Eastern Busway

Eastern Busway – EB2/ EB3R

Erosion and Sediment Control Plan

Document Number: EB234-1-PL-RP-Z2-000037

Eastern Busway – EB2/EB3R

Document History and Status			
Rev	**Date**	**Author**	**Status**
A	8/03/2022	Mathew Campbell	Draft Document
B	21/04/2022	Campbell Stewart	Draft Document
C	19/07/2022	Campbell Stewart	Final Draft

Document Approval					
Rev	**Action**	**Name**	**Position**	**Date**	**Signature**
A	Reviewed by	Craig Redmond	Executive Consultant	28/03/2022	On file
B	Reviewed by	Craig Redmond	Executive Consultant	21/04/2022	On file
C	Reviewed by	Nicola Bishop	Alliance Senior RMA Planner	21/07/2022	On file
1	Approved by	Roger McDonald	Principal Planner	25/07/2022	On file

Table of Contents

Figures

Tables

List of Abbreviations and Definitions

Abbreviation and Definitions	Description
AT	Auckland Transport
CEMP	Construction Environmental Management Plan
CHTMP	Chemical Treatment Management Plan
CPESC	Certified Professionals in Erosion and Sediment Control
CTMP	Construction Traffic Management Plan
DEB	Decanting Earth Bunds
EB2	Eastern Busway 2 (Pakuranga Town Centre)
EB3 Residential/ EB3R	Eastern Busway 3 (SEART to Gossamer Drive)
EBA	Eastern Busway Alliance
ESCP	Erosion and Sediment Control Plan
GD05	Auckland Unitary Council's *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region Guideline Document 2016/005*
km	Kilometre(s)
m	Metre(s)
m^2	Square Metre(s)
m^3	Cubic Metre(s)
NoR	Notice of Requirement
RRF	Reeves Road Flyover
RMA	Resource Management Act 1991
SSESCP	Site Specific Erosion and Sediment Control Plan

1 Introduction

Eastern Busway Alliance (EBA) has developed this Erosion and Sediment Control Plan (ESCP) on behalf of Auckland Transport (AT) to support the following stages of the Eastern Busway Project:

- The application for a notice for requirement (NoR) and resource consents in relation to Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station; and
- The applications for resource consents in relation to Eastern Busway 3 – Residential (EB3 Residential) – Ti Rakau Drive from the South Eastern Arterial (SEART) to Pakuranga Creek, including Edgewater and Gossamer Intermediate Bus Stations.

The combined EB2 and EB3 work packages are hereon referred to as 'EB2/EB3R'.

1.1 Purpose and Scope

The purpose of the ESCP is to provide overarching principles and procedures to manage the environmental impacts associated with erosion and sediment control (ESC) during construction of EB2/EB3R. The ESCP is to be read in conjunction with the following appended plans and procedures:

- Appendix A - Chemical Treatment Management Plan.
- Appendix B - Dewatering Procedures.

The ESCP and its appendices have been developed in accordance with:

- The relevant NoR and resource consent conditions submitted with the application
- Auckland Unitary Council's *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region Guideline Document 2016/005* ("GD05")
- Eastern Busway – Sections EB2 and EB3 Residential - Erosion and Sediment Control Effects Assessment (2022) prepared by Southern Skies ("ESC Technical Assessment")

This ESCP may be updated throughout the course of EB2/EB3R to reflect changes to construction techniques or the physical environment. All material changes to the ESCP will require recertification by the Auckland Council. Further details on the recertification process are set out ins Section 1.5 of this ESCP.

Site Specific Sediment Control Plans (SSESCPs) will be prepared for individual work areas and activities throughout the construction process. SSECPs will be developed in accordance with the overarching ESCP (this plan). Details on the SSECP preparation and approval process are provided in Section 1.5.2 of this ECSP.

1.1.1 Erosion and Sediment Control Plan Objectives

The ESCP objectives are as follows:

a) Avoid to the extent practicable, and otherwise minimise to an acceptable level, adverse sediment effects on the receiving environment;
b) Provide an overview of construction methods and provide specific erosion and sediment control works for each construction stage (location, dimensions, capacity) in accordance with industry best practice, as well as GD05:

c) Provide supporting calculations and design drawings where necessary;
d) Set out monitoring and maintenance requirements to demonstrate compliance with legal requirements;
e) Liaise closely with the Auckland Council and its agents during construction over matters of erosion and sediment control; and
f) Provide a safe and healthy working environment for all staff on, or near the site.

1.2 Project Description

As noted in section 1, EB2/EB3R relates to stages EB2 and EB3R of the overarching Eastern Busway Project.

EB2 commences from the intersection of William Roberts Road and Pakuranga Road and traverses west to the Ti Rakau Drive / Pakuranga Highway/South-Eastern Arterial (SEART) intersection.

EB2 will improve safety by simplifying intersections and the provision of extra crossings to the town centre (including more regular crossing intervals). New cycle lanes and walking paths will make it possible to walk or cycle off-road, improving accessibility and safety around the town centre.

Key elements of EB2 include:

- Pakuranga Station - the key station for Pakuranga/Howick users of the busway leading to the Panmure Station and Botany; and
- Reeves Road Flyover - provides for local traffic to bypass the heavily congested Pakuranga Road and Ti Rakau Drive route to the SEART via an overpass between SEART and Pakuranga Road (north).

An overview of the proposed works is shown in Figure 1 below.

Figure 1 EB2 Overview

EB3R will provide the extension of the Rapid Transport Network from SEART in the west to Pakuranga Creek in the east, including additional walking and cycling infrastructure. The construction of the busway within EB3R will involve a staged approach to construction to minimise disruption on the existing road network.

Key elements of EB3R include:

- A separated busway through the centre of Ti Rakau Drive
- The construction of two new westbound lanes for general traffic
- Two intermediate bus stations, being Edgewater Station and Gossamer Station (interim design)
- The western abutment for a future bridge across Pakuranga Creek, adjacent to the existing Ti Rakau Drive Bridge
- Intersection upgrades along Ti Rakau Drive, including William Roberts Road and Gossamer Drive.

The location of EB3R is shown in yellow in Figure 2 below.

Figure 2 EBRR location (shown in yellow)

1.3 Roles and Responsibilities

The team responsible for implementing the ESCP is set out in Table 1 below. A team approach shall be taken when planning and implementing any of the erosion and sediment control methodologies and measures set out in this ESCP. Team members have the appropriate experience, project involvement and responsibility to ensure that all relevant aspects of EB2/EB3R are considered when making decisions on ESCP implementation. This will ensure adequate resources, commitment and expertise is applied to erosion and sediment controls throughout EB2/EB3R life cycle (design through to dis-establishment).

Table 1 Roles and Responsibilities

Name	Role	Contact Details	Responsibility
Matt Zame	Project Director	matt.zame@easternbusway.nz	Overall Project Responsibility
Andrew Gibbard	Construction Manager	andy.gibbard@easternbusway.nz	Overall responsibility for ESCP and SSESCP Compliance.

Michael Cassidy	Environmental Lead	michael.cassidy@easternbusway.nz	Responsibility for the day to day ESCP implementation and the regular maintenance and auditing required. Review and approval of SSESCP for submission to Auckland Council.
Tommy Temple	Environmental Supervisor	tommy.temple@easternbusway.nz	Support the environmental Lead.
Campbell Stewart	ESC Technical Specialist	Campbell@Southernskies.co.nz 021 837 824	Suitably qualified and experienced ESC specialist who prepares SSESCPs and oversees implementation

The earthworks operations will be split into separate management zones for EB2 and EB3R. Each zone will have a civil works team that will be responsible for the day-to day ESC activities. Each team will report to the Environmental Lead stated in Table 1.

Dedicated project wide Environmental Engineering resources will coordinate with Project Engineers/Superintendents/Site Supervisors/Site Foremen regarding the implementation, management and reporting of Environmental requirements.

Zone Managers/Area Leads will report directly to the Construction Manager and will have direct day-to-day responsibility for the operation and maintenance of the earthworks and ESC within their zone/area, supported and advised by the Environmental Engineers.

1.4 ESC Technical Specialist

An appropriately qualified and experienced person (identified as the ESC technical specialist in Table 1) will be the lead advisor in all ESC design, construction, maintenance and monitoring. SouthernSkies Environmental Limited (SouthernSkies) will fill the techncial specialsit role, led by Campbell Stewart. Mr Stewart held the same role in numerous other transport infrastructure projects thorughout New Zealand. SouthernSkies personnel are currently Certified Professionals in Erosion and Sediment Control (CPESC) who will fulfill the "appropriately experienced and qualified professional" role in all design and certification of ESC controls.

Prior to earthworks commencing, the technical specialist will assess whether the erosion and sediment controls have been constructed in accordance with the relevant SSESCP. Provided compliance with SSESCP has been achieved, the technical specialist will sign a certificate to certify the works which will be submitted to the Auckland Council. The certified controls are to include the decanting earth bunds, sediment retention pond, clean and dirty water diversion bunds, silt fences, cesspit protection and stabilised construction entrances as required. The request for certification for these measures is to be supplied immediately on completion of their construction.

1.5 ESCP Certification

As stated in Section 1.1 the ESCP provides overarching principles and procedures to manage the environmental impacts associated with erosion and sediment control (ESC) during construction of EB2/EB3R and SSESCPs will be developed throughout the construction process to provide detail on ESC measures. The ESCP and the SSESCPs are subject to separate review and approval processes as discussed in Section 1.5.1 and 1.5.2 below.

1.5.1 ESCP Certification and Update

Once certified, minor amendments as a result of changes in design, construction materials, methods or management of effects can be made to the ESCP without the need to seek recertification provided that the amendments are agreed to by Auckland Council, prior to the implementation of any changes.

The ESCP may be submitted in parts or stages to address activities or to reflect the staged implementation of the Project. If submitted in part, management plans will clearly show the linkage with plans for adjacent stages and interrelated activities.

Any amendments to the certified ESCP that may result in a materially different outcome/effect will be submitted to Auckland Council to certify that these amendments are consistent with the relevant designation and resource consent conditions prior to implementation.

If no written response is received from Auckland Council within 10 working days of the ESCP being submitted for certification, the management plans will be deemed to have certification and works can commence.

1.5.2 Site Specific Erosion and Sediment Control Plan Approval Process

Whilst the ESCP sets out the overarching approach to ESC management throughout the construction phase of EB2/EB3R, numerous SSESCMPs will be developed in accordance with the ESCP to provide further detail on ESC management in specific areas of works. The SSESCMPs will not introduce any material changes to the ESCP and will be submitted to the Auckland Council in accordance with Section 1.5.1 above. No works will commence in any area until the SSESCP has been certified for that particular area.

2 Designation and Resource Consent Condition Requirements

The ESCP has been prepared in accordance with the relevant designation and resource conditions contained in the condition set submitted with the application. This document is intended to provide a framework and information that will assist in the implementation of these requirements.

If there is a conflict between the management plan and the corresponding legislative requirements, including consent conditions, then the legislative requirements shall prevail.

3 Potential Impact of Earthworks on the Environment

3.1 Overview of Earthworks

3.1.1 Protection of Waterways

All watercourses affected by construction will be protected from adverse effects of sediment by applying the principles and practices outlined in this ESCP.

The Tamaki River is a significant waterway of the region, and has significant cultural, ecological and community values.

3.1.2 Key Waterway Construction Effects on the Environment

Short-term effects on the environment are principally those associated with construction related earthworks. When compared to the process of natural erosion, construction related earthwork activities dramatically increase erosion rates. This is because during earthwork activities, soil particles become detached from the ground surface making them easier to transport via stormwater to the downstream receiving environment. Consequently, if best practice ESC measures are not established to mitigate this increase in sediment runoff, one or several of the following adverse environmental effects may occur to the downstream receiving environment:

a) Smothering of aquatic life by build-up of sediment in the bed of waterbodies

b) Alteration of habitats

c) Abrasive action against aquatic life (e.g. increasing susceptibility to disease)

d) Scouring of algae (i.e. aquatic life food supply)

e) Increased turbidity

f) Temperature change (associated with turbidity)

g) Reduction in biological productivity due to increased turbidity and associated decrease in photosynthetic activity

h) Accumulation of contaminants transported by sediments

i) Reduced aesthetic value

j) Dust nuisance from exposed earthwork surfaces

k) Risks to vehicles and pedestrians.

Section 4 of the ESCP outlines the erosion and sediment control management practices and principles that will be adopted for this Project to mitigate the short-term effects of erosion and increased sediment during construction.

3.2 Staging and Sequencing of Works

The high-level construction programme set out in Section 3.3 of the Construction Environmental Management Plan (CEMP), indicates that earthworks will be required over four years. The areas to be worked in each year will vary based on construction programming, and progressive and permanent stabilisation. The estimated earthwork areas and volumes are detailed in Table 2 and Table 3 below[1].

