# Supporting Growth

## Trig Road Corridor Upgrade

## Erosion and Sediment Control Plan

Version 1.0

December 2022

TE TUPU NGĀTAHI Supporting Growth

NZ TRANSPORT AGENCY WAKA KOTAHI

## Document Status

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| **1.0** | December 2022 | Final for issue |

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## Acronyms

| Acronym/Term | Description |
|---|---|
| **AUP:OP** | Auckland Unitary Plan Operative in Part 2016 |
| **AT** | Auckland Transport |
| **AEE** | Assessment of Effects on the Environment |
| **GD05** | Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region – Guideline Document 2016/005 |
| **ESC** | Erosion and Sediment Control |
| **NoR** | Notice of Requirement |
| **Project** | Trig Road Corridor Upgrade |
| **RMA** | Resource Management Act 1991 |
| **SH18** | State Highway 18 |
| **SRP** | Sediment Retention Pond |

# 1 Introduction

## 1.1 Background

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part 2016 (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency, to investigate, plan and deliver the transport networks needed to support Auckland's future urban growth areas over the next 30 years.

## 1.2 Purpose of this Report

Trig Road, Whenuapai has been identified in the Supporting Growth Programme as a future arterial corridor that is needed to support the urban development of Whenuapai.

This report has been prepared to support AT's notice of requirement (**NoR**) and application for resource consents for the Trig Road Corridor Upgrade (the **Project**). The NoR under the Resource Management Act 1991 (**RMA**) is to designate land for the construction, operation and maintenance of the Project.

Funding for the upgrade of Trig Road between Hobsonville Road and State Highway 18 (**SH18**) has been made available through the Housing Infrastructure Fund[1]. As there is funding available for construction, AT are also applying for the necessary resource consents under the RMA, concurrently with the NoR process.

This report outlines the Erosion and Sediment Control (**ESC**) approach for the Project, with regards to reducing and isolating environmental effects associated with the earthworks, construction works and future functioning of the Project on the receiving environment. This report has been prepared in conjunction with the Assessment of Stormwater Effects and the indicative construction methodology, to inform the Assessment of Effects on the Environment (**AEE**).

The report provides the framework for the construction of ESC measures and provides site specific detail. The Report describes the methods and practices to be implemented to ensure the effects of erosion and sediment generation are minimised and managed, and degradation to the receiving environment is avoided.

[1] See North West Housing Infrastructure Fund Assessment of Environmental Effects for further detail regarding the Housing Infrastructure Fund.

The Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region – Guideline Document 2016/005 (**GD05**) was used as a reference for the appropriate methods and practices applied.

This report is a draft report only and will be subject to a contractor preparing a final ESC Plan and obtaining certification from Auckland Council.

# 2 Project Description

## 2.1 Project Location

As shown in Figure 1 below, the full length of Trig Road is located in Whenuapai, a suburb in the North West area of Auckland. Trig Road is approximately 2.28km, starting from the urban fringe of West Harbour, at the intersection on Hobsonville Road to the south, crossing SH18, and extending towards Brigham Creek Road intersection to the north.


**Figure 1: Locality Plan**

## 2.2 Project Description

The Project consists of the widening and upgrade of Trig Road transport corridor between the SH18 off-ramps and Hobsonville Road. The widening has capacity to provide for a two-lane arterial standard corridor including new footpaths on both sides of the road and a cycleway which is indicatively shown as a bi-direction cycleway on the eastern side of the corridor. The Project will upgrade the current rural standard corridor, currently 20m wide, to an urban standard, proposed to be approximately 22.4 to 24.8m wide, which is appropriate to support the soon to be urban environment on either side of Trig Road.

To safely tie into the existing road network, the Project also includes the signalisation of the intersections at Trig Road / Hobsonville Road and Luckens Road / Hobsonville Road and upgrade of Hobsonville Road between these intersections. This will require some localised widening of the road corridor along Hobsonville Road. The SH18 over-bridge will also be reconfigured to provide for a cycleway, and additional tie in works to the north of the over-bridge within the existing road reserve.

Table 1 below provides a breakdown of the earthworks coverage and cut/fill volumes expected across Trig Road and Hobsonville Road. A hypothetical maximum allowance for site clearance and earthworks remediation for the remaining designation area, outside of the road corridor, has also been provided for

as included in the table, although there is a possibility that not all of this area will be disturbed, and these values may be lower.

**Table 1: Earthworks volumes and areas**

| | Approx. Cut | Approx. Fill | Approx. Area |
|---|---|---|---|
| **Site Clearance** | 17,000m$^3$ | 17,000m$^3$ | 61,000m$^2$ |
| **Corridor Earthworks** | 3,000m$^3$ | 35,000m$^3$ | 45,000m$^2$ |

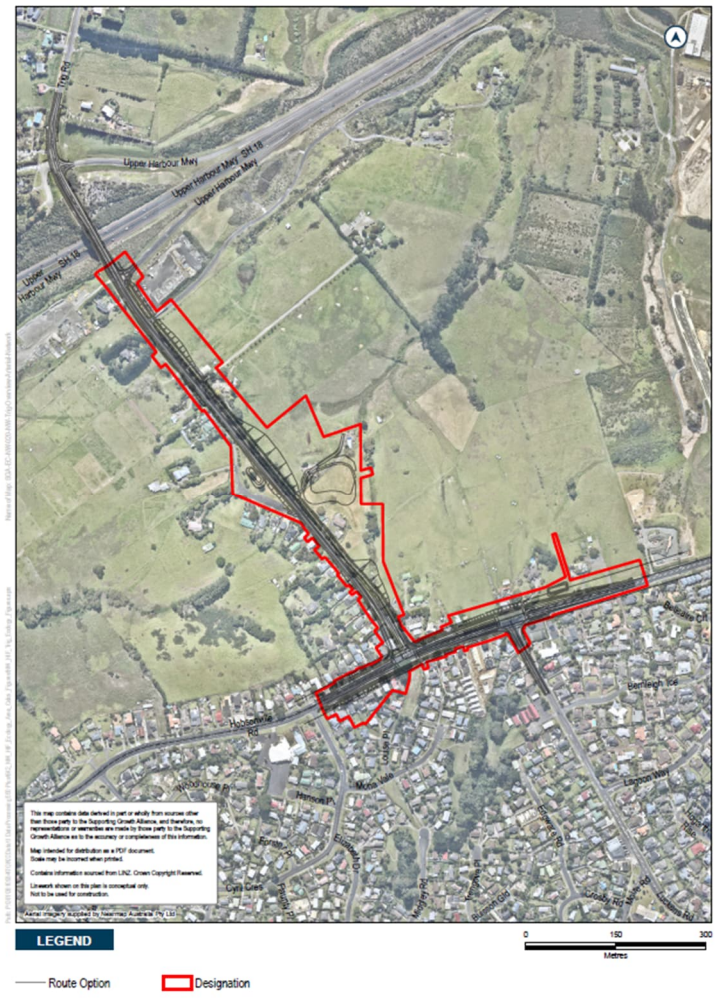


**Figure 2: Whenuapai – Trig Road Corridor Upgrade**

## 2.3 Project/Site Features

### 2.3.1 Cross-Section

The indicative existing Trig Road corridor consists of a ±7m wide two-lane road and 1.5m footpath along the majority of the western side of the road length. While the final layout of the upgraded

corridor will be confirmed as part of detailed design, a typical cross-section has been developed for the corridor. The indicative cross section for the road alignment includes:

***Trig Road:***

- 2 x 3.5m wide traffic lanes divided by a 3m wide median

***Trig Road - Adjacent to western road edge:***

- 1.5 – 2.7m wide berm containing trees and raingardens
- 1.8m wide footpath
- 0.5m wide berm containing street lighting

***Trig Road - Adjacent to eastern road edge:***

- 2.7m wide berm containing trees and raingardens
- 4m wide cycleway adjacent to the eastern berm
- 1.8m wide footpath
- 0.5m wide berm containing street lighting

***Trig Road – SH18 bridge:***

- Provision for a new footpath and cycleway crossings along the existing SH18 bridge crossing (within the corridor of the existing bridge)

***Hobsonville Road and Intersections:***

- Localised widening around the upgraded intersections at Trig Road/Hobsonville Road and Hobsonville/Luckens Road to accommodate vehicle stacking and tie-ins of new footpaths and cycleways

***General***

- Batter slopes and retaining walls to tie the corridor into the surrounding ground level.

An indicative cross-section for Trig Road is provided in Figure 3.

