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			
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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

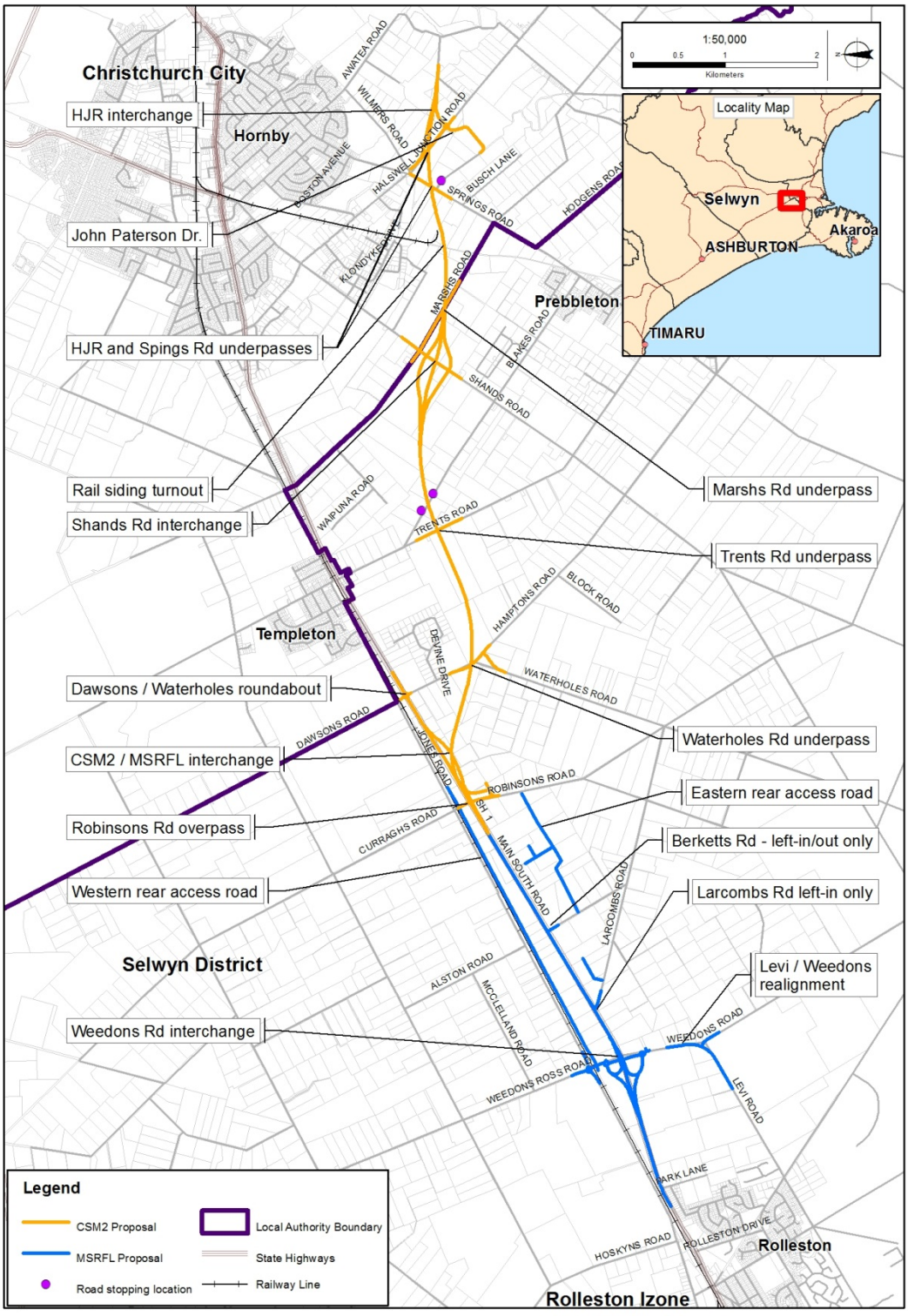


Figure 1 – Proposed Site Location Map

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.