[1] Note: Within Tables 2 and 3, estimated earthworks duration includes the cut and earth fill programmed timeframes. The imported aggregate filling operations (aggregate defined as a stabilised product in GD05) have not been included in the estimated earthwork durations as that involves the placement of non-erodible material. In some instances the days will be continuous, in others they will be staged. They have been provided to give context in regard to the duration of earthworks.

Table 2 EB2 Earthworks Area and Volumes

Area	Cut Material m³	Fill Material m³	Earthworks Area m²	Estimated Earthworks Duration
SEART Off ramp	4,000	4,400	17,000	14 days
Reeves Road Flyover abutment ramps (north and south) and WRR cul de sac	15,675	3,900	13,000	74 days
Ti Rakau Drive Widening, Pakuranga Plaza	1,500	400	5,000	15 days
Ti Rakau Drive Widening, Pakuranga Plaza [Milling Operations]	10,300	Refer above	N/A	N/A
Main Site Compound and Laydown	0	200	N/A	N/A
Trenching Operations	Cut to fill trenching operations estimated 8,825	1,100	N/A	Trenching operations sequenced throughout project
Total	30,000	10,000	35,000	103 days

Table 3 EB3R Earthworks Area and Volumes

Area	Cut Material m³	Fill Material m³	Earthworks Area m²	Estimated Earthworks Duration
Ti Rakau Drive Widening, EB2 to EB3C (southwest side)	10,800	11,000	34,500	38 days
Ti Rakau Drive Widening, Gossamar Dr to EB3C (north side)	1,600	3,750	6,500	9 days
Ti Rakau Drive Widening, [Milling Operations]	7,495	Refer above	N/A	N/A

Residential boundary clearance area beyond earthworks design footprint	**N/A**	**N/A**	**27,000**	**N/A**
Trenching: water main and stormwater pipelines, combined service trenching (large and deep pipe work)	**Cut to fill trenching operations estimated 7,600**	**900**	**N/A**	**Trenching operations sequenced through project**
Total	**20,000**	**15,650**	**41,000 (design EW) 27,000 (additional clearance)**	**47 days**

With the exception of the new SEART off ramp, the widening of Ti Rakau Drive, and the structural fill associated with the Reeves Road Flyover, EB2/EB3R includes a wide range of small earthworks activities that will be based on the "cut and cover" methodology, supplemented by traditional ESC measures.

The new SEART off ramp, the widening of Ti Rakau Drive, and the structural fill associated with the Reeves Road Flyover, whilst larger and more complex filling operations in regard to EB2/EB3R, will primarily use aggregate as the fill material, ensuring exposed areas are minimised at any given time.

A significant driver of this staged and progressive approach is the nature of EB2/EB3R working adjacent to a live road network with limited construction space.

The indicative staging generally involves:

EB2

- Construction of the SEART (offline). Once completed traffic can be relocated to the new SEART;
- Construction of the Reeves Road Flyover. The southern abutment works can now be undertaken offline as the traffic is redirected onto the new SEART. The northern abutment works can be undertaken off line.
- Ti Rakau Drive and Pakuranga Plaza works to be tightly staged works (milling, resealing, services etc) dictated by traffic management requirements.

EB3R

- The widening of Ti Rakau Drive (west). Offline initial earthworks operation. Once completed traffic can be relocated to the new north bound lanes.
- Ti Rakau Drive (central). The central lanes will now be milled, resealed, services and bus stations constructed.
- Ti Rakau Drive (east). Milling, resealing, services to final south bound lane design.

Due to the gentle slopes of the area, the relatively small area of earthworks proposed and the staged nature of the works incorporating progressive stabilisation, the risk of significant sediment discharges is low.

4 Construction Erosion and Sediment Control System

4.1 ESC Design Standard

All erosion and sediment control measures implemented through the extent and duration of EB2/EB3R will be designed, constructed and maintained in accordance with GD05.

4.2 ESC Design Principles

EB2/EB3R will adopt and implement the following ESC design principles:

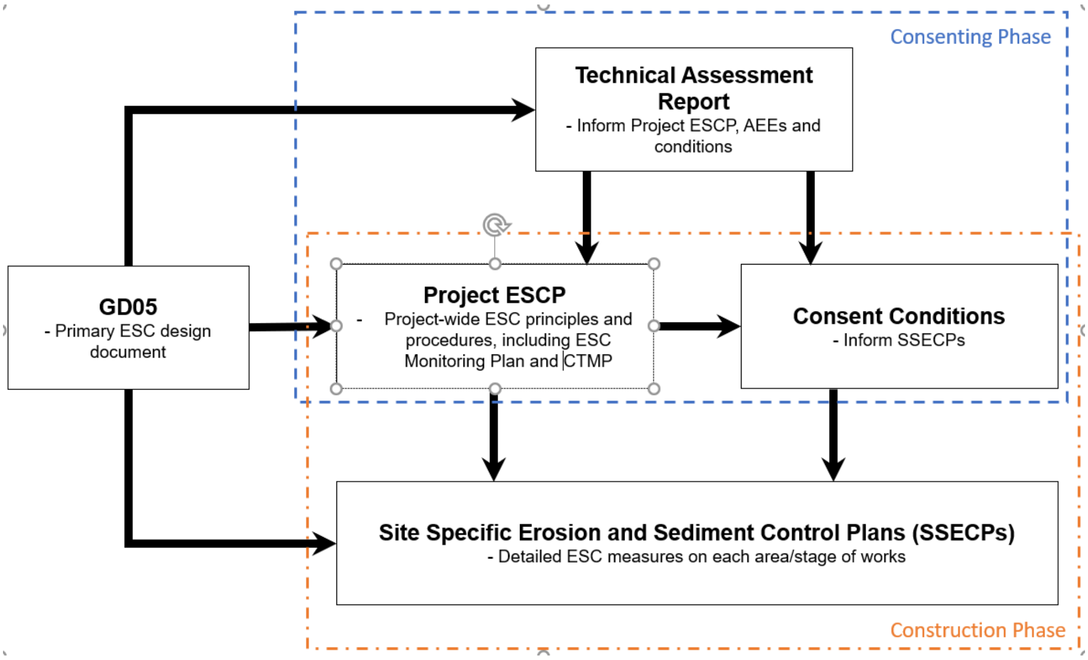
- Emphasis will be given to erosion control and the most effective means of minimising potential sediment generation and sediment discharge from EB2/EB3R.
- Sediment controls will be diligently managed to maximise their efficiency at all times.
- A "treatment train" approach will be adopted, whereby the suite of erosion control and sediment control measures, including staging and stabilisation, will be implemented to maximise sediment treatment efficiency and minimise sediment yield.
- Clean water will be diverted away from works sites via the existing curb and channel network or hotmix bunds.
- Disturbance of soil will be staged and limited wherever possible to reduce the risk of sediment generation.
- Areas of disturbed soil will be stabilised either temporarily or permanently as soon as practicable to limit sediment generation through erosion.
- Chemical treatment will be used on decanting earth bunds (DEBs) in accordance with EB2/EB3R CTMP.
- All weather machinery access will be provided for maintenance of all DEBs.

4.3 Overall Approach

The ESC design approach is illustrated in Figure 3 below. This ESCP provides the overarching principles of the ESC implementation, and the various procedures that will be implemented, including ESC monitoring. The ESCP and appendices have been informed by the ESC Technical Assessment, GD05 and the set of NoR and resource consent conditions submitted with the application.

SSESCPs will be prepared for each works area, based on this ESCP and GD05 and any additional requirements imposed through consent conditions. The SSESCPs will be focussed technical documents including drawings that will detail the ESC measures of that area. They will be consistent with this ESCP but will not repeat the general content of this plan.

Figure 3 ESC Design Structure



4.4 Site Specific Erosion and Sediment Control Plans

The construction of all SSESCPs will be managed as follows:

4.4.1 SSESCP Development

The ESC Technical Specialist will prepare a SSESCP in conjunction with the relevant Construction Zone Manager and Engineer. The SSESCP must be prepared in accordance with this ESCP, GD05, industry best practice, and knowledge gained from the site; and will set out the specific ESC works for each stage or activity including location, dimensions, and capacity. Where appropriate, SSESCPs will be supported with calculations and design drawings and details of construction methods.

The SSECPs will be prepared in a staged manner as final construction details and methodologies are confirmed and will integrate design elements, environmental management and monitoring methods into a set of plans for each stage or location, defining how the ESC components of EB2/EB3R will be practically implemented on site.

The format of the SSECPs will be a succinct document with a standard format, with the majority of the information presented in a 'bullet point' type format. As a guiding principle, lengthy descriptions and repetition of the overarching information provided in this ESCP will be avoided. Each SSESCP will contain sufficient detail to address the following matters:

- Specific erosion and sediment control works for the relevant area or stage (location, dimensions, capacity).
- Supporting calculations and design drawings.
- Catchment boundaries and contour information.
- Details of construction methods.
- Timing and duration of construction and operation of control works (in relation to the staging and sequencing of earthworks).

- Details relating to the management of exposed areas (e.g., grassing, mulch).
- Monitoring and maintenance requirements. The SSESCP will be approved by the Environmental Lead and then submitted to Auckland Council for certification in accordance with Section 1.5.2.

Once certified, the Environmental Lead will issue an approved SSESCP to the Zone Managers responsible for the implementation.

No earthworks activity within the specific area or stage will commence until the Auckland Council has certified the SSESCP.

4.4.2 **Site Prestart Communication**

At least 5 days prior to commencement of construction, EBA will ensure all of the construction team are aware of the relevant designation/ resource consent conditions applying to EB2/EB3R and will communicate the following information with Auckland Council's Monitoring Officers:

- the erosion and sediment control measures.
- the earthworks methodology.
- an update on current SSESCP's, obtaining future SSESCP certification and the relevant designation/ resource consent conditions applying to EB2/EB3R.
- the approximate timeframes for key stages of authorised works and details on the timing and development of SSESCP's.

4.4.3 **Sign Off to Start**

Prior to earthworks commencing, a certificate signed by an appropriately qualified and experienced person (SQEP) is to be submitted to the Auckland Council to certify that the erosion and sediment controls have been constructed in accordance with the designation and resource consent conditions. The certified controls will include the decanting earth bunds, sediment retention pond, clean and dirty water diversion bunds, silt fences, cesspit protection and stabilised construction entrances. The request for certification for these measures will be supplied immediately on completion of their construction. The information supplied, if applicable, will include:

- Contributing catchment area.
- Volume of structure (dimensions of structure).
- Stabilisation of the structure.

The construction of the controls will be overseen by the Zone Supervisors and members of the construction team.

4.4.4 **ESC Device Installation**

Hold points for construction will be established for each control whereby the Environmental Lead will inspect the work completed.

Sediment control measures such as sediment retention ponds (SRPs) and decanting earth bunds (DEBs) will be labelled clearly with their identification number to aid identification of controls and effective communication both with Project and Auckland Council personnel.

4.5 Changes to ESC Measures

Minor amendments to the SSECP may be necessary that would not trigger the recertification set out in Section 1.4. These minor amendments to the SSESCPs will be discussed with Auckland Council and recorded via email or the compliance inspection record. By way of example, such amendments may include:

- Minor relocation of a silt fence
- Installation of additional control measures i.e. installation of a silt fence during the establishment of a DEB
- Construction of additional ESCs where devices are within the permanent works footprint and do not affect construction of the erosion and sediment controls that are already constructed and certified
- The amendment is an administrative change, such as a change in contact details
- The amendment is a minor location change of an erosion and sediment control where each control is sized for the captured area and shown on as-built plans in new location and compliance with GD05 is maintained;
- The amendment provides additional lay down areas within the area of works subject to the SSESCP and does not impact on existing controls or
- The amendment changes bund or diversion construction (excluding changes to dimension and capacity)

4.6 Decommissioning

No ESC measures will be decommissioned without the written approval of Auckland Council (unless approval is not received within 10 working days, then approval is assumed to be granted). The Environmental Lead will be responsible for liaising with Auckland Council regarding the SSESCPs and will provide all decommissioning requests in writing. Copies of all Auckland Council ESC decommissioning approvals and plan amendment approvals will be stored electronically on site.

Once written approval for decommissioning to proceed has been received from Auckland Council, the process of decommissioning an ESC device will be as follows:

1. The weather conditions will be dry or no more than light showers.
2. The contributing catchment of the device to be decommissioned will be stabilised (in accordance with Section 0) or diverted to another appropriate ESC device prior to decommissioning.
3. If the control is holding water, it will only be discharged if it has at least 100mm visual clarity. If it does not have that clarity, it will be treated to achieve a minimum 100mm visual clarity for discharge or otherwise disposed via tanker either to another impoundment or to an authorised facility.
4. The control will be dewatered subject to approval (permit to pump) by the Environmental Lead.
5. Any pipe work and other materials will be dismantled.
6. Impoundment areas will be filled and bunds will be removed or spread, and grassed and mulched or otherwise covered to achieve a non-erodible surface.
7. A decommissioning notification will be given to Auckland Council by the Environmental Lead confirming the control has been removed.