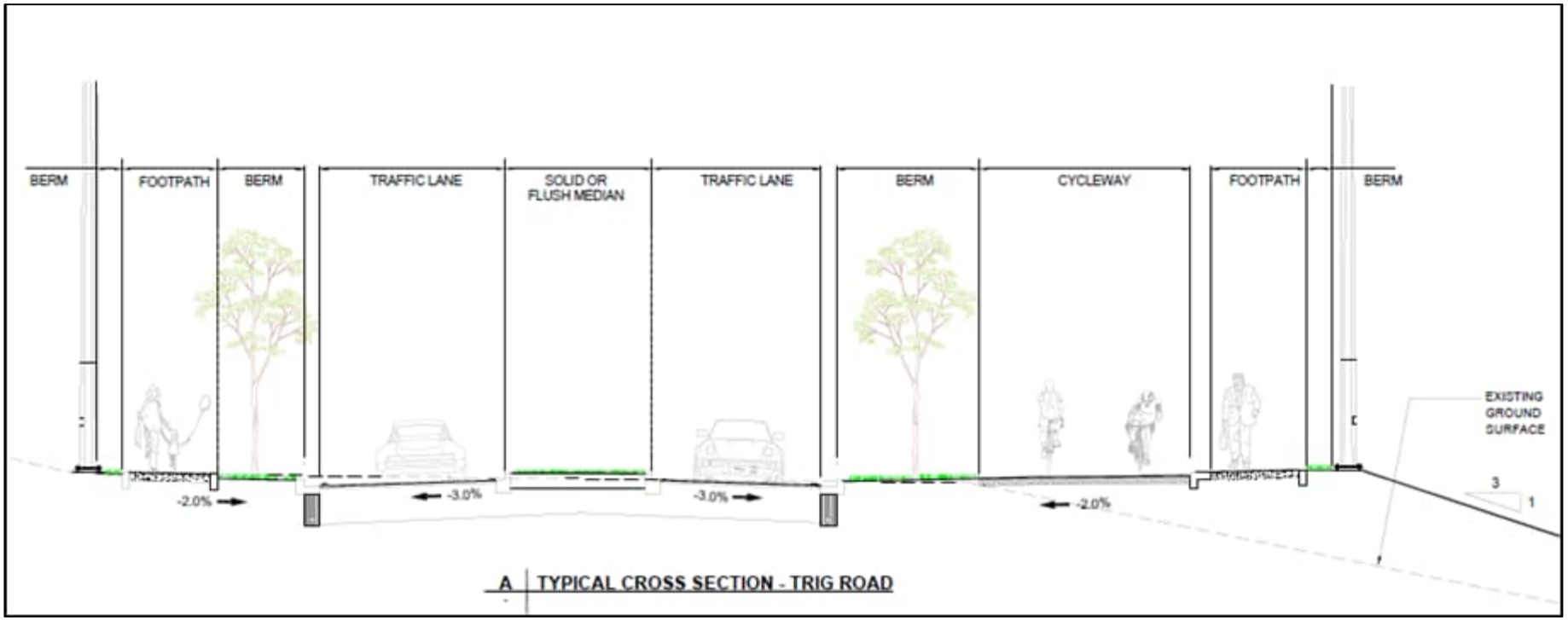


**Figure 3: Indicative Trig Road Cross Section**

### 2.3.2 Stormwater Infrastructure

The upgrades to Trig Road will induce necessary upgrades to the existing stormwater infrastructure, allowing for upgrades to accommodate future urban development, and new stormwater management devices. In summary, the specific stormwater infrastructure elements associated with the upgrade of Trig Road will include the following:

- Replacement and upgrading of three existing stormwater culverts under Trig Road, including energy dissipating outfalls
- Construction of new primary stormwater network within the new Trig Road corridor, as well as for portions of Hobsonville Road to be widened
- Installation of new stormwater treatment devices
- Construction of a new detention pond with energy dissipating outfall to Trig Stream (wetland)

Assessment of the construction of these elements will be evaluated in terms of ESC in the sections to follow.

### 2.3.3 Existing Ground Conditions

Soil classifications obtained from the New Zealand Geology Maps indicated two main soil groups in the Trig Road area. The two main soil groups are as follows (GNS Science, 2018):

- East Coast Bays Formation (Waitemata Group) forming in the steeper slopes. This group consists of a variation of interbedded, graded sandstone and siltstone, or mudstone and sandstone, as well as local intercalated volcanic grit.
- Puketoka Formation forming in the gentle slopes and low-lying areas. Undifferentiated alluvium can be found in gullies and within flood plains around streams.

These soils comprise of areas of both low permeability as well as pockets with high soakage potential.

### 2.3.4 Topography, Catchments, Drainage and Receiving Environments

The greater Whenuapai 3 precinct topography has been identified as a predominately low-lying catchment, with mostly flat to rolling landscapes, with localised areas of steeper terrain mainly to the south. Figure 4 below indicates the contours, typical topographical flow paths and major receiving waterbodies for the Project area and its surrounding catchment areas.


**Figure 4: Trig Road surrounding overland flow paths and receiving waterbodies**

As depicted from the contours, the existing Trig Road alignment is predominately located on a ridge line with the surrounding catchment areas falling away from the road. Trig Road comprises of a steep fall from south-east to north west just off Hobsonville intersection (±8%) for ±300m, with the remaining road length towards the SH18 comprises flatter grades and localised low points.

The catchment area west of Trig Road has a general fall to the west, with two main sub-catchments draining into/forming into a head branch of Totara Creek, which subsequently drains out of the Whenuapai 3 Precinct, discharging into Brigham Creek. The catchment area east of Trig Road (and those which form in smaller sub-catchments of localised low points along Trig Road) has a general fall to the east, with three main sub-catchments draining into/forming into head branches of predominately Trig Stream and Rawiri Stream, followed by Waiarohia Stream, all of which subsequently drain towards the Waiarohia Inlet.

A geotechnical study was carried out within the Project area and identified a highwater table and groundwater seepage at the south eastern branch head of Trig Stream (wetland), adjacent to Trig Road, with water encountered at ±800mm below ground level.

Waiarohia Stream and Trig Stream (and related wetlands) will be the most directly affected environmental areas of significance during construction works due to large fill embankments encroaching into the watercourse and the upgrades to the existing stormwater crossing discharging into these streams.

### 2.3.5 Contaminated Land Assessment

Previous studies and site investigations carried out within the Whenuapai area, as mentioned within the Whenuapai Structure Plan (2016) and Whenuapai 3 Precinct Stormwater Management Plan (a technical document supporting Council's Proposed Plan Change 5), past applications of pesticides and fertilisers for agricultural activities present the potential for elevated contaminations of soil within

the general area, and a historical landfill site has been identified just east of the Whenuapai Air Base which is the only notable/specific land contaminant point of interest near Trig Road.

A Preliminary Site Investigation has been completed for the Project. Contaminated land should be managed in accordance with the recommendations of that report.

# 3 Statutory Context

## 3.1 Notice of Requirement

This assessment has been prepared to support the NoR process for the Project. Section 171 of the RMA sets out the matters that must be considered by a territorial authority in making a recommendation on a NoR. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement.

## 3.2 Regional Resource Consent Application

AT are also seeking regional resource consents under the AUP:OP and resource consent under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Consents are required to a number of activities including bulk earthworks.

Overall, the application is assessed as a Discretionary Activity.

### 3.2.1 Relevant Standards and Guidelines

The following standard documents and guidelines were utilised in the development of a suitable ESC Plan for the Project:

- AUP:OP – Particularly with regard to:
    - Chapter E3: Lakes, Rivers, Streams and Wetlands
    - Chapter E11: Land disturbance – Regional
    - Chapter E12: Land disturbance – District
    - Chapter E26: Infrastructure
- GD05
- Technical Publication No. 108: Guidelines for Stormwater Runoff Modelling in the Auckland Region

# 4 Indicative Construction Methodology

An indicative construction methodology has been prepared to inform the assessment of the Project and, while subject to change, assists in determining the envelope of effects. An overview of the construction methodology is set out in the AEE. The final construction methodology for the Project will be confirmed during the detailed design phase and finalised once a contractor has been engaged for the work.

A summary of the key components of the indicative construction methodology is outlined in the sub-sections below and plays an integral role in the development of a suitable ESC Plan for the Project.

## 4.1 General Construction Overview

The total construction phase of the Project is expected to take approximately 18 to 24 months. It is anticipated that the works will be broken down into separate construction zones based on the type of works required and the nature of the work environment. These anticipated zones are:

- **Zone 1:** Trig Road North of the SH18 bridge
- **Zone 2:** Trig Road South including the SH18 bridge
- **Zone 3:** Hobsonville Road.

## 4.2 Construction Methodology

Each zone has different construction activities depending on the type of work to be done and the surrounding environment. In all cases the general sequence of construction is likely to be:

1. Divert or remove services
2. Construct permanent stormwater drainage crossings and environmental controls
3. Move traffic away from works longitudinally
4. Construct earthworks and retaining structures
5. Construct new longitudinal drainage
6. Construct new pavement to half of the road
7. Move traffic onto newly constructed pavement
8. Complete longitudinal drainage
9. Complete pavement and median
10. Move traffic to new alignment
11. Complete footpath and cycleway

The activities for each zone are summarised in Table 2 below.

**Table 2: Trig Road Corridor Upgrade Construction Activities Summary**

| Zone | Construction Activity |
|---|---|
| 1 | • Site clearance<br>• Remarking of existing road and bridge deck<br>• New cycleway and footpath on west side<br>• New cycleway crossing |
| 2 | • Site clearance<br>• Diversion of overhead services on west of Trig Road<br>• Construction of three new drainage culverts<br>• Construction of new dry pond for stormwater attenuation<br>• Cut/fill earthworks<br>• New retaining walls to the front of properties on the west of Trig Road<br>• Construct new berm and footpath on the west of Trig Road<br>• Construct new berm, footpath and cycleway on the east of Trig Road<br>• New road surface and median<br>• Line marking<br>• Lighting and road furniture |
| 3 | • Site clearance<br>• Divert services<br>• Cut/fill earthworks<br>• Construct new stormwater drainage<br>• New retaining walls to the front of existing property<br>• Construct new cycleway and footpath on both sides of Hobsonville Road<br>• New road surface and median<br>• Lighting and road furniture |

All three zones consist of works for which ESC measures will be applied with varying magnitude. The construction works in Zone 2 consist of the majority of earthworks and stormwater drainage upgrades and will have the greatest potential impact on the downstream receiving environment and watercourses to be addressed.

The current construction methodology and programme is based on works being constructed concurrently across all 3 zones to achieve the shortest construction period.

Environmental controls will be set up prior to start of site clearance within each zone and be maintained for the duration of works and until such time that any exposed surfaces have been stabilised. General ESC measures to be expected on site as well as specific ESC measures for each zone will be discussed in section 5 and 6 respectively.

## 4.3 Plant and equipment

Table 3 provides an indicative list of plant and equipment which may be required for the construction across the three zones.

### Table 3: Trig Road Corridor Upgrade Plant and Equipment Summary

| Construction Type | Construction Activity |
|---|---|
| **Typical across all works** | • Site facility<br>• Light vehicles<br>• Hiab truck<br>• Small tools and plant |
| **Clearing** | • 20T excavator<br>• Mulcher<br>• Tandem tipper |
| **Overhead line relocation** | • Line crew<br>• Elevated work platform or cherry picker<br>• Directional drilling equipment |
| **Bulk Earthworks** | • 30T excavator<br>• 20T excavator<br>• Compactor/Sheepsfoot roller<br>• Water cart<br>• Tippers/ADT's |
| **Drainage** | • 20T excavator<br>• Trench shields<br>• Tandem tipper<br>• Loader<br>• Plate compactor |
| **Pavement Construction** | • Grader<br>• Smooth drum roller<br>• Tandem tippers<br>• Kerbing machine<br>• Plate compactor<br>• Paver |

# 5 Principles of ESC

Erosion and the associated effects of sediment deposition has the potential to cause both physical and ecological disturbance within a watercourse/stream, and control measures both during construction and within the design of permanent structures needs to be considered. This should be in accordance with GD05, which supersedes the previously used Technical Publication 90.

