risk profile of each site and to develop specific management approaches appropriate to any identified risks during construction and to provide input to the detailed design to avoid land contamination risks following Project completion.

9.14.3 Summary

The PSI has identified potentially contaminated land associated with current or historical activities within the Project area. These activities include landfill sites, waste water treatment plants, the placement of fill of unknown origins, and petroleum service stations.

Potential adverse effects associated with the proposed development works could arise from human or environmental exposure to the identified contaminants during excavation activities, stormwater runoff carrying contaminated sediment impacting off-site areas, or members of the public being exposed to contaminants carried in airborne dust. To manage these risks a draft CSMP has been prepared and is to be updated with the results of the DSI prior to works commencing within the Project area.

The risks associated with these potential adverse effects can be managed for the Project to ensure that they are avoided through design or process to the extent that they are minor.

9.15 Freshwater Ecological Effects

An Assessment of Freshwater Ecological Effects (**Technical Assessment 5**) has been prepared by Bioresarches Group Ltd to assess potential effects on freshwater ecology from the construction and operation of the Project.

The aquatic ecological values within the Project area were assessed to determine the quality of freshwater habitats and the presence freshwater flora and fauna. The assessments were undertaken over the entire Project area and included desktop and database reviews, site visits and formal surveys.

9.15.1 Effects

9.15.1.1 Temporary effects during construction

Sedimentation from disturbed soils presents a risk to all watercourses within the vicinity of the proposed construction works area. In particular, the construction of the proposed outfall (OF3) has the potential to result in increased sedimentation within Lucas Creek.

Sedimentation, bank failure and loss of low or moderate quality aquatic habitat could also occur at Oteha Valley Stream and Alexandra Stream. Construction works could also potentially obstruct or restrict fish passage within Alexandra Stream.

9.15.1.2 Effects during operation

Adverse water quality effects during the operational phase of the Project may rise from increased stormwater runoff due to the increase in impervious surfaces. Runoff may include hydrocarbons and trace metals and the effects of these contaminants entering the downstream freshwater environment without treatment are considered to be moderate. However, stormwater treatment devices are proposed as part of the Project which will provide treatment, detention and attenuation of stormwater runoff from impervious areas as part of the Project.

Culverts have the potential to form barriers to fish passage and alter the hydrology of the watercourses. All sections of the stormwater drains that will be piped are highly modified aquatic habitats designed for stormwater conveyance. The operational effects of the proposed culverting of



the existing open channel stormwater drains is considered to be less than minor in those drains that are considered to have very low value aquatic habitats.

Several stormwater channels within the Project area are affected by the proposed works through either piping, culverting or filling as follows:

- The stormwater pond discharge channel between Masons Road and SH1 southbound – this discharge channel will be lost as a result of the removal of the stormwater pond. This ephemeral watercourse is an ‘artificial watercourse’ as defined under the AUP. The channel provides a refuge for native freshwater fish and its ecological values have been assessed as moderate;
- The stormwater drain south of Arrenway (Moro Pond) – this channel is an ‘artificial watercourse’ as defined under the AUP. The channel is lined and its ecological values are low;
- The channel downstream of SH1 UHH on ramp north – this ephemeral watercourse is also an ‘artificial watercourse’ under the AUP and its ecological values are low;
- Pond 1 open drain (follows the southern boundary of Pond 1) – this channel is an artificial watercourse and its ecological values are low;
- RWWTP watercourses south of Pond 1 – while these watercourses are highly modified concrete lined channels which contain very low quality aquatic habitat, historic aerial photographs show there was historically a stream in this approximate location within the catchment. Accordingly, Auckland Council considers that it should be classified as a ‘stream’ under the AUP. The works will result in approximately 602m of ‘streams’ and stormwater drains with very poor quality aquatic habitat being piped between UHH and Pond 1 at the RWWTP; and
- The extension of the SH1 causeway between the two ponds at the RWWTP will result in the loss of a small portion of low quality artificial aquatic habitat. The removal of existing stormwater ponds will also result in the loss of some low quality aquatic habitat. New stormwater ponds, if not designed well, have the potential to increase the temperature of stormwater discharges to streams.

9.15.2 Mitigation

Erosion and sediment control measures are proposed with CESCPS to be certified by Council prior to construction commencing (refer to **Section 9.13**). The CESCPS will detail the specific measures to control sediment from entering the downstream freshwater environment and the proposed monitoring and adaptive management is proposed. Specific sedimentation controls are also proposed for works in the vicinity of streams, including the construction of outfalls as outlined in the Assessment of Construction Water Management. The Assessment of Surface Water Quality Effects concludes that the potential effects of sedimentation from earthworks on water quality will be no more than minor. Accordingly, the potential sedimentation effects of the construction works on streams and watercourses can be readily managed to the extent that they will be no more than minor.

The Project will treat 99% of all new and existing HUR from within the Project area in accordance with TP10. As a result, the quality of stormwater discharges from within the Project area will improve (refer to the Assessment of Surface Water Quality Effects). The inclusion of detention and attenuation devices, rip-rap aprons and basins will also mitigate the adverse effects of increased flows in the downstream freshwater environment such as stream erosion.

Any native fish or eels located in watercourses that are to be affected by the Project will be recovered and relocated by a suitably qualified freshwater ecologist. Fish movement barriers are proposed to be installed to the lower and upper limits of stream works and over the inlet and outlets of stormwater ponds to prevent fish from re-entering the stream works area. Native fish are to then be captured and relocated on the same day to a suitable and similar habitat immediately downstream of the works area within the same catchment.



While some watercourses are affected by the Project, these generally provide very low ecological habitat and are highly modified aquatic habitats designed for the movement of stormwater between various stormwater devices and/or culverts. New stormwater management wetlands are proposed and riparian planting around the wetlands will increase shading and substrate, increase temperature control and provide backside shelter and habitats for birds using the wetlands. One such area is that within the RWWTP south of Pond 1, where 'stream' and stormwater drains with very low quality aquatic habitat is proposed to be piped, but where a wetland structure (to manage stormwater) is to be constructed. This will result in a vastly improved environmental outcome.

