NZ TRANSPORT AGENCY
WAKA KOTAHI

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Construction Environmental Management Plan

November 2012

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Quality Assurance Statement			
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The draft Construction Environmental Management Plan (CEMP) has been produced in support of the Assessment of Environmental Effects (AEE) for the Main South Road Four Laning & Christchurch Southern Motorway Stage 2 Project. It is contained within volume 4 of the lodgement document, along with the Specialised Environmental Management Plans (SEMP) which are appendices to the CEMP.

This document has been prepared to meet the NZTA minimum requirements for a Contractors Social and Environmental Management Plan as per SM030 minimum standard z/4.

The technical reports produced in support of the AEE form Volume 3 of the lodgement document. Cross-references to the relevant reports and the CEMP itself are provided in the AEE where appropriate. A full list of technical reports is shown in the table below, with links to the relevant sections of the AEE and to any applicable SEMP. For a full understanding of the Project all technical reports need to be read in full along with the AEE itself.

Schedule of Technical Reports for the AEE

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For further information on the structure of the lodgement documentation, refer to the 'Guide to the lodgement documentation' document issued with the AEE.

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F. SEMP 006 Accidental Aquifer Interception Management Plan
G. CEMP Risk Assessment & Risk Register
H. CEMP Construction Programme
I. Accidental Discovery Protocol
J. CEMP Environmental Feedback Form
K. CEMP Environmental Non Conformance Form
L. CEMP Environmental Corrective Actions Log
M. CEMP Environmental Training Form (ETF) Template

List of Abbreviations

Term	
AEE	Assessment of Environmental Effects
CAQMP	Construction Air Quality Management Plan
CCC	Christchurch City Council
CEM	Construction Environmental Manager
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CSM1	Christchurch Southern Motorway Stage 1
CSM2	Christchurch Southern Motorway Stage 2.
EIR	Environmental Incident Register
ECAN	Environment Canterbury
EMS	Environmental Management System
ENCR	Environmental Non Conformance Report
ESCP	Erosion and Sediment Control Plan
FR	Feedback Register
GCS	General Control Statement
HJR	Halswell Junction Road
MSRFL	Main South Road Four Laning
NCR	Non Conformance Report
QMS	Quality Management System
SDC	Selwyn District Council
SEMP	Specialised Environmental Management Plan
SOP	Standard Operating Procedures
SSTMP	Site Specific Traffic Management Plans

1. Part A – Background

This draft Construction Environmental Management Plan (CEMP) details principles, practices and procedures to be implemented by the Christchurch Southern Motorway Stage 2 (CSM2) and Main South Road Four Laning (MSRFL). These principles, practices and procedures are intended to meet the conditions of resource consents and designations, other relevant legislation and the environmental objectives of the NZ Transport Agency (NZTA).

This CEMP has been prepared prior to the appointment of a Principal contractor. The Principal contractor will be required to produce its own Contractors Environmental Management Plan in accordance with the conditions of consent and NZTAs requirements that will build upon and provide more detail to this CEMP.

It should be noted that the requirements of this CEMP do not remove or overwrite the legal duties, responsibilities and obligations of the Principal Contractor and other parties in accordance with contract documents and legislation. If at any time the CEMP conflicts with the contractual and legal obligations for the project in general the Contractor will inform the Engineer to the contract at the earliest opportunity, highlighting the action or area of conflict. Legal obligations shall take precedence in any such instance. Contractual obligations should take precedence over CEMP requirements until such time as the conflict is resolved.

1.1 Scope and Application

This CEMP is the umbrella document for environmental management of the construction phase of the CSM2 and MSRFL Project (the" Project"). It is supported by a range of Specialised Environmental Management Plans (SEMPs) which are attached as appendices to this CEMP.

This CEMP will be reviewed after confirmation of the resource consent and designation conditions, and the document revised in accordance with these conditions. The CEMP and the SEMPs that are included within the Appendices of this CEMP should be updated, with the necessary certification, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the physical environment.

While all sections should be reviewed prior to implementation, sections to be completed or significantly updated prior to works commencement by the Principal contractor, are clearly labelled throughout this Draft CEMP. Where appropriate a section labelled "*CEMP Expectations for the appointed Principal Contractor"* will set out requirements.

1.1.1 Purpose of the CEMP

The purpose of the CEMP is to:

- Specify practicable methods and measures to avoid and mitigate adverse environmental effects arising from construction work.
- Achieve compliance with environmental legislation;
- Meet the expectations of NZTA national policy for environmental protection;

- Adhere to project environmental objectives;
- Provide the Principal Contractor with sufficient information to enable the development of a Contractors Environmental Management Plan, or provide a CEMP for direct adoption and refinement by the appointed Principal Contractor;
- Identify and manage environmental risks associated with the Project; and
- Provide the framework for the Contractor responsible for this CEMP to achieve compliance with the conditions of resource consents and designations.

The CEMP defines details of who, what, where, when and how environmental management and mitigation measures should be implemented.

This CEMP and the SEMPs will require review and amendment during the construction phase of the Project to reflect changes to activities, risks, mitigation measures, responsibilities and management processes. The ability to make changes to the CEMP is an important aspect of continually improving its effectiveness. Modification will be required once the consents and designations are obtained and detailed design and construction methods finalised.

In preparing this CEMP, the following considerations have been factored into the development process for mitigation measures:

- The identified significant environmental issues within the main Assessment of Environmental Effects Report (AEE)[1];
- The extent and duration of the activities (e.g. multiple year construction project);
- The location, and in particular the vicinity to sensitive receiving environments; and
- The principle that environmental management needs to be incorporated into day-to-day operations.

This CEMP has also been structured in accordance with NZTA guidance document[2] and with best practice following a "plan –do –check –review" cycle as established within ASNZS ISO14001:2004[3]. The ISO14001 standard sets out an internationally recognised and adopted framework for an environmental management system that is at the heart of this CEMP.

The CEMP has been divided into four main sections plus Appendices, as follows:

1. *Part A Background* – provides an outline of the CEMP development process and the scope and application of the CEMP, a Project description, a description of the anticipated construction activities and the relevant NZTA Environmental Policy. It also outlines the applicable NZTA environmental objectives and key performance indicators;

2. *Part B Social and Environmental Management* – identifies the significant environmental aspects of the project and identifies the applicable legal requirements.

1 Christchurch Southern Motorway Stage 2 and Main South Road Four Laning Assessment of Effects GHD Ltd 2012

2 Draft guideline for the preparation and implementation of Contractor's Social and Environmental Management Plans, NZTA, August 2011 and NZTA Minimum Standard Z/4 – Contractor's Social and Environmental Management Plan.

3 Environmental management systems — Requirements with guidance for use.

3. *Part C Implementation and operation* – describes the management structure, contractor training expectations, relevant operating procedures and emergency contacts and response plans;

4. *Part D Monitoring and review* – outlines the procedure for compliance monitoring, audit processes, procedures for corrective action and management reviews.

5. *Appendices* – including specific Management Plans for the Project.

1.2 The Project

Before considering environmental issues and construction environmental management it is necessary to outline the main features of the Project.

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

1.2.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.2.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1 (CSM1, currently under construction) at Halswell

Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in each direction, with a median and barrier to separate oncoming traffic and provide for safety.[4] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

1.2.3 Key Design Features

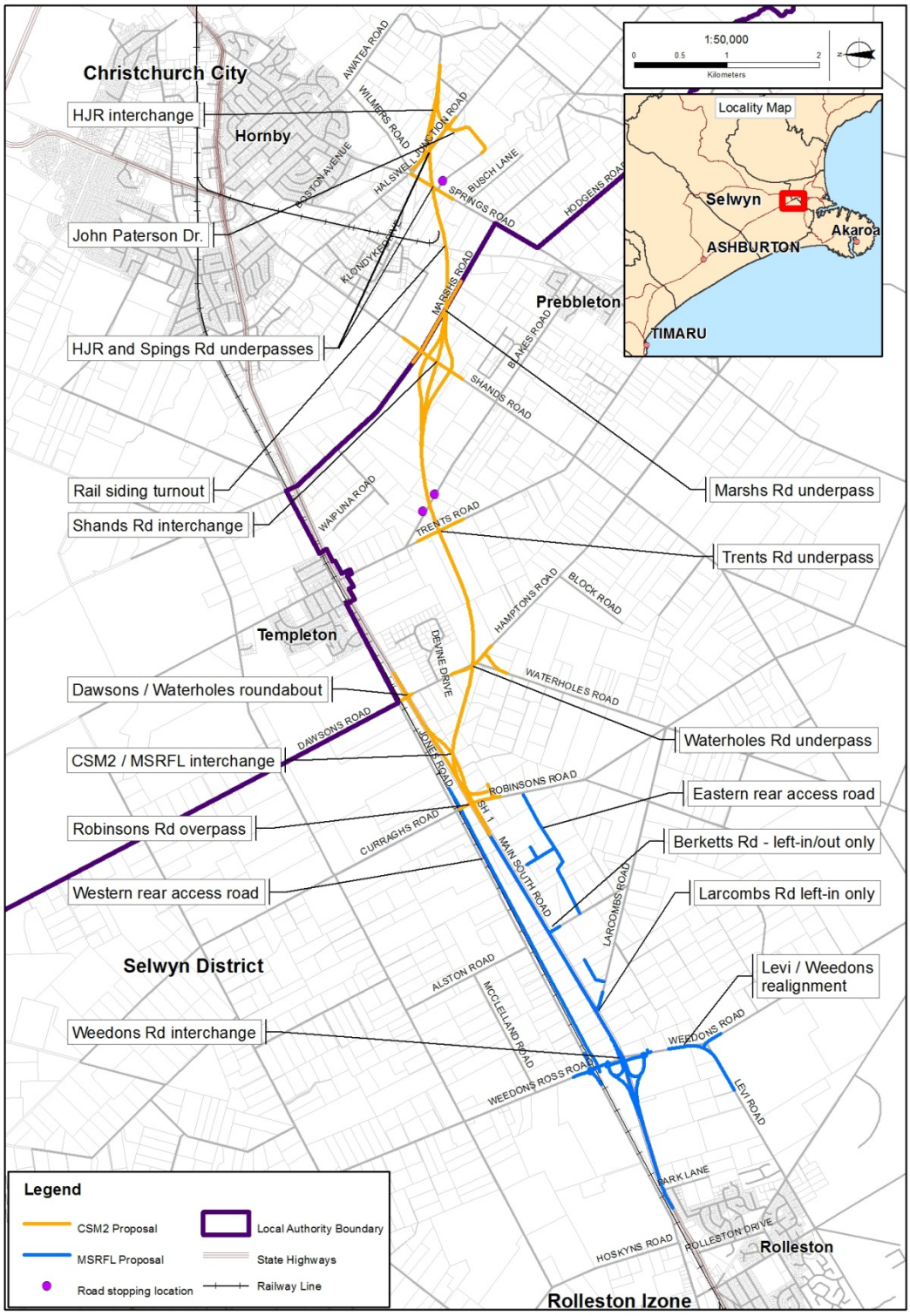
The key design features and changes to the existing road network (from south to north) proposed are:

- a new full grade separated partial cloverleaf interchange at Weedons Road;
- a new roundabout at Weedons Ross / Jones Road;
- a realignment and intersection upgrade at Weedons / Levi Road;
- a new local road running to the immediate east of the rail corridor, to the west of Main South Road, between Weedons Ross Road and Curraghs Road;
- alterations and partial closure of Larcombs Road intersection with Main South Road to left in only;
- alterations to Berketts Road intersection with Main South Road to left in and left out only;
- a new accessway running to the east of Main South Road, between Berketts Road and Robinsons Road;
- an overpass at Robinsons and Curraghs Roads (the local roads will link under the motorway);
- construction of a grade separated y-junction (interchange) with Main South Road near Robinsons Road;
- a link road connecting SH1 with Robinsons Road;
- a short new access road north of Curraghs Road, adjacent to the rail line;
- a new roundabout at SH1 / Dawsons Road / Waterholes Road;
- an underpass at Waterholes Road (the local road will pass over the motorway);
- an underpass at Trents Road (the local road will pass over the motorway);
- the closure of Blakes Road and conversion to two cul-de-sacs where it is severed by CSM2;
- a new full grade separated diamond interchange at Shands Road;
- an underpass at Marshs Road (the local road will pass over the motorway);
- providing a new walking and cycling path linking the Little River Rail Trail at Marshs Road to the shared use path being constructed as part of CSM1;
- an underpass at Springs Road (the local road will pass over the motorway);
- a new grade separated half interchange at Halswell Junction Road with east facing on and off ramps linking Halswell Junction Road to CSM1; and
- closure of John Paterson Drive at Springs Road and eastern extension of John Paterson Drive to connect with the CSM1 off-ramp via Halswell Junction Road roundabout (east of CSM2).

[4] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

The proposed alignment is illustrated in Figure 1and encompasses the MSRFL and CSM2 alignments between Rolleston and Halswell Junction Road.

Figure 1 Location Map of MSRFL and CSM2 Project



1.3 Construction Activities

This section contains a high level summary about the construction activities of the Project. A more detailed construction methodology is provided in Chapter 5 of the AEE and the Design Philosophy Statement (Technical Report 1). The information provided below should be treated as being indicative only. It is intended to provide sufficient detail on the proposed construction activities to assess their potential environmental effects and to identify any necessary measures to avoid, remedy or mitigate those effects, where appropriate.

Detailed work programming will depend on a number of factors, and it is recognised that once the contract for the Project has been awarded and a contractor is in place, the construction methodology will be further refined and developed. This will be undertaken within the scope of the designation and consent conditions which will be in place to manage the environmental effects of the construction activities. Construction management plans will be informed by conditions of the designations and consents to ensure all mitigation measures are implemented as required. Should a contractor wish to undertake construction activities in a manner which is not authorised by the consents held, appropriate authorisations would need to be obtained at that time.

1.3.1 Construction Programme

An outline preliminary construction programme has been developed and is shown in Appendix H. Construction of the Project is likely to take 36–48 months with work undertaken on multiple sites simultaneously at any one time. The outline programme shows enabling works (utilities, property access roads etc.) and site establishment work being undertaken first, followed by local road connections with associated structures and embankments. The CSM2 main alignment will also commence at this time followed by the MSRFL after the rear access roads are complete. Landscaping and installation of roadside infrastructure, including lighting, barriers and signage, will complete the programmed works.

1.3.2 Enabling Works

Prior to the commencement of construction of the main alignment works, it is assumed that some early enabling works will be undertaken, namely:

- relocation of significant existing businesses where required;
- treatment of Transpower's 66 kV transmission lines around Shands Road / Marshs Road intersection;
- modification of Orion utility infrastructure;
- modification of Telstra Clear and Chorus underground fibre optic cables;
- construction of Main South Road rear property access roads and accesses;
- construction of local access road connections and accesses;
- water race diversions/ modifications; and
- construction of Southern Woods Nursery access from Waterholes Road.

Four possible locations for site compounds have been identified at Weedons Road interchange, CSM2/Robinsons Road interchange, and Shands Rd interchange and near Trents Road. Additional smaller satellite compounds may be required by the contractor at each interchange or bridge location.

The main site compound(s) will contain features commonly associated with construction facilities, including temporary site buildings, material laydown areas, workers' office and workshop accommodation, plant and equipment maintenance facilities, refuelling facilities, wheel washing and cleaning facilities, car parking; and plant and equipment storage areas.

1.3.3 Construction vehicle movements

The extent of construction traffic will be dependent on the phase of works. The majority of construction vehicle movements are expected to be to/from quarries located in areas to the west of the airport (north of Main South Road). Construction vehicles will therefore access Main South Road from the north via left turn movements, predominantly from Weedons Road, Dawsons Road or Curraghs Road. Access to the project from the city will be predominantly via Shands Road and Halswell Junction Road. The specific route is dependent on the location of the site works, so other alternatives will be required for some sections.

1.3.4 Materials required for construction

Approximately 1,035,000m^3 of fill will be required for the Project. Some of the fill material required will be sourced from cuts undertaken as part of the Project. The remaining bulk fill material and aggregates required for the Project are expected to be sourced from selected earthquake demolition material, local quarries or rivers (Waimakariri/ Selwyn).

All other common components of the Project will be manufactured off-site and transported in as required, including concrete, pavement surfacing materials, steel, road furniture and stormwater treatment and erosion and sediment control devices.

1.3.5 Earthworks methodology

As the Project will involve reasonably large volumes of earthworks, (generating approximately 405,000m^3 of excavated material and requiring approximately 1,035,000m^3 of fill material) earthworks will need to be carefully carried out. However due to the flat terrain, the effects of the bulk earthworks can be efficiently managed.

Cut slopes will be minimal, generally up to 2.9m in height with shallow cut slopes of 4h:1v. The only exception will be the Robinsons Curraghs link which passes under Main South Road in a 7m deep cutting. Cut material will be excavated mechanically and will be stockpiled or loaded directly onto trucks to be transported for use elsewhere on the Project.

The fill embankment slopes, typically up to 8m in height (but a maximum of 10.5m high), will be formed from materials sourced from cuttings but predominately from imported fill, which is likely to include selected earthquake demolition material.

It is anticipated that there will be approximately 85,000m³ of excavated (cut to waste) material that is deemed unsuitable for construction. For the most part, this material will be disposed of on site, reducing haulage distances.

1.3.6 Bridges and retaining walls

The construction of the nine bridges and associated retaining walls for the interchanges, overpasses and underpasses will be a significant part of the Project. Bridge components such as deck beams (both concrete and steel) will be manufactured in a controlled environment at an off-site facility. Other components will be cast in-situ using local ready mixed concrete providers. Both piled and spread footing bridge foundations will be used, with piles likely be either bored concrete or H-steel sections.

1.3.7 Utilities

There are several utilities that will need relocation, amendment or protection throughout the project. Each utility provider has been consulted to understand the various requirements and limitations in the local area that may impact relocation or protection of the services. These include:

- Transpower's Islington to Springston 66 kV transmission lines to the southwest of the Shands Road and Marshs Road intersection where the alignment falls within the transmission line clearance envelope;
- Orion's overhead electricity supply network;
- Chorus and Telstra Clear telecommunications networks;
- Water supply and wastewater disposal networks;
- Water Races.

The necessary written approvals and agreements to enable the works will need to be obtained at a future stage, where required.

1.3.8 Stormwater

Surface water will be dealt with differently in the MSRFL and CSM2 alignments. Main South Road and the adjacent rail embankment have impediments to overland flows, and they have little stormwater infrastructure in place. The widening of Main South Road will have little impact on the current behaviour of the catchment. Therefore, isolated soak pits in the low lying areas are proposed, with allowances for potential over topping.

For the CSM2 section at low points in the topography of the area, the surface water flood flows will pass underneath the motorway using a series of siphons. Bunds will protect the roadside swales and dispersal points. The additional disposal areas at locations of concentrated overland flows will provide protection to the road against flooding. Stockwater races will be passed under the motorway via a siphon system, typically measuring between 300mm and 450mm.

There are nine existing stockwater races, two along MSRFL and seven along CSM2, noting that a stockwater race runs parallel to MSRFL on the South Eastern side within the road reserve for approximately 2100m. These will be subject to alterations, including crossings under the

alignment, early in the Project. At locations where stockwater races are protected against overland flow, e.g. inside the Marshs Road intersection, a second siphon will be required at a similar diameter to the dry weather flow siphon for maintenance.

1.3.9 Pavement construction

The proposed materials for the CSM2 and MSRFL mainline pavement are an Open Grade Porous Asphalt (OGPA) or stone mastic asphalt (SMA) surfacing over a foamed bitumen stabilised base, which in turn overlays a sub-base. The depth of the sub-base material varies at different locations. The pavement for the local roads has still to be determined; however the surfacing is likely to be chip seal unless required for noise attenuation.

The sub-base and base course granular materials will be imported to site by trucks and laid by a grader and roller compacted to the required levels. The base layer will utilise specialist equipment to modify the material to create the foamed bitumen layer. The asphalt surfacing material will be delivered to site by trucks and laid by a paving machine.

It is likely that one main alignment carriageway will be utilised as a haul route through the site after the sub-base material has been laid. The other carriageway will be completed to seal to enable immediate protection of the pavement layers. Following completion of all earthworks, the haul route will be paved and surfaced.

1.3.10 Water requirements for construction

Water will be required for a number of construction activities, including:

- dust suppression;
- earthworks supply (moisture conditioning for engineered fill construction);
- ground improvements;
- concrete and aggregate production (placement and curing);
- irrigation for landscaping to establish a vegetation cover; and
- vehicle tyre wash to prevent tracking of sediment on roads.

Water will need to be sourced from existing wells or wells which have been relocated. The peak water demand (typically full scale construction occurring during the summer months) has been estimated at 2,500m^3 per day. The volume of water required will be reduced during periods of wet weather. This water needs to be readily available across the construction site.

1.3.11 Erosion and sediment control

Erosion and sediment control will be provided throughout the duration of the construction works and maintenance period to ensure protection of the downstream receiving environment from the adverse effects of sediment from the work area. An Erosion and Sediment Control Plan (ESCP) will be required to be prepared by the Principal Contractor as part of its final CEMP and the requirements for this plan together with proposed mitigation measures is included as SEMP 002 in Appendix 2.

1.3.12 Roadside furniture and Landscaping

Once the main construction activities have been completed it will be necessary to install roadside furniture including lighting, roadside barriers and signage. Landscaping of areas that have been disturbed but are not paved will be carried out and will need to be maintained while plants establish. Further detail can be found in Landscape Management Plan (SEMP 005) in Appendix 5.

1.3.13 Traffic management

Construction of the Project involves road closures, traffic diversions and periods of lowered speed limits on some roads, all of which have the potential to cause inconvenience to road users and residents. A Construction Traffic Management Plan (CTMP) is included as SEMP 004 in Appendix 4 which details traffic management methodologies and mitigation measures to be adopted for the Project during construction.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor is reminded that the preliminary methodology and programme does not remove or overwrite the contractual obligation of the Principal Contractor to programme and determine how the works will be constructed. The main purpose of the illustrative construction methodology and programme is to identify the environmental constraints and responsibilities that the Principal Contractor will need to plan, programme and manage while constructing the works in accordance with the contract documents, designation and resources consent conditions and obligations, other relevant legislation and this CEMP.

The Principal Contractor will be required by the NZTA to submit a methodology and programme to the Engineer to the Contract (and if required the consent authorities) for approval before construction commences. The programme should demonstrate how the requirements of the CEMP have been considered, planned and programmed. The Engineer to the Contract will approve the programme in liaison with the Construction Environmental Manager ensuring environmental constraints and issues are addressed within the programme.

When the construction programme has been finalised it should be referenced to the CEMP, and if required the CEMP should be updated by the Construction Environmental Manager. The timings of the project require that all forward planning should consider the measures contained within the SEMPs, and that the construction programme and replacement SEMPs/method statements should clearly demonstrate how requirements will be met.

1.4 CEMP Policy and Objectives

To ensure that environmental management on this Project aligns with the NZTA's policy framework for environmental management, the Project will be undertaken in accordance with the NZTA Environmental Policy, objectives and key performance indicators.

1.4.1 NZTA Policy

The NZTA has a number of policies governing its operations in accordance with s96 of the Land Transport Management Act 2003 that defines the Agency's operating principles particularly the need to exhibit a sense of social and environmental responsibility (s96(1)(a)). In this regard the NZTA's Environmental and social responsibility policy[5] states:

Section 96(1)(a) of the Land Transport Management Act requires that the NZTA exhibit a sense of social and environmental responsibility. We promote an accessible and safe transport system that contributes positively to New Zealand's economic, social and environmental welfare, and we are committed to acting in an environmentally and socially responsible manner.

We are committed to: protecting and enhancing the natural, cultural and built environment, enhancing the quality of life for New Zealanders by improving community liveability including land transport safety, taking appropriate account of the principles of the Treaty of Waitangi, providing meaningful and transparent engagement with stakeholders, customers and the general public and providing customer focused services that are fair, trusted and efficient.

To implement our policy we will:

- *promote the safe and efficient movement of goods and people in a manner that avoids, to the extent reasonable in the circumstances, adverse environmental and social impacts;*
- *continuously improve performance in the management of environmental and social impacts;*
- *integrate good urban design into all our activities;*
- *work to improve our knowledge and understanding of the extent and condition of New Zealand's environmental and cultural heritage assets;*
- *maintain and improve opportunities for Maori to contribute to our decision-making processes;*
- *actively and meaningfully engage with affected and interested persons and organisations;*
- *identify and comply with all relevant environmental and social legislation and regulations;*
- *seek whole-of-life value for money by taking into account environmental and social costs and benefits when procuring goods and services; and*
- *provide our employees with the skills, awareness and leadership to achieve environmental and social objectives.*

1.4.2 Environmental Objectives

The NZTA adopted the Transit New Zealand (TNZ) Environmental Plan 2008, which outlines key social and environmental impacts that are relevant to the NZTA's activities. Objectives associated

[5] NZTA Statement of Intent 2011-2014 p28

with these impacts are provided and those relevant to construction of CSM2 and MSRFL are described in Table 1 below.

Table 1 Summary of relevant NZTA environmental objectives provided in the NZTA Environmental Plan 2008

Environmental Impact	Relevant Environmental Objective/s
Noise	**N3** Manage construction and maintenance noise to acceptable levels
Air quality	None specifically related to construction activities
Water resources	**W1** Ensure runoff from State Highways complies with RMA requirements **W2** Limit the adverse effects of run-off from state highways on sensitive receiving environments. **W3** Ensure stormwater treatment devices on the network are effective.
Erosion and sediment control	**ES1** Ensure construction and maintenance activities avoid, remedy or mitigate effects of soil erosion, sediment runoff and sediment deposition **ES2** Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular emphasis on high-risk areas **ES3** Use bio-engineering and low-impact design practices where practicable
Social responsibility	None specifically related to construction activities
Culture and heritage	**H1** Proactively limit the disturbance of significant cultural and heritage features along state highways
Ecological resources	**E2** No net loss of native vegetation, wetlands, critical habitat or endangered species **E3** Limit the spread of plant pests
Spill response and contamination	**S1** Design stormwater control and retention devices that can accommodate spills in areas of high environmental risk **S2** Ensure the removal, placement and disposal of contaminated soils is achieved in accordance with the Soil NES
Resource efficiency	None specifically related to construction activities

Environmental Impact	Relevant Environmental Objective/s
Climate change	**C3** Mitigate activities associated with the construction, operation and maintenance of state highways to effect a net reduction of GHG from transport
Visual quality	None specifically related to construction activities
Vibration	**V2** Mitigate vibration where levels are unreasonable and exceed relevant criteria set in New Zealand or internationally accepted thresholds **V3** Avoid or reduce, as far as is practicable, the disturbance to communities from vibration during construction and maintenance

Environmental management methods set out in this CEMP will remain consistent with the NZTA's overall objective, as well as the objectives and policies in the NZTA's Environmental Plan.

2. Part B – Social and Environmental Management

This section outlines significant environmental issues identified in the AEE. It is intended to be used to:

- Outline the existing environment;
- Identify matters to be included in the Specialised Environmental Management Plans (SEMPs) or in General Control Statements (GCS's); and
- Outline any recommendations in technical reports relating to environmental management during the construction phase.

2.1 Environmental Management

2.1.1 Identification

The environmental impacts that are discussed within this CEMP have been derived from three information streams:

1. AEE – The potential environmental impacts for the project have been identified within the Assessment of Environmental Effects (AEE). This document has analysed potential effects and identified the levels of risk and significance for each potential impact as well as identifying measures to avoid, remedy or mitigate adverse effects.
2. NZTA – The NZTA Environmental Plan 2008 set of objectives, (referred to in section 1.4.1 above), are based on known impacts for its road projects. The list of impacts has been based upon NZTA's Social and Environmental Management form[6] but adapted to focus on construction activities associated with the Project. This plan only identifies potential impacts, and does not risk assess for the significance as this has to be done project by project.
3. CEMP as a living process – This CEMP requires the Principal Contractor to review risks and potential impacts that have been identified, which results in an always current understanding of potential impacts upon the environment.

Each of the issues identified as requiring significant controls have been discussed in a SEMP to address risks and set out appropriate management. General Control Statements (GCS) that cover more general matters that do not require specific management plans are also recommended.

2.1.2 SEMPs

The need for SEMPs has been determined by an understanding within the AEE of the:

- Potential construction risks and effects;
- Environmental receptors; and
- Construction activities.

[6] http://www.nzta.govt.nz/resources/state-highway-professional-services-contract-proforma-manual/forms/docs/sm030-psf13-v2-1mar10.pdf

The specialist subject author contributing to the technical reports has been responsible for the development of the appropriate SEMP. The SEMPs can be regarded as plans to either protect the environment or manage a construction activity. In effect they are a combination of impacts and operational management plans. The following outlines the SEMPs that are addressed within this CEMP (refer Appendices A to F of this CEMP).

- SEMP 001 Air Quality Management (Dust)
- SEMP 002 Erosion and Sediment Control
- SEMP 003 Construction Noise and Vibration Management
- SEMP 004 Construction Traffic Management
- SEMP 005 Landscape Management
- SEMP 006 Accidental Aquifer Interception Management

2.1.3 General Control Statements

Below the SEMPs sits another layer of controls termed General Control Statements (GCS). The GCS cover the less significant issues for the Project, could lead to a localised impact on the environment. While a SEMP is a discrete management plan that is complementary to this CEMP, it is also a self-contained document that covers specific issues from the AEE. A GCS is a control statement that is reliant on the CEMP for systems support

It is expected that prior to construction commencing that the Principal Contractor will need to provide evidence to the NZTA that the following matters are covered in its own Environmental processes.

- Hazardous Substances and Spillage Response
- Accidental discovery of contaminants;
- Terrestrial Ecological Protection;
- Construction lighting;
- Utilities management;
- Materials and Waste Management; and
- Good housekeeping (a general statement that covers issues and controls not considered elsewhere).

In addition the contractor will need to provide evidence of its processes in relation to accidental discovery of koiwi, taonga or archaeological material. Specifically an Accidental Discovery Protocol covering NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) is in place to manage any such occurrences while NZTA have also adopted the Ngai Tahu Koiwi Tangata Policy 1993 relating to unknown burials. The NZTA Accidental Discovery Protocol is attached as Appendix I.

2.2 Existing Environment

Prior to considering specific construction impacts it is important to provide the physical context.

The Project is located on the outskirts of Christchurch, within the Canterbury Region. There is a diversity of urban and rural land use within the Project area, ranging from open farmland, rural lifestyle blocks and urban areas. The residential communities in proximity to the alignment extend from south west Christchurch, where Hornby is the dominant commercial centre, to the towns of

Rolleston and Lincoln, including the towns of Templeton and Prebbleton. In the area close to the alignment, there is the rural area of Weedons and recent rural-residential subdivisions at Aberdeen and Claremont.

The environmental baseline is described in the AEE (Section 3) and should be referred to for a more in-depth description of the existing environment. The following table provides an outline of the existing environment assessed for each of the specialist technical reports. The respective report should be referred to for further and more detailed information.

Table 2 Existing environment

Feature	Description	AEE technical specialist report
Air Quality	The easternmost end of CSM2 between Halswell Junction Road and Springs Road is situated within the Christchurch Clean Air Zone 2 as identified in the Canterbury NRRP, although this is not a gazetted airshed, in terms of the National Environmental Standards for Air Quality. The remainder of the Project is outside of the clean air zones. There are a number of sensitive receptors within the project area, namely residential houses within 200m of the proposed CSM2 and MSRFL alignments.	Technical Report No. 10

Feature	Description	AEE technical specialist report
Terrestrial Ecology	The project is located within pastoral farmland on the south west outskirts of Christchurch in an area of the Canterbury Plains that has been largely cleared of indigenous vegetation cover. Land Environments of New Zealand (LENZ) classifies the land traversed by the proposed motorway into three acutely threatened land environments, I3.2b, J2.1b and N1.1a being flat plains differentiated according to soil drainage and fertility and the parent material. The Project area contains no land administered by the Department of Conservation or any designated areas of natural significance. An ecological heritage site exists on the corner of Wilmers and Springs Road where an area of semi-natural *Danthonia* grassland exists and a RAP encompassing an area of flax and swamp kiokio (*Blechnum minus*) by a water race adjacent to Marshs Road. Both these areas lie outside the designation and will not be affected by the Project. As a result of investigations carried out to date there is a high likelihood of populations of indigenous lizards that may be disturbed by construction activities.	Technical Report No. 18
Aquatic Ecology	The majority of habitats in the South-West are highly modified and show evidence of degradation by existing land uses. Indigenous vegetation is fragmented and reduced to remnant patches. The study area contains no natural waterways or wetlands but does contain a number of manmade water races of limited ecological value. There are no sites of conservation significance such as ecological heritage sites, Recommended Areas for Protection (RAPs) or significant natural areas within the motorway footprint.	Technical Report No. 17

Feature	Description	AEE technical specialist report
Noise and Vibration	The dominant noise source affecting the ambient noise environment at dwellings close to the roads within the Project area is traffic. The majority of dwellings within the noise assessment area are accessed directly from, or are in close proximity to existing roads, namely Springs Road, Shands Road and Main South Road. Ambient noise levels at these locations are primarily affected by traffic flow and by local obstacles such as perimeter fences and other dwellings. Dwellings in these locations are in both the Rural 2 and Inner Plains zones under the Christchurch City Plan and Selwyn District Plan respectively.	Technical Reports No. 8 and 9
Land use, Topography and Landscape	Land use in the surrounding area is predominantly rural and semi-rural, with a mixture of dairy farming, horticulture, cropping, lifestyle blocks and agricultural activities, with the exception of the eastern end of the alignment and the northern side of Main South Road, where some industrial land use exists. The landscape along the proposed alignment is characterised by flat alluvial plains, and the overall setting is rural characterised by open space and dominated by pasture and shelterbelt vegetation.	Technical Reports No. 4, 5, 6, and 7
Geology	The Project area is covered by river alluvium soils of Yaldhurst and Halkett Members in the Springston Formation of the Holocene age. Historical use of underlying loess soils in the CSM2 section for horticulture and agricultural activities have potentially influenced the composition of these soils.	Technical Report No. 11
Hydrology	The Project area consists of a network of water races which are owned and operated by Selwyn District Council. The majority of the catchment subject to the proposed Project does not directly contribute to any natural watercourse (stream).	Technical Report No. 3
Traffic and Transport	The traffic and transport network within the Project area has been described and assessed for the existing road network, public transport, cycle and pedestrian routes and railway infrastructure.	Technical Report No. 2

Feature	Description	AEE technical specialist report
Groundwater	The regional groundwater depth is in the order of 12 to 20 m below ground level towards Rolleston, becoming gradually shallower with proximity to the city and measuring 3 to 5 m below ground level at the Springs Road junction. The gradient is generally towards the south east, reflecting the same gradient as ground levels across the same area. No artesian water was encountered during project investigations.	Technical Report No. 11
Ground Contamination	No contamination issues were identified within the designation of the alignment. Contaminated soils outside of the designated alignment were encountered at the former Southbridge Branch Rail Line and former gravel pit north of the alignment near Springs Road. The north east corner of Main South Road and Curraghs Road is recorded on the Canterbury Regional Council (ECan) Listed Land Use Register (LLUR) as a landfill site (site no. 3789).	Technical Report No. 16
Archaeology, Culture and Heritage	There are two recorded archaeological sites of Māori origin in the general vicinity of the Project area, both of which were middens/ovens. These indicate that Māori people were passing through this area, possibly on their way to Banks Peninsula or Lake Ellesmere where important resources were present. There is little evidence to suggest there were any settlements in the area.	Technical Reports No. 12 and 15
Social	The social assessment area was defined as extending from southwest Christchurch city, where Hornby is the dominant commercial centre, to the towns of Rolleston and Lincoln, and including the towns of Templeton and Prebbleton. It also considers construction effects.	Technical Report No. 13
Economic	The economic assessment considers the economic effects and benefits of the Project on community economic wellbeing within the Project area including during construction.	Technical Report No. 14

2.3 Project Construction Environmental Issues

Based on the understanding of the construction programme and the understanding of the local environment (from the Assessment of Environmental Effects) the environmental issues are discussed and potential mitigation measures are outlined.

The following sections identify project related potential impacts, the guidance for the management of the impacts and the project issues that need to be considered in the management of the impacts. Thereafter each section concludes with a reference to either a SEMP or a possible GCS, and sets out the expectations for the appointed Principal Contractor.

2.3.1 Air quality management (SEMP 001)

Potential Impacts

The construction of the Project will entail relatively large scale earthworks. Exposed earthworks can be a significant source of dust which can affect human health and plant life along the edge of the earthworks area, can be a nuisance to the surrounding public, and can contribute to sediment loads by dust depositing in areas without sediment control measures. Sediments deposited on sealed public roads can also result in a dust nuisance. Rainfall, water evaporation, and wind speed, are meteorological conditions having the greatest effect on dust mobilisation.

The following are potential sources of dust and other air contaminant discharges associated with the construction phase of the project.

- dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions;
- excavation and disturbance of dry material;
- loading and unloading of dusty materials to and from trucks;
- smoke and odour from diesel-engine machinery and truck exhausts; and
- stockpiling of materials including material placement and removal.

Project-Specific Issues and Requirements

The most effective way to control construction dust is through good on-site management. Mitigation measures include:

- wind break fencing;
- dust suppression – through the use of using water sprinkler systems during dry conditions;
- semi-permanent working areas and construction site access roads should be constructed with an appropriate base, kept metalled, and kept damp.
- managing the extent of earthworks especially during dry conditions;
- excavated areas should be watered as necessary, or preferably stabilised e.g. through metaling, grassing or mulching;
- stockpile dampening and covering;
- minimising stockpile drop heights;
- plant and vehicle maintenance and management –
- managing vehicle and tyre wash-down areas to avid dust nuisance

- setting vehicle speed limits;
- minimising and managing material spills.

All construction activities should follow the guidance set out in SEMP 001 Construction Air Quality (Dust) is contained within Appendix A while chapter 18.5 of the AEE also contains a detailed list of the proposed mitigation measures to be adopted for this Project.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in SEMP 001 Air Quality Management Plan within Appendix A of this CEMP of this CEMP should be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.2 Erosion and Sediment Control (SEMP 002)

Potential Impacts

The scale of the Project means that a relatively large area of land will be disturbed. Erosion and sediment control will need to be provided throughout the duration of the construction works and maintenance period to ensure protection of the downstream receiving environment from the adverse effects of sediment from the work area. As much of the receiving environment is groundwater, the protection of the groundwater aquifer is also required.

Project-Specific Issues and Requirements

Key issues which will require addressing include:

- control of stormwater and isolating runoff from the stock-water network;
- separating clean from dirty water;
- protecting adjacent landowners from surface flows;
- minimise sediment leaving the site; and
- disposal to land.

One of the key mitigation measures is sediment retention ponds, where the number, sizing and location of sediment retention ponds will be relative to the size of the land area subject to. Where higher sediment loads are expected (typically in larger catchments and/or on steeper cut slopes) the effectiveness of ponds will be increased through the addition of a chemical flocculation agent. This causes sediment to bind together and hence fall out of suspension.

More detail regarding erosion and sediment control measures for the Project is set out in Appendix B of the CEMP, which contains the Draft Erosion and Sediment Control Plan for key sectors of the Project and section 19.5 of the AEE.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations out in SEMP 002 within Appendix B of this CEMP should be followed and where necessary be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

Erosion and sediment control should be provided by the Principal Contractor throughout the duration of the construction works and maintenance period to ensure protection of the downstream receiving environment from the adverse effects of sediment from the work area.

The Erosion and Sediment Control Guidelines document prepared by ECan should be used as the principal basis for the formation of an Erosion and Sediment Control Plan. The NZTA Erosion and Sediment Control Standard for State Highway Infrastructure should be used in order to reinforce best industry practice.

2.3.3 Construction Noise and Vibration (SEMP 003)

Potential Impacts

The construction of the Project will require the use of large mobile mechanical equipment and processes that are likely to generate elevated levels of noise at the nearest residences. As such, there are likely to be some significant temporary noise effects through the construction phase.

Construction noise is expected from the following activities.

- Enabling Works using heavy machinery e.g. excavators, compactors, rollers;
- Topsoil Stripping through the use of motor scrapers;
- General Earthworks (Main Alignment and Bridges) utilising heavy machinery e.g. excavators, compactors, spreaders;
- Ground Improvements utilising vibratory construction techniques and most piling activities using rollers/compactors and boring concrete piles.
- Bridge Construction abutment preparation using driven steel piles or auger piles.
- Installation of precast bridge structures.
- Pavement Construction where there is likely to be multiple items operating simultaneously.

Sources of vibration identified as being most likely to cause building damage are vibratory rollers and piling. Other construction machinery and activities such as truck movements and excavators will also produce ground vibration. Prior experience has shown that these activities can give rise to adverse effects (particularly adverse human response).

Project-Specific Issues and Requirements

Construction noise effects are assessed in relation to the recognised construction noise standard NZS 6803:1999, which contains recommended noise criteria that are considered appropriate and applicable to noise from construction operations.

The Standard provides for higher noise levels during normal working hours for construction noise received in residential areas in order to enable normal construction activity to take place. For commercial and industrial areas, higher noise criteria are allowed during night-time when it is less likely that people or business activity will be affected by construction noise.

The AEE (section 17.6- 17.9) outlines general and specific mitigation measures. These include

- The restriction in the use of heavy machinery outside of specified working hours for enabling works, topsoil stripping, general earthworks, ground improvements, bridge construction and pavement construction.
- Site specific measures relating to the proximity of sensitive receivers including temporary noise barriers.
- General good practice techniques including training of personnel, maintenance of equipment, equipment enclosures to attenuate noise at source, selection of low noise plant and avoiding night time activities;
- Temporary relocation of residents (only where absolutely necessary); and
- Consultation and communication with sensitive receivers.
- The most effective way to control construction noise and vibration is through good on-site management, with measures to be implemented through the CNVMP.

In relation to vibration, for crucial activities, such as vibratory compacting and piling where large vibration energy is typically produced, test measurements of the initial works are recommended. As the number of on-site measurements increases, the models can be refined to allow more accurate prediction of the subsequent construction stages and improved controls can be achieved.

More detail regarding noise and vibration control measures for the Project is set out in Appendix C of the CEMP, which contains the Draft Construction Noise and Vibration Management Plan for key sectors of the Project.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in SEMP 003 Construction Noise and Vibration Management Plan within Appendix C of this CEMP should be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.4 Traffic management (SEMP 004)

Potential Impacts

Temporary traffic management for the construction of the Project will be required. The potential impacts identified include:

- the need to minimise disruption on State highways and local roads as far as is practicable and maintain existing flows and travel times;
- the desirability of minimising the number of construction vehicle trips and their effects on local roads and seek to avoid residential areas where practicable;

- the need to minimise the effects of construction vehicle parking;
- the importance of providing for effective communication and the gathering of feedback from key affected parties; and
- providing a safe environment for the general public and construction staff during construction.

Project-Specific Issues and Requirements

There are several aspects to this and Site Specific Traffic Management Plans (SSTMP's) will be required to be implemented. These are included in Technical Report 2 and in SEMP 004 and are summarised below.

Co-ordination of Traffic Management – An overarching construction sequencing plan will be required that identifies the various activities that will take place and when. The outline details of the temporary traffic management will be included in the construction sequencing plan in order to identify the potential cumulative traffic effects associated with several construction locations being active at the same time. The aim of the sequencing plan will be to avoid and/ or mitigate significant traffic effects arising from multiple activities that individually result in only marginal effects.

Traffic Effects – Whilst increased traffic congestion is to be anticipated with the majority of temporary traffic management measures can be put in place to minimise disruption to the greatest extent possible. This applies to traffic on a given route and traffic on diversion routes. Alternative methodologies may need to be considered or mitigation measures to minimise the effects, such as:

- undertaking works at times of low traffic flow (school holidays or night works);
- advanced communication of the works to pre-warn the public or enable them to think of alternative routes.

Site Access – The site accesses will need to be considered and will need to operate in a safe manner that does not cause undue disruption to general traffic flows. The SSTMPs will need to consider the following with regard to site accesses:

- signage to identify the accesses for delivery vehicles and suppliers;
- permitted vehicles (trucks / articulated trucks / cars) and permitted uses (visitors / deliveries / staff);
- permitted movements and / or movement restrictions e.g. left in / left out;
- pedestrian, cycle and public safety;
- deceleration and acceleration requirements to minimise traffic disruption and provide for safe access/ egress.

Diversions – Road closures are anticipated to be required on some of the local roads to enable the construction of structures. These closures and the proposed diversion routes would be discussed with the Road Controlling Authorities prior to implementation. The diversion routes would utilise arterial roads and avoid residential areas where possible.

Property Access – Measures to minimise the effects on property access (including turning restrictions) and on-site parking / manoeuvring are included in SEMP 005. Consultation will need

to be undertaken with affected property owners where they are affected to identify the impact on their access, duration and date of work. All reasonable steps to maintain property access or a satisfactory alternative route will be implemented.

Passenger Transport – All practical steps will need to be taken to minimise any effects of the on passenger transport services. Consultation will need to be undertaken early in the construction planning stage to identify the potential passenger transport effects. This consultation will include:

- Environment Canterbury
- Christchurch City Council
- Selwyn District Council
- Passenger Transport Operators
- Ministry of Education (with regard to school bus services).

Walking and Cycling – Pedestrian and cycle requirements (including the mobility impaired) will need to be considered and the likely effects identified. Suitable alternative access will be incorporated which may include the following:

- temporary access in accordance with recognised standards;
- temporary diversions or routes;
- safety fencing and protection barriers from traffic;
- temporary bridges across uneven surfaces.

Long-term closures or diversions will be discussed and agreed with the appropriate Road Controlling Authority. More detail regarding construction traffic control measures for the Project is set out in Appendix D of the CEMP, which contains the Draft Construction Traffic Management Plan. Construction Traffic Management is also considered in chapter 11.7 of the AEE.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in SEMP 004 Construction Traffic Management Plan within Appendix D of this CEMP should be followed and where necessary be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager. The Principal Contractor should provide information regarding anticipated site compounds and lay down points, and traffic management plans or method statements for effective traffic management.

2.3.5 Landscape (SEMP 005)

Potential Impacts

Temporary landscape and visual effects will result from construction of the project. The visual effects of removal of existing vegetation may also have short term effects in particularly sensitive locations. Soil exposed by earthworks can have visual effects depending on the length of time it is exposed. The location of vehicle accesses and the location of stockpiles of excavated material or hardfill can also have adverse visual effects.

Project-Specific Issues and Requirements

The approach to landscape management should take into account the following:

- preserving and complimenting the existing landscape and rural qualities that characterise the receiving environment, through retaining existing vegetation where possible and replicating existing landscape / planting patterns;
- protecting valued view shafts such as views to the Port Hills and Canterbury Foothills by retaining and or providing gaps in existing and proposed vegetation;
- identifying areas where plantings are required for visual screening and improving amenity. The visual screening will be located to control headlight glare, "back dropping" curves and intersections and obscuring views of the motorway from adjoining residential properties;
- the provision of screen planting to ensure a high quality experience for users of the motorway;
- choosing plant species to reflect the local landscape character;
- the selection of native and exotic plant species that are appropriate to and will thrive in the local environment;
- the development of a visual theme to promote consistency and continuity with CSM1 and other local sections of SH1; and
- earth mounding as enhancement for a length of 700 m to the south of the proposed alignment, between Trents Road and Shands Road. These mounds will be approximately 2m high gently contoured features with areas of landscape planting (trees) to provide visual amenity to neighbouring properties and motorway users.
- specific riparian planting adjoining Stockwater races affected by the Project.

More detail regarding landscaping measures for the Project is set out in Appendix E of the CEMP, which contains the Draft Landscape Management Plan.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in the SEMP 005 Landscape Management Plan within Appendix E of this CEMP should be followed and where necessary be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.6 Ecological management (freshwater, terrestrial)

Potential Impacts

Freshwater – There are no natural watercourses throughout the project length however there are a number of stock water races that maintain aquatic habitats. Potential adverse effects on aquatic ecology during construction relate to potential sedimentation and contamination of water races and habitat disturbance.

Terrestrial – Adverse effects on terrestrial ecology will be most pronounced during construction when sections of shelterbelt, stands of trees and areas of pasture are removed. The two potential direct impacts on terrestrial ecology are the loss of habitat through clearance and earthworks; and disturbance, displacement, injury and mortality of birds and lizards.

The effect of vegetation removal on indigenous fauna arising from the loss of those habitats has been considered as no more than minor due to the similarity of nearby habitats and wide ecological tolerances and adaptability of the affected indigenous bird species. However the protection of lizards in the project area has been identified as having particular importance.

Project-Specific Issues and Requirements

Freshwater – There is the potential for long term positive effects to be realised through riparian enhancement of realigned and other existing water races within the project area and improved water quality through stormwater treatment. In addition, culverts will be designed to ensure the provision of fish passage or where the proposal involves long sections of piping, fish screens will be included to prevent entry and stranding of fish. In addition management of sediment (SEMP 002) and landscaping (SEMP 005) will assist in maintaining and enhancing the aquatic environment.

Terrestrial – The Project presents an opportunity to enhance the ecological value of the affected and surrounding land, which is highly modified and contains little in the way of naturally occurring indigenous vegetation. The proposed landscape measures will also mitigate the adverse effects of the Project resulting from habitat loss and disturbance.

Extensive landscape mitigation measures are proposed as part of the Project. These incorporate a large component of totara/matai forest and shrubland plantings that in combination with mixed indigenous/exotic woodland plantings this will significantly enhance ecological values within a highly modified landscape. Low plantings of appropriate species proposed along sections of stock water races will improve the habitat value of the riparian margins and their connectivity at a landscape scale. A GCS concerning Terrestrial Ecological Protection is recommended to be developed that sets out an approach to manage terrestrial features such as existing vegetation that is to remain within the Project area from any construction activities undertaken. The procedure shall also include an approach to minimise introduction and colonisation of pest species.

The landscaping also provides the ability to accommodate boulder fields and boulder strips that can include appropriate planting to mitigate against any habitat loss as a result of the development. The incorporation of boulder fields will be confirmed upon the outcome of the lizard survey which is currently being undertaken.

CEMP Expectations for the appointed Principal Contractor

The SEMPs for Erosion & Sediment Control (SEMP 002 within Appendix B of this CEMP) and the Landscape Management Plan (SEMP 005 within Appendix E of this CEMP), should be followed and where necessary be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager. A General Control Statement for Terrestrial Ecological Protection should also be developed.

2.3.7 Groundwater management

Potential Impacts

Existing groundwater levels have been a key influence in the design of the Project, as it has dictated the vertical level for the road and preventing the placement of the Project into a cutting. While groundwater levels can change over time, the risk of groundwater inundation is considered to be low given the dispersed nature of the disposal system, meaning that failure of any individual soakage device is unlikely to cause inundation of the road.