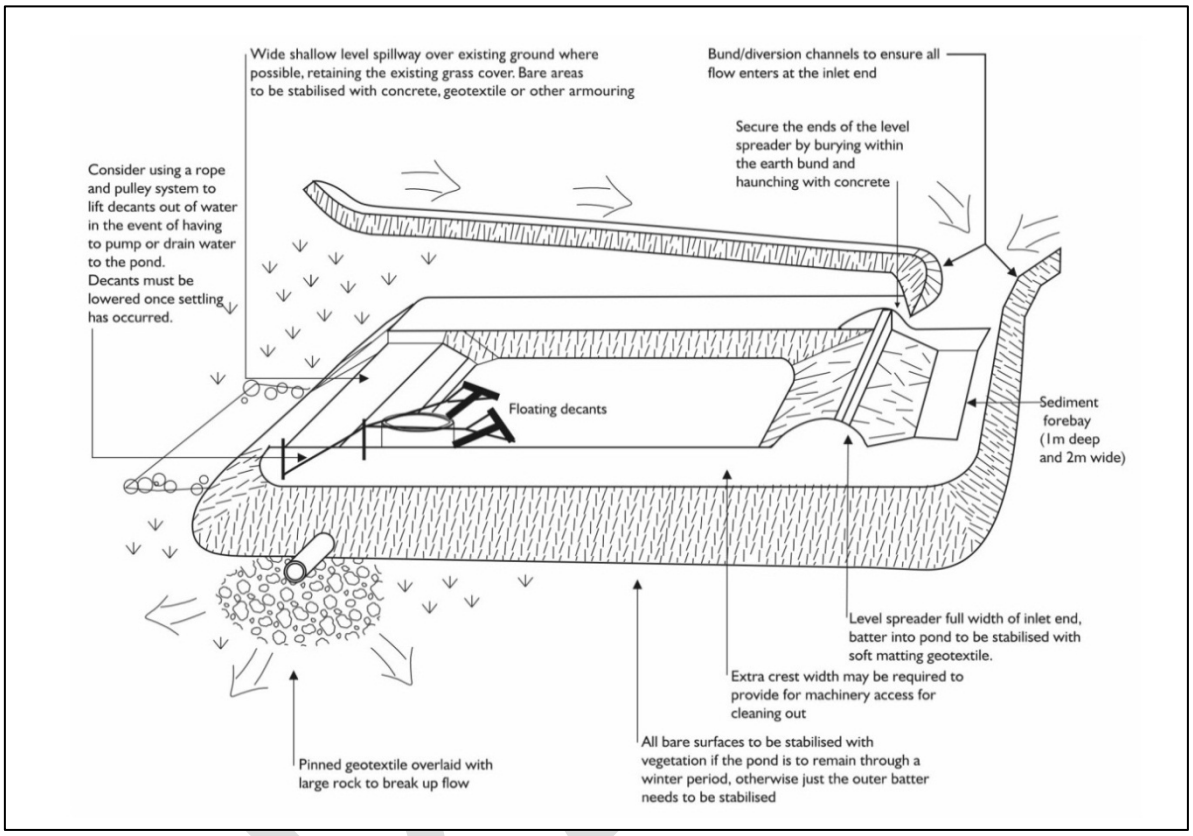


Figure 2 – Sediment Retention Pond

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.

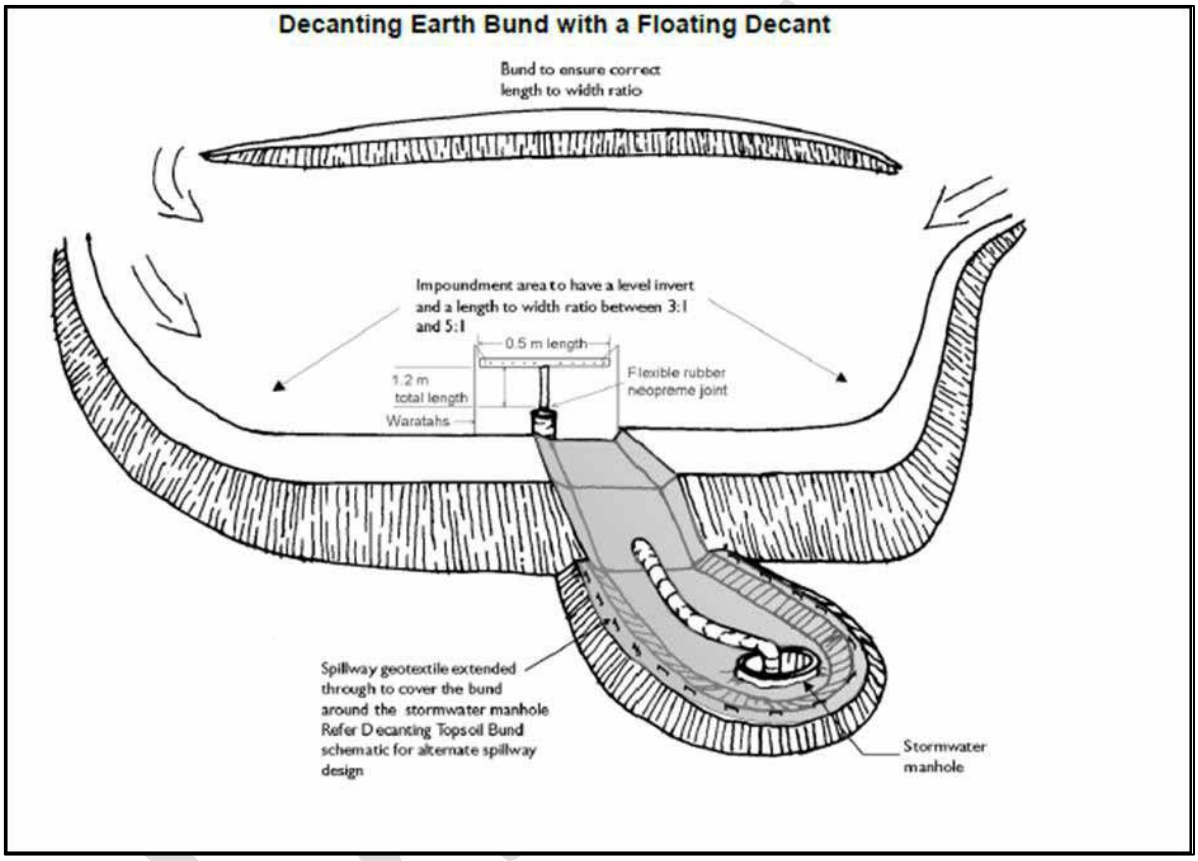


Figure 3 – Decanting Earth Bund

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.