9.15.3 Summary

There is the potential for adverse freshwater ecological effects arising from stormwater runoff from roads, including hydrocarbons, and from sediment discharge during construction. However, the Assessment of Freshwater Ecological Effects concludes that both in construction and operation phases of the Project, these potential adverse effects can be mitigated to ensure that those effects will be no more than minor.

9.16 Terrestrial Ecological Effects

An Assessment of Terrestrial Ecological Effects (**Technical Assessment 13**) has been prepared by Bioresearches Group Limited to assess the extent to which terrestrial ecology will be affected by the construction and operation of the Project.

The potential terrestrial ecological values considered within the Project area include vegetation (flora) and fauna (including lizards, birds and long-tailed bats).

9.16.1 Effects

9.16.1.1 General/Project-wide

Overall, the existing terrestrial ecological environment is considered to be of low value. Given the highly urbanised nature of the Project area, the majority of vegetation is areas of planting associated with the management of the State highway network rather than natural or regenerating vegetation. While vegetation clearance is proposed within the Project area, the overall value of this vegetation is low. Consequently for the majority of the extent of the Project, the potential adverse terrestrial ecological effects are minor or negligible.

9.16.1.2 Oteha Valley Road near Lucas Creek

To the north-west of the Project area is an SEA (SEA_T_8297) with a large area of native vegetation extending between it and existing State highway designation to the north of Oteha Valley Road and bounding Lucas Creek. The fragmented vegetation extending under SH1 and along Oteha Stream is considered to have moderate botanical value. A new culvert is proposed to drain to Lucas Creek between the southbound on-ramp and the existing motorway which will pass through mainly juvenile planted vegetation surrounding the existing stormwater pond and riparian vegetation. No works are proposed within SEA_T_8297 nor the vegetation surrounding it.

9.16.1.3 Rosedale Wastewater Treatment Plant ponds

Two SEA overlays are located over the RWWTP; SEA_T_8364 overlays Pond 1 and SEA_T_8365 overlays Pond 2. There is some potential for parts of the Project area around the RWWTP to be used for nesting by At Risk or Threatened birds, such as dabchick, from July to December inclusive. These areas include the northern sides of Ponds 1 and 2 (including the pines) and these areas may also be used for nesting by other native waterfowl, including New Zealand scaup or Australasian shoveler. Construction effects that result in nest destruction or abandonment (if any were established) would be a significant adverse effect.



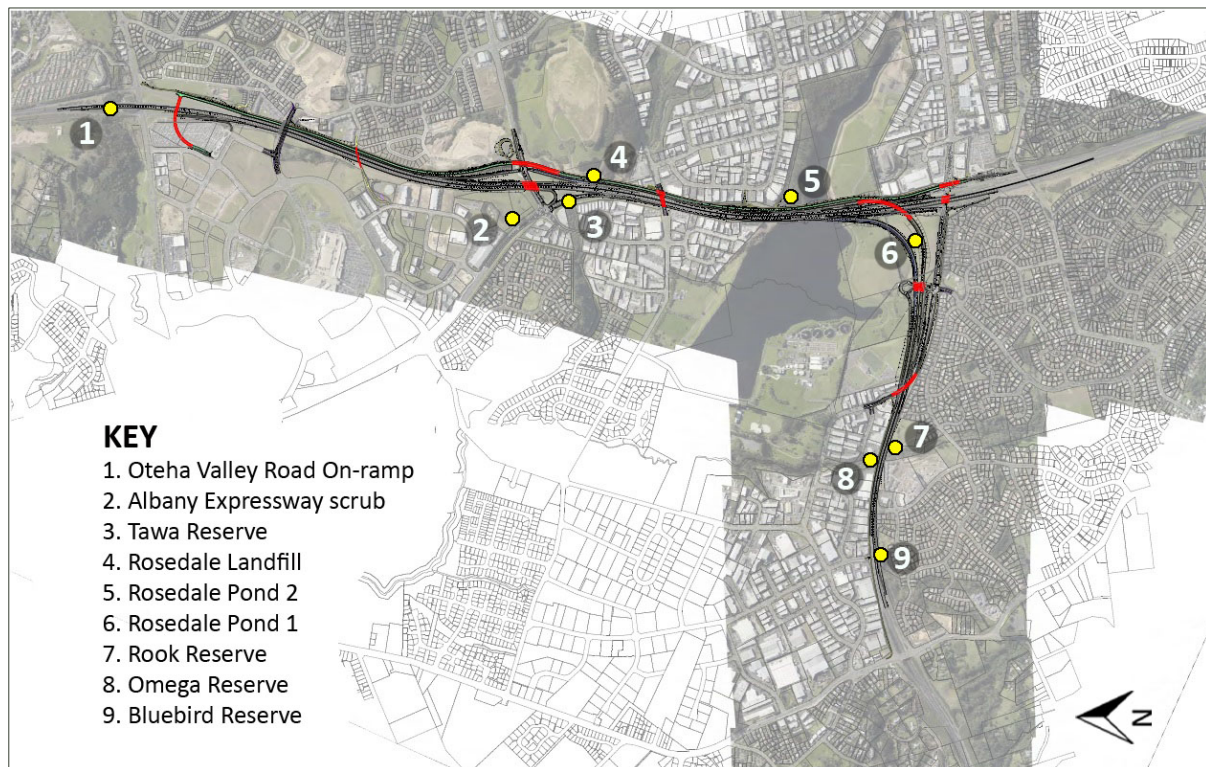
In terms of the potential effects on the birds within the RWWTP during operation, the population has adapted to industrial activities at the RWWTP, farming activities and motorway works and operation, together with overflights of helicopters using the adjacent Helitransz heliport. The probability of the population being adversely affected by the operation of the Project is negligible. The networks of stormwater ponds and associated vegetation may have a habitat enhancement effect, particularly for waterfowl that currently use RWWTP.