In general terms the groundwater is currently at sufficient depth not to impact on the construction of the Project. It is not envisaged that large scale dewatering systems will be required during the construction phase, although some localised dewatering during deeper trenching or excavations may be needed on a site by site basis. There is however a possibility that during construction groundwater will be encountered.

Project-Specific Issues and Requirements

The proposed stormwater treatment measures and implementation of the CEMP will avoid contamination of the Christchurch Groundwater Protection Zone. However ECan have advised that during a recent subdivision near to the project that groundwater was encountered and that there needs to be a process for capping and confining any springs or other groundwater encountered. In response to this a specific and targeted management plan has been developed entitled "Accidental Aquifer Interception Management Plan" (SEMP 006). This outlines practices to be undertaken should the aquifer be accidentally intercepted during construction including methods to cap and confine groundwater encountered.

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in the Accidental Aquifer Interception Management Plan (SEMP 006 within Appendix F of this CEMP), of this CEMP should be followed and where necessary be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.8 Hydrology & Stock race management

Potential Impacts

The key stormwater issues are the collection and disposal of stormwater generated within the Project, the passage of stock-water race flows beneath the Project and the passage of overland flows generated in the upstream catchment beneath the Project.

The majority of the catchment crossed by the Project does not directly contribute to any natural watercourse. Surface water typically ponds in local depressions on the catchment surface and soaks to land or evaporates. In larger events overland flows have the potential to flow along surface flow paths. These overland flow paths are often intercepted by field drains, irrigation channels and the existing stock-water race network, which either eventually discharges to the Halswell River or discharges to land via engineered soak pits.

Nine stockwater races cross the current project alignment. Many or all of these races are piped under the existing SH1 and local road network. Some of the races are in pipes at grade, with the balance depressed under the carriageway in pipes but using the (inverted) siphon principle.

Stockwater races perform a land drainage function during heavy rainfall events. During or prior to such events, the upstream stock water race intakes are closed or shut off. SDC advises that runoff can exceed water race capacity and some localised flooding does occur. Stockwater races in some cases need either to be closed or realigned and this is discussed in Technical Report 3. The key potential issues are:

- ensuring that the stockwater races can still fulfil their land drainage and stockwater functions;
- that construction of closed or realigned stockwater races is carried out without sediment entering the system and limited effect on aquatic ecosystems;
- that riparian landscaping occurs that will enhance aquatic ecosystems; and
- that users of the stockwater races have the ability to comment.

Project-Specific Issues and Requirements

Technical Report 3 and Chapter 19 of the AEE outline the four key stormwater issues which need to be addressed with the proposed infrastructure:

- collection and disposal of stormwater generated within the Project;
- passage of stock-water race flows (both wet and dry weather) beneath the Project; and
- passage of overland flows generated in the upstream catchment beneath the Project.
- adaptation and integration of installed detention and collection systems (e.g. as a part of CSM1).

In terms of stockwater a series of proposed siphons will be used to convey stock-water races from one side of the MSRFL and CSM2 alignments to the other. A second parallel pipe has been proposed to maintain the land drainage function of the races and to prevent flooding immediately upstream of the crossing points.

A shallow earth 'spillway' is proposed near the crest of the existing water race to allow the activation of the second, normally dry pipe. Thus after a significant rainfall event has passed the secondary siphon pipe will drain to a short soakage trench and drain away leaving a dry pipe.

Closure of stock-water races is proposed in a limited number of locations. Given the likelihood of penetrating the porous subsoil layers the races may have to be lined to prevent water loss. In addition riparian landscaping is proposed as part of the Landscape Management Plan (SEMP 005) while sediment potentially entering the system will need to be managed in accordance with an approved Erosion and Sediment Control Management Plan (SEMP 002).

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in SEMP 002 Erosion and Sediment Control Plan (within Appendix B of this CEMP) and SEMP 005 Landscape Management Plan (within Appendix E) should be reviewed and updated once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.9 Construction Lighting

Potential Impacts

Lighting from construction activities can have an adverse effect on amenity through glare and light spill, if it is not appropriately managed particularly for sensitive receivers close to the alignment.

Project-Specific Issues and Requirements

Construction lighting is temporary in nature. Management of any lighting effects and the avoidance of any glare or light spill will be a matter of good practice. Any potential adverse effects will need to be mitigated through a GCS produced by the contractor that will contain the following mitigation measures in respect to lighting:

- careful location of site offices and equipment in relation to any nearby residential or sensitive areas; and
- use of lighting fixtures that do not produce spill glare or upward light above the relevant standards.

In addition it will be important to have a feedback process to manage any concerns that there may be. This is covered in detail in Chapter 3 below.

CEMP Expectations for the appointed Principal Contractor

Once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager a GCS on construction lighting should be developed and implemented.

2.3.10 Hazardous substances and spill response management

Potential Impacts

The management of any hazardous substances by a contractor is a key factor as unintentional discharges can have an effect on land or potentially the water resource. It will be important that measures are in place to avoid unintentional discharges. However based on the experience of constructing CSM1, it is expected that less than 5000 litres of hazardous substances (primarily diesel) will be stored on site at any one time during construction.

Project-Specific Issues and Requirements

There are a number of relevant conditions in the Natural Resources Regional Plan (NRRP) and the Proposed Land and Water Regional Plan (PLWRP). These include hazardous substance design, containment, management and certification along with location restrictions including not within 20m of a bore, not within a flood area or within 100m of an active fault if it has been assessed that these can be met. There are no known faults at ground surface or mapped within the project area, and any areas identified as being prone to flooding can be avoided.

However measures to be considered include bunding or metalling surface storage areas, providing spill response procedures, spill kits and factors such as no refuelling within 50 metres of any watercourses including stockwater races. Even though the storage of hazardous substances will be low in volume the NZTA is seeking consent for the use and storage of hazardous substances due to the PLWP limitation of 2000 litres stored at any one time. In any event management of any hazardous substances and the avoidance of any spills will be a matter of good practice.

CEMP Expectations for the appointed Principal Contractor

A GCS Hazardous Substances and Spillage Response Plan should be developed once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.11 Soil Contamination Discovery

Potential Impacts

Soil Contamination investigations have been undertaken along and adjacent to the proposed CSM2 and MSRFL alignment. The results of this investigation conclude that contaminants do not exceed relevant standards (see Technical Report 16 and Chapter 22 of the AEE). Remedial action resulting from soil contaminant concentrations is therefore not required.

Even though a soil contamination assessment has been completed for the alignment, it is possible that unexpected contamination is encountered during the construction phase of the project, and this soil will need to be managed in an appropriate manner.

Project-Specific Issues and Requirements

An outline of recommended steps to be taken if contaminated soil is discovered during the construction phase is provided below. Actual contingency action will be site specific and dependant on the extent and nature of the discovered contamination.

Contaminant indicators in soil may include:

- Visual (buried refuse, metal objects, building material, soil or water staining/bleaching or discolouration),
- Olfactory (fuel, sulphurous, rotting vegetation or sewage)
- Auditory (gas leaks, flowing or dripping liquid).
- Fibrous cement based board materials may contain asbestos.

If any such indicator is observed during earthworks, the following steps should be taken:

- Cease all work within a 20 m radius and make the work safe;
- If possible contain any contaminant dispersion and shut off/divert any water flow; and
- Advise the Site Manager

The construction manager shall assess the site. If the assessment concludes that confirmation of contamination is required, the Site Manager shall:

- Control the site: install temporary fencing, temporary cover, silt traps and bunding as required around the exclusion zone;
- Notify the project manager that contamination has been discovered;
- Small volumes of excavated soil shall be contained in covered skips to control leachate formation from rainfall;
- If this is not possible, larger volumes should be covered and bunded to manage storm water; and
- Dispose of any pooled rainwater to an appropriately licensed treatment facility and must not be discharged to the construction storm water system.

The construction manager representative shall:

- Notify NZTA that suspected contamination has been discovered and contingency action is being taken;
- If landfill gas or leachate breakout is suspected, arrange for an immediate field investigations and recapping of the affected area to contain the discharge;
- Direct appropriately trained and qualified personnel to collect samples for laboratory analyses using appropriate procedures;
- If fibrous cement based board materials are encountered, direct appropriately trained personnel to collect samples for analytical testing to confirm/disprove the presence of asbestos.
- Arrange the analysis of soil and/or water samples by an IANZ accredited laboratory;
- Assess the results against the National Environmental Standard for Assessing and Managing contaminants in Soil to Protect Human Health, January 2012 and relevant risk based environmental acceptance criteria where appropriate;
- Advise should be sought from an appropriately qualified contaminated land practitioner on suitable course of action for the contaminated soil and/or water, and any specific health and safety precautions that may need to be taken to minimise risk to construction workers / and or general public;
- Where friable asbestos containing materials are confirmed in the soil matrix, all works (including the excavation and disposal of affected materials) shall be undertaken in accordance with the Health and Safety in Employment (Asbestos) Regulations 1998, and the Department of Labour Guidelines for the Management and Removal of Asbestos (Revised) 1999;
- Any material requiring offsite disposal must be disposed of at facilities consented to accept contaminated material;
- Maintain a register of any contaminated material discovered, including location, type, quantity and disposal record (landfill receipts and waste manifest).

CEMP Expectations for the appointed Principal Contractor

A GCS Soil Contamination Discovery Plan should be developed once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager.

2.3.12 Materials and waste management

Potential Impacts

The NZTA has policies around reducing waste to the greatest extent as efficient use of resources is both environmentally and financially beneficial. In addition inefficient use of raw materials, leaks from liquid stores, ground and controlled water contamination from materials stores, contamination from spills while handling wastes, litter blow, associated presence of pests (flies, rodents and birds), and propagating non-native invasive species are also significant issues to be managed

Project-Specific Issues and Requirements

A GCS has been developed concerning waste management that sets out an approach to manage waste production and disposal within the Project area from any construction activities undertaken. The procedure also includes an approach to minimise introduction of waste to the environment within and surrounding the Project area.

CEMP Expectations for the appointed Principal Contractor

Once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager a GCS on waste management should be developed and implemented.

2.3.13 Utilities

Potential Impacts

The Project directly affects a number of network utilities, including electricity transmission and distribution lines, telecommunications, water supply, wastewater and stormwater disposal utilities, stock water races and also the rail network. Ensuring that disruptions to service supply are kept to a minimum are critical as any outage or loss of levels of service can have a direct impact upon public health, safety or user convenience.

Project-Specific Issues and Requirements

NZTA has consulted with network utility operators to identify network utilities that will be directly affected and how they can be protected and /or how relocation can be appropriately undertaken. The outcomes of these initial discussions concluded that all adverse effects on network utilities directly affected by the Project will be able to be appropriately avoided, remedied or mitigated.

Enabling works will be required prior to construction, in particular rectifying the clearance violation under the existing electricity transmission lines and the relocation of electricity distribution lines. Construction activities may impact on existing network utilities as a result of dust affecting electricity and rail infrastructure operations and sediment entering stock water races. These effects will need to be mitigated through the processes in the CEMP or in SEMPS relating in particular to dust (SEMP 001) or Erosion and Sediment Control SEMP 002).

Protection and/or relocation of existing utilities will occur in conjunction with the Project's construction and be appropriately planned for during detailed design. The appointed contractor will need to work closely with the relevant network utilities owner's contractor to undertake the necessary protection and/or relocation works to ensure effects on these networks are avoided or mitigated.

CEMP Expectations for the appointed Principal Contractor

Once a detailed construction programme and build methodology has been agreed with the NZTA by the Principal Contractor and the Construction Environmental Manager a GCS on utilities management and allied communication processes should be developed and implemented.

2.3.14 Archaeology and Artefacts

Potential Impacts

There are no recorded archaeological sites within the Project area although there is potential that finds may be accidentally encountered. Without due care, destruction or damage to finds may result.

Project-Specific Issues and Requirements

Consent conditions proposed record a process if burials, taonga or other finds are encountered. Specifically an Accidental Discovery Protocol covering NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) is in place to manage any such occurrences while NZTA have also adopted the Ngai Tahu Koiwi Tangata Policy 1993 relating to unknown burials. This is attached as Appendix J. The contractor should ensure that the NZTAs Policy and the Ngai Tahu Koiwi Tangata Policy 1993 is followed

CEMP Expectations for the appointed Principal Contractor

The guidance and expectations set out in the Accidental Discovery Protocol (Appendix J) covering NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) Ngai Tahu Koiwi Tangata Policy 1993 relating to unknown burials should be followed.

2.4 Legislative and other requirements

The legislative requirements in relation to the CEMP need to be identified in order for them to be managed. The legislative requirements to consider, but not limited to are:

- Resource consents and associated conditions;
- Designations and associated conditions;
- Department of Conservation concessions;
- Historic Places Trust archaeological authorities;
- Building consents;
- Permitted activities in the regional/district plans;
- Regional strategies e.g. Pest Management Strategies; and

- Wildlife Act 1953 permits.

2.4.1 Project Approval Process

The NZTA is seeking all necessary Resource Management Act approvals to construct, operate and maintain the State Highway and local road works required for the Project. This includes Notices of Requirement for new and altered designations within the Christchurch City and Selwyn District Plans. The Notice of Requirement applications also incorporate sufficient detail to satisfy Outline Plan requirements, in accordance with Section 176A(2)(b) of the RMA. Furthermore, all regional resource consents for the construction and operation of the road and associated drainage infrastructure are being sought.

2.4.2 National Legal Requirements and Policies

As outlined in the NZTA Environmental Plan 2008, the Land Transport Management Act 2003 (LTMA), New Zealand Transport Strategy (NZTS) and Resource Management Act 1991 (RMA) are the primary enabling legislation for environmental management of NZTA activities. These mandate sustainable management with the expectation that the NZTA "exhibits a sense of social and environmental responsibility" in meeting the statutory objective of operating a state highway network that contributes to an integrated, safe, responsive and sustainable land transport system. Other relevant legislation, regulations and standards, which have either direct or indirect bearing on the CEMP include:

- Conservation Act 1987;
- Energy Efficiency & Conservation Act 2000;
- Historic Places Act 1993;
- Local Government Act 2002;
- Government Roading Powers Act 1989;
- Public Works Act 1981;
- Reserves Act 1977;
- Hazardous Substances and New Organisms Act 1996;
- Dangerous Goods Act, 1974 and Regulations;
- Protected Objects Act 1975 for the relevant archaeological and heritage standards/practices;
- Wildlife Act 1953;
- National Environmental Standard – Air Quality 2004;
- National Environmental Standard for assessing and managing contaminants in soil to protect human health 2011; and
- National Policy Statement for freshwater management 2011.

2.4.3 The NZTA Consent Compliance Management System

CS-VUE™ is a legal compliance system adopted by the NZTA to manage environmental statutory requirements. It is the NZTA's contractual requirement that CS-VUE™ is used to track and record the compliance of the following legal obligations;

- resource consents,
- designation conditions,

- Department of Conservation concessions,
- Historic Places Trust authorities, and
- Any other agreements or obligations which have compliance conditions.

CS-VUE™ is a secure database which matches each consent and condition of (or other legal obligation) with a consent manager and condition manger and automatically sends an email notifying them of compliance requirements. The consent manager is the NZTA project manager who is responsible for overseeing consent compliance management, and the condition manager is the project MSQA consultant who is responsible for ensuring day-to-day compliance.

Evidence to demonstrate compliance is entered in CS-VUE™ with all entries/changes annotated with the person's name and date who undertook the changes. Post-construction, the responsibility of any conditions which have on-going maintenance and operational requirements will be transferred to the NZTA Asset Manager.

2.5 Environmental Risk Register

An Environmental Risk Register shall be prepared and should be periodically updated by the appointed Principal Contractor and Construction Environmental Manager. As a starting point for the Risk Register the AEE development process and the conditions attached to consents and approvals shall be utilised. The Risk Register shall set out the risks and links to the appropriate section of a GCS or SEMP, which stipulate the required mitigation should it be required.

The Environmental Risk Register, to be populated and maintained by the Principal Contractor, is a tool for the identification, prioritisation and management of activities that have the potential to impact on the environment. As part of this update process the Principal Contractor is expected to use a recognised Risk Assessment methodology for consensus agreement with the NZTA. The risk assessment process shall define a process of identifying significant risks. These risks are then entered into the Risk Register.

The Environmental Risk Register will allow the Principal Contractor to search and sort on activities, locations, environmental aspects, and risk ratings, and provide a quick reference to the mitigation measures and controls that are in place to manage the significant impacts.

The Construction Environmental Manager will also be required to maintain the Environmental Risk Register. The risk assessment results will need to be reviewed at regular intervals and repeated at critical times within the Project. Triggers for this review and update include:

- NZTA instruction;
- Before commencement of construction (once detailed programme and methodologies are understood);
- When there is a new or changed activity, equipment or location of activities;
- When there is a change to legislative or consent and designation requirements; and
- As a result of a significant environmental incident or non-compliance.

The Register will be reviewed and updated on a quarterly basis in the event that none of the preceding activities have already triggered a review.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall develop, implement and maintain the environmental risk register throughout the duration of the CSM2 construction phase. A risk assessment procedure is required to be submitted to NZTA to demonstrate that risks are being identified throughout the construction phase.

3. Part C – Implementation and Operation

This section of the CEMP addresses the implementation and operation of the CEMP and the SEMPs.

3.1 CEMP Management Structure and Responsibility

The following areas are covered in this section:

- CEMP Management Structure and Responsibility;
- Training;
- Operating Procedures inclusive of mitigation measures;
- Emergency Contacts and Response; and
- Feedback Management.

3.1.1 CEMP Roles

Table 3 outlines expected environmental anticipated management roles on site. Each contractor will likely have its own management structure and will need to provide a description of roles and responsibilities to NZTA upon contract award.

Table 3 Management roles and responsibilities

Position	Name	Company	Responsibility
NZTA Project Manager	TBC	NZTA or delegate	• Overall responsibility for the project
Engineer to the Contract	TBC	Consultant	• Overall responsibility for civil engineering/ construction activities • Responsibility for implementation of the CEMP • Administration of the contract to NZS 3910
Principal Contractor Project Manager	TBC	TBC	• Contractor representative with overall responsibility for the Project • Compliance and updating of the CEMP • Successful delivery of the Project

Position	Name	Company	Responsibility
Resident Engineer	TBC	TBC	• Support the Project Manager • Successful delivery of the Project
Construction Environmental Manager (CEM) (or equivalent)	TBC	Contractor	• Environmental induction and training of personnel including subcontractors and visitors • Responding to incidents and providing feedback to interested or affected parties. • Environmental Reporting • Maintaining CEMP • Compliance with CEMP, aspect management plans and consent conditions • Liaison with Regional and District Councils and other regulatory authorities

CEMP Expectations for the appointed Principal Contractor

Table 3 should be reviewed and completed upon appointment of the Principal contractor. An organisational chart should also be included in this CEMP by the Construction Environmental Manager. This organisation chart should show the relationships and connections for the positions identified in Table 3.

The defined roles and responsibilities and the chart do not remove or overwrite the legal duties, responsibilities and obligations of the Principal Contractor in accordance with the contract documents and legislation.

3.2 Training

The Policy and Objectives of this CEMP will only be met successfully when all those responsible for its implementation and review are thoroughly conversant with its content, interpretation and performance measurement. The NZTA is committed to providing training for its site workforce and putting in place contractual arrangements with the Principal Contractor that stipulate the need for adequate training to be provided to all contracted members of the workforce.

Staff involved in environmental monitoring required by any resource consent conditions and by the requirements identified within this CEMP will be trained and competent in the operation, calibration and maintenance of the equipment. Sampling staff will also be trained and competent in sample collection, handling, storage and transport methodologies and techniques. Records of staff training will be auditable and available for inspection, on request.

3.2.1 CEMP Training

All Project employees and subcontractors are to be inducted and given appropriate environmental awareness training. The training is to be relevant to their different roles to ensure that they are aware of:

- The importance of conformance with the environmental policy and procedures and with the requirements of this CEMP;
- The actual and potential environmental impacts of their work activities and the environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the environmental policy and this CEMP; and
- The potential consequences of departure from specified operating procedures.

The Project specific site environmental induction will include an overview of resource consent conditions, designation conditions, permitted activity standards, environmental control procedures and the SEMPs. Specific individuals with environmental responsibilities may require the following training:

- Emergency response training;
- Spill kit training;
- Environmental auditing; and
- Sampling and Monitoring.

All environmental training records are to be held at the Project Construction Office. The Construction Environmental Manager will have responsibility for maintaining and updating these records.

As a requirement of each training session a record should be completed with the date of the training exercise, a description of the training content, the name of the trainer and trainee(s), and the signature of the trainer and relevant manager. See Appendix M for an example training schedule that can be used. Conversely, the Principal Contractor may use its own format if available.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall develop, implement and maintain training systems that meet the requirements of this CEMP. These training systems shall be discussed and if so required submitted to the NZTA for review and agreement prior to construction start.

In particular the Principal Contractor shall submit to the NZTA prior to the commencement of operations, a procedure for Environmental Training and Awareness, which identifies and addresses all training requirements. The training should address the specific requirements of this CEMP and the identified environmental risks as set out in the risk register. Environmental performance relies

to a great extent on the general awareness of environmental issues of all personnel involved in the project. Training and awareness tools and indicators could include, but not be restricted to:

- Professional or trade qualifications;
- Experience;
- On the job training;
- Training and Awareness literature e.g. posters and leaflets.
- Formal skill training;
- Inductions;
- Tool box talks; and

3.3 Operating Procedures

This CEMP contains a series of instructions and expectations that need to be followed in order to successfully satisfy the Policy and objectives of this CEMP.

The instructions given within this CEMP control situations where the absence could lead to a deviation away from environmental legal requirements, NZTA objectives and relevant policies, plans, standards, specifications and guidelines that this CEMP abides by.

The NZTA has a series of Standard Operating Procedures (SOP) that all contractors have to abide by. These will be provided to the Principal Contractor upon award of the contract and includes those identified in the Social and Environmental Assessment section of the PSF13. This includes *Minimum Standard Z/22 Accidental Discovery Procedures.*

CEMP Expectations for the appointed Principal Contractor

Operating procedures need to be established and documented to control situations where the absence could lead to a deviation away from the NZTA Environmental & Social responsibility Policy, Environmental Objectives and/or Legislative Requirements.

It is expected that the Principal Contractor should develop and implement a series of Standard Operating Procedures (SOP) in order to facilitated CEMP adoption and implementation prior to construction start. These SOP shall be agreed upon with the NZTA.

3.4 Emergency Contacts and Response

There is the potential for unforeseen events to occur that may impact on the environment that will require emergency response. The following sections detail how environmental incidents or emergencies are to be managed by the Contractor.

3.4.1 Incident/Emergency Management

An environmental incident is an occurrence which has (or potentially could have had) a negative or 'adverse' effect on the environment. An adverse effect is something that causes (or could have caused) environmental harm. An environmental incident can also be a deviation from this CEMP.

This means there has been a failure to follow the established process or procedures that help the Project achieve best practice (e.g. failure to report a spill).

Environmental incidents include but are not restricted to:

- Unforeseen impact on areas of high environmental value such as protected flora or fauna, archaeology;
- Environment Canterbury non-compliances (for example relating to erosion and sediment control);
- Significant (large volume) chemical / oil spill to a waterway or land;
- Hazardous substance release to air; and
- Other consent or designation non-compliances.

An environmental emergency is an event which has a detrimental effect on the surrounding environment. A detrimental environmental effect is something that causes significant harm to the environment, which is not legally allowed and requires immediate response or a failure to follow the established process or procedures that help the Contractor achieve best practice.Table 4 below outlines key contacts in case of an environmental emergency.

Table 4 Environmental Emergency Contacts

Name	Role	Contact phone number	Contact email
TBC	Construction Environmental Manager		
TBC	Superintendent		
TBC	Principal Contractor Project Manager		
TBC	Project Manager		
TBC	Other relevant personnel as appropriate.		
New Zealand Fire Service/Police		111	
Environment Canterbury		0800 324 636 (0800 EC INFO)	
24 Hour pollution hotline		0800 76 55 88 or (03) 366-4663	
Selwyn District Council contact	TBC		

Name	Role	Contact phone number	Contact email
Christchurch City Council contact	TBC		
Spill equipment stockist	TBC		

The Construction Environmental Manager should devise the emergency response procedures for the approval of the NZTA Project Manager.

3.4.2 Environmental Incident reporting

Where there is an environmental incident an Environmental Non Compliance Report (ENCR) should be completed by the Principal Contractor (or representative) and submitted for review to the NZTA by the CEM. An indicative ENCR is attached for use in Appendix K, but the Principal Contractor may use any similar incident reporting form.

All environmental incidents occurring at the site during the project will be added to an Environmental Incident Register (EIR). The Construction Environmental Manager will be responsible for ensuring all data from completed ENCRs are included in the EIR as soon as practicable.

Discussion of the EIR will be an agenda item for all Project Management Team meetings. These meetings will review incidents that have occurred, suitability of response and preventative measures that have been put in place, as well as any patterns that may emerge over time and how these should be managed to avoid future incidents.

3.4.3 Location and Use of Emergency Management Equipment

Emergency response and management equipment shall be made available at all times during construction activities. All site staff and subcontractors shall be made aware of the location of this equipment as part of the induction process and as part of refresher toolbox talks (when deemed appropriate by the CEM or after an incident has occurred).

A site plan showing the location of spill kits and other emergency management equipment within the site compounds and at intervals along the route shall be prepared.

All staff and subcontractors shall be trained and made aware of their responsibilities in emergency response situations. The training shall include, but not be limited to, education regarding the environmental consequences of emergency situations and in the use of equipment and in the procedures of the CEMP.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall develop and implement an emergency response plan prior to construction start. This emergency response plan should detail

- *How to raise the alarm, and to assess and respond to possible pollution incidents through immediate environmental damage limitation action following the "source-pathway-receptor" model (reduce/eliminate the source of contamination- prevent the contaminant moving through the pathway and protect receptor);*
- *Identifying and nominating personnel with suitable training, knowledge and experience, for an emergency response team, and determining their responsibilities and lines of communication;*
- *Notification of and liaison with external parties such as emergency services, statutory consultees/undertakers, local authorities and local community;*
- *Location plan of emergency response equipment;*
- *Arrangements for rehearsal;*
- *Training of staff in emergency response and the use of emergency response equipment; and*
- *A system to identify and document training and awareness needs and attendance.*

The plan should be agreed upon with the NZTA prior to construction start.

4. Part D – Monitoring and Review

In order to ensure that legal requirements, NZTA objectives and relevant policies, standards and guidelines are being complied with, on-going evaluation of environmental performance is required. Monitoring will be undertaken to check that the activity specific controls have been implemented and to identify any potential or actual problems and rectify them.

Environmental monitoring will include both scheduled (regular) monitoring and triggered (response) monitoring. As the focus of this CEMP is to anticipate and prevent adverse environmental effects associated with the construction works, monitoring is crucial. The main focus of this monitoring will be field checks of the environmental controls or measures to reduce the risk of failure and thereby any adverse environmental impacts.

4.1 Compliance Monitoring

Scheduled monitoring of environmental performance and compliance with resource consents and designations is required throughout the construction phase of the Project. This enables the effectiveness of the environmental controls to be determined and allows areas of noncompliance to be identified so that corrective actions can be taken.

Environmental monitoring will take place:

- Prior to construction to establish the baseline;
- During construction to assess the impact of the construction on the environment; and
- After construction to assess the impact of the completed Project.

Environmental monitoring is required at various stages of construction for each environmental aspect as developed in SEMPs and required by consent conditions. The overall monitoring schedule, including environmental aspects (i.e. noise, water quality, air quality etc), frequency and monitoring requirements should be updated by the Principal Contractor. The monitoring schedule is intended as a working document and will be amended and updated to reflect resource consent and designation conditions and management review changes.

Environmental monitoring will be undertaken according to the following:

- The CEM is responsible for managing the environmental monitoring programmes relevant to the site activities and location, and arranging training and specialist consultants for the monitoring as required;
- Monitoring will be conducted in accordance with the approved methods stated in the resource consent and designation conditions, or as otherwise agreed by relevant authorities;
- Monitoring results exceeding relevant standards and resource consent and designation conditions will be managed as per the Corrective Actions process and issued with a Non Compliance Report;
- The CEM will advise the Project Manager of any noncompliance found during monitoring and will report these to relevant authorities as required;

- Where required by consent conditions, environmental monitoring results will be inputted by the Project Consultant to NZTA's CS-VUE database for the project. This will be overviewed on a regular basis by the Contractor's Project Manager; and
- Environmental monitoring results will be reported to the relevant authorities as required.

Should inspections indicate that the environmental controls are not functioning as intended, the Construction Environmental Manager and Principal Contractors Project Manager or Engineer will instigate a review of the CEMP or relevant aspect environmental management plans as required. Specific response targets will be developed by the Construction Environmental Manager prior to construction commencing.

As part of the commitment to CEMP environmental performance evaluation, Environmental Compliance with all applicable legislation forms part of the CEMP audit process. Routine compliance audits are provisioned in order to assess on-going performance and compliance.

4.1.1 General Site Monitoring

In addition to formal environmental monitoring, the following general site monitoring will be undertaken:

- Daily – Environmental team will conduct inspections (including all subcontractor activities), and issues will be noted. These inspections are informal visual inspections in order to check compliance with this CEMP;
- Daily – checking of weather forecast and on-site weather conditions and any pre and post storm inspections as required;
- Inspections as required by environmental control procedures e.g. sediment control devices inspected daily to ensure that they are installed correctly, operating effectively and are properly maintained;
- Weekly – Formal site inspections are to be completed by the Construction Environmental Manager. Site specific checklists will be developed to check compliance with resource consent and designation conditions and this CEMP. Issues will be noted if they present significant environmental risks (e.g. noisy works, works near waterways, sediment basin maintenance etc); and
- Monthly – The NZTA's Project Manager, and CEM will undertake a monthly site inspection, to confirm the environmental monitoring programmes and work procedures containing environmental controls are being implemented in accordance with the CEMP, Operational Work Programme and resource consent and designation conditions.

Triggered inspections will be undertaken in response to the following:

- Feedback – upon receiving feedback on any issue, an inspection of the area affected or involved will be undertaken;
- Extreme weather – site control measures will be inspected immediately before, during and after extreme weather for any non-compliance with resource consent conditions; and
- Non-compliance – inspections will be undertaken immediately following spills or other incidents or emergencies and after "near miss" events.

The findings of these triggered inspections need to be recorded. The CEM will submit a site inspection and environmental performance report to the Contractor's Project Manager at the

monthly management meeting. The Principal Contractor Project Manager will report to the NZTA Project Manager. The report will include, but not be limited to, a summary of environmental issues and actions during the month to ensure compliance with this CEMP including any details of any action item requests, feedback received, incidents, associated investigations and corrective actions, and environmental inductions and awareness training provided.

Sampling protocols, equipment and calibration

As part of the sampling and monitoring requirements there is a need for the use of sampling equipment to obtain compliance and surveillance data; regardless who performs these task (specialist subcontractor/consultant or Principal contractor staff). The CEM shall make sure that staff are appropriately qualified and trained and the equipment is appropriate for the task and calibrated.

Table 5 sets out requirements for the maintenance and use of sampling equipment that could be used for the collection of compliance data i.e. Noise, pH Probe etc.

Table 5 Equipment Calibration and Maintenance

Tasks	Monitoring	Performance Criteria	Corrective Action
Calibrate and maintain equipment used in environmental monitoring	Construction Environmental Manager to inspect records to establish regular maintenance and calibration programme	• Calibration and maintenance records	Prohibit use faulty or un-calibrated equipment
Sampling, calibration and maintenance undertaken by Competent person	Construction Environmental Manager to inspect training records to establish staff competence	• Observation of calibration and maintenance procedures to supplier/ manufacturers guidelines • Laboratory sample control documents	Provision of adequate training/ instruction

4.1.2 Monitoring Data Review

The CEM and Principal Contractor Project Manager will review the daily inspection forms on a weekly basis to confirm that the checks and subsequent required works are being carried out, and additional inspections are included as per construction progress.

A regular meeting will be held on site between the NZTA Project Manager, Principal Contractor Project Manager and the CEM to discuss the results of the weekly and monthly site monitoring.

On a monthly basis the Construction Environmental Manager will review the monitoring schedule and compliance results from the required Environmental Monitoring as per the resource consent and designation conditions. The policy, objectives and procedures described in this plan will be regularly reviewed for effectiveness and revised accordingly.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement, a compliance and general monitoring procedure that meets the requirements of this CEMP.
The procedure should set out as a minimum

- *Responsibilities;*
- *Competency required;*
- *Frequency;*
- *Data analysis techniques;*
- *Duration; and*
- *Reporting formats*

4.2 Reporting

Table 6 below outlines the reporting requirements as detailed within the CEMP. This will be reviewed and refined following the appointment of a Contractor and it may be possible to combine reporting requirements with the agreement of the NZTA project manager.

Table 6 CEMP Reporting requirements

Report	Reporting Requirements	Timing	Responsibility	Recipient
Resource Consent and Designation Compliance Reports	As per resource consent and designation conditions	As per resource consent and designation conditions	CEM	The Construction Project Manager, NZTA, Environment Canterbury/Christchurch City Council/Selwyn District Council
Feedback Form	Obtain respondents details	At the time of the feedback	CEM	Feedback Register
Environmental Feedback Register	Information provided on Environmental Feedback Form	At feedback closure	CEM	Project Manager Construction Project Manager NZTA Project Manager

Report	Reporting Requirements	Timing	Responsibility	Recipient
Non-Compliance Report	Identification of non-complying activity which has resulted in environmental feedback or an incident onsite	During feedback investigation	CEM	Project Manager
Construction Compliance Report	Summary of feedback received and resolutions	Quarterly	CEM	The Project Manager and the relevant authority or authorities.
General Site Monitoring Report	Summary of site inspections, including daily, weekly and monthly inspections – consent and designation and CEMP compliance	Monthly	CEM	Principal Contractor Project Manager
Environmental Formal Site Inspection	Weekly site inspection sheets	Weekly	Environmental Management Team	CEM
Environmental Incident Reports	Obtain the incident details	At the time of the incident	On site personnel involved in the incident	CEM
Incident Response Reports	Obtain incident information	At the completion of the Incident situation	CEM and on site personnel involved in the environmental emergency	Principal Contractor Project Manager, Project Manager and Environment Canterbury/Christchurch City Council/Selwyn District Council – where appropriate and required under legislation

Report	Reporting Requirements	Timing	Responsibility	Recipient
Environmental Audits	Summary of quarterly environmental audit findings	Quarterly, within two weeks of audit completion	CEM	NZTA Project Manager and Construction Project Manager
Site Audits	Summary of informal audit findings	Monthly, within two weeks of audit completion	CEM	Construction Project Manager and on site personnel.

A monthly report shall be produced that provides a summary of information pertaining to the following:

- Permits and any resource consent approvals granted during the month;
- Results of environmental monitoring (inspections and audits) conducted during the month; and
- Any environmental non-conformances: incidents, emergencies, negative feedback, near misses etc.

This report shall be prepared by the CEM or delegate and tabled at Project Management Team meetings. The report should coincide with the CEMP Audit programme; whereby audit observations and findings can be included in a timely manner for discussion at the next monthly meeting.

Any resource consent conditions that require data and information reporting to Environment Canterbury and/or Selwyn District/ Christchurch City Council will be identified and provision made for submission by the Principal Contractor and the Construction Environmental Manager.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement a reporting schedule that meets the requirements of this CEMP.

4.3 Documents and Records

4.3.1 Principal Contractor Documentation

The Principal Contractor will undertake the construction of the works in accordance with the contract documents, legislation and the CEMP. As a minimum the Principal Contractor should demonstrate to the NZTA that documentation systems should cover the base requirements of the CEMP and is fully tried and tested.

Documents relating to the CEMP, their issue, revision, storage and archiving will be in accordance with the requirements of the Quality Management System (QMS) and Environmental Management Systems implemented by the Principal Contractor. A schedule of ***Environmental Records*** will be maintained by the Construction Environmental Manager.

The environmental records will include amongst others, monitoring results, results of any watching briefs and surveys and pollution incidents in accordance with the contract. A separate record of any feedback or comments will be maintained, together with any actions taken and responses given.

Site induction and staff training records will also be kept in a separate filing system, which will be regularly checked by the site Construction Environmental Manager, as this will help show that all staff are trained at sufficient intervals for their area of work.

The records will be archived as required by the requirements of the QMS and Environmental Management Systems implemented by the Principal Contractor.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement procedures for Document and Record management and control, that sets out as a minimum

- *Retention times;*
- *Types of records;*
- *Responsibilities;*
- *Formats;*
- *Circulation and issue control; and*
- *Revision and updates.*

This can be as part of a documented QMS.

4.4 CEMP audits

Environmental audits are a means of obtaining information about environmental performance and compliance with the objectives and targets of the CEMP. They also help to signpost any areas of concern or where corrective action may be required in order to reduce the potential for any adverse environmental impacts.

Performance of the CEMP will be reported back to the NZTA Project Manager and Engineer by the Principal Contractor and the CEM. Performance will be assessed in terms of the delivery of the objectives. The objectives of the CEMP are the benchmarks of performance and will be subject to ongoing monitoring.

The Principal Contractor and CEM shall devise an audit schedule in accordance with the finalised construction programme in order to assess the overall performance on site in a timely and appropriate manner.

The CEM and the Principal Contractor shall audit the construction site on a regular basis as deemed appropriate by the CEM, by utilising an audit checklist to be provided by the Principal Contractor.

At any time the Project Engineer may accompany the audit. It is also foreseeable that Environment Canterbury and or CCC, or SDC inspectors will attend from time to time.

Audit checklists should be updated and refined by the CEM and the Principal Contractor regularly to consider the changing nature of the construction programme and inputs from corrective actions logs originating from non-conformance reports.

Audits will be conducted during the course of the construction works by various people and with regular frequencies. Table 7 below provides proposed environmental auditing frequency and outlines who will undertake the audits.

Table 7 Environmental Audits Schedule

Type of Audit	Responsibility	Purpose	Frequency
Internal audit	CEM or delegate	Assess effectiveness of controls and compliance with environmental procedures. This may be combined with internal site safety inspections if appropriate.	Fortnightly
Quarterly audit	External environmental personnel TBC	Identify issues or other matters that may not be noticed by personnel who are working on the project on a day-to-day basis.	Quarterly
External audit	Regulatory authorities	Confirming compliance with consent conditions	As required

Discussion of environmental audits will be an agenda item for all Project Management Team meetings. These meetings will review audits that have occurred, and any measures that may be required to improve conformance with the CEMP, as well as any updates to the CEMP that may be needed.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement an auditing procedure and schedule that meets the requirements of this CEMP.

4.5 Corrective Action

Corrective actions are required when a non-conformity is identified. Corrective actions are needed for any problem, such as legal non-compliances, to devise and initiate appropriate controls in order to prevent a reoccurrence. The need for corrective action may be identified under the following circumstances:

- When inspecting environmental protection measures on site and identifying that they have not been correctly installed or maintained;
- When site inspections or audits are undertaken;
- When negative environmental feedback is investigated;
- After analysing what happened in an incident, emergency or near miss; or
- From checking or reviewing the CEMP.

Preventative action is part of the corrective action process and involves identifying any potential problems before they occur and to minimise the potential to reoccur.

4.5.1 Environmental Non Compliance and Corrective Actions

If a non-conformance is discovered during an audit or otherwise reported an Environmental Non Conformance Report Form (ENCR) (see Appendix K for an example ENCR that can be used, conversely the Principal Contractor can use their own format if available) shall be completed and corrective actions shall be devised. The recommended corrective actions will be recorded in the Corrective Actions Log (an example Corrective Action Log is found in Appendix L, conversely the Principal Contractor can use its own format if available).

Substandard performance will be measured by resulting actions i.e. negative feedback, incidents and emergencies, and compliance with the CEMP, resource consents, designations and operational procedures. Where failure to comply with these requirements occurs the responsible on-site personnel will be issued with a Non-Compliance Report (NCR).

The NCR is to contain the corrective actions required to be completed by the on-site personnel to:

- Eliminate; or
- Isolate; or
- Minimise; or
- Improve; or
- Remove; or any combination of the above.

A NCR can also be used in a proactive situation by on-site personnel where current operational procedures or the CEMP do not cover newly identified significant environmental aspects. On-site personnel are responsible for the identification and reporting of non-compliance's, and the usage of NCRs.

Predominantly NCRs will be issued after investigations and inquiries as follow up for negative environmental feedback, incidents and emergencies.

The CEM is responsible for handling and investigating any non-compliance. Any action required will then be directed to the relevant personnel for action and a time frame given for completion. Upon completion of the corrective action, the relevant personnel shall notify the Environmental Manager of the action taken, at which time the CEM will update the NCR and close it out if appropriate.

Progress of any corrective actions will be recorded in the NCRs. This information will be monitored and reported to the NZTA or their delegate in conjunction with the schedule of site inspections. Audit records will be maintained in accordance with the expectations of this CEMP.

Corrective actions should be ranked commensurate to the risk. On occasions where legal compliance is an issue or environmental pollution is imminent, then the corrective actions should be implemented as soon as possible.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement a procedure that details the approach toward identifying environmental non-conformances and the development, implementation and validation of corrective action, this can be as part of a QMS.

4.5.2 Communications

Communications Internal and External

An important procedure for any project is the communication procedure. A Communications Plan is required to be prepared and a designated public liaison person who will be the main and readily accessible point of contact at all times for persons or parties affected by construction work should be appointed.

The internal component of the Communications Plan shall state how the NZTA and the Principal Contractor will communicate on matters relating to the CEMP. This will include a section in the Principal Contractor's Monthly Report on the implementation of the CEMP covering;

- Inspection and measurement done;
- Any non-compliance;
- Any corrective/preventative action required, by when and who will do it;
- Opportunities pursued for social and environmental enhancements; and
- Successful innovations that may contribute to best practice.

As part of the external Communications Plan a procedure is required for receiving, documenting, notifying and responding to relevant external parties and the community. This could include;

- 24-hour project construction response number or maintenance hotline;
- Project website;
- Letterbox drops;
- Public events;
- Media releases or other advertising activities; and
- Methods for responding to feedback received.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement a communication procedure that meets the requirements of this CEMP. This should be done in conjunction with any Stakeholder Management and Communication plan (or equivalent) that may be prepared for the project.

4.6 Feedback Management

When environmental feedback (complaints, comments or compliments) is received, it will be actioned as necessary by the Construction Environmental Manager. The Construction Environmental Manager will then complete the following forms:

Feedback Form

A standard Feedback Form template will be used for all site specific activities throughout the Project.

The Construction Environmental Manager will ensure that the details of the investigations and any follow up actions are completed and recorded for each feedback response. The form will contain but not be limited to;

- Name and address of respondent
- Identification of the nature of the feedback
- Date and time of the feedback and alleged event

An example of the Feedback Form is included in Appendix J. The CEM will commence an inquiry as soon as practicable from receiving adverse feedback.

Contact will be made with the respondent within the same working day – an interim response advising that investigations are continuing is acceptable. A formal written response will be provided to the respondent and appropriate regulatory authorities (e.g. Environment Canterbury, Historic Places Trust (HPT) Selwyn District Council and/or Christchurch City Council) within 10 days of adverse feedback receipt.

Feedback Register

A Feedback Register (FR) will be controlled by the Environment Manager. It will contain all feedback (both positive and negative), received for the Project. The CEM will input all data from completed environmental incidents forms as soon as possible.

The CEM will summarise all feedback received throughout the site to on-site staff members during weekly Tool Box sessions.

The Feedback register shall also be discussed at regular meetings held between the Environmental Manager, Principal Contractor Project Manager and the Project Manager.

CEMP Expectations for the appointed Principal Contractor

The appointed Principal Contractor can use the templates and process contained within this CEMP or should submit to the NZTA for prior evaluation and agreement a procedure for the capture, documentation, investigation and resolution of feedback particularly adverse feedback.

4.7 CEMP Management Review

The CEMP will be reviewed after confirmation of the resource consent and designation conditions and will be revised in accordance with those conditions. The CEMP and the SEMPs will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the physical environment.

Approval from the Environment Canterbury, Selwyn District Council and Christchurch City Council will be required for any relevant revisions of a material nature to the CEMP or SEMP, for which these authorities have jurisdiction.

A management review of the CEMP will be undertaken at least annually by the Project Management team and the Principal Contractor Project Manager. The management review will be organised by the CEM. The review will take into consideration:

- Input from the NZTA;
- Site personnel comments;
- Audit findings and recommendations;
- Environmental monitoring records;
- Environmental feedback, incidents and emergencies;
- Details of corrective and preventative actions;
- Environmental non-compliances;
- Changes to organisational structure;
- On-going compliance with objectives, conditions and targets; and
- Possible changes in legislation and standards.

The review process will include looking at the environmental controls and procedures to make sure they are still applicable to the activities being carried out. Reasons for making changes to the CEMP will be documented. A copy of the original CEMP document and subsequent versions will be kept for the Project records, and marked as superseded. Each new/updated version of the CEMP documentation will be issued with a version number and date to eliminate superseded CEMP documentation being used.

The on-going effectiveness of the arrangements made in this CEMP will be monitored and reviewed through the audit and monitoring process and during all meetings that occur as part of the Project management process.

4.7.1 Final CEMP close-out report

The Construction Environmental Manager will be responsible for the preparation and drafting of a close out report that details CEMP performance over the construction phase, sets out issues that any relevant Operational Environmental Management Plan needs to consider or will inherit, and sets out recommendations and observations regarding overall performance and effectiveness of the CEMP.

The closeout report will be reviewed by the NZTA Project Engineer, Design Team and NZTA delegates. The NZTA Network Maintenance Manager who will take over the asset should also be provided a copy for comment.

The final close out report will be signed off by the NZTA Project Manager and Principal Contractor, all records and reports relating to the CEMP plus the close out report will be compiled by the CEM into a single final CEMP document. Copies of this final document will circulated as required and at the discretion of the NZTA Project Manager. This report should be timed to coincide with the transition phase.

CEMP Expectations for the appointed Principal Contractor

The Principal Contractor shall submit to the NZTA for agreement a review and reporting schedule that meets the requirements of the contract, any consent conditions and this CEMP.

APPENDIX A

SEMP 001 Air Quality Management Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix A SEMP001

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Construction Air Quality Management Plan

November 2012

Quality Assurance Statement			
	Prepared by:	Charles Kirkby	November 2012
	Reviewed by:	Lindsay Daysh	November 2012
	Approved for Issue:	Gary Payne	November 2012

Record of amendment

Amendment number	Description of change	Effective date	Updated by

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Glossary of Terms

CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CSM2	Stage 2 of the Christchurch Southern Motorway, between Halswell Junction Road and Main South Road
MSRFL	Four-laning of Main South Road between CSM2 and Rolleston
HAPs	Hazardous air pollutants
HCV	Commercial vehicles with a gross laden weight of over 3.5 tonnes
FIDOL	Factors used in the assessment dust or odour discharges: • the **frequency** of dust nuisance events • the **intensity** of events, as indicated by dust quantity and the degree of nuisance • the **duration** of each dust nuisance event • the **offensiveness** of the discharge, having regard to the nature of the dust • the **location** of the dust nuisance, having regard to the sensitivity of the receiving environment
Hazardous air pollutants	Include fine particles (PM10 and PM2.5) and a wide range of chemicals that may cause adverse effects on human health
Highly sensitive air pollution land use	A location where people or surroundings may be particularly sensitive to the effects of air pollution. Examples include residential dwellings, hospitals, schools, early childhood education centres, childcare facilities, rest homes, marae, other cultural facilities and sensitive ecosystems.
LTMA	Land Transport Management Act
$\mu g/m^3$	Micrograms per cubic metre
mg/m^3	Milligrams per cubic metre
MfE	Ministry for the Environment
MfE Dust GPG	Ministry for the Environment Good Practice Guide for the Assessment of Effects of Dust
NRRP	Natural Resources Regional Plan
NoR	Notice of Requirement
NZTA	The New Zealand Transport Agency

RMA	Resource Management Act 1991
Sensitive receptor	Highly sensitive air pollution land use
TSP	Total suspended particulate matter, typically with an aerodynamic diameter of less than 30 micrometres

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State Highway 1 (SH1) to the Christchurch City Centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road new construction and improvements, are referred to hereafter as 'the Project'.

A Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to Construction Air Quality.

1.1 Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1 (CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to motorway standard comprising four lanes, with two lanes in each direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, while at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

An overview of the air quality components along the Project length is indicated in Figure 1.

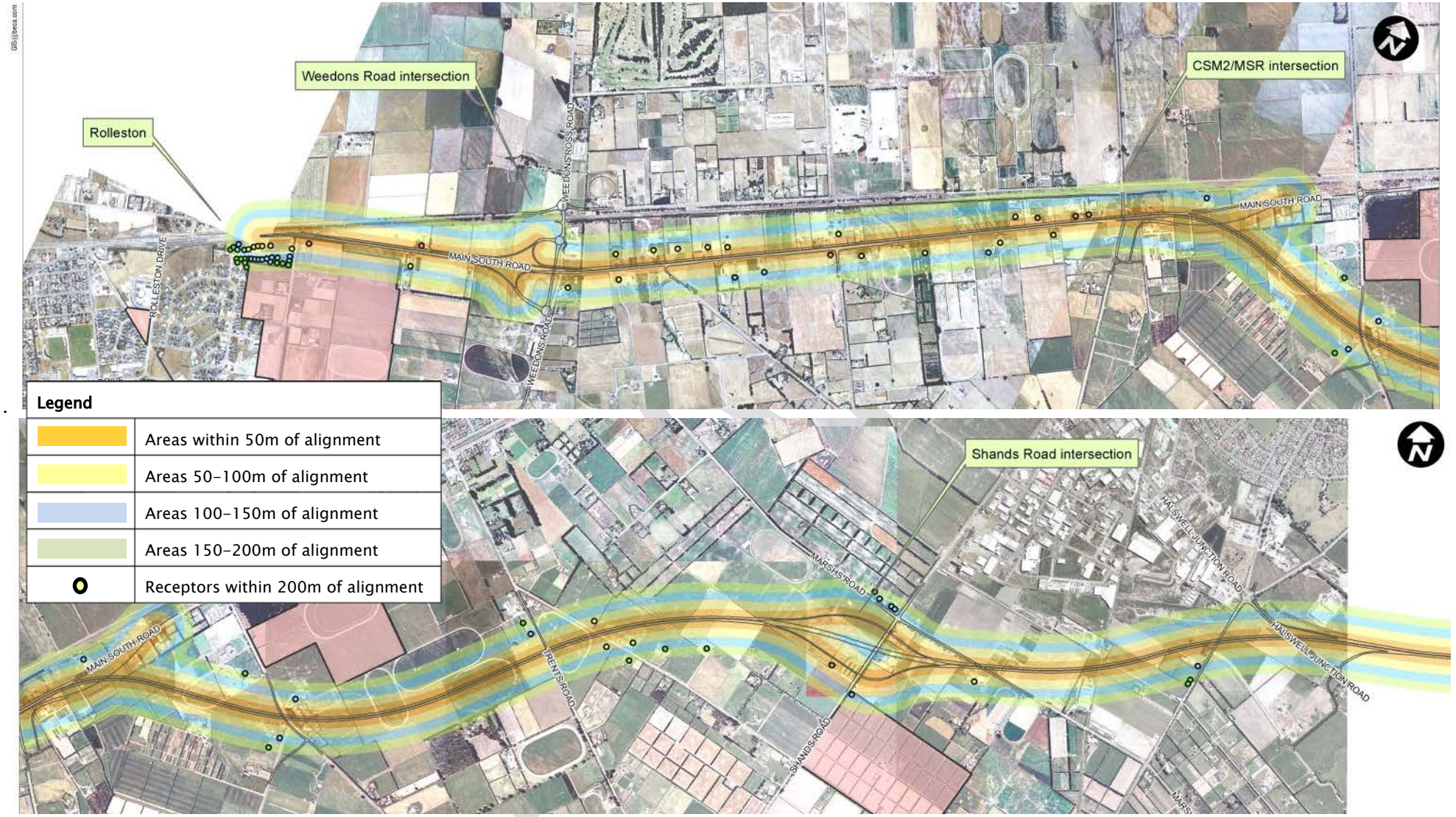


Figure 1: Residential premises in the vicinity of the Project

1.2 Purpose and Scope

SEMP 001, this Construction Air Quality Management Plan (CAQMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The potential for dust discharges associated with the construction of the Project is somewhat elevated due to the relatively flat topography of the area, with relatively high wind speeds and fine soils The CAQMP addresses the potential construction air quality impacts associated with earthworks and construction activities of the Project, particularly related to earthworks.