4.7 Specific Erosion and Sediment Retention Measures

The ESC measures will be constructed and maintained in general accordance with Auckland Council's GD05 and any amendments to that document, except where a higher standard is detailed in the documents listed in the NoR/ resource consent conditions (section 2), in which case the higher standard is to apply.

4.8 Training

The objectives of this ESCP (Section 1.1.1) will only be met successfully when all those responsible for ESCP implementation and review are thoroughly conversant with its content, interpretation and performance measurement.

The construction team will be trained and up skilled to be aware of the potential impact their role can have on environmental performance and compliance of EB2/EB3R. This is fundamental to achieving good compliance and environmental outcomes. The Environmental Lead will be responsible for ensuring that training is provided.

Training content will include the most relevant information for various staff roles. All training will include awareness of the activities and associated effects that earthworks can have on the local receiving environments, including an overview of the values of those environments. Training will also ensure that all staff understand what ESC measures are, the function of those measures, and the importance of diligently complying with the ESCP and SSESCPs. Training will ensure that staff understand the ESC management structure, and how to report on any maintenance requirements they identify during their work. It will also address the legal responsibilities of all personnel and legal consequences of non-compliance.

More specific training will be provided to staff that will be involved in the day-to-day implementation of ESC measures. This will include on-the-ground practical training on the construction, maintenance and decommissioning of devices.

All key earthworks and construction environmental team will complete the International Erosion Control Association (IECA) Approved GD05 Erosion and Sediment Control Training Course will be delivered by a CPESC qualified staff member on the ESC Team (Section 1.4).

Induction training will also make the construction team aware of resource consent conditions, designation conditions, environmental control procedures and the requirements of the ESCP. Specific individuals with environmental responsibilities may require the following training:

- Emergency response training
- Spill response training
- Environmental auditing
- Sampling and monitoring

A record will be kept of people who have undertaken induction training. The Environmental Lead will have responsibility for maintaining and updating these records.

Staff involved in environmental monitoring required by designation/ resource consent conditions and by the requirements identified within this ESCP will be trained and competent in the operation, calibration and maintenance of the relevant equipment. Relevant staff will also be trained and competent in sample collection, handling, storage and transport methodologies and techniques. Records of staff training will be kept and made available for inspection upon request.

4.9 Materials

The Environmental Lead will establish and maintain an on-site supply of ESC related materials such as geotextile fabrics, wire, piping, decant kits, safety fences, waratahs, and ground staples to ensure that all necessary construction and maintenance of devices can be undertaken in a timely and responsive manner for the duration of EB2/EB3R.

4.10 Site Entry and Exit Point(s)

All entry and exit(s) points will be stabilised in accordance with GD05.

Site entry and exits points will be strictly controlled. All site exits will be via a stabilised exit point. If the exit point is not already stabilised, then one will be created (a concrete/ asphalt/ rock aggregate apron).

The emphasis will be on maintaining the vehicles in a “clean” state to maximise the effectiveness of the stabilised site entrances and further minimise the risk of tracking any sediment off-site. If any material is tracked onto a road, it will be swept up as soon as practicable.

4.11 Plant and Machinery

The Construction Manager and Zone Managers will be responsible for ensuring that plant and machinery is / will be available at all times for the ongoing and responsive maintenance of ESC measures throughout EB2/EB3R.

EB2/EB3R will adopt the principles and practices of the guideline *“Keep It Clean – Machinery hygiene guidelines and logbook to prevent the spread of pests and weeds”* issued by the National Pest Control Agencies (NPCA) in collaboration with the Local Government Biosecurity Managers Group, Rural Contractors New Zealand, Federated Farmers, and Ministry for Primary Industries, Published June 2013.

4.12 Stabilisation

Stabilisation forms a key component of the overall environmental strategy for EB2/EB3R.

Any topsoil bunds will be seeded and mulched immediately. Progressive stabilisation and staging will be undertaken, partially as a result of working adjacent to and within a live road environment and the requirement to maintain an operational road network at all times.

The “bulk earthworks” operations will be staged and will be progressively stabilised. The methodology will ensure that the site will be in a continual state of progressive stabilisation.

In addition, the imported fill material will be “hard fill” (aggregate) which is regarded as a stabilised material in accordance with GD05 definitions. That material presents a low risk from a sediment generating perspective.

It is noted that across EB2/EB3R site there are only small, isolated areas where actual “earthworks” will be undertaken at any one time.

In many areas, other than the initial topsoil stripping, all the works will be undertaken using hardfill ensuring that the works are generally a stabilised operation. This is referred to as a cut and cover methodology. All remaining works following the site set up will be stabilised works.

4.13 Cut and Cover

A cut and cover operation is a process of rapid same day construction during fine weather. The concept in terms of sediment control is that exposed dirt is not left uncovered overnight or during rain events and involves small areas being worked on quickly and covered or stabilised either immediately or after several hours. The stabilisation of these surfaces will either involve aggregate, geotextile fabrics, or mulch. The advantage of a cut and cover methodology is that it is less reliant on structural sediment control devices and therefore often more efficient at minimising sediment discharge.

Due to the nature of EB2/EB3R working adjacent to a live roading network it is anticipated that rapid stabilisation utilising cut and cover methodologies will be used extensively (Figure 4). The cut and cover operations will be in accordance with GD05 Section G3.0.

Figure 4 Rapid stabilisation, cut and cover (geotextiles and aggregate) used on the Albany Highway project

4.14 Clean Water and Dirty Diversions

Clean water and dirty water management will often be achieved by constructing perimeter bunds. Perimeter bunds will be installed in a number of locations around the working areas. The bunds will also create a physical barrier for staff and help define the extent of works.

Perimeter bunds will be installed to prevent clean water from other areas entering the work sites. However, due to the topography and relative levels of the proposed works and filling, there are only minor areas where upslope clean water could enter a works site should a bund not be in place.

The perimeter bunds will likely be created using topsoil stripped from an area and will be sized as a minimum in accordance with GD05 guidelines. Specific sizing details will be included within the SSESCPs to be submitted to Auckland Council for approval. The perimeter bunds will be stabilised as they are constructed.

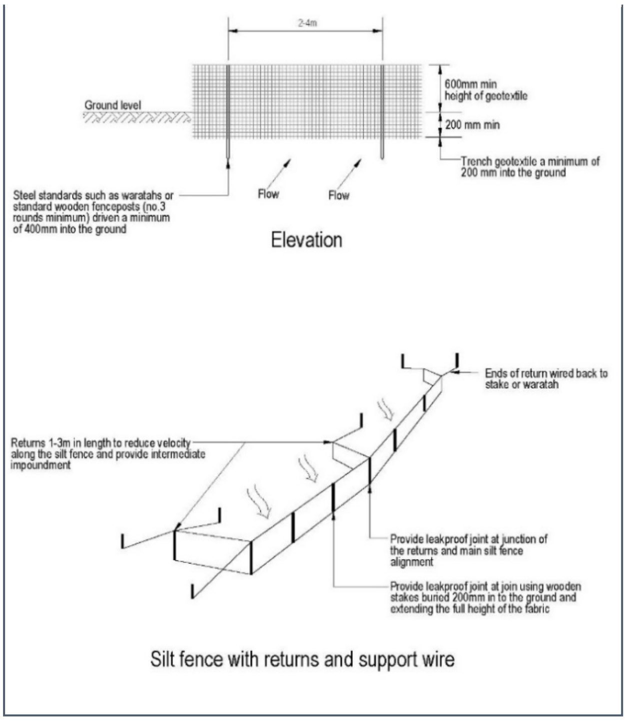
In addition, there will be times where hotmix bunds are installed to create temporary curbs to divert clean water road runoff away from the works areas.

4.15 **Silt Fences**

The primary sediment control measure for the works will be the installation of silt fences across EB2/EB3R. Silt fences will be installed as close to the extent of the works boundary as possible. Silt fence construction detail is provided in Figure 5.

A silt fence will remain in place until the site / area is fully stabilised.

Figure 5 Standard Silt Fence Construction Detail



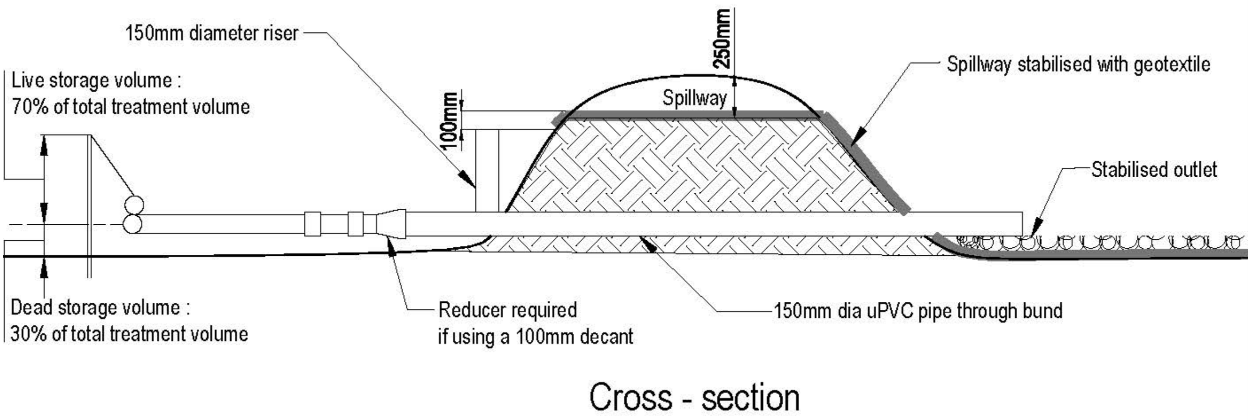
4.16 **Decanting Earth Bunds**

Decanting Earth Bunds (DEBs) will be the main control devices utilised during the initial construction of the filling operations. The DEBs will be designed and constructed in accordance with GD05 requirements (Figure 6).

The DEB will have the following features:

- The primary decanting structure will consist of a floating 'T-bar' identical to that used in sediment retention ponds detailed in GD05. The T-bar height will be set to activate once 30% of the storage volume (dead storage) is occupied. The T-bar decant will be able to float up to within 100mm of the emergency spillway.
- The capacity of the DEB will be a minimum 2% of the contributing catchment area.
- The inlet to the DEB will be set at least 5m away from the outlet (T-bar) wherever physically achievable and as the control capacity increases so too will the minimum distance between the inlet and outlet.
- The emergency spillway will be covered with two layers of non-woven geotextile fabric pinned at 500mm centres.

Figure 6 DEB Construction Detail (Cross Section)



4.17 **Cesspit Inlet Protection**

Cesspit inlet protection is a secondary sediment control device and is not considered a standalone device. In active works areas they will be used in conjunction with other ESC methods and measures, as part of a broader and more comprehensive ESC system.

In and around live cesspits, cesspit protection will be installed during active works but will be removed at the end of the day once the works have been completed and the works area stabilised, to ensure the stormwater network can operate as per design. An example of cesspit protection is provided in Figure 7.

Figure 7 Example of Cesspit Protection

4.18 **Silt Socks**

Silt socks will be used as a secondary control within larger treatment areas and as primary controls within smaller discrete treatment areas. They are particularly useful for controlling the velocity of stormwater or sediment laden water on route to treatment devices such as decanting earth bunds.

Silt socks will be frequently positioned in roadside berms adjacent entranceways, around storm water inlets and cesspits, and along perimeters of flat or near flat sections of exposed material. Examples of silt sock protection is provided in Figure 8 and Figure 9 below.

Figure 8 Silt or Filter Socks used as Edge Protection

Figure 9 Silt or Filter Socks used as Edge Protection

4.19 **Dewatering**

All dewatering will be undertaken in accordance with the Dewatering Procedures set out in Appendix B.

Sediment control for dewatering will comprise a water treatment container or similar. Sediment laden water from within excavation areas will be pumped via a manifold system prior to discharge into the treatment container system.

During pumping, water clarity within the container will be tested using the black disc method and pH will be tested using pH strips or an electronic pH meter. The results of these tests will be recorded. If the water is found to be outside acceptable levels for clarity (<100mm depth) or pH (5.5-8.5), then pumping will cease and appropriate contingencies will be put in place. This will likely involve re-circulating the water from the container through the treatment manifold to provide additional chemical dosing.

If the water does not have that clarity, it will be treated or otherwise disposed via tanker. The control will be dewatered subject to approval (permit to pump) by the Environmental Lead.

4.20 Chemical Treatment

All chemicals will be managed in accordance with Chemical Treatment Management Plan provided in Appendix A.

The flocculation (chemical treatment) procedures are based around providing industry best solutions to achieve optimal sediment removal efficiencies. Chemical treatment will be investigated for all sediment retention devices such as DEBs and the water treatment containers.