9.16.1.4 Lizard habitats

No lizards were recorded from all habitat searches and funnel trapping. The habitat quality was low to marginal at most sites investigated. Vegetation at Sites 1, 2 and 4 provided the greatest potential to support lizard habitat.

Clearance or disturbance of potential lizard habitat was identified as being limited to two sites (being Sites 1, and 4 as identified in **Figure 49**). The potential habitat values for Site 1 are high (four 'At Risk' species may occur there) while the potential habitat values at Site 4 are considered to be of low quality although there is some potential for the presence of 'At Risk' ornate skinks.

Figure 49 Sites identified as supporting Potential Habitat for Indigenous Lizards



9.16.1.5 Birds/Avifauna (outside the RWWTP area)

Two New Zealand dotterel were observed at the proposed construction yard alongside Elliot Rose Avenue on three occasions in August 2016 however none were observed during the seven subsequent visits during September and October 2016. Given these birds are known to roost, forage and breed on vacant land at the nearby Albany commercial block (adjacent to the proposed designation), dotterel may choose to roost or nest at the construction yard at Elliot Rose Avenue and potentially in other similar parts of the Project area during construction if they are not discouraged from nesting within the works areas.



9.16.1.6 Bats

No bats were found during bat surveys and it is considered very unlikely that bats are present within the Project area, even on an intermittent basis. Accordingly, construction of the Project is not expected to affect bats.

9.16.2 Mitigation

The following mitigation is recommended in the Assessment of Terrestrial Ecological Effects:

- Replanting should occur in general accordance with the Landscape Mitigation and Enhancement Plan attached to the Assessment of Landscape and Visual Effects;
- Measures should be implemented to protect native vegetation where it lies adjacent to the construction works where practicable;
- The potential effects of construction on nesting native birds adjacent to the RWWTP ponds can be appropriately managed by vegetation clearance prior to the nesting season; and
- Prior to construction and the removal of vegetation at Sites 1 and 4, any lizards found to be present should be removed and relocated to areas of suitable habitat.

9.16.3 Summary

The Assessment of Terrestrial Ecological Effects concludes that in overall terms, the terrestrial ecological values within the Project area are low, being predominantly planted areas. With the mitigation measures described above in place, all the ecological effects of the Project can be mitigated to a level that the effects of the Project on the terrestrial environment are negligible.

9.17 Stormwater Effects

The Project will increase the coverage of impervious areas throughout the Project area and will generate increased runoff from motorway surfaces and other surfaces including the Busway extension and SUPs. The Assessment of Stormwater Management (**Technical Assessment 11**) has been prepared by Aurecon NZ Limited to describe the design for the proposed stormwater management system, outline the level of treatment that will be achieved and assess the potential effects of stormwater on flooding during the operation of the Project. The effects of the Project on water quality are assessed in the Assessment of Surface Water Quality Effects (**Technical Assessment 12**).

Hydrologic and hydraulic modelling has been undertaken for the Lucas Creek and Oteha Valley catchments to determine the potential effects of the additional runoff generated by the Project. Any changes to stormwater infrastructure associated with the Project are also assessed. AC's flood models has been used as a basis. These models are used to identify habitable floors at risk of flooding within existing flood areas and assess the performance of the existing and proposed stormwater drainage network system. Due to limitations and difficulty separating existing and predicted motorway runoff, the proposed stormwater management system design is based on the conveyance, treatment, detention and attenuation (where required) of all stormwater runoff from existing and proposed pavement areas as one combined network.

9.17.1 Effects

The Project will create an increase in impervious surfaces for the additional lanes along SH1 and SH18 corridors, the Busway extension, the new SUPs which run along SH18 and SH1, the upgrade of Constellation Bus Station and local roads which are affected by the Project. The management of runoff from external catchments has also been considered in the stormwater design.

Stormwater generated within the Project area is to be either discharged into AC's stormwater network and discharged via outfalls consented under the NDC, or is to be discharged via NZ Transport Agency



owned stormwater outfalls to the receiving environment (Lucas Creek, Oteha Valley Stream and Alexandra Stream).

9.17.1.1 Stormwater quality

The AUP categorises roads with volumes exceeding 5,000 vehicles per day as high use roads. High use road excludes the Busway and the SUPs proposed as part of the Project. The Project will add approximately 8.3ha of additional impervious surfaces classified as HUR under the AUP. The stormwater runoff from these areas is likely to contain pollutants and therefore Chapter E9 of the AUP requires additional treatment prior to discharge.

The proposed stormwater management devices described below will provide for 99% of HUR impervious areas (existing and new) within the Project area to be treated at levels of 75% TSS removal in accordance with TP10. This is a significant increase from the existing 52% of discharges within the Project area that currently meet this standard. The effects of the stormwater discharges on the water quality of the receiving environments is assessed in Section 10.2 of the Assessment of Surface Water Quality Effects.

9.17.1.2 Stormwater quantity - Flow

The increase in impervious surfaces within the motorway corridors will increase the volume of runoff from the identified catchments and potentially the peak flows during flood events.

The Project area is covered by two SMAF areas in the AUP - a SMAF 1 area to the north of the McClymonts Road bridge and a SMAF 2 area to the south of the McClymonts Road bridge. These stormwater management areas indicate that the identified streams and their contributing catchments are particularly susceptible to the effects of development or have relatively high ecological values, and therefore require specific treatment or attenuation measures. Chapter E10 of the AUP requires the provision of additional hydrology mitigation in the form of detention for the 90th and 95th percentile rainfall events to manage the flow of stormwater discharge and to avoid deteriorating the downstream receiving environment. Full detention of the 95th and 90th percentile rainfall events is provided for the Project through the use of wetlands and/or dry ponds, without any reduction allowance for retention. This is achieved using controlled outlets within these devices.