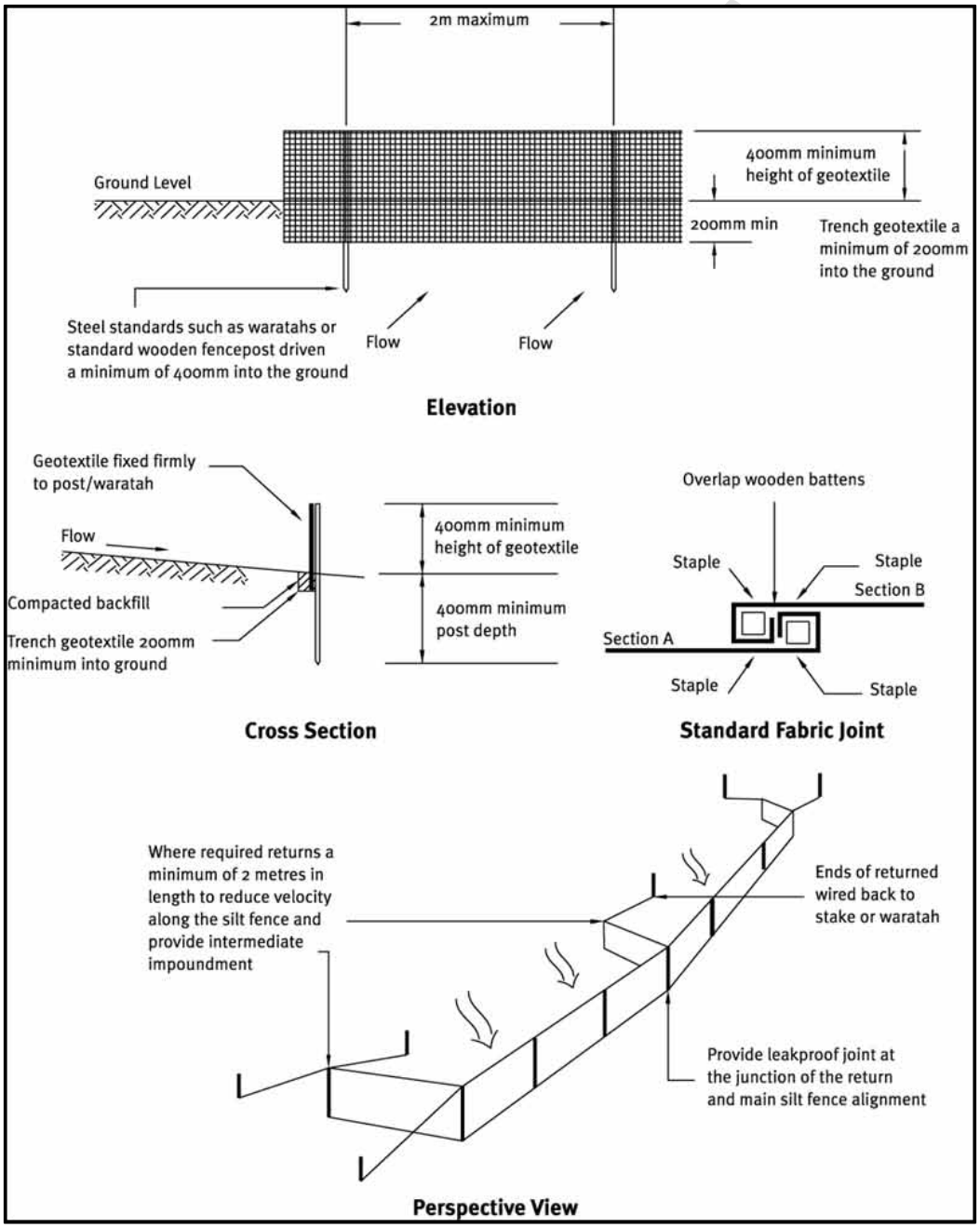


Figure 4 – Silt Fence

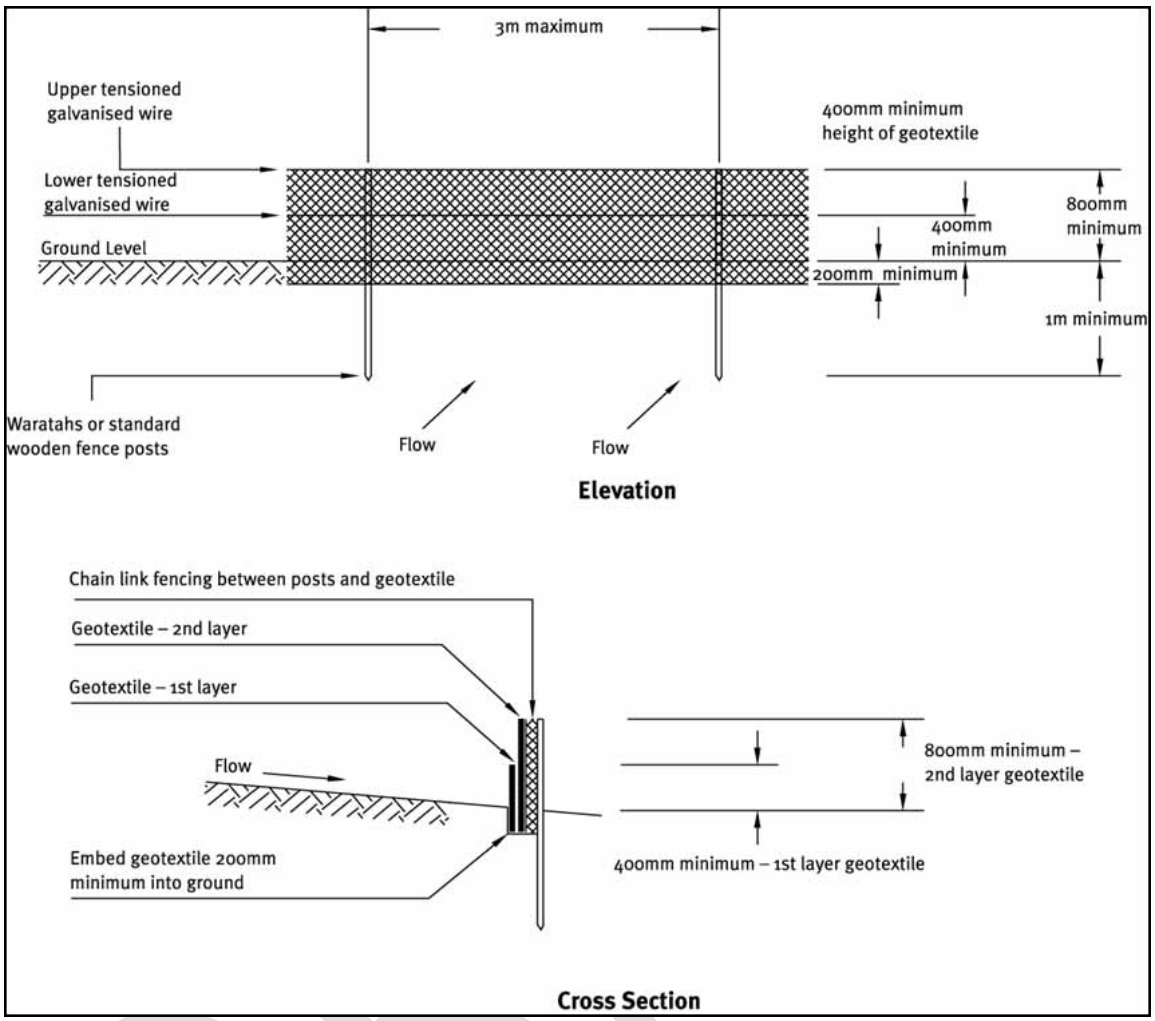


Figure 5 – Super Silt Fence

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

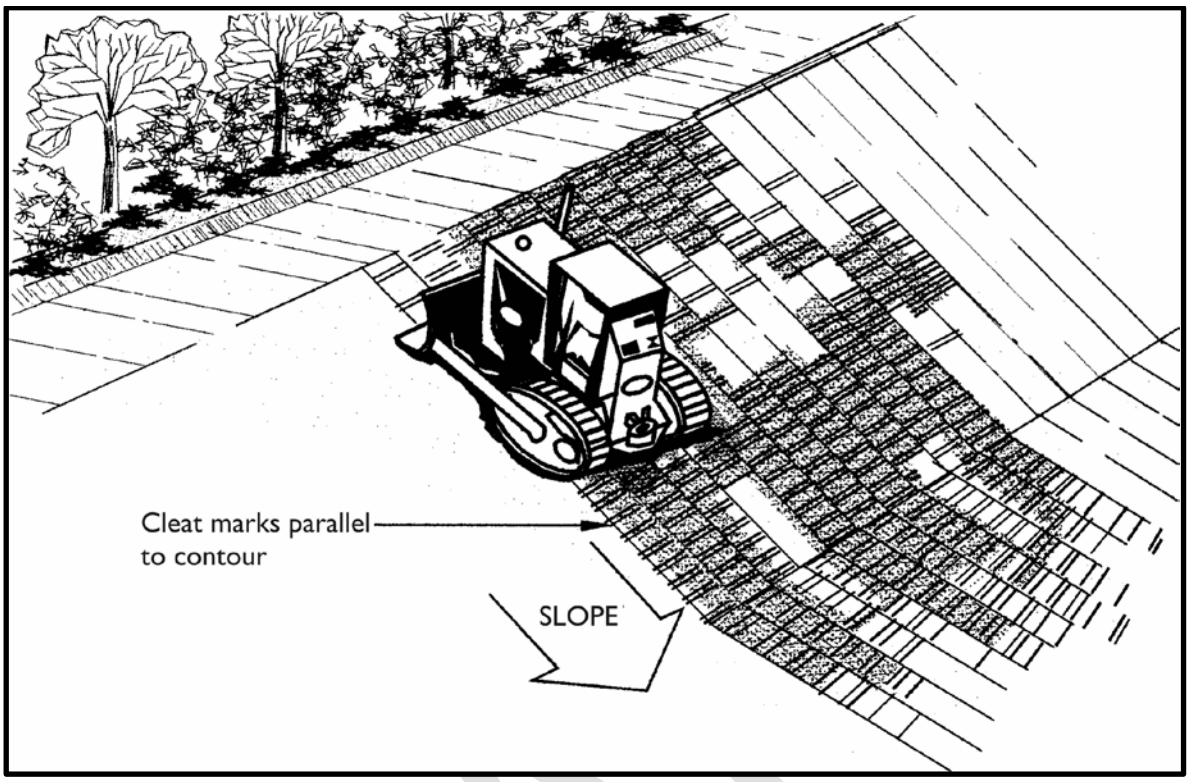


Figure 6 – Surface Roughening

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

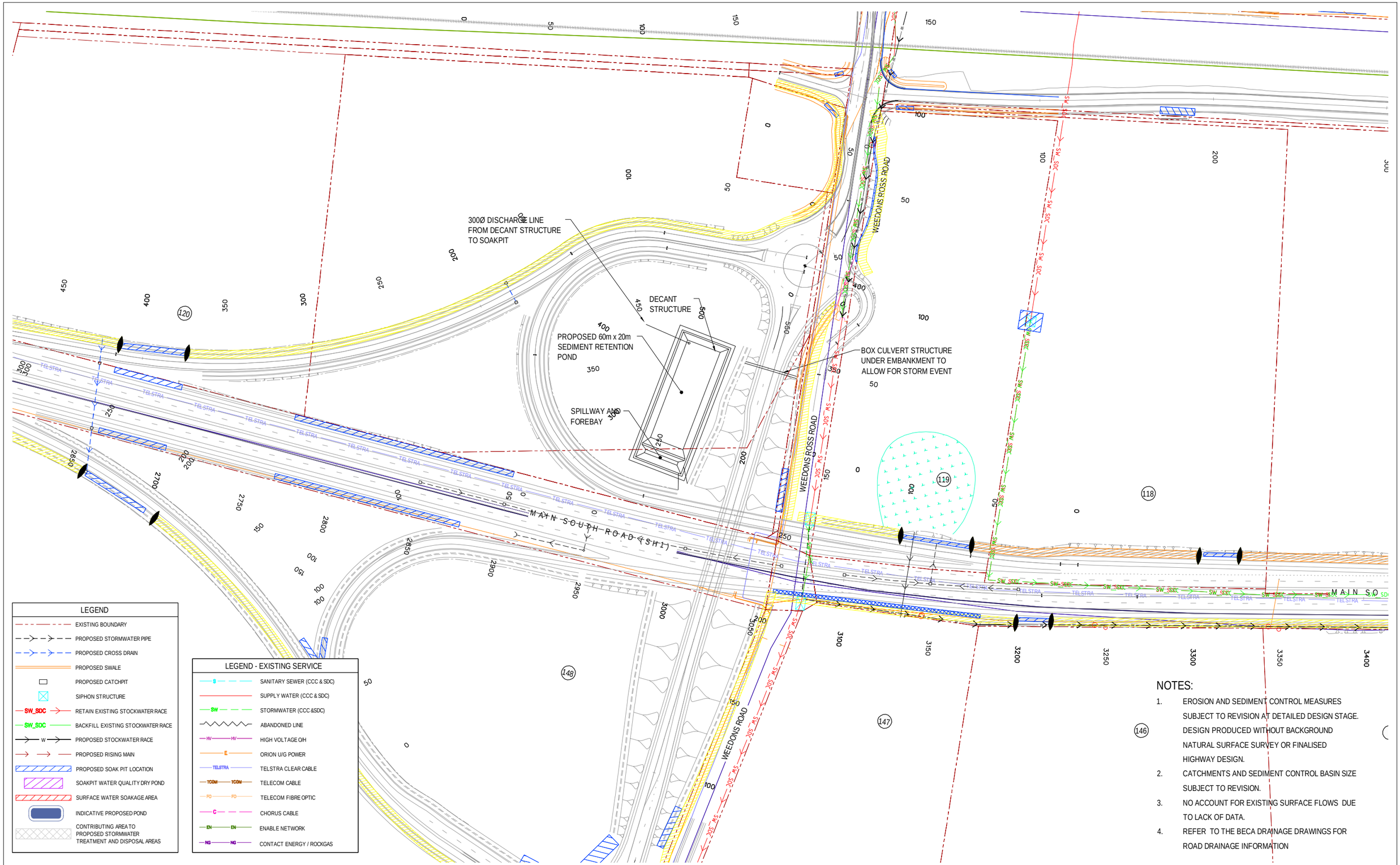
SK202 – Robinson Road

SK203 – Hamptons Road

SK204 – Trents Road

SK205 – Shands Road

SK206 – CSM1 / CSM2 Junction



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:

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

INDICATIVE

No	Revision	Drawn	Job Manager	Project Director	Date
B	INDICATIVE	AWC			09.12
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Drafting Check		Design Check	
Approved (Project Director)			
Date			
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Client: NEW ZEALAND TRANSPORT AGENCY
Project: CSM2 AND MSRFL
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
Cad File No: N:\NZ\Christchurch\Projects\51\28982 CSM2\CADD\CSM 2+3\CAD\Drawings - Scheme Assessment\Sketches\GHD\62236-A-SK201 - REVB.dwg

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:

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 DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFORMATION

INDICATIVE

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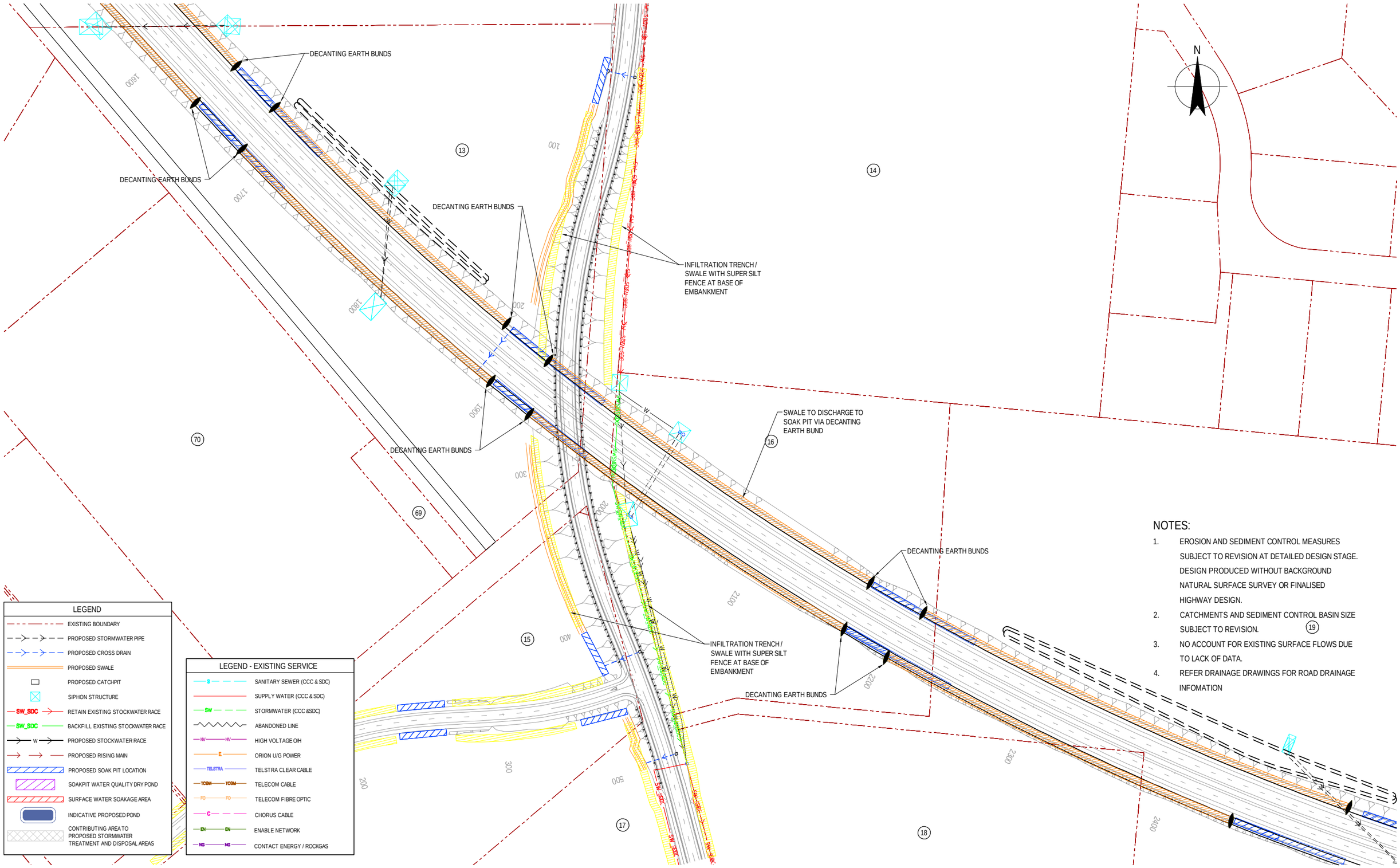
Client: NEW ZEALAND TRANSPORT AGENCY
Project: CSM2 AND MSRFL
Title: EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - ROBINSONS ROAD SKETCH

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

Plot Date: 18 October 2012 - 4:53 p.m. Plotted by: Tony Cain
Cad File No: N:\NZ\Christchurch\Projects\51\28982 CSM2\CADD\CSM 2+3\CAD\Drawings - Scheme Assessment\Sketches\GHD\62236-A-SK202.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

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

INDICATIVE

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Approved (Project Director)			
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Client: NEW ZEALAND TRANSPORT AGENCY
Project: CSM2 AND MSRFL
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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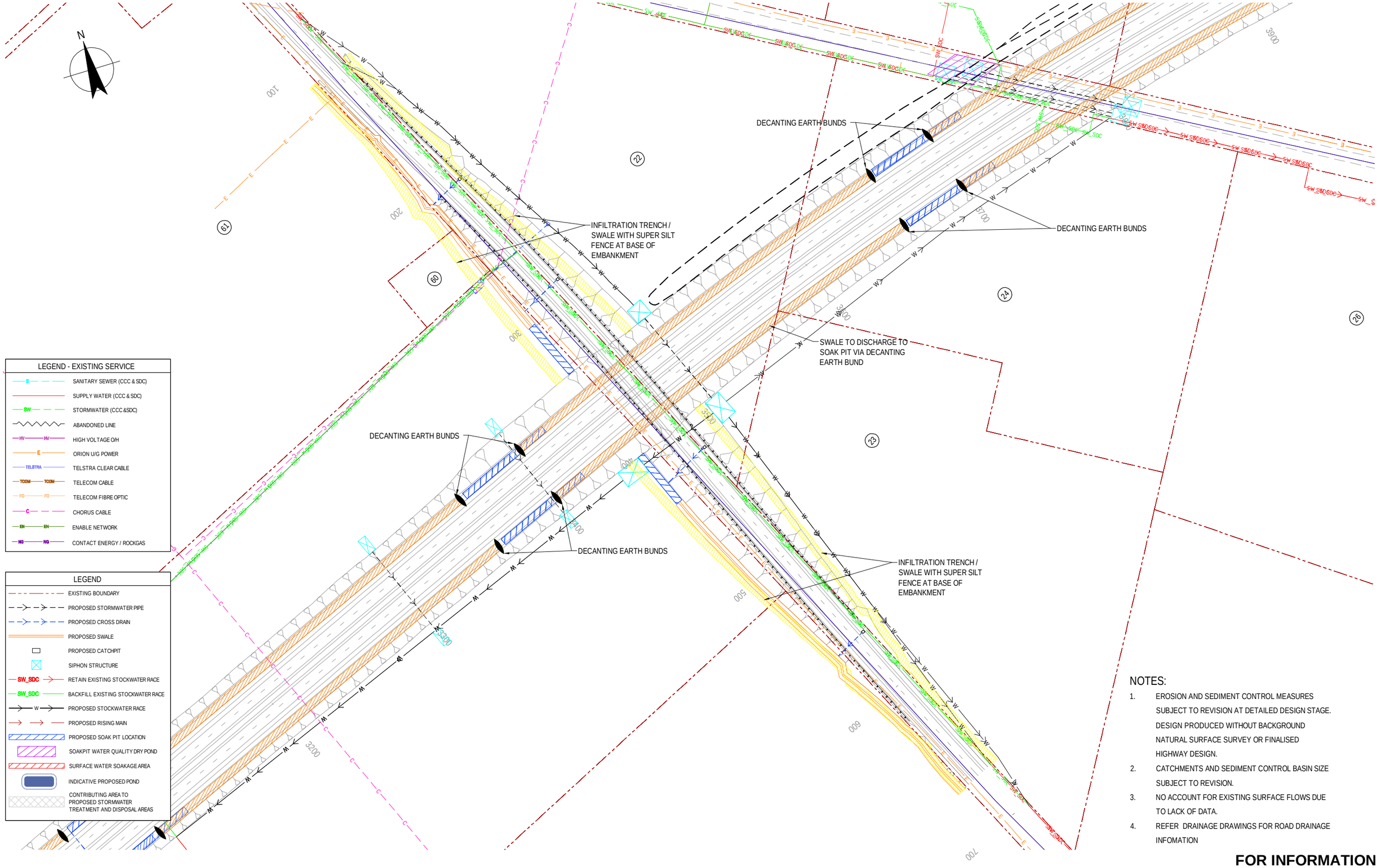