In this regard, samples will be taken from the excavated materials when bulk earthworks commence (within the catchment of the sediment retention devices) and bench testing will be undertaken to determine the optimum chemical dosing regime. The bench testing will consider the effects on pH of the treated water for the sediment retention devices. The results of the bench testing will be forwarded to Auckland Council. Ongoing monitoring will also be undertaken of the sites sediment retention devices as outlined in Section 5.3 below. If the monitoring highlights any deficiencies further bench testing will be undertaken.

Chemical treatment for DEBs will be operated via rainfall activated treatment sheds supported by batch dosing as required.

4.21 Road and Footpath Maintenance

Earthworks will be managed to avoid deposition of earth, mud, dirt or other debris on any road or footpath outside the works area resulting from earthworks activity associated with EB2/EB3R. In the event that such deposition does occur, it will be removed as soon as practicable. In no instance will roads and/or footpaths be washed down with water without appropriate erosion and sediment control measures in place to prevent contamination of the stormwater drainage system, watercourses and/or receiving waters.

Road and footpath maintenance will also be achieved through the methods to control vehicle circulation as set out in Section 4.10 Site Entry and Exit(s) Points and Section 4.21.1 Road Sweeping.

4.21.1 Road Sweeping

The site will be regularly swept with a combination of tractor mounted road broom and sucker truck to maintain a clean road surface leaving the site. This will mitigate any spilt material that may end up on the local road as a consequence of material and debris being tracked out onto the road on the wheels and tracks of vehicles. Sweeping will be carried out in a manner that ensures that material being swept is collected and removed off site. Examples of road sweeping machinery is provided in Figure 10 Examples of the Proposed Road Sweeping VehiclesFigure 10 and Figure 11.

Figure 10 Examples of the Proposed Road Sweeping Vehicles

Figure 11 Examples of the Proposed Road Sweeping Vehicles

4.22 **Dust Management**

Good practice dust mitigation measures will be carried out in accordance with the good practices described section 8 of the *Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions*, Ministry for the Environment (2016) (GPG) and other relevant guidelines for dust mitigation.

Throughout the construction phase the overall emphasis of dust management will be one of prevention. General measures for dust management include, but are not limited to:

- Minimising extent of exposed surfaces;
- When deciding the location of dust sources within site consideration will be given to the prevailing wind direction and sensitivity of downwind receptors;
- Topsoil stockpiles and bunds will be covered with geotextile or grassed and mulched as soon as practicable;
- Screening will be used where necessary;
- Double handling and drop heights of spoil or fill materials will be minimised
- Vehicle movements on site will be governed by speed restrictions which will, among other things, assist in preventing dust generation;
- A water cart will be made available if required along with sufficient water supply; and
- The Supervisors will obtain daily forecasts from metservice and the weather stations (discussed in Section 5.2) which will be circulated to all appropriate staff by a method approved by the

environmental lead to ensure that during dry weather or when strong wind speeds are forecasted, everyone knows the probability of dust creation. Dust control measures will be put on standby if dry, windy conditions are forecast.

The management of dust that is generated from the disturbance of potentially contaminated soil is addressed in Section 5.1 of the Contaminated Land Management Plan (CLMP).

4.22.1 **Areas Subject to Increased Risk of Dust Nuisance**

Residential and commercial properties are located in close proximity to all parts of the construction areas. The majority of these properties have a medium or high risk of experiencing offensive or objectionable impacts from dust emissions. Therefore, attention to dust management and monitoring is required over all parts of the construction areas, including methods for minimising dust emissions, monitoring procedures and adaptive management procedures in the event of a dust nuisance event.

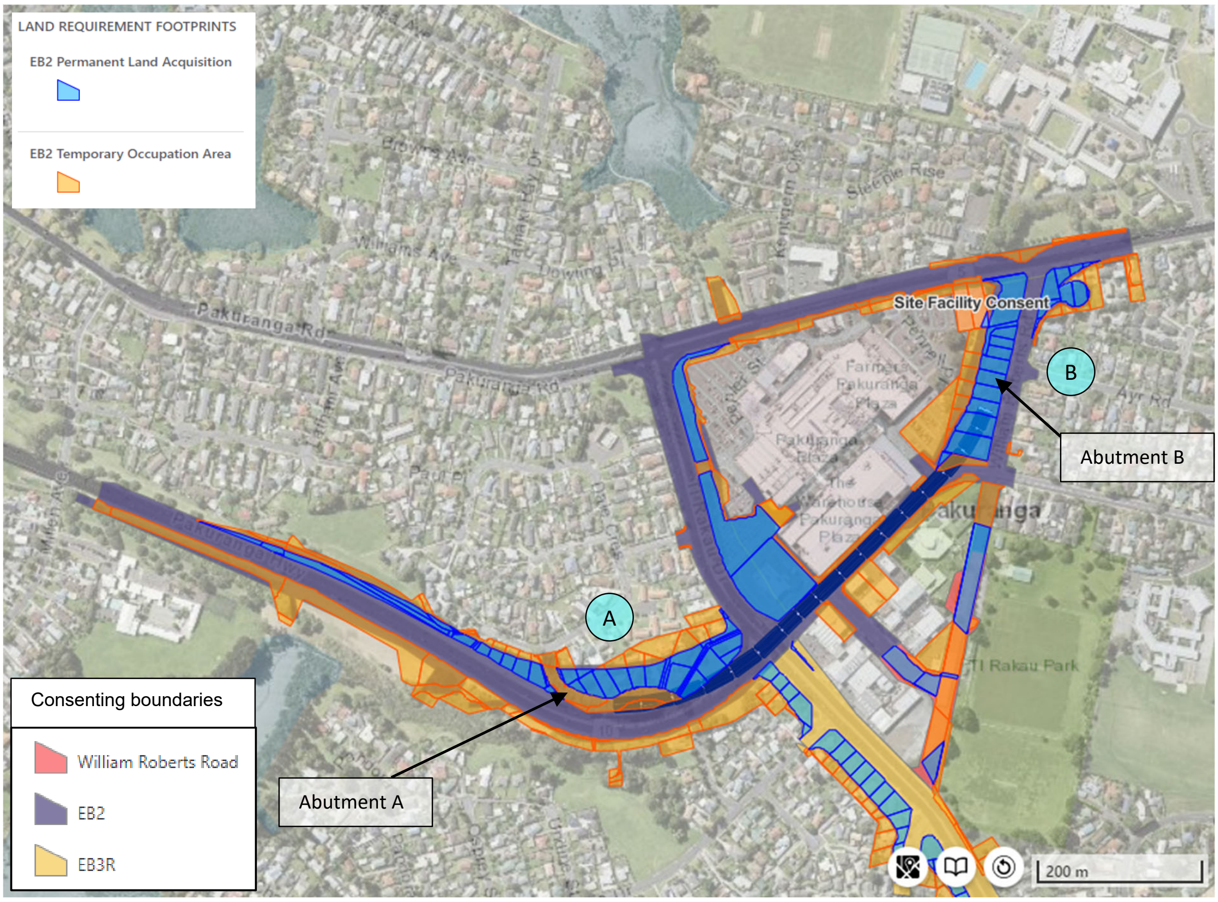
Neighbouring locations that are predicted to have a high risk of dust impact during the construction period and any construction activities in close proximity will be subject to more stringent dust management and prevention measures.

There are two neighbourhood areas within EB2 where construction poses a higher risk of potentially objectionable dust impacts. These locations are shown as A and B in Figure 12 and are described as follows:

Area A- Houses on Dale Crescent (outside of the permanent acquisition and temporary occupation boundaries) are downwind of the construction area for Abutment A of the RRF under the prevailing south-westerly wind direction. Houses on Dale Crescent, Palm Ave and Ti Rakau Drive in this area are also downwind of the construction works required for the proposed Pakuranga Station under a north-easterly wind.

Area B- Houses on William Roberts Road and Ayr Road in the vicinity of Annotation B are downwind of the construction area for Abutment B of the RRF under prevailing wind conditions.

Figure 12 Areas with potential high risk of objectional dust nuisance



The key personal set out in Section 1.3 will be the primary contacts for dust generation issues. Any complaints relating to dust generation will be directed to the Environmental Lead and will be addressed in accordance with Section 4.2 of the Community Consultation Plan (CCP).

Relevant staff training on dust mitigation and monitoring is described in Section 3.6 of the CEMP. The training will also provide specific information on approaches to dust management in the high-risk areas identified above.

4.22.2 **Dust Sources**

The main sources of dust associated with the construction of EB2 include:

- Mechanical disturbance of soil material (bulldozing, scraping, digging)
- Excavation, handling and stockpiling of spoil
- Demolition of existing structures
- Formation of access tracks
- Construction of foundations
- Construction of retaining walls and engineered fill
- Movement of plant and equipment across exposed, unsealed ground
- Driving trucks and light vehicles on unsealed roads
- Wind erosion of uncovered stockpiles of spoil, topsoil and/or construction and demolition materials

- High wind speeds moving across unsealed surfaces

These sources are expected to be most intensive around the construction zones for the two abutments for the RRF, due to the ground improvements required and the construction of MSE Walls.

4.22.3 **Dust Control Measures**

Dust control measures will be applied to prevent dust generation where possible, and to minimise the movement of dust beyond the works site boundaries. These measures include relevant methods set out in the GDG, Transport Agency *Guide to Assessing Air Quality Impacts from State Highway Projects*, Version 2.3, 2019 and other relevant guidance. An indication of the options for managing dust are set out in Table 4. This table will remain live throughout the construction period and will be updated by the construction team when additional measures for dust mitigation are identified as appropriate.

Table 4 Dust Mitigation and Management Measures

ID	Measure
Stockpiling and material handling	Stockpiles will be located away from the site boundary, prevailing winds, waterways and catchments, residential areas, and other sensitive receivers.
	Stockpile heights will be limited based on their stability, manageability, dust and amenity impacts.
	Gentle slopes will be used for unstable soils.
	Where practicable fine or powdery material will be stored inside buildings or enclosures.
	Minimise duration of stock piling.
	Stabilise inactive soil stockpiles left for long periods of time by chemical suppression, physical covering (for example tarpaulins) or by establishing vegetation or grass (for example hydroseeding).
	Erect fences, screens with shade cloth or use other windbreaks such as trees, hedges and earth-banks of similar height and size to the stockpile.
	Enclose stockpiles within bunkers.
	Limit drop heights from conveyors, loaders or other equipment transferring material to and from stockpiles
	Suppress dust from small stockpiles using water, applying using a water truck or hand-held hose. Alternatively cover with tarpaulins or textiles.
Manage Site Access	Minimise site access to limit the impact from vehicles on roads
	Identify entry and exit points, and high traffic areas.
	Stabilise site entry and exit points with a sealed road, aggregate or road base.
	Use a water-assisted dust sweeper on access and local roads to remove material tracked off site.
	If needed to keep public roads clean, install rumble grids at site exit points to shake soil off trucks. Ensure the road between rumble grids and the site exit is stabilised and with adequate distance and wheel rotations (recommended minimum three-wheel rotation). Submerge rumble grids in water so tyres are washed as the truck crosses the rumble grid.
	Regularly clean paved surfaces, such as by using a broom and shovel, water or street sweeper, or mobile vacuum sweeper
Manage Road Use	Minimise the number of access roads vehicles use.
	Seal roads with asphalt or a spray seal, or stabilise with aggregate, gravel or road base. Replace aggregate or gravel periodically.
	Clean up spillages as soon as practicable
	Manage dirt and mud on access roads/routes
	Maintain, clean and grade haul routes on a regular basis.
	If roads are not stabilised or sealed, minimise dust using water sprays.
	Minimise haul route distances and locate haul routes away from sensitive receivers.
	Set appropriate and site-specific speed limits to minimise generating dust (typically 10-15 kph).
	Use judder bars (speed humps) to assist with speed restriction in appropriate locations
	Limit load size to avoid spillages.

Machinery hygiene	Cover trucks transporting loose materials with fitted canopies. Ensure all loads are covered before trucks leave site.
	Limit drop heights for machinery loading material to or unloading from trucks
General	Minimise dust generation at sources by considering appropriate physical and engineering controls for the situation and work activities.
	Suppress dust during concrete cutting and construction and demolition activities.
	Install shade cloth or solid security fencing as a wind break to slow down winds and minimise wind carried dust.
	Suppress dust from construction activities such as rock breaking and drilling where appropriate with on-tool dust extraction and enclosure of activities.
	Temporarily stop works if dust is visibly discharging or emitting nuisance airborne particles beyond site boundaries. Resume works only when effective controls can be implemented, or weather conditions and air quality improve.
	In high dust impact risk areas, monitor air quality for dust with use of ambient dust monitoring equipment located onsite and offsite in the surrounding community to assist with identifying the effectiveness of implemented dust controls.
	Conduct post-installation maintenance of established controls (including dust monitoring equipment) and assess control effectiveness at regular intervals.
	A water cart will be made available if required, along with sufficient water supply access. The typical water requirements for most parts of New Zealand are up to 1 litre per square metre per hour (equivalent to 1mm of water application), or at least 5mm per day. Repeated application to keep ground moist is more useful than intensive, infrequent applications. It is important to check that the available water supplies and the application equipment are able to meet the water requirements.
	Re-vegetate exposed surfaces wherever practicable, and stage construction works to minimise extent of active exposed surfaces.
Check controls	Monitor controls that have been put in place and ensure they operate effectively.
	Monitor site entry, exit points and haul routes, and any rumble grids or wheel-wash facilities if used, and perform maintenance as required.
	Monitor driver compliance with speed limits and canopy use on trailers
	Inspect local roads for tracked soil and dust regularly

Monitoring and reporting of dust mitigation is discussed in Section 5 which includes adaptive management approaches when increased dust trigger levels (Section 5.4.2) are detected.