Discharges of stormwater will either be to AC's network where authorised under the NDC, or to the receiving environment post-treatment. The Project will require the installation of additional culverts to convey stormwater. Additional outfall structures will be required with erosion protection to control the flow of stormwater as it discharges to the receiving watercourse (as discussed in **Section 9.17.2.2**).

9.17.1.3 Stormwater quantity - Flooding

Discharges to the receiving environment are required to comply with the flooding provisions in order to minimise the likelihood of adverse effects on the downstream receiving environment. Standard E8.6.1(3) of the AUP provides that discharges should not increase flooding to other properties in rainfall events up to the 10 per cent AEP or the inundation of buildings on other properties up to the 1 per cent AEP.

AC's flood assessment of the Oteha Valley Stream catchment identifies building floor flood risks downstream of the Project in the 100 year average recurrence interval (ARI) event. The AC flood assessment predicts that there are currently six residential and four business floors likely to be inundated in the 100 year ARI Maximum Probable Development (MPD) floodplain. There are no predicted increases in peak flood levels due to the Project at these properties in any event up to the 100 year ARI event.

The stormwater management devices proposed as part of the Project aim to reduce the risk of increased flooding on properties outside of the Project area. The design has achieved this except for



several properties at Tait Place that will experience a slight increase of the 10 per cent AEP or the 1 per cent AEP. It is important to note that these properties have been assessed as already being within a flood prone area or are at potential risk of flooding due to their low-lying nature within close proximity to a watercourse or outfall location.

Within the Oteha Valley and Lucas Creek catchments there are approximately nine locations that will experience an increase in peak flood levels of between 10mm to 80mm in the 10 year ARI. A number of these properties include the open channel itself within their property boundary and do not have a building floor which is at risk of flooding.

It is also anticipated that the likelihood of flooding occurring at several sites within this catchment will be reduced as a result of the Project. These properties include:

- Meadowood Reserve (300mm decrease in 2 year ARI, 410mm decrease in 10 year ARI, 460mm decrease in 100 year ARI);
- Upstream of Albany Lakes Reserve (270mm decrease in 10 year ARI, 120mm decrease in 100 year ARI); and
- Rosedale Road/SH1 interchange ponding area (40mm decrease in 2 year ARI, 150mm decrease in 10 year ARI).

There are no properties predicted to receive increases in peak flood levels up to the 100 year ARI event at properties at risk of above floor flooding.

Peak water levels are expected to decrease for several properties along Mills Lane, Gills Road, and Oteha Valley Road.

All of the properties referred to above are already located within existing floodplains. Overall, the proposed stormwater management devices are considered to be appropriate for managing the stormwater runoff from the Project. Of particular note, however, are the significant decreases (of between 40mm and 460mm) that are predicted at several properties (as identified above). Any increases in flooding are to occur at properties that have already been identified as being at risk of flooding.

Overland flow paths have also been assessed to ensure the 100 year ARI peak is safely accommodated with the Project. Where existing stormwater cross-drainage exists under the motorway in areas where widening is proposed, these pipelines are to be extended as necessary.

9.17.1.4 Existing Auckland Council ponds

Three existing stormwater management devices are proposed to be affected by the Project. These include:

- Moro Pond (attenuation only) – live volume is approximately 50m³;
- ARC Refuse Pond (treatment and attenuation) – volume is approximately 1,600m³ and live volume is 3,400m³; and
- Constellation Pond (attenuation only) – volume is approximately 19,100m³.

Consultation has occurred with AC relating to the replacement of these ponds which currently accommodate stormwater runoff from residential and commercial properties outside the Project area. Where these ponds are to be filled in or altered, their loss in treatment and attenuation performance is to be compensated for in the stormwater treatment devices or they will be replaced as part of the Project.

9.17.2 Mitigation

The effects of stormwater discharges from the Project during the operational phase will be mitigated by the treatment devices that are proposed as part of the design. The BPO approach has been used



to determine the most appropriate treatment devices for the Project design, in accordance with the assessment criteria set out in the AUP. The merits of each treatment device are discussed in detail within the Assessment of Stormwater Management.

9.17.2.1 Stormwater quality

Planted wetlands are proposed as the primary treatment and flow management solution for the Project and have been sized to treat the 90th percentile event. Wetlands are favoured as BPO over stormwater ponds due to their increased filtering and biological treatment performance. Constructed wetlands are also the stormwater management device preferred by AC, the NZ Transport Agency and Mana Whenua. **Figure 50** below shows the proposed stormwater devices which will treat and convey stormwater from the existing and proposed State highway (HUR) within the Project area.

The majority of additional impervious areas identified as HURs have been treated to the levels set out in the standards in Chapter E9 of the AUP. This includes:

- Treating all stormwater runoff from the impervious areas by stormwater management devices; and
- Designing all stormwater management devices in accordance with TP10 or are designed to achieve an equivalent level of performance to TP10.

The overall treatment level of 75% TSS removal is achieved for 99% of HUR impervious areas along the Project corridor. However, it is important to note that this has not been achieved solely for the new impervious areas. There are areas of the existing corridor that currently does not receive any treatment. As a result of the Project, the vast majority of HUR within the Project area will gain treatment to the required current standard.

The stormwater management devices included to treat stormwater runoff from HURs are designed in accordance with the standards in TP10. This will ensure that any adverse effects from contaminants in runoff from the majority of the HURs and other impervious surfaces will be treated to minimise any adverse environmental effects on the quality of receiving waters and the wider environment. Therefore no additional mitigation is required.

Engineered planted swales are the desired informal pre-treatment solution for the Project. These have been proposed in locations where the inclusion of swales does not impact the designation boundary by requiring additional land. Two dedicated treatment swales have been provided in accordance with TP10 in locations where wetlands cannot be located (SW-SER-1, 160m and SW-C2PM-1, 230m shown in Figure 9 of the Assessment of Stormwater Management). Swales generally convey runoff and provide informal pre-treatment, and eliminate the impacts and costs associated with piping runoff over the same distance. Therefore informal pre-treatment planted swales have been provided where there is sufficient width within the designation footprint.