The purpose of this CAQMP is to facilitate the avoidance, remediation and mitigation of any adverse effects of discharges of dust generated from the construction activities, and to promote proactive solutions to the control of dust discharges from the site.

The CAQMP identifies the following:

- Various sources of dust that may be created during the construction project.
- Dust mitigation and prevention methods.
- Monitoring methods
- Methods for managing complaints regarding discharges into air and keeping records related to compliance.

The CAQMP will provide an overall framework for the control of discharges into air on site. The CAQMP will be updated, with the necessary approvals, throughout the course of the Project to reflect material changes associated with construction techniques or to the natural environmental. Any relevant revisions of a material nature for the CAQMP will be submitted to the Selwyn District Council and / or the Christchurch City Council for review (as appropriate). A formal review process is described in section 5 of the CAQMP.

This CAQMP is also focussed on the protection of human health and amenity values from the effects of dust (and odour) discharges. A parallel document, the Erosion and Sediment Control Plan (SEMP002) addresses the issue of avoiding potentially sediment laden water from discharging to land or directly to water.

1.3 Performance standards

The CEMP identifies relevant legislative requirements associated with management of dust, odour and hazardous air pollutants.

The requirements of the statutes, regulations, designations and resource consents have a common aim which is to avoid, remedy or mitigate adverse effects on the environment, including effects on the health of people and ecosystems and amenity effects. In order for the construction of the Project to comply with all statutory requirements, the discharge of dust from the site must comply with the following, which is commonly known as the "no nuisance policy"[2]:

"The dispersal or deposition of particles shall not cause an objectionable or offensive effect beyond the boundary of the property where the discharge originates."

[2] This is taken from the conditions attached to Permitted Activity Rule AQL38 of the Environment Canterbury Natural Resources Regional Plan (NRRP), which relates to discharges of dust from unsealed aces on industrial or trade premises and/or from industrial or trade processes.

There are no national air quality standards or guidelines for nuisance dust; however the Ministry for the Environment (MfE) has recommended trigger levels which can be applied to individual dust sources[3]. The recommended trigger levels for airborne dust (total suspended particulate matter or TSP) are shown in Table 1.

Table 1: MfE TSP trigger levels

Sensitivity of Area	Standard/Guideline
High sensitivity	80 µg/m³ (fixed 24-hour average)
Moderate sensitivity	100 µg/m³ (fixed 24-hour average)
Low sensitivity	120 µg/m³ (fixed 24-hour average)

High sensitivity areas are defined by the MfE to be typically areas in which there is significant residential development. Low sensitivity areas are typically sparsely populated rural areas.

The MfE trigger levels for TSP are designed to avoid dust discharges causing a dust nuisance (i.e. to avoid offensive or objectionable discharges of dust). However, because they are measured as 24-hour averages, they cannot readily be used as management tools to prevent dust nuisance – the typical response to exceedences of MfE trigger levels is to investigate the cause of the exceedence with a view to preventing a recurrence.

It should be noted that continuous dust monitoring instruments do not form part of the standard suite of recommended monitoring for this Project. The MfE trigger values have been included in this CAQMP for reference only if continuous ambient monitoring is undertaken in response to specific dust management issues.

1.4 Environmental plans / maps

The only area within 100m of the construction footprint that is considered to be likely to be highly sensitive or moderately sensitive to discharges of dust is the residential area on the northeastern fringe of Rolleston and the adjacent land zoned Living Z under the Selwyn District Plan (if residential development has occurred on that land before the Project is completed). These are indicated in Figure 2.

[3] Ministry for the Environment "Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions", 2001.

Figure 2: Sensitivity of receiving environment between Rolleston and Weedons Road

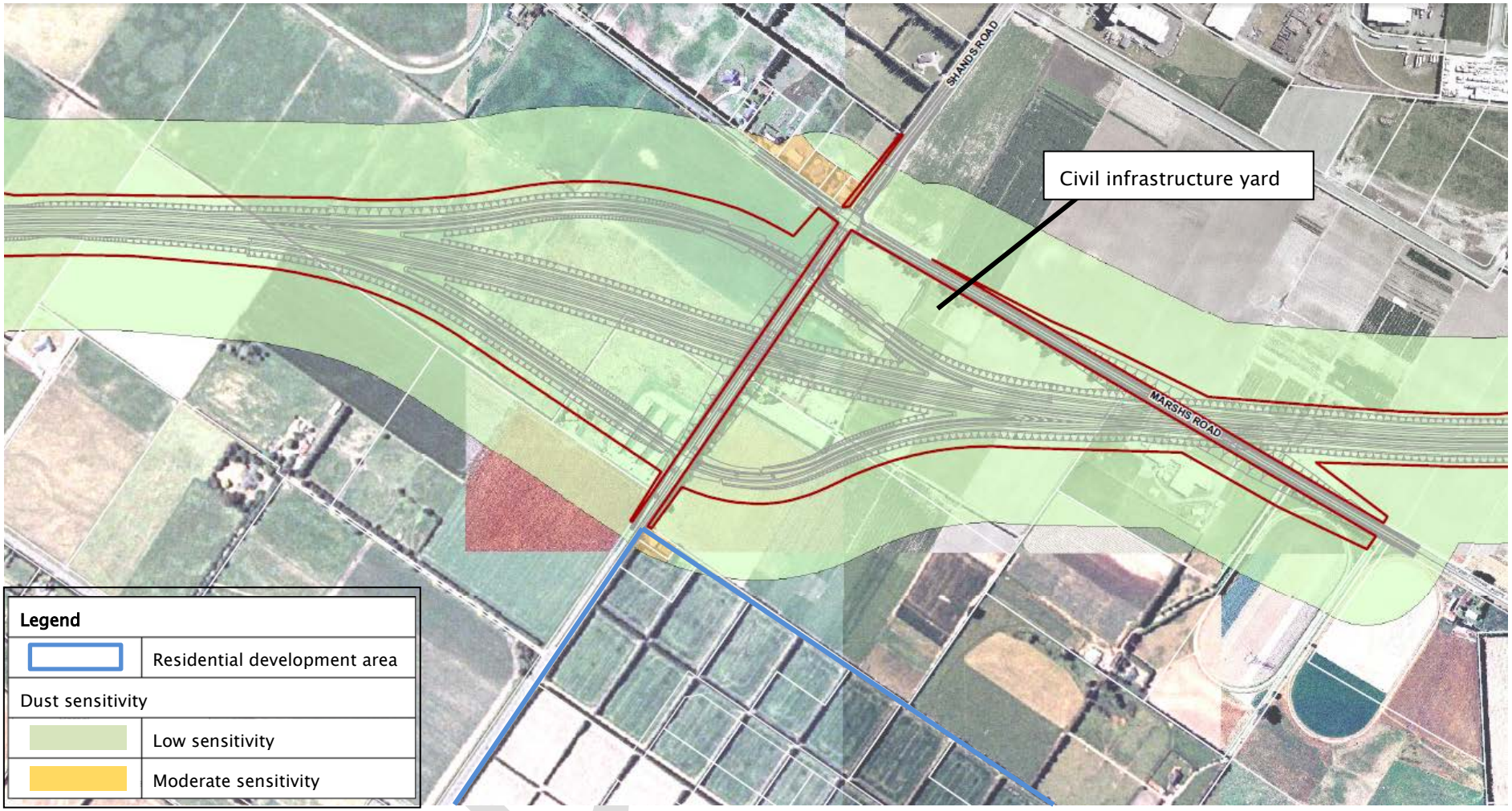


Figure 3: Sensitivity of receiving environment at Shands Road intersection

2. Environmental impacts summary

2.1 Dust

When considering the potential environmental effects of dust emissions, the main issue relates to residential areas. Section 5 of the Assessment of Air Quality Effects (Technical Report 10, Volume 3) outlines the nature of dust discharges from road construction activities. The main issues relate to the visual soiling of clean surfaces, such as cars, window ledges, and household washing; dust deposits on flowers, fruit or vegetables; and the potential for contamination of roof-collected water supplies. Excessive discharges of dust may also impact on visibility on roads in the immediate vicinity of the Project.

Due to the relatively large size of construction dust particles, only areas within about 100m of the construction footprint are likely to be at high risk of significant exposure to dust discharges. Most of these sensitive receptors are located along Main South Road, especially on the northeastern fringe of Rolleston.

There are a number of large residential developments under way in areas adjacent to the Project, the construction of which will also be sources of dust discharges that are outside the control of the Project.

Figure 2 of this CAQMP identifies those parts of the alignment between Rolleston and Weedons Road where there are sensitive receptors (mostly residential dwellings) and, consequently, effective dust control measures are most critical. Figure 3 indicates the sensitivity of areas around the Shands Road intersection: there are several residential dwellings to the northwest of the civil infrastructure yard by the Marshs Road / Shands Road intersection, all of which are within 100m of the designation; while the northern extremity of the Aberdeen subdivision is also within 100m of the designation.

2.2 Contaminated soil

There are no known or suspected contaminated sites on any part of the Project alignment. If any such sites are identified during the course of construction, specific measures related to air discharges from such sites will be incorporated into this CAQMP.

2.3 Odour

There are no known or suspected sources of odour associated with the construction of the Project.

2.4 Vehicle exhaust emissions

Engine exhaust emissions from construction vehicles contain a range of hazardous air pollutants, including fine particles, oxides of nitrogen, carbon monoxide and organics such as benzene, which can adversely affect human health. Poorly maintained vehicle engines discharge many times the amount of air pollutants than well maintained engines; and unnecessary idling of vehicle engines while parked can also cause significant local effects.

3. Implementation and operation

3.1 Operating/management procedures

3.1.1 Dust

This section of the CAQMP provides further explanation of the causes of dust nuisance and of methods that may be used to control dust discharges.

Potential sources of dust and other air contaminant discharges which may cause nuisance beyond the site boundary during adverse conditions, if adequate controls and mitigation measures are not adopted, are:

- Dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions
- Excavation and disturbance of dry material
- Loading and unloading of dusty materials to from trucks
- Stockpiling of materials including material placement and removal
- Smoke and odour from diesel engine machinery and truck exhausts

There are five primary factors which influence the potential for dust to be generated from the site. These are:

- **Wind speed across the surface**. Dust emissions from exposed surfaces generally increase with increasing wind speed. However dust pick up by winds is only significant at wind speeds above 5 m/s (11 knots or a Beaufort scale number of 3 – see Appendix A). Above wind speeds of 10 m/s (20 knots) dust pick up increases rapidly.
- **Moisture content of the material**. Moisture binds particles together preventing them from being disturbed by winds or vehicle movements. Similarly, vegetated surfaces are less prone to wind erosion than bare surfaces.
- **The area of exposed surface**. The larger the areas of exposed surfaces the more potential there will be for dust emissions.
- **The percentage of fine particles in the material on the surface**. The smaller the particle size of material on an exposed surface the more easily particles are able to be picked up and entrained in the wind.
- **Disturbances such as traffic and loading and unloading of materials**. Vehicles travelling over exposed surfaces tend to pulverise any surface particles. Particles are lifted and dropped from rolling wheels to the surface. Dust is also sucked into turbulent wake created behind moving vehicles.

Systems for controlling dust emissions include:

- Methods that modify the condition of the materials (e.g. use of water sprays) so that it has a lesser tendency to lift with the wind or disturbances such as vehicle movements.
- Methods that reduce the velocity of the wind at the surface (e.g. the use of wind breaks).

Watering of exposed surfaces and materials that may be disturbed is a primary method of control ("wet suppression"). The main soil type across the Project area is alluvial silt, which contains a high proportion of relatively fine particles, although it is also readily wetted.

As a general guide, the typical water requirements for most parts of New Zealand are up to 1 litre per square metre per hour[4]. Watering of surfaces is most effective when the water is applied prior to strong winds occurring and prior to particularly dusty activities commencing (which therefore requires that weather forecasts are checked on a daily basis). In certain areas, polymer additives may be used in water sprays to assist the formation of a surface crust, particularly for exposed surfaces that will be undisturbed for periods of up to a month or two.

The discharge of dust from the Project has the potential to have effects on two scales. The first is individually from a source where the effects of dust discharges are localised in the immediate area surrounding the construction area. Secondly, cumulative effects may be observed where the dust generated from all nearby dust sources combine to affect local air quality as a whole. Therefore it is important that all dust sources be minimised as far as practicable, including those well separated from sensitive locations, as all dust generated will have an effect on the overall air quality in the area.

The dust prevention methods recommended in Table 2 below are methods that have been found to be effective for many sites across New Zealand. The methods can be used alone or in combination depending on the circumstances. The methods summarised in Table 2 are considered to be sufficient to mitigate adverse effects of dust discharges from the Project. However, this list is not exhaustive and the Contractor's Environmental Manager or subcontractors may suggest other effective methods. If alternate methods are to be employed, the effectiveness of those methods must be demonstrated and this Plan updated accordingly, following the process laid down in Section 5.

[4] Section 8.2 of the MfE Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, Ministry for the Environment, 2001

Table 2: Potential dust sources and controls

Dust Source	Control
Stockpiles	• Limit the height and slope of stockpiles to reduce wind entrainment. Stockpiles exceeding 3m in height have a higher risk of discharging dust. • Orientate stockpiles to maximise wind sheltering as much as possible. • Maximise shelter from winds as far as practicable. • Keep active stockpiles damp at all times or cover stockpiles of fine materials. • Dampen inactive stockpiles if they are producing visible dust emissions. Use polymer additives to assist in forming a surface crust or cover with mulch or straw. • Vegetate stockpiles if inactive for more than three months. Supply adequate water to support optimum vegetation growth.
Unpaved Surfaces such as Roads and Yards	• Limit the amount of exposed surfaces as much as possible. • Retain as much vegetation as possible. • Keep unpaved roads and exposed surfaces damp. Typical water requirements for most parts of New Zealand are up to 1 litre per square metre per hour. • Cover surfaces with coarse materials where practicable. • Compact all unconsolidated surfaces where practical. • Regularly maintain roads by grading and the laying of fresh gravel. • In very high risk areas, haul roads should be sealed. • Stabilise cleared areas not required for construction, access or for parking, if liable to cause excessive dust during windy conditions. Methods may include wetting with polymer additives to facilitate crusting, metalling, grassing, mulching or the establishment of vegetative cover.
Sealed Surfaces	• Regular removal of dust through washing or vacuum sweeping.
Vehicles	• Limit vehicle speeds on unsealed surfaces to 10 km/h. • Limit load sizes to avoid spillages. • Cover loads of fine materials. • Minimise travel distances through appropriate site layout and design. • Minimise mud and dust track out from unsealed areas to sealed areas by establishing stabilised entranceways at all ingress and egress points to sealed roads. • If necessary, provide wheel wash facilities.
Earthmoving and Construction	• Limit the extent of earthworks in sand carried out during dry conditions as far as practicable. • Adequate irrigation systems must be available on each site to dampen areas that are to be earthworked prior to any earthwork commencing and shall be used permanently on sites until the final site shape has been established and further earthworks are not required. • Limit drop heights.

Dust Source	Control
Miscellaneous	• Ensure sufficient water is available on site. • Take account of daily forecast wind speed, wind direction and soil conditions before commencing an operation that has a high dust potential. • Install windbreak fences where practicable and appropriate. Effectiveness is greatest where fencing is perpendicular to the prevailing wind direction with a porosity of about 50%. • Minimise the area of surfaces covered with fine materials.

3.1.2 Vehicle Exhaust Emissions

Poorly maintained vehicle engines discharge many times the amount of air pollutants than well maintained engines; and unnecessary idling of vehicle engines while parked can also cause significant local effects. In consequence, the following key actions should be carried out to minimise emissions:

- All construction machinery used on the site must be maintained at least in accordance with manufacturers' requirements.
- Where excessive exhaust smoke is identified from any construction vehicle, that vehicle should be serviced as soon as is practicable and taken out of use until such maintenance has been completed.
- Construction vehicles should not be left idling while parked or unattended.

3.2 Monitoring

Table 3 outlines the dust monitoring programme that is to be implemented. The application of this monitoring will be the responsibility of the Environmental Manager in conjunction with site personnel. The frequency of the monitoring is defined but in the instance of strong winds, discharges of dust that cross the site boundary or a complaint, the monitoring programmes will be undertaken more regularly.

Table 3: Dust monitoring programme

Monitoring Activity	Frequency
Inspect land adjacent to the site, construction exits and adjoining roads for the presence of dust deposits.	Twice Daily in highly sensitive areas, daily in all other locations.
Check weather forecasts for strong winds and rainfall to plan appropriate dust management response (7 day forecasts available on www.metvuw.co.nz)	Daily
Observe weather conditions, wind via observations and data outputs from weather stations and presence of rain.	Daily and as conditions change
Inspect all unsealed surfaces (including earthworks sites) for dampness and to ensure that surface exposure is minimised.	Daily and as conditions change

Monitoring Activity	Frequency
Inspect all sealed surfaces to ensure that they are clean and all spillages have been cleared.	Daily
Inspect stockpiles to ensure enclosure, covering, stabilisation or dampness. Ensure stockpile height is less than 3m or appropriately stabilised.	Weekly and at times of expected high winds
Inspect dust generating activities (as listed in section 3.1 – Table 2) to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly
Inspect site access and egress points to ensure effective operation of wheelwash/truckwash systems and/or judder bars (if installed).	Weekly
Ensure site windbreak fences, if used, are intact.	Weekly
Review effectiveness of contractors' site induction training related to dust management	Monthly

Additional monitoring of dust generating activities and water application rate may be required in winds over 5.5 m/s (11 knots or a Beaufort scale number of 3 – see Appendix B).

3.3 Reporting

General reporting requirements are included in the CEMP. The specific reporting requirements associated with managing dust, odour and hazardous air pollutants include the following:

Site Staff to Environmental or Project Manager

Site personnel shall inform the Environmental Manager of the following:

- Any problems they observe or foresee with dust management on their site
- The measures taken for dust prevention and mitigation during the previous reporting period.
- Any complaints received regarding dust, odour or hazardous air pollutants within 24 hours of receipt of the complaint.

Environmental or Project Manager to the Regulatory Authority

- Any complaints received during the previous period regarding dust, odour or vehicle exhaust emission and the remedial actions taken

The Environmental Manager will also provide the Regulatory Authority with a copy of the CAQMP annually and if any significant revisions of the CAQMP are made during the year.

3.4 Training

Environmental training for all staff will be undertaken as part of the site induction programme. Details of training are included in the CEMP. The environmental induction will include the following information specific to this Plan:

- Information about the activities and stages of construction that may cause dust impacts within the construction area
- Consent requirements
- Complaints management procedures
- Dust and management procedures
- Description of dust monitoring for the Project.

3.5 Feedback

Feedback (complaints, comments or support) management procedures are detailed in the CEMP. The specific requirements for managing feedback associated with dust or vehicle exhaust nuisance effects are detailed further below.

In addition to recording general details of the incident on a Feedback Record Form, the person receiving the feedback must record:

- A description of the discharge from the respondent –constant or intermittent, how long it has been going on for, whether it is worse at any time of day and/or comes from an identifiable source
- Wind direction and strength and weather conditions.

The site inspection undertaken by the Environmental Manager should note:

- All dust/odour/vehicle exhaust producing activities taking place
- The dust/odour mitigation methods that are being used.
- If the complaint was related to an event in the recent past, note any dust/odour/vehicle exhaust producing activities that were underway at that time, if possible.

If it becomes apparent that there may be a source of dust/odour/vehicle exhaust other than the construction project causing the feedback, it is important to verify this.

4. Roles and responsibilities

All Site Staff

- Attending inductions, tool box talks and training to manage dust and odours
- Responsible for reporting all incidents involving dust and odours
- Ensuring processes for managing dust and odour are adhered to

Environmental or Project Manager

- Prepares, reviews and updates CAQMP
- Monitors and reports performance against the CAQMP
- Investigates and reporting of all complaints
- Ensure sufficient resources are provided to manage dust and odour in accordance with the CAQMP
- Provides leadership to the Project team in the area of dust and odour management

5. Review

This section describes how the CAQMP will be reviewed, including looking at the environmental controls and procedures to make sure that they are still applicable to the activities being carried out.

The CAQMP will be reviewed by the Principal Contractor(s) after confirmation of the resource consent and designation conditions and will be revised in accordance with those conditions. The CAQMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the natural environment. Approval from the Selwyn District Council and/or the Christchurch City Council will be required for any relevant revisions of a material nature for the CAQMP.

A management review of the CAQMP will be undertaken at least annually by the Principal Contractor(s). The management review will be organised by the Environmental or Project Manager. The review will take into consideration:

- Any significant changes to construction activities or methods
- Key changes to roles and responsibilities within the Project
- Changes in industry best practice standards or recommended dust controls
- Changes in legal or other requirements (social and environmental legal requirements, consent conditions, NZTA objectives and relevant policies, plans, standards, specifications and guidelines)
- Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments
- The outcome of investigations into discharges of dust or odour.
- Recent building developments.

Reasons for making changes to the CAQMP will be documented. A copy of the original CAQMP document and subsequent versions will be kept for the Project records, and marked as obsolete. Each new/updated version of the CAQMP documentation will be issued with a version number and date to eliminate obsolete CAQMP documentation being used.

Appendix A
Beaufort Wind Scale

Beaufort scale	Wind speed			Label	Observations on land
	m/s	Knots	km/h		
0	0 - 0.2	<1	<1	Calm	Calm. Smoke rises vertically.
1	0.3-1.5	1-3	1-5	Light Air	Wind motion visible in smoke.
2	1.6-3.3	4-6	6-11	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	3.4-5.4	7-10	12-19	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	5.5-7.9	11-15	20-28	Moderate Breeze	Dust and loose paper raised. Small branches begin to move.
5	8.0-10.7	16-21	29-38	Fresh Breeze	Branches of a moderate size move. Small trees begin to sway.
6	10.8-13.8	22-27	39-49	Strong Breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	13.9-17.1	28-33	50-61	Near Gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	17.2-20.7	34-40	62-74	Gale	Twigs broken from trees. Cars veer on road.
9	20.8-24.4	41-47	75-88	Severe Gale	Larger branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	24.5-28.4	48-55	89-102	Storm	Trees are broken off or uprooted, saplings bent and deformed, poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	28.5-32.6	56-63	103-117	Violent Storm	Widespread vegetation damage. More damage to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	32.7-36.9	64-71	118-133	Hurricane	Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.

Appendix B
Wind Speed and Direction

Wind Speed and Direction – Christchurch Airport, 2006-2009

Figures B1 and B2 present a summary of hourly average wind speeds and directions recorded at Christchurch Airport between 2006 and 2009, as follows:

- Figure B1 – Annual wind roses for 2008, 2009 and 2010
- Figure B2 – Seasonal wind roses for spring, summer autumn and winter for the period 2006-2009.

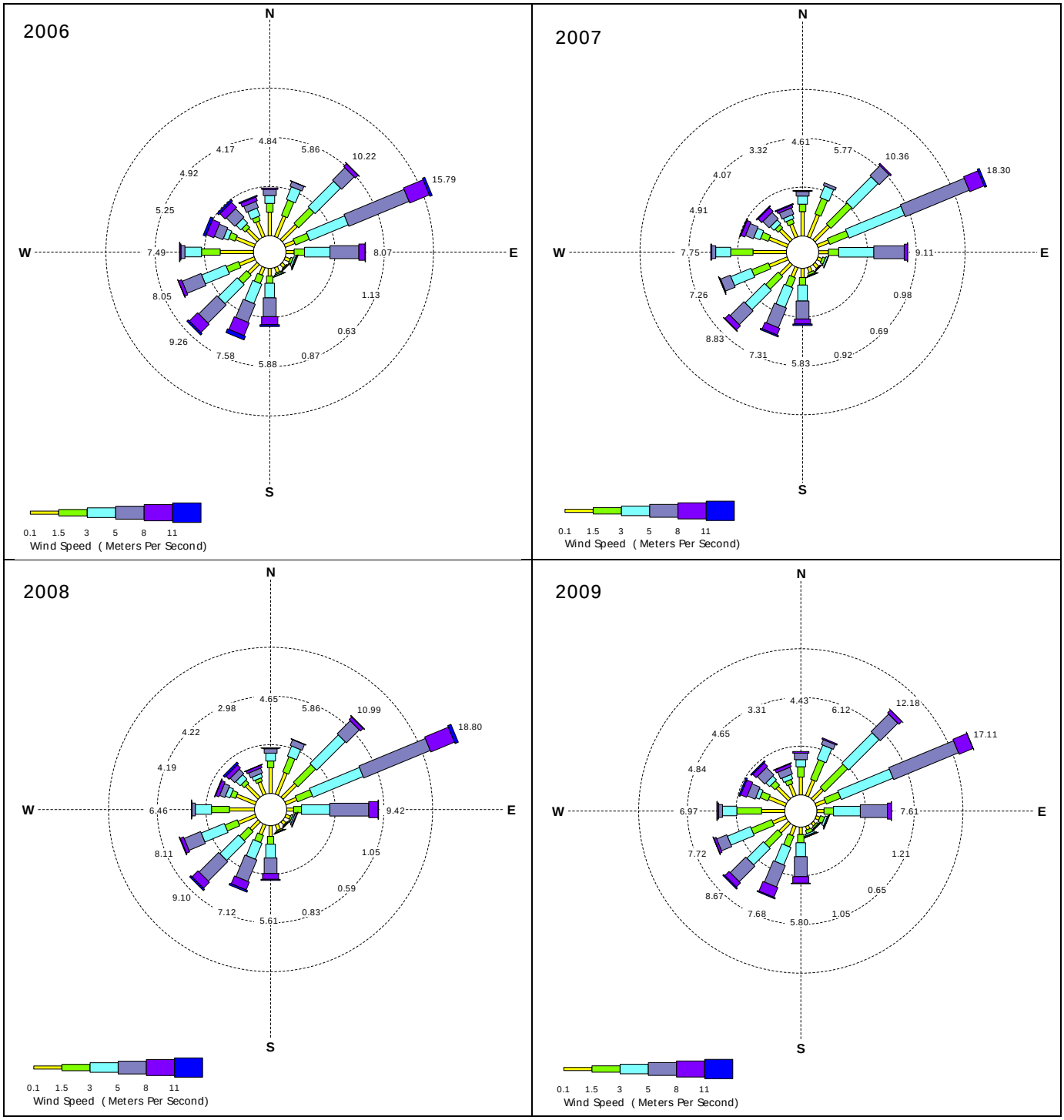


Figure B1: Annual wind roses showing wind speed and wind direction at Christchurch International

Airport, 2006-2009

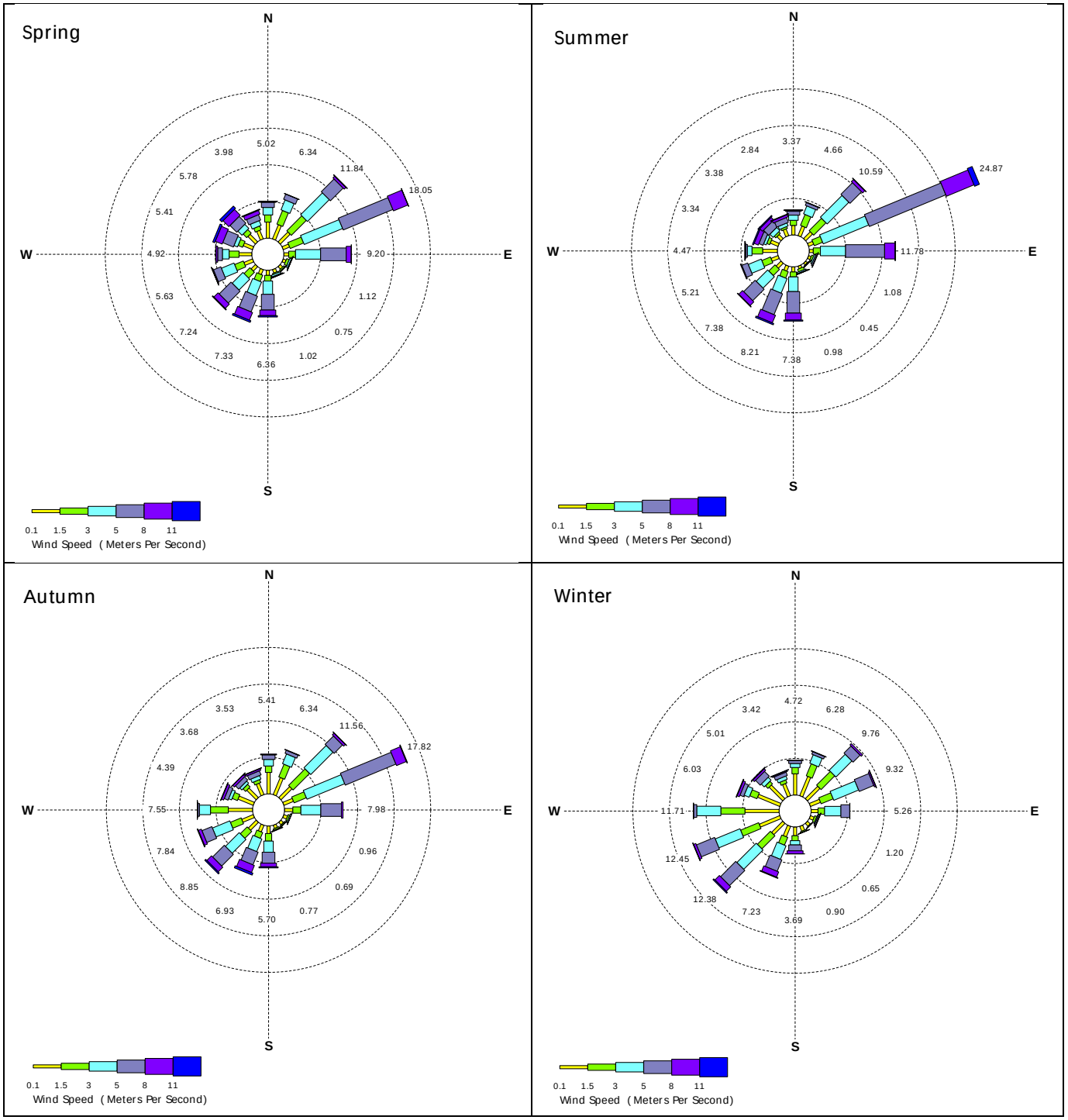


Figure B1: Seasonal wind roses showing wind speed and wind direction at Christchurch International Airport, 2006-2009

Appendix C
Relevant Project Conditions

[To be added when confirmed]

APPENDIX B

SEMP 002 Erosion and Sediment Control Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix B SEMP002

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Erosion and Sediment Control Plan

November 2012

Quality Assurance Statement			
GHD Beca	Prepared by:	Tony Cain	November 2012
	Reviewed by:	Lindsay Daysh	November 2012
	Approved by:	Gary Payne	November 2012

Record of amendment

Amendment number	Description of change	Effective date	Updated by

Contents

Glossary of Terms

AEE	Assessment of Environmental Effects
CEMP	Construction Environmental Management Plan
CSM2	Stage 2 of the Christchurch Southern Motorway, between Halswell Junction Road and Main South Road
ECan	Environment Canterbury
ESC	Erosion and Sediment Control
ESCP	Construction Stage Erosion and Sediment Control Plan
ESCMP	Erosion and Sediment Control Management Plan
HJR	Halswell Junction Road
LTMA	Land Transport Management Act
m^3	cubic metre
mg/m^3	Milligrams per cubic metre
MSRFL	Main South Road Four Laning
NoR	Notice of Requirement
NRRP	Natural Resources Regional Plan
NZTA	The New Zealand Transport Agency
RMA	Resource Management Act 1991
SDC	Selwyn District Council
SEMP	Specialised Environmental Management Plan
SWR	Stockwater Race
TR11	The Christchurch Southern Motorway Extension Stage 2 and Main South Road Four Laning Technical Report 11 – Geotechnical Engineering and Geo-hazard Report
USLE	Universal Soil Loss Equation

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A draft Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to erosion and sediment control (ESC) during construction.

1.1 Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell

Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in each direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

1.2 Purpose and Scope

SEMP 002, this Draft Erosion and Sediment Control Management Plan (ESCMP) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project.

This ESCMP addresses the importance of controlling the potential impacts of erosion and sediment loss associated with construction activities for the Project. This ESCMP has been prepared to describe the methods and practices that can be implemented to minimise the effects of erosion and resulting sediment generation and yield on the receiving environment associated with the Project

This ESCMP describes and is applicable to all sections of the project. A copy of the project layout and general arrangement drawings, which provide an overview of the extent of the works, are provided in Appendix A.

Whilst it is intended that this ESCMP is a standalone document, it has been prepared with reference to, the other SEMPs produced for the project and the following documents:

- Construction Methodology contained within Chapter 5 of the AEE and within the CEMP;
- Christchurch Southern Motorway Extension Stage 2 and Main South Road Four Laning Stormwater Management and Disposal Report; May 2012;
- Environment Canterbury (ECan) – Erosion and Sediment Control Guideline 2007;
- New Zealand Transport Agency (NZTA) – Erosion and Sediment Control Standard for State Highway Infrastructure 2012.

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

Material changes to this ESCMP proposed by the contractor prior to and during construction shall be done in consultation with ECan and the NZTA.

Once the ESC measures are in place, they will be subject to on-going inspection and site monitoring by the project team and the NZTA representatives to ensure they have been installed correctly and regularly maintained during construction

The ESC measures must be appropriately maintained to ensure they continue to function effectively throughout the duration of the works and until the surface of the ground has become stabilised, following which the ESC measures can be decommissioned.

1.3 ESCMP Further Development

This ESCMP details the extent and type of ESC measures required to be put in place prior to and during construction to manage sediment loss from the project and has been prepared with reference to the ECan document *Erosion and Sediment Control Guidelines, 2007* and NZTA's *Erosion and Sediment Control Standard for State Highway Infrastructure 2012*.

Upon award of the construction contract this ESCMP will be expanded and developed in line with the contractor's site specific methodology and will be incorporated into the Contractor's Social and Environmental Management Plan (CSEMP).

No material changes to the proposals included in the ESCMP will be made without prior discussion with the relevant Environment Canterbury (ECan) manager.

In order to best manage stormwater runoff, erosion and sediment yield, a detailed methodology including the staging of construction works will need to be provided by the appointed contractor.

2. Design Philosophy & Principles

The following section of this ESCMP outlines the general site description and sets out the context of the development of an Erosion and Sediment Control Plan for the construction stage of the project.

2.1 The Site

The CSM2 and MSRFL projects are described above and for the purposes of this ESCMP the CSM2 project have been divided into three sections from west to east with a fourth section for the MSRFL section of the project as follows:

- Section 1 – From SH1 to Marshs Road
- Section 2 – From Marshs Road to Springs Road
- Section 3 – From Springs Road to Halswell Junction Road Intersection (HJR)
- Section 4 – MSRFL – From Rolleston to Robinsons Road

An overview map of the Project is provided in Figure 1 below

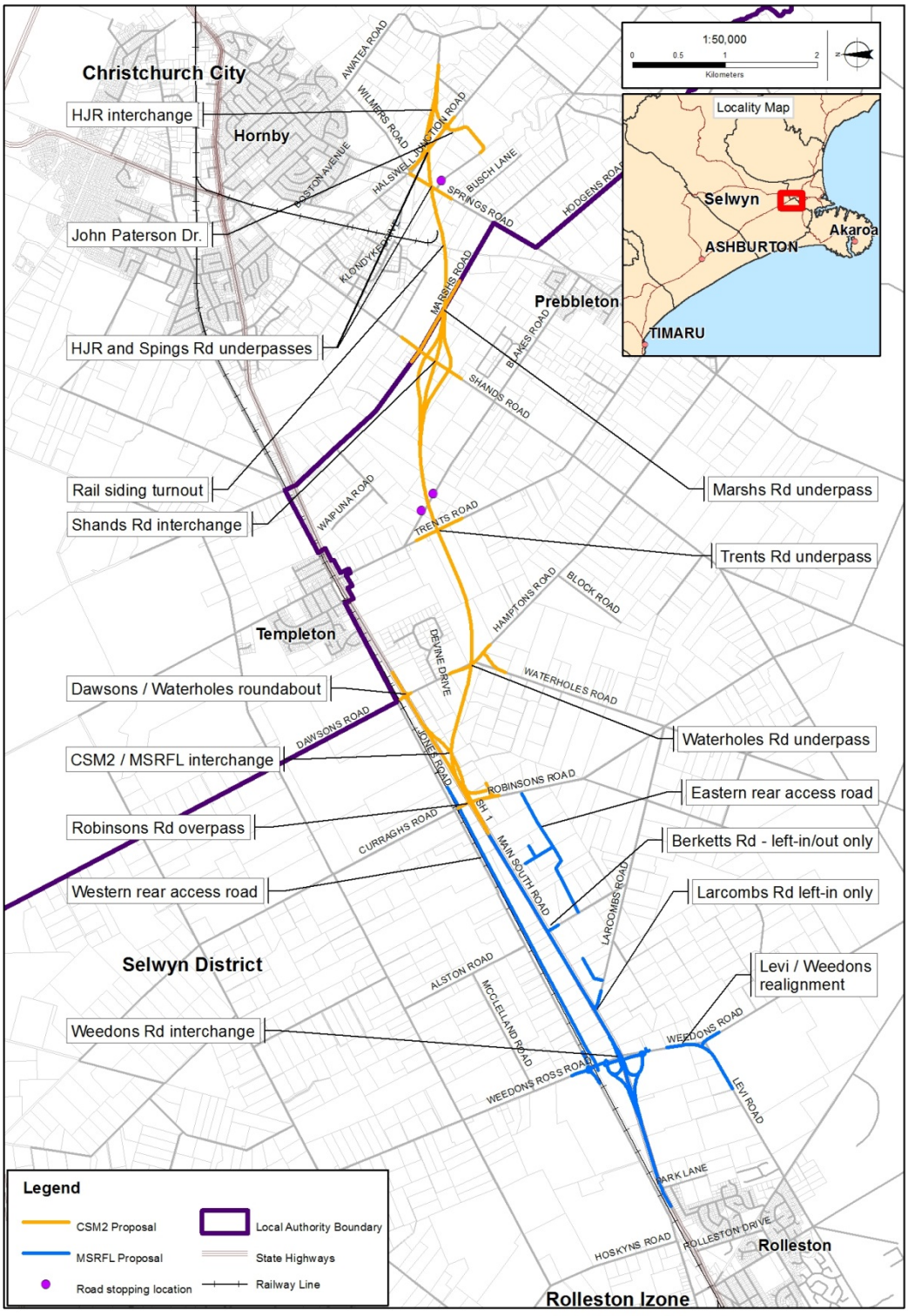


Figure 1 – Proposed Site Location Map

2.2 Construction Sequencing

An indicative construction programme has been developed to inform the AEE, which is provided in Figure 27 of the AEE. It is expected that the construction of the Project will take three to four years to complete and will be carried out simultaneously at several locations along the Project alignment.

The overall philosophy adopted for the construction would be to firstly relocate businesses and re-establish property access, then to construct local road connections in order maintain local connectivity and minimise disruption during construction.

Early construction activities involve shifting of boundary lines, relocation of businesses and other property related affects, temporary and permanent property access, temporary road connections, modification to utilities including high voltage transmission lines.

Early works will also involve establishing the four construction site compounds and smaller satellite compounds at interchange and bridge locations. Construction related activity is to be kept within designated areas and relate to site clearing, establishing traffic management, constructing and maintaining sediment controls, earthworks, building of retaining and bridge structures, storm water devices, intersection upgrades, pavement surfacing, landscaping and related road furniture.

Erosion and sediment control will be installed prior to bulk earthworks and will be maintained throughout the duration of the construction works to ensure protection of the downstream receiving environment from the adverse effects of sediment from the work areas.

2.3 Earthworks

It is anticipated that The Project will generate approximately 405,000 m^3 of excavated (cut) material (excluding topsoil) with approximately 320,000 m^3 of this cut material suitable to be placed for fill embankments.

Approximately 1,035,000 m^3 of fill will be required for the Project of which it is intended to import approximately 715,000 m^3 of fill material. Approximately 300,000 m^3 of topsoil will be stripped and stockpiled for reuse on site.

2.3.1 Imported fill

The imported fill will be sourced from suitable demolition material as a result of the recent Christchurch earthquakes or from local quarries or rivers (Waimakariri/Selwyn).

2.3.2 Cut slopes

Cut slopes will be minimal, generally up to 2.9 m in height with shallow cut slopes of 4h:1v. The only exception will be the Robinsons Curraghs link which passes under Main South Road in a 7m deep cutting.

Cut material will be excavated mechanically and will be stockpiled or loaded directly onto trucks to be transported for use elsewhere on the Project.

2.3.3 Fill embankments

The fill embankment slopes, typically up to 8m in height (to a maximum of 10.5m high), will be formed from materials sourced from cuttings but predominately from imported fill.

2.3.4 Disposal of surplus material

There will be approximately 85,000 m^3 of excavated material that is deemed unsuitable for construction. The majority of this material will be disposed of on-site reducing haulage distances. There is more than enough capacity within the site to accommodate the currently identified volume of waste fill material although the NZTA may also choose to use some of the fill for one or more of its other projects in the region.

2.3.5 Topography

The majority of the catchment crossed by CSM2 does not directly contribute to any natural watercourse, surface water typically ponds in local depressions throughout the area and soaks to ground.

In larger events overland flow paths are likely to occur along old river channels, these overland flow paths are often intercepted by field drains, irrigation channels and the stockwater race network.

The northern extent of CSM2 (Section 1) forms part of the Halswell River catchment. This area drains to the Halswell River via Montgomery's Drain and Upper Knights Stream. The Halswell River has a history of flooding and is sensitive to any increase in peak discharge rate and volume.

The catchment upstream of the MSRFL is intercepted by SH1 and the railway embankment, both of which form significant barriers to overland flow and there is little existing stormwater infrastructure to allow the passage of flood flows from west to east.

The topography of the Project area is gently undulating, sloping generally from south west to north east. The majority of the proposed route is within the Selwyn District, with a short section within the Christchurch City boundary to the north and east of Marshs Road. The Project alignment crosses the Canterbury Plains to the south of Christchurch.

The surrounding land is predominantly rural, but also includes residential, commercial and industrial zoned areas. Land use in the rural areas includes grazing (predominantly sheep and beef), stud farms, market gardens, nurseries, orchards, crops, and viticulture.

Commercial areas include the shops at Templeton on SH1, Trents Road Winery, and businesses along Halswell Junction Road. There is also the industrial area to the northwest of Rolleston, and between Shands Road and Halswell Junction Road. Occasional commercial sites are dotted along SH1 between Rolleston and Waterholes Road.

Residential developments in the vicinity of the Project include the settlements of Rolleston, Templeton, Claremont Estate near Templeton, Aberdeen, Prebbleton and the outlying suburbs of Hornby.

The majority of the catchment crossed by the CSM2 and MSRFL route does not directly contribute to any natural watercourse and is illustrated by the absence of watercourses in the vicinity of the Project.

The Project is located within the Halswell River catchment. The drainage and overland flow from the land surrounding Halswell Junction Road typically drains to land/soakage. In rainfall events where overland flow is generated it will discharge directly to the Halswell River via Montgomery's Drain and Upper Knights Stream, which carries little or no flow except (1) at the end of large storm events when overland flow enters the drain, (2) when Halswell Junction Road Pond fills and spills from the service spillway.

Surface water typically ponds in local depressions on the land surface and soaks into the ground or evaporates. In larger events overland flows have the potential to flow along surface depressions. These overland flow paths are often intercepted by field drains, irrigation channels and the existing stockwater race network, which eventually discharge to the Halswell River or to land via engineered soak pits.

Selwyn District Council (SDC) has advised that the stockwater race network performs a land drainage function during heavy rainfall events. During or prior to such events, the upstream stockwater race intakes are closed or shut off. SDC advises that runoff can exceed water race capacity and some localised flooding does occur. The natural catchment upstream of the proposed MSRFL alignment is intercepted by SH1 and the railway embankment. Both of these structures form impediments to overland flows, particularly the railway embankment, and there is little existing stormwater infrastructure in place to allow for the passage of flood flows through or under Jones Road and the rail embankments. There is significant capacity for ponding upstream of these embankments.

2.3.6 Climate and Rainfall

The Project area has a dry, temperate climate typical of the wider Canterbury Plains, with mean daily maximum air temperatures of 22.5 °C in January and 11.3°C in July.

The climate is broadly defined as oceanic. The summer climate is often moderated by a sea breeze from the Northeast. The Mean Annual Rainfall (1981 to 2010) for the project site is approximately 600mm

A notable feature of the weather is the north-westerly wind in summer; a hot föhn wind that occasionally reaches storm force. In winter, it is common for the temperature to fall below 0 °C at night. There are on average 70 days of ground frost per year, and snow fall occurs about once or twice every two years on the wider plains area.

2.4 Sensitivity of Receiving Environment

2.4.1 Sensitivity of land to the discharges

The land is predominantly rural, dominated by pasture and shelterbelt vegetation, and localised industrial areas. These existing uses of land are not particularly sensitive to stormwater discharges. The areas of land where discharge will occur are within the project footprint and will be modified for the treatment and disposal of stormwater and suitable grass grown for that purpose.

2.4.2 Sensitivity of surface watercourses to discharges

Watercourses in the catchment are not particularly sensitive to discharges of stormwater. Stockwater races and subsequently the streams they flow into presently act as drainage channels in storm events. The aquatic species present in these watercourses are pollution-tolerant. The watercourses, particularly the stockwater races, are not protected for human consumption.

2.4.3 Sensitivity of groundwater to discharges

Groundwater at the Rolleston end of the alignment is less sensitive to discharges as the depth to groundwater is in the order of 12-15 m below ground.

At the Halswell end of the catchment the groundwater is more sensitive as groundwater is shallower at this end of the alignment (5-7 m below ground). The 3 km section of the alignment within the CCC boundary is also located within the Christchurch Groundwater Protection Zone identified in the relevant regional plans. This zone is established to protect high quality, untreated groundwater sources available to Christchurch City as a potable supply. Approximately 160 wells supply Christchurch City's drinking water supply.

2.4.4 Construction Discharge Locations

During Construction it is proposed to discharge treated stormwater runoff to ground via soak pits, however, during construction, rainfall events in excess of the design events considered for the various erosion and sediment control measures identified in this ESCMP, may cause the ESC measures to overflow and discharge to the locations shown on drawing SK207 in Appendix B. These locations are described in the Table 1 below.

Discharge Location Reference	Description
MSRFL	
MSR A	Discharge of construction runoff to stockwater race at Weedons Ross Road
MSR B	Discharge of embankment runoff to stockwater race at Weedons Ross Road
MSR C	Discharge of embankment runoff to stockwater race at Weedons Road
MSR D	Discharge of construction runoff to stockwater race at Larcombs Road
MSR E	Discharge of construction runoff to stockwater race at Berketts Road
MSR F	Discharge of construction runoff to stockwater race
CSM2	
CSM2-A1	Discharge of construction runoff stockwater race at Robinson Road
CSM2-A2	Discharge of embankment runoff to stockwater race approx 100m north Robinson Road
CSM2-B1	Discharge of construction runoff at to stockwater race at Waterholes Road (Adj SH1 intersection)
CSM2-B2	Discharge of embankment runoff to stockwater race at Waterholes Road (Adj CSM2 intersection)
CSM2-C1	Discharge of embankment runoff to stockwater race at Trents Road
CSM2-D	Discharge of embankment runoff to land drainage race at Marshs Road
CSM2-E	Discharge from embankment to land drainage race at Springs Road
CSM2-F1	Discharge to Montgomery's Drain adjacent Halswell Junction Road

Table 1 – Potential ESC Measure overflow Discharge Locations During Construction

2.5 Ground Conditions

The *Christchurch Southern Motorway Extension Stage 2 and Main South Road Four Laning Technical Report 11 – Geotechnical Engineering and Geo-hazard Report* (TR11) describes the ground conditions likely to be encountered along the proposed route and generally falls into the category of Sandy Silts and Sand and Gravels.

Section 10 of TR 11 states the following:

Sandy Silts *– The material that is to be obtained from cutting is expected to consist predominantly of silt, with varying proportions of sand, the exception being to the west, where sandy gravel may be encountered. Laboratory testing of the silt recorded an average Plasticity Index of 6%, with a*

range of 3 to 10%, confirming its low plasticity. Three compaction tests on the silt gave consistent results, with an optimum moisture content of 15% (range 13 to 16%) compared to a natural moisture content of 15% (range 10 to 19%) and a maximum dry density of 1.79 Mg/m³ (range 1.73 to 1.84 Mg/m³).

Generally the silt is likely to have a high degree of sensitivity, being stiff or very stiff on initial excavation, but being susceptible to softening if it becomes wet. Due to the lower drained strength of the silt and its susceptibility to wetting, it is not recommended that it be used as structural fill beneath foundations or on the external faces of embankments and slopes. It could potentially be utilised within the core of embankments, subject to further assessment.