LEGEND - EXISTING SERVICE

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

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

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

FOR INFORMATION

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
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Client: NEW ZEALAND TRANSPORT AGENCY
Project: CSM2 AND MSRFL
Title: EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - TRENTS ROAD SKETCH

Original Size: A1 | Drawing No: 62236-A-SK204 | Rev: B

Plot Date: 18 October 2012 - 4:25 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-SK204.dwg

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

LEGEND - EXISTING SERVICE

- S — SANITARY SEWER (CCC & SDC)
- SUPPLY WATER (CCC & SDC)
- SW — STORMWATER (CCC &SDC)
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- TCOM — TELECOM CABLE
- FO — TELECOM FIBRE OPTIC
- C — CHORUS CABLE
- EN — ENABLE NETWORK
- NG — CONTACT ENERGY / ROCKGAS

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

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

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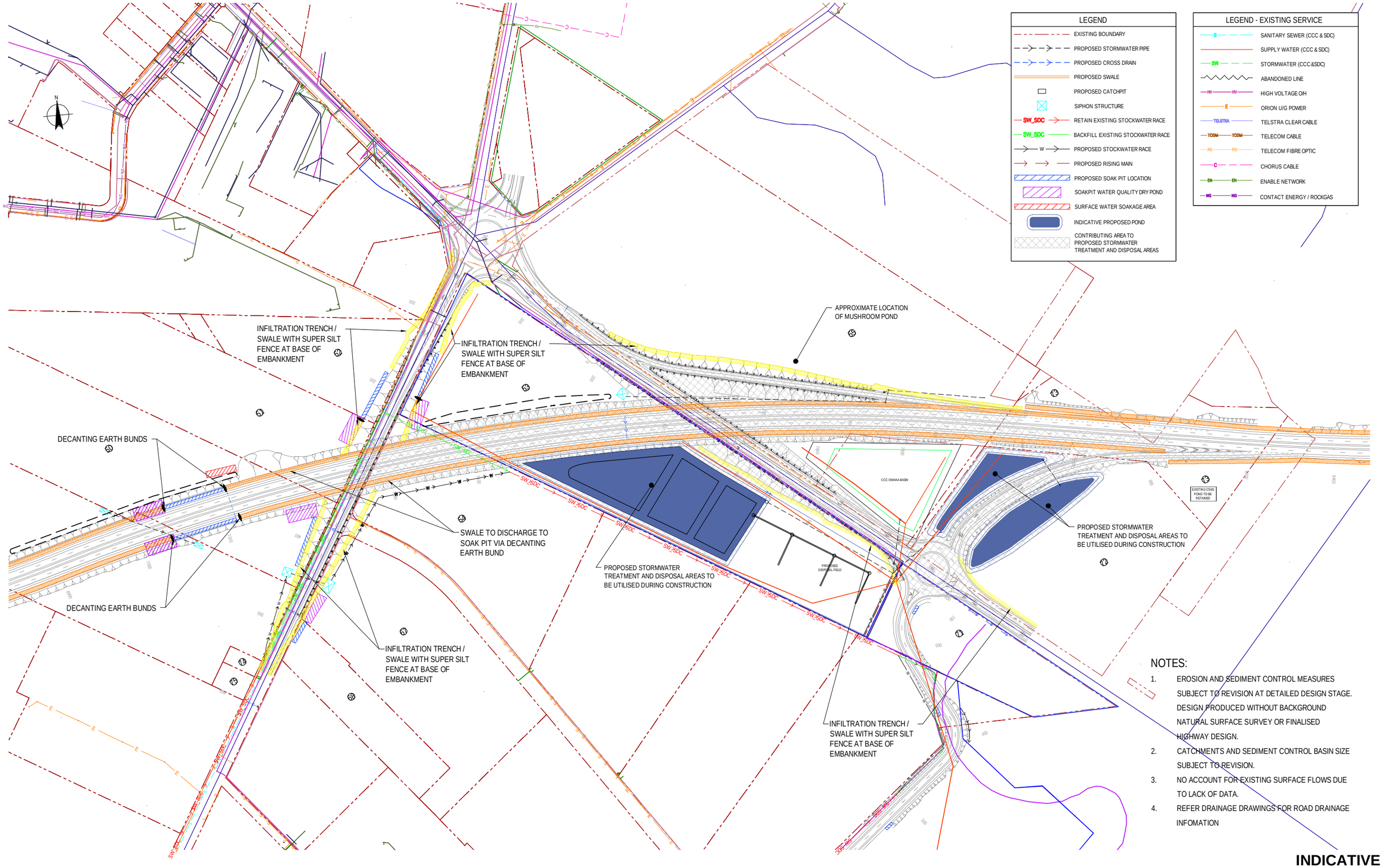
Client NEW ZEALAND TRANSPORT AGENCY
Project CSM2 AND MSRFL
Title EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - SHANDS ROAD SKETCH