This section outlines the objectives of implementing ESC measures, and describes the typical methods utilised during various construction activities. Section 6 following will provide site specific erosion control measures in order to achieve these objectives.

## 5.1 Key Objectives

Key objectives of the ESC Plan for the Project and associated works include the following:

- *Construction methodology/staging of works:*

  Selection and implementation of appropriate construction methods to facilitate staged construction works. This allows for more manageable ESC measures by confining works to smaller sections, making it easier to monitor and maintain, particularly when multiple measures are in place. Staging also means that the areas of exposed soils during earthworks is minimised or limited to only the specific area where works are taking place, minimising erosion of loose soils by wind and runoff, and facilitating dust management. Staging earthworks allows for progressive stabilisation during the construction period.

- *Minimising disturbance*

  Minimising disturbance by keeping earthworks and area of works to a minimum during operations, ensuring stability of surrounding slopes and structural integrity of nearby infrastructure is maintained. This is applicable to both vegetation removal, earthworks required to carry out cut/fill operations and works within existing watercourses during stormwater crossing upgrades.

- *Protection of existing watercourses*

  Diversion of clean water away from areas of disturbance and diversion of sediment laden runoff from disturbed areas/exposed soils during earthworks to prevent sediment laden runoff discharging into watercourses and adversely affecting downstream stream health (both ecological and physical).

  Pollutants and debris/construction materials should also be carefully controlled so that these are not deposited within the bed, with the potential to be conveyed downstream along with sediment.

  Minimising earthworks and vegetation removal around and within watercourses to reduce the exposure of soils, and consequential erosion potential from scouring or wind during stormwater crossing upgrades.

  Protection of receiving streams is also applicable for the permanent structures. Outfalls will be designed to ensure stormwater discharges have minimal erosion and scouring impacts.

- *Protection and stabilisation of embankments*

  Protection of steep embankments by means of clean water diversion, contour channels along embankments, and progressive rapid stabilisation with the application of temporary straw mulch, geotextiles or similar, and hydro-seeding/grassing for permanent measure.

Protection of existing watercourse embankments by limiting vegetation removal and earthworks during stormwater crossing upgrades.

- *Retention devices to allow for settlement of suspended solids/sediment laden runoff*

  Allow for sediment laden runoff to be detained and treated to facilitate the settlement of solids prior to discharging back into downstream watercourses.

- *Monitoring and maintenance*

  ESC measures should be monitored and maintain throughout the construction works so that they remain operational and fit for purpose, and modified accordingly to suit changes on site.

## 5.2 Erosion and Sediment Prevention/Sources Control Measures

Non-structural ESC principles applied from the start of a project can reduce the need for structural controls. Preventing erosion is considered more effective that managing the consequences of it. The following general measures can be taken to facilitate in preventing erosion and sediment generation/transport at its source:

### Table 4: Erosion and Sediment Source Control Measures

| Source/Activity | Source Control Measure |
|---|---|
| **General site management** | • Schedule construction works with wet and dry seasons taken into consideration. Plan according to climate/weather forecast to account for heavy rainfall/wind<br>• Stage earthworks within the construction methodology to allow for more manageable sections of works and keep exposed surfaces to a minimum as far as practically possible<br>• Stabilise work areas with high sediment generation potential by placing geotextile or using other approved methods prior to commencement of works<br>• Provide unobstructed and stabilised overland flow paths prior to rainfall events<br>• Regularly sweep or remove any accumulated sediment associated with the works<br>• Provide stabilised permanent entranceways/exits to the site with aggregate, and optionally incorporate a wheel wash system to provide additional prevention of sediment transfer outside of the construction area<br>• Use water sprinkling from water carts to minimise wind distribution of sediments/dust |
| **Stockpiles** | • Stockpiles are to be in construction areas serviced by ESC measures only<br>• Stockpiles should not be located near overland flow paths or within floodplains<br>• Removal and handling of contaminated material must follow a prescribed Soil Management Plan<br>• Stockpiles of fine material are to be wetted to reduce the potential for windblown sediments, or receive temporary coverings such as geotextile fabric during periods of inactivity |

| | |
|---|---|
| **Sediment transport due to runoff from external catchments entering the construction site** | • Construct cut off channels/diversion bunds to divert clean upstream runoff away from the site, and prevent exposed soils being lifted and washed downstream<br>• Use clean water diversions (e.g. sandbags, compacted earth) where there is steep terrain uphill of the works area to reduce the volume of water requiring management |
| **Works within a watercourse or watercourse/replacement of existing stormwater crossings** | • Upstream and downstream sandbag coffer dams to be used to isolate work areas or temporarily divert flow, to allow for dry construction works, or where possible opt for offline construction only, and diversion of flow to new structure after completion<br>• Temporary pipes and culverts to be used to divert flows<br>• Erosion and scour protection (e.g. rip rap or geotextile) to be used at temporary and permanent outlets |
| **Erosion due to runoff over reinstated ground** | • Maintain ESC structures in place after completion of works until stabilisation has been established |

## 5.3 General ESC measures

The following general measures can be applied for different types of construction activities in the Project to control erosion and sediment transport, manage sediment deposition and subsequently prevent adverse effects thereof to the receiving environment.

**Table 5: General ESC Measures**

| ESC Measures | Application |
|---|---|
| **Catchpit/ Stormwater inlet protection** | Install permeable silt socks/coir logs or small silt fences as a ring around stormwater inlets to act as a barrier for filtering out sediment fines from channel flow runoff. Can also be installed in series upstream of the stormwater inlet to act as check dams.<br><br>Additionally gratings/inlets can be covered with a geotextile to filter sediment laden runoff before discharging into the stormwater network.<br><br>These methods are to be used in conjunction with other sediment control measures. |
| **Chemical Treatment** | Used to improve the efficiency of sediment retention devices by dosing sediment laden runoff with coagulant reagents to assist in flocculation of particles and faster settlement of sediment fines. This treatment method requires a high level of monitoring and maintenance to ensure safe and effective usage on site, and its viability as a treatment method is dependent on soil type.<br><br>The two main methods of treatment/dosing are batch dosing and rain activated dosing. |

| | |
|---|---|
| **Contour drains** | Install/construct across the contours of long and/or steep exposed slopes, as a temporary measure only, during earthworks to break sheet flow by reducing slope length, subsequently reducing flow velocities and the erosive power of thereof. Contour drains should have erosion protected outlets and drain towards diversion channels/bunds. |
| **Decanting earth bund** | Smaller than, however similar to, sediment retention ponds (**SRP**) in function, decanting earth bunds are enclosed areas used to collect and retain runoff and allow for sediments to settle out of water before being discharged off site. Used for catchments, <0.3ha, with high concentrations of sediment laden runoff, where runoff treatment is required, and where silt fences cannot be used due to steeper than appropriate slopes. |
| **Diversion channel/bund** | Clean water diversion channel/bund:<br>• Install upstream of site of works to prevent clean runoff entering site of works, washing over exposed soils and transporting sediments downstream.<br>Dirty water diversion channel/bund:<br>• Install downstream of the site of works/bottom of catchment/embankment slope to collect sediment laden runoff and transport to appropriate retention site to allow for settlement of solids. Can be used with drop out pits along channel to allow for heavier sediments to settle prior to entering a sediment retention device, reducing the load on the device. |
| **Geotextiles and erosion control blankets** | Permeable geotextile blankets or biodegradable fabrics installed as a form of temporary rapid stabilisation on slopes or in channels where permanent vegetation is slow to establish, or where conventional methods such as mulching does not provide sufficient erosion resistance due to high flow velocities.<br>Installed temporarily at inlets/outlets of SRP, within diversion channels or as covers over slopes/batters or stockpiles during periods of inactivity. Plastic covers can also be utilised for covers over stockpiles, stockpiled contaminated soils or material for reuse. |
| **Grass seeding** | Temporary or permanent stabilisation by seeding grass to provide vegetative cover for exposed soils, to protect against raindrop impact, reduce runoff velocities and assist in binding of loose soils. Rapid-growing annual grass can provide quicker coverage with rapid establishment for short term stabilisation, and perennial grass can provide for permanent stabilisation. |
| **Hydroseed** | Stabilisation method by application of seed and fertiliser mix in the form of a slurry, to allow for seeding and revegetation on steep, inaccessible slopes or in areas with minimal/no existing topsoil to facilitate seeding. |
| **Mulching** | Typically, straw applied to the soil surface as a protective layer for short to medium rapid stabilisation to assist in erosion protection from raindrop impact or wind on exposed soils/embankments (not within channels or overland flow paths). Assists in retaining moisture to facilitate vegetation regrow. |

| | |
|---|---|
| **Silt fence** | A fence of woven geotextile fabric installed along contours, downstream of disturbed areas to intercept and slow down sediment laden sheet flows, temporarily detain the runoff and allow for larger sediment to settle out of water. Best used on sites with flatter grades, in confined areas, areas with smaller contributing catchments, around water courses, bush reserves etc. These are not to be installed across watercourses or in areas of highly concentrated flows. |
| **Silt socks** | Tubular socks filled with filter material (compost, wood, straw, bark etc) used to intercept and filter sediment laden runoff, ideal for very small or isolated catchments for short term sediment control (or for stormwater inlet protection as described above). It can also be filled with sand and used to divert runoff or overland flow to allow for works within existing streams. |
| **SRP** | Large ponds used as an end of line sediment control structure in order to collect sediment laden runoff from diversion bunds etc, and allow for settlement of sediment through retention and regulated outflow. Ideally combined with chemical treatment for improved settlement efficiency. Most appropriate end of line sediment control method for sites of 0.3ha to 5ha. |

## 5.4 Establishment

ESC mitigation measures will be installed by the contractor prior to the start of any vegetation clearance, site set up or earthworks.

The contractor is responsible for updating the ESC Plan once the construction and traffic management methodology has been confirmed and resubmitting the updated ESC Plan to Auckland Council for certification, prior to the commencement of works.

## 5.5 Decommissioning

Decommissioning of ESC measures should only be carried out once the site/contributing catchment surface areas are deemed to be stabilised, with a resistance to erosion typically by mulch, geotextile mats, grassing or a combination of the above. Typically for grassing/vegetation stabilisation, 80% coverage established is considered sufficient for allowing decommissioning of temporary controls. Upon removal of controls, any accumulated sediment deposits must be cleared and disposed of appropriately, and any disturbed areas left by the controls themselves after removal should be stabilised.