***Sands and Gravels**- The laboratory testing of the sand and gravel indicates that this material can be used as engineered hardfill within the works, including beneath foundations and on the external faces of embankments and slopes, subject to detailed design. It has been assumed that the approach embankments for underpasses will be constructed of imported pit run or river run gravel, comprising well graded sand and gravel, with minimal fines content.*

Section 10.4 of TR 11 states that approximately 1 million m³ of material will be required during construction, approximately one third of which can be sourced from cut material and the remainder being imported onto the site.

The imported material will likely be clean river run gravels, however, TR11 states that there is the opportunity to use alternative material such as waste glass or crushed concrete from the ongoing demolition of earthquake damaged buildings to be used as embankment fill and/or sub-base material for the carriageway.

The cut-fill balance for the project reported in TR11 is such that little waste material will require disposal, however where necessary waste material arising from the works will be taken to landfill.

It will be necessary to stockpile both waste and imported material and these should be placed at strategic locations throughout the site to minimise traffic movement and haulage and appropriate measures and practices be put in place to control runoff and suppress dust.

2.6 Stockwater Races

Within the proposed route are a number stockwater races (SWRs) which are owned and operated by Selwyn District Council (SDC).

These SWRs are used for stock water and are an important asset of SDC. The SWRs supply water throughout the area with some discharging to Prebbleton approximately 3km south east of the proposed alignment. The larger SWRs discharge to streams in the Upper Halswell River Catchment whilst the smaller races discharge to soak pits.

The proposed route of CSM2 and MSRFL cross approximately 9 existing SWRs (7 along CSM2 and 2 along MSRFL, one additional SWR runs parallel to the MSRFL alignment for approximately 2.1km). Some SWRs can be decommissioned but other will require piping beneath the proposed road alignments and the design of the SWR realignments and accommodation works are discussed in more detail in Section 7 of the Stormwater Management and Disposal Report – September 2012[2].

It is noted in that report that during a meeting with SDC that SDC would not allow the discharge of stormwater runoff to the SWR network, even after being treated, and therefore it is proposed to discharge all treated stormwater runoff to ground via soakage structures. This restriction also applies to the disposal of stormwater runoff during construction.

The stockwater races are managed by SDC under the Water Race Bylaw 2008. The majority of the Bylaw concerns water takes but there is a process of consultation required for closure as there are a number of existing users that have existing rights to use the water race system. Closure of stockwater races is proposed in a limited number of locations and these are outlined in the detailed project description in the AEE. SDC processes for closure are to seek landowner agreement and subsequently the Water Race sub-committee will approve the proposal under the Bylaw.

While SDC's policy is to seek unanimous agreement from paying race users affected by the closures, approval from SDC can be granted if there is no unanimous agreement. In any event the process of consultation with approvals under the Bylaw will need to be commenced firstly with SDC and then with individual landowners at detailed design stage.

During consultation with SDC, the Council also has advised that stockwater races can be closed for up to 24 hours without notice and for longer periods with the prescribed notice.

[2]Christchurch Southern Motorway Extension Stage 2 and Main South Road Four Laning Stormwater Management and Disposal Report; September 2012

3. Erosion and Sediment Control Methodology

3.1 Introduction

Erosion and sedimentation are natural process, however, increased erosion and sedimentation occur through human activity which when carried out can happen more rapidly than would be expected to occur through natural processes.

Erosion occurs when the surface of the land is worn away by the action of water, wind, ice or geological processes and sedimentation occurs when this eroded material is deposited.

On most earthworks sites, including motorway projects, sediment generally arises from the bulk earthworks operations and is affected by the size of the area exposed by earthworks operations and the length of time that these areas exposed to the elements during the construction of the permanent works.

There are a number of other land disturbance activities to be carried out during the construction of the project. In particular; these include the establishment of temporary carriageways to facilitate temporary traffic diversions around the works, the realigning of existing, and the construction of new, stockwater races, the construction of bridges and other permanent structures.

These activities have been taken into account in the preparation of this ESCMP and the placement and use of ESC measures and practices to minimise the effects of earthworks on the receiving environment.

On this project effective ESC will be accomplished through the combination of:

1) Physical structures and barriers, such as clean water diversion bunds and channels, Sediment retention ponds, silt fencing and decanting earth bunds, and;

2) Site management measures such as effective stockpile management, site inductions for site staff, timely stabilisation of exposed earth and the surface roughening of embankment slopes.

The various measures and practices to be proposed are discussed in Section 5 and 6 of this ESCMP.

3.2 ESCMP Structure

This ESCMP takes cognisance of the expected construction methodology and explains the ESC measures that are expected to be put in place prior to and during construction activities on site.

A copy of the drawings showing an indicative layout of the location and type of ESC measures to be provided can be found in Appendix A

The main purpose of this ESCMP is to identify appropriate measures to:

- Reduce stormwater runoff from upstream of the works entering the site;
- Minimise sediment leaving areas disturbed by the construction process and prevent silt laden stormwater runoff from entering the stormwater drainage system;
- Identify suitable temporary ESC measures to be placed prior to and during construction; and
- Provide guidance for the production of construction phase ESCMP by the Contractor for the works.

3.2.1 Principles of erosion and sediment control

The principle of this ESCMP is to identify appropriate ESC measures and practices that reduce the potential for erosion and sedimentation effects of the earthworks. The construction process will endeavour to minimise areas of exposed open ground, which are the principal source of silt laden runoff during rainfall events.

The general principles and measures that will be adopted during construction are as follows:

- Prevention: Excluding clean water runoff from entering the active work areas therefore preventing clean water runoff from combining with excavated spoil and/or construction material.

  This will require the use of clean water diversion channels and/or bunds to divert runoff from the upstream side of the work area.
- Capturing any silt laden runoff generated within the working area through the use of runoff diversion bunds on the downstream side of the construction which will direct silt laden runoff from the site to an appropriate erosion and sediment control device.
- Minimisation: Limiting the extent of exposed areas and the length of time they are exposed to reduce the potential to generate erosion. Timely stabilisation of exposed areas and the construction of impermeable areas will also reduce the potential for erosion to occur.
- Staging of work: Work will be carried out in stages and working areas will be stabilised once each stage is completed.

The contractor appointed to undertake the works shall install ESC measures prior to work commencing on site, shall maintain them for the duration of the works and until the ground has become stabilised. ESC measures will not be removed without the prior agreement of NZTA and if necessary under resource consent conditions with the approval of ECan representatives.

- Maintenance: All ESC devices are to be regularly inspected to identify rips, tears and movement in fabrics and repairs made as soon as any defect is observed. ESC measures are to be inspected

on a daily basis and especially following weather events. A maintenance schedule shall be developed to ensure sediment build-up is cleared and disposed of within the site.

- Management of materials: Prompt removal of excavated material away from any sensitive areas will be required (e.g. adjacent to the stockwater races, the Upper Knights Stream or other water treatment and attenuation devices).

Material stockpiles shall be surrounded by silt fencing or be covered, where practical, to prevent rainwater washing sediment off the stockpiled material.

3.3 General provisions for erosion and sediment control

3.3.1 Erosion control measures

The following general measures will be adopted to minimise erosion during the works:

- Ensuring that all bare areas of earthworks are protected against erosion for the duration of the works. The contractor shall inspect bare areas of earth for the signs of actual and/or potential erosion by daily inspections and carrying out any maintenance works as necessary. The contractor will also monitor weather forecasts on a daily / weekly basis in order to plan and execute works around forecast periods of wet or extreme weather.
- Protection of the earthwork areas that will not be built on or surface paved by mulching and re-vegetation. If required geotextile material or similar covering will be used to prevent and reduce erosion.
- Minimising the period during which bare earth is exposed to the elements. Works should be programmed to limit the extent of ground clearance activities and the time that exposed surfaces are open to the elements. Where surfaces are to be exposed for a significant period of time they shall be managed through the use of surface roughening measures or mulching to reduce the risk of sediment generation through rainfall or dust generation during dry periods..
- Prepare and Implement a Construction staging plan to reduce the amount of exposed earth on the site during construction as outlined in this plan;
- Arranging work practices to minimise the need for stockpiling of waste/spoil on site;

3.3.2 Sediment control measures

The Contractor will take all reasonably practical steps to minimise sedimentation and the increased turbidity of run off from the earthworks areas during the construction, implementation and maintenance of the works.

The Contractor will adopt the following general measures to minimise adverse effects from sediment discharge:

- Completing all works in the minimum time practicable;

- Ensuring that all sediment-laden runoff from the site is treated by control measures outlined in this plan;
- Reusing or importing cleanfill material and removing excess material off site as quickly as possible.
- Installation of appropriate sediment control measures (Silt Fencing, Sediment Retention Ponds and Decanting Earth Bunds) prior to bulk earthworks operations commencing on site.

3.3.3 Applicable erosion and sediment control devices

This section lists the primary protection measures designed to minimise the quantities of sediment generated at the construction sites i.e. those designed as prevention controls to stop water entering sites and stockpiles or trapping sediment as close as possible to its generation point. They include:

- Earthworks – Limiting earthworks to appropriate weather conditions in accordance with conditions of consent.
- Timely stabilisation of exposed earth through mulching and/or seeding to promote and encourage revegetation,
- Surface roughening activities should also be carried out on embankment slopes until they are ready to be permanently stabilised through mulching and seeding
- Covering exposed areas of earth and stockpiled material with appropriate geotextile material.
- Construction of clean water diversion drains placed on the upstream side of working areas to prevent clean water entering the construction area. Clean water diversion drains would be formed by the construction of earth bunds or open channels
- Erection of Silt Fences – to intercept runoff and trap sediment
- The provision of sediment retention ponds and decanting earth bunds

3.3.4 Emissions to Air

Emissions to air (e.g. dust) from site activities can settle and contribute to sediment load in runoff as well as creating a nuisance to the public, adjoining roads and premises. Emissions to air are discussed in the Specialised Environmental Management Plan 001.

3.4 Preventing clean water entering construction areas

Clean water diversion drains will be formed upstream of the construction area to prevent stormwater entering the construction area and eroding / mobilising silts

Source prevention measures reduce the quantity of sediment laden runoff generated, making silt capture and removal easier to implement. Bunds formed with sand bags, or earth, will be used to divert stormwater away from and around the construction areas.

3.5 Preventing Sediment Laden Water Leaving Construction Areas

A combination of measures such as silt fences, super silt fences, earth bunds, swales and sediment retention ponds will be placed on the downstream edges of the site to contain sediment within the site boundary.

Where appropriate stormwater runoff generated within the site is to be directed to one of a number of sediment retention ponds to be constructed as part of the works and will be designed to promote the settlement of sediment from the stormwater runoff. Treated stormwater runoff will then be allowed to infiltrate into the ground via infiltration ponds or other soakage structures.

Perimeter controls such as clean water diversion drains and permanent stockwater race diversions channels, pipes and siphons shall be constructed and in place prior to construction commencing.

3.6 Stockpiles and Spoil Heaps

This section of the report presents a range of control and mitigation measures designed to prevent or minimise adverse erosion effects on the environment and local community beyond the boundary of the construction site.

- Certified clean fill material, for site reinstatement upon works completion, shall be stored separately.
- Stockpiles of topsoil, sand, and other materials liable to dry out and generate significant dust during windy conditions, should be monitored and options such as dampening, allowing piles crust over, or covering, will be considered as appropriate.
- Stockpiles should be within a bunded area to prevent migration of eroded material.
- Stockpiles will be managed to prevent rainfall washing out silt, or in dry periods blowing dust outside the site boundary where it could be remobilised during rainfall events
- Water spraying (to control dust) will require uniform application rates and be consistent with evaporation rates. Care should be taken to prevent over-watering, which can saturate the bulk of a stockpile. Excessive watering (especially during building-up of stockpiles) may cause flow slides and cause slips. Water application rates, and therefore the capacity of the water spray system, should be carefully evaluated during the design and construction phases.

3.7 Stormwater Management during Construction

This report recommends as a minimum that the SWR diversions and siphon structures are constructed and commissioned prior to any major earthworks occurring, in order to minimise impact on these waterways.

As noted in Section 2.2 above, due to constraints imposed by Selwyn District Council no stormwater collected from the construction works, treated or untreated can be discharged into the existing or proposed SWRs.

All on site stormwater runoff and the resultant sediment yielded from the works must be dealt with within the construction site.

As a result of this restriction all stormwater runoff shall be discharged, to ground soakage pits or other temporary infiltration devices. There shall be no discharge to permanent ground water disposal devices until the site is substantially stabilised and the risk of sediment generation has been minimised.

Details of the locations of these SWRs and their usage / management can be found in section 3.4 of Technical Report 3 – Assessment of stormwater disposal and water quality

This poses some challenges in regards to disposal of stormwater from the area of works. A limited program of infiltration investigations was undertaken in July 2009. Further percolation tests were undertaken in October 2010 & September 2011. The results of these findings can be found in the Stormwater Management and Disposal Report May 2012, Section 4.1.4

The findings of these investigations are to be used for sizing of appropriate infiltration structures in their respective locations.

The options for stormwater disposal during construction are limited by the absence of surface water disposal points. Key issues which will require addressing in the CSEMP plan include:

- Control of stormwater and isolating runoff from the stockwater network;
- Separating clean water from silt laden water;
- Protecting adjacent landowners from surface water flows from the site;
- Minimise sediment leaving the site; and
- Disposal to ground.
- Construct Clean Water Diversion drains early in the construction programme to manage overland flows.

4. Assessment of Risk

Much of the existing catchment does not drain to a defined watercourse and therefore the risk of sediment laden water contaminating the receiving environment is considered to be low.

The main area of concern is where construction works are being carried out in close proximity to SWRs and existing stormwater treatment ponds and open watercourses. (Montgomery's Drain and the Upper Knights Stream).

Estimating sediment yields for the Project will be carried out by following the procedures Universal Soil Loss Equation (USLE) and will be carried out prior to construction. The primary purpose of the USLE is to provide an assessment of the risk of sediment generation and yields, and to assist in identifying appropriate ESCs required for managing this risk to the environment from sediment discharges from earthworks sites.

As discussed above much of the runoff generated from the construction works will soak to ground via soakage structures placed at regular intervals along the mainline carriageway. ULSE calculations will be carried out prior to construction stage to provide an indication of the sediment yield expected at each of the ESC controls proposed, to provide the contractor with an indication of the volume of sediment to be removed from each of the ESC measures proposed.

The project will involve works that will be carried out on several fronts and will also be subject to ongoing stabilisation as works progress. The USLE should be used as a risk assessment and not as a specific sediment loading tool,

The key elements of risk during the construction process are the exposure of bare land, the receiving environment locations and the value of these receiving environments

The major risks from an ESC perspective are:

- Diversion of stockwater races
- Works adjacent to stockwater races
- The pumping of sediment laden water from excavations and;
- The stockpiling of excavated, waste and imported material.

The 3 major aspects of ESC are related to the risk of sediment yield as follows:

- Sediment Generation Potential – The sediment generation potential of a site depends on a number of factors including catchment slope, the slope length soil type, rainfall intensity and volume and the erosion control measures
- Sediment Delivery – The sediment delivery relates to the amount of material that is retained on site and within the natural contours of the site prior to it reaching any sediment treatment device

- Sediment Yield –this is the amount of sediment that leaves the site and enters the receiving environment.

The USLE allows for an assessment of the areas of higher sediment yield to be made and indicates which areas of the site should be targeted.

5. Overall Erosion and Sediment Control Approach

The following section outlines the measures that will be implemented as part of the ESCMP and expands on the principles outlined above.

The aim of the ESCMP is to demonstrate that negligible sediment-related effects will result from construction activities with appropriate measures put in place. The focus on the ESC measures is based on:

1. Viewing the proposed Project works such that all construction activities, and the full effects of these construction activities, are considered as a package.
2. Minimising potential adverse effects by utilising measures which meet or exceed industry best practice guidelines (ECan Guidelines and NZTA Standard).
3. Implementation of an integrated management approach (as outlined in Section 5.1 below) for design, implementation, maintenance and decommissioning of ESC measures. This will ensure ownership of the ESC measures and therefore better implementation, management and maintenance.
4. Undertaking pre-construction meetings for specific stages of work and having regular weekly meetings (toolbox meetings) on site with relevant personnel as part of the construction phase.
5. Maintaining a register of control measures and "As Built" information of key controls such as clean water diversion bunds, decanting earth bunds and sediment retention ponds to allow for quick referencing and understanding of ESC measures.
6. Including both structural and non-structural elements within the methodologies to be employed such as:

a) Manually raised decant devices on SRPs;

b) Chemical treatment utilising polyacryamide as a risk management tool, where appropriate;

c) Proactive monitoring programme;

d) Risk identification and management accordingly;

e) Progressive stabilisation as works progress;

f) Weather response; and

g) Ensuring contracting staff are aware of the ESCs employed and do not remove them without seeking appropriate approval.

It is expected that the specific ESC plans will follow the principles and details outlined within this report. This enables the Project team and the consenting authority to have further input into the methodologies implemented

5.1 ESC Integrated Management Approach

An integrated management approach will be taken for ESC measures and practices on site to ensure that the planning, implementation, inspection, operation and maintenance of all the ESC measures is undertaken by an experienced team of people ensuring that all relevant aspects of the Project are taken into consideration.

This will ensure that adequate resources, commitment and expertise are provided to ESC from the design through to dis-establishment and will ensure that all key stakeholders are involved and communicated with as necessary.

All staff working on site, or with site responsibilities, will undertake a formal site induction and will include ESC and ensure familiarisation with the ECan Guidelines and the NZTA Standard. No-one will be permitted to work on the site until they have completed the site induction process.

The reduction in the potential for erosion will depend on the timely stabilisation of disturbed ground, and the degree to which successful stabilisation will occur will largely be dependent on the establishment of planting. The timing of the works shall also take into account the permanent landscaping requirements for the Project. Further information of the landscaping requirements for the project can be found in the Draft Landscape Management Plan (SEMP005).

5.2 Erosion and Sediment Control Measures

ESC measures are designed to minimise the extent of soil erosion and sediment yield from the site and the proposed ESC measures discussed in Section 6 below have been designed in accordance with the ECan Guidelines and the NZTA Standard.

Any significant modifications to the ESC measures shown on the drawings originally approved as part of any consent may require further approval by the consent authority prior to implementation in the construction phase.

This will take place where necessary through preparation of site and activity specific CESCPs and a pre-construction meeting on site with the consent authority, before any ESC measures are installed prior to bulk earthworks activity taking place.

5.2.1 Sediment Retention Ponds

Figure 2 below provides an example of a sediment retention pond which will be used on this Project. Treatment of all collected stormwater must be carried out in accordance with the ECan and NZTA guidelines to ensure that sediment is removed from the stormwater runoff before been discharged to ground via soakage structures.

Captured stormwater is to enter the forebay either by gravity or in areas where gravity feed is not possible, via pumping. Treated stormwater from the discharge structure is to be piped to a soakage

structure. This may be of an open basin, or an underground soakage structure containing large rip rap material, encased in a geofabric surround.

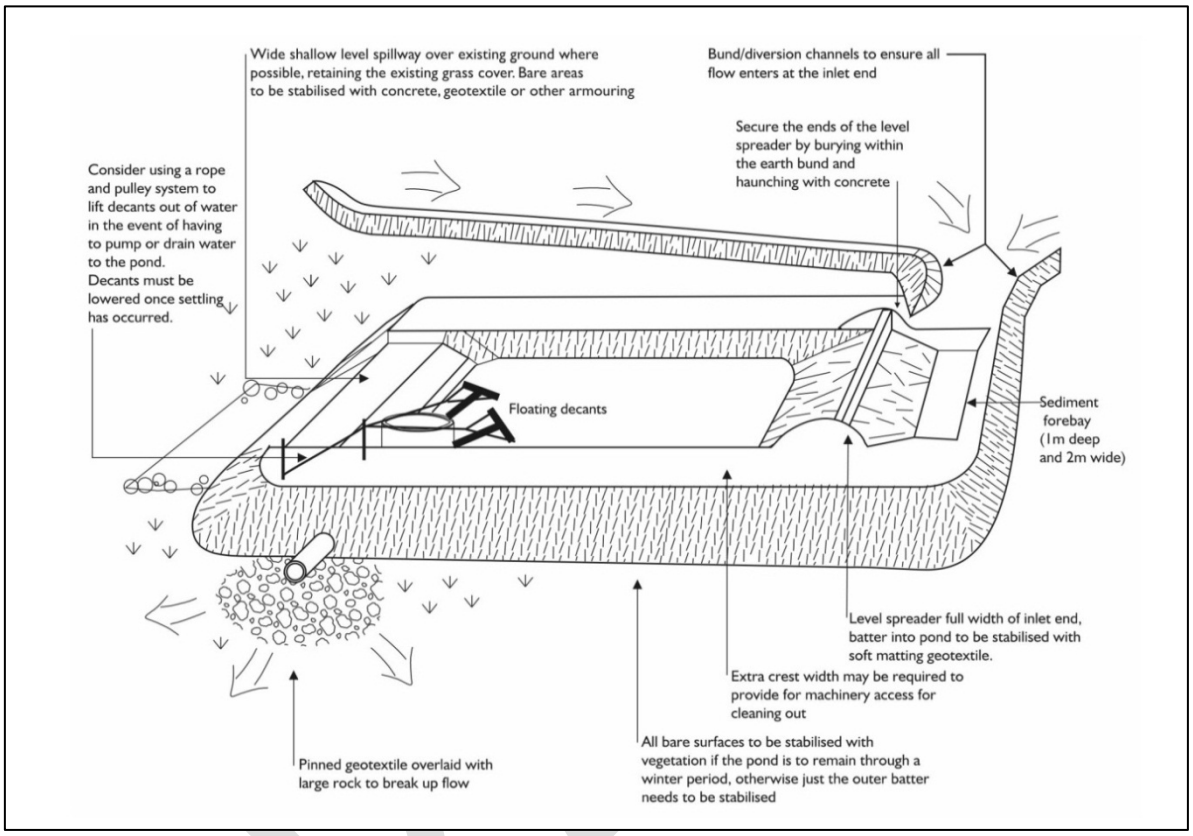


Figure 2 – Sediment Retention Pond

5.2.2 Decanting Earth Bunds

Figures 3 below provide an example of a Decanting Earth Bund that will be used on this Project. The design, construction, maintenance and decommissioning of decanting earth bunds must be carried out in accordance with the ECan and NZTA guidelines.

Decanting earth bunds will be used along the mainline carriageway to protect the permanent soakage structures from sedimentation.

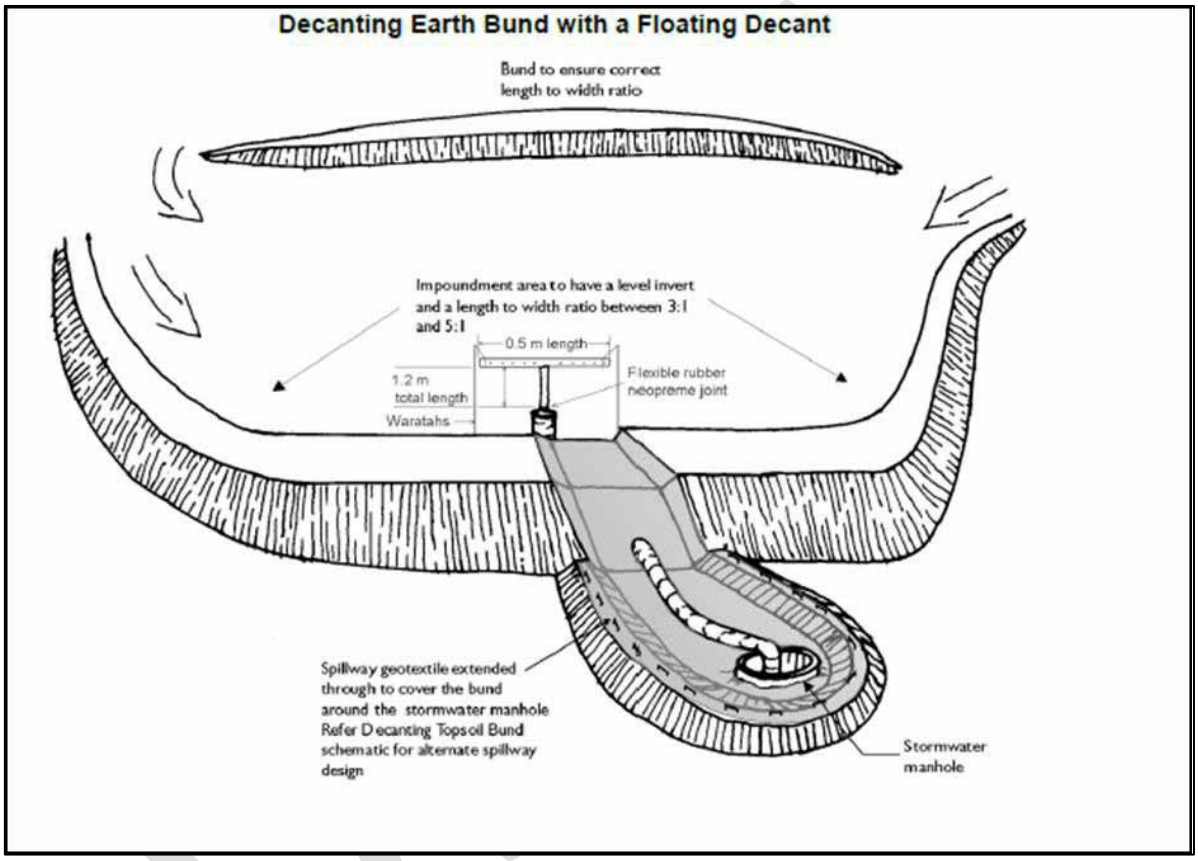


Figure 3 – Decanting Earth Bund

5.2.3 Silt Fencing and Super Silt Fencing

Figures 4 and 5 below provide examples of a silt fence and super silt fences that will be used on this Project. The design, construction, maintenance and decommissioning silt fencing and super silt fencing must be carried out in accordance with the ECan and NZTA guidelines.

Super silt fences will be used in areas where protection of open watercourses and stockwater races is required.

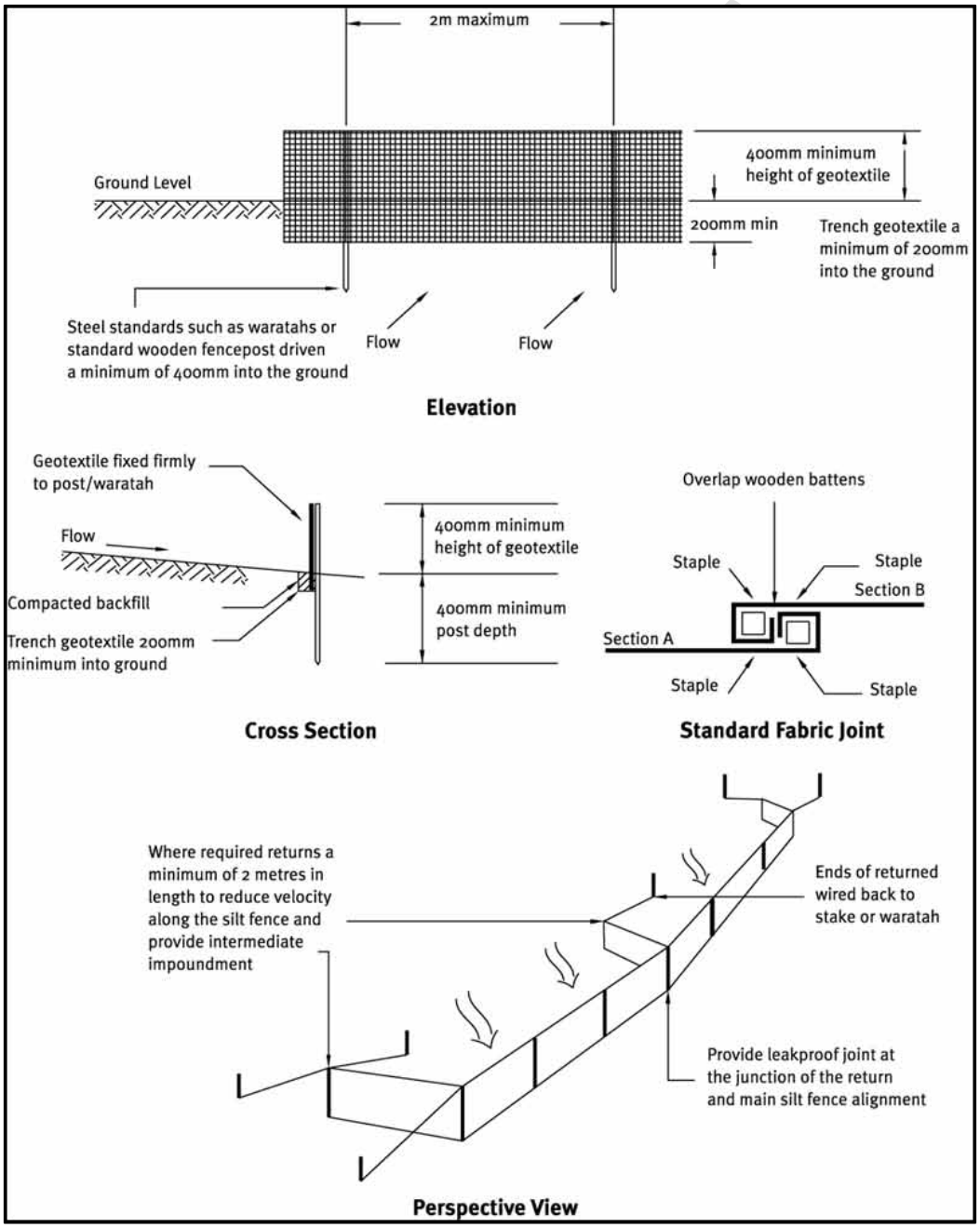


Figure 4 – Silt Fence

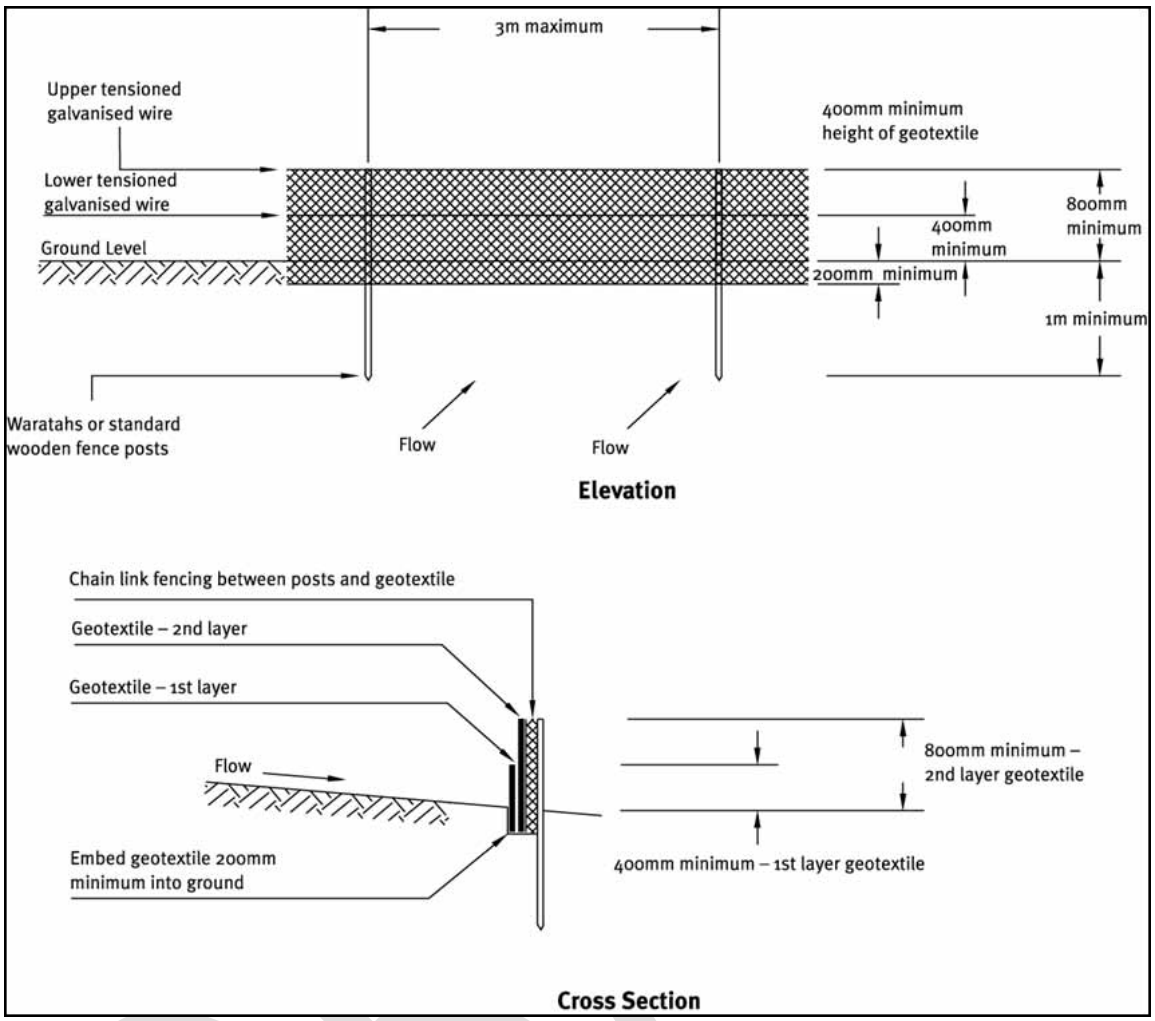


Figure 5 – Super Silt Fence

5.2.4 Surface Roughening

Figure 6, below, indicates the roughening of the surface of an embankment. Surface roughening is a temporary erosion control procedure that reduces runoff velocity, promotes infiltration, delays formation of rills and can significantly reduce short-term soil losses.

It also helps to capture small quantities of sediment. Roughening can also reduce wind velocities at ground level, making a soil less prone to wind erosion.

Ripping or scarification may also break up hard or compacted surfaces before seeding for either temporary or permanent revegetation programmes. Furrows act to trap seed and provide a moisture sink enhancing the establishment of vegetation

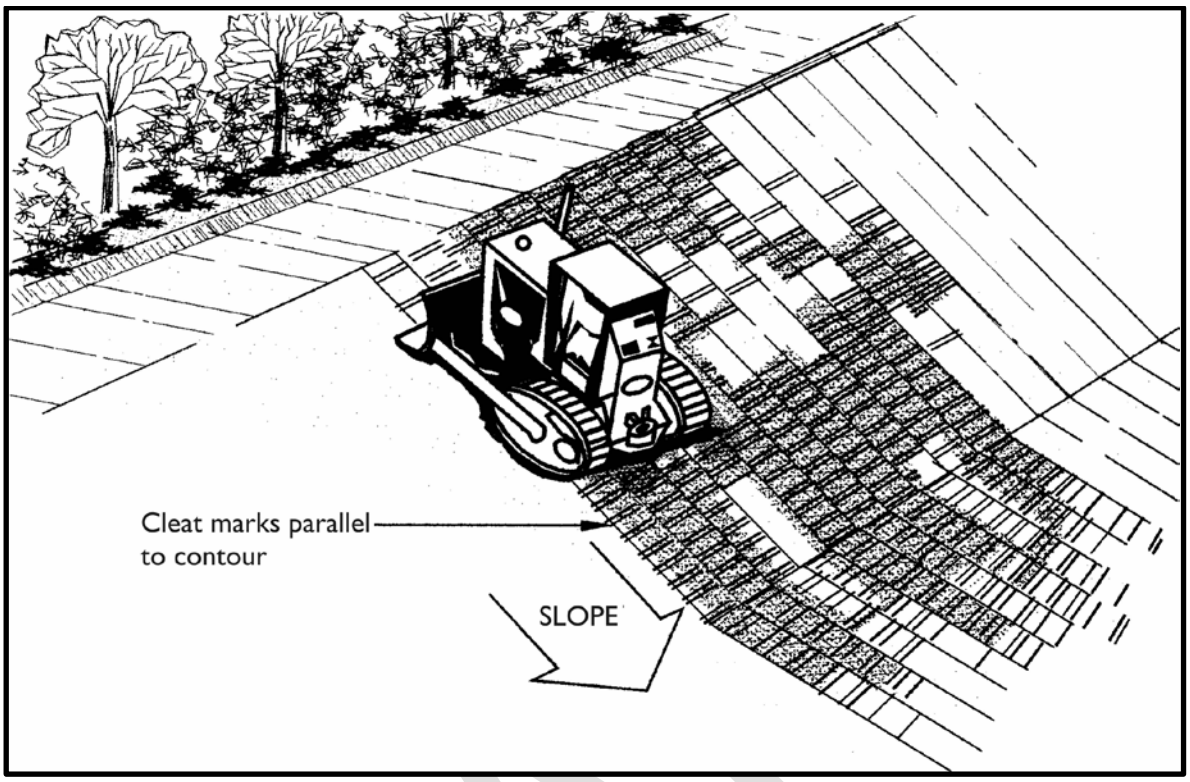


Figure 6 – Surface Roughening

5.3 Erosion and Sediment Control Monitoring

As part of the ESC methodology, it is envisaged that ongoing site monitoring by the Project team will occur to ensure that the ESC measures have been installed correctly; working practices and methodologies are being followed; and are functioning effectively throughout the duration of the works.

Any ESC measures or working practices that require attention or adjustment will be identified, and if necessary, relevant team members consulted to ensure continual compliance and improvement of working practices. This may include undertaking further assessment of risk, including sediment yields. In the circumstance of higher risk areas being identified more stringent controls will be considered, in particular more progressive stabilisation.

Where applicable, visual assessments of the receiving environment will continue to be undertaken during the works with particular attention being given during and after periods of rainfall and pumping activities.

Visual assessment the receiving environment is defined as the immediate receiving environment adjacent to the area of works. Any noticeable change in water clarity or sediment deposition from that prior to the rainfall event, or upstream of the site of works occurring as a result of the

earthworks activity will require a review of the ESC measures and a change in ESC and/or working practices as necessary.

Weather forecast monitoring will also ensure that critical works such as those associated with the stock water race diversions works only occur during a suitable weather window.

5.3.1 Device Management & Monitoring

Environmental compliance for the Project during construction period will be based on the appropriate location, installation, operation, maintenance, and monitoring of the various ESC devices.

It is important to note that ESC measures are not restricted to physical structures, such as silt fences and sediment retention ponds (SRPs) but will also include working practices and methodologies, such as mulching, stabilisation, surface roughening of exposed embankments and stockpiled material.

The purpose of such monitoring activities is to ensure that all practices and ESC measures are constructed, operated, maintained and implemented so they remain effective at all times and protect the receiving environment from the effects of erosion and subsequent sedimentation.

Monitoring of ESC measures and practices is aimed at detecting and addressing any problem areas that have the potential to have a significant adverse environmental effect and the frequency of the devices monitoring will vary during the construction and at different times of the year, it will also adapt to changing activities and risk associated with inclement weather, construction activity and areas at particular risk associated with sedimentation.

It is expected that in areas where the risk is to be considered high that the monitoring of ESC devices and practices will be undertaken on a daily basis and more frequently during and after heavy rainfall.

These inspections will be carried out and recorded in accordance with the NZTA's Erosion and Sediment Control Field Guide for Contractors.

It is also necessary to carry out monitoring activities during storm events so that the operation of the devices can be observed first hand so that any controls or measures that require attention a can be attended to in the minimum amount of time.

The visual inspections will include the following:

- the integrity and effectiveness of all erosion control and sediment treatment devices,
- activities on site,
- general site conditions and other activities occurring within the catchment,
- general status of the immediate receiving environment.

The details of these visual inspections will be recorded on the check lists included in the NZTA Field Guide. Where a problem with the integrity of a device or the effectiveness of ESC measures and practices are discovered they shall be rectified in a minimum amount of time.

In addition, detailed inspections of devices, on-site practices and other catchment activities will be undertaken in response to problems areas identified during the routine devices monitoring programme.

Additional or more intensive investigations will be carried out in response to the following issues:

- On-site activities that are likely to compromise the effectiveness or integrity of the ESC measures
- A change of water colour at monitoring locations
- Accumulation of sediment in the vicinity of the discharge points, or within or in close proximity to the active construction zones;
- Streambank collapse or signs of channel erosion / instability in the immediate receiving environments;
- Reports or receipt of evidence of changes to downstream structures (e.g. fish kills, death or discolouration of instream plant communities, increased weed growth); and
- Spillage / accident reports by site personnel.

If the results of any device monitoring suggest that adverse effects are likely to have occurred then a response in line with the process outlined below will be followed.

- ascertain that the issue is associated with the construction of the project;
- inform and liaise with the consent authority;
- ascertain the magnitude of the adverse effects (this may involve undertaking immediate monitoring of the ecological variables);
- if the effects have been more than minor, ascertain what response is necessary;
- determine how to monitor the effectiveness of the response(s); and
- implement and monitor the response.

Changes to construction site practices or to specific devices may also need to be implemented to avoid any future similar events.

6. Specific Erosion and Sediment Control Methodology

Due to the lack of open watercourses along the proposed route, the disposal of stormwater runoff from the completed carriageway surface is to be via soakage structures constructed at the edge of the carriageway at regular intervals.

The same issue arises for the management of the stormwater runoff during the construction process, with all of the runoff generated from the construction works being discharged to ground.

The following section describes the various project sections and outlines how stormwater runoff from the construction activities will be managed from an ESC perspective and reference should be made to Section 5.2 above for indicative sketches of each of the various measures discussed below.

6.1 Mainline Carriageway

The disposal of stormwater runoff from the mainline carriageway during construction will utilise the same measures as that of the final design. However, to prevent the soakage structures from becoming clogged with sediment from stormwater runoff it is proposed to construct Decanting Earth Bunds (DEBs) immediately upstream of the soakage structure locations and along the length of the swale.

Stormwater runoff arising during construction will discharge into the swale at either side of the carriageway where it will both flow towards the soakage structures and percolate into the ground along the length of the swale.

To remove any construction related sediment from the swale collected during construction it is proposed to remove a 100mm thick layer of material from the surface of the swale once the sealing of the carriageway surface has been completed.

This will remove any sediment collected and retained in the swale during the construction process; the swale will then be topsoiled and seeded to provide sufficient treatment of runoff post-construction.

6.1.1 ESC Measures

Clean water diversion bunds or channels will be constructed on the high side of the site to prevent clean water runoff from adjacent land from entering the construction site.

During construction it is not expected that stormwater runoff from the mainline carriageway will be able to flow off the site, as the majority of the carriageway is constructed in cut or at grade. The main form of ESC for the mainline carriageway will be via swales at the edge of the carriageway,

which will discharge to the permanent soakage structures to be constructed in the verges of the proposed road.

To prevent the permanent soakage structures from becoming clogged with sediment arising from the construction process it will be necessary to protect these structures on the upstream side of the swale. This protection will take the form of Decanting Earth Bunds (DEBs) which will retain sediment behind them; the level of sediment retained will be monitored on a daily basis and after rain events to ensure their continued effective operation.

The soakage structures will be protected by the placement of Bidim cloth on top of the structures which will, in the event of heavy rainfall causing the DEBs to overflow, prevent the soakage structures from becoming clogged with sediment.

The Bidim cloth will allow water to pass through into the soakage structure whilst retaining any sediment on the surface.

6.2 Weedons Ross Road Intersection

This intersection has a stockwater race running along the eastern side of Weedons Ross Road. The stormwater management and disposal plans allow for a siphon structure to be installed, to maintain flows within the stockwater race during and post-construction.

This stockwater race is to be diverted from its exiting route and the pipework should be constructed prior to the commencement of the construction of the adjacent road embankment.

6.2.1 ESC Measures

Clean water diversion bunds or channels will be constructed on the high side of the site to prevent clean water runoff from adjacent land from entering the construction site.

The proposal is to install a SRP inside the northern exit ramp, to pick up any resultant stormwater flows from the low point on the MSRFL alignment.

Flows will also enter from the low-point in the alignment on MSRFL into the SRP forebay where coarse sediment will settle out of suspension. When the water level increases in the forebay it will overtop the level spreader and enter the main bay of the SRP. The discharge from the pond will be via floating decants located at the end of the main bay. The use of floating decants to control the discharge from the pond allows for additional sediment settlement time.

Treated stormwater flowing through the floating decants will be discharged to ground via a soakage structure, located to the south of the SRP.

A box or pipe culvert structure will be required beneath the road embankment to allow for overland flow paths from the land to the east during a major storm event.

As an alternative, pumping of stormwater flow during construction may be provided to pump stormwater into the SRP. If pumping is provided then chemical flocculation will also be required to assist in the settlement of sediment from the flow.

To protect the existing and proposed stockwater race to the east of the interchange, from stormwater runoff from the face of the embankment during the construction of the Weedons Road embankment and bridge structure, it is proposed that an infiltration ditch or swale is constructed between the base of the embankment and the stockwater race.

The stockwater race will further be protected from sedimentation by the placement of a silt fence between the infiltration ditch and the stockwater race to provide an added level of protection to the stockwater race in severe rainfall events.

During construction to reduce the risk of erosion of the embankment face surface roughening of the embankment slope will be carried out.

6.2.2 Decommissioning of ESC Measures

As soon as the filling of the embankment has been completed, embankment surface should be topsoiled and planting established in accordance with the Landscape Management Plan to stabilise the face and further reduce the risk of erosion.

Once stabilisation of the face has occurred and the landscape planting has become established the infiltration trench or swale can be backfilled, stabilised and grass seeded following establishment of the grass along the line of the trench or swale the silt fence can be removed.

Refer to drawing SK201 in Appendix A for further information.

6.3 CSM2 / Main South Road

Robinson Road/ Curraghs Road passes beneath the mainline of the CSM2 alignment at this point. There is a high point in the CSM2 alignment directly above the current intersection of Main South Road with Robinson Road and Curraghs Road and Robinson Road itself is to be constructed in a cutting.

Therefore the only stormwater runoff anticipated with this site will come from the major cut associated with the lowering of Robinson Road to pass beneath CSM2.

Stormwater runoff during construction of the Robinson's Road Cut will be pumped to a SRP located to the south east of the intersection.

6.3.1 ESC Measures

Clean water diversion bunds or channels will be constructed on the high side of the site to prevent clean water runoff from adjacent land from entering the construction site.

The ESC measures proposed for the construction of the Robinson's Road cut are to pump stormwater runoff during construction to an SRP.

Particular care will need to be taken with the selection of the pump as pumping produces fine-textured sediments that are very difficult to settle out and retain on-site.

There are two possible solutions to this problem the first is to provide and oversized SRP which will allow stormwater to be retained for a longer period of time in which to allow sediment to settle out of suspension; the second, would be to introduce a baffle arrangement within the main body of the pond will increase the flow length through the pond again assisting with the settlement process.

Floating decants will also be provided on the outlet of the pond prior to discharge into a soakage structure.

Timely stabilisation of the cut slope will be required to prevent erosion of the cut face onto Robinsons Road.

6.3.2 Decommissioning of ESC Measures

Excess sediment within the pond will be removed and the pond backfilled and the immediate area regraded to final design levels and the area stabilised and planted in accordance with the Landscape Management Plan.

Soakage structures constructed for use during the construction phase of works are to be utilised as part of the ultimate stormwater management design.

Refer SK202 in Appendix A for further information.

6.4 Waterholes Road (CSM2 Underpass)

The only discharge to the environment of stormwater runoff from this junction will be from construction works associated with the Waterholes Road overpass.

Erosion of sediment from the embankment during construction can be reduced by roughening the surface of the embankment thereby reducing the velocity of stormwater runoff down the face of the embankment and reducing the risk of erosion and sediment mobilisation. Timely or progressive stabilisation of the embankment face will be carried out to further reduce the potential for erosion

To further prevent sediment from being deposited on the adjacent land an infiltration ditch or swale at the base of the embankment will be constructed and a silt fence erected to provide an added level of protection to the adjacent land in severe rainfall events.

The infiltration trench or swale would allow the infiltration of stormwater whilst retaining any silt eroded from the embankment surface. A regular and robust maintenance regime would need to be in place to regularly remove sediment from the infiltration ditch or swale and prevent it from becoming clogged during the construction works.

A second phase of ESC would be to provide surface stabilisation to the embankment face which would be to mulch, secure with biodegradable matting and to plant.

The mulch and matting will have a secondary purpose, which is to prevent face of slope from drying out and generating dust. It is expected that these landscaped areas will be irrigated to allow rapid development of plants to control both sediment but also to control dust generation.

Protection of the stockwater race to the east of the Hamptons Road is critical in both the construction phase as well as at completion of construction. No discharge of any stormwater from the area of works shall be allowed to pass into any stockwater race.

Stormwater runoff on the mainline section of CSM2 will discharge to soakage structures along the edge of the carriageway. The management of stormwater runoff and hence sediment control will be as that discussed in Section 5.1 above.

Refer SK203 in Appendix A for further information.

6.5 Trents Road Underpass

Due to the relatively long length and flat grade of CSM2, only discharge to the environment of stormwater runoff from this junction will be from construction works associated with the Trent's Road overpass.

Protection of the existing stockwater race to the east of the Trent's Road is critical in both the construction phase as well as at completion of construction.

Erosion of sediment from the embankment can be reduced by roughening the surface of the embankment thereby reducing the velocity of stormwater runoff down the face of the embankment and reducing the risk of erosion and sediment mobilisation.

To further prevent sediment from being deposited on the adjacent land it may be prudent to construct an infiltration ditch or swale at the base of the embankment, along with the erection of a silt fence to provide an added level of protection to the adjacent land in severe rainfall events.

The infiltration trench or swale would allow the infiltration of stormwater whilst retaining any silt washed from the embankment surface. A regular and robust maintenance regime would need to be in place to regularly remove sediment from the infiltration ditch or swale and prevent it from becoming clogged during the construction works.

A second phase of ESC would be to provide surface stabilisation to the embankment face which would be to mulch, secure with biodegradable matting and to plant.

The mulch and matting will have a secondary purpose, which is to prevent face of slope from drying out and generating dust. It is expected that these landscaped areas will be irrigated to allow rapid development of plants to control both sediment but also to control dust generation.

Protection of the stockwater race to the south of the mainline CSM2 and the east of Trent's Road is critical in both the construction phase as well as at completion of construction. No discharge of any stormwater from the area of works should pass into any stockwater race.

Since CSM2 is complete at grade at this point, no stormwater will discharge from the construction area of this road. Stormwater runoff occurring within the cut section of the mainline alignment will be collected in infiltration ditches or swales and will be directed to a number of soakage structures placed along the length of the road. As stated above a regular and robust maintenance regime would need to be in place to regularly remove sediment from the infiltration ditch or swale and prevent it from becoming clogged during the construction works.