As detailed in the Assessment of Stormwater Management, the effects on hydrology and the hydrological cycle within the downstream freshwater environment of the catchments are appropriately mitigated by the proposed treatment devices.

9.17.2.2 Stormwater quantity – Flow

The Project incorporates detention devices in accordance with the criteria set out within Chapter E10 of the AUP (SMAF controls), including providing detention for the 95th and 90th percentile runoff volumes. Discharges from new impervious areas and any existing impervious areas that discharge to the same network point are to be in accordance with the hydrology mitigation requirements. Retention of collected stormwater is not required due to soil infiltration rate expected to be less than 2mm/hr (approximately 0.004mm/hr) and there is no opportunity to reuse the runoff on-site.

New culverts are proposed in addition to the existing culverts to convey the flow of stormwater where necessary. In addition, a number of extensions are necessary to existing culverts due to the widening of the motorway.



All proposed pipe outfalls to the receiving environment will contain erosion protection measures (rip-rap aprons and basins designed to accommodate for the 100 year ARI event). Existing outfalls for the Project are generally able to be retained without the need for modification due to there being no changes to existing peak flow rates and existing outfall structure being considered to be in good working order. The channel downstream of OF12 has been identified as being vulnerable to further erosion during future extreme storm events and discussions are currently occurring with AC regarding rock armouring and lining the channel bend outside of the Project.

9.17.2.3 Stormwater quantity - Flooding

The Project manages existing flood risk from the motorway by increasing the size of the existing culvert at the Caribbean Drive intersection with SH18 and replacing the existing naturally occurring watercourse (overland flow path) along SH18 with a concrete channel of the same capacity, but with increased velocity mitigated by outfall protection.

Stormwater management devices have been incorporated into the design of the Project to minimise (and where possible decrease) flooding on properties in addition to providing treatment.

The capacities of existing culverts are considered to be acceptable and therefore no mitigation or upgrades are required for those culverts being retained as enlarging them may lead to increased downstream flooding. In the event any culverts are found to be in poor condition as identified by CCTV and physical survey during the detailed design phase, they are to be replaced or repaired without being upsized. This will ensure that the downstream environment is not adversely affected.

9.17.2.4 Existing Auckland Council ponds

Due to locational requirements of the Project, three AC ponds within the Project area are to be removed. In order to mitigate the effects from their removal, the hydraulic performance of the stormwater system upstream and downstream of these three ponds is to be replicated via the proposed new stormwater wetlands and devices to minimise the effects to the receiving environment and the RWWTP ponds.

9.17.3 Summary

The proposed stormwater management system for the Project addresses both quality and quantity and has been selected using a BPO approach. The proposed stormwater devices include a combination of planted swales and wetlands, dry ponds, wet ponds and AC approved proprietary treatment devices.

The Project results in an overall increase in the volume of stormwater runoff generated during rainfall events in the Oteha and Lucas Creek catchments due to the increase in impervious areas. Unmitigated, the increase in runoff volume has the potential to increase downstream peak discharges during flood events, causing stream erosion and increased flood water levels.

As a result of the stormwater management controls proposed for the Project, the assessment in the Assessment of Stormwater Management shows that predicted increased flood levels will be no more than minor for nine identified properties and will decrease for a number of properties previously identified on flood maps and reporting as being at risk of flooding. The devices are also expected to result in a water quality improvement over the current situation.

The implementation of the proposed stormwater system design and consent conditions will ensure potential adverse effects associated with the Project are mitigated. Overall, the Project is expected to result in an improved situation with respect to stormwater quality over that which currently exists. A net benefit in terms of potential stormwater quality will result.



9.18 Effects of Encroachment on Rosedale Closed Landfill

Elements of the Project will encroach into the Rosedale Closed Landfill (an Auckland Council asset). An assessment of the Project works which encroach into the Rosedale Closed Landfill has been prepared by Riley Consultants Ltd. The Assessment of Effects – Corridor Encroachment on Rosedale Landfill is contained in **Technical Assessment 7**.

The Busway and SUP elements of the Project will encroach into the Rosedale Closed Landfill along the entire length of the site's western boundary (a length of approximately 475m). The proposed works may encroach up to 250m into the Rosedale Closed Landfill refuse mass itself. This will result in effects on some of the existing landfill infrastructure, particularly along the western edge of the Rosedale Closed Landfill where a series of gas pipes, leachate pipes, bores, manholes, and outlet pipes are located. There is also infrastructure related to the compliance monitoring network (subject to resource consents held by AC). An important consideration, discussed with AC, is the requirement for much of the landfill infrastructure needing to remain operational during the landfill aftercare phase and beyond (i.e. 30 to 50 years).

As noted in the Assessment of Effects – Corridor Encroachment on Rosedale Landfill, refuse within the western part of the Rosedale Closed Landfill adjacent to the Project works is likely to have been in place for at least 30 years. As such, it is expected that this area will have a lower gas generation potential. However, there is some more recent refuse in the north-western section of the Rosedale Closed Landfill where parts of the Project works including the SUP and the Busway are proposed.

The Landfill Reinstatement Concept, which has been the subject of detailed discussions with AC and ongoing refinement, aims to:

- Minimise excavation into refuse;
- ensure the removal of refuse from within/below the Busway and SUP alignment;
- provide a new sidewall liner;
- reinstate the affected landfill infrastructure and the landfill monitoring network; and
- Provide a two-tier system for preventing lateral migration of landfill gas.

The Rosedale Closed Landfill owner (AC) holds all consents associated with the on-going discharges to land, air and water. The aftercare management and monitoring of the Rosedale Closed Landfill is the responsibility of AC's CLCLR.

9.18.1 Effects

There will be a number of actual and potential effects associated with Project works encroaching on the landfill infrastructure. These actual and potential effects arise as a result of construction activities and during the operational phase.