# 6 Specific ESC Measures

This section is to be read in conjunction with the indicative ESC Plan Layouts provided in Appendix 1, with a detail of the SRP included. The measures described for each zone are based off the indicative construction methodology at the time of AEE development. The contractor's final methodology may differ based on final design detail changes and future staging requirements, as such, the contractor will be responsible (on behalf of AT) for seeking certification of a revised ESC Plan to reflect the final detailed design and construction works thereof.

All environmental/management controls are to be set up prior to construction works occurring in that zone and to be assessed and certified for its suitability by Auckland Council.

## 6.1 Zone 1

Zone 1 includes all works on the SH18 bridge crossing and works north of the bridge. The construction activities consist of widening the existing corridor to incorporate a new cycle and footpath extension from the western road edge to ±180m north of the bridge (including crossing), and a new cycle and footpath extension from the eastern edge for a shorter ±60m portion. Works on the SH18 bridge consist only of modifications to the road markings to accommodate a cycle and footpath.

### 6.1.1 Clean water diversion

Upstream runoff currently flows overland, across the western road edge and into the carriageway. The scale of works within this zone is relatively minor, with minimal earthworks, minimal cut/fill batters and low volumes of adjacent upstream runoff is expected over the site. Diversion of clean upstream runoff can be managed mainly with sand bags/logs, and at worst low level hotmix diversion bunds.

The first ±100m of cycle/foot path works lies adjacent to an existing bund/mound with an existing scruffy dome inlet collecting majority of upstream runoff. Cutting into the existing mound will be required for the width extension and a shallow diversion trench connecting to the existing field inlet can be used to divert minor flows and prevent runoff over new layerworks for the cycle path. Alternatively, if upstream runoff potential is found to be minor, temporary sand bags/logs can be used instead.

Sand bags/logs can be used for the remaining western edge works to divert upstream runoff away from the new layerworks and expected exposed soils, and onto existing impervious driveway surfaces for drainage into the carriageway.

### 6.1.2 Silt fences/silt socks

Silt socks should be used downstream of and adjacent to the new cycle and footpath extension works along the western road edge to prevent sediment laden runoff entering the carriageway. A silt fence should be used on the eastern road edge, downstream of the ±60m long cycle and footpath extension to capture any runoff from this area of work. Only minor works to the existing berm and kerbs can be expected on the remainder of the eastern edge, for which runoff can be managed with silt socks/coir logs.

Two existing inlets within the Zone 1 carriageway should receive silt sock/coir log rings for additional inlet protection.

## 6.2 Zone 2

Zone 2 includes all works south of the SH18 bridge crossing up to the intersection of Hobsonville Road. The construction activities in this zone includes redevelopment of Trig Road from an existing 2-lane carriageway to a 2-lane carriageway with centre median, footpath along the western edge and 2-way cycle lane and footpath on the eastern edge.

The majority of the corridor widening occurs on the downstream eastern edge resulting in fill embankments over 5m high. Earthworks of this nature, particularly occurring in and around existing watercourses where diversions are required, needs the construction methodology to be carefully planned and a high level of monitoring carried out during construction so that the control measures are in place and operating correctly prior to them being needed.

The area of works consists of three low points/watercourses downstream, each of which will receive different management and control measures.

### 6.2.1 Catchment 1

Catchment 1 includes all works and activities upstream of, and with the potential to affect the receiving Waiarohia Stream.

#### 6.2.1.1 Stabilised entranceway

The existing greenfield areas adjacent to the Waiarohia Stream overland flow path will be used for site establishment, with access off the existing service roads. Entranceways from Trig Road into the site establishment and into the adjacent greenfield area will be stabilised in accordance with GD05, with minimum 50mm aggregate placed 150mm thick. Wheel washing may also be incorporated within this area to minimise transfer of sediments between work areas and site establishment.

#### 6.2.1.2 Clean water diversion

Two clean water diversion bunds/channels will be required upstream of Trig Road to direct clean runoff from the upstream catchment (total ±1.3ha) towards the existing inlet and Ø150mm pipe crossing into the gully leading to Waiarohia Stream and prevent runoff towards new fill embankments and over new cut embankments. Initial diversion bunds should be placed so as to divert runoff past the new pipe crossing location to allow for dry, off line construction works. Once the new pipe crossing has been established the diversion bunds should be reconstructed to divert all runoff into the new inlet and allow for offline decommissioning of the existing crossing.

#### 6.2.1.3 Silt fences

A silt fence will be required downstream of the fill embankment on the eastern side of Trig Road, to manage sediment laden runoff expected after these earthworks are completed, constructed behind the new stormwater pipe crossing headwall when crossing upper Waiarohia Stream. The silt fence should incorporate short returns to accommodate for slope grades as well as a minimum 5m grass buffer either end at Waiarohia Stream discharge. The initial placement of the silt fence should be further downstream to allow for vehicle access during embankment construction, shifted up on completion of earthworks and stabilisation. A perimeter silt fence should also be installed along the downstream boundaries of the site establishment yard to manage sediment laden runoff from construction vehicles and stockpiling sources, preventing washing off into the overland flow path.

### 6.2.2 Catchment 2

Catchment 2 includes all works and activities upstream of, and with the potential to affect the receiving Trig Stream.

#### 6.2.2.1 SRP and chemical treatment

The stormwater drainage system for Trig Road incorporates a dry pond for on-site attenuation. This pond will be utilised temporarily as a SRP for the duration of the construction works, allowing for collection of runoff from dirty water diversion bunds, runoff retention, treatment and settlement of fines for a portion of catchment 2 earthworks.

All piped stormwater flow is designed to drain into the dry pond from various catchments, thus any sediment laden runoff collected from the carriageway during the construction period will be diverted to the pond for retention and settlement of fines. All catchpit inlets and dropped kerb inlets into raingardens should receive protection by use of silt socks regardless.

The dry pond has been designed to accommodate a peak attenuation volume of 1220m³, fully draining. As per GD05 requirements the SRP will cater for minimum 3% of the contributing catchment volume which equates to ±205m³ for the immediate bunded earthworks area catchment and a maximum total of ±1075m³ for the catchment including runoff from the carriageway directed to the pond through the piped network.

The SRP will be designed to allow for level spreading of sediment laden runoff entering in from the dirty water diversion bunds, and the intake manhole will be designed to allow for 30% retention volume. Upon decommissioning of the SRP, modifications will be made to restore dry pond functionality as per detail design.

Appendix 1 includes details for the SRP components in accordance with GD05 standards. The SRP design is to be finalised once detailed design for the Project has been completed in future and the final dry pond location/size is clarified. The SRP pond is to incorporate GD05 standards while making use of the proposed dry pond structure. All final SRP details must be outlined in a revised ESC Plan for certification by council prior to commencement of works.

The SRP will include chemical treatment (typically by the rainfall activated method) in its process to assist with settlement of sediment and improve its efficiency. Bench testing will be carried out and details of the selected reagents and dosing procedures must be specified in a separate flocculation management plan to be required under conditions of consent for certification by Auckland Council.

The SRP must be constructed prior to all works commence, along with the construction of its own required sediment control measures.

#### 6.2.2.2 Clean water diversion

Similarly to catchment 1, two diversion bunds/channels will be required upstream of Trig Road to direct clean runoff from the upstream catchment (total ±1.95ha) towards the existing inlet and Ø375mm pipe crossing into Trig Stream and prevent runoff into the proposed raingarden excavation area, towards new fill embankments and over new cut embankments. Initial diversion bunds should be placed to divert runoff past the new pipe crossing location to allow for dry, offline construction works.

Once the new pipe crossing has been established the diversion bunds should be reconstructed to divert all runoff into the new inlet and allow for offline decommissioning of the existing crossing. This diversion bund should extend along the boundary of the proposed raingarden excavation to allow for dry works area. A clean water diversion bund should also be incorporated south east of the SRP, upstream of the pond cut embankment.

#### 6.2.2.3 Dirty water diversion

Dirty water diversion bunds/channels will be utilised for transporting sediment laden runoff from the fill embankment on the eastern side of Trig Road towards the SRP to allow for treatment and settlement of fines prior to discharge.

Dirty water diversion bunds will also be required along the toe of the SRP fill embankment, these will drain towards a decanting earth bund for settlement of fines prior to discharge.

#### 6.2.2.4 Decanting earth bund

A decanting earth bund will be placed at the base of the SRP, adjacent to the SRP outlet, for collection and retention of only the runoff from the pond fill embankment, sized to accommodate a minimum 2% of the contributing catchment volume (±30m³) and constructed in accordance with GD05 requirements.

#### 6.2.2.5 Silt fences/silt sock

A silt fence will be required along the downstream side of the proposed fill embankment off the western road edge to prevent sediment laden runoff entering the existing adjacent residential properties.

### 6.2.3 Catchment 3

Catchment 3 includes all works and activities upstream of, and with the potential to affect the receiving Trig Stream (upper branch).

#### 6.2.3.1 Dirty water diversion

Dirty water diversion bunds will be utilised for the collection and transport of sediment laden runoff from the large fill embankment within the upper branch of Trig Stream, and discharge into a decanting earth bund adjacent to the new stormwater pipe outlet. The diversion bund will cut across the embankment above the new headwall outlet.

Given the long slope length, a temporary cut-off drain should be used mid-way of the slope when high rainfall is expected, to intercept sheet flow. A silt fence should be incorporated at the base of the embankment adjacent to the stream for additional protection.

#### 6.2.3.2 Decanting earth bund

A decanting earth bund will be placed at the base of the fill embankment for collection and retention of runoff from the fill embankment, sized to accommodate a minimum 2% of the contributing catchment volume (±60m³) and constructed in accordance with GD05 requirements.

#### 6.2.3.3 Silt fences/silt sock

A silt fence will be required along the downstream side of the proposed fill embankment off the western road edge to prevent sediment laden runoff entering the existing adjacent residential properties.

## 6.3 Zone 3

Zone 3 includes all works within Hobsonville Road associated with corridor widening to accommodate for new cycleways and footpaths, new turning lanes to accommodate for the Trig Road intersection, new raingarden and temporary laydown yard north of Hobsonville Road, and an additional lane for a portion of Luckens Road. Construction activities in this area are to be to be managed to reduce the effects on adjacent residential properties, on the downstream piped stormwater network and Rawiri overland flow paths north of Hobsonville Road.