Refer SK204 in Appendix A for further information.

6.6 Shands Road Interchange

At Shands Road all stormwater flows will pass along the main CSM2 alignment. Any construction flows will need to be managed via construction methodology utilising the ESCMP guidelines and BPO. The ultimate stormwater design proposal for CSM2 deals with all stormwater via soak-pits in the table drains. There should be no discharge to the environment from the main alignment.

Erosion of sediment from the embankment can be reduced by roughening the surface of the embankment thereby reducing the velocity of stormwater runoff down the face of the embankment and reducing the risk of erosion and sediment mobilisation.

A second phase of ESC would be to provide surface stabilisation to the embankment face which would be to mulch, secure with biodegradable matting and to plant.

An additional measure required is to construct an infiltration ditch or swale between the base of the embankment and the stockwater race, and the erection of a silt fence between the swale and the stockwater race will provide an added level of protection to the stockwater race in severe rainfall events.

Stormwater runoff within the cut sections of the alignments will be collected through the use of infiltration ditches or swales to be constructed at the edges of the proposed carriageway. These will intercept stormwater runoff from the construction site and allow stormwater to infiltrate into the ground whilst retaining any mobilised sediment.

Excess stormwater flows would flow along the ditches or swales and will flow into soakage structures located along the mainline alignment. As stated above a regular and robust maintenance regime would need to be in place to regularly remove sediment from the infiltration ditch or swale and prevent it from becoming clogged during the construction works.

The Interchange on and off ramps as well as the Shands Road overpass will require treatment in order to prevent erosion of the earth embankment. This can be achieved through roughening of the embankment surface to reduce runoff velocities down the face of the embankment thereby reducing the risk of erosion and sediment mobilisation.

The treatment of runoff reaching the base of the embankment is proposed using two sediment retention ponds, one to the north and one to the south of the interchange. These will operate in the same manner as other sites that require retention ponds and treated stormwater will discharge to ground via soakage structures.

Treatment methods as outlined in the ESCMP shall be utilised to both minimise sediment and erosion caused by runoff and for treatment of any all stormwater before discharge to soaks.

Marsh's Road has a stockwater race running along the northern side of the road. The proposal is to relocate this stockwater race to the south side of this road along with a siphon structure crossing at the junction with Shands Road, prior to any major works taking place. Most importantly no bulk earthworks should take place prior to the siphon structures being installed and commissioned.

Refer SK205 in appendix A for further information

6.7 Marshs Road, Springs Road and Halswell Junction Road

Significant stormwater flows can be expected at this location. The proposed longitudinal design of CSM2 is for a long flat grade forming an ultimate low point at this interchange. The centreline of the mainline carriageway is essentially at grade with the edges of the carriageway in a shallow cutting through this section.

Falls in a cut through the existing natural surface, effectively forming an open channel that would expect to pick up a considerable amount of stormwater runoff. During the construction phase and critically the bulk earthworks stage of the construction, appropriate management of significant flows will be required.

The Stormwater Management and Disposal Report May 2012 recommends that significant ponds are to be constructed in the general area of the interchange. These will also be utilised as SRPs during

the construction phase, then reverting back to their final purpose as stormwater management ponds.

Stockwater races in this area require significant removal / relocation and siphon structures as detailed in the Stormwater Management and Disposal Report May 2012. These structures are to be installed and commissioned prior to any major earthworks taking place.

The termination of CSM1 includes the construction of a large stormwater management pond named the "Mushroom Pond". The proposed design of CSM2 includes the construction of a ramp that will encroach into this Pond

Sediment released into this pond could be difficult to control and will require a high level of management and maintenance.

The recommendation is for the installation of suitable floating or staked silt fence(s) with a secondary staked or floating fence suitable non-woven geofabric.

Controlled rates of earthwork inundation of the mushroom pond will need to be regulated and controlled, as large earthwork movements could cause overtopping of the proposed silt and geofabric fence causing contamination of the existing pond.

Design and maintenance of use of the mushroom pond which currently provides treatment to existing road runoff will need to be managed. Construction should also not compromise existing soakage to ground during construction.

Treatment of these earth embankments will need to be such that they are temporarily stabilised against erosion until vegetation becomes established and the embankment face becomes stabilised Hydromulching or other suitable measures will be required in order to suitably stabilise these batters prior to removal of the silt fence.

Preferred seeding windows for grassing are autumn (March and April) and spring (September, October and November). If irrigation is available, grassing may be done throughout the summer. Construction will need to be programmed to fit within these windows.

Refer SK206 in appendix A for further information.

7. Activity Details and Methodology

7.1 Contractors Construction Management Plan

Once a contractor is appointed, and prior to start of the main construction works, a Construction Social and Environmental Management Plan (CSEMP), based upon the Construction Environmental Management Plan (CEMP), will be prepared which set out the detail of the proposed construction methodology and the measures to be taken to minimise potential adverse effects.

Based on the contractor's CSEMP this Erosion and Sediment Control Plan will be amended, as appropriate and incorporated into the CSEMP for the project.

7.2 Requirements for Contractors Erosion and Sediment Control Plan

In order to successfully manage erosion and sediment generation on the project, the Contractor will consider the proposals and measures outlined in the ESC Plan and will expand on the detail as required and will take note of the following when suggesting any alterations to the construction staging or other element of the work:

- Phase and plan work on site to take account of weather forecasts and severe weather events
- How disturbance will be minimised;
- Construction phasing / staging and sequencing;
- Set out stabilisation methodologies;
- Details of Perimeter, Sediment and any other controls; and
- Maintenance programmes and procedures to ensure the integrity and function of the ESC measures is not compromised by the site operations and /or severe weather

It is anticipated that the environmental controls, including ESCs, on site will be subject to periodic environmental compliance auditing by representatives of NZTA and ECan

8. References

1. Erosion and Sediment Control Guideline – Environment Canterbury; 2007
2. Erosion and Sediment Control Standard for State Highway Infrastructure – New Zealand Transport Agency 2012
3. Christchurch Southern Motorway Extension Stage 2 and Main South Road Four Laning Stormwater Management and Disposal Report – New Zealand Transport Agency – May 2012

APPENDIX A – ESCMP Drawings

SK201 – Weedons Ross Road

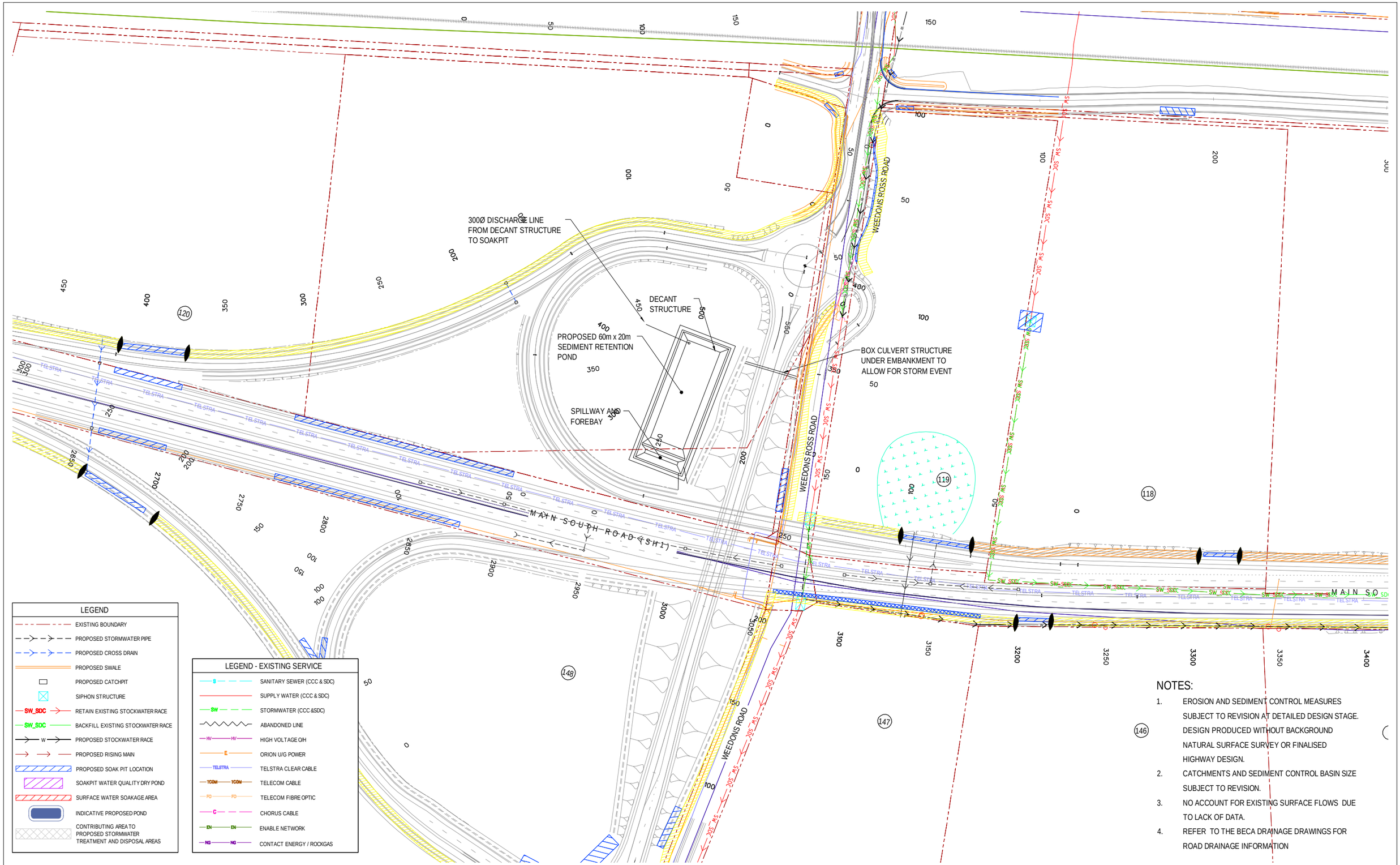
SK202 – Robinson Road

SK203 – Hamptons Road

SK204 – Trents Road

SK205 – Shands Road

SK206 – CSM1 / CSM2 Junction



NOTES:

1. EROSION AND SEDIMENT CONTROL MEASURES SUBJECT TO REVISION AT DETAILED DESIGN STAGE. DESIGN PRODUCED WITHOUT BACKGROUND NATURAL SURFACE SURVEY OR FINALISED HIGHWAY DESIGN.
2. CATCHMENTS AND SEDIMENT CONTROL BASIN SIZE SUBJECT TO REVISION.
3. NO ACCOUNT FOR EXISTING SURFACE FLOWS DUE TO LACK OF DATA.
4. REFER TO THE BECA DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFORMATION

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Client: NEW ZEALAND TRANSPORT AGENCY
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Title: EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - WEEDONS ROAD SKETCH

Original Size: A1
Drawing No: 62236-A-SK201
Rev: B

Plot Date: 18 October 2012 - 5:04 p.m. Plotted by: Tony Cain
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DECANTING EARTH BUND

DECANTING EARTH BUND

SWALE TO DISCHARGE TO SOAK PIT VIA DECANTING EARTH BUND

DECANTING EARTH BUND

DECANTING EARTH BUND

DECANT STRUCTURE

OVERFLOW STRUCTURE TO SOAK

SPILLWAY AND FOREBAY

PROPOSED 7m x 21m SEDIMENT RETENTION BASIN

DECANT STRUCTURE

OVERFLOW STRUCTURE TO SOAK PIT

DECANTING EARTH BUND

DECANTING EARTH BUND

PROPOSED 7m x 21m SEDIMENT RETENTION BASIN. WATER TO BE PUMPED TO SETTLEMENT POND FROM UNDERPASS AS REQUIRED

INFILTRATION TRENCH / SWALE WITH SUPER SILT FENCE AT BASE OF EMBANKMENT

103 102 6 129 128 1 2 7

LEGEND

- EXISTING BOUNDARY
- PROPOSED STORMWATER PIPE
- PROPOSED CROSS DRAIN
- PROPOSED SWALE
- PROPOSED CATCHPIT
- SIPHON STRUCTURE
- SW_SDC — RETAIN EXISTING STOCKWATER RACE
- SW_SDC — BACKFILL EXISTING STOCKWATER RACE
- W — PROPOSED STOCKWATER RACE
- PROPOSED RISING MAIN
- PROPOSED SOAK PIT LOCATION
- SOAKPIT WATER QUALITY DRY POND
- SURFACE WATER SOAKAGE AREA
- INDICATIVE PROPOSED POND
- CONTRIBUTING AREA TO PROPOSED STORMWATER TREATMENT AND DISPOSAL AREAS

LEGEND - EXISTING SERVICE

- S — SANITARY SEWER (CCC & SDC)
- SUPPLY WATER (CCC & SDC)
- SW — STORMWATER (CCC &SDC)
- ABANDONED LINE
- HV — HIGH VOLTAGE O/H
- E — ORION U/G POWER
- TELSTRA — TELSTRA CLEAR CABLE
- TCOM — TELECOM CABLE
- FO — TELECOM FIBRE OPTIC
- C — CHORUS CABLE
- EN — ENABLE NETWORK
- NG — CONTACT ENERGY / ROCKGAS

NOTES:

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3. NO ACCOUNT FOR EXISTING SURFACE FLOWS DUE TO LACK OF DATA.
4. REFER TO THE DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFORMATION

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Client: NEW ZEALAND TRANSPORT AGENCY
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Title: EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - ROBINSONS ROAD SKETCH

Original Size: A1
Drawing No: 62236-A-SK202
Rev: B

Plot Date: 18 October 2012 - 4:53 p.m. Plotted by: Tony Cain
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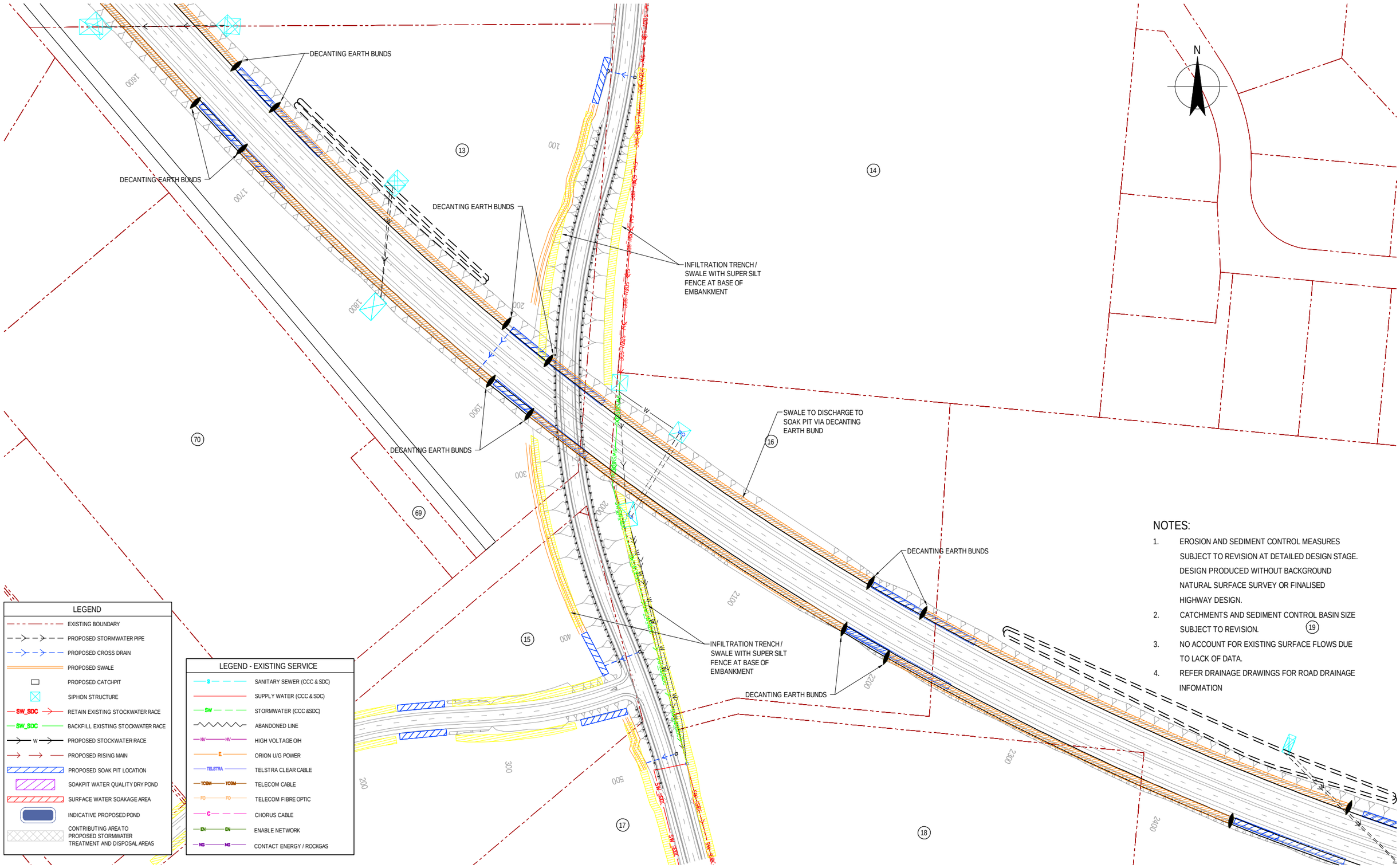

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LEGEND

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- PROPOSED STORMWATER PIPE
- PROPOSED CROSS DRAIN
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- PROPOSED CATCHPIT
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- SW_SDC — RETAIN EXISTING STOCKWATER RACE
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- SOAKPIT WATER QUALITY DRY POND
- SURFACE WATER SOAKAGE AREA
- INDICATIVE PROPOSED POND
- CONTRIBUTING AREA TO PROPOSED STORMWATER TREATMENT AND DISPOSAL AREAS

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Client: NEW ZEALAND TRANSPORT AGENCY
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Title: EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - WATERHOLES ROAD SKETCH

Original Size: A1
Drawing No: 62236-A-SK203
Rev: B

Plot Date: 18 October 2012 - 4:28 p.m. Plotted by: Tony Cain
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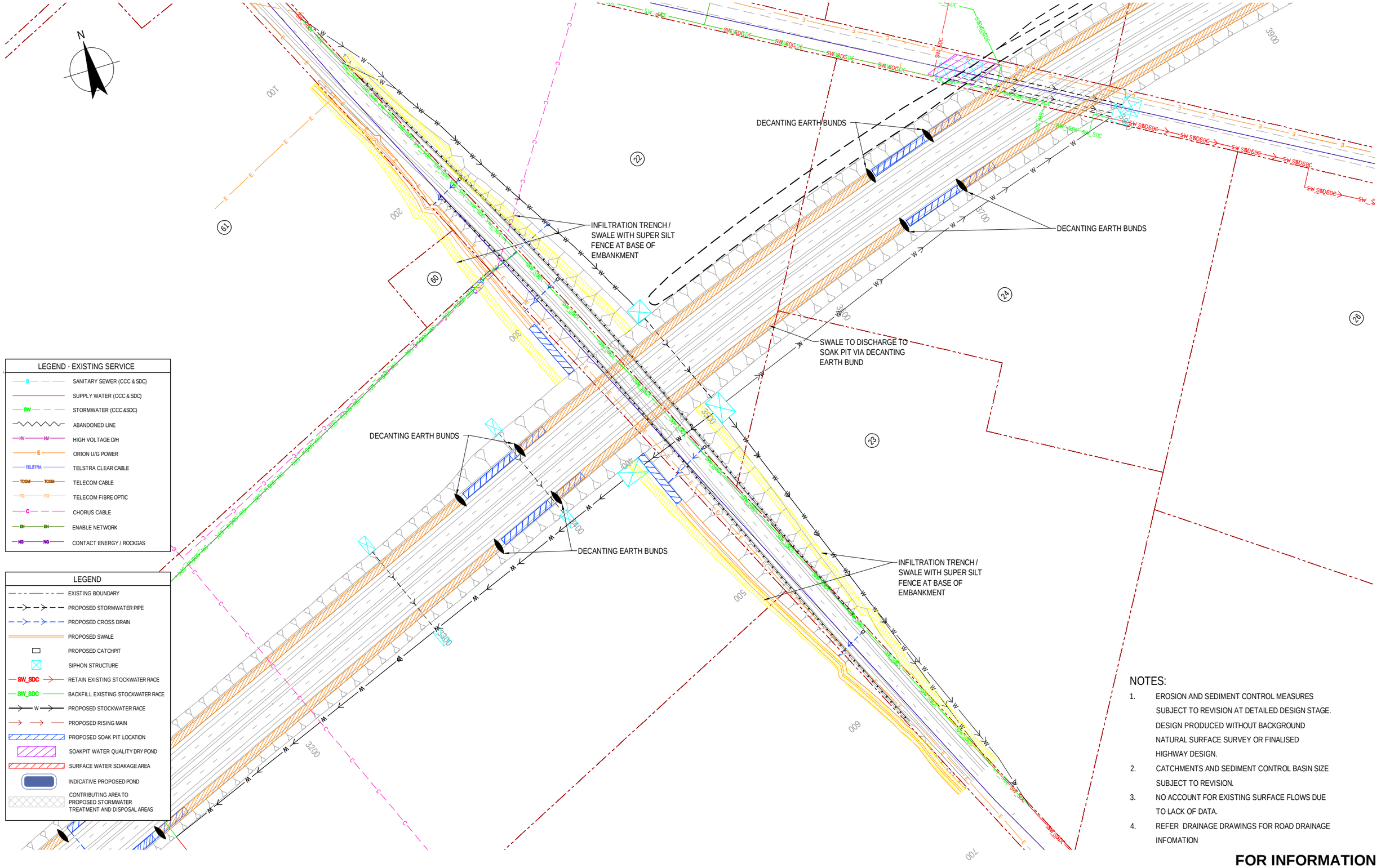

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- SOAKPIT WATER QUALITY DRY POND
- SURFACE WATER SOAKAGE AREA
- INDICATIVE PROPOSED POND
- CONTRIBUTING AREA TO PROPOSED STORMWATER TREATMENT AND DISPOSAL AREAS

NOTES:

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2. CATCHMENTS AND SEDIMENT CONTROL BASIN SIZE SUBJECT TO REVISION.
3. NO ACCOUNT FOR EXISTING SURFACE FLOWS DUE TO LACK OF DATA.
4. REFER DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFOMATION

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N

SPILLWAY AND FOREBAY

SURFACE WATER SOAKAGE AREA
DISPOSAL LEVELS TO BE LOWER
THAN ADJACENT SWALE INVERT

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

DECANTING EARTH BUNDS

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

SHANDS ROAD UNDERPASS

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

SURFACE WATER SOAKAGE AREA
DISPOSAL LEVELS TO BE LOWER
THAN ADJACENT SWALE INVERT

INFILTRATION TRENCH /
SWALE WITH SUPER SILT
FENCE AT BASE OF
EMBANKMENT

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

DECANTING EARTH BUNDS

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

SWALE TO DISCHARGE TO
SOAKPIT VIA DECANTING
EARTH BUND

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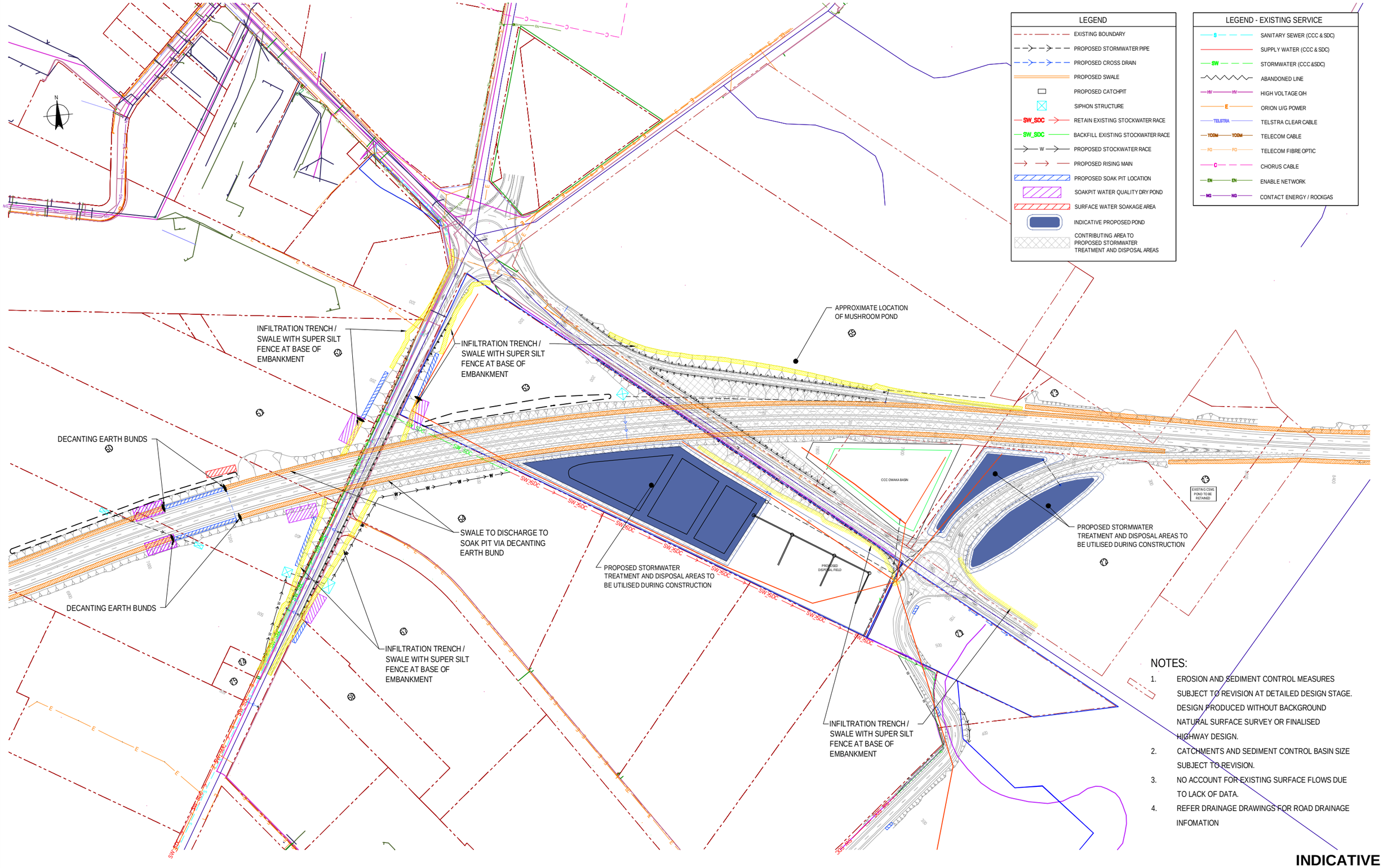
Date	
Scale 1:2000	This Drawing must not be used for Construction unless signed as Approved

Client NEW ZEALAND TRANSPORT AGENCY
Project CSM2 AND MSRFL
Title EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - SHANDS ROAD SKETCH

Original Size A1 **Drawing No: 62236-A-SK205** **Rev: B**

Plot Date: 18 October 2012 - 4:23 p.m. Plotted by: Tony Cain Cad File No: N:\NZ\Christchurch\Projects\51\28982 CSM2\CADD\CSM 2+3\CAD\Drawings - Scheme Assessment\Sketches\GHD\62236-A-SK205.dwg



NOTES:

1. EROSION AND SEDIMENT CONTROL MEASURES SUBJECT TO REVISION AT DETAILED DESIGN STAGE. DESIGN PRODUCED WITHOUT BACKGROUND NATURAL SURFACE SURVEY OR FINALISED HIGHWAY DESIGN.
2. CATCHMENTS AND SEDIMENT CONTROL BASIN SIZE SUBJECT TO REVISION.
3. NO ACCOUNT FOR EXISTING SURFACE FLOWS DUE TO LACK OF DATA.
4. REFER DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFOMATION

INDICATIVE

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	INDICATIVE LAYOUT		AWC			09.12
A	FOR INFORMATION					

GHD
Level 3, GHD Centre
27 Napier Street, Freemans Bay, Auckland 1011 New Zealand
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Drawn	FNH	Designer	FNH
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	1:2000	This Drawing must not be used for Construction unless signed as Approved	

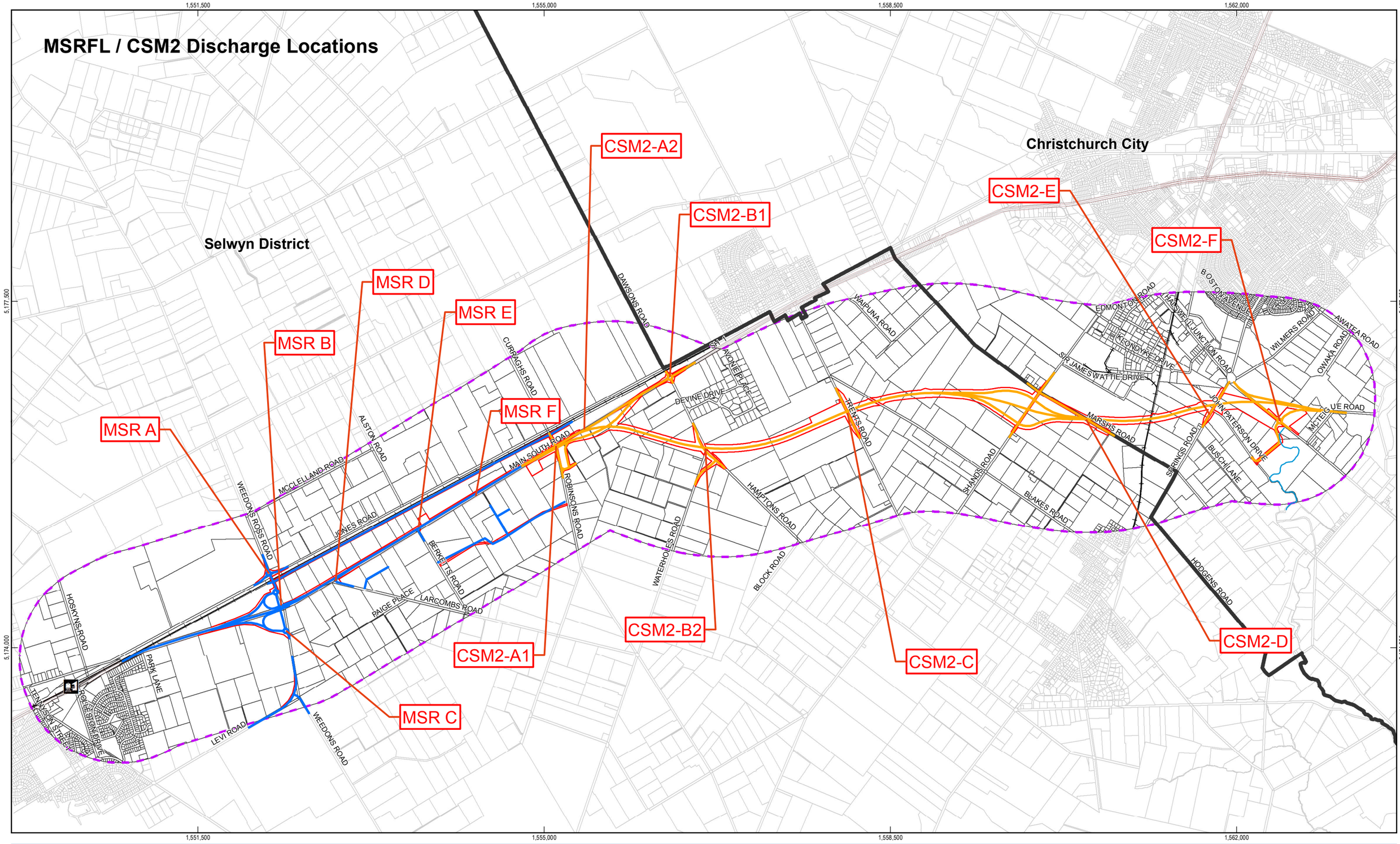
Client NEW ZEALAND TRANSPORT AGENCY
Project CSM2 AND MSRFL
Title EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - CSM2 AND MSRFL JUNCTION SKETCH

Original Size A1 **Drawing No: 62236-A-SK206** **Rev: B**

Plot Date: 18 October 2012 - 4:21 p.m. Plotted by: Tony Cain Cad File No: N:\NZ\Christchurch\Projects\51\28982 CSM2\CADD\CSM 2+3\CAD\Drawings - Scheme Assessment\Sketches\GHD\62236-A-SK206.dwg

APPENDIX B – Construction Discharge Locations Sketch

MSRFL / CSM2 Discharge Locations



Paper Size A3

0 0.25 0.5 0.75 1 1.25

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

LEGEND

- CSM2 Proposal
- MSRFL Proposal
- Local Authority Boundary
- Road Designation
- Study Area
- State Highways
- Railway Stations
- Rail Track
- Parcel Boundary
- Stream

GHD CLIENTS | PEOPLE | PERFORMANCE

Beca

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Transport Agency
CSM2 and MSRFL

Job Number	51-3085402
Revision	B
Date	12 Oct 2012

Construction Discharge Locations

SK207

N:\NZ\Christchurch\Projects\51\30854\GIS\Maps\Mxd\51_30854_02_G03_RevB_Figure SK207_Construction_Discharge_Locations.mxd

Level 3, 27 Napier Street, Freemans Bay, Auckland 1011, New Zealand **T** 64 9 370 8000 **F** 64 9 370 8001 **E** auckland.mail@ghd.com **W** www.ghd.com

Data source: Koordinates: State Highway, Roads ,Railway - 20110808; Selwyn District Council: Heritage Building - 20101212, Parcel, roads - 20110505; Christchurch City Council: Heritage features - 20110803, Parcel, roads - 20110505; GHD: Proposed Alignment, Study Area - 20110505; Created by: hpipe, jhchen, eatonson, rsalunga2

APPENDIX C

SEMP 003 Construction Noise and Vibration Management Plan

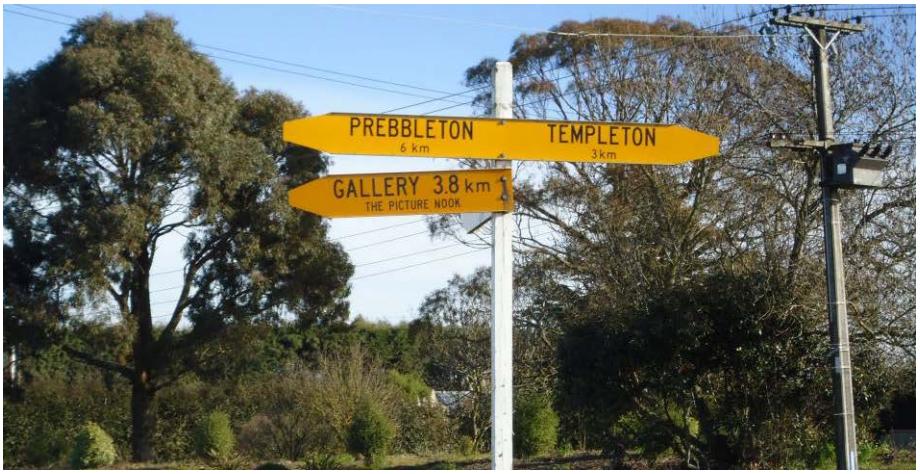
NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix C SEMP003

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Construction Noise and Vibration Management Plan

November 2012



Document control

Status:	Issue:	Comments	Date:	Prepared by:	Reviewed by:
Approved	01		November 2012	Jon Farren	Robbie Blakelock

Record of amendment

Amendment number	Description of change	Effective date	Updated by

Contents

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to Construction Noise and Vibration.

1.1. Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in each

direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

2. Purpose and Scope

This Construction Noise and Vibration Management Plan (CNVMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The CNVMP addresses the potential construction noise and vibration impacts associated with earthworks and construction activities of the Project.

This construction noise and vibration management plan (CNVMP) details noise limits, predicted levels, mitigation measures, monitoring requirements, and communication and complaint procedures, for:

- State Highway: 1
- Project: Christchurch Southern Motorway Stage 2 & Main South Road Four Laning
- Construction location: Rolleston in the south to Halswell Junction Road in the north
- Construction start date: [TBC when known]
- Construction finish date: [TBC when known]
- Designation number: [TBC when known]
- NZTA CSVue permit number: [TBC when known]

This CNVMP identifies the noise and vibration performance standards that must, where practicable, be complied with. It also sets out best practicable options for noise and vibration management for the Project. This CNVMP is intended as a framework for the development and implementation of particular noise and vibration management and control methodologies to minimise adverse effects on the health and safety of residents and to reduce the adverse impact on the environment.

This CNVMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with any changes to the construction methodologies or techniques or the natural environment. The document shall be reviewed annually to ensure that any changes are reflected.

A Glossary of technical terms is contained in **Appendix A**.

This CNVMP will be implemented in accordance with information, management tools and standards as specified on the NZTA website for the management of transport noise located at http://acoustics.nzta.govt.nz/tools.

Contact details

Role	Name	Organisation	Phone	Email
Client		NZTA		
Engineer				
Acoustics advisor				
Contractor				
Contractor's acoustics advisor				
CCC– Noise/ Environmental Health				
SDC – Noise/ Environmental Health				
Public complaint contact number				

[Name of person responsible – TBC when known] will be responsible for ensuring that this construction noise management plan is correctly implemented. [He/she] will review all documentation relating to construction noise before it is issued.

All site personnel will be required to read and sign the construction noise induction form appended to this plan and any relevant schedules. If required, specific training will be provided for site personnel.

3. Project overview

The New Zealand Transport Agency (NZTA) is improving access to and from the south of Christchurch via State Highway 1 (SH1) to the Christchurch City centre and Lyttelton Port, by improving the capacity, safety and alignment of the Christchurch Southern Corridor.

The Project scope includes the widening and upgrading of Main South Road (SH1) to provide for a four-lane median separated expressway along the existing arterial route (MSRFL); and the construction, operation and maintenance of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway.

CSM2 will link into Christchurch Southern Motorway Stage 1 (CSM1). CSM1 connects Halswell Junction Road with Brougham Street (SH73) in the east.

3.1 Construction methodology

[This section to be revised once details of construction methods are known]

At this stage, the outline construction methodology includes:

- Enabling works including connecting utilities, erecting construction compounds and fencing;
- Relocation of overhead transmission lines and other network utilities;
- Ground improvements at main structure locations which may involve piling and installation of stone columns;
- Transportation of fill to form approaches to bridge structures;
- Construction of bridge structures;
- Construction of interchanges;
- Excavation of swales and stormwater treatment ponds;
- Work on surrounding roads;
- Road construction which will involve the stripping of topsoil and bringing the road to formation level; and
- Installation of road pavement and street furniture (barriers, signs etc).

These works have been grouped into general Construction Activities, as described in the following table.

Table 1: Construction activities

Construction Activity	Likely Plant and Machinery required
Enabling Works	Heavy earthmoving machinery for road construction and site compound erection.
Topsoil Stripping	Motor-scraper, excavator and trucks.
General Earthworks	Large excavators, spreaders, rollers/compactors and trucks.
Ground Improvements	Rollers/compactors, pile drivers for bored concrete piles and driven steel piles, excavators, truck movements.

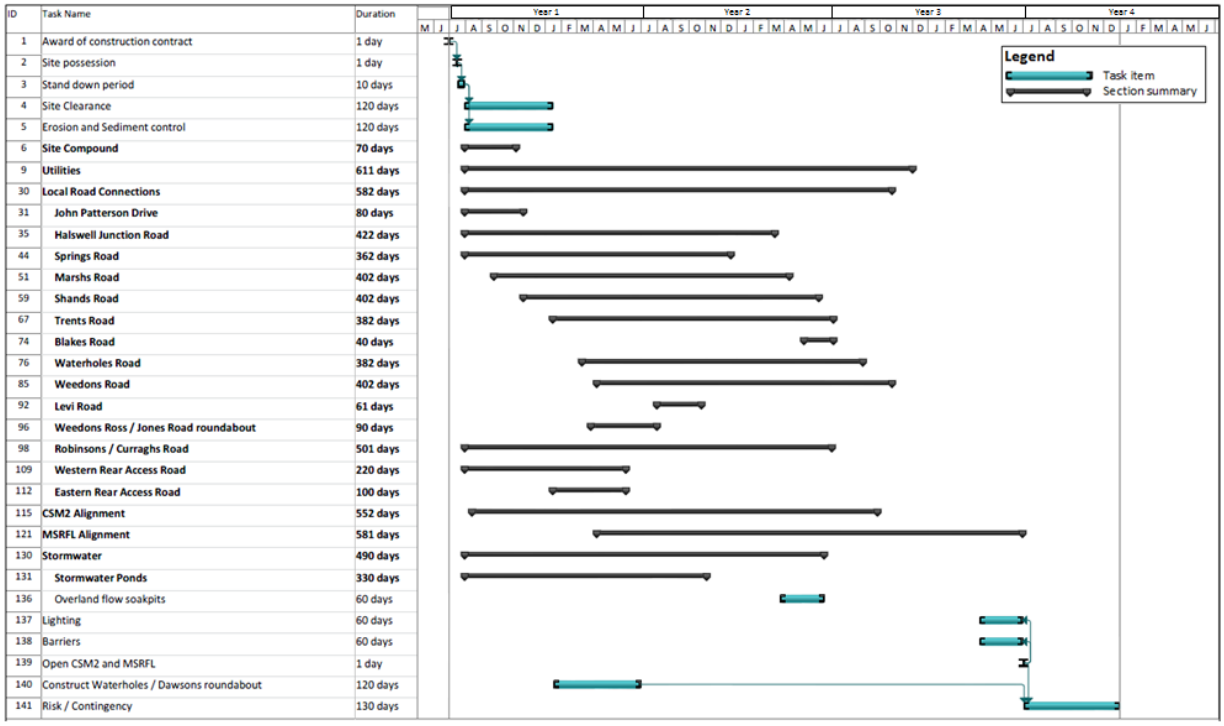
Construction Activity	Likely Plant and Machinery required
Bridge Construction	Mobile cranes, truck movements, concrete pumping, steel sheet piling, excavators, rollers/compactors. (If impact piling is required, a revised noise and vibration assessment should be conducted).
Pavement Construction	Spreader machine, grader, paving roller, vibratory roller, truck movements.
Electricity Network Utilities	Mobile cranes and jointing methods (note, controlled by Transpower).

Note that all of the activities listed may not occur at the same time at all locations. For some construction activities, multiple construction methods are available (such as bored concrete piling or impact steel piling) and the final methodology will be determined during the detailed construction planning process.

3.2 Timeframe

The overall construction timeframe for the entire Project is expected to be four years. The indicative construction timeline for the project is provided in Figure 1.

Figure 1: Indicative construction programme

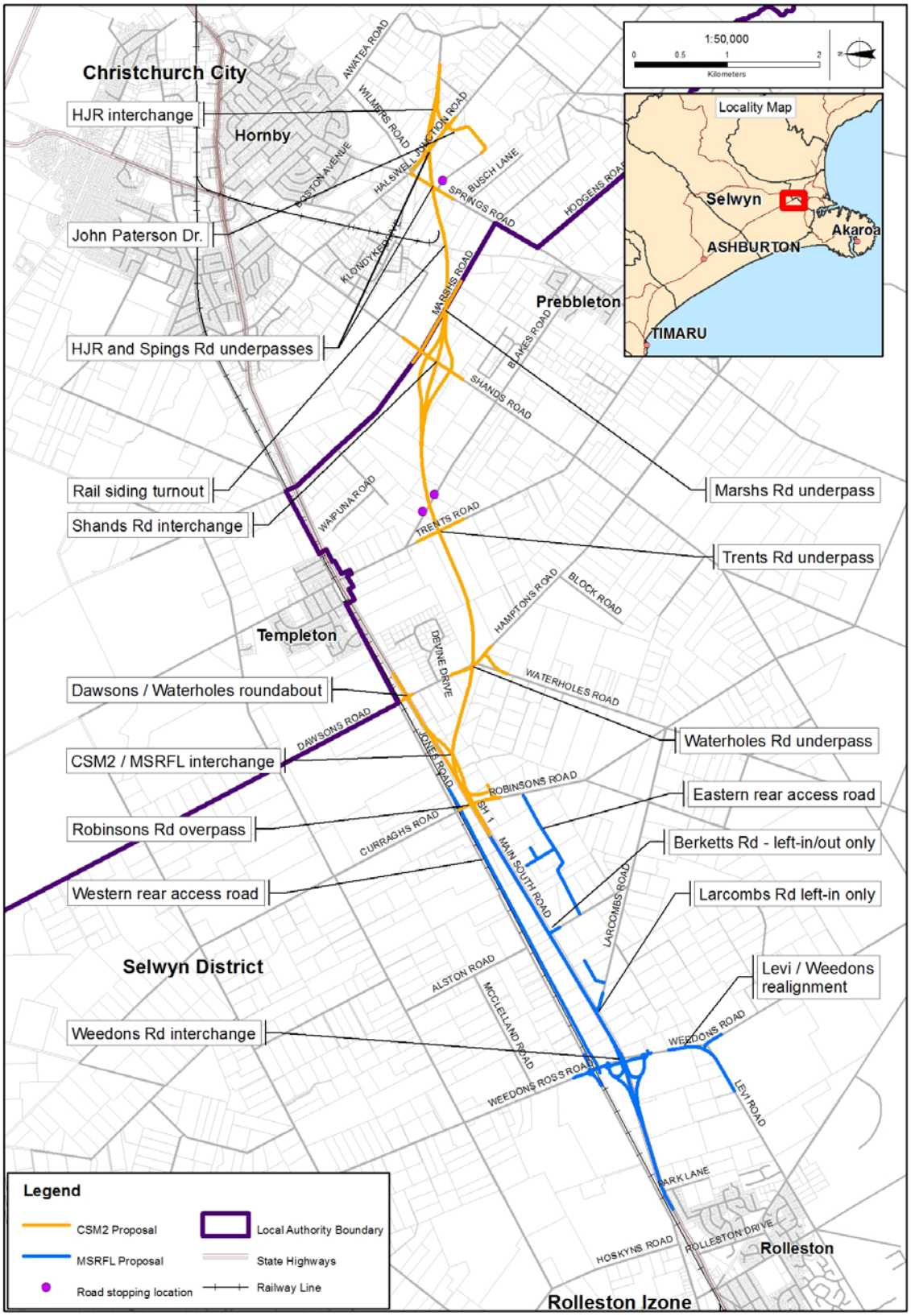


ID	Task Name	Duration
1	Award of construction contract	1 day
2	Site possession	1 day
3	Stand down period	10 days
4	Site Clearance	120 days
5	Erosion and Sediment control	120 days
6	**Site Compound**	**70 days**
9	**Utilities**	**611 days**
30	**Local Road Connections**	**582 days**
31	**John Patterson Drive**	**80 days**
35	**Halswell Junction Road**	**422 days**
44	**Springs Road**	**362 days**
51	**Marshs Road**	**402 days**
59	**Shands Road**	**402 days**
67	**Trents Road**	**382 days**
74	**Blakes Road**	**40 days**
76	**Waterholes Road**	**382 days**
85	**Weedons Road**	**402 days**
92	**Levi Road**	**61 days**
96	**Weedons Ross / Jones Road roundabout**	**90 days**
98	**Robinsons / Curraghs Road**	**501 days**
109	**Western Rear Access Road**	**220 days**
112	**Eastern Rear Access Road**	**100 days**
115	**CSM2 Alignment**	**552 days**
121	**MSRFL Alignment**	**581 days**
130	**Stormwater**	**490 days**
131	**Stormwater Ponds**	**330 days**
136	Overland flow soakpits	60 days
137	Lighting	60 days
138	Barriers	60 days
139	Open CSM2 and MSRFL	1 day
140	Construct Waterholes / Dawsons roundabout	120 days
141	Risk / Contingency	130 days

These durations relate to the entire activity and would not occur for the entire time at all closest receivers. Management and mitigation shall be applied as appropriate (i.e. as machinery progresses along the alignment).

Each receiver will be subject to varying noise levels throughout the construction period which may range from relatively quiet to relatively loud.

Location plan



3.3 Project assessment sectors

The MSRFL/CSM2 alignment has been broken up into 12 sectors for assessment. These sectors are described in south to north direction in Table 2 below, and shown in **Appendix B**.

Table 2: Assessment sectors

Assessment Sector	Description	Sector
MSRFL – South of Weedons	MSRFL from existing four-laning at Rolleston to Weedons Road	12
Weedons Road	MSRFL/Weedons Road Interchange	11
MSRFL – Robinsons to Weedons	Main MSRFL alignment between Weedons Road/Weedons Ross Road and Berketts Road	10
MSRFL – Robinsons to Berketts	Main MSRFL alignment between Berketts Road and Robinsons Road	9
Robinsons Road	CSM2/MSRFL Interchange at Robinsons Road	8
Waterholes Road	Waterholes Road overbridge and realignment	7
CSM2 – Trents to Waterholes	Main CSM2 alignment between Waterholes Road and Trents Road	6
Trents Road	Trents Road overbridge	5
CSM2 – Marshs to Trents	Main CSM2 alignment between Trents Road and Marshs Road	4
Shands Road	CSM2/Shands Road Interchange and Marshs Road overbridge	3
CSM2 – Springs to Shands	Main CSM2 alignment between Shands Road and Springs Road	2
Halswell Junction/Springs Road	Halswell Junction Road/Springs Road Interchange and Springs Road overbridge	1

4. Criteria

4.1 Designation conditions

The following noise and vibration criteria are based on the requirements set out in the designation conditions for the Project. The relevant conditions are attached in full in **Appendix C**.

4.2 Noise performance standards

Construction noise shall be measured and assessed in accordance with NZS 6803:1999 'Acoustics – Construction Noise'.

The limits outlined in the following tables apply at a distance of one metre from the façade of any occupied building:

Table 3: Project construction noise criteria: residential receivers

Day	Time	$L_{Aeq(1h)}$	L_{AFmax}
Weekdays	0630h – 0730h	55 dB	75 dB
	0730h – 1800h	70 dB	85 dB
	1800h – 2000h	65 dB	80 dB
	2000h – 0630h	45 dB	75 dB
Saturday	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	70 dB	85 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Sundays and public holidays	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	45 dB	75 dB
	1800h – 2000h	55 dB	85 dB
	2000h – 0630h	45 dB	75 dB

Table 4: Project construction noise criteria: commercial and industrial receivers

Time	$L_{Aeq(T)}$*
0730h – 1800h	70 dB
1800h – 0730h	75 dB

* T means an assessment duration of no less than 10 minutes and not exceeding 60 minutes

There may be circumstances where noise limits cannot be achieved, such as night-time work. However appropriate justification and work methodology needs to be carefully considered and provided for through appropriate measures, such as the development of Noise Management Schedules.