5 Management and Monitoring

This Section details the ESC management and monitoring system that will be implemented for the duration of the earthworks period of EB2/EB3R. The operational effectiveness and efficiency of all erosion and sediment control measures specifically required by designation or resource consent conditions, or by this ESCP will be maintained throughout the duration of earthworks activity, or until the site is permanently stabilised against erosion.

The sub sections below set out processes and procedures that will be followed and confirming how the ESC monitoring will be undertaken to ensure that effects are appropriately avoided or minimised and remain with the scope of the assessment within the ESC Technical Report. The ESC monitoring procedures provide rapid and real time information and control to EB2/EB3R team.

The ongoing monitoring and reporting will establish the continuous feedback loop on the performance of the ESC management system (Section 4) and all SSESCPs. Any material changes to the management and monitoring approaches set out in this section will be confirmed with Auckland Council and submitted for certification in accordance with Section 1.5 prior to being implemented.

5.1 Erosion and Sediment Control Inspection

The Environmental Lead will conduct routine (minimum weekly) inspections of the site. These inspections will take place with adequate time allocated and will be thorough and systematic. Members of the construction team including the Zone Managers, will accompany the Environmental Lead on these inspections so that the Environmental Manager can better understand the work occurring at that time and that programmed to take place. It is also useful for the Zone Managers to be reminded of their ESC obligations and for both parties to recognise good performance and outcomes, and where performance has not been to the standard expected or required by consents. This is particularly relevant in identifying how communication between personnel can be improved to avoid a recurrence of an issue.

Communication is critical to the successful implementation of SSESCPs. Internal inspections will cover all areas of EB2/EB3R, even those that may have been dormant for some time, to ensure that the controls are still operating properly. A record of internal inspections will be maintained including the date, time, any actions required and timeframes for close out.

5.2 Weather Monitoring

5.2.1 Rain Forecast

Rain forecasts relevant to the site will be checked daily using MetService / MetVuw online forecasting system. Close monitoring of the rain forecast will be necessary to ensure the appropriate site works can be implemented prior to rainfall trigger events.

The daily weather forecast checks will be forwarded to all Zone Managers, Project Engineers and Site Superintendents every morning via email.

If the forecasts show more than 20mm of rainfall over a 24-hour period then this will trigger the pre-rain event environmental team inspections as outlined in section 5.3 (pre-rain event with forecast >20mm over 24 hours). This is in addition to the routine pre-rain event inspections undertaken by Site Engineers and Site Superintendents as detailed in Section 5.3 below.

5.2.2 **Wind Forecast**

MetService weather forecasts will be checked daily to understand wind speed and direction and to predict dry weather or wind events which will trigger dust management responses set out in Section 4.22.

5.2.3 **Weather Station**

A weather station will be installed on site to provide real-time rainfall intensity and volumes, for the site personnel. This will support the overall management and performance monitoring of ESCs.

5.3 ESC Device Monitoring

5.3.1 **Site Inspections**

Routine inspections will be undertaken during and post construction of ESC devices. During construction certain stages are identified for inspection, such as the T-bars for DEBs.

Post construction monitoring is undertaken once a device is operational.

Monitoring will take place as soon as practicable following the first rainfall event that generates runoff and for DEBs and silt fences, that generates a treated discharge. This is to assess the performance of the devices (including chemical treatment systems) and the resulting quality of treated water being discharged from the site.

The site will be inspected weekly as a minimum by the Environmental Lead and / or Site Superintendent / ESC Technical Specialist. These inspections will ensure that all ESC devices are installed correctly and operate effectively. This inspection programme will provide certainty to all parties that appropriate measures are being undertaken to ensure compliance with designation and resource consent conditions and the SSESCPs. The inspection regime will keep ESC management at the forefront of works on site. Any potential problems will be identified immediately, and remedial works will be promptly carried out.

The inspection programme shall consist of:

- Weekly site walkovers involving the environmental team to inspect all ESC measures, identify any maintenance or corrective actions necessary, assign timeframes for completion, and identify any devices that are not performing as anticipated through the SSESCP.
- Pre-rain event: Prior to all forecast rainfall events, additional inspections will be made of ESC devices, including chemical treatment systems, to ensure that they are fully functioning in preparation for the forecast event. These will be undertaken by the Zone Engineers and Supervisors.
- Pre-rain event with forecast > 20mm over 24 hours: Prior to forecast rainfall "trigger" events the site will be inspected by the Environmental Management Team (in addition to the business-as-usual pre-rain inspections undertaken by the Zone Engineers and Supervisors). The aim of the inspection will be targeted at any additional ESC measures that are required to be installed to ensure that the sites ESC management system performs effectively during an expected larger event.
- Post-rain event: Within 24 hours of a rainfall events, inspections will be made of all ESC measures to ensure that the function and performance of controls have operated as expected and to identify any maintenance requirements. Any remedial works identified during

monitoring inspections will be recorded as per the process set out in Section 5 and immediately addressed.

5.3.2 Clarity Monitoring

Clarity checks will be made at each DEB or when dewatering, using the following procedure:

Black disc

- A 50-80mm diameter is attached to a 1m long stick with a centimetre scale starting at the disc is lowered vertically into the water to be tested until it disappears, and then is raised until it just reappears. The depth of reappearance is recorded as the clarity of the water.

Clarity Tube

- A clarity tube including a magnetic back disc will be filled with water from the device. The tube will be laid horizontal, and disc is moved down the tube until it disappears, and the distance is recorded. The disc is then moved back until it reappears, and the distance is recorded;
- Readings will be taken in diffuse sunlight or shade. If it is impossible to avoid bright sunlight, work will be undertaken with the tube perpendicular to the sun's plane; and
- Readings will not be taken in very low light conditions (insufficient for colour perception).

5.3.3 pH Monitoring

pH will be recorded at each device receiving chemical treatment, using the following procedure:

- Ensure that the pH meter has been calibrated and that the calibration fluid has not expired;
- Use the pond water (or water that is to be discharged) to rinse out a small container then half fill with water from the same source; and
- Immerse the pH meter in the water and leave for up to 1 minute or until the reading stabilises and doesn't change. Place the container in a shaded place (out of direct sunlight) while it stabilises.

Record the pH reading given on the meter along with the date, time, and device.

5.4 Dust Monitoring

Monitoring for dust outside the construction site boundaries will comprise a combination of visual observations, stakeholder communications (as set out in the CCP), and instrumental monitoring. Dust monitoring will be concentrated around activities with higher risk of objectional dust generation (Section 4.22).

5.4.1 Visual Inspection

Daily visual dust monitoring will be undertaken by the site superintendent which will include (but is not limited to):

- Checking internal and external access road surfaces for tracked dust that requires cleaning;
- Checking effectiveness and maintenance of truck rumble grids and wheel wash;
- Checking integrity of shelter fences;

- Inspecting surfaces outside boundary near sensitive receptors for signs of dust deposition;
- Observations of visible dust suspended in air carrying beyond site boundary; and
- Closed-circuit television (CCTV) monitoring of boundaries and/or dust sources.

5.4.2 Instrumental Monitoring

Real-time instrumental monitoring of TSP will be undertaken at the two locations discussed in Section 4.22 that are at higher risk of objectional dust generation. The trigger levels set out in Table 5 will be used for the proactive management of dust on site. The trigger levels are not linked to adverse effects and are therefore intended to provide an indication of increases in dust production rather than for use for enforcement.

Table 5 Trigger levels for TSP instrumental monitoring for receiving environment of high sensitivity. From GPG Dust Table 4.

Trigger	Averaging Period	Value Recommended
Short term	5 minute	250 µg/m^3
Short term	1 hour	200 µg/m^3
Daily (for managing chronic (i.e. long term) dust only)	24 hours (rolling average)	60 µg/m^3
Wind warning	1 minute	10 m/s (during two consecutive 10-minute periods)
Rain warning	12 hours	No rain in previous 12 hours
Visible dust (measured by operator/site manager observations, and/or CCTV camera).	Instantaneous	Visible dust crossing the boundary

Swift implementation of management responses (Section 5.5.1) following an exceedance (or near exceedance) of the Table 5 trigger levels will assist to prevent adverse dust generation effects.

5.5 Management Responses

In the event that unanticipated discharges occur, the Environmental Lead or ESC Technical Specialist will undertake the following actions:

- Investigate whether the thresholds have been exceeded as a result of a natural process.
- Investigate whether there have been any significant events or failures that could have caused the discharge.
- Ensure all site controls are operating in accordance with approved plans and best practice.
- Determine if the discharge is an isolated case or is likely to be repeated.
- Investigate and implement modifications, including:
    - Investigate erosion and sediment control measures to determine whether there has been a discharge from the devices;
    - Make alterations to erosion and sediment control measures and methodologies; (check that a further approval is not required from Auckland Council)
    - Consider additional ESC;
    - Refinement of chemical treatment systems;
    - Additional stabilisation;
    - Increase maintenance of controls; and

    - Amendments to methodologies and sequencing of works and refinement of controls as necessary.

5.5.1 Adaptive Dust Management

If the trigger levels set out in Table 5 are exceeded, the EBA will adopt an adaptive management approach to dust mitigation. This will involve identification of the potential causes of dust emissions and the implementation of additional control measures to reduce the level of dust emissions. Examples of specific control measures that could be undertaken for activities that are identified as the source of a trigger include the following:

- Increased use of water to dampen surfaces;
- Improved cleaning of hardstand surface around stockpiles, and/or reduce stockpile size;
- Relocation of sources of dust within the construction site (such as stockpiles), if possible;
- Increased extent or quality of hardstand surfacing on site, and/or seal hardstand surfaces if not already done
- Further reduction of vehicle speeds in areas where wheel-driven dust is an issue – if that cannot be remedied by watering, sweeping, sealing or hardstand surfacing
- Construction of additional windbreaks, or make existing windbreaks taller and/or more solid
- Provision to reduce work intensity (or temporarily stop work)
- Modification of the type of earthmoving or excavation equipment used, if this is found to be a significant source.

5.6 Reporting

5.6.1 Site Auditing

Daily visual inspections will be undertaken by the Ste Supervisor.

An internal audit will be undertaken by the Site Supervisor at least weekly. Any maintenance actions will be undertaken that day. The internal audits are intended to encourage proactive management of ESC performance and dust management.

Actions will be loaded into the EBA Environmental Management System with details and timeframes will be issued by the Environmental Lead to the relevant Project Engineers, with specific actions and closeout timeframes. EB2/EB3R Engineers will report completion of those action and an Environmental Lead will inspect the works and close-out the items in the management system.

For programmed Auckland Council inspections, a member of the construction team will accompany the Auckland Council Monitoring Officer in all audits. Usually, a member of the construction team will also be present.

As for internal audits, all ESC maintenance actions identified by the Monitoring Officer will be recorded into EB2/EB3R ESC management system. Work Instructions with details and timeframes will be issued to EB2/EB3R Engineer by the Environmental Lead, based on the Auckland Council's instruction. EB2/EB3R Engineer will report back the completion of those actions to the Environmental Lead and the works will be inspected and confirmed by the Environmental Manager. Confirmation will be emailed to the Auckland Council Monitoring Officer.

6 Appendices

Appendix A Chemical Treatment Management Plan

Eastern Busway – EB2/EB3R Erosion and Sediment Control Plan Appendix A: Chemical Treatment Management Plan

Document History and Status			
Rev	Date	Author	Status
A	25/01/2022	Campbell Stewart	Draft Document
B	21/04/2022	Campbell Stewart	Final Draft

Document Approval					
Rev	Action	Name	Position	Date	Signature
A	Reviewed by	Craig Redmond	Executive consultant	28/03/2022	On file
B	Reviewed by	Nicola Bishop	Senior Alliance Planner	26/07/2022	On file
1	Approved by	Roger McDonald	Principal Alliance Planner	27/07/2022	On file

Table of Contents

1 Introduction

1.1 Purpose and Scope

This Chemical Treatment Management Plan (CHTMP) is for the construction of the Eastern Busway EB2 and EB3R works (EB2/EB3R). The purpose of this plan is to set out management methods, controls, and reporting standards to be implemented in order to meet the designation and resource consent conditions contained in the condition set submitted with the application relating to the chemical treatment of the sediment control devices associated with the project.