### 6.3.1 Silt socks/silt fences/sand logs

Erosion and sediment will mainly arise from activities during corridor extension and associated cut /fill operations for new road layerworks, and trench excavations for stormwater pipe installation.

A combination of silt fences and/or sand logs are to be used to divert clean runoff from properties away from site excavations, discharging into the carriageway downstream outside out the area of works, or to prevent sediment laden runoff from the site entering onto adjacent properties. These measures are to be utilised either side of Hobsonville Road and along the western edge of Luckens Road.

A perimeter silt fence should be installed around the proposed raingarden excavation area and outlet piped down to Rawiri overland flow path. The silt fence should also extend east to incorporate the proposed temporary laydown area north of Hobsonville Road.

Silt sock rings must be installed around all existing stormwater inlets within Hobsonville Road and Luckens Road area of works, as well as further downstream to ensure no sediment laden runoff from the site enters the existing stormwater network.

### 6.3.2 Decanting earth bund

The proposed new raingarden includes a 600mm deep, 200m³ attenuation capacity which can be utilised as a temporary treatment device for settlement of sediment laden runoff from the nearby works.

## 6.4 Dewatering

Dewatering will be applicable across all three zones for a combination of works including trench excavations for stormwater pipes, excavations for manhole and catchpit construction, and dewatering of sediment control devices for maintenance or decommissioning, with water originating from either surface runoff after rainfall events or ground water or a combination.

Minimal dewatering is expected in Zone 1. Dewatering in Zone 2 from stormwater structure excavations can be pumped to silt fenced areas downstream for small volumes, or into dirty water bunds/channels for subsequent drainage into decanting earth bunds or the SRP for larger volumes.

Dewatering from excavations in Zone 3 can be pumped to localised devices such as turkey nests for treatment prior to discharge or pumped through dewatering bags or pipe socks for smaller volumes. All water discharged off site should have a minimum water clarity of 100mm. Minimising long runs of open trenches and ensuring trenches/excavations are backfilled as soon as practicable will decrease the volume of dewatering required.

As noted in section 2.3.4, a continuous groundwater feed should be expected within the large fill embankment area on the south eastern side of Trig Road. In-situ counterfort drains and drainage layers will be installed as part of these construction works to cater for groundwater flows and subsequently, a constant sediment laden runoff should be expected to be managed during the in-situ drainage installation.

## 6.5 Stream protection

Construction works within Zone 2 consists of activities directly within the upper gullies leading to existing watercourses (catchment 1 – Waiarohia Stream, catchment 2 – Trig Stream/wetland, catchment 3 – Trig Stream/wetland upper branch) with potential to cause adverse effects to ecological health of the streams.

All three stormwater culvert crossing upgrades/extensions under Trig Road can be completed offline given their realignment, therefore typical control measures such as bunds/silt/sand logs should be used to prevent loose soil runoff into the adjacent watercourse.

Outlets will be constructed in approximately similar positions downstream as existing structures and some water diversion from existing outlets with the use of sandbags may be required to allow for dry working space while the existing outlets remain functional. Silt fences should be used around the downstream perimeter of outlet construction areas. Water diversion and sediment control measures are to be used progressively as required and adapted to suit changes to conditions on site.

The earthworks operations will be handled with controls as described above. Tree removal will be required on Trig Stream upper branch to accommodate for the embankment fill, and measures should be taken to minimise disturbance to surrounding vegetation and soils, followed up with compaction and temporary stabilisation of the area to cater for the period prior to continuance of earthworks.

## 6.6 Stockpiling

Stockpiles consisting of spoil or materials to be used in the construction activities will for the most part be located in the allocated construction yards (indicatively identified at 19 Trig Road and 80 Hobsonville Road), alternatively small stockpiles can be located adjacent to immediate areas of work. As far as practical, measures should be taken to ensure materials are only stockpiled for short periods of time and are located clear of overland flow paths, watercourses and construction vehicle traffic. Stockpile height should be kept to a minimum and placed in areas sheltered from wind.

Cut/fill material should receive immediate cover once stockpiled for extended periods by use of plastic covers or geotextiles blankets. Larger stockpiles should receive bunds/perimeter silt fencing if high rainfall is expected.

## 6.7 Stabilisation

All cut/fill embankments will be progressively stabilised by mulching or geotextiles/biodegradable fabric covers upon completion of individual sections of work or during periods of inactivity for short term stabilisation. Grass seeding will be required for long term/permanent stabilisation, for which hydroseeding can be utilised for more inaccessible slopes. All sediment control measures are to be kept in place until vegetation coverage has been 80% established.

## 6.8 Specific Controls Summary

Table 6 and 7 below provide a summary of the larger/significant environmental/sediment control methods, catchment sizes and expected flow rates for clean and dirty water respectively.

### Table 6: Clean water controls

| Zone | Catchment Size | Control/Method | Size | 5% AEP Storm Flow Rate ($m^3/s$) | 1% AEP Storm Flow Rate ($m^3/s$) |
|---|---|---|---|---|---|
| 2 (Catchment 1) | 9500$m^2$ | Diversion bund | See typical detail | 0.175$m^3/s$ | 0.240$m^3/s$ |
| 2 (Catchment 2) | 17560$m^3$ | Diversion bund | See typical detail | 0.323$m^3/s$ | 0.445$m^3/s$ |
| 2 (Catchment 2) | 2255$m^3$ | Diversion bund | See typical detail | 0.041$m^3/s$ | 0.057$m^3/s$ |

### Table 7: Dirty water controls

| Zone | Catchment Size | Control/Method | Size | 5% AEP Storm Flow Rate ($m^3/s$) | 1% AEP Storm Flow Rate ($m^3/s$) |
|---|---|---|---|---|---|
| 2 (Catchment 1) | 1950$m^3$ | Silt Fence | See typical detail | 0.046$m^3/s$ | 0.062$m^3/s$ |
| 2 (Catchment 2) | 6800$m^3$ | Diversion bund/channel | See typical detail | 0.160$m^3/s$ | 0.215$m^3/s$ |
| | 6800$m^3$ + 28700$m^3$ (Including new road footprint) | SRP | 1075$m^3$ (new dry pond structure to be used as temporary SRP including baffles to achieve desired length to width ratio) | 0.160$m^3/s$ + 0.625$m^3/s$ | 0.215$m^3/s$ +0.824$m^3/s$ |
| 2 (Catchment 2 - SRP Embankment) | 1430$m^3$ | Diversion bund/channel | See typical detail | 0.034$m^3/s$ | 0.045$m^3/s$ |
| | 1430$m^3$ | Decanting earth bund | ±30$m^3$ | 0.034$m^3/s$ | 0.045$m^3/s$ |
| 2 (Catchment 3) | 2825$m^3$ | Diversion bund/channel | See typical detail | 0.066$m^3/s$ | 0.089$m^3/s$ |
| | 2825$m^3$ | Decanting earth bund | ±60$m^3$ | 0.066$m^3/s$ | 0.089$m^3/s$ |

# 7 Monitoring and Maintenance

The contractor will identify the person on site responsible for the ESC measures (most likely the Site Supervisor or Specialist Environmental/ ESC Manager). The contractor will keep daily records of site inspections and any erosion or sediment issues that may arise. The records will be included with other site information required under the contract and will be available for inspection by the Engineer to the contract. These records will be retained for the duration of the contract.

All silt fences, bunds, dewatering mechanisms and site specific measures constructed for the purpose of ESC will be inspected on a daily to weekly basis and after rainfall events. Details of the inspection schedule will include, but not be limited to, the following as described in Table 8 below.

**Table 8: Monitoring and Maintenance Requirements**

| ESC | Inspection/Maintenance Requirements | Frequency |
|---|---|---|
| Chemical Treatment | • Rainfall activated treatment system will require on-going adjustments to suit runoff and site characteristics.<br>• To be serviced as outlined in an approved management plan. | Weekly & before and after rainfall |
| Clean & Dirty Water Diversion Bunds and Channels | • Check for scour and areas where a breach may or has occurred – repair immediately.<br>• Remove sediment build up deposited in the channel.<br>• Check inlets/outlets to ensure they are free from scour and erosion.<br>• Check for low spots, formation of gullies or debris – repair immediately. | Weekly & after rainfall |
| Dewatering Devices | • Check for a minimum of 100mm water clarity before pumping treated water directly offsite. It can be measured using a black target (e.g. black disc).<br>• Ensure that outlet of any pumped water pipes is not creating erosion issues.<br>• Ensure dosing rates and batch dosing methodology is accurate for flocculant treatment. | Daily, before & after rainfall |
| SRP | • Remove accumulated sediment deposits once volume reaches 20% of total pond volume using high capacity sludge pumps.<br>• Clean out forebay area after each rainfall event if sediment is present.<br>• Dispose of pumped sediment in a contained location away from overland flow paths and watercourses.<br>• Check for and repair any damages to the SRP caused by construction activities or erosion.<br>• Check inlets and outlets for obstructions and erosion. | Daily, before & after rainfall |

| | | |
|---|---|---|
| Silt Fence | • Check geotextile material for tears, broken support wires, undercutting and other damages – repair immediately.<br>• Silt build up removal required when bulges in the fabric occur, overtopping or when sediment accumulation reaches 20% of fabric height.<br>• Dispose of cleared sediment in a location away from overland flow paths and watercourses. | Weekly & after rainfall |
| Silt Sock | • Check to ensure sediment control efficiency is maintained.<br>• Accumulated sediment greater than 20% of the silt sock height should be removed, or another silt sock can be placed on top of existing.<br>• Check integrity of silt sock and media prior to reuse elsewhere on site. | Regularly & after rainfall |
| Stabilised areas | *Varies with stabilisation method:*<br>Hydroseeding/grass seeding:<br>• Apply fertilisers as required after initial hydroseeding.<br>• Water regularly to promote growth.<br>• Protect from being washed away by heavy rainfall or reseed where necessary.<br>Mulching:<br>• Replace mulch in areas of damaged cover, particularly after heavy rainfall or strong winds.<br>Geotextiles/covers/blankets:<br>• Check for tears, damage or displacement and repair, replace or reapply and secure as required. | Daily & after rainfall |
| Stabilised Entranceway | • Check quantity of aggregate and geotextile for sediment build up and deterioration – apply more aggregate as required to ensure ability of entranceway to prevent sediment leaving the site is maintained.<br>• Ensure structures used to trap runoff are cleaned out regularly as required.<br>• Where additional flows from wheel wash are generated, ensure sediment retention devices can accommodate additional flows.<br>• Regularly sweep or vacuum sealed pavements to removed sediment. | Weekly & after rainfall |
| Stormwater Inlet Protection | • Check for damage, blockages and leaks – repair immediately. Remove accumulated sediment immediately. | Daily, before & after rainfall |
| Weather forecast | • Check weather and rainfall forecast.<br>• Set up site stabilisation and prepare controls for high rainfall suitability. | Daily |

# 8 Conclusion

The ESC measures outlined in this report satisfy the regulatory standards and effectively implement the guidelines specified in GD05 for minimising impact to the receiving environment, addressing the triggers for resource consent.