4.3 Vibration performance standards

The construction vibration criteria for this Project are based on the draft NZTA vibration guide for managing vibration during construction associated with state highway projects. The guide addresses both building damage and human response to vibration by applying appropriate international vibration standards in a dual category approach, as follows:

4.3.1 Vibration Category A

Category A adopts criteria from British Standard BS 5228-2:2009 and is designed to practically address the human response effects in dwellings during the daytime and night-time periods, and offices during the daytime. For other building types, and offices during the night-time (i.e. unoccupied), the policy reverts to the building damage criteria from German Standard DIN 4150-3:1999.

If measured or predicted vibration levels exceed the Category A criteria then a suitably qualified expert shall be engaged to assess and manage construction vibration and to comply with the Category A criteria. If the Category A criteria cannot be practicably achieved, the Category B criteria shall be applied.

4.3.2 Vibration Category B

Category B is designed to protect buildings against damage and adopts criteria from DIN 4150-3:1999 and BS 5228-2:2009, but retains a higher degree of protection for dwellings at night-time, as contained in the human response criteria of BS 5228-2:2009.

If measured or predicted vibration levels exceed Category B criteria, then construction activity shall only proceed if there is continuous monitoring of vibration levels and effects on buildings at risk of exceeding the Category B criteria, by suitably qualified experts.

Measurements of construction vibration shall be undertaken in accordance with German Standard DIN 4150-3:1999 "Structural Vibration Part 3: Effects of vibration on structures". The Project criteria for construction vibration are given in **Table 5** below:

Table 5: Project construction vibration criteria

Receiver	Details	Category A	Category B
Occupied dwellings	Night-time 2000h - 0630h	0.3 mm/s PPV	1 mm/s PPV
	Daytime 0630h - 2000h	1 mm/s PPV	5 mm/s PPV
Other occupied buildings*	Daytime 0630h - 2000h	2 mm/s PPV	5 mm/s PPV
All other buildings		5 mm/s PPV	BS 5228-2: Table B.2
	Vibration - continuous**		BS 5228-2, 50% of Table B.2 values

* 'Other occupied buildings' is intended to include daytime workplaces such as offices, community centres etc., not industrial buildings. Schools, hospitals, rest homes etc. would fall under the occupied dwellings category.

5. Stakeholder engagement

A key aspect of this construction noise management plan is stakeholder engagement. The site contact(s) for the public for the duration of the works are listed in the table below. In lieu of a specific contact person, the Project team's Environmental Manager or appointed representative will assume the role.

[Table TBC once construction contract is awarded]

Table 6: Public site contacts for construction

Site	Name	Title/Role	Organisation	Phone

There will be the following communication with the community regarding construction noise issues:

- The site contact person or appointed representative will be available on site at all times when construction is being undertaken, and should be contactable by affected parties regarding noise.
- The contact details of this person will be prominently displayed at the entrance to each contractor's yard and at relevant positions around the construction site. These contact details will also be included in any written documentation, particularly for those potentially most affected.
- Prior to the works a newsletter or similar will be distributed to all neighbours within at least 100 metres of the works. The newsletter will provide contact details and will detail the overall nature of the works. The same information will also be published in an advertisement in a local newspaper.
- Individual notification will be provided and meetings offered to all neighbours within 50 metres of the works. For any neighbours within approximately 20 metres of the works individual consultation will be continued throughout the works.
- Further information will be regularly provided to all neighbours with an update on the progress of the works, and the specific activities (including locations) due to be undertaken next. This may be provided by newsletters or possibly by email. Updates will be provided every two or three months.

Prior to any particularly noisy processes identified in a construction noise management schedule, the nearest affected neighbours will be contacted individually. Neighbours will be informed of the proposed timing of the specific works and where practicable any times which are particularly sensitive for neighbours will be avoided.

Further details on at-risk receivers in each Sector are contained in the mitigation options provided in Appendix E]

6. Noise sources

The following table lists all significant equipment proposed to be used on the site. The sound level for each item of equipment has been estimated from library data in British Standard BS 5228-1:2009. During initial site noise monitoring the validity of this data will be confirmed and adjusted where necessary for the major items of equipment.

Table 7: BS5228-1:2009 Typical construction noise levels

Source/Activity	Sound Pressure Level at 10m (dB L_{Aeq})	
	Range	Average
Asphalt Paver	75 – 84	78
Auger piling	75 – 81	78
Bulldozers (up to 350kW/50t)	74 – 86	79
Concrete Mixer Trucks	75 – 80	77
Diesel Generator less than 20kW	65 – 66	65
Diesel Water Pumps	68 – 81	73
Diesel Scissor Lift	70 – 78	74
Concrete/Rock Drilling	85 – 92	89
Dumping Rubble	80 – 80	80
Excavators	65 – 91	77
Hydraulic Breaking	83 – 93	90
Loaders	61 – 91	80
Mobile Crane	67 – 82	73
Pneumatic Breaker (Hand-Held)	82 – 95	87
Excavator-mounted Pulveriser	72 – 80	76
Concrete Pumping	75 – 82	77
Road Planer	68 – 82	75
Rockbreaking (30t Excavator)	85 – 95	91
Road Roller (20t)	73 – 80	77
Rotary Bored Piling	75 – 83	79
Steel Sheet Piling – Hydraulic Jacking	59 – 68	63
Steel Sheet Piling – Vibratory	88	88
Tubular Steel Piling – Drop Hammer	69 – 88	80
Vibratory Compaction	67 – 84	77

The following table contains predicted noise levels at a nominal distance of 100m from the various construction activities associated with the Project.

Table 8: Construction scenarios

Construction Scenario	Predicted Noise Level at 100m (dB L_{Aeq})
Enabling Works	45 – 71
Topsoil Stripping	75
General Earthworks*	57 – 64
Ground Improvements**	57 – 83
Bridge Construction	64 – 83
Pavement Construction*	55 – 63
Electricity Network Utilities***	53

* Upper value assumes multiple items of large plant operating

** Noise emissions highly dependent on construction method and equipment used

***Mobile crane only

Table 9 outlines the Sectors where each of these construction scenarios may occur.

Table 9: Sectors where construction activities may occur

Construction Scenario	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	Sector 12
Enabling Works	*	*	✓	*	*	*	*	*	*	*	*	*
Topsoil Stripping	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
General Earthworks	✓	✓		✓		✓			✓	✓		✓
Ground Improvements**	✓		✓		✓		✓	✓				
Bridge Construction	✓		✓		✓		✓	✓			✓	
Pavement Construction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electricity Network Utilities***	–	–	–	–	–	–	–	–	–	–	–	–

Construction Scenario	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	Sector 12

* The main compound is likely to be situated to the east of the CSM2/Robinsons Road. The civil/earthworks compound is likely to be situated on the SE corner of the Marshs / Shands intersection, in the space between the intersection and the proposed on ramp. There will be other smaller compounds along the length of the site dependant on the Contractor's requirements.

** Ground improvements will be required at the bridge abutments. At this stage there are no other dynamic ground improvement works planned. A general assessment of effects from this activity has been conducted to inform any future works.

*** There are a number of existing electricity network utilities within the project area that will require protection and/or relocation, in particular the relocation of Transpower's overhead lines at Shands Road Interchange. Construction relating to the relocation or laying of electricity infrastructure is controlled by Transpower and Orion.

7. Mitigation

Indicative construction noise calculations have been conducted for the main items of equipment based on the outline construction methodology and minimum distances to the nearest neighbours. On this basis general noise mitigation measures have been identified for each of the Project Sectors and are described in Appendix E. We note that these outline mitigation measures could be translated into schedules once final construction methodology becomes available.

8. Schedules

For each significant activity/location within 50 metres [distance to be confirmed once detail methodology is known] of neighbours a separate schedule will be prepared. The schedule will identify the potentially affected neighbours and confirm the proposed methodology and equipment to be used.

Predictions of construction noise will be made using an appropriate calculation method, such as the calculator on www.acoustics.nzta.govt.nz. These calculations will be used to identify where specific mitigation measures are required, which will be recorded in the schedule.

The schedule will detail any specific monitoring or communication requirements.

The schedule will be read and signed by all site personnel involved in the work, prior to the activity commencing.

Example schedules are provided on the NZTA website at http://acoustics.nzta.govt.nz/tools/templates.

9. Monitoring

9.1 Requirements – Noise Monitoring

Construction noise monitoring shall be conducted by a suitably qualified and experienced independent consultant [or by the following staff – include if appropriate] in accordance with NZS 6801:2008 and NZS 6803:1999, using the NZTA construction monitoring survey sheet and procedures. (www.acoustics.nzta.govt.nz).

Trained noise monitoring staff:

- [TBC when known]

[Following details of dedicated sound level meter kit should be completed if and when this information is known]

Noise monitoring performed by the staff listed above will be conducted using the dedicated sound level meter kit detailed below which will be stored in [location TBC when known] for the duration of the project. The calibrator will be verified by an accredited laboratory annually and the sound level meter and microphone biannually.

Table 10: Sound level meter kit details

Equipment	Make	Model	Serial	Last verification
Sound level meter				
Software				
Microphone				
Calibrator				
Wind shield				
Tripod				
Other				

Monitoring will be conducted as follows,

- Baseline monitoring prior to construction work commencing at positions representative of noise sensitive locations within 300 metres of construction activity.
- When the works start to verify the sound levels assumed for each of the major items of equipment, and to assess the effectiveness of noise control measures and implementation of this plan.
- At regular intervals during the works, at least every two weeks, to check ongoing compliance with the construction noise limits.
- During critical phases of construction, such as during the use of heavy earth moving machinery, rock breaking, and other noisy activities within 50 metres of neighbours.
- As required by a construction noise management schedule.
- In response to reasonable complaints being received.

Following each noise survey, the results will be reported on the NZTA survey report template and any issues discovered will be investigated. Results will be recorded on the project web page on www.acoustics.nzta.govt.nz.

9.2 Requirements – Vibration Monitoring

Construction vibration levels shall be monitored and assessed by a suitably qualified and experienced person in accordance with the requirements of German Standard DIN 4150-3:1999 *"Structural vibration – Part 3: Effects of vibration on structures"*.

The following persons are trained vibration monitoring staff:

- [TBC when known]

Monitoring will be conducted as follows,

- Baseline monitoring prior to construction work commencing at positions representative of vibration sensitive locations within 50 metres of construction activity;
- By a suitably qualified and experienced acoustic/vibration specialist.
- At monthly intervals throughout construction, but not at pre-arranged times or locations.
- During critical phases of construction, such as during the use of heavy earth moving machinery, rock breaking, and other vibration generating activities within 50 metres of neighbours.
- As required by a construction vibration management schedule.
- In response to reasonable complaints being received.

Following each vibration survey, the results will be reported on the NZTA survey report template and any issues discovered will be investigated. Results will be recorded on the project web page on www.acoustics.nzta.govt.nz.

9.3 Contingency measures

Prior to commencing construction works, appropriate procedures should be put in place in the event that measurements result in a non-compliance with the Project criteria. These should include the following:

- For noise, the process should include further measurement to be undertaken where necessary to determine the extent of non-compliance and preparation of a report outlining the non-compliance and, if required, potential mitigation and management measures.
- For vibration, the process should include a building condition survey and a report prepared by a suitably qualified person, including photographs, detailing the state of repair of the existing structure, and an opinion as to whether any damage may be due to construction activity. Subsequent additional monitoring and other management as required. Upon implementation of any additional mitigation measures, further measurements shall be undertaken to confirm the effectiveness of those mitigation measures.
- The Environmental Manager shall liaise with affected receivers throughout the process.

10. Complaints

The following procedure shall be followed for all noise and vibration complaints:

1. All noise and vibration complaints should be immediately directed to [TBC when known].
2. As soon as the complaint is received it will be recorded on the project web page on www.acoustics.nzta.govt.nz.
3. An initial response will be made and recorded on the project web page. Depending on the nature of the complaint the initial response could be to immediately cease the activity pending investigation, or to replace an item of equipment. However, in some cases it might not be practicable to provide immediate relief. The complainant and council will be informed of actions taken. Contact details for council are recorded in the Introduction section of this plan.
4. Where the initial response does not address the complaint, further investigation, corrective action and follow-up monitoring shall be undertaken as appropriate. The complainant [and council] will be informed of actions taken.
5. All actions will be recorded on the project web page and the complaint will then be closed.

Proposed Designation Condition DC.38 requires that:

(a) At all times during construction work, the Requiring Authority shall maintain a permanent register(s) of any public or stakeholder feedback received and any incidents or non-compliance noted by the contractor, in relation to the construction of the Project. The register(s) shall include:
   i. the name and contact details (as far as practicable) of the person providing feedback or contractor observing the incident/ non-compliance;
   ii. identification of the nature and details of the feedback/ incident; and
   iii. location, date and time of the feedback/ incident.

(b) The Requiring Authority shall promptly investigate any adverse feedback, incident or non-compliance. This shall include, but need not be limited to:
   i. recording weather conditions at the time of the event (as far as practicable), and including wind direction and approximate wind speed if the adverse feedback or incident relates to dust;
   ii. recording any other activities in the area, unrelated to the Project that may have contributed to the adverse feedback/ incident/ non-compliance, such as non-Project construction, fires, traffic accidents or unusually dusty conditions generally (if applicable);
   iii. investigating other circumstances surrounding the incident.

(c) In relation to Condition DC.37(b), the Requiring Authority shall:
   i. record the outcome of the investigation on the register(s);
   ii. record any remedial actions or measures undertaken to address or respond to the matter on the register(s);
   iii. respond to the initiator, in closing the feedback loop, if practicable; and
   iv. where the adverse feedback or incident was in relation to a non-compliance, the Manager shall be notified in writing of the matter within 5 working days of the non-compliance, and inform of the remedial actions undertaken.

(d) The register(s) shall be maintained on site and shall be made available to the Manager upon request.

11. CNVMP review

This CNVMP, including environmental controls and procedures, shall be reviewed to ensure that it remains applicable to the activities being carried out.

The CNVMP will be reviewed by the contractor after confirmation of the resource consent and designation conditions and will be revised in accordance with these conditions. The CNVMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the natural environment. Consultation with the Selwyn District Council and Christchurch City Council, or nominated representative will be required for any relevant revisions of a material nature for the CNVMP.

A management review of the CNVMP will be undertaken at least annually by the Project management team and the NZTA environmental representative. The management review will be organised by the Project Manager, and the Project team will be informed of any changes to this plan through the regular project communications processes.

The review will take into consideration:

- Significant changes that affect the noise and/or vibration generation;
- Key changes to roles and responsibilities within the Project;
- Changes in industry best practice standards;
- Changes in methodology or management in response to noise and/or vibration monitoring showing non-compliance;
- Changes in legal or other requirements (social and environmental legal requirements, consent conditions, NZTA objectives and relevant policies, plans, standards, specifications and guidelines);
- Sensitive receivers not present during the previous review of the CNVMP; and
- Public complaints.

Reasons for making changes to the CNVMP will be documented. A copy of the original CNVMP document and subsequent versions will be kept for the Project records, and marked as obsolete. Each new/updated version of the CNVMP documentation will be issued with a version number and date to eliminate obsolete CNVMP documentation being used.

12. Documentation

12.1. File

A construction noise and vibration management file will be held by [TBC] and kept [TBC]. All electronic files relating to construction noise and vibration will be kept in [TBC]. The construction noise and vibration management file will contain the following sections:

- Section 1 – Construction noise and vibration management plans
  - This Construction Noise and Vibration Management Plan and any revisions
  - Construction Noise Management Schedules
  - Construction Vibration Management Schedules
  - Construction noise and vibration induction sheets
- Section 2 – Consultation and complaints registers
- Section 3 – Noise and vibration monitoring
  - Site survey sheets and associated aerial photographs
  - Site survey summary sheet
  - Survey reports
  - Survey and equipment operating procedures
  - Current and past equipment kit details and calibration summary
  - Copies of calibration certificates
- Section 4 – Mitigation register

12.2. Web site

The following information will also be recorded on the project construction noise web page on www.acoustics.nzta.govt.nz:

- This Construction Noise and Vibration Management Plan and any revisions,
- Construction Noise Management Schedules,
- Construction Vibration Management Schedules,
- Noise survey results, and
- Complaints and any subsequent outcomes, follow up or mitigation.

The project area on this web site will be administered by [TBC]. It will be made accessible to the following people listed in the contacts table in the Introduction of this plan.

12.3. Reporting

The following information will be provided to the key project contacts as listed in the contacts table in the Introduction of this plan, within the timeframes stated.

Information	Timeframe
Construction Noise and Vibration Management Plan	At least one week before works commence
Construction Noise Management Schedules	At least one week before specific works commence
Construction Vibration Management Schedules	At least one week before specific works commence
Noise or vibration survey report	Within one week of monitoring
Noise or vibration complaint initial report	Within twenty-four hours
Noise or vibration complaint closed	Within one week of closing complaint

This information will all be sent by email with files in pdf format.

Appendix A: Glossary

Noise

Ambient Noise	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
A-weighting	A frequency filter which is applied to a measurement of sound so as to more closely approximate the frequency bias of the human ear.
dB	Decibel – the basic measurement unit of sound. It is a logarithmic ratio of measured sound pressure level with respect to a reference level of 20 micropascals.
$L_{Aeq(T)}$	The A-weighted, time averaged sound level (on a logarithmic/energy basis) over the measurement period T (e.g. between 10 and 60 minutes).
L_{AFmax}	The maximum A-weighted sound level recorded during the measurement period. Measured with fast time weighting i.e. a 125 millisecond time constant
L_{A10}	The A-weighted sound level which is equalled or exceeded for 10% of the measurement period.
L_{A90}	The A-weighted sound level which is equalled or exceed for 90% of the measurement period. L_{A90} is an indicator of the mean minimum noise level and is used in New Zealand as the descriptor for background noise
L_{A95}	The A-weighted sound level which is equalled or exceed for 95% of the measurement period.
L_{Zpeak}	The peak instantaneous pressure level recorded during the measurement period, with a flat (i.e. no) frequency weighting.
Noise	A sound that is unwanted by, or distracting to, the receiver.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of Sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise".*
NZS 6803:1999	New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*".

Vibration

BS 5228-2:2009	British Standard BS 5228-2:2009 "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration". This is the standard adopted for this Project to assess human response to construction.
DIN 4150-3:1999	German Standard DIN 4150-3:1999 "Structural Vibration – Part 3: Effects of vibration on structures". This standard is generally adopted in NZ to assess building damage.
PPV	Peak Particle Velocity, measured in mm/s. This is the standard metric for assessing construction vibration levels.
Risk contour	The closest distance to a vibration source at which a measurement would be expected to comply with the risk assessment criteria

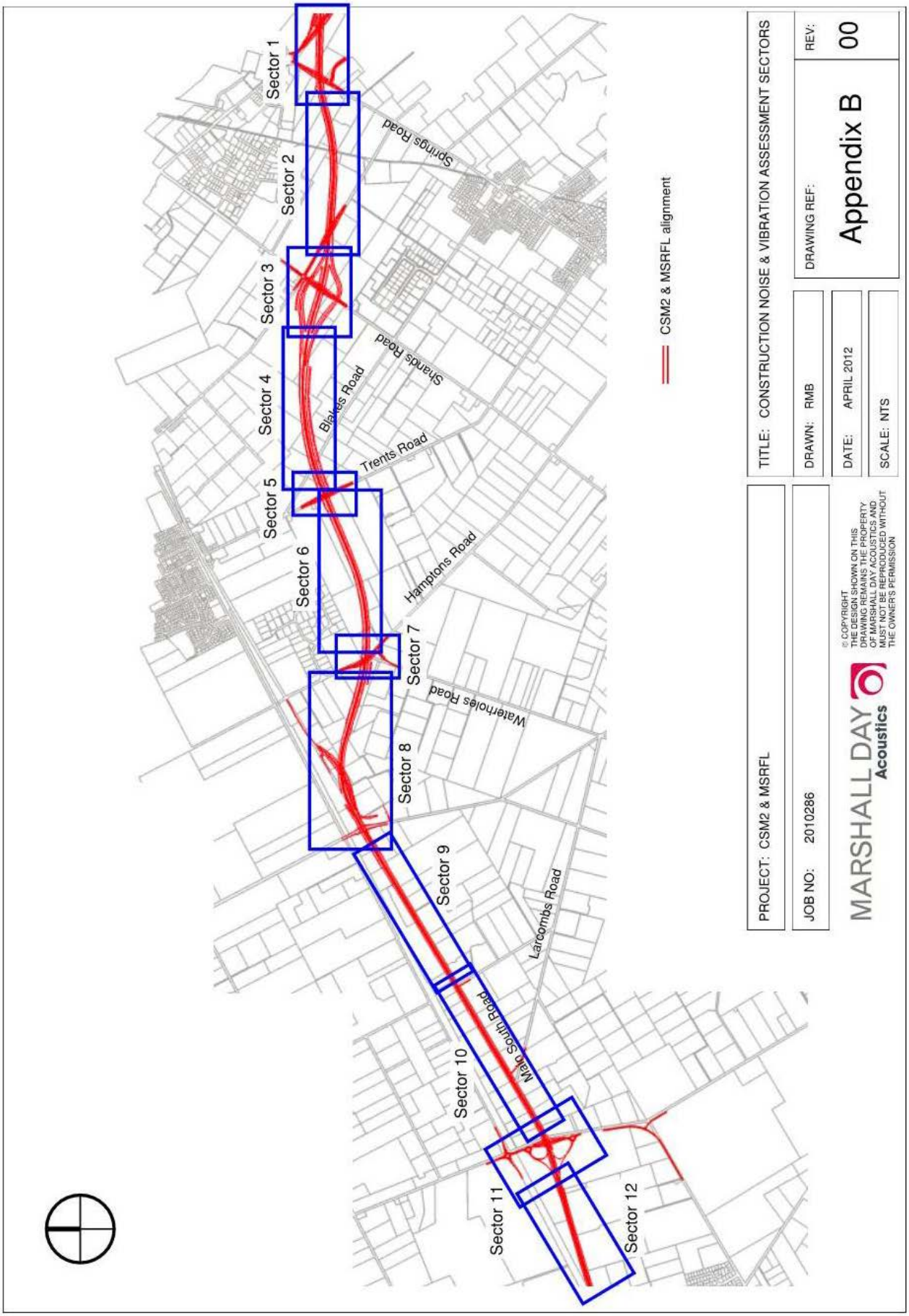
General

AEE	Assessment of Environmental Effects. A document relating to, and assessing the effects of a specific element of the Project e.g. Noise, Air Quality, Traffic, Vibration
CNVMP	Construction Noise and Vibration Management Plan. This document.
"Suitably qualified acoustics specialist"	A person who has sufficient qualifications and experience in the relevant field(s) of acoustics (noise and/or vibration) to undertake robust measurements and assessments i.e. a Member of the Acoustical Society of New Zealand.
SSCNMP	Site Specific Construction Noise Management Plan
SSCVMP	Site Specific Construction Vibration Management Plan

Appendix B: Project assessment sectors map

(Following page)

[To be updated as required]


Sector 1
Sector 2
Sector 3
Sector 4
Sector 5
Sector 6
Sector 7
Sector 8
Sector 9
Sector 10
Sector 11
Sector 12
Springs Road
Shands Road
Blakes Road
Trents Road
Hamptons Road
Waterholes Road
Larcombs Road
Main South Road
CSM2 & MSRFL alignment
TITLE: CONSTRUCTION NOISE & VIBRATION ASSESSMENT SECTORS
DRAWING REF: Appendix B
REV: 00
DRAWN: RMB
DATE: APRIL 2012
SCALE: NTS
PROJECT: CSM2 & MSRFL
JOB NO: 2010286
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Appendix C: Project designation conditions

(Following page)

[To be added when confirmed]

Appendix D: Construction noise and vibration induction

Project: CSM2/MSRFL

There are several residential and commercial neighbours in close proximity to the works, where noise limits apply. To ensure limits are achieved, all staff are responsible for good noise management.

1. When arriving at work, please drive slowly on site and keep revs to a minimum. Keep stereos off and do not slam doors.
2. No shouting or swearing on site. Either walk over and talk to somebody or use a radio/phone.
3. Be careful with tools and equipment. Place them down and do not drop them.
4. Do not drag materials on the ground. Place them down when you arrive at the work area.
5. Equipment and vehicles should not be left running when not in use.
6. When loading trucks try not to drop material from a height. Load softer material at the bottom.
7. Noise enclosures should always have all doors/hatches closed when the equipment is in use.
8. Stationary equipment such as pumps and generators should be located away from neighbours.
9. All equipment is to be well maintained.
10. No noisy works shall be conducted outside the hours of 0630h to 2000h Monday to Saturday except as specifically permitted by the CNVMP.
11. If you see anything/anyone making unnecessary noise then stop it/them. If the source cannot be stopped then report it to [TBC].
12. It is essential that good relationships are maintained with the local community. Any queries from members of the public should be responded to politely and referred to [TBC]. Staff shall assist the public to make contact with this person. Staff shall not enter into debate or argue with members of the public.
13. No potentially noisy or vibratory work is to be conducted until all staff involved in the task have read and signed the Management Schedule for that task.

Name	Company	Signed	Date

Appendix E: Noise Mitigation

(Following Pages)

Noise mitigation

The following sections provide indicative mitigation requirements for sensitive locations within each sector along the Project alignment. This information may be translated into schedules for specific dwellings once detailed methodology has been developed. Schedules should be developed in line with the templates available on the NZTA website http://acoustics.nzta.govt.nz/tools/templates.

South of Weedons Road (Sector 12)

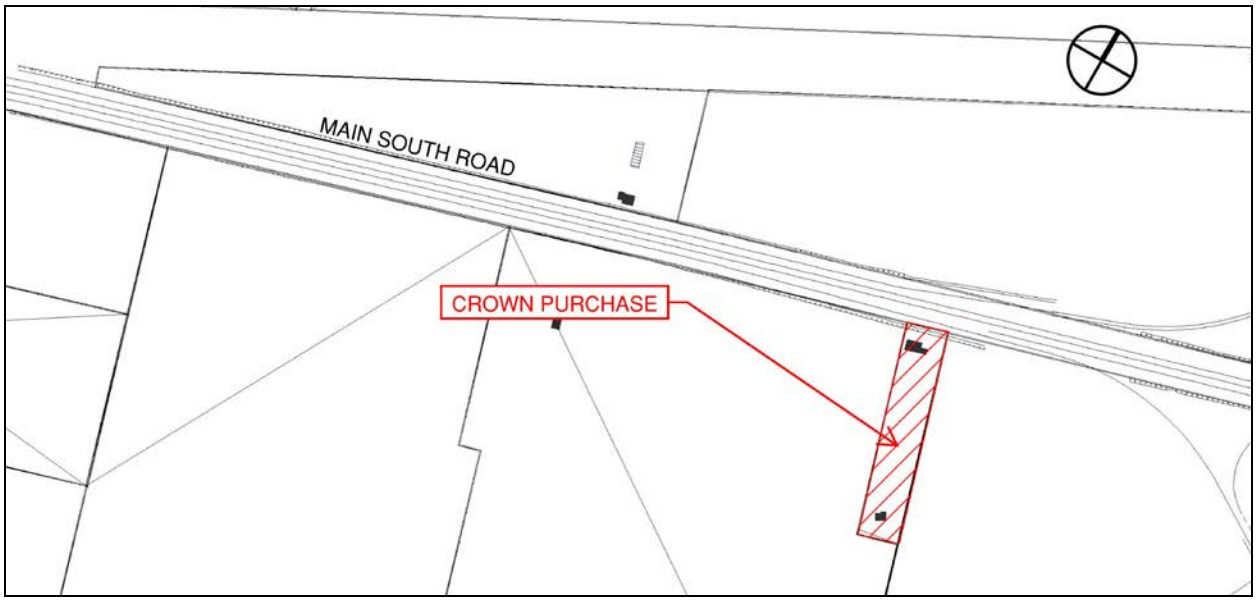


Table 11: Sector 12 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	
Bridge Construction			See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
Ground Improvements			See general mitigation section for a discussion on Ground Improvements and Piling Techniques.

Weedons Road (Sector 11)

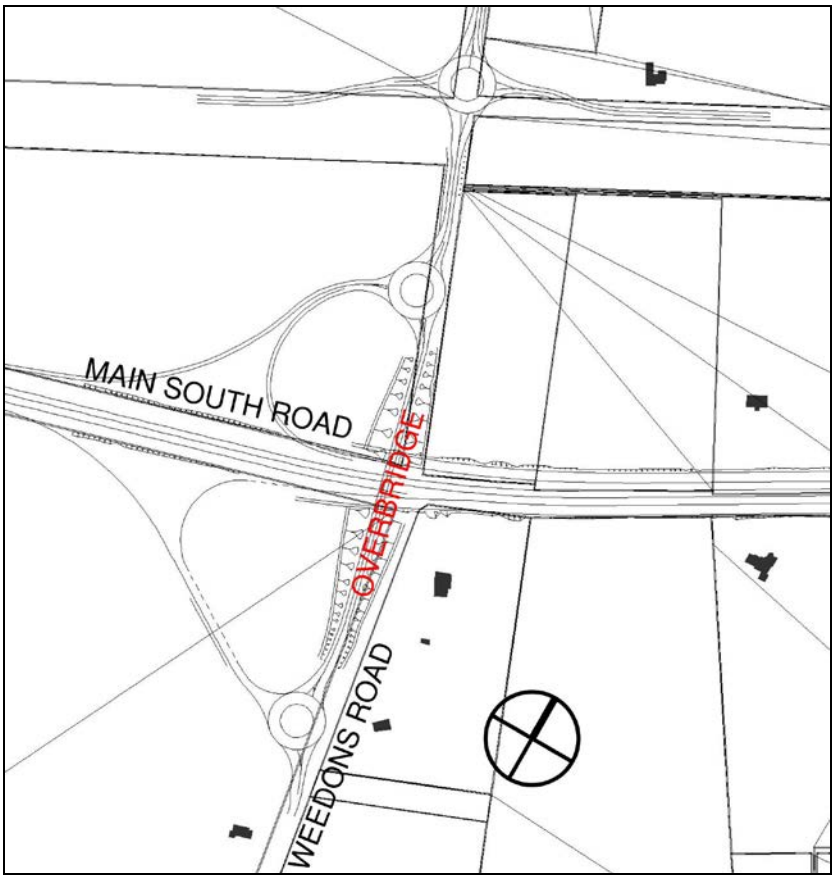


Table 12: Sector 11 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Weedons Road overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

MSRFL – Berketts to Weedons (Sector 10)

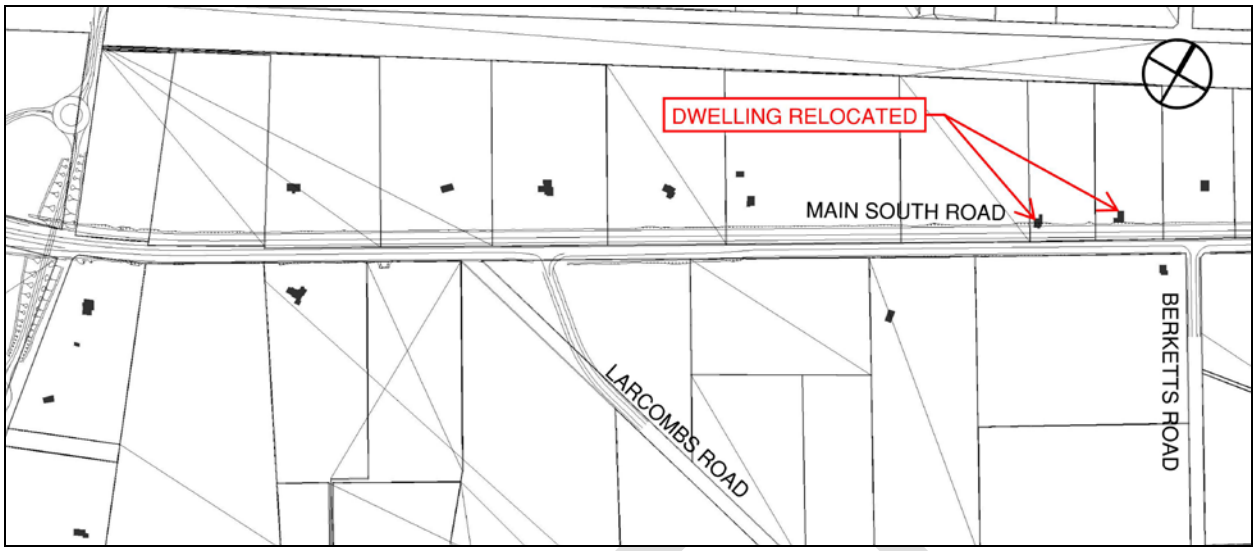


Table 13: Sector 10 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

MSRFL – Robinsons to Berketts (Sector 9)

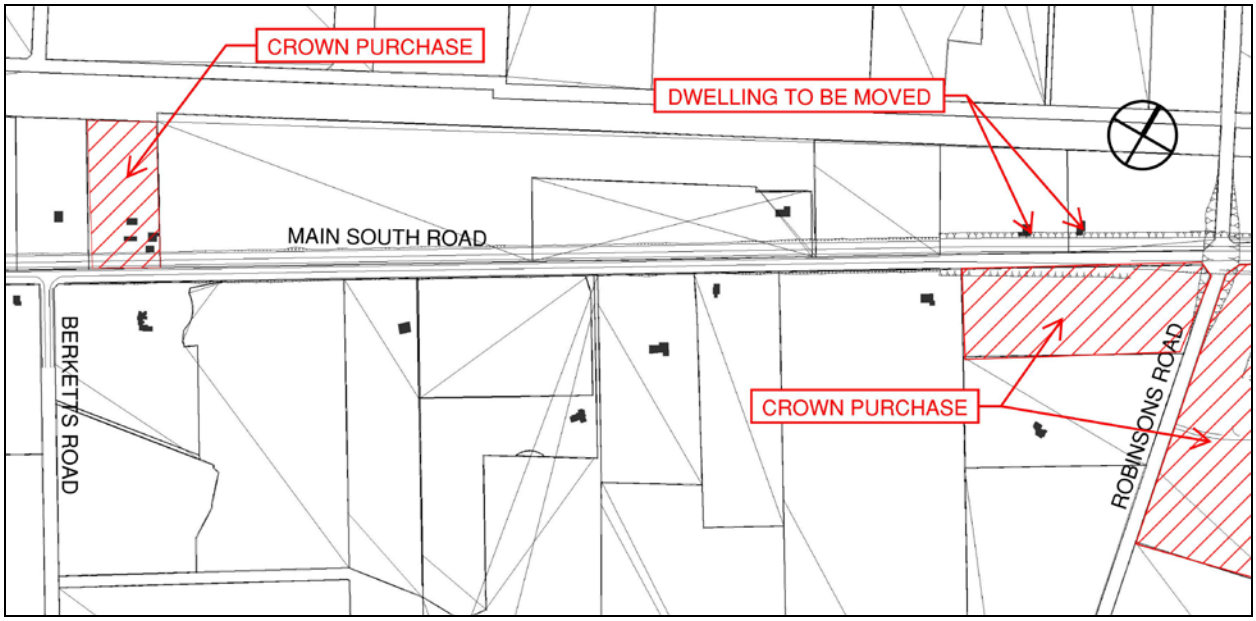


Table 14: Sector 9 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Robinsons Road (Sector 8)

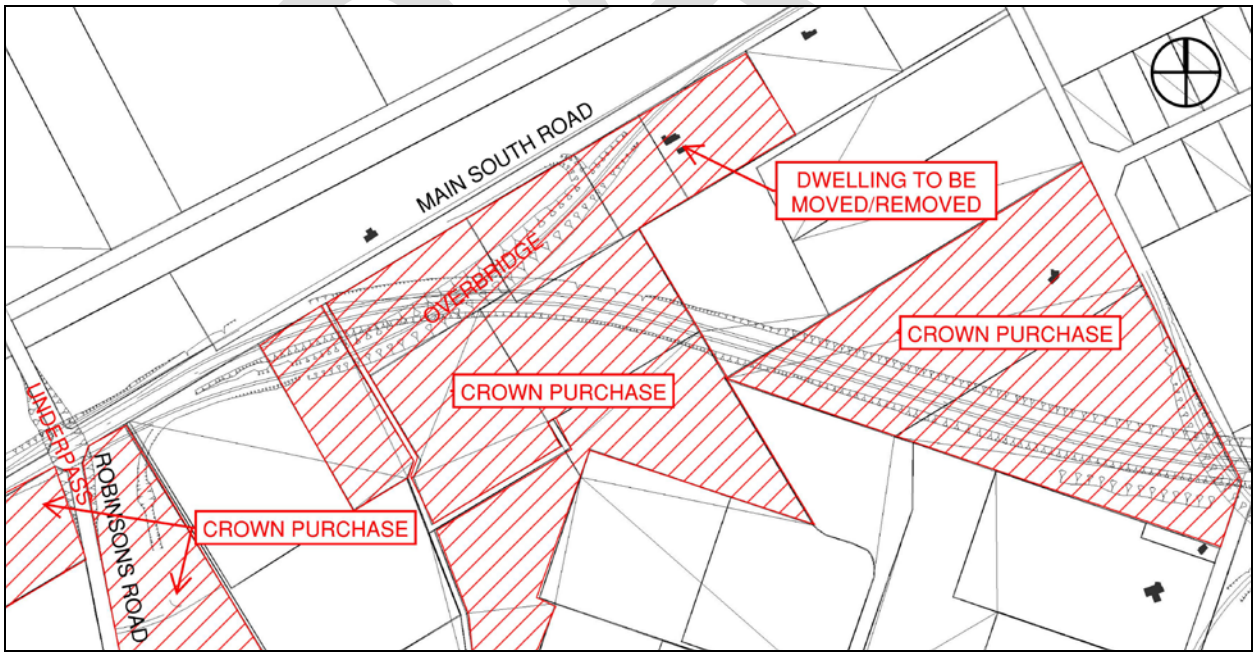


Table 15: Sector 8 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northern end of MSRFL overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of MSRFL overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Waterholes Road (Sector 7)

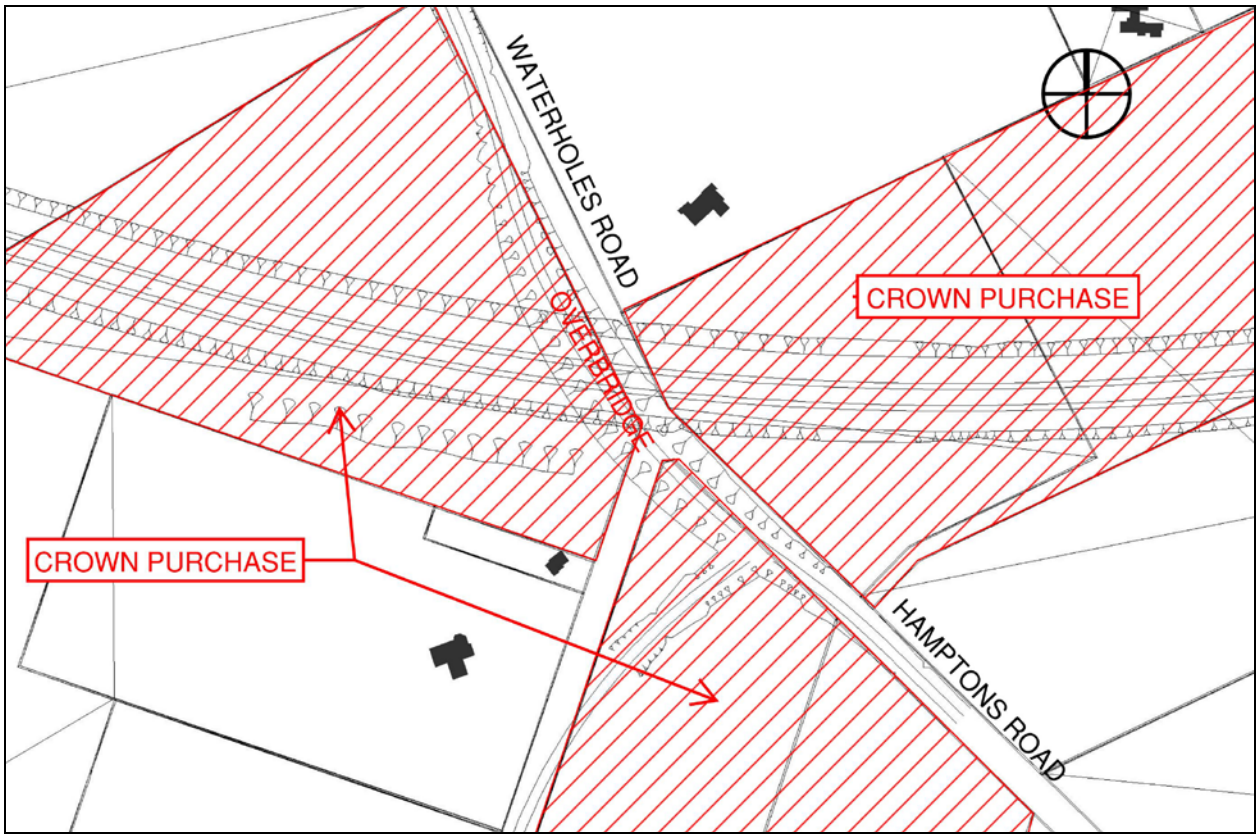


Table 16: Sector 7 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday..
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Waterholes Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Trents to Waterholes (Sector 6)

Table 17: Sector 6 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Trents Road (Sector 5)

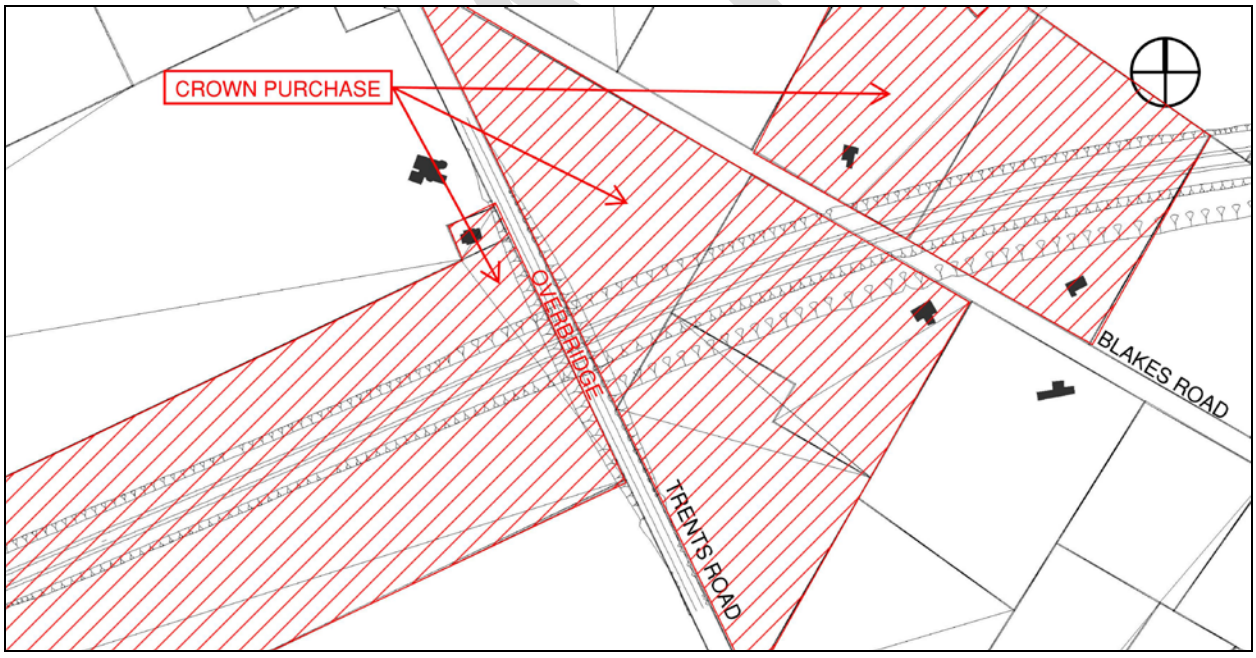


Table 18: Sector 5 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northern end of Trents Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Trents Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Marshs to Trents (Sector 4)

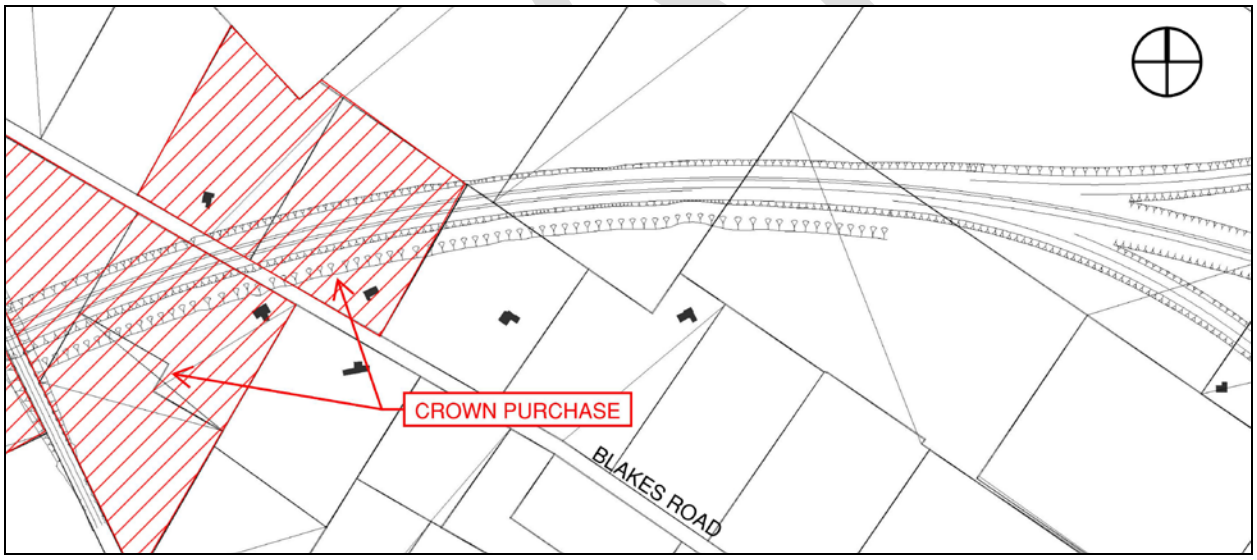


Table 19: Sector 4 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Unlikely to exceed 70 dB L_{Aeq} daytime noise criterion. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Shands Road (Sector 3)

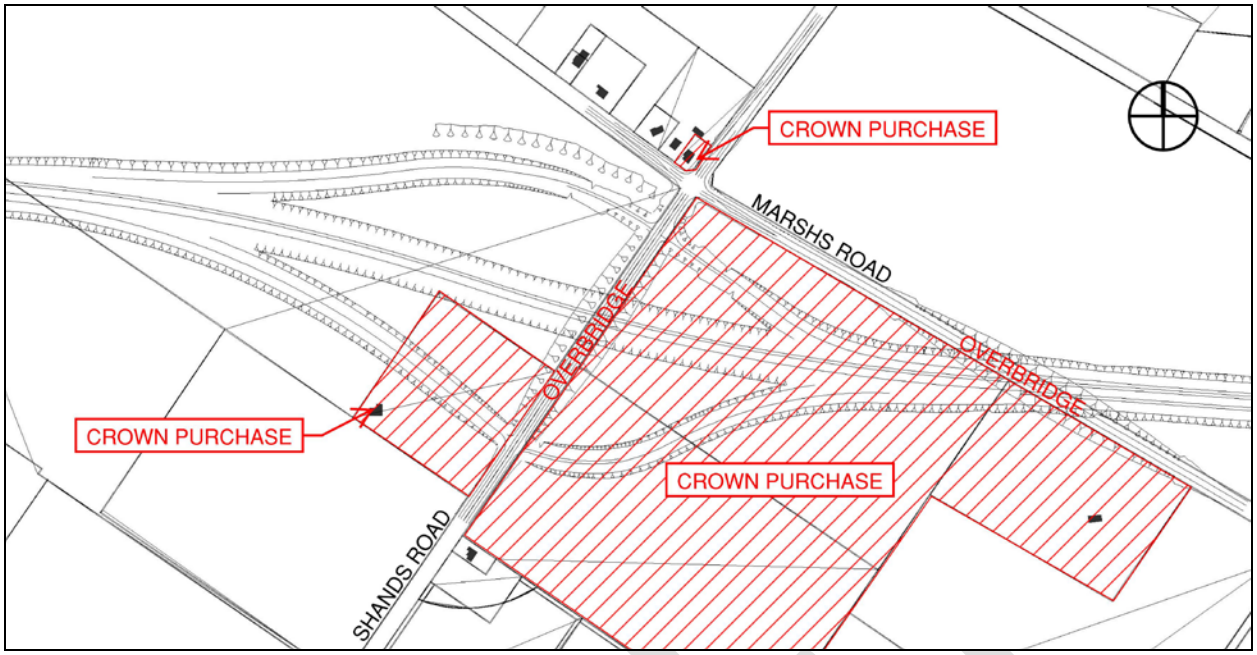


Table 20: Sector 3 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northen end of Shands Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Shands Rd and Marshs Road overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Shands to Marshs (Sector 2)

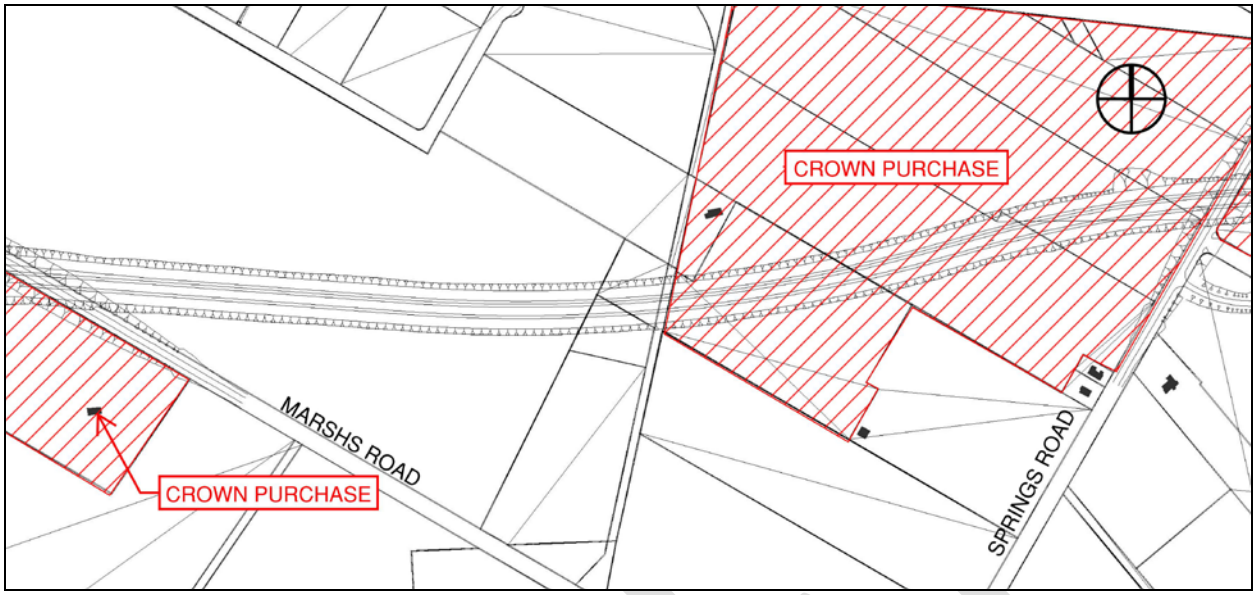


Table 21: Sector 2 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Unlikely to exceed 70 dB L_{Aeq} daytime noise criterion. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Halswell Junction/Springs Road (Sector 1)

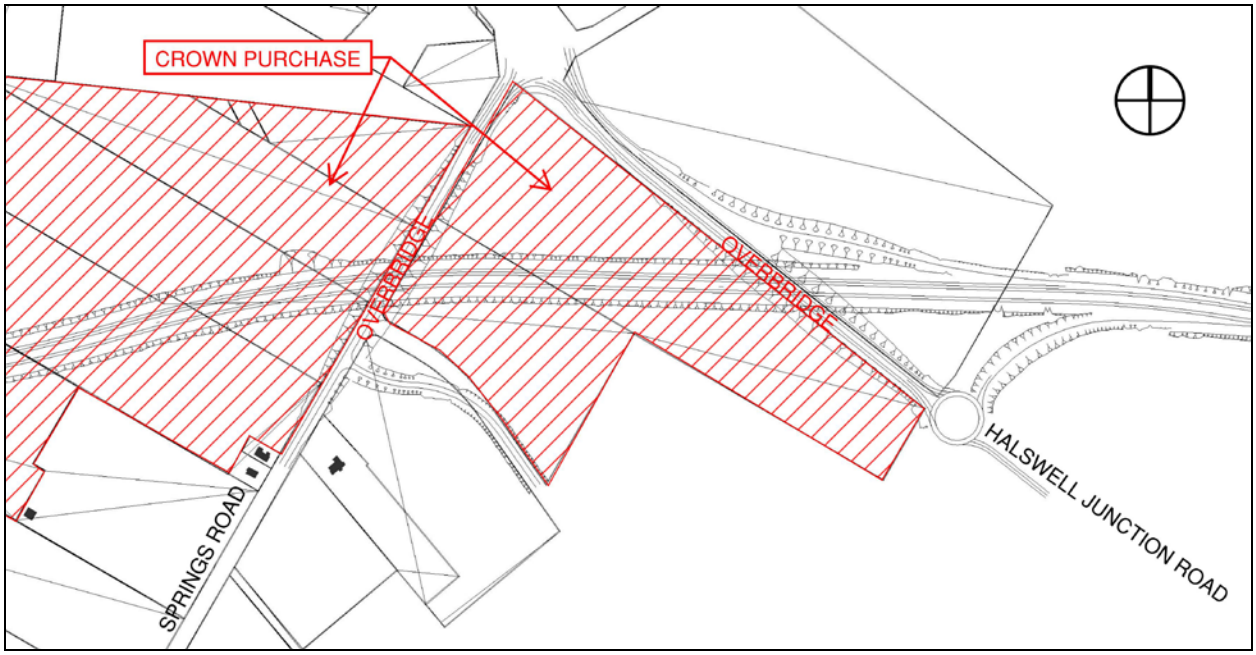


Table 22: Sector 1 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at southern end of Springs Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Springs Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

APPENDIX D

SEMP 004 Construction Traffic Management Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix D SEMP004

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Traffic Management Plan for Construction

November 2012

Record of Amendment

Amendment number	Description of change	Effective date	Updated by

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

Quality Assurance Statement			
GHD Beca	Prepared by:	Martin Crossen	November 2012
	Reviewed by:	Richard Bailey Andrew Watt	November 2012
	Approved by:	Gary Payne	November 2012

Contents

List of Tables

Glossary of Terms

MSRFL	**Main South Road Four Laning**
CSM2	**Christchurch Southern Motorway – Stage 2**
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AEE	Assessment of Environmental Effects
ATTE	Assessment Traffic and Transportation Effects
CCC	Christchurch City Council
CEMP	Construction Environmental Management Plan
CIMS	Coordinated Incident Management System
COPTTM	Code of Practice for Temporary Traffic Management
CSM1	Christchurch Southern Motorway – Stage 1
CTMP	Construction Traffic Management Plan
EED	Engineering Exception Decision
HCV	Heavy Commercial Vehicles
L1 STMS	Level 1 Site Traffic Management Supervisor
L2/3 STMS – NP	Level 2 & 3 Site Traffic Management Supervisor – Non Practising
L2/3 STMS – P	Level 2 & 3 Site Traffic Management Supervisor – Practising
MBIE	Ministry of Business, Innovation and Employment
MOTSAM	Manual of Traffic Signs and Markings
MSR	Main South Road
MTC	Manual Traffic Control
NZTA	New Zealand Transport Agency
PPE	Personal Protection Equipment
RCA	Road Controlling Authority
SDC	Selwyn District Council

SH	State Highway
SSTMP	Site Specific Traffic Management Plan
STMS	Site Traffic Management Supervisor
TC	Level 1 Traffic Controller
TCD	Traffic Control Devices
TMC	Traffic Management Coordinator
TMP	Traffic Management Plan
TTM	Temporary Traffic Management
VMS	Variable Message Sign
vpd	Vehicles per day

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A draft Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to traffic management during construction.