9.18.1.1 Temporary effects during construction

Construction activities that require encroachment into the landfill infrastructure will result in potential short-term adverse effects in the vicinity of, and on, the Rosedale Closed Landfill itself. These effects have the potential to be significant if not carefully managed. These potential effects include the discharge of odour, the release of landfill gas, uncovering of hazardous materials, refuse, release of leachate, contaminated runoff, and the effects of the works on the stability of the Rosedale Closed Landfill itself.

The perforation of the existing Rosedale Closed Landfill cap will result in a release of landfill gas and odour into the atmosphere. The effects of odour on off-site receptors are potentially significant, with the nearest residential receptors being 400m to the east of the proposed works and the nearest commercial buildings being approximately 120m away. It is anticipated that carbon dioxide (CO₂) and



methane levels will be elevated at the ground surface. One of the main risks of working within levels of elevated CO₂ and methane is the risk of explosion hazards.

The effects on construction workers encountering hazardous materials or leachate within the refuse as a result of skin contact, ingestion or inhalation during excavation is considered to be a key issue that will require close management. Refuse may contain materials which contain human pathogens which could present a biological hazard to staff. Dust generated from excavations into the Rosedale Closed Landfill may result in adverse health effects due to the potential presence of heavy metals and other contaminants that have the potential to become airborne.

Leachate is currently collected via a leachate collection system and discharged as trade waste to the sewer. Any contaminated runoff from minor seepages through the Rosedale Closed Landfill cover are intercepted via perimeter drains and conveyed to the stormwater pond for treatment prior to discharge. Excavation into the refuse will result in perched leachate being released into the excavated area. Contaminated runoff could be generated from leachate coming into contact with surface water. Any discharges to land are potentially significant as excavated refuse has the potential to cross-contaminate other areas of land if not managed appropriately.

The excavations are likely to intersect zones of perched groundwater between the Rosedale Closed Landfill and the State highway. The majority of perched groundwater in the excavation is to be removed and very low rates of seepage through the cut face are expected during the excavation phase itself. The predicted effects of construction activities on the groundwater system within the Rosedale Closed Landfill are therefore expected to be negligible (refer to Section 7.2.10 of the Assessment of Effects – Corridor Encroachment on Rosedale Landfill).

Due to the nature of the Rosedale Closed Landfill, the effects of works on the stability of the Landfill are assessed as being a potentially significant issue if not managed through careful construction management practices. Instability could result in severe harm to construction workers and discharges to land, air and surface water.

9.18.1.2 Effects during operation

The actual and potential effects following completion of construction (the operational phase) include the potential lateral migration of landfill gas off-site and the associated potential effects on the regional groundwater system and perched groundwater layers.

Following construction and during the operation of the Project, it is also possible that migration pathways could potentially form to the lighting and underground services infrastructure to be installed as part of the Project. The Assessment of Effects – Corridor Encroachment on Rosedale Landfill concludes that the likelihood of such pathways forming is low given the nature of the retaining wall design proposed.

The addition of paved surfaces as a result of the Project will reduce recharge to the regional groundwater table, however due to the increase in impervious coverage being small in comparison to the total catchment, the effects will be negligible. The perched groundwater layer between the Rosedale Closed Landfill and the State highway will be removed as a result of the works and the land above this perched system will be replaced with paved surfaces limiting the likelihood of any notable perched groundwater reform. There are no users of the perched groundwater system at the Rosedale Closed Landfill nor any dependent ecological systems. Consequently, the predicted effects on groundwater once the Project is constructed will be negligible.

Once the design has been constructed and the resultant Rosedale Closed Landfill area capped, Landfill maintenance staff will not need to access the operational Project area with the exception of the area around Pond 7 at the north-western corner of the Rosedale Closed Landfill. This area is isolated from the resulting Rosedale Closed Landfill operational area and the operational Project area. Given



the design which has been developed, maintenance staff exposure to environmental influences following completion of construction/ operation is expected to be minimal. It is expected that normal health and safety procedures will be employed.

9.18.2 Mitigation

Section 8 of the Assessment of Effects – Corridor Encroachment on Rosedale Landfill describes the mitigation measures proposed to address the effects outlined above in both the construction phase and following completion of construction (i.e. the operational phase).

9.18.2.1 Construction effects mitigation

Specific construction management aspects and health and safety issues will be considered and addressed during detailed design and construction of the elements of the Project in the vicinity of the Rosedale Closed Landfill and those aspects associated with the landfill reinstatement works. These include:

- Preparation and certification of Landfill Construction Method Statements (LCMS) for all landfill reinstatement works;
- Preparation and certification of a Landfill Reinstatement Works Plan (LRWP) for the elements of the Project in the vicinity of the Rosedale Closed Landfill to address specific issues principally associated with refuse, leachate, and landfill gas management during construction (including a specific Landfill Health and Safety Plan (LHSP)); and
- Supervision of landfill reinstatement works by appropriately qualified and experienced persons.

Refuse that is required to be removed is to be disposed of at an off-site licenced waste disposal facility. This would be required to occur as soon as possible following excavation (depending on gas levels in the works area). This would include any excavated cover material or undercut material. Exposed refuse is to be managed to minimise potential odour effects. The contractor is to minimise odour by limiting the areas of exposed refuse as far as practicable. Refuse is not to remain on-site for more than eight hours and odour suppressant sprays and heavy tarpaulins shall be available on site and used where necessary to manage the potential odour risk. To further minimise odour effects, works in refuse material are to be closed/covered overnight and excavated refuse is not to be stockpiled on-site overnight.

Safety fences are to be erected around open work areas with health and safety procedures, as set out in the LHSP, to be followed if any refuse is exposed. In the event that material with potentially higher hazard levels than municipal refuse is identified, work is to cease immediately until the hazard has been investigated by a suitably qualified environmental scientist. AC's Resource Consenting and Compliance team is required to be informed immediately if hazardous material is identified.