This report has been development for preliminary design stage and to support the AEE as part of the NoR and resource consent application process. A finalised ESC Plan must be compiled and submitted for certification to Auckland Council prior to construction commencement, amended to suit the final detailed design and the contractor's final construction methodology.

# Appendix 1. Indicative Erosion Control Plans

## LEGEND

- PROPOSED DESIGNATION BOUNDARY
- EXISTING 1% AEP FLOOD PLAIN
- PROPOSED DRY POND
- PROPOSED NEW CULVERT
- INDICATIVE PROPOSED SW PIPE & FLOW DIRECTION
- INDICATIVE FLOW DIRECTION
- RIP RAP
- RAINGARDEN LOCATED WITHIN BERM
- BIORETENTION RAINGARDEN (WITH ATTENUATION)
- INDICATIVE HEADWALL
- INDICATIVE MANHOLE
- EXISTING MANHOLE
- INDICATIVE SCRUFFY DOME INLET MANHOLE
- INDICATIVE CATCHPIT
- INDICATIVE DROP KERB INTO RAINGARDEN
- EXISTING OVERLAND FLOW PATH
- SW — EXISTING STORMWATER PIPES
- EXISTING PROPERTY BOUNDARY
- EXISTING CONTOUR

## ESCM LEGEND

- EXISTING SWALE
- CLEAN WATER DIVERSION BUND
- 'DIRTY' WATER DIVERSION BUND
- SILT FENCE
- SAND BAG/LOG
- SILT SOCK
- CONTOUR DRAIN
- SILT STABILIZED ENTRANCEWAY
- DECANTING EARTH BUND
- EXTEND SURFACING/LAYERWORKS (DISTURBED AREAS). APPLIES TO FULL LENGTH OF TRIG ROAD AND HOBSONVILLE ROAD AS INDICATED

## GENERAL NOTES (APPLICABLE TO ALL LAYOUTS):

1. ALL ENVIRONMENTAL CONTROLS TO BE SET UP PRIOR TO COMMENCEMENT OF WORKS AND APPROVED FOR SUITABILITY BY ENGINEER.
2. CLEAN WATER DIVERSION BUNDS TO DIRECT RUNOFF TO EXISTING CROSSINGS UNTIL OFFLINE CONSTRUCTION OF NEW STORMWATER CROSSINGS HAVE BEEN COMPLETED, INCLUDING OUTFALL AND EROSION PROTECTION, AFTER WHICH CLEAN RUNOFF WILL BE DIVERTED TO NEW STORMWATER CROSSINGS.
3. STORMWATER CROSSINGS UNDER TRIG ROAD TO BE CONSTRUCTED OFFLINE ALONG NEW ALIGNMENT. DOWNSTREAM DISCHARGE FROM EXISTING CROSSINGS TO BE TEMPORARILY DIVERTED TO ALLOW FOR DRY WORKS AREA AT NEW OUTFALL POSITION.
4. WHERE EXISTING STORMWATER PIPES TIE INTO NEW NETWORK, ENSURE DOWNSTREAM STORMWATER PIPES AND OUTFALLS ARE COMPLETED PRIOR TO CONNECTION.
5. TRAFFIC MANAGEMENT PLAN TO BE SUPPLIED BY CONTRACTOR FOR ZONE 2 AND 3 OF WORKS FOR WHICH FULL ROAD RECONSTRUCTION IS EXPECTED WITH DETAILS OF PROGRESSIVE CHANGES TO SEDIMENT CONTROL METHODS WITHIN THE CARRIAGEWAY.
6. WORKS AND ASSOCIATED EROSION AND SEDIMENT CONTROL MEASURES TO BE STAGED TO MAINTAIN ACCESS TO EXISTING PROPERTIES THROUGHOUT.
7. USE CUT AND COVER METHOD FOR OPEN TRENCH INSTALLATION.
8. ALL STOCKPILES TO BE COVERED DURING PERIODS OF INACTIVITY.
9. ALL EXISTING STORMWATER INLETS AND NEW INLETS DRAINING INTO EXISTING STORMWATER SYSTEMS, TO RECEIVE SEDIMENT PROTECTION.
10. ALL SEDIMENT CONTROL MEASURES TO REMAIN IN PLACE POST CONSTRUCTION UNTIL >80% STABILIZED SURFACES HAVE BEEN ESTABLISHED.
11. ANY SEDIMENT LADEN RUNOFF COLLECTED OFF THE TRIG ROAD SURFACE AREA WILL BE COLLECTED VIA THE NEW STORMWATER PIPE NETWORK AND DISCHARGED INTO THE SEDIMENT RETENTION POND FOR TREATMENT.
12. ANY SEDIMENT LADEN RUNOFF COLLECTED OFF THE ROAD SURFACE OF HOBSONVILLE ROAD, JUST EAST OF THE INTERSECTION, WILL BE COLLECTED VIA THE NEW STORMWATER PIPE NETWORK AND DISCHARGED INTO THE PROPOSED ATTENUATION POND / RAINGARDEN (TO USED AS A TEMPORARY TREATMENT DEVICE DURING CONSTRUCTION) FOR TREATMENT.
13. NEW SLOTTED KERB ENTRY INTO AND OUT OF THE PROPOSED RAINGARDENS WITHIN THE BERM ARE TO BE ADDED ONLY AFTER FULL SITE STABILIZATION IS ACHIEVED AND ROAD SURFACE RUNOFF IS NO LONGER SEDIMENT LADEN. RAINGARDENS ARE TO RECIEVE PERIMETER SEDIMENT PROTECTION MEASURES AND TEMPORARY COVERS DURING THIS PERIOD UNTIL OPEN FOR USE.

ORIGINAL IN COLOUR

**NOT FOR CONSTRUCTION**

| REV | REVISIONS | DRAWN | DATE |
|---|---|---|---|
| B | ISSUED FOR NOTICE OF REQUIREMENT LODGEMENT | VDLT | DEC. 2022 |
| A | FOR NOTICE OF REQUIREMENT AND RESOURCE CONSENT | VDLT | AUG. 2020 |

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|---|---|---|
| SURVEYED | | |
| DRAWN | V. DELA TORRE | 20.08.20 |
| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Project: **SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title: EROSION & SEDIMENT CONTROL LEGEND AND GENERAL NOTES

Drawing Status: **FOR LODGEMENT**

Drawing Date: 07.12.2022

A1 Scales: NTS | A3 Scales: NTS

Discipline: ENVIRONMENTAL

Drawing No.: SGA-DRG-NWE-002-EN-1500

Revision: **B**

SGA-DRG-NWE-002-EN-1500 Drawing Plotted 4 Dec 2022 11:05 AM

KEY PLAN

NOTE:
FOR GENERAL NOTES AND LEGEND
REFER DWG No. SGA-DRG-NWE-002-EN-1500

INSET A-A

MATCHLINE SEE INSET A-A

SILT FENCE AROUND
PIPE EXCAVATION AREA

NEW RAINGARDEN TO UTILIZED AS A TEMPORARY TREATMENT DEVICE FOR SETTLEMENT OF SEDIMENT LADEN RUNOFF FROM THE NEARBY WORKS, AS WELL AS ANY ROAD SURFACE RUNOFF PROPOSED TO DRAIN INTO THE RAINGARDEN VIA THE NEW STORMWATER PIPE SYSTEM

PROPOSED LAYDOWN AREA
AND PERIMETER SILT FENCE
WITH INCREMENTAL RETURNS

MATCHLINE - REFER DRG-NWE-002-EN-1502

SILT FENCING DOWNSTREAM OF
MINOR FILL EMBANKMENT
INCLUDING INCREMENTAL RETURNS

HOBSONVILLE ROAD

ROAD HIGHPOINT

LUCKENS ROAD

SILT SOCKS TO BE INSTALLED AROUND
NEARBY EXISTING DOWNSTREAM INLETS

ENTIRE ROAD WIDTH ONWARDS TO
BE REDEVELOPED AND DISTURBED

SILT SOCK DOWNSTREAM OF
MINOR FILL EMBANKMENT

SILT SOCK DOWNSTREAM OF
MINOR FILL EMBANKMENT

SILT SOCK DOWNSTREAM OF NEW
ROAD AND FOOTPATH CONSTRUCTION

ORIGINAL IN COLOUR

"AERIAL IMAGERY SUPPLIED BY NEARMAP AUSTRALIA PTY LTD"

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|---|---|---|---|
| B | ISSUED FOR NOTICE OF REQUIREMENT LODGEMENT | VDLT | DEC. 2022 |
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| DRAWN | V. DELA TORRE | 20.08.20 |
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| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Project:
**SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title:
EROSION & SEDIMENT CONTROL PLAN
SHEET 1 OF 5

Drawing Status: **FOR LODGEMENT**
Drawing Date: 07.12.2022
A1 Scales 1:500 | A3 Scales 1:1000
Discipline: ENVIRONMENTAL
Drawing No.: SGA-DRG-NWE-002-EN-1501
Revision: B

SGA-DRG-NWE-002-EN-1501 Drawing Plotted: 16 Dec 2022 11:05 AM


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|---|---|---|
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| DRAWN | V. DELA TORRE | 20.08.20 |
| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R.SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

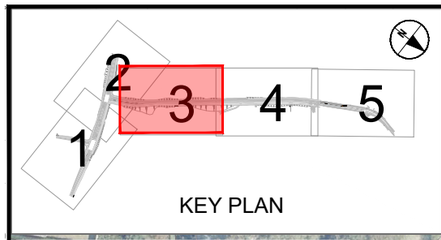
TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Project:
**SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title:
EROSION & SEDIMENT CONTROL PLAN
SHEET 2 OF 5