1.1 Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Lane and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in

each direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

1.2 Purpose and Scope

SEMP 004, this draft Traffic Management Plan for Construction (CTMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The CTMP addresses the potential traffic impacts associated with construction activities for the Project

A CTMP is required for this Project as there is likely to be significant safety and environmental impacts on SH1 and CSM1 as well as the surrounding network of local authority roads. These impacts could include congestion and delays, distraction of drivers, construction traffic, road diversions and closures.

The purpose of this Construction Traffic Management Plan (CTMP) is to set out the minimum standards required for the implementation of temporary traffic management utilised on the Christchurch Southern Motorway Stage 2 and Main South Road Four Laning Project (the Project). These minimum standards, and any practices and procedures created from them, aim to eliminate, mitigate or isolate any risks to the environment, Project site staff and all road users.

During the development of Site Specific Traffic Management Plans (SSTMP) there is the possibility that an activity may not meet the minimum standards identified in the CTMP, therefore the CTMP also outlines the procedures if minimum standards cannot be met.

The CTMP is a live document that will be continuously reviewed and updated throughout the duration of the Project. It is expected that during the detailed design and construction phases of the Project, the regulations, methodologies, effects and mitigation may be refined or change completely.

This report should be read in conjunction with the Assessment of Traffic and Transportation Effects (ATTE) report, and the other parts of the Construction Environmental Management Plan (CEMP).

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

1.3 Performance Standards

In New Zealand, Temporary Traffic Management (TTM) is governed by legislation, specifically the Land Transport Act 1998. Various Land Transport Rules, and their amendments, relating to TTM have been made in accordance with the Act and these are as follows:

- Land Transport Rule: Setting of Speed Limits 2003, Rule 54001 with two amendments;
- Land Transport Rule: Traffic Control Devices 2004, Rule 54002 with five amendments; and
- Land Transport (Road User) Rule 2004, Rule 61001 with six amendments.

The Code of Practice for Temporary Traffic Management (COPTTM) is the principal standard when considering TTM. This code is currently in its 4th Edition. All works associated with TTM are to meet the requirements COPTTM and any amendments or procedures specific to the relevant Road Controlling Authorities (RCA).

The NZTA's Project team will engage all relevant RCAs at the earliest possible opportunity to agree procedures and identify any specific requirements. The Project team will also discuss and agree TTM methodologies for works at critical locations with each RCA, meeting any specific requirements and providing clarity to all parties.

Where road environment constraints affect compliance with COPTTM, the Engineering Exception Decision (EED) process shall be followed. This process identifies the problem, why compliant TTM can't be installed and how safety risks will be mitigated. The EED forms part of the relevant SSTMP.

All relevant consent conditions and designations for this Project will also form part of the requirements for implementation of this CTMP.

The NZTA is currently developing the Traffic Control Devices Manual (TCD Manual) which will provide guidance on industry good practice, including where necessary, practice mandated by law in relation to the use of traffic control devices. This manual will support and reference New Zealand legislation and, in particular, the Land Transport Act 1998 and associated rules and general polices contained in Austroads Guides by providing detailed guidance to meet specific requirements of New Zealand law and practices, New Zealand and, as appropriate, Australian standards and codes of practice, guidelines and published standards of various authorities. The TCD manual will, on completion, replace the Manual of Traffic Signs and Marking (MOTSAM).

2. Environmental Impacts Summary

The Environmental Impacts Summary outlines the anticipated traffic management activities on the Project and their foreseeable impacts. These environmental impacts may change as the Project progresses through the detailed design and construction phases.

2.1 Summary of Traffic Management Activities

This Project is split into two parts, the Main South Road Four Laning (MSRFL) and the Christchurch Southern Motorway Stage 2 (CSM2).

The MSRFL phase of the Project involves pavement widening to four lanes and associated rehabilitation works as well as the construction of an interchange at Weedons Road. The four laning of SH1 will occur from the CSM2 connection to just north of Rolleston. This phase is treated as one zone.

The CSM2 phase of the Project is predominantly "greenfields" construction from the end of the Christchurch Southern Motorway Stage 1 (CSM1) north of Halswell Junction Road to just south of the Robinsons Road intersection on Main South Road State Highway 1 (SH1). Along this route there are interchanges with Halswell Junction Road, Shands Road and SH1 just north of Robinsons Road. CSM2 and associated works will also have an impact on Springs Road, Marshs Road, Blakes Road, Trents Road, Hamptons Road, Waterholes Road, Curraghs Road and Robinsons Road. This phase of the Project has been broken into five zones.

Provided below is a description of the TTM activities for each of the zones of the work based on the currently proposed construction methodology. It is expected that during the detailed design and the early construction phases of the project this construction methodology may be altered.

For a detailed description of the proposed construction methodology refer to the Assessment of Environmental Effects (AEE) and the Construction Environmental Management Plan (CEMP).

2.1.1 Zone 1 – MSRFL including Weedons Road Interchange

During the construction of the alternative property accessways, Jones Road/Weedons Ross Road roundabout and the realignment of the Weedons Road/Levi Road intersection, narrowed lane widths, lane shifts, manual traffic control (MTC) and speed restrictions will be used.

The widening of SH1 will initially be offline and will require only shoulder closure traffic management. As it begins to tie into the existing carriageway, SH1 will have speed restrictions, delineation, narrowed lanes and lane shifts.

When traffic is diverted to the western side speed restrictions and delineation will be in place allowing works to upgrade the existing eastern side. Works on the eastern side also include adjustments to the Berketts Road and Larcombs Road intersections. When works are undertaken to adjust the Berketts Road intersection with SH1, it will be closed with traffic detoured onto Larcombs Road and vice versa for when adjustments are made to the Larcombs Road intersection with SH1. The adjustments to Larcombs Road will permanently prevent entry onto SH1 and temporary information signage, later

replaced with permanent "No Exit" signs, will be placed at the intersection of Larcombs and Berketts Roads to notify the public.

When construction of the Weedons Interchange begins, Weedons-Ross Road will be closed with a detour in place, utilising Jones Road and Hoskyns Road, while maintaining access for properties on Weedons-Ross Road. The construction of the Weedons Road roundabout will require some diversions around the worksite but will remain open as the bulk of the works will be carried out offline. Narrowed lane widths, lane shift and MTC methods of traffic management will be utilised.

Weedons Ross Road has an AADT of 1,290 vpd and is classified as a local road.

2.1.2 Zone 2 – Robinsons Road/Curraghs Road

Construction of the SH1/Waterholes Road roundabout and new southbound SH1 alignment will initially begin offline but as adjustments to the existing carriageway are required, lane shifts, speed restrictions and manual traffic control will be utilised. Robinsons Road will be closed from the proposed roundabout to SH1 to allow partial construction of the overbridge and the Robinsons Road embankment and will remain closed until completion of the overbridge. A detour will be in place utilising Waterholes and Jones Roads. The Robinsons Road roundabout will not be closed during its construction but will have delineation and speed restrictions as there is a need to maintain access to local businesses.

There will also be a requirement for localised traffic management to aid in the construction of the western and eastern rear accesses early on in the Project. The western rear access involves the construction of a new continuous road between Weedons Ross Road and 250m north of Curraghs Road, with the majority of works being undertaken offline. The eastern rear access road utilises existing local roads, private right of ways and a proposed extension of Berketts Drive, which are low trafficked roads.

Upon completion of the new SH1 alignment and partial construction of the Robinsons Road overbridge traffic will be diverted onto the new SH1 southbound lanes. Shoulder closures, lane shifts and speed restrictions will be in place at the southern transition with only a shoulder closure at the northern transition until completion of the off-ramp. Although the new SH1 alignment will be temporarily bi-directional, standard pavement markings, as per MOTSAM, will be utilised.

Once the diversion is in place, Curraghs Road will be closed from the railway line to SH1. The existing detour for Robinsons Rd will remain in place and access roads will be provided for affected businesses on Curraghs Road. This will allow for the completion of the Robinsons Road overbridge, the tie in of CSM2 to SH1 and adjustments to SH1 for the off-ramp.

Robinsons Road has an AADT of 70 vpd and is classified as a local road while Curraghs Road has an AADT of 330 and is classified as a local road.

2.1.3 Zone 3 –Waterholes Road and Trents Road

The temporary diversion of Trents Road will utilise the CSM2 footprint to connect with Blakes Road. Once the Trents Road overbridge is complete, it will be reopened and Blakes Road will be closed permanently either side of CSM2.

Waterholes Road and Hamptons Road traffic is to be diverted along a temporary carriageway west of the existing road while the new alignment and overbridge is constructed. Speed restrictions and delineation will be required at the transition points of the temporary carriageway as these points will also be used for site access.

Upon completion of the new alignment, Waterholes Road will be realigned to intersect Hamptons Road at a new location requiring speed restrictions, delineation and manual traffic control when the carriageway is reduced to a single lane alternating flow.

2.1.4 Zone 4 – Shands Road / Marshs Road

Shands Road traffic is to be diverted along a temporary carriageway west of the existing road while a new alignment and overbridge is constructed. Speed restrictions and delineation will be required at the transition points of the temporary carriageway as these points will also be used for site access. Marshs Road traffic will be diverted along a temporary carriageway south of the existing road while a new alignment and overbridge is constructed. The temporary alignment will also include a shared path for use by the Rail Trail users with a temporary crossing point near Shands Road. Improvements to the Shands Road/Marshs Road intersection will also be undertaken in the early phases of construction at this site. Narrowing of lanes, lane shifts, speed restrictions and manual traffic control will be required to be in place during Shands Road and Marshs Road intersection works.

Once diverted back to the new alignment, Shands Road will have shoulder closure traffic management in place at each of the motorway entry/exit points. Lane closures and manual traffic control will be in place when pavement and surfacing works are undertaken.

2.1.5 Zone 5 – Halswell Junction Road

The construction of an off-ramp will require the closing of the left hand southbound lane of CSM1 for the construction transition point. This work will require a speed restriction but live lane works will occur outside peak periods allowing full capacity in the PM peak. The new Halswell Junction Road roundabout and John Paterson Drive extension can initially be built offline. The existing John Paterson Drive carriageway is a cul-de-sac that intersects with Springs Road. It is planned that this connection will be severed upon completion of the link from the cul-de-sac to the proposed roundabout at Halswell Junction Road and the CSM1 off-ramp.

Traffic will then be shifted onto the new formations so roundabout works on the existing carriageway can commence. A temporary shared footpath/cycleway will be built on the southern side of the new roundabout. Speed restrictions and delineation will be required over the uneven and unbound surface.

Halswell Junction Road and Springs Road traffic are both to be diverted along temporary carriageways south and west respectively of their existing alignments while the new alignments and overbridges are constructed. Speed restrictions and delineation will be required at the transition points of the temporary carriageway as these points will also be used for site access. The John Paterson Drive connection to Springs Road would also be permanently terminated at this time. As the construction of the Halswell Junction Road overbridge will require the removal of the existing roundabout, built as part of CSM1, traffic will be diverted up the off-ramp onto CSM1 from the new Halswell Junction Road roundabout. This will require a 24 hour lane drop on the southbound CSM1 lanes and delineation on the off-ramp to allow for bi-directional flows.

During the construction of CSM2 and the associated on-ramp, a shoulder closure at the motorway on-ramp will be in place for the majority of the time. Only during pavement and surfacing works will a lane drop and speed restriction need to be in place.

2.2 Summary of Impacts

This section is an overview of the expected environmental impacts that result from the TTM associated with the Project. Reference should be made to the ATTE for a detailed assessment of the traffic impacts resulting from the construction and traffic management activities of the Project.

All construction activities expected to be performed during the Project are regularly undertaken in the Christchurch region. The general impacts from these types of operations are understood by the local construction industry and mitigation measures have previously been successfully implemented.

The expected traffic control operations to be undertaken during the Project and their anticipated impacts are summarised in Table 1. The three components are:

- traffic management activity – the types of traffic management operations likely to be used during construction of the Project;
- impacts – the expected impacts resulting from each traffic management operation on road users; and
- relevant zones – the zones that are expected to experience each type of traffic management activity.

Table 1: Traffic management activity and impacts

Traffic Management Activity	Impact	Relevant Zones				
		1	2	3	4	5
Shoulder Closure	• Increased side friction reducing comfort and safety of road users • Reduced or no shoulder restricting areas for pulling over, i.e. breakdowns or to allow emergency services to pass. • Distraction to motorist by visibility of works	✓	✓	✓	✓	✓
Lane Closure – Single Direction Flow	• Reduced capacity due to fewer lanes than existing carriageway. • Increased risk of accidents resulting from merge point • Distraction to motorist by visibility of works	✗	✗	✗	✗	✓
Lane Closure – Single Lane Alternating Flow	• Reduction in capacity • Increased travel time and delays resulting from Stop/Go operation • Distraction to motorist by visibility of works	✓	✓	✓	✓	✓
Lane Closure – Temporary Diversion	• Driver confusion due to unfamiliar road environment • Increased travel time • Increased side friction due to reduced lane widths and reduced shoulders • Distraction to motorist by visibility of works • Increased risk due to unbound surface	✗	✗	✓	✗	✗
Lane Closure – Two Lane Diversion	• Driver confusion due to unfamiliar road environment • Increased travel time • Distraction to motorist by visibility of works • Increased risk due to unbound surface • Increased accident risk of accident due to contra-flow	✗	✓	✓	✓	✓
Temporary Speed Limit (TSL)	• Slower operating speed resulting in increased travel time. • Road user non-compliance with speed restriction.	✓	✓	✓	✓	✓

Traffic Management Activity	Impact	Relevant Zones				
		1	2	3	4	5
	• Driver frustration due to low TSL over long worksite					
Road Closure	• Increased travel times • Congestion on detour routes • Congestion on alternative routes • Confusion and Inconvenience of road users • Detour routes utilising undesirable routes • Disruption to residents and businesses within or adjacent to closure • Severance of Rail Trail link					
Short-Term Closure for Installation of Long-Term Traffic Management	• Increased congestion and reduction in capacity for short periods.					
Cycle Lane Closure	• Increased exposure to traffic and construction activities. • Disruption to users. • Undesirable surface to cycle on.					
Footpath / Shared Path Closures	• Increased exposure to traffic and construction activities. • Disruption to users • Severance of Rail Trail link or temporary shared use path and crossing • Disconnection from Bus stops					
Site Access	• Increased truck movements at point of access slowing traffic and reducing capacity. • Increased heavy traffic on routes to site access resulting in increased travel times, congestion and disruption to local residents/businesses. • Debris spread on carriageway from vehicles leaving site.					
Property Access Relocation and Closures	• Disruption to residents and businesses					

2.3 Summary of Mitigation Measures

This section identifies the traffic management measures that can be undertaken to eliminate, mitigate and isolate the impacts identified in Section 2.2. Traffic management methods shall be implemented, as per COPTTM, to ensure minimal risk and disruption to all road users in and around the Project area.

Measures to reduce the impact on road users that could be undertaken during the Project are summarised in Table 2. The three components are:

- traffic management activity – the types of traffic management operations possibly used during construction of the Project;
- impacts – the expected impacts resulting from each traffic management operation on road users; and
- typical mitigation measures – activities to be considered that may reduce the impacts during traffic management planning (SSTMPs) and Project management of the works.

Table 2: Mitigation measures

Traffic Management Activity	Impact	Typical Mitigation Measures
Shoulder Closure	• Increased side friction reducing comfort and safety of road users • Reduced or no shoulder restricting areas for pulling over, i.e. breakdowns or to allow emergency services to pass. • Distraction to motorist by visibility of works	• Install temporary speed limit • Reduce worksite encroachment on live lanes as much as possible
Lane Closure – Single Direction Flow	• Reduced capacity due to fewer lanes than existing carriageway. • Increased risk of accidents resulting from merge point • Distraction to motorist by visibility of works	• Public notification in local publications and/or by on-site information signage (VMS) • Undertake operations outside peak hours • Provide advanced warning of lane merging. • Extent length of merging point in high speed areas. • Allowances in TM setup for property access.
Lane Closure – Single Lane Alternating Flow	• Reduction in capacity • Increased travel time and delays resulting from Stop/Go operation • Distraction to motorist by visibility of works	• Public notification in local publications and/or by on-site information signage (VMS) • Letter drop to affected parties notifying them of the upcoming works. • Directing traffic away from worksite by way of advanced VMS signage. • Use of temporary barrier systems or sight screens to prevent distraction • Undertake operations outside peak hours • Allowances in TM setup for property access. • Monitoring of queue lengths and delays. • Install temporary speed limit
Lane Closure – Temporary Diversion	• Driver confusion due to unfamiliar road environment • Increased travel time • Increased side friction due to reduced lane widths and reduced shoulders • Distraction to motorist by visibility of works • Increased risk due to unbound surface	• Public notification in local publications and/or by on-site information signage • Sealed carriageway surface • Install temporary speed limit • Provide directional signage • Construct diversion routes with adequate carriageway widths
Lane Closure – Two Lane Diversion	• Driver confusion due to unfamiliar road environment • Increased travel time • Distraction to motorist by visibility of works • Increased risk due to unbound surface • Increased accident risk of accident due to contra-flow	• Public notification in local publications and/or by on-site information signage • Sealed carriageway surface • Use of delineation or markings on diversion • Install temporary speed limit • Construct diversion routes with adequate carriageway widths

Traffic Management Activity	Impact	Typical Mitigation Measures
Temporary Speed Limit (TSL)	• Slower operating speed resulting in increased travel time. • Road user non-compliance with speed restriction. • Driver frustration due to low TSL over long worksite	• Public notification in local publications and/or by on-site information signage • Monitoring and review of use of temporary speed limit to assess if appropriate • Installation of traffic calming measures (narrowing lanes, approach curves and speed humps), once approved by RCAs • Request Police presence on-site • Use of a higher TSL outside working hours if site conditions allow. • Use of a lower TSL in active area of a long worksite • Use of pilot vehicle to control road user speeds
Road Closure	• Increased travel times • Congestion on detour routes • Congestion on alternative routes • Confusion and Inconvenience of road users • Detour routes utilising undesirable routes • Disruption to residents and businesses within or adjacent to closure • Severance of Rail Trail link	• Consultation with RCAs to identify detour routes. • Public notification in local publications, radio and/or by on-site information signage (VMS) • Discuss planned activities and impacts with affected residents and businesses. • Letter drop to affected parties notifying them of the upcoming works. • Identification and usage of secondary detour routes if required • Directing traffic away from worksite by way of advanced VMS signage. • Short-term closures to be programmed for night or weekend work • Barriers/fencing to prevent public access • Resident only access routes from intersections or around closure.
Short-Term Closure for Installation of Long-Term Traffic Management	• Increased congestion and reduction in capacity for short periods.	• Undertake time consuming activities (barrier installation) at night or in off-peak times.
Cycle Lane Closure	• Increased exposure to traffic and construction activities. • Disruption to users. • Undesirable surface to cycle on.	• Provide cycle lane provisions through or around the worksite. • Notify in advance of closure of facilities and direct to alternate route. • Temporary warning signage to warn of cyclists merging • Install temporary speed limit
Footpath / Shared Path Closures	• Increased exposure to traffic and construction activities. • Disruption to users • Severance of Rail Trail link or temporary shared use path and crossing • Disconnection from Bus stops	• Letter drop to affected parties notifying them of the upcoming works. • Provide footpath/shared path provisions through or around the worksite. • Provide detour routes in advance of worksite • Direct users to existing crossing points • Provide provisions for alternative crossing points, i.e. signage, delineation and temporary refuges. • Close existing bus stop and direct to alternative bus stop

Traffic Management Activity	Impact	Typical Mitigation Measures
Site Access	• Increased truck movements at point of access slowing traffic and reducing capacity. • Increased heavy traffic on routes to site access resulting in increased travel times, congestion and disruption to local residents/businesses. • Debris spread on carriageway from vehicles leaving site.	• Develop site access strategy identifying access points, times and procedures • Identify with RCAs specific routes to be used for haulage of plant and materials, avoiding built up or sensitive areas. • Provision for truck manoeuvres at site access outside of live lanes. • Restrict plant and material movements/deliveries to and from site to period outside of peak periods. • Plant cleaning facilities at site access points. • Frequent cleaning/sweeping of carriageway at access points.
Property Access Relocation and Closures	• Disruption to residents and businesses	• Discuss planned activities and impacts with affected residents and businesses. • Letter drops to residents and businesses in works area prior to mobilisation. • Provide provisions to allow access to properties. • Restrict works activities to periods of low or no demands for services.

3. Implementation and Operation

This section covers the operational procedures for TTM activities during the Project.

3.1 Operation / Management Procedures

3.1.1 Traffic management Procedure Governance

This CTMP is to be the main working document throughout the Project for all activities associated with traffic management and will be reviewed and approved by the key stakeholders and implemented via the Traffic Management Plan (TMP) process. The key stakeholders are envisaged to be the three RCAs, namely the NZTA, Christchurch City Council (CCC) and Selwyn District Council (SDC), as well as the NZ Police. The key stakeholders will be consulted on a regular basis on the requirements prescribed with amendments to be undertaken when identified.

The governance of all traffic management activities will occur through the approval/acceptance process for SSTMPs by the Approving Engineer, NZTA, CCC and SDC or their representatives. Worksites with established traffic management will be routinely monitored and assessed against Key Performance Indicators.

A collaborative approach with key stakeholders will be undertaken from the early stages of the construction phase. This will allow for a "no surprises" approach when planning traffic management activities and will reduce any time related risks in the approval/acceptance process as the stakeholders will have had the opportunity to provide feedback on the proposed methodologies.

3.1.2 Site Specific Traffic Management Plans

SSTMPs describe the nature and extent of TTM operations for the Project and identify how all road users will be managed by the TTM while ensuring their safe negotiation through the Project site. The SSTMPs also identifies procedures to be undertaken by the Project staff to minimise traffic associated risks on site.

All construction activities that have an impact of the roading network, whether it is within the road reserve or not, shall have a SSTMP identifying the approved mitigation measures to be undertaken prior to and during the establishment of the worksite. SSTMPs must be accepted by the relevant RCAs prior to any worksite mobilisation. The process for approval and acceptance of SSTMPs is outlined in Section 3.2.

3.2 Site Specific Traffic Management Plan Development

All SSTMPs that are developed are to comply with the standards and codes of practice identified in Section 1.3, as well as assessing the safety requirements of Project staff and all road users.

During the development of each SSTMP, the impacts and mitigation measures identified in the ATTE as well as the expected impacts and typical mitigation measures in this report are to be considered and documented in the SSTMP. The relevant RCAs will determine the suitability of the proposed SSTMP.

At the completion of the works and removal of all traffic management measures, the worksite is to be free of hazards that have been introduced or left behind as part of the construction activities. This is to ensure the safety of all road users.

The general operational procedures for the development, approval and acceptance of SSTMPs for the Project is set out in Section 3.2.1 to 3.2.3 inclusive.

3.2.1 Site Specific Traffic Management Plan Structure

Each SSTMP will include, but is not limited to, the following:

- SSTMP proforma – This contains all relevant information relating to the Project, the traffic management methodology and standards and identifies the required approvals/acceptances to be attained. The Traffic Management Plan (TMP) – Full Form from COPTTM (4th Edition) will be used for all SSTMPs;
- temporary speed restriction application – this contains specific details about the proposed speed restriction including proposed temporary speed limit, signage locations and timing. The route position information needs to be accurate to allow for Police involvement if worksite speeds need to be managed by enforcement;
- engineering exception decisions – all EEDs relevant to the traffic management operations outlined in the SSTMP, if any, will be appended to the SSTMP;
- layout plans – computer generated (CAD or similar) drawings of the proposed traffic management set out as defined by the proforma. These plans will contain all relevant road features to assist in the management of construction impacts. This shall include existing traffic management sites that are part of the Project or belong to another contractor;
- temporary road closure application – the road closure application and other required information for the relevant RCA; and
- communication documentation – the communication documentation is all relevant public notification information to the SSTMP. This shall include, but not be restricted to, variable message signs (VMS) location strategies, wording for site information signs, draft copies of public notifications (newspapers, advertisements, radio communications and flyers) and a copy of the draft letter to be distributed to affected businesses and residents.

3.2.2 Specific Requirements

3.2.2.1 Network Capacity

Delays caused by construction activities and their associated TTM is a major indicator in the impact a set of works is having on road users. All TTM activities affect the capacity of a network in some form. The impacts of the TTM on the roading network capacity will be assessed and mitigation measures put in place.

Delays are assessed on traffic passing through the worksites as well as vehicle movements on any diversion routes. The maximum delay allowable by COPTTM is 5 minutes. Delays to vehicles travelling through or directly affected by construction activities will be evaluated as well as assessing the capacity of the diversion routes for opportunities to increase the capacity, therefore reducing delays.

Lane closure activities have been shown to cause delays on high usage carriageways and therefore will be avoided if possible. If these are required, they will be used outside of peak hour flows and will be removed if delays exceed 5 minutes or back up to the extent that it's impacting other parts of the network.

When preparing SSTMPs the Project team may need to undertake traffic modelling to assist with the assessment of the impacts on the road network. This modelling will look at queue lengths and delay estimates through the site and effects on the surrounding network. This modelling data is to be provided to the relevant RCAs to assist with the review of the SSTMP.

Activities likely to cause significant delays should avoid being programmed during periods of increased vehicular movements along the State Highways. This includes public holiday weekends, significant events and the Christmas period. NZTA general policy requires the removal of all TTM activities from the network over the Christmas period.

3.2.2.2 Peak Hour Capacity

During the preparation of the SSTMP, the impact of the construction activity and associated TTM on traffic flows will be assessed. Generally, the option of undertaking works during peak periods depend on the classification of the carriageway, traffic volume or strategic significances. The SSTMP will identify the requirements of each RCA in relation to working during peak periods. Any Level 2 classified carriageway, as per COPTTM, Clause A4.3.1, will be required to maintain a two lane two directional flow during peak periods, although these may vary depending on the RCA. These restrictions will prevent activities that are likely to cause significant delays occurring during peak periods but other activities with a minimal risk of delay will be assessed on a case-by-case basis.

3.2.2.3 Lane Delineation

Delineation of traffic lanes will be detailed within the relevant SSTMP for the traffic management activity in place. The selection of appropriate delineation devices can directly affect the impact a TTM set up has on road users. All delineation devices and their placement are to meet the requirements of COPTTM.

Short-term worksites, up to a week in duration, will utilise cones as delineation as they are quick to install and remove and can be easily replaced or repaired if damaged. Issues surrounding the use of cones are that they are easy to knock over, stolen or adjusted by unauthorised persons.

Long-term worksites will use barriers and stick on markers for delineation as well as pavement markings. Barriers and stick on markers are a semi-permanent form of delineation that is generally resilient when hit by a vehicle. The barriers have a larger footprint and require a larger safety zone behind but also provide an additional level of safety for road users and site staff. Stick on markers are positioned the same as cones yet do not fall over blocking lanes like cones. Both barriers and stick on markers require the installation of a short-term worksite to install, creating initial set up delays.

Worksites where a temporary carriageway has been installed for a diversion that has been surfaced will have its delineation provided by pavement markings. This is a cost effective and low impact method of delineation requiring minimum maintenance. It is also likely to have no impact during installation as it can be undertaken prior to being opened as a diversion.

3.2.2.4 Site Access

Site access points are a large contributor to the reduction in capacity of a road network. Each site access will be shown in an accepted SSTMP, detailing the methodology for entry and exit of the worksite. Site access points will be designed to minimise impacts to road users.

The specific requirements for each site access point will be detailed within and installed in accordance with the SSTMP. The requirements may include:

- Types of traffic control, including manual traffic control;
- Restricted/permitted movements into and out of site;
- Restricted periods of usage; and
- Installation of vehicle cleaning facilities.

All vehicle operators will be briefed by the STMS on the procedures and restrictions associated with the relevant site access point.

3.2.2.5 Construction Traffic Movements

Due to the scale of the Project, there will be a significant number of construction vehicle movements in the area, with a large portion of these being heavy commercial vehicles (HCVs). These HCVs will predominantly be carting bulk materials and plant to and from the worksites. The increase of HCVs will impact the capacity of some roads and intersections as well as directly affecting traffic at points of site access.

Any over dimensioned vehicle will require a permit from the relevant RCAs and may require additional traffic management activities to allow it to travel to and from and access the relevant worksites.

Construction vehicle movements, specifically HCVs, will be detailed in each SSTMP for acceptance by the relevant RCAs. The SSTMP will also outline the operating hours for HCVs on public roads with Level 2 carriageways to minimise activity during peak periods, the frequency of HCV movements and routes to be used for haulage of materials and the points of access to each site. The SSTMP will also outline any mitigation measures to be undertaken to reduce any impacts associated with HCV movements.

All truck drivers are to be briefed on the appropriate routes and movements for entering the site. There are also to be made aware of sensitive areas and points of high pedestrian and cyclist usage.

Truck washes are to be present at all major site access points to reduce spoil on the carriageways. Routine inspections of cartage routes and removal of loose material will be undertaken to mitigate risks to the road users.

3.2.2.6 Traffic Detours

Road closures and their associated detour routes will be contained within the accepted SSTMPs. The relevant RCAs are to be engaged prior to the submission of the SSTMP with any comments included in the SSTMP. Any comments from a RCA found to be unsuitable or impractical for the traffic management operation are to be responded to, identifying why they will not be included.

A public information campaign for each road closure will be undertaken via approved media, publication and radio advertisements, information signage including VMS, for a period suitable to the requirements of the relevant RCA, generally 7 or 14 days. The aim of advertising the road closure is to encourage road users to find an alternative route thereby reducing traffic flows on the planned road closure.

The SSTMP will also detail procedures to mitigate any impacts on residents and businesses affected by the road closure or the detour route. Traffic flows on the detour routes will be monitored and assessed over the course of the closure, as detailed in section 3.3.3

3.2.2.7 Passenger Transport Services

During the initial planning stages of the construction phase of the Project, the affected bus services will be identified. This will allow for early consultation with public transport stakeholders assisting in the development of mitigation measures or allowing a suitable period of time to adjust services. Consultation will be carried out with the following public transport stakeholders during the formation of the relevant SSTMPs.

- NZTA;
- Environment Canterbury;
- public transport operators; and
- the Ministry of Education (for school bus routes).

During the development of the SSTMPs, impacts on the public transport network will be assessed with mitigation measures detailed within the SSTMP for acceptance by the relevant RCAs.

3.2.2.8 Property Access, Existing On-Site Parking and Manoeuvring Areas

The construction activities of the Project and their associated traffic management operations will impact on residential and business property access. These impacts are expected to include:

- worksites blocking direct access or delaying access to property;
- access being within a road closure; and
- access being on a detour or alternate route.

Communications with all affected properties are to be undertaken with detailed records kept by the Project team. The SSTMP shall contain details identifying the proposed mitigation measures for all relevant impacts on the properties for acceptance by the relevant RCA. These mitigation measures shall be undertaken as detailed and may include provisions for alternate access, access during critical periods of time and amended construction methodologies to reduce the impact.

3.2.2.9 Pedestrian, Mobility Impaired and Cycling Access

Pedestrian and shared facilities will be maintained where possible. If the use of such facilities is restricted by the works an alternative will be provided. This alternative could be any of the following:

- temporary footpath/shared path including signage and barriers separated from traffic;
- designation of an alternate route with signage directing users to it;
- measures mitigating localised hazards; and
- temporary crossing points including median islands.

The use of such facilities will require careful consideration as some mitigation measures also create other impacts. When closing a footpath and directing pedestrians to cross to the other side, they are now more exposed to the traffic. In this instance, a temporary refuge will need to be installed or the footpath will be closed at the nearest existing crossing point. The SSTMP is to include and detail any required provisions for pedestrians.

Cyclist facilities will be maintained where possible. If the use of such facilities is restricted by the works an alternative will be provided. Possible alternatives could include the supply of a temporary facility or directing users to a diversion prior to them entering the worksite. If an alternative facility is not available, the SSTMP will detailed warning signage and speed restrictions to be installed so cyclists can safely negotiate the worksite in the live lane. The closure of a cycle facility without alternative provisions will require justification as to its closure.

Long-term or permanent closures of pedestrian and cyclist facilities will be advertised in local media.

3.2.2.10 Traffic Management Communications

Communication campaigns will be undertaken at various stages of the Project for traffic management related activities. The strategy for these campaigns is identified in the Stakeholder and Communication Management Plan, which is part of the AEE Report.

The level of communication for each part of the works will depend on the location, timing and impact of the specific worksite. Communication activities may include:

- letter drops to affected properties;
- visit by Project team member to discuss impacts of works;
- project signs and information boards;
- VMS or static signage informing of Project dates, timeframes and alternate routes; and
- public notifications in local publication, on the internet and on the radio.

3.2.2.11 Emergency Action Plan

Prior to the implementation of any TTM, an Emergency Action Plan must be prepared and approved by all RCAs. This action plan will outline systems, procedures and responsibilities on the Project team in the event of an emergency. The Emergency Action Plan will also conform to the principles of the Coordinated Incident Management System (CIMS) and any specific requirements of the RCAs. Emergency services will also be consulted during the development of the Emergency Action Plan.

Each SSTMP will also outline site specific requirements in case of an emergency. This will include diversion routes or secondary detour routes in case of an accident or major delays in the worksite or detour route (if a road closure is in place). Methodologies to reduce Project time over-run should also be considered.

In the event of an accident the NZTA's Project team will provide immediate assistance to emergency services as well as maintaining appropriate TTM whilst the site is being bought under control. The STMS will ensure that traffic management staff remain safe while continuing to provide safe passage through the worksite, notify the relevant authority, assisting where possible and meeting all requirements of COPTTM.

3.2.3 SSTMP Approval/Acceptance Process

A collaborative approach will be undertaken with the RCAs from an early stage of the Project to ensure a "no surprises" environment. This will result in an agreed traffic management methodology, meeting any specific requirements of the RCAs and reducing the risk of time delays in getting acceptance. Any impacts resulting from the construction and subsequent traffic management will be assessed on a case-by-case basis prior to submission to the relevant RCAs.

All SSTMPs for the NZTA or the CCC shall be submitted via the Transport for Christchurch website (www.transportforchch.govt.nz), identifying it as part of this Project and assigning the designated Approving Engineer.

All SSTMPs for SDC are to be submitted to the Approving Engineer, who will forward to the SDC's Traffic Management Coordinator (TMC) for acceptance once they are approved.

The Approving Engineer will be appointed by the NZTA's Project team and must be independent from the preparation of the SSTMP and hold the Level 2/3 Site Traffic Management Supervisors – Non Practicing (L2/3 STMS-NP) qualification as a minimum. The Approving Engineer's role is the review of all SSTMPs prior to submission to the relevant RCAs TMCs to ensure they meet the requirements of COPTTM.

3.3 Monitoring

It is the responsibility of the STMS, who can be assisted by others of appropriate qualification, to undertake the monitoring requirements as set out in the SSTMP and governed by COPTTM. The site layout, TTM control devices, traffic behaviour and on site staff behaviour and PPE are all evaluated by the STMS for compliance with the SSTMP.

Each site will also be evaluated as to the effectiveness of the any mitigation detailed in the SSTMP by via traffic management audits, travel time assessments and feedback.

3.3.1 Traffic Management Auditing

External audits are to undertaken randomly of each worksite on a monthly basis to ensure compliance with the SSTMP and COPTTM. The auditor must be suitably qualified and independent from the preparation of the SSTMPs and the implementation of the traffic management. This would generally be the Approving Engineer or approved representative.

The process to undertake an audit is defined within COPTTM and is to be carried out as such. The auditor is to contact the STMS, or the designated STMS, upon arrival on-site and give them the opportunity to be present when the audit is undertaken. This will provide for a collaborative working environment between the parties involved in traffic management and allows the STMS to make the required changes to comply with COPTTM, although these will still be recorded in the audit.

If the audit is undertaken while the site is unattended, the auditor will provide the results to the STMS when practical unless there are issues that affect the safety of road users. If this is the case, the auditor will contact the STMS immediately and advise of the changes required to make the site safe.

All audit scores will be supplied to the RCAs on a monthly basis and are to be kept available if directly requested by a RCA.

3.3.2 Travel Times

The key objectives of the traffic management operations during the Project is to provide a safe and efficient road network to all road users, which can both be monitored by a travel time analysis. Significant delays can result in changes to driver behaviour, increasing the risk to all road users.

Travel times will be monitored by the Project team to assess the performance of road network while TTM is in place. These assessments will be undertaken on a fortnightly basis to evaluate delays attributed to any TTM activities. The base journey time will be measured prior to the commencement works.

Journey times will be monitored between Templeton and Rolleston in both directions. These trips are to be undertaken using a GPS unit, recording speeds, locations and travel time between two fixed points.

The travel time surveys are to be provided to NZTA on a monthly basis.

3.3.3 Feedback

All feedback (positive and negative) received is to be recorded, identifying the relevant site, time and date, contact details of respondent (if given) and reason for feedback. The Project team is to then assess the feedback against the relevant SSTMP and identify any measures to be undertaken and provide and brief report to the relevant RCAs. The Project team is to also follow up the feedback with the respondent informing them of measures taken to resolve the issue, if any, or to seek additional information. All additional communications with the public are to be recorded.

The types of feedback are to be recorded and assessed monthly to identify trends where performance can be improved.

All feedback received by the RCAs or the Project team are to be communicated to the other parties as per section 3.4. A monthly report summarising all feedback, additional communications and their outcomes is to be provided to the RCAs.

3.4 Reporting

This will be undertaken in conjunction with the monitoring activities stated in Section 3.3.

3.4.1 Reporting by NZTA's Project Team to RCAs

The NZTA's Project team shall communicate the following to the NZTA, CCC and SDC or their representatives:

- all crashes within the Project's worksite within 24 hours as specified in COPTTM. The Ministry of Business, Innovation and Employment (MBIE) must also be notified of crashes resulting in serious harm injuries;
- a quarterly report with results from monitoring of the Project as detailed in Section 3.3;
- foreseeable issues with their traffic management, including road user behaviour;
- problems resulting from traffic management of an unrelated party;
- any feedback received relating to the traffic and/or traffic management;
- any instances of non-compliance with the SSTMP or the CTMP of the traffic management setup. This report is to identify the cause and actions undertaken to mitigate any impacts resulting from the non-compliance; and
- a copy of the CTMP when revisions are made.

3.4.2 Reporting by RCAs to NZTA's Project Team

The NZTA, CCC and SDC or their representatives shall inform the NZTA's Project Team of the following:

- any feedback received through their organisations relating to the traffic and/or traffic management; and
- any audit undertaken by their staff of a worksite that is part of the Project.

3.5 Training

The Contractor shall identify at least two staff members qualified as Level 2/3 Site Traffic Management Supervisors – Practicing (L2/3 STMS-P) who will be permitted to control all the worksites within the Project. One L2/3 STMS-P must be within 30 minutes of each worksite at any time.

This Project contains worksites that are situated on Level 1 roads, Level 2 roads or a combination of the two. Any worksite on Level 1 roads requires a qualified Level 1 Site Traffic Management Supervisors (L1 STMS), as a minimum, to be on-site when the site is attended or within 60 minutes if unattended. Each worksite on a Level 2 road or a combination of Level 1 and 2 roads requires a L2/3 STMS-NP, as a minimum, to be on-site. The L2/3 STMS-P is required to brief the L2/3 STMS-NP prior to handover, document the briefing and be present for the setup, alterations and removal of the worksite. All other traffic management staff are to undergo NZTA's Traffic Controller (TC) training prior to any involvement with this Project as a minimum.

Any Project staff undertaking the planning or monitoring of the worksites shall be qualified, as a minimum, L1 STMS for Level 1 worksites or L2/3 STMS-NP for Level 2 worksites.

The appointed STMS for each worksite shall wear the STMS yellow high-visibility vest so they are readily identifiable to visitors to site. The appointed STMS is also to brief all site staff of the requirements of the SSTMP, including PPE, and his authority as STMS.

3.6 Feedback

The CEMP (Section 5.6) identifies the process by which feedback is to be managed.

All feedback received by the Contractor and its site personnel, including the STMS, relating to the traffic and/or traffic management shall be reported to the Approving Engineer, the NZTA and the other relevant RCAs or their appointed representative. The feedback is to be assessed with the relevant SSTMP(s) and a draft response is to be provided to the Approving Engineer who will discuss it with the relevant RCAs. Possible response could involve the revision of the relevant SSTMP, changing of traffic control devices and/or a revision to this document (the CTMP). All changes to the SSTMP will require approval from the Approving Engineer and acceptance by the relevant RCAs.

3.7 Roles and Responsibilities

The Project team is responsible for the preparation and implementation of each SSTMP. It is also their responsibility to ensure that each SSTMP and all TTM meet the requirements of COPTTM and the CTMP. The Project team will be responsible for all documentation associated with the TTM and are to ensure its compliance with the CTMP. This documentation is to be supplied to any of the RCAs at their request.

Each SSTMP will be approved by the Approving Engineer and accepted by the NZTA, CCC or SDC or a combination of the three of them.

Independent TTM audits will be undertaken as detailed in section 3.3.1. The audit findings are to be provided to the relevant RCAs within 2 days of being undertaken. If an audit identifies the site “needs improvements” or is “dangerous” the audit result will be forwarded to the relevant RCA upon completion of measure to bring the site up to compliance. The Project team will also undertake other monitoring activities as indicated in section 3.3. These results will be provided to the RCAs in monthly reports, unless otherwise requested.

3.8 Post-Construction Transition Phase

Upon completion of this Project the remaining TTM will be removed, leaving the sites in a condition equal or better than time of possession. Once a SSTMP has expired or been closed, the roadspace becomes available to the RCA to use as they see fit.

4. Review of the Construction Traffic Management Plan

The CTMP will be reviewed and updated during the course of the Project. Outcomes of each review will be supplied to the key stakeholders prior to undertaking amendments to the CTMP. Changes to COPTTM or the requirements of the key stakeholders may trigger a review.

Reviews are to be undertaken by the Project team with involvement of the NZTA Project manager at the start of construction and at regular intervals throughout the Project. The frequency of reviews will be agreed at the completion of the first pre-construction review. All decisions, and their reasoning, will be recorded and draft changes made to the CTMP. These changes will then be approved by the key stakeholders. The review will cover the following topics:

- role and responsibility changes within the Project affecting the CTMP;
- changes in legal requirements, standards or specifications of any of the RCAs;
- changes to traffic management process, including industry best practice;
- the results of monitoring as documented in the CTMP; and
- to cover any other Project issues.

The original CTMP and subsequent revision will be retained on file, but marked as superseded. Each new revision is to be identified with a version number and issue date.

Appendix A: Relevant Project Conditions

[To be added when confirmed]

APPENDIX E

SEMP 005 Landscape Management Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix E SEMP005

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Landscape Management Plan

November 2012

Quality Assurance Statement			
GHD Beca	Prepared by:	Jeremy Cooke	November 2012
	Reviewed by:	Lindsay Daysh	November 2012
	Approved for Issue:	Gary Payne	November 2012

Record of amendment

Amendment number	Description of change	Effective date	Updated by

Contents

Glossary of Terms

CEMP	Construction Environmental Management Plan
CSM2	Stage 2 of the Christchurch Southern Motorway, between Halswell Junction Road and Main South Road
LMP	Landscape Management Plan
MSRFL	Four-laning of Main South Road between CSM2 and Rolleston
NZTA	The New Zealand Transport Agency

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A draft Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to landscape management.

1.1 Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Lane and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in

each direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

1.2 Purpose and Scope

SEMP 005, this draft Landscape Management Plan for Construction (LMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The LMP outlines the methods and measures to avoid, remedy and mitigate adverse effects on the landscape amenity during the construction phase of the Project. This LMP documents the permanent mitigation measures such as planting. Other character, amenity and ecological related landscape works are also documented. The LMP also outlines the necessary maintenance and monitoring during the construction and transition to the operational phase of the motorway.

1.3 Alignment with other documents

The LMP takes account of the following relevant documents:

1. Proposed designation conditions
2. NZTA policies, including:
3. NZTA Environmental Plan
4. NZTA Guidelines for Highway Landscaping
5. NZTA Urban Design Policy
6. Other specialised management plans
7. Technical Report 4 – Landscape and Visual Effects
8. Technical Report 6 – Urban and Landscape Design Framework
9. Technical Report 7 – Landscape Context Report
10. Technical Report 18 – Terrestrial Ecology

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

2. Landscape Values and Potential Effects

2.1 Introduction

The Project is described in 1.1. The extent of the Project is illustrated in Figure 1 of the Landscape Context Report.

2.2 Landscape and Visual Effects Assessment

2.2.1 Landscape character and values

The assessment of Landscape and Visual Effects *the Assessment) provides a general description of the existing environment traversed by the Project[2] and divides it into four Landscape Character Areas[3]. The key physical and experiential characteristics of the environment include:

1. Flat topography
2. Open, expansive character
3. Proliferation of agricultural land use
4. Rectangular land parcels
5. Pasture
6. Predominantly exotic vegetation with proliferation of shelterbelts
7. Farm fencing and tracks
8. Woodlots
9. Local road network
10. Relatively low density development including residential houses, accessory buildings, stables and agricultural commercial buildings
11. Limited number of residential subdivisions
12. Compartmentalised views with dominant skyline and views to the Port Hills and Canterbury foothills
13. Overall moderate level of naturalness
14. Low to high, but predominantly moderate level of rural character
15. Low to high, but predominantly low visual amenity.