The CHTMP shall be implemented throughout the entire construction period when erosion and sediment controls are in place and is intended to be the primary tool to inform the projects management of chemical treatment for sediment control. This plan is an appendix to the EB2/ EB3R Erosion and Sediment Control Plan (ESCP).

2 Methodology

Decanting earth bunds (DEBs), impoundment areas and/or water treatment containers may be installed or located on the site as required and detailed in the SSESCPs. It is proposed to chemically dose the DEBs and impoundment devices in accordance with this plan to improve the efficiency of the device and that the ensure water quality discharging off site is in accordance with the Projects expectations and industry best practice.

Dewatering will be undertaken in accordance with the dewatering will be in accordance with the CHTMP.

The CHTMP is based around providing industry best solutions to achieve optimal sediment removal efficiencies. In this regard samples (soil or water) will be taken from the contributing catchment to determine the optimum chemical dosing regime.

Ongoing sampling may also be required as the earthworks progress, when imported fill material is used or during dewatering. In this regard protocols have been established and are set out in Section 4.

The testing methodology to be used is based on best practice and guidelines developed by Auckland Council including *"The Use of Flocculants and Coagulants to Aid the Settlement of Suspended Sediment in Earthworks Runoff" (Technical Publication 227 – dated June 2007) and Auckland Council Guideline Document 2016/005 'Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region'*, Incorporating Amendment 1 (GD05).

Prior to the work being started bench test trials will be undertaken for the new catchments proposed to be worked.

Bench test flocculation trials will be undertaken using chemicals to determine soil reactivity to chemical treatment in accordance with the Auckland Council GD05 guidelines.

The three chemicals to be tested are:

1. Poly Aluminium Chloride (PAC).
2. SuperFloc. SuperFloc is a blend of PAC and PolyDADMAC. To be tested with a blend ratio of 80% PAC to 20% PolyDADMAC.
3. Vital Eco SuperFloc. Vital SuperFloc is a water-based product containing chitosan, a natural biopolymer and acetic acid (<2%).

The bench test result will be submitted to the Auckland Council as part of the as built process of the SSESCPs and will also be filed as an amendment to Appendix B.

3 Flocculation Systems

3.1 Rainfall Activated Dosing System

The rainfall activated dosing system has been developed specifically for earthworks sites. The system uses a rainfall catchment tray to capture rainfall with the size of the tray being determined by the required chemical dose and the land catchment size.

Rainwater caught by the catchment tray is piped into a header tank, and then into a displacement tank which floats in a larger tank containing the flocculant filled to the level of an outlet pipe leading to the sediment laden diversion about 10m upstream of the DEB. The greater the rate of rainwater flow into the displacement tank the greater the flow of flocculant into the sediment laden runoff channel. The header tank is designed to provide for no dosing during the initial rainfall of up to 12mm of rain under dry conditions, and for attenuation of the chemical flow during the initial stages of a storm and after rain has ceased at the end of a storm.

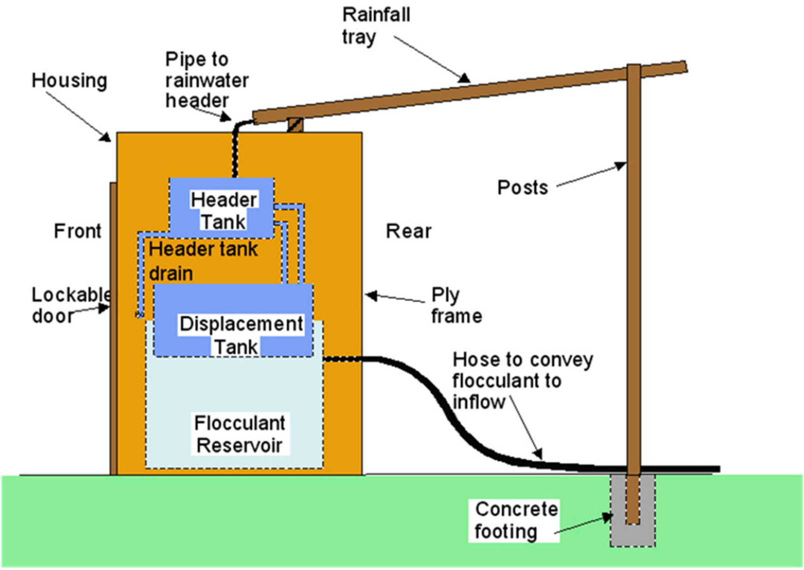


Figure 1: Schematic of a floc shed.

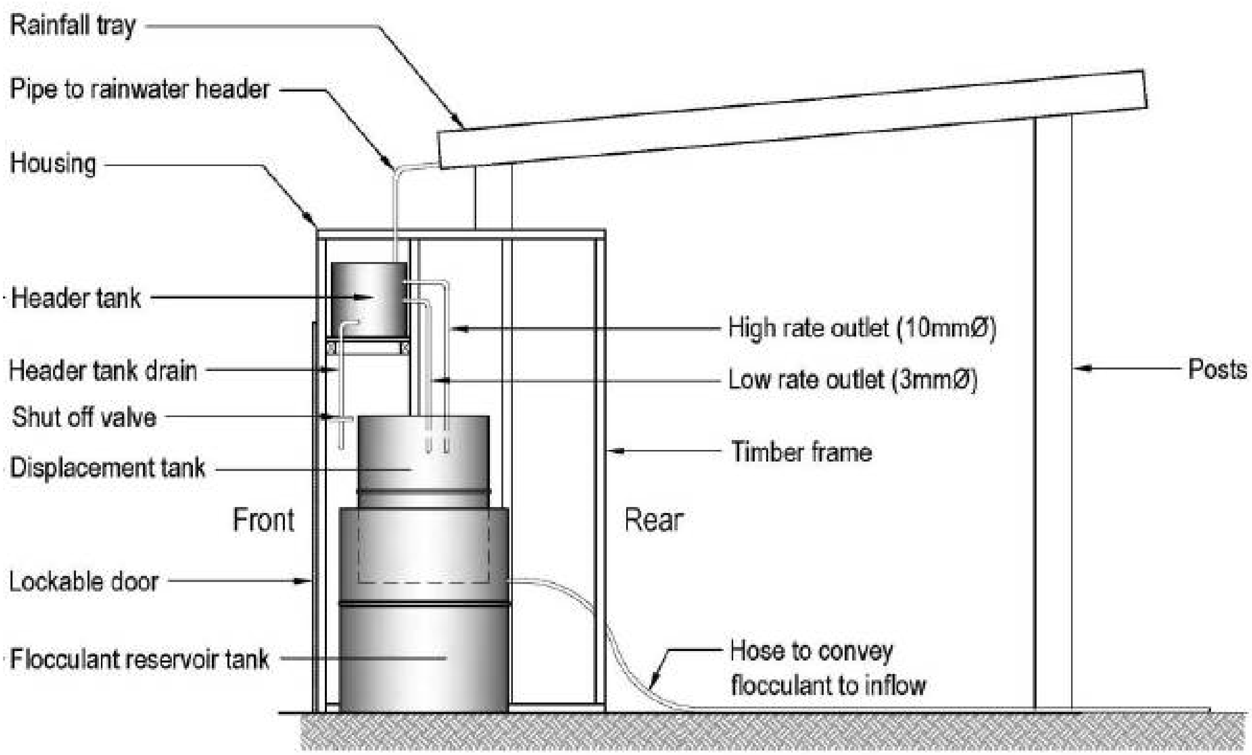


Figure 2: Components of a floc shed.

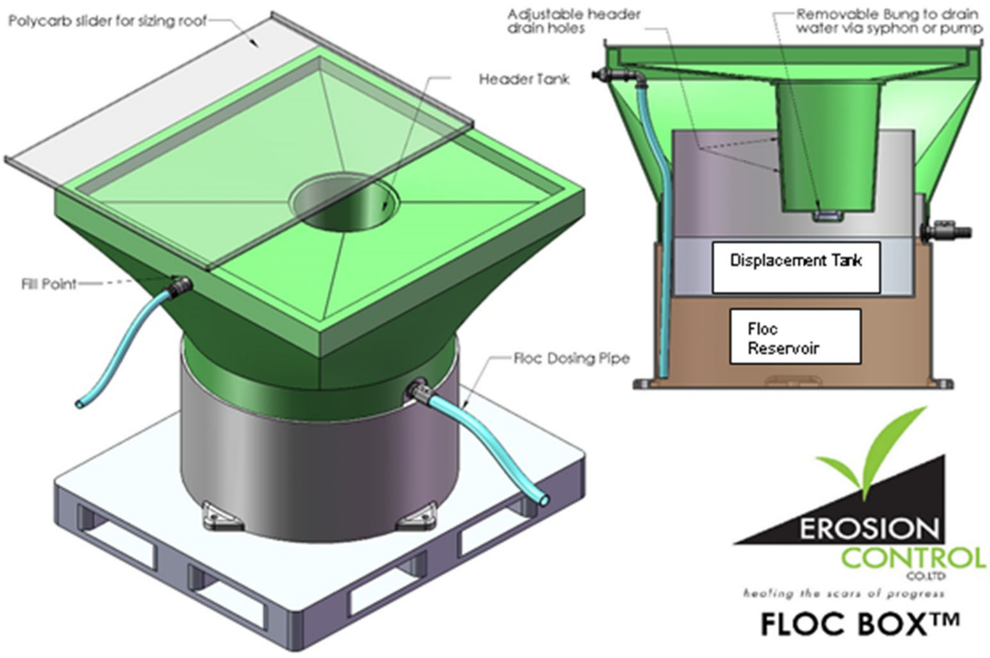


Figure 3: Erosion Control's floc box.

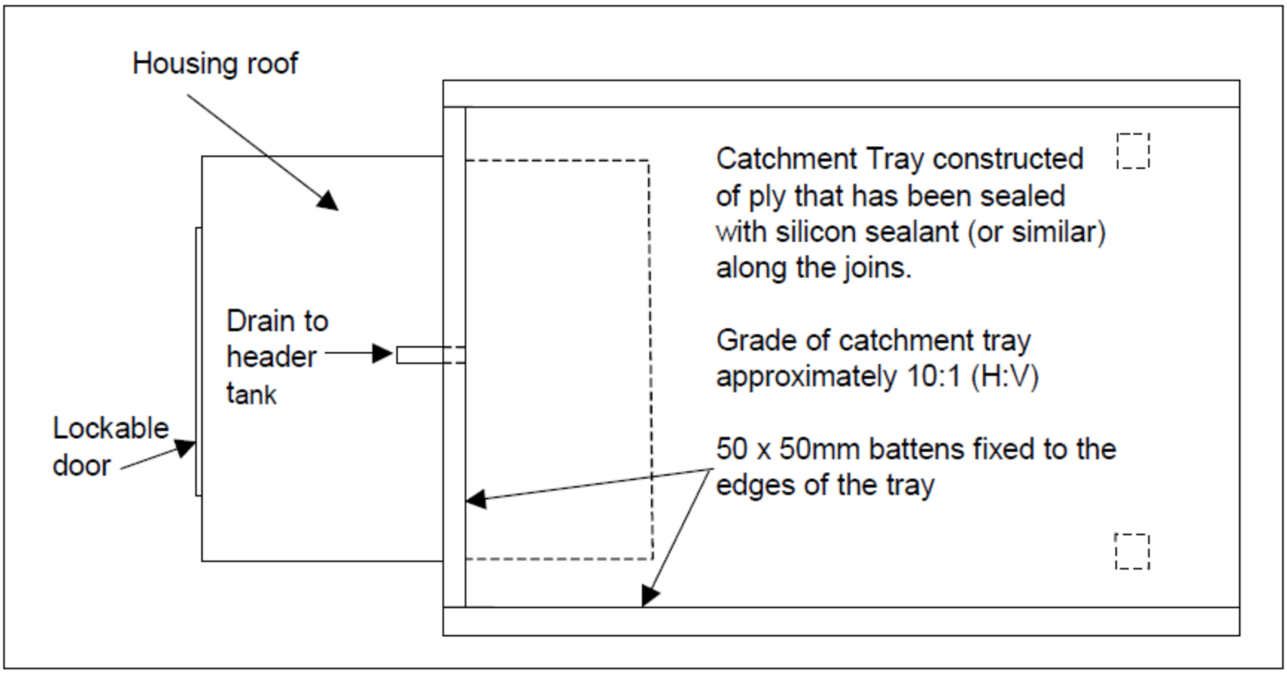


Figure 4: Roof tray details for a floc shed.