Drawing Status: **FOR LODGEMENT**
Drawing Date: 07.12.2022
A1 Scales 1:500 | A3 Scales 1:1000
Discipline: ENVIRONMENTAL
Drawing No. SGA-DRG-NWE-002-EN-1502
Revision: B




KEY PLAN

NOTE:
FOR GENERAL NOTES AND LEGEND
REFER DWG No. SGA-DRG-NWE-002-EN-1500

CATCHMENT 2 UPSTREAM CATCHMENT AREA TO BE DIVERTED BY CLEAN WATER DIVERSION BUNDS

NEW UPSTREAM INLET AND RIPRAP EROSION PROTECTION. EXISTING LOW POINT TO BE SLIGHTLY SHIFTED WITH LOCALIZED EARTHWORKS SHAPING TO ACCOMMODATE FOR NEW PIPE ALIGNMENT

CLEAN WATER DIVERSION BUND AROUND PROPOSED RAINGARDEN, INCLUDING GRASS BUFFER AT INLET, INITIALLY DRAINING INTO EXISTING STORM CROSSING AND DIVERTED TO NEW CROSSING UPON COMPLETION

EXISTING Ø375mm CONCRETE PIPE INLET AND OUTFALL TO BE DEMOLISHED AFTER COMPLETION OF NEW CROSSING AND CLEAN WATER DIVERSION BUND HAS BEEN MODIFIED TO DRAIN TOWARDS NEW CROSSING

ANY SEDIMENLY LADEN RUNOFF ENTERING INTO PROPOSED RAINGARDEN FROM THE ROAD SURFACE PIPE NETWORK OR SURROUNDING AREA OF WORKS WILL BE DIRECTED TO SRP FOR TREATMENT

CATCHMENT 2 DOWNSTREAM.
DIRTY WATER DIVERSION BUND TO DISCHARGE RUNOFF (BETWEEN TOP OF EMBANKMENT AND BUND) INTO SEDIMENT RETENTION POND

SILT FENCE DOWNSTREAM OF FILL EMBANKMENT INCLUDING INCREMENTAL RETURNS

LOCALISED SEDIMENT CONTROL MEASURES TO BE IN PLACE DURING TREE REMOVAL. EARTH TO BE COMPACTED AND STABILIZED

TRIG ROAD

MATCHLINE - REFER DRG-NWE-002-EN-1504

MATCHLINE - REFER DRG-NWE-002-EN-1502

CATCHMENT 3 DOWNSTREAM.
DIRTY WATER DIVERSION BUND TO DISCHARGE RUNOFF (BETWEEN TOP OF EMBANKMENT AND BUND) INTO DECANTING EARTH BUND

SILT FENCE ADJACENT ADDITIONAL PROTECTION

TEMPORARY CONTOUR DRAIN

DECANTING EARTH BUND WITH STABILIZED OUTLET INTO TRIG STREAM

CATCHMENT 3

CATCHMENT 2

NEW PERMANENT DRY POND TO ACT AS TEMPORARY SEDIMENT RETENTION POND INVERT = 49.2m

FLOW CONTROL OUTLET WITH SCRUFFY DOME. INVERT LEVEL = 48.000
INLET LEVELS/SIZES TO ACCOMMODATE FOR SEDIMENT POND REQUIREMENTS AND MODIFIED AFTER COMPLETION OF WORKS TO DRY POND DESIGN DETAIL

TRIG STREAM (UPPER BRANCH)

DECANTING EARTH BUND WITH STABILIZED OUTLET INTO TRIG STREAM

NEW DOWNSTREAM OUTLET AND RIPRAP EROSION PROTECTION

DESIGN DRY POND OUTLET TO BE UTILIZED AS SEDIMENT RETENTION POND OUTLET, DISCHARGING TO TRIG STREAM INCLUDING RIPRAP EROSION PROTECTION

CHEMICAL TREATMENT DOSING STATION

DIRTY WATER DIVERSION BUND TO DISCHARGE RUNOFF FROM POND EMBANKMENT INTO DECANTING EARTH BUND

ORIGINAL IN COLOUR

"AERIAL IMAGERY SUPPLIED BY NEARMAP AUSTRALIA PTY LTD"

**NOT FOR CONSTRUCTION**

| REV | REVISIONS | DRAWN | DATE |
|---|---|---|---|
| B | ISSUED FOR NOTICE OF REQUIREMENT LODGEMENT | VDLT | DEC. 2022 |
| A | FOR NOTICE OF REQUIREMENT AND RESOURCE CONSENT | VDLT | AUG. 2020 |

| | | |
|---|---|---|
| SURVEYED | | |
| DRAWN | V. DELA TORRE | 20.08.20 |
| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

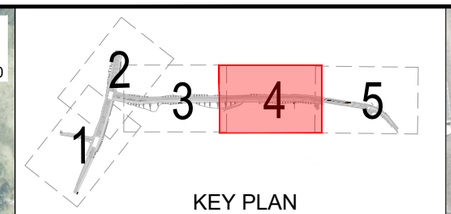
WAKA KOTAHI NZ TRANSPORT AGENCY

Project
**SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title:
EROSION & SEDIMENT CONTROL PLAN
SHEET 3 OF 5

Drawing Status: **FOR LODGEMENT**
Drawing Date: 07.12.2022
A1 Scales 1:500 | A3 Scales 1:1000
Discipline: ENVIRONMENTAL
Drawing No. SGA-DRG-NWE-002-EN-1503
Revision: B

NOTE:
FOR GENERAL NOTES AND LEGEND
REFER DWG No. SGA-DRG-NWE-002-EN-1500




CATCHMENT 1 UPSTREAM CATCHMENT AREA TO BE DIVERTED BY CLEAN WATER DIVERSION BUNDS

CLEAN WATER DIVERSION BUND, INCLUDING GRASS BUFFER AT INLET, INITIALLY DRAINING INTO EXISTING STORM CROSSING AND DIVERTED TO NEW CROSSING UPON COMPLETION

EXISTING Ø150mm STORMWATER PIPE AND INLET AND OUTFALL TO BE DEMOLISHED AFTER COMPLETION OF NEW CROSSING AND CLEAN WATER DIVERSION BUND HAS BEEN MODIFIED TO DRAIN TOWARDS NEW CROSSING

NEW UPSTREAM INLET AND RIPRAP EROSION PROTECTION

NEW Ø525mm CONCRETE PIPE CROSSING COMPLETED OFFLINE

SILT SOCK/COIR LOG

ENTIRE ROAD WIDTH ONWARDS TO BE REDEVELOPED AND DISTURBED

REFER DRG-NWE-002-EN-1503

MATCHLINE - REFER DRG-NWE-002-EN-1505

ROAD LOWPOINT

ROAD HIGHPOINT

ROAD LOWPOINT

TRIG ROAD

-1.1%

-1.4%

-4.6%

-4.2%

-3.5%

-2.5%

CATCHMENT 2

CATCHMENT 1

55.00

55.00

150 STD

-33.3%

-33.3%

PROPOSED NEW Ø600mm RCRRJ PIPE CROSSING

CATCHMENT 2 DOWNSTREAM DIRTY WATER DIVERSION BUND TO DISCHARGE RUNOFF (BETWEEN TOP OF EMBANKMENT AND BUND) INTO SEDIMENT RETENTION POND

SILT FENCE

SILT SOCK FOR EXISTING SW INLET PROTECTION

INITIAL STABILIZED ENTRANCEWAYS

PROPOSED SITE ESTABLISHMENT AREA AND PERIMETER SILT FENCE, BOTH SIDES OF OVERLAND FLOW PATH

50.00

LONG TERM SILT FENCE INCLUDING RETURNS AND GRASS BUFFER ADJACENT TO STREAM OUTLET. TO REMAIN UNTIL EMBANKMENT PERMANENT STABILIZATION HAS BEEN ESTABLISHED. POSITION AFTER SHIFTED UP[ TOWARDS EMBANKMENT TOE AFTER FILLING IS COMPLETE

NEW DOWNSTREAM OUTFALL AND RIPRAP EROSION PROTECTION

-12.3%

-10.9%

-8.5%

-9.4%

SILT FENCE ADJACENT STREAM EDGE FOR ADDITIONAL PROTECTION

45.00

CATCHMENT 2

CATCHMENT 1

WAIARORIHA STREAM (UPPER BRANCH)

ORIGINAL IN COLOUR

"AERIAL IMAGERY SUPPLIED BY NEARMAP AUSTRALIA PTY LTD"

**NOT FOR CONSTRUCTION**

Drawing Plotted: 14 Dec 2022 11:06 AM
SGA-DRG-NWE-002-EN-1504.DWG

| REV | REVISIONS | DRAWN | DATE |
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| SURVEYED | | |
| DRAWN | V. DELA TORRE | 20.08.20 |
| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

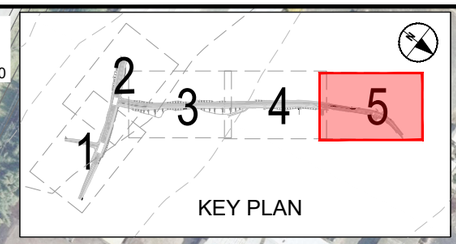
WAKA KOTAHI NZ TRANSPORT AGENCY

Project
**SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title:
EROSION & SEDIMENT CONTROL PLAN
SHEET 4 OF 5

Drawing Status: **FOR LODGEMENT**
Drawing Date: 07.12.2022
A1 Scales 1:500 | A3 Scales 1:1000
Discipline: ENVIRONMENTAL
Drawing No.: SGA-DRG-NWE-002-EN-1504
Revision: **B**

NOTE:
FOR GENERAL NOTES AND LEGEND
REFER DWG No. SGA-DRG-NWE-002-EN-1500




MATCHLINE - REFER DRG-NWE-002-EN-1504

STATE HIGHWAY 18

50.00

55.00

END OF CATCHMENT. DRAINAGE BEYOND THIS POINT TO REMAIN AS PER EXISTING

EXISTING BRIDGE

SILT SOCK TO MANAGE RUNOFF FROM DISTURBED AREA (NEW CYCLE AND FOOTPATH EXTENSION)