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:

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2. CATCHMENTS AND SEDIMENT CONTROL BASIN SIZE SUBJECT TO REVISION.
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4. REFER DRAINAGE DRAWINGS FOR ROAD DRAINAGE INFOMATION

INDICATIVE

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

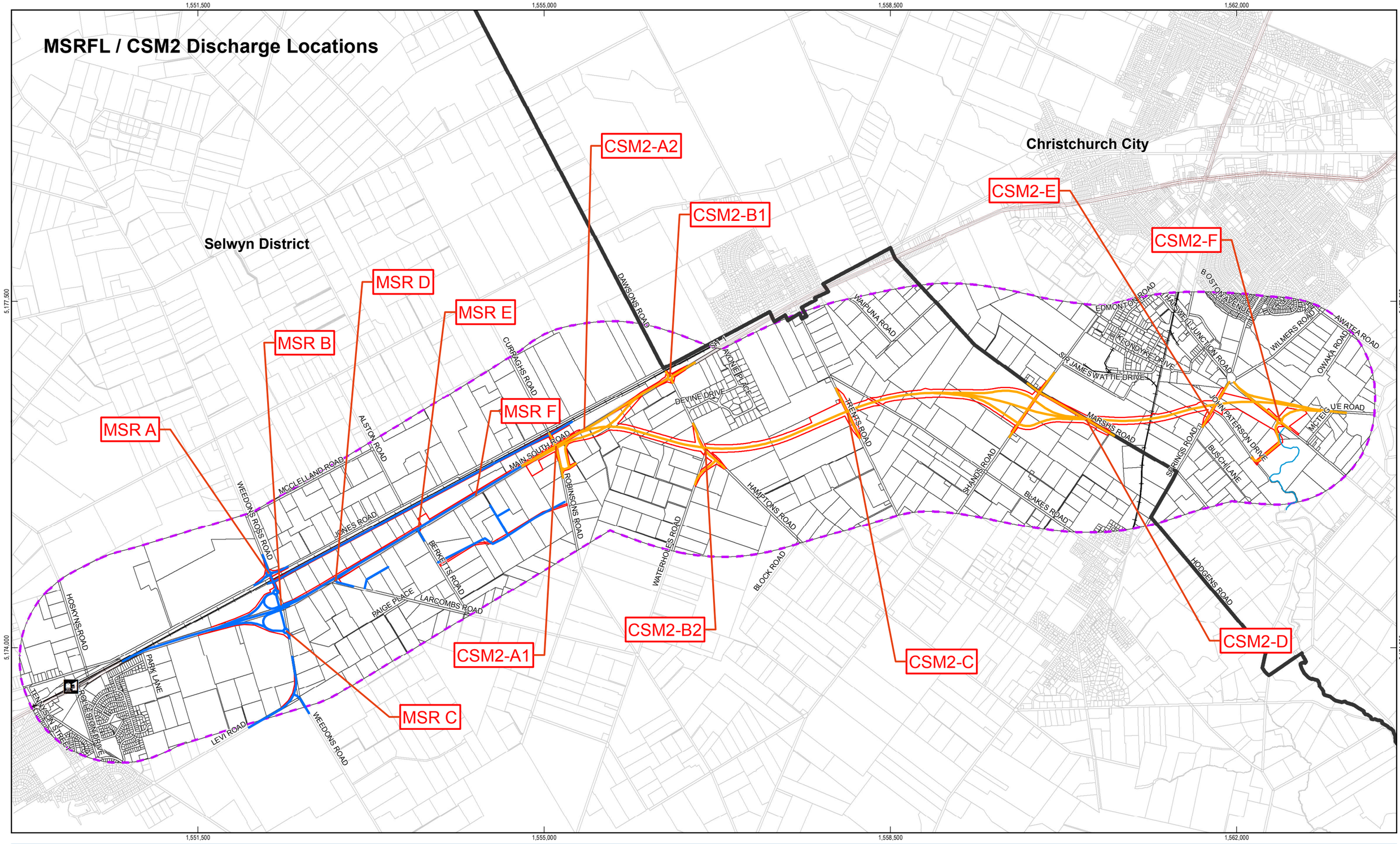
Client NEW ZEALAND TRANSPORT AGENCY
Project CSM2 AND MSRFL
Title EROSION & SEDIMENT CONTROL MANAGEMENT PLAN - CSM2 AND MSRFL JUNCTION SKETCH

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



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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

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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