Header Tank Management in summer months will as per the Council guidelines as follows:

- After 3 days without rain – reduce volume by 50%
- After 6 days without rain – empty completely

3.1.1 Area of Rainwater Catchment Tray Required for Rainfall Activated System

The area of the rainwater catchment tray is determined by the dose required, and the area of the earthworks catchment draining to the DEB.

All water flowing into the DEB needs to be treated, and the rainwater catchment tray size is determined by the total land catchment area draining to the DEB including both the 'open' area and stable areas. If the catchment area draining to a DEB is changed, then the catchment tray size should also be changed in proportion. Reduction of the tray size is easily achieved by placing a piece of plywood on top of the upstand over the lower end of the tray, thereby allowing the rain which falls on the plywood to run to waste.

The required tray size will be calculated and submitted as part of the staged SSESCPs and included in Appendix C.

3.1.2 Header Tank Outlet Spacing

The volume between the drain (lowest) header tank outlet and the first dosing outlet is equal to the volume of 12mm of rain on the catchment tray and the volume between the first and second dosing outlets is the same.

The required header tank outlet spacing details will be calculated and submitted as part of the staged SSESCPs and included in Appendix C.

3.1.3 Sediment Laden Runoff Channel and Dosing Point for Rainfall Activated System

The chosen chemical needs to be added to the sediment laden runoff channel to provide mixing with the sediment laden runoff before it reaches the area of ponded water in the forebay or the DEB itself.

All sediment laden runoff from the catchment should be combined into a single channel if possible before it reaches the chemical dosing point which should be located 5 - 10 metres prior to the point where the runoff reaches the ponded water of the forebay, so the chemical can be added to and mixed with the total inflow.

The dosing point should be at a location where the chemical will fall into the sediment laden flow during periods of low flow. The end of the dosing tube should be only a few centimetres above the diversion channel to ensure that the chemical falls into the sediment laden runoff and is not blown away during periods of strong wind.

3.2 Inline Treatment Container (Lamella or Similar)

Sediment laden water within deep excavations (including deep trenches and piling) will be pumped into a settling container system (lamella or treatment container) adjacent to the operation. The pumped sediment laden water will be chemically treated as required prior to entering the settlement container. This will promote settlement of suspended solids in the container system, providing appropriate water quality discharging from the site.

The treatment devices generally follow GD05 principles with regard to dimension ratios and promotes sheet flow at the inlet and outlet ends. Treated water from the treatment devices will likely discharge to the adjacent stormwater network.

Chemical treatment of the treatment device will either be via batch dosing (refer to Section 3.3 below) of inline electronic dosing.

Inline electronic dosing is a flow activated dosing system triggered by a pump. The does rate is programmed into the device and the system will then accurately chemically treat runoff entering the treatment device during pumping operations.

Figure 4: Example of an in-line electronic chemical dosing system (Source: Erosion Control).

During pumping, water clarity within the treatment container will be tested using the black disc method (refer Appendix A1), and pH will be tested using pH strips or an electronic pH meter. The results of these tests will be recorded on the attached check sheet (Appendix A2). If the water is found to be outside acceptable levels for clarity (<100mm depth) or pH (below 5.5 or higher than 8.5), then pumping will cease and appropriate contingencies will be put in place. This will generally involve re-circulating the water from the container to provide additional chemical dosing, or possibly removal off site.

3.3 Batch Dose Treatment

The criterion to establish the need for batch dosing is the clarity of the sediment laden runoff. Clarity is measured using a black disk lowered vertically into the water to be tested. A small black disk of 50-80mm diameter is attached to a 1m long stick with a centimetre scale starting at the disk.

The disk is lowered into the water until it disappears, and then is raised until it just reappears. The depth of reappearance is recorded as the clarity of the water.

Water with a clarity of 100mm or greater is considered to be acceptable for discharge. Water with a depth of clarity of less than 60mm should be batch dosed. If the sediment laden runoff has clarity between 60-100mm after rainfall has ceased, it should be left for 48 hours to settle. If the clarity has not reached 100mm after 48 hours, or if sediment laden runoff has to be discharged within 48 hours because the pond is full, the sediment laden runoff should be batch treated.

The batch dose rate will be outlined in Appendix A3.

3.3.1 Application Procedure (Batch Dosing)

The chemical dose should be applied evenly over the surface of the DEB or treatment container as quickly as practicable. It is best to apply the dose in one application, rather than going over the surface of the DEB or treatment container two or more times.

The total dose may be applied in one of two ways.

(a) Spray.

The chemical can be applied to the surface of the pond using a sprayer that produces large drops.

(b) Bucket.

Place no more than 1 litre of chemical in a 10 litre bucket and throw the chemical onto the pond surface so that the chemical divides into drops before hitting the surface.

Following batch treatment and the settlement of the coagulated solids the DEB / treatment container water can be discharged. Settlement generally requires 1-2 hours.

3.3.2 Timing

As the water in a DEB or treatment container often develops marked temperature gradients during the day which can inhibit mixing of the chemical that is added to the surface of the DEB or treatment container and the settlement of coagulated solids, batch treatment should be carried out in the early morning to optimise mixing of the chemical with the sediment laden runoff and the subsequent settlement of coagulated solids.

If there is a possibility that a DEB will overflow during a large rainstorm as a result of surface sediment laden inflows, batch treatment can be carried out while it is still raining. The clarity of the water in the DEB should be determined, and if the surface clarity is less than 60mm then treatment can be undertaken.

4 Determination of Dose Rate

Bench testing will be undertaken to determine the preferred chemical treatment system and optimum dose for suspended solids removal. The bench testing will also consider the effects on pH of the treated water for the sediment retention devices.

Bench testing will be undertaken during the preparation of the SSESCPs and the results submitted to Auckland Council as part of the SSESCP approval process.

For areas where imported fill is to be used, bench testing will commence as soon as a fill source has been identified or dewatering and pumping is required, and the results provided to Auckland Council. Refer to Appendix A3 for the Bench Testing Results Sheet.

Ongoing monitoring will also be undertaken of the sites sediment retention devices as outlined in Appendix A2. If the monitoring highlights any deficiencies further bench testing will be undertaken.

5 Monitoring and Maintenance Requirements

5.1 Routine Management and Maintenance

Instructions for routine management and maintenance of the chemical treatment system are provided in Appendix A1. A copy of this table be kept onsite and available for review.

All monitoring records and maintenance checks and actions will be recorded on the monthly record sheet provided in Appendix A2. The systems will be checked after each rainfall event, and during dry periods the systems will be checked weekly.

It is also noted that chemical treatment increases the sediment removal efficiency of the sediment controls. The sediment controls will need to be regularly desilted to ensure that the maximum volume is re-established after rain events.

5.2 Contingency Management

Contingencies could include poor performance of the treatment system, or effects of other influences on sediment laden runoff quality, such as reduced pH, that might make the use of chemical inappropriate.

If the treated water in the sediment control device is consistently very clear it could indicate overdosing, and the possibility of lowered pH which can present a risk to receiving waters as a result of elevated free aluminium concentration in the discharge. If the treated water is consistently clear the pH of the water in the DEB will be tested.

Contingencies such as poor treatment performance or consistently very clear treated water should be dealt with as part of the day-to-day environmental management of the site. Refer to the ESCP for additional monitoring and maintenance procedures that are to be implemented across the project.

A treatment chemical spill contingency procedure is provided in Section 5.6 below.

5.3 Record Keeping and Reporting

A copy of the maintenance record for the chemical treatment system will be kept on site (Appendix A2).

A copy of the maintenance record for the chemical treatment system will be provided to the Auckland Council on request.

5.4 Storage of Flocculent On Site

Bulk PAC, SuperFloc, and Vital Eco Floc which can be supplied by the manufacturer in 200L polyethylene drums or 1,000L IBC's, should be kept in secure storage, either in a locked shed or container. Drums of chemical should always be stored on end with the screw caps uppermost. Topping up of flocculent chemical will be made weekly as part of the regular inspection regime.

5.5 Procedure for Transportation

PAC, SuperFloc and Vital Eco Floc will be delivered to the site by commercial carriers in accordance with current Hazardous Goods, Traffic and Transport regulation. These chemicals can be requested from the supplier generally in 20 litre containers, 200 litre drums and/or 1,000 litre IBCs. PAC, SuperFloc and Vital Eco Floc all weigh about 250kg, and is most easily moved within the site in a loader bucket. The use of these or any other chemical must be done in accordance with the Site Health and Safety Plan.

5.6 Flocculation Chemical Spill Contingency Procedure

If there is a spill of either of these chemicals onto the ground it should be immediately contained using earth bunds to prevent it entering water. The spilt chemical should be recovered if possible and placed in polyethylene containers. If the spilt chemical cannot be recovered, it should be mixed with a volume of soil equal to at least ten times the volume of spilt chemical. This will effectively neutralize the chemical. The soil with which the chemical has been mixed should be buried in the ground a minimum of 0.5 metres below the surface.

If there is a spill of chemical into ponded water, discharge from the pond to natural water should be prevented.

If there is any spill into flowing water:

1. The Auckland Council should be advised immediately.
2. The volume of the spill should be recorded.
3. If possible, the water and spilt chemical should be pumped into a bund or DEB until all the spilt chemical has been removed from the watercourse.
4. If the chemical cannot be removed from the watercourse any downstream users should be identified and advised.

5.7 Chain of Responsibility for Monitoring and Maintenance

The Project team shall have primary responsibility for maintenance and monitoring the effectiveness of the chemical treatment systems.

Construction Environmental Manager and the Erosion and Sediment Control Specialist will have overall responsibility chemical treatment systems.

PAC / SuperFloc

The Project team will check the effect of PAC or Superfloc dosing on the pH of the treated water once the pond has filled for the first time, and monitor pH and overall performance throughout the duration of works.

Vital SuperFloc

The Project Team will monitor pH and overall performance throughout the duration of works.

5.8 Training of Person Responsibility for Maintenance and Monitoring

The monitoring and maintenance of chemical treatment systems will only be undertaken by individuals trained to carry out the routine monitoring and maintenance of the chemical treatment system, and to keep the required records.

5.9 Procedure Modification

It is expected that as the project progresses, performance checks of the chemical systems may be required due to changing soil types etc. This will be undertaken following additional sampling and testing and approval from the Environmental Lead.

6 Appendices

6.1 Appendix A1 - Instructions for Maintenance of Rain Activated Treatment Systems

A) Chemical Dosing System

Reducing the Header Tank Water Volume

The header tank is used to avoid dosing during the initial stages of rainfall when site conditions are dry and no runoff is to be expected.

The volume in the header tank is lowered using the lowest of the three outlet tubes.

- After 3 days without rain - reduce volume to 50%.
- After 6 days without rain - reduce volume to empty (level at lowest outlet).

Refilling the Chemical Reservoir

The chemical reservoir tank should be refilled when the white displacement tank is half full, or sooner if heavy rain is predicted. This is done by first emptying the white tank (baling with a bucket is efficient), and then refilling the black reservoir tank until the PAC or SuperFloc level is at the lower edge of the outlet.

Observation of Water Quality in Pond

The pond water quality will be observed at least weekly, and the clarity determined using a black disk and recorded on the monitoring sheet. pH shall be recorded once the pond has filled up to ensure that chemical dosing does not have an unacceptable effect.

Periodic System Checks

Check that the rainfall catchment tray is not leaking – especially along the lower edge of the tray. This should be done after rainfall has ceased.

Check the lower hose with the small tube outlet, from the header tank to the displacement tank, is not blocked.

Monitoring Records

A separate sheet is provided for monitoring records for each month. The information to be recorded is as follows:

Visual check

Check the tray for leaks, the plumbing, and the hoses from the header tank. Record 'ok' or if maintenance is required write 'M' and note requirement in Notes column.

How full is the header tank (%)

This is the volume between the lowest and middle outlets. After rain this should be either 100% after 12mm or more rain, or between 0-100% after less than 12mm rain. In summer: 50% when lowered after 3 dry days; 0% when emptied after 6 dry days.

Depth in Displacement Tank (%)

Measure depth of water in cm. Reduces to 0 when emptied.

Chemical *volume added*

Record the PAC or SuperFloc volume added. 1 drum = 200L, 9cm in the 200L drum = 20L. The volume can also be calculated from change in water level in displacement tank where 1cm change = 4 litres of chemical.

Pond Clarity: Record using black disc near pond outlet. (Refer above)

6.2 Appendix A2 – Chemical Treatment Monitoring and Maintenance Record

Rainfall Activated Dosing System

Site: EB2 / EB3R

DEB Name: Month: Maintenance Person:

Date	Visual check	% Header Full	Water depth In Displacement Tank (cm)	Chemical Volume Added	Water Clarity (cm)	pH	Notes on maintenance required or additional information	Initial
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

In-line Chemical Dosing System

Location:

Permit to Pump reference and holder:

Date / Time	Water clarity	pH	Other: Inspect for issues, e.g. scour at outlet, water quality issues, silt level in tank	Sign off

Actions/Notes:

Requirements:

- Water clarity >100mm
- pH between 5.5- 8.5

6.3 Appendix A3 – Bench Testing Results Sheets

1 Introduction

Soil samples was taken from the contributing catchments of (*insert description of devices and catchment*).