CLEANWATER DIVERSION BUND DRAINING INTO EXISTING INLET

-7.6%

-6.3%

TRIG ROAD

SILT SOCK TO MANAGE RUNOFF FROM DISTURBED AREA

-3.0%

TEMPORARY SAND BAGS FOR CLEAN WATER DIVERSION. TO DISCHARGE CLEAN RUNOFF INTO CARRIAGEWAY

-3.5%

SILT SOCK FOR EXISTING SW INLET PROTECTION

-7.2%

SILT SOCK ALONG EASTERN ROAD BOUNDARY DOWNSTREAM SIDE OF MINOR WORKS TO BERM AND KERB

-7.3%

-7.0%

EXISTING SCRUFFY DOME INLET

-10.8%

-10.9%

-8.7%

SILT FENCE ALONG EASTERN ROAD EDGE DOWNSTREAM SIDE OF DISTURBED AREA (NEW CYCLE AND FOOT PATH EXTENSION)

SILT SOCK FOR EXISTING SW INLET PROTECTION

EXISTING SWALE

ORIGINAL IN COLOUR

"AERIAL IMAGERY SUPPLIED BY NEARMAP AUSTRALIA PTY LTD"

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| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

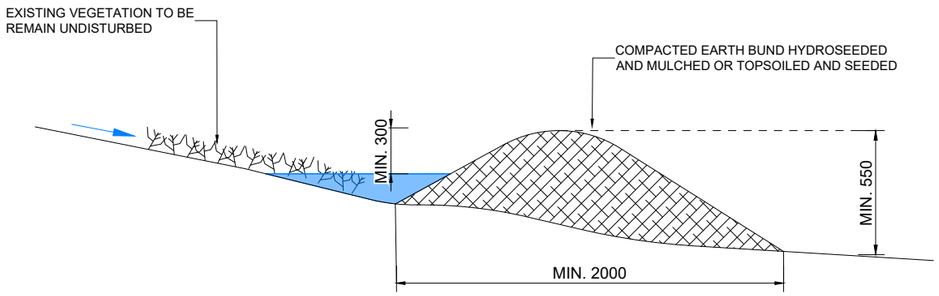
WAKA KOTAHI NZ TRANSPORT AGENCY

Project
**SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title:
EROSION & SEDIMENT CONTROL PLAN
SHEET 5 OF 5

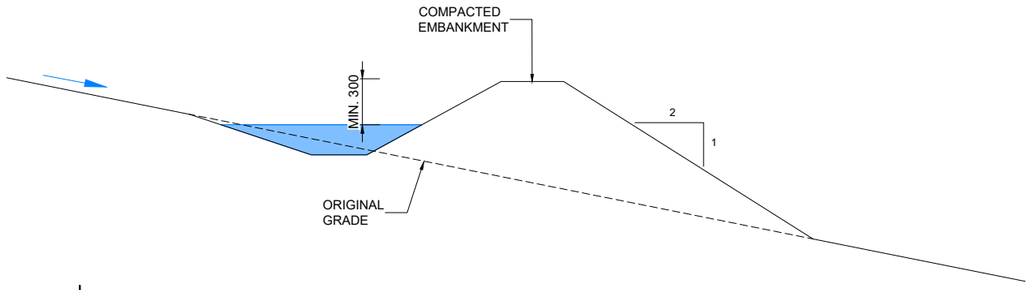
Drawing Status: **FOR LODGEMENT**
Drawing Date: 07.12.2022
A1 Scales 1:500 | A3 Scales 1:1000
Discipline: ENVIRONMENTAL
Drawing No.: SGA-DRG-NWE-002-EN-1505
Revision: B

SGA-DRG-NWE-002-EN-1505.DWG | Drawing Plotted 14 Dec 2022 - 11:08:37



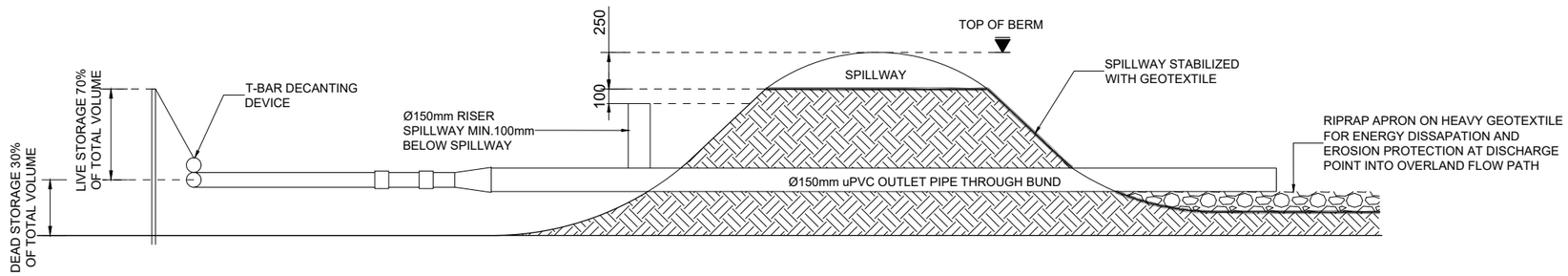

## B | TYPICAL CROSS SECTION : CLEAN WATER DIVERSION BUND

Scale 1:20



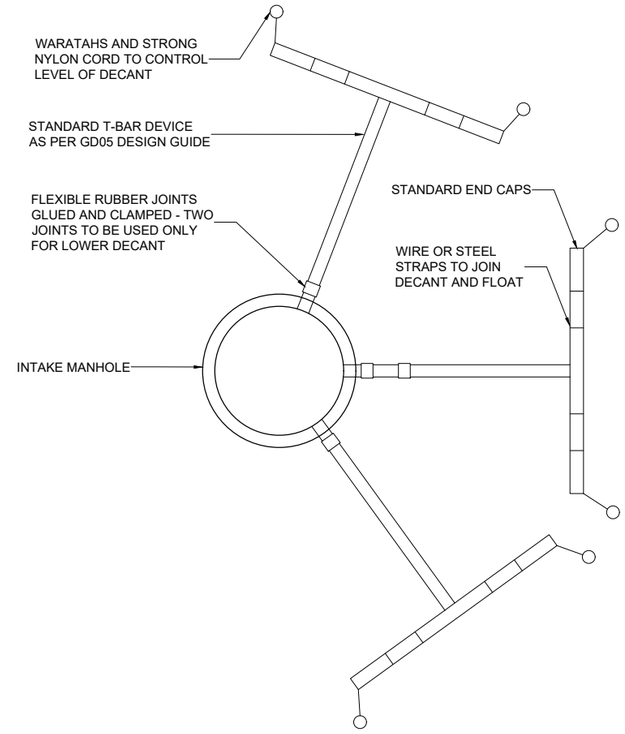

## C | TYPICAL CROSS SECTION : DIRTY WATER DIVERSION BUND

Scale 1:20



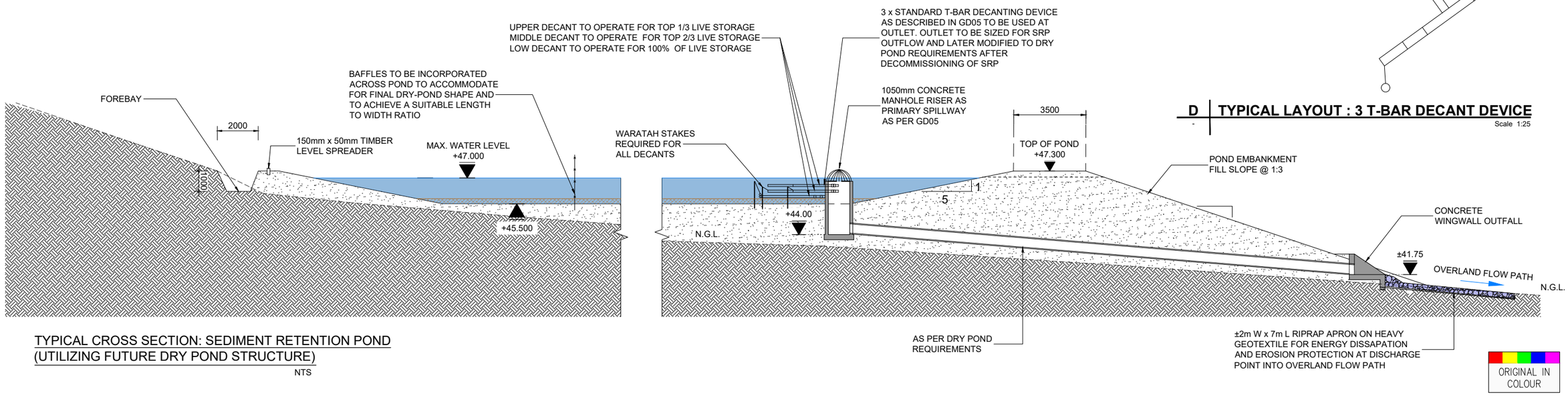

## A | TYPICAL CROSS SECTION : DECANTING EARTH BUND

Scale 1:20




## D | TYPICAL LAYOUT : 3 T-BAR DECANT DEVICE

Scale 1:25




## TYPICAL CROSS SECTION: SEDIMENT RETENTION POND (UTILIZING FUTURE DRY POND STRUCTURE)

NTS

ORIGINAL IN COLOUR

**NOT FOR CONSTRUCTION**

| REV | REVISIONS | DRAWN | DATE |
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| DRAWN | V. DELA TORRE | 20.08.20 |
| DRAWING CHECK | J. DELA TORRE | 20.08.20 |
| DESIGN | N. WOLFAARDT | 20.08.20 |
| DESIGN REVIEW | R. SEYB | 20.08.20 |
| APPROVED | B. BUSNARDO | 07.12.2022 |

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Project: **SUPPORTING GROWTH PROGRAMME**
**NORTH WEST - HIF TRIG ROAD (SOUTH)**

Drawing Title: EROSION & SEDIMENT CONTROL
SEDIMENT RETENTION DEVICES

Drawing Status: **FOR LODGEMENT**

Drawing Date: 07.12.2022

A1 Scales: AS SHOWN | A3 Scales: HALF SCALE

Discipline: ENVIRONMENTAL

Drawing No.: SGA-DRG-NWE-002-EN-1510

Revision: **B**

SGA-DRG-NWE-002-EN-1510.DWG Drawing Plotted: 14 Dec 2022 11:07 AM