Leachate that accumulates in excavations will not be suitable for discharge to the stormwater system. All groundwater and surface water that has come into contact with refuse is to be treated as contaminated, and therefore contained, collected, and removed by sucker truck for discharge at a licenced facility or via a trade waste discharge to the sewer.

Site specific measures will be included in the LRWP to control dust emissions during the construction period, particularly the potential effects on on-site and off-site receptors. Dust monitoring will need to include a provision for control of the release of asbestos fibre.

Asbestos management and removal measures will be prepared by the contractor (and included in the LRWP) prior to the disturbance of Rosedale Closed Landfill capping material in order to manage the risks associated with the potential presence of asbestos on the site. The LRWP will detail how the asbestos removal will be carried out (including the method of work used), details of the asbestos to be removed, a detailed description of the asbestos removal work area and air monitoring points, and details of the means of transport and disposal of asbestos waste.



Landfill gas released from the excavation may contain explosive concentrations of methane. In order to minimise the hazard no naked flames or hot work shall occur on-site while intrusive works are being undertaken, or in open excavations. No smoking will be allowed on site. Warning notices are to be posted in appropriate positions along with dry powder chemical or CO₂ type fire extinguishers being available. Continuous gas monitoring shall be undertaken at the ground surface in the intrusive works area during works. If oxygen and methane concentrations in these areas do not comply with the limits set out in the Assessment of Effects – Corridor Encroachment on Rosedale Landfill, works shall cease until such time as the limits are met. If explosive gas levels are found to be regularly in excess of the limits, improved engineering controls are to be employed to minimise the explosion hazard. In particular, the ventilation of confined spaces shall be used to help ensure that landfill gas levels are kept at a non-hazardous level.

As proposed to form part of the LHSP, Personal Protective Equipment is to be worn by all personnel in the works area including chemical resistant gloves and overalls until the refuse is removed. Care is to be exercised when using equipment to avoid the splashing of liquids. If water has ponded in an area it is to be pumped from the site for disposal at an approved facility. Any breaks in skin shall be disinfected immediately and covered.

9.18.2.2 Design to manage longer-term effects

In order to control gas migration within the Rosedale Closed Landfill and minimise the likelihood of gas migrating to the west from the site once reinstated, it is necessary to break the migration pathway between the source and the receptor. This is to be achieved by installing a two-tier gas migration barrier system adjacent to the SUP which consists of a low permeability barrier and a passive venting trench behind the barrier which will intercept landfill gas and leachate from migrating further west. The adoption of this method will ensure that any adverse effects of lateral gas migration during the operation of the Project will be less than minor.

9.18.3 Summary

There are significant risks associated with encroachment by the Project into the Rosedale Closed Landfill during construction with the potential for exposure of construction workers to hazardous materials including asbestos, the release of landfill gas, and effects relating to leachate. However, the adoption of a LRWP, LHSP and LCMS for dust, construction safety, landfill stability, odour, asbestos and gas monitoring will mitigate these risks and ensure there is no discharge of contaminants to stormwater, surface water, or groundwater. Leachate is to either be removed from the site or discharged as trade waste to the sewer. The Assessment of Effects – Corridor Encroachment on Rosedale Landfill concludes that the effects of operation of the Project on the Rosedale Closed Landfill are assessed to be negligible or less than minor with mitigation measures implemented and the implementation of the proposed conditions.

9.19 Surface Water Assessment

An Assessment of Surface Water Quality Effects (**Technical Assessment 12**) has been prepared by Pattle Delamore Partners to establish a baseline of existing surface water quality and flow within the Project area and to undertake an assessment of the effects of the construction and operation activities on surface water quality.

Baseline data was acquired from six sites within the Oteha Valley, Alexandra Stream and Lucas Creek catchments. Results were analysed against AC long term monitoring records, ANZECC (2000) guidelines and typical mature landfill leachate values.

As detailed at Section 7 of the Assessment of Surface Water Quality Effects, elevated values were recorded for zinc and copper, however there were no physical stressors of concern at the monitoring



sites. Water quality data was found to be representative of the existing urbanised stormwater catchments having roads, residential and industrial land use upstream.

The assessment concluded that there is no measureable influence of landfill leachate on the surface waters monitored.

9.19.1 Effects

Temporary effects during construction

Sediment is the key contaminant expected to be discharged to surface water during construction. The assessment of effects assumed that all construction sediment retention ponds would utilise chemical treatment.

AC's 2006 Contaminant Load Model was used to determine the predicted sediment load of discharges. The assessment predicted that the loads discharged to the Alexandra Stream and Lucas Creek will be smaller than those to the Oteha Stream via sites 1 and 2. The smaller area of disturbance within the catchments of Alexandra and Lucas Creeks are also more favourable and reduces the potential for adverse effects. The larger earthworks area within the Oteha Stream catchment contribute to predicted discharges having temporary greater sediment loads than what currently exist.

Effects during operation

Metals are expected to be the key contaminant to be discharged with stormwater during operation. The annual stormwater loads have been estimated for the current level of development within the Project area and compared to the proposed development which includes stormwater treatment detailed within the Assessment of Surface Water Quality Effects. With the proposed stormwater treatment devices installed and maintained, annual loads of TSS, zinc and copper from the Project are predicted to decrease. It is therefore predicted that overall quality of stormwater discharged from the Project area will improve which would contribute to enhancing water quality.

9.19.2 Mitigation

A CESCOP is to be implemented throughout the construction phase of the Project as detailed in the Assessment of Construction Water Management. The CESCOP must require all sediment retention ponds to utilise flocculants, where practical, and incorporate a regime of surface water discharge and freshwater quality monitoring consistent with Section 12 of the Assessment of Surface Water Quality Effects.

To further inform the water quality monitoring with the CESCOP, as outlined in Section 11 of the Assessment of Surface Water Quality Effects, further baseline monitoring is recommended to be undertaken during the summer periods within the Lucas Creek, Alexandra Stream and Oteha Stream catchments for specific parameters.