2.2.2 Potential landscape and visual effects

Landscape effects are considered in a general sense under Section 7.2 of the Assessment and relate to *"…changes in landform, land cover and land use. The main landscape effect that may be experienced is that of a change in land cover and use…"*

[2] Page 11, Section 5.2 – Landscape description of the receiving environment.

[3] Page 12-14, Section 5.3 – Landscape Character Areas.

Identified landscape effects, include:

1. Effects on **landform** resulting from earthworks required to construct interchanges, overbridges, stormwater detention ponds and bunding.
2. Effects on **land cover** resulting from earthworks excavation and removal of vegetation (both utilitarian and private amenity) and rural structures
3. Effects on **land use** resulting from the loss of rural/ pastoral land to make way for the construction of the Project.

Visual effects are considered in general sense under Section 7.3 of the Assessment where it states:

1. *"In general, amenity values include rural outlook (openness), spaciousness, privacy, tranquillity, and ease of access*.
2. *Adverse visual effects on amenity values are not likely to be widespread but restricted in extent to the immediate vicinity (within 500m to each side) of the proposed road corridors*.
3. *For the most part… the amenity values of the setting will be preserved*.
4. *For residents that live in close proximity to the Project visual effects are likely to impact adversely on a spacious rural outlook*.
5. *Although effects on amenity values may be moderate, the recommended mitigation will ensure that effects are slight to negligible within the overall scale of the Project.*"

The Assessment also identifies the drivers and resulting landscape and visual effects in relation to:

1. CSM2, including:
    a. The removal of farm trees, amenity planting, sections of shelterbelt and hedges
    b. The removal of dwellings and/ or buildings
    c. Introduction of a new corridor, engineered structures and landforms
    d. Introduction of the Shands Road interchange
    e. Introduction of overbridge structures and associated approach embankments at Halwsell Junction Road, Springs Road, Trents Road and Waterholes Road
    f. Introduction of the CSM2 and MSRFL Interchange with the Robinsons Road underpass and SH1 overbridge structures and associated approach embankments
2. MSRFL, including:
    a. The removal of farm trees, amenity planting, sections of shelterbelt and hedges
    b. Introduction of a new corridor, engineered structures and landforms
    c. Introduction of the Weedons Road Interchange
3. Noise Barriers
4. Temporary Construction Effects
5. Swales and Stormwater Basins
6. Lighting (referred to as 'ephemeral effects')

A summary table of these potential effects and associated mitigation measures was provided under Section 8 – Mitigation Measures of the Assessment and is replicated under Section 3.2 below.

3. Mitigation

The landscape treatment outlined lined below are illustrated on the Project Landscape Concept Plans, drawing numbers 62236-A-L011 to 62236-A-L018 Revision 0 and 62236-B-L011 to 62236-B-L024 Revision 0 within the Plan Set.

3.1 Integration of permanent works into surrounding landscape

3.1.1 Landscape Concept

The landscape design vision for the Project:

"…is to provide an environment that supports the "Garden City" image of Christchurch currently being established as part of the (CSM1) project. This is proposed to be achieved by integrating the existing landscape character associated with the rural and peri-urban environment that transitions from Selwyn District through to Christchurch City.

The long term vision for the landscape design is therefore to establish an open 'rural parkland' along the route that incorporates the surrounding rural landscape features and allows open views across the plains to both the Port Hills and the Southern Alps. Planting will be featured at key node points with the establishment of native tree copses, native embankment planting, and specimen tree planting and planting associated with proposed landscape mitigation measures."[4]

The following principles underpin the landscape (planting) concept of the Project:

1. **Underlying landscape character** – retention of the existing rural pastoral character by introducing planting that represents the existing cultural planting patterns and historic planting fabric of the plains landscape.
2. **Integration with CSM 1 planting** – adopt similar landscape design principles used on CSM 1 to help integrate the planting designs, target plants best suited for the receiving environment and consider the planting that best suits the transition between urban, peri-urban and rural landscape character.
3. **Continue the curvilinear road** that is well integrated with the CSM1 motorway alignment and provides a strong contrast to the straight roads and patchwork land pattern associated with the plains landscape.
4. **Views** – Maintain areas along the alignment with open views to the Port Hills and Southern Alps and contained enclosed views to the immediate rural surroundings.
5. **Nodes** – include more detail at key nodes (intersections/ interchanges) through planting and material selection to provide a change in the visual environment at these driver decision points. Develop native tree copses that represent historic vegetation patterns and that are best suited to the soil and environmental conditions.
6. **Existing vegetation** – where possible, retain existing vegetation within the Project designation to retain the existing landscape character. Of particular importance is the retention of

[4] Beca Infrastructure Ltd and GHD Ltd (August 2012). *Technical Report 7 – Landscape Context Report.* Section 1.5

shelterbelt lines that bisect the motorway alignment and existing mature trees species found along the motorway alignment.

7. **Landscape mitigation planting** – integrate informal woodland cluster planting and shelterbelt planting into the motorway alignment to avoid, reduce or mitigate any visual effects associated with the motorway.
8. **Cycleway/walkway connectivity** – provide cycleway and walkway links that are aligned with those outlined in the South West Area Plan and linked to the existing cycle rail trail. The alignment of the cycleway/walkway across the motorway alignment will allow for safety sightlines, setbacks and consider CPTED (Crime Prevention through Environmental Design) provisions as part of future design phases.
9. **Riparian planting** – incorporate planting to accommodate identified riparian habitat through both CSM2 and MSRFL.

3.1.2 Character, amenity and ecological treatments

Section 1.10.2 of the Landscape Context Report sets out those treatments required to give effect to those principles listed above. The table below excludes specific mitigation planting, which is identified in Section 3.2 below:

Area	Treatment	Purpose
Weedons Road to SH1		
	Development of native tree copses and dry land shrub planting within the geometry of the SH1 and Weedons Road interchanges. Use of native 'nursery crop' prior to planting emergent tree species.	To establish quick vegetation cover and increase the survival chances of emergent canopy trees species
	Embankment planting at the SH1 and Weedons Road interchanges and Robinsons Road overpass will incorporate a mix of native species on steep slopes and retention of grass cover on slopes deemed mow-able	Reducing maintenance costs Increasing visual amenity for road users
	Boulder fields and boulder strips along the northern margin of the slip road at Weedons Road interchange and along the northern margin of Main South Road where MSRFL merges with CSM2. Low growing native plant species to be included within boulder areas.	Creation of lizard habitat
	Additional specimen tree planting will feature along this section with particular emphasis on treatment where local roads intersect with SH1.	Increasing visual amenity for road users
	Site specific landscape treatment to compliment any noise mitigation recommendations.	Increased visual amenity for both residents and the motorway users
	Low native shrubs and grasses at Jones Rod and Weedons interchange roundabouts	Increasing visual amenity for road users, maintains low levels of maintenance and allows open sightlines.

Area	Treatment	Purpose
SH1 to Trents Road		
	Embankments planting at the Hamptons Road overpass incorporating a mix of native species on steep slopes and retention of grass cover on slopes deemed mow-able	Reducing maintenance costs Increasing visual amenity for road users
	Specimen tree planting incorporated at the base of the slope and arranged in informal clusters/groups alongside Waterholes and Hamptons Road	Increasing visual amenity for road users
	Boulder field immediately north of the motorway and west of Trents Road including low growing native plant species.	Creation of lizard habitat
	Low native shrubs and grasses at Waterholes Road roundabout.	Increasing visual amenity for road users, maintain low levels of maintenance and allow open sightlines.
	Native plant species will be incorporated with the drain alignment proposed to extend along the base and eastern side of the Waterholes Road bridge embankments	Provide suitable water habitat and shade conditions for the native fish species
Trents Road to Shands Road		
	Embankment planting incorporating a mix of native species on steep slopes and retention of grass cover on slopes deemed mow-able	Reducing maintenance costs Increasing visual amenity for road users
	Specimen tree planting is incorporated at the base of the slope and arranged in informal clusters/groups alongside Trents Road	Increasing visual amenity for road users
	A cluster of trees are incorporated on the north side of the motorway	Provide a visual barrier and a means to reduce the risk of headlight glare from Blakes Road onto the Motorway.
	A cluster of trees will be incorporated on the south side of the hedgerow adjacent to the motorway	Improve the amenity associated with the termination point of Blakes Road.
	Native plant species will be incorporated with the drain proposed to extend along the base and eastern side of the Trents Road bridge embankments and on the south side of the motorway both east and west of Trents Road	Provide suitable water habitat and shade conditions for the native fish species

Area	Treatment	Purpose
Marshs Road / Shands Road Interchange		
	Development of four native tree copses and dry land shrub planting within the geometry of the Shands Road interchange. Use of native 'nursery crop' prior to planting emergent tree species.	To establish quick vegetation cover and increase the survival chances of emergent canopy trees species
	Low native grass and shrubland planting aligned under the existing power transmission lines	Compliance with the Transpower clear zone and setback requirements
	Embankment planting incorporating a mix of native species on steep slopes and retention of grass cover on slopes deemed mow-able	Reducing maintenance costs Increasing visual amenity for road users
Marshs Road to Springs Road		
	Native plant species will be incorporated with the drain alignment proposed to extend along the base and south side of the Marshs Road bridge embankments	Provide suitable water habitat and shade conditions for the native fish species
Springs Road / Halswell Junction Road		
	Mix of exotic and native specimen tree clusters, native re-vegetation planting and open grass areas	Integration of CSM1 and CSM2 design concepts. Integration with surrounding landscape character
	Development of a native tree copse and dry land shrub planting within the geometry of the Springs Road overpass and CSM2 motorway alignment. Use of native 'nursery crop' prior to planting emergent tree species.	To establish quick vegetation cover and increase the survival chances of emergent canopy trees species
	Embankment planting incorporating a mix of native species on steep slopes and retention of grass cover on slopes deemed mow-able	Reducing maintenance costs Increasing visual amenity for road users
	Lower margins of the embankments to incorporate low growing native species and boulder/rock fields	Creation of lizard habitat
	Roundabout planting of low native shrubs and grasses	Integrate with CSM1 roundabout landscape treatment Maintains low levels of maintenance Maintains open sightlines for motorway users
	Native plant species will be incorporated with the drain proposed along the designation south of both Springs Road and Halswell Junction Road	Provide suitable water habitat and shade conditions for the native fish species

3.2 Outline of landscape works which mitigate identified potential effects

3.2.1 Temporary construction treatments

The following methods are proposed[5] to address potential construction effects:

1. Retention of as much existing vegetation as possible
2. Planting of appropriate species in visually sensitive locations
3. Limit the extent of exposed earthworks and the length of exposure
4. Locate construction vehicle accessways to minimise visual effects
5. Locate stockpiles of excess material and/ or hard fill so that visual effects are minimised
6. Control effects resulting from dust by:
    a. Keeping all exposed, unsealed surfaces and areas for re-vegetation moist
    b. Covering truck and trailers to prevent escape of dust and debris
    c. Keeping stockpiles moist
7. Return disturbed areas of land to pasture immediately following construction in a staged manner. Avoid leaving areas within the construction footprint exposed.

3.3 Visual mitigation treatments

The following visual mitigation measures are taken from Figure 1, Section 8 of the Assessment with references made to the Sheets 24 – 28 of the Graphic supplement from Appendix 1 of the Assessment:

	Potential Visual Effect	Recommended Mitigation
MSRFL –Park Lane to Robinsons Road (Sheets 27 and 28)		
(a)	Removal of amenity planting, farm trees, including sections of shelterbelt and hedges along the MSRFL alignment. Affecting dwellings H17, H18, H19 and H20. Removal of oak trees approaching Rolleston.	Planting of sections of exotic hedgerows and extensive native planting along the road corridor. A condition to ensure retention of oak trees.
(b)	Removal of planting resulting in exposure of several commercial properties to road users.	Planting of exotic hedgerows and extensive native planting.
(c)	Increased width of road surface.	None required
(d)	Introduction of interchange at Weedons Road intersection, affecting dwellings H21, H22 and H23.	Substantial planting to the embankments and along the MSRFL approaches to the overpass bridge.
(e)	Introduction of the overpass at Robinsons Road, affecting dwelling H15.	Extensive planting to the embankments and the approach roads.

[5] Page 32, Section 7.5. Rough and Milne Landscape Architects (July 2012). Technical Report 4 – Landscape and Visual Effects.

	Potential Visual Effect	Recommended Mitigation
CSM2 – Robinsons Road to Halswell Junction Road (Sheets 24, 25 and 26)		
(a)	Removal of farm trees, amenity planting, sections of shelterbelt and hedges along the CSM2 alignment.	Landscape planting, including native planting, exotic hedgerows and groves of exotic trees.
(b)	Removal of several houses along CSM2 alignment – identified on Sheet Legend.	None required.
(c)	Introduction of the motorway as seen from dwellings H01, H02, H04, H05,H06, H07, H08, H09, H10 and H11.	Retention of existing hedgerows and trees to provide screening. Recommended landscape planting including native shrub, hedge and exotic tree planting.
(d)	Introduction of Shands Road Interchange as seen from dwellings H05, H06, H07, H08 and H09.	Landscape planting, including native planting, exotic hedgerows and groves of exotic trees.
(e)	Introduction of the overbridge structures and associated approach embankments at Halswell Junction Road, Springs Road, Shands Road and Trents Road and the Waterholes Road underpass. Affecting dwellings H01, H02, H04, H05, H06, H07, H08, H09, H11, H12, H13, H14.	Recommend that bridges are designed to allow views of surrounding landscape from vehicles using the road. Landscape planting, including native planting, exotic hedgerows and groves of exotic trees.
Noise mitigation barriers		
(a)	Dwelling H25 – 1.8 m barrier to three sides of the property.	Replacement planting along the inside and roadside of property
(b)	Dwelling H26 – 1.8 m barrier to northern boundary.	Dense infill planting required
(c)	Dwelling H16 – 1.8 m barrier	Design of fence to use recessive colours and simple texturing or patterning. Planting in association with the fence along the roadside boundary.
(d)	Dwelling H23 – 1.8 m barrier	Planting in association with the fence – infill to property side and along extent of fence to roadside facing Weedons Road.
(e)	Dwelling H20 – 1.8 m barrier	Planting in association with the fence to roadside.

	Potential Visual Effect	Recommended Mitigation
Ephemeral effects		
	Traffic movement and glare from headlights and lighting.	Retention of existing planting – shelterbelts, woodlots and amenity planting associated with dwellings. Landscape planting along CSM2 alignment; including native planting, exotic hedgerows and groves of exotic trees.

4. Implementation

The following section details measures to be undertaken during the implementation of both mitigation and general amenity planting.

4.1 Roles and responsibilities

Section 3.1 of the Construction Environmental Management Plan (CEMP), defines the expected roles and responsibilities for the implementation of construction. Within this framework it is expected that a Project Landscape Architect will be engaged to monitor the construction activities and the implementation and maintenance of the landscape works with a particular focus on the desired outcome for landscape and visual amenity.

All personnel working on the CSM2 & MSRFL project have a responsibility for following the requirements of this LMP.

4.1.1 Training

Section 3.2 of the CEMP, defines the framework for contractor training where all staff will be required to undertake environmental training as part of their site induction. The training will include specific aspects relating to landscape management:

- An outline of the post construction 'vision' and objectives for the CSM2 & MSRFL landscape works;
- Information on how construction activities have the potential to cause impact on landscape features and values;
- How vegetation to be retained shall be protected from construction activities, including the specific measures required;
- Consent and designation requirements;
- Landscape monitoring and maintenance procedures.

4.2 Meetings

Prior to earthworks and site clearance being undertaken, the Project Landscape Architect shall meet on site with the Project Team (including site construction staff) to go through the drawings together and identify vegetation to be retained and protected, discuss the work programme and agree when site visits will be undertaken by the Project Landscape Architect to monitor works prior to the next stage of construction works proceeding.

Other meetings required with between the Project Landscape Architect and site staff during the implementation shall include inspection of plant material prior to planting and inspection of plant set out prior to planting.

Prior to undertaking the works, the Project Team in consultation with the Project Landscape Architect shall consider how maintenance of the landscape works will be carried out when implementing the works to avoid creation of inefficient areas to maintain.

4.3 Planting

4.3.1 Retention of existing vegetation

Some vegetation removal will be required to enable the construction and safe operation of the Motorway project. However this vegetation removal should be kept to the minimum required. Existing vegetation is important to retain landscape character and integrate the proposed new planting into the broader landscape.

The Project Team shall be aware of the vegetation to be retained as identified on the drawings. The following management measures shall be undertaken to protect the retained vegetation.

- All vegetation to be retained shall be confirmed on site with the Project Landscape Architect and fenced off at the drip line of the vegetation.
- Vegetation clearance boundaries shall be clearly marked with stakes and marker tape or similar approved.
- Land disturbance shall be avoided within the drip line of the retained vegetation.
- Machinery shall be operated well clear of retained vegetation outside the drip line to avoid damage to vegetation canopy and below ground roots.
- Where vegetation is to be felled it shall be done in a way to minimise damage to adjacent vegetation that is to be retained.
- Consideration should be given to mulching the felled vegetation for use within the Project.
- Where a change to construction activities is proposed that will impact on vegetation to be retained, this shall be checked first with the Project Landscape Architect before undertaking the work.

4.3.2 Site Preparation

Areas to be planted shall be cleared of all grass, weeds or other undesired vegetation using blanket or spot spraying prior to planting being undertaken. Weed Control shall be undertaken in accordance with horticultural best practice, meeting all national and local standards and the requirements of Technical Report 18 – Terrestrial Ecology.

Prior to commencing construction all site machinery shall be thoroughly cleaned to remove any potential problem weed seeds being conveyed to the Site on the machinery.

Compaction of areas to be planted by construction vehicles shall be minimised to avoid poor soil conditions for plant growth.

Prior to planting the Project Team shall inspect the condition of the existing soil structure. The Project Team shall advise the Project Landscape Architect immediately if they consider the existing conditions to be adverse to successful plant establishment and growth. The Project team shall be responsible for ensuring adequate drainage and avoiding over compacted or stony soil.

4.3.3 Topsoil

It is expected that topsoil excavated from the site will be reused within the contract provided it is loose and friable, well aerated and free of large debris, inorganic material, weeds, and other unsuitable materials and contaminants. The Project Landscape Architect may require testing of topsoil samples to confirm that it is suitable for use.

Topsoil may be stored in the open for up to 3 months provided stockpiles are less that 3m in height. Topsoil may be stored for longer periods if under cover and air-dry with a stockpile height of less than 3m.

4.3.4 Plant Selection

All native plants shall be propagated from 'eco-sourced' seed from within the Canterbury Ecological District. Plants will be 'hardened off' in the Canterbury region for a minimum of two months prior to planting. Plants will be inspected and approved by the Project Landscape Architect prior to being planted.

4.3.5 Planting

The planting programme shall be staged together with the broader construction works to ensure that adequate time is allowed for propagation of plants to the required grade, and that planting is undertaken to take advantage of the seasonal conditions most suitable for planting (considered to be between April and September subject to local dry or wet weather spells).

The Project team shall also minimise the length of time from preparation of the planting areas through to planting to avoid weed growth or loss of soil through erosion.

Prior to planting the Project Landscape Architect shall inspect the ground conditions and plant set out together with the Project Team to ensure it is consistent with project objectives and the Drawings.

Planting shall be undertaken in accordance with best horticultural practice to ensure successful establishment.

4.3.6 Succession Planting

Within the proposed native forest 'copses' at the key intersection nodes the planting shall be completed in two phases. An initial 'nursery crop' of fast growing and hardy native shrubs and trees shall be planted to establish a nurse cover for later emergent canopy species which require more shelter to establish successfully. The emergent canopy species shall be planted once the nursery crop

has completed canopy closure (usually two years growth). Emergent canopy plants shall be planted through the nursery crop allowing for their anticipated established size.

4.3.7 Grassing

All areas to be grassed shall be mowable in accordance with NZTA regulations and best practice. Ease of maintenance and reducing the long term maintenance costs for grassed areas shall be considered by the Project during implementation. The Project Team shall undertake inspections of the ground surface together with the Project Landscape Architect prior to grassing to ensure the slopes are mowable without scalping or low areas and easily maintained.

4.3.8 Mulching

All planted areas shall be mulched. A suitable bark mulch shall be used including on site mulching or removed vegetation (excepting for pest or unwanted weed plant species). In wet areas, embankments or other slopes that will not hold bark mulch; a biodegradable mulch mat shall be used.

4.4 Regulations and standards

The landscape works shall be undertaken in accordance with all relevant regional and national standards, regulations and consent requirements. Plant selection and placement shall be in accordance with the NZ Electricity (Hazards from Trees) Regulations 2003 incorporating Schedule (Growth Limit Zones).

4.5 Samples

The Project Team will be required to submit samples of bark mulch, biodegradable mulch mat, tree stakes and any plant protection sleeves to the Project Landscape Architect for approval, prior to implementation.

4.6 Noise Barriers

Planting shall be associated with the noise barriers as outlined in Section 3.3.

4.7 Pedestrian and Cycleway facilities

Refer to alignment shown on the Project Landscape Plans.

The shared use path shall be 3m wide and surfaced in asphalt to provide a suitable surface to allow smooth movement for pedestrians, cyclists and disabled access. Paths on bridges shall be 2m wide and surfaced in asphalt. The path edges shall be built with timber batten and peg construction.

Asphalt surfaces shall be used for the full extent of the combined footpath / cycleway and tie into existing paths and / or cycleways with an even and smooth transition.

The alignment of the combined footpath / cycleway shall be subject to minor adjustments to accommodate changing ground conditions, adjustments to motorway geometry, provision for stormwater detention basins, fit within the motorway designation and connections to the existing footpath and cycleway network outside of the designation.

4.8 Fencing

Fencing shall be located between the combined footpath / cycleway and the motorway.

The fence shall be a 1.3m high galvanised fold top fence with galvanised steel posts ("Hurricane" system or equivalent approved by NZTA). The fence shall be aligned with adequate separation from the combined footpath / cycleway to avoid conflict between pedestrians and cyclists and the fence.

4.9 Stormwater detention basin design

Ease of maintenance must be considered during design and construction. Particular attention shall be given to grassed slopes subject to mowing which shall be constructed to avoid scalping of the grass at areas where there is a change in gradient.

4.10 Boulder fields and Boulder Strips

The construction and landscape works associated with the boulder fields and boulder strips (for lizard recovery and habitat if they are necessary after survey), shall be co-ordinated with the requirements of the relevant conditions relating to lizard management.

Should they be required, the boulder fields and strips shall be constructed 3-6 months before civil construction work being undertaken, if practicable, to allow lizard recovery from the existing landscape and transfer to the boulder fields and strips to occur. Consideration should also be given to lizard recovery and a temporary transfer to an off-site location, followed by transfer back to site once civil construction is complete. Alternatively a permanent site could be found outside but close to the construction zone.

Should lizard relocation be required the timing of lizard recovery, locations for transfer sites, construction and planting of the rock field and boulder strips shall be coordinated with and supervised by a qualified Ecologist to ensure appropriate lizard habitat is created. Specific monitoring, pest and weed control measures are required for the boulder field and boulder strip sites.

4.11 Riparian planting / Stock Water Races

The edges of Stock Water Races shall be planted with species and at the distances listed in the "Approved Planting List for Selwyn District Council Water Race Margins". Rock edges formed from boulders shall be used where possible along the edge of the stock water races associated with the riparian planting.

5. Maintenance and Monitoring

5.1 Overall approach

From final completion of the construction works (subject to confirmation of Period of Defects Liability), a two year maintenance period is proposed for planting. A longer maintenance period may be required for successional planting areas to allow for the staged planting programme.

It is anticipated that this LMP will be a 'live' document being revised and updated over the life of the Project to allow for adaptive management and broader annual management review of the LMP.

Adaptive management allows for the improvement or adaption of management practices to take into account monitoring assessments – to anticipate potential problems or ensure that any effects of an existing activity and reduced or mitigated.

Monitoring and Maintenance shall follow a maintenance schedule drafted by the Project Landscape Architect, and then developed for approval by the Project Team.

5.2 Monitoring

5.2.1 Baseline conditions

Where appropriate, and prior to construction being undertaken, the Project team shall complete an assessment collecting baseline information on the landscape values and features within the Project that will be potentially affected by the construction works. A photographic record shall be completed as part of this pre works assessment. This baseline information will then be used to compare with any change in the condition of the vegetation (or other feature) picked up during the monitoring.

5.2.2 Reporting

Monitoring of the landscape works shall be undertaken on a regular monthly basis by the Project Team and reported to the Project Landscape Architect. Reports should include dates of visits, condition of the vegetation or grass, any weed or pest issues, condition of protective fencing, works undertaken in the vicinity and any action required. As part of this monitoring process, the Project Landscape Architect can make recommendations to the Project Team.

5.3 Maintenance

5.3.1 General

Maintenance of the landscape works shall be undertaken according to best horticultural practice throughout the Contract implementation and maintenance periods. Maintenance shall include at a minimum irrigation, weed control, pest control, cultivation, staking, mulching, pruning and other horticultural operations necessary for the proper growth and good health of the landscape works.

5.3.2 Restricting access

The Project team shall restrict access to completed landscape areas through appropriate means to avoid accidental or carless damage to the planted and grassed areas. Consideration shall also be given the potential for of plant theft.

5.3.3 Weed and Pest control

Control of weeds and pest animals is critical for successful plant and grass establishment. The Project team shall identify the weeds and pests that are likely to be a threat in advance of site preparation, planting and maintenance and formulate a removal or control strategy to be carried out throughout implementation and maintenance. This strategy shall be reviewed regularly to allow for information gathered during monitoring.

5.3.4 Replacements (blanking)

The replacement of plants that are unhealthy or do not establish successfully is important to ensure the desired landscape outcomes are achieved. Replacements shall be carried out within the planting season in which the plant loss has occurred and a minimum of six months prior to completion of the contract works.

Appendix A
Relevant Project Conditions

[To be added when confirmed]

APPENDIX F

SEMP 006 Accidental Aquifer Interception Management Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix F SEMP006

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Accidental Aquifer Interception Management Plan

November 2012

Quality Assurance Statement			
GHD Beca	Prepared by:	Mark Utting	November 2012
	Reviewed by:	Lindsay Daysh	November 2012
	Approved for Issue:	Gary Payne	November 2012

Record of amendment

Amendment number	Description of change	Effective date	Updated by

Contents

Glossary of Terms

Aquifer	A formation, group of formations or part of a formation that contains sufficient saturated permeable material to yield viable quantities of water to wells and springs
Artesian Aquifer	A confined aquifer containing groundwater under positive pressure
CEMP	Construction Environmental Management Plan
Confined Aquifer	A formation in which the groundwater is isolated from the atmosphere at the point of discharge by low permeability geological formations
CSM2	Stage 2 of the Christchurch Southern Motorway, between Halswell Junction Road and Main South Road
MSRFL	Four-laning of Main South Road between CSM2 and Rolleston
NoR	Notice of Requirement
NZTA	The New Zealand Transport Agency
RMA	Resource Management Act 1991
Piezometer	A device used to measure static groundwater pressure by measuring the height to which a column of the water rises against gravity, or the pressure (the piezometric head) of groundwater at a specific point
Unconfined Aquifer	An aquifer where the water table is exposed to the atmosphere through pore spaces in the overlying materials

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A draft Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to accidental aquifer interception management during construction.

1.1 Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to a motorway standard comprising four lanes, with two lanes in

each direction, with a median and barrier to separate oncoming traffic and provide for safety.1 Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

1.2 Purpose and Scope

SEMP 006, this draft Accidental Aquifer Interception Management Plan (AAIMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The AAIMP addresses the potential impacts on aquifers that might be encountered during construction activities for the Project.

Interception of artesian aquifers in piling might result in floating of piles, loss of pressure in the artesian aquifer or mixing of water between aquifers if depressurisation of the aquifer occurs. Interception of artesian aquifers in excavations that is uncontrolled might result in piping of sands into the excavation or heave of silts; require excessive pumping, drawdown and potential ground settlement beyond the excavation.

While it is anticipated that some groundwater will be intercepted during the normal course of earthworks and consents and compliant procedures are in place to address this, the purpose of this AAIMP is to set out the activities that would need to be carried out to mitigate and remediate:

- Accidental artesian aquifer interception in an excavation
- Accidental artesian aquifer interception during pile installation
- Unexpected interception of large non-artesian groundwater inflow to an excavation.

The AAIMP provides an overall framework for the control of accidentally intercepted groundwater.

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

2. Context

2.1 Hydrogeology

Springston Formation (fine grained alluvial sands and silts up to about 15 to 17 m thick) covers the eastern side of the project (the Halswell junction side) where groundwater is encountered at depths of 4 m to 7 m below ground surface (median depth to groundwater of 6 m). The Springston Formation may act as a confining layer to the underlying Riccarton Gravel Aquifer. On the western (Robinson Road) side of the project, gravelly soils occur up to the surface and groundwater levels are quite variable (5 m to 14 m below ground surface; median depth of 11.5 m), but are expected to be generally unconfined.

The Riccarton Gravels (Aquifer 1 of the Canterbury Aquifer system) are typically a few metres to some 30 m thick (encountered at a depth of 15 m to 40 m in the vicinity of the project) and comprise gravel and clayey/silty/sandy gravel. Piles driven or bored as part of the project will need to penetrate and be founded within the Riccarton Gravels.

The nearest wells abstracting water from the Riccarton Gravels aquifer with associated current consents to take and use groundwater are:

- South: M36/7502 (500 m S), M36/7671 (1 km S), M36/4458 (1 Km S),
- North: M36/8502 (400 m N), M36/10126 (750 m N), M36/8870 (1 km N).

In addition piezometers have been installed in investigation boreholes drilled as part of the Project to depths of 12 m to 20 m. Water level monitoring in piezometers should be carried out in accordance with the Groundwater monitoring conditions.

2.2 Construction Methods

The following subsurface construction techniques will be utilized that might result in accidental interception of aquifers:

- Driven steel H piles penetrating the Riccarton Gravels Aquifer at 20 m to 30 m below ground level (along the eastern side as proposed at Shands, Marshs, Springs and Halswell Junction Roads);
- Shallow footings founded on sandy gravels (at Trents and further westwards)
- Earthworks excavations to a maximum depth of 7.5 m below ground surface at Robinsons (in the west) and 3.5 m at Halswell Road in the east.

3. Operation

3.1 Operating/management procedures

- Locate a local supplier of construction material. Maintain adequate supplies of Portland cement, grout additives, sand bags, bentonite and geotextile. If an artesian flow is sediment laden, time is crucial.
- Understand grout mix design calculation procedure. By measuring the artesian head and knowing the depth at which the flow was encountered, a grout mix can be designed with a sufficient unit weight to arrest the flow. An underweight grout mix will not only be unsuccessful but may hinder further attempts to stop the flow.
- Emergency phone contact list. Establish an emergency phone contact list. Include phone numbers for ECan, the Engineer, the piling company, local suppliers, and any supporting or stand-by contractors that may be of assistance.

3.2 Observer Equipment

- Cellular phone, camera. Be prepared to communicate the artesian situation with ECan and the Engineer and effectively document the situation.
- Water level indicator (dip meter) and tape measure. Determine the height of artesian flow. A water level indicator should be used to determine the height (additional casing stickup may need to be added).
- 1000 ml graduated cylinder or measuring cup. Allows a qualitative estimate of the turbidity of the flow or used with a timer, determination of the rate of flow.
- Grout mix design property sheets. Typical mix design details to readily establish the cement content based on the artesian head and depth encountered. Include use of additives to increase grout unit weight.

3.3 Remedial Equipment

- Non-coated bentonite chips. For sealing the annular space of bored piles to confine the flow to within the casing so a head and flow rate can be measured.
- Packers, riser pipe, pressure gauges and appropriate fittings. Artesian flow may be cut off with use of a packer system at depth within the pile hole. Pressure gauges may be used to determine the artesian head and flow meters to determine rate of flow. This equipment is needed high flow/ high volume artesian situations.
- Portland cement and necessary amendments. Portland cement is the key component of any grout mixture should the pile hole or excavation need to be immediately abandoned. Bentonite addition can be used in low flow conditions, calcium chloride additives can be used

to accelerate the set time of the grout and thixotropic modifiers can be used to increase grout viscosity and limit fluid mobility.

- Portable grout plant with moyno pump. Necessary to achieve the desired grout consistency, especially if a heavier grout is needed to arrest the artesian flow.
- Geotextile and sandbags. These items can be used after grouting to filter any additional artesian flow while the grout sets and provide a normal force at the top of the hole.
- Polymer Drilling Mud. Use of a drilling mud will create a head differential to offset and suppress low artesian flows during pile advancement.

4. Implementation

This section outlines steps to be taken to control, stop, and seal groundwater flow during construction.

4.1 Piling

Avoidance of interception of artesian aquifers in piling is desirable to:

- Avoid floating of piles
- Avoid depressurisation of the aquifer
- Avoid the potential for mixing of water from the Springston Formation with the Riccarton Gravels (and possible spread of contaminants into that aquifer) if depressurisation of the aquifer occurs.

4.1.1 Driven Piles

It is anticipated that most piles will be driven through the Springston Formation to the top of the Riccarton Gravels. Because the artesian pressure in the Riccarton Gravels is generally 2 m to 5 m below the ground surface, water might rise around the pile for a time, but as it cannot flow out, the pressure will be transferred to more permeable layers within the Springston Formation and no remedial action would be needed. Minor temporary depressurisation of the aquifer may occur.

4.1.2 Bored Piles

In the event that bored piles are required, the following steps shall be taken: precast tremie down centre; pot hole; redesign foundation to fit

- Install a temporary casing around the pile to 8 m below ground surface
- Complete the drilling of each pile hole (using a high viscosity, dense polymer if required; however as the groundwater level is not expected to rise above the ground level polymer fluids should not be needed)
- Once full depth is reached, complete the pile with concrete tremied from the base up
- Recover and re-use the displaced polymer which will be pumped from the hole as the tremie proceeds
- Have any remaining neutralized polymer trucked away by Envirowaste.

The polymer to be used should be a 1:1 mix of SC mud P System (produced by ECP Ltd, Environmental Control Products) or similar, and soda ash.

The density of the polymer must be sufficient to exceed the artesian pressure of the Riccarton Gravels aquifer. The viscosity of the polymer will allow the hole to remain open until the tremie is complete. However, if polymer is used all polymer must be cleaned out of the pile before concrete can be added to avoid the development of a gel-concrete annulus that will not set. The concrete will seal against the formation.

4.1.3 Artesian Pressures above the Ground Surface

In the unlikely event that artesian ground water is encountered above the ground surface, the following procedures will apply:

- Stop work
- Contact the Engineer
- Instigate mitigation works as agreed between the Engineer, the Contractor and ECan which are likely to include the following:
    - Attach a vertical pipe to the pile hole (bored pile) or insert into the side of the pile (driven pile); a seal will need to be made secure against the pile or casing or standpipe. The water up-flow will be allowed to stabilise within the pipe and its level above ground measured
    - If the level inside the standpipe exceeds 2 m above ground, provision will be made to hold the standpipe in place by added weight
    - The hole should be grouted using 1:1 (by volume) water: cement ratio grout. Grout will be injected at the base of the hole at pressures controlled to be 2 m to 3 m above the static water level. Grouting can be done either through the extended standpipe or injected through a pipe inserted into the base of the hole. Grouting can only be effective if the situation is sealed and no exit flow from the aquifer occurs, otherwise the exit flow, even if minor, will wash the cement out.
    - Grouting will be discontinued at refusal
    - After the grout has set, an alternate method of piling will be used.

4.2 Excavations

Avoidance of artesian aquifer interception and large groundwater inflows to excavations is desirable to:

- Avoid piping of sands into the excavation or heave of silts;
- Avoid excessive pumping, drawdown and potential ground settlement;
- Avoid the need to discharge large volumes of sediment laden water.

4.2.1 Larger Earthworks Excavations

In the case of uncontrolled aquifer inflows to larger excavations bound by sheetpiles or similar, the following steps shall be taken:

- **Assess the situation**. Determine if the flow is constant or increasing. Determine if the turbidity is constant or increasing. Determine if the flow is confined to the pile hole or excavation, and if not, take measures to confine flow.
- **Notify project engineer and/or project manager**. Be able to describe in detail the conditions and events prior to encountering artesian flow.
- **Email photographs and/or video, in real-time if possible**. Consult with the Engineer and determine primary strategy and contingency plan should the primary strategy be insufficient to arrest the artesian flow.
- **Notify ECan and NZTA**. Inform ECan and NZTA representative of the situation and planned action items.

Actions are likely to include:

- Tremie mass concrete into the excavation until the mass of the concrete is sufficiently heavy to stem the flow; a thickness of 1.5 m to 2 m is likely to be needed;
- Install a vibrating wire piezometer in the grout in a suitable location to allow monitoring of water pressure and record water levels in project piezometers in proximity;
- Control any discharge of water by established site erosion and sediment control measures;
- Pump out excess water to the sediment control basin;
- Leave overnight for the concrete to harden;
- Design will need to be altered to allow a casing to be "spun" into the "green" concrete to allow control of the artesian pressures;
- Excavate with balancing pressure;
- Place a thickness of graded crushed aggregate to act as a controlled filtered exit. Design the thickness of the aggregate to avoid piping or heaving depending on the difference in height between the aquifer level and the depth to be excavated;
- Pump out gradually, allowing water to flow out from the aquifer without sand piping or silt heaving.

4.2.2 Shallow Footings or Pipe Laying

In the case of excavation of sumps or piles or the laying of pipes, the method described for larger excavations could be used or the use of concrete could be substituted with the placement of filtered gravels which will allow water to continue to flow but avoid piping.

5. Roles and responsibilities

All Site Staff

- Attending inductions, tool box talks and training to manage accidental artesian aquifer interception
- Responsible for reporting all incidents involving accidental artesian aquifer interception
- Ensuring processes for managing accidental artesian aquifer interception are adhered to.

Environmental or Project Manager

- Prepares, reviews and updates AAIMP
- Monitors and reports performance against the AAIMP
- Ensures sufficient resources are provided to manage accidental artesian aquifer interception in accordance with the AAIMP
- Provides leadership to the Project team in this area.

6. Monitoring

Monitoring of water levels in piezometers should be carried out monthly prior to commencement of construction, increasing in frequency to twice weekly in piezometers that are located within 100 m of active construction. This gives warning of changing or elevated groundwater levels and also allows confirmation that groundwater conditions have stabilised following completion of works, in particular where accidental artesian or large unconfined inflows have been encountered.

Appendix A
Relevant Project Conditions

[To be added when confirmed]

APPENDIX G

CEMP Risk Assessment & Risk Register

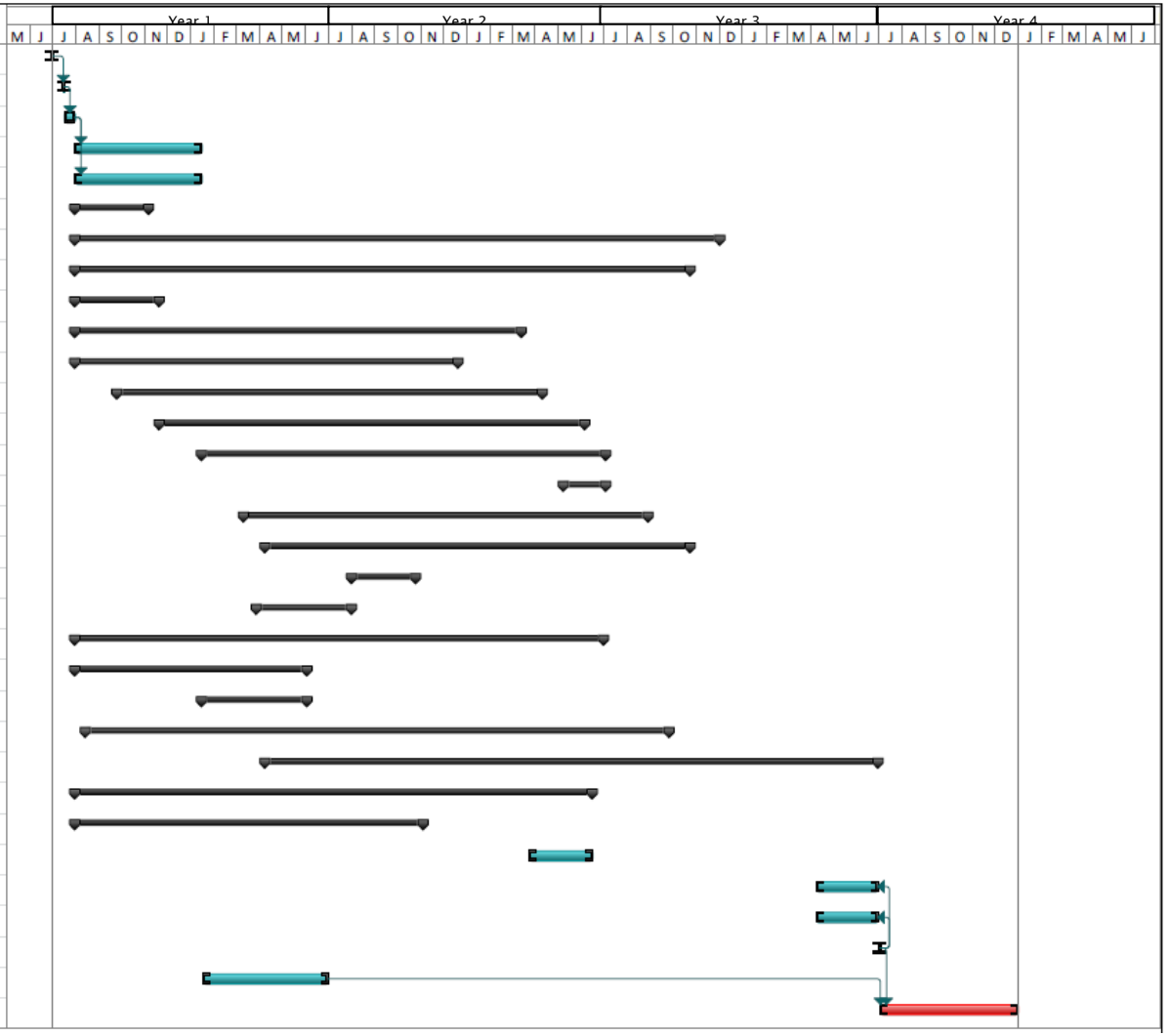
[To be provided by the contractor after contract award]

APPENDIX H

CEMP Construction Programme

[Indicative attached. Final to be provided by the Principal Contractor prior to construction commencement]

ID	Task Name	Duration
1	Award of construction contract	1 day
2	Site possession	1 day
3	Stand down period	10 days
4	Site Clearance	120 days
5	Erosion and Sediment control	120 days
6	**Site Compound**	**70 days**
9	**Utilities**	**611 days**
30	**Local Road Connections**	**582 days**
31	**John Patterson Drive**	**80 days**
35	**Halswell Junction Road**	**422 days**
44	**Springs Road**	**362 days**
51	**Marshs Road**	**402 days**
59	**Shands Road**	**402 days**
67	**Trents Road**	**382 days**
74	**Blakes Road**	**40 days**
76	**Waterholes Road**	**382 days**
85	**Weedons Road**	**402 days**
92	**Levi Road**	**61 days**
96	**Weedons Ross / Jones Road roundabout**	**90 days**
98	**Robinsons / Curraghs Road**	**501 days**
109	**Western Rear Access Road**	**220 days**
112	**Eastern Rear Access Road**	**100 days**
115	**CSM2 Alignment**	**552 days**
121	**MSRFL Alignment**	**581 days**
130	**Stormwater**	**490 days**
131	**Stormwater Ponds**	**330 days**
136	Overland flow soakpits	60 days
137	Lighting	60 days
138	Barriers	60 days
139	Open CSM2 and MSRFL	1 day
140	Construct Waterholes / Dawsons roundabout	120 days
141	Risk	130 days



APPENDIX I

Accidental Discovery Protocol

Te Runanga o NGAI TAHU

TRANSIT NEW ZEALAND ARARAU AOTEAROA

NZ HISTORIC PLACES TRUST POUHERE TAONGA

Accidental Discovery Protocol

for Transit New Zealand Regions 11 (Canterbury) and 12 (West Coast)

This protocol recognises the importance of archaeological sites to both New Zealand, as set out in the *Historic Places Act* 1993, and to Ngäi Tahu, who consider that the study and analysis of such sites furthers the academic understanding of their tupuna and their world. Through scientific study, the Tribe learns more about their tupuna, and therefore, learns more about themselves. It also recognises the importance of maintaining the safety and efficiency of the State highway network to the community and the need to promote this work while minimising delays, which have both safety and cost implications, when works are being undertaken.

In the event of an "accidental discovery" of archaeological matter, including human remains, the following steps shall be taken:

1. All work within 100m [1] of the site[2] will cease immediately.
2. The plant operator will shut down all construction equipment and activity and advise the construction supervisor for the project site[3].
3. The construction supervisor will take immediate steps to secure the site to ensure the archaeological matter remains undisturbed and the site is safe in terms of health and safety requirements. Work may continue outside of the site area.

   (Note: Should further sites be found outside the 100m protection zone around the original discovery then Transit will adopt a precautionary approach and halt all work on the project site until consultation with the NZ Historic Places Trust (the Trust) and kaitiaki Papatipu Rünanga has occurred. Transit will only qualify this approach when the project site is very large, eg the 10 km length of the proposed southern motorway. Where work may be being undertaken up to a kilometre or more apart then work will only halt in that part of the project site where the discoveries have occurred.)
4. The site construction supervisor will notify the consultant who in turn will contact the Project Manager at Transit New Zealand. In the event of the Project Manager being unavailable the matter will be reported to the Regional Manager.
5. Transit New Zealand will ensure that the matter is reported to the Regional Archaeologist at the Trust, the kaitiaki Papatipu Rünanga and to any required statutory agencies[4] if this has not already occurred.
6. Transit New Zealand will ensure that a qualified archaeologist is appointed to ensure all archaeological matter is dealt with appropriately.
7. In the event that the accidentally discovered material is confirmed as being archaeological, under the terms of the *Historic Places Act*, then Transit shall ensure that

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[1] This is consistent with the NZAA site protection requirements

[2] The immediate area or location where the material, artefacts or human remains (without being exclusive) have been discovered.

[3] The project site is the area of the total project as defined in the Transit New Zealand contract documents.

[4] For example, the New Zealand Police in the event that human remains are found.

an archaeological assessment is carried out by the archaeologist, and if appropriate, an archaeological authority is obtained from the Trust before work resumes.

8. In the event of the material being of Maori origin Transit will ensure that the kaitiaki Papatipu Rünanga is contacted in order that appropriate cultural processes are implemented to remedy or mitigate any damage to the site.

9. Any and all visits to the project site must be cleared by Transit New Zealand who will obtain and maintain a list of authorised personnel and advise the consultant and contractor accordingly. Under law, Transit is charged with the overall safe management of the site, including the health and safety of all persons visiting the site. To meet this requirement and also to protect the integrity of the accidental discovery, Transit considers it important that all visits to the project site are recorded, cleared and visitors inducted into the site.

10. Transit will ensure that representatives of the consultant and the contractor, as appropriate, shall be available to meet and guide representatives of the Trust and kaitiaki Papatipu Rünanga , and any other party with statutory responsibilities, to the site.

11. Works in the site area shall not recommence until authorised by Transit New Zealand after consultation with the Trust, kaitiaki Papatipu Rünanga, the NZ Police (and any other authority with statutory responsibility) to ensure that all statutory and cultural requirements have been met.

12. All parties will work towards work recommencing in the shortest possible timeframe while ensuring that any archaeological sites discovered are protected until as much information as practicable is gained and a decision regarding their appropriate management is made, including obtaining an archaeological authority if necessary. Appropriate management could include recording or removal of archaeological material.

13. Although Transit is bound to uphold the requirements of the *Antiquities Act*, it recognises the relationship between Ngäi Tahu Whanui, including its kaitiaki Papatipu Rünanga , and any Maori artefacts that may be discovered.

Mark Solomon
Kaiwhakahaere
Te Rünanga o Ngäi Tahu

Date: 13-8-03

Robin Odams
Regional Manager
Transit New Zealand

Date: 6/8/03

Bruce Albiston
General Manager, Southern Region
New Zealand Historic Places Trust

Date: 18.8.03

APPENDIX J

CEMP Environmental Feedback Form

[To be replaced or updated by the Principal Contractor prior to construction commencement]

Feedback Report

Date Received | Time Logged

Section 1 Respondent Details

Name
Address

Contact Telephone Number
Cell Phone Number
Email

Section 2 Details

Date of Event
Time of Event
Duration (how long did event last?)
Event location

Impact Description

Water
Air
Ground
Archaeology
Stock Race
Erosion & Sediment

Other Description

Comments

Section 3 Weather Conditions

Investigate by asking respondent and by looking at site weather log

Temp
Conditions (raining, dry and sunny, overcast)
Wind direction
Wind speed(blustery, calm, breeze)
Cloud Cover (clear, partial overcast)

Section 4 Site Operations

Did the Event happen during site working hours? Yes No (Circle)

Site operating conditions, events and activities

Section 5 Assessment of event

1	2	3	4	5

Least Most

Completed By

Section 6 Actions (to be completed by site manager)

Are any further actions required based upon evaluation of sections 1 thru 5? Yes No (Circle)

Initial Investigation Findings

Detailed Investigation Findings

Regulator/External Investigation Findings

Recommendations

APPENDIX K

CEMP Environmental Non Conformance Form

[To be replaced or updated by the Principal Contractor prior to construction commencement]

CEMP Non Conformance Report	NCR No.:
Construction Site Audited Address	Audit No.: Date Issued: Requirement Docs SEMP No:

Non Conformance Major ☐ Minor ☐ Observation ☐

Issued By_____ Acknowledged By _____

(Auditor) (Auditee)

Corrective Action Proposed by Auditee

Corrective Action Ref Number

Date For Completion:

Signature (Auditee representative) ……..

Verification of Corrective Action Complete

Close Out Action Report Number

Signature ……

Date ……..

APPENDIX L

CEMP Environmental Corrective Actions Log

[To be replaced or updated by the Principal Contractor prior to construction commencement]

Corrective Action Log								
Audit Report No	**NCR ref**	**Date Issued**	**Date Corrective Actions Agreed**	**Proposed Close Out**	**Follow Up**	**Champion/Owner of Action**	**Close Out Report Number**	**Any Further Action**

APPENDIX M

CEMP Environmental Training Form (ETF) Template

[To be replaced or updated by the Principal Contractor prior to construction commencement]

TRAINEE NAME	TRAINING DESCRIPTION	DATE OF TRAINING	TRAINER	TRAINEE SIGNATURE	LINE MANAGER SIGNATURE