The three chemicals were tested: (*delete any chemical that was not tested)*

1. **Poly Aluminium Chloride (PAC)**
2. **SuperFloc**
   SuperFloc is a blend of PAC and PolyDADMAC. We tested with a blend ratio of 80% PAC to 20% PolyDADMAC.
3. **Vital Eco SuperFloc**
   Vital SuperFloc is a water-based product containing chitosan, a natural biopolymer and acetic acid (<2%).

Bench test flocculation trials were undertaken to determine soil reactivity to chemical treatment in accordance with the Auckland Council guideline.

2 Bench Test Trials

2.1 Results of PAC Bench Test

Bench testing undertaken using PAC. The results of the bench tests are as follows.

Sample 1, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
2					
4					
6					
8					
10					

Sample 2, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
2					
4					
6					
8					
10					

Sample 3, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
2					
4					
6					
8					
10					

2.2 Results of Superfloc Bench Tests

Bench testing undertaken using Superfloc. The results of the bench tests are as follows.

Sample 1, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
1.6					
3.2					
4.8					
6.4					

Sample 2, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
1.6					
3.2					
4.8					
6.4					

Sample 3, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
1.6					
3.2					
4.8					
6.4					

2.3 Results of Vital Eco Superfloc Bench Tests

Bench testing undertaken using Vital Eco Superfloc. The results of the bench tests are as follows.

Sample 1, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
25					
50					
100					
150					
200					
250					

Sample 2, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
25					
50					
100					
150					
200					
250					

Sample 3, Catchment 1 Initial pH = Initial Turbidity: =

Aluminium Dose (mg/L)	Clarity (mm) after 5mins	Clarity (mm) after 30mins	Clarity (mm) after 60mins	Final pH after 60mins	Final Turbidity after 60mins
0					
25					
50					
100					
150					
200					
250					

3 Discussion

Insert discussion and conclusion based on the bench testing results.

Include recommendation / chemical to be used and dose rate

3.1 Batch Dosing Rate

Insert batch dose rate and requirements

3.2 Rainfall Activated Dosing System Details

Floc Shed Tray Size

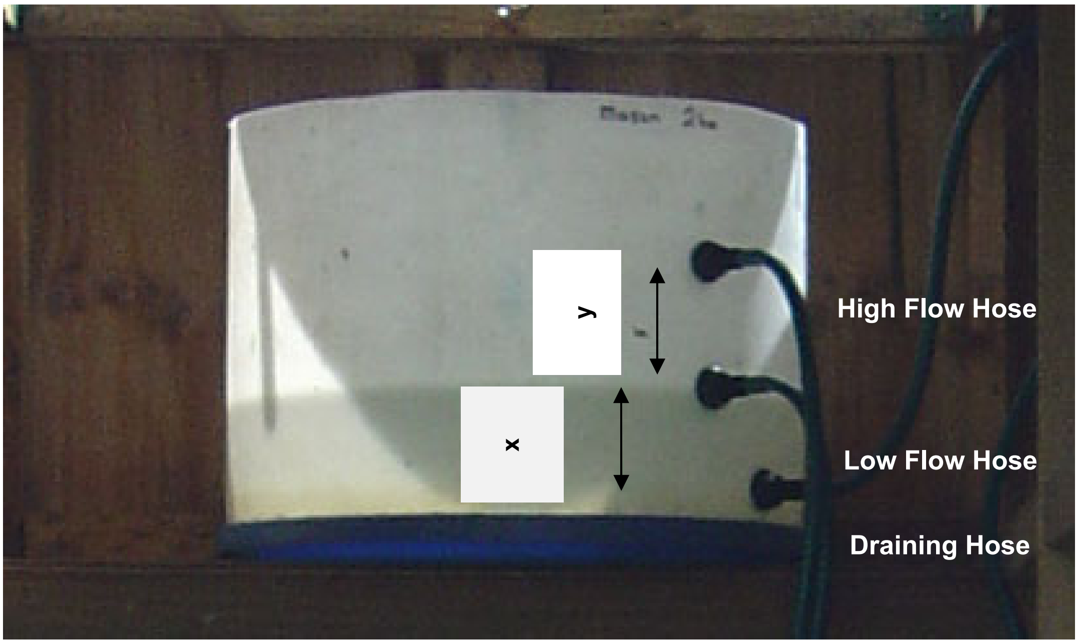
Based on the bench test results displayed in Appendix 3 undertaken on XX.XX.22 the required tray size is XXX square metres per hectare of exposed land catchment draining to the SRP. This is the area inside the upstand around the edge of the tray.

Sediment Retention Device	Catchment area (ha)	Tray Size (m^2)
XX	X	X
XX	X	X

Header Tank Outlet Spacing

The distance between the drain and first dosing outlet, and between the two dosing outlets, for a standard header tank made from a 200 litre drum with an internal diameter of 55 cm would be:

Sediment Retention Device	Catchment Area (ha)	Distance (x) (cm)	Distance (y) (cm)
XX	XX	X	X
XX	XX	X	X



Appendix B Dewatering Procedures

1. Application

This Procedure forms a part of the Erosion and Sediment Control Plan (ESCP) for Eastern Busway 2 (EB2) and Eastern Busway 3 Residential (EB3R) sections of the overarching Eastern Busway Project (EB2/EB3R). The proposed construction works will include piling and earthworks operations that require dewatering by pumping.

The purpose of this procedure is to set out a clear methodology for treating and discharging water from the site via pumping to ensure that the required level of sediment treatment on site is achieved during these operations. This procedure applies across EB2 and EB3R.

Pumping water on site is controlled with a Permit to Pump system. A blank copy of the Permit is provided in Appendix B1. The permit contains information like the frequency of monitoring required and who is responsible for the monitoring, and it is issued by the Environmental Lead.

2. Scope of Works

The construction activities of EB2/EB3R include the following:

- Ground improvements
- Excavations
- Bridge construction
- Service relocation and installations, including new stormwater outfall structures
- Upgrading of existing road network
- Construction of Bus stations

3. Potential Environmental Effects

The key potential environmental aspects and impacts relating to dewatering are set out in Table 6 below.

Table 6 Dewatering Aspects and Impacts

Aspects	Impacts
High sediment loads from construction water. Incorrect machinery being used. Damage to aquatic life & environment.	Overloading of sediment control devices, causing sediment to discharge direct to water. Incorrect processes being followed onsite, causing sediment discharge to land where it may enter water, or direct to water.

4. Reference Documents

Dewatering and Pumping Record Sheet (Appendix B1).

5. Water Quality Requirements

During pumping or dewatering of water off site to the receiving environment the following two water quality standards must be met:

1. Water clarity >100mm

2. If using chemical to improve water clarity, then a pH between 5.5 and 8.5 is required.

Chemical treatment will be undertaken in accordance with the Site's Chemical Treatment Management Plan (CHTMP).

6. General Procedure

Decanting earth bunds (DEBs) and treatment containers / devices (i.e. lamella plate clarifiers) are to be constructed or used in accordance with Auckland Council's Guideline Documents 2016/005 '*Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region, June 2016'* (GD05). Control devices will be chemically treated in accordance with the Site's Chemical Treatment Management Plan (CTMP) to improve the efficiency of the devices when receiving pumped water from dewatering operations.

There will be two procedures for dewatering excavations from the site. Each of these procedures has a specific methodology for ensuring that the sediment treatment achieved by the procedure is in accordance with GD05 requirements and industry best practice.

The two procedures are:

- Pumping directly from the excavation to the stormwater network without any treatment.
- Pumping to a sediment control device where the flows will be stored, batch dosed (if required) with chemical, and then discharged to the receiving environment.

6.1. Direct Pumping

This option is the least likely to be utilised in practice and relies on impounded flows within the excavation having a greater clarity than 100mm and the ability of the pump to be able to remove the impounded water without disturbing any sediment. This method is not to be used for dewatering depths of less than 500mm.

The procedure for pumping directly to the stormwater network will be as follows:

- Dewatering and Pumping Record Sheet is to be completed.
- Prior to pumping the clarity of the impounded water is to be confirmed as being greater than 100mm and pH within the range of 5.5-8.5.
- The inlet to the pump is to be supported no less than 500mm above the base of the excavation in a location and manner where the inlet will not disturb settled sediments within the excavation. Where possible a floatation device shall be installed on the pump inlet to ensure pumping down from the cleanest water.
- The outlet of the pump is to be located and stabilised to prevent erosion. It is preferable to discharge the pump to a piped stormwater system.
- During pumping directly off-site the clarity of the impounded water is to be checked and recorded every 15 minutes. If the clarity drops below 100mm pumping is to stop and an alternative pumping procedure used.

6.2 Batch Dosing

In this method impounded flows are to be pumped to a DEB or treatment container (or similar) to be stored and batch dosed, with chemical. When the depth of clarity has increased to greater than 100mm and the pH has been checked and confirmed to be within the range of 5.5 – 8.5 then the stored flows will be discharged via the decant of the DEB or treatment device allow to discharge via a skimming outlet.

The procedure for batch dosing is as follows:

- Dewatering and Pumping Record Sheet is to be completed.
- The outlet of the DEB or treatment container to receive the pumped flows is to be capped to prevent a discharge during pumping to the device.
- The pumped flows are to be discharged in a manner that minimises disturbance within the DEB or treatment device.
- Pumping is to continue until complete or until the DEB or treatment device has filled to the level of the primary spillway. Pumping is not to continue once this level has been reached.
- Once pumping is complete, the water clarity and pH is to be checked. If water clarity is greater than 100mm and pH is within the range 5.5-8.5, then the DEB or treatment device can be allowed to discharge. If not, the volume of stored water is to be noted and the correct volume of chemical added.
- The dose rate is determined by the Chemical Treatment Management Plan (Appendix A).
- The chemical is to be added to the surface of the DEB or treatment device by spraying with a backpack sprayer with a 'stream' outlet rather than a 'mist'. Chemical is to be sprayed evenly over the surface of the device. Ponded water can develop marked temperature gradients during the day through its depth which can inhibit mixing of chemical. It is therefore recommended that batch treatment be carried out, whenever possible, in the early morning.
- Chemical is to be mixed into the surface as well as practical using a pole or similar.
- The device is then to be left for a minimum of two (2) hours to allow settlement to occur.
- After 2 hours the clarity and pH is to be checked and recorded.
- In the event that the clarity of the device is still less than 100mm, specialist advice is to be sought.
- In the event that once the clarity of the device is greater than 100mm, however the pH is outside the limits of 5.5 – 8.5 then specialist advice is to be sought regarding correction of the pH level.
- Once the clarity of the device is greater than 100mm and the pH is within the range of 5.5 – 8.5, the device is to be discharged by removing the cap. The time of this discharge and the pH and clarity are to be recorded on the Dewatering and Pumping Record Sheet.

Figure 13 Dose rates per volume of water

	Volume of water to be treated		
	$10m^3$	$25m^3$	$50m^3$
Dose Rate	**Litres of PAC to be used (l)**		
2mg Al	0.31	0.8	1.6
4mg Al	0.62	1.55	3.1
6mg Al	0.94	2.35	4.7
8mg Al	1.24	3.1	6.2

7. Procedure Modification

It is expected that as EB2/EB3R progresses, modification of the dosage rates may be required due to changing soil types etc. This will be undertaken following additional sampling and testing and approval from the Environmental Lead.

Appendix B1 Dewatering and Pumping Record Sheet- Permit to Pump

Date:			Time:		
Location of water to be pumped					
Estimated volume of water to be pumped					
Weather forecast for following 24hrs					
Proposed dewatering method (Circle)			Signed		
Direct Pumping					
Batch Dosing					
Direct Pumping			Sign as Confirmation		
Clarity of impounded water is greater than 100mm					
Pump inlet is supported a minimum of 500mm above the base of the excavation					
Outlet of pump is stabilised to prevent erosion					
Confirm clarity of water at pump inlet every 15 minutes during pumping					
Time					
Clarity					
Signed					
Pumping to an impoundment device				Sign as Confirmation	
Impoundment device to be used					
Outlet plugged prior to pumping					
Volume pumped (stored within impoundment device) Time pumping stopped			m^3 am/pm		
If, clarity is greater than 100mm and pH is between 5.5-8.5 – Ok to discharge. Record details			mm pH		
Or, if not, batch dosing to occur. Confirm volume of impounded water Confirm batch dose rate			 m^3 L		
Clarity is greater than 100mm prior to discharge (record clarity)			mm		
Measured pH is between 5.5-8.5 prior to discharge. Note: if pH is outside this range refer to Environmental Lead / Project Director for corrective actions			pH		
Time of discharge			am/pm		