9.19.3 Summary

With the implementation of the proposed mitigation, the effects of construction on water quality will be no more than minor.

During the operational phase, the proposed stormwater quality treatment of existing impervious areas is predicted to result in loads of key metals to be reduced. This will result in the Project having a net beneficial effect on stormwater quality and the receiving environment.

9.20 Air Quality Effects

An Assessment of Air Quality Effects (**Technical Assessment 1**) has been prepared by Golder Associates Ltd to assess the potential effects on air quality from the construction and operation of the Project. Reference has been made to the Ministry for the Environment (MfE) ambient (outdoor)



NES_{AQ} and to the AUP for the Auckland Ambient Air Quality Standards (AAAQS) in preparing this assessment.

9.20.1 Effects

9.20.1.1 Temporary effects during construction

Section 5 of the Assessment of Air Quality Effects identifies the main discharge into air arising from the proposed construction activities is particulate matter (dust). Combustion emissions from construction vehicles and machinery engine exhausts will also occur.

Construction support areas, haul roads, excavation and backfilling activities are most likely to generate dust. The potential adverse dust impacts of such activities can be exacerbated by weather conditions. Wind can make particulates airborne and carry them beyond the site and dry conditions can provide the potential particulates, particularly along exposed surfaces.

As outlined at Section 5 of the Assessment of Air Quality Effects, health effects are unlikely because fine particles less than 10 microns will constitute only a small fraction of dust emissions. However, if the Project were to be undertaken in an unmanaged or uncontrolled manner, there would be a moderate to high potential for dust to create amenity and nuisance effects and for such effects to be considered objectionable and/or offensive (albeit for a short period of time). Such effects are to a large extent location-specific within the Project area.

9.20.1.2 Effects during operation

A detailed technical assessment of the potential operational effects associated with the Project and network under a range of scenarios is provided at Section 8 of the Assessment of Air Quality Effects. The scenarios calculate ground level concentrations of pollutants discharged from the vehicles that are predicted to utilise the road system.

'With Project' scenarios have been compared with 'without Project' scenarios across a range of timeframes (2015, 2021, and 2031) and relative to current air quality standards.

This assessment shows that none of the relevant air quality standards are likely to be exceeded in any of the scenarios. A comparison of the 2021 'with Project' and 'without Project' scenarios shows that, with the Project being built, the concentration of pollutants at residential receptors is likely to remain at similar levels (Unsworth Heights) or increase slightly (Oteha). Between 2021 and 2031 the effects are likely to decrease over time as the effects of lower vehicle emissions outweigh the effect of increased vehicle numbers.

Section 8.5 of the Assessment of Air Quality Effects assesses the regional air quality effects of the Project. Overall, it is predicted that the Project is likely to result in a small net improvement to regional air quality relative to the Project not being built.

9.20.2 Mitigation

9.20.2.1 Construction effects mitigation

Potential adverse dust effects are responsive to a range of tested management and avoidance techniques that can be applied systematically such that mobilisation can be generally avoided and if not, then minimised. The staging of works can limit the extent of the areas generating potential effects at any one time. If a construction dust management methodology is instituted, potential adverse dust impacts can be avoided such that any resultant potential adverse impact is minor or less than minor.

As outlined at Section 6 of the Assessment of Air Quality Effects, it is recommended that the CEMP include the provision of a Construction Air Quality (Dust) Management Plan (CAQMP). The CAQMP would include measures to (so far as practicable):



- Reduce dust from the Project at any point beyond the designation boundary that borders a highly sensitive receiver;
- Ensure Total Suspended Particulate limits are maintained;
- Describe the works, anticipated processes and duration, and periods of time when dust might arise from construction activities;
- Identify highly sensitive receivers likely to be affected by dust emissions from the Project;
- Mitigate dust that might arise from ground disturbing activities and construction support areas;
- Undertake monitoring and reporting; and
- Communicate with stakeholders and handle complaints.

Note: the proposed conditions of consent refer to this document as a Dust Management Plan.

9.20.2.2 Operational effects mitigation

No mitigation is recommended for operational air quality effects of the Project.

9.20.3 Summary

Overall, with the mitigation proposed during construction, it is assessed that the Project effects on air quality are no more than minor.

9.21 Summary of effects

The Project has the potential to give rise to a range of potential adverse effects and these have been covered in the preceding assessment and in the Technical Assessments in **Volume 3**.

Potential construction noise and vibration is considered to be an effect that, while temporary, could have a significant effect on receivers for short durations. While there is the potential for adverse effects (many of them temporary in nature, particularly when staging is taken into account), a range of monitoring and mitigation measures have been recommended through the proposed conditions to ensure that these potential effects can be avoided, remedied or mitigated. In particular, standard construction mitigation measures will be implemented through a certified CEMP and a range of associated management plans. This will address and seek to avoid or minimise potential construction noise and vibration, traffic, earthworks, contamination, odour, water quality and ecological effects (terrestrial and freshwater).

From an operational perspective, the Project has been designed to ensure that the longer-term visual effects associated with larger structures and the corridor itself are mitigated to the extent practicable, through the requirement to adhere to design principles during detailed design and through planting, flooding effects are largely avoided and the on-going potential effects associated with the discharge of gas, odour and leachate from the Rosedale Closed Landfill are minimised.

The Project will bring significant benefits to the local and wider community through increased efficiency and capacity of the State highway network and Busway in the UHH and Albany area, improved walking and cycling facilities and through facilitating the delivery of improved recreation and reserve facilities for the wider community. Other benefits include improvements in the level of stormwater treatment associated with the increased impervious surface areas, which will greatly exceed the minimum requirements of TP10 and will also significantly improve the runoff quality from those existing today. In particular, proposed new stormwater management wetlands will result in vastly improved outcomes from an ecological habitat perspective to that existing in the Project corridor today.

Overall, while the Project will result in some short term temporary construction related effects, the longer term benefits that the Project will deliver, will result in an overall positive effect.