# Erosion and Sediment Control Plan (ESCP)

NZ TRANSPORT AGENCY
WAKA KOTAHI

1 MacKays to Peka Peka Expressway

## Erosion & Sediment Control Plan (ESCP) Revision History

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## Independent Review

| Action | Name | Signed | Date |
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| Reviewed by | Mike McConnell | D.M.McConnell | 3 May 2013 |

## Document Acceptance

| Action | Name | Signed | Date |
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| on behalf of | M2PP Alliance | | |

## Final for GWRC Certification

| Action | Name | Signed | Date |
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| Regulatory Manager Approval | Al Cross | | 20/8/13 |
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## Quick Reference Guide to Conditions

| Condition Number | Condition Requirement | Comments | Key Final ESCP Reference |
|---|---|---|---|
| G.27(a)(i) | Outline ESCP Principles | Full principles detailed which will be required to be adhered to with CESCP's | Section 3.3 and Principles 1 to 22 |
| G,27(a)(ii) | Identify High Risk Areas | Identified and managed as high risk areas. | Section 3 and 4 |
| G.27(a)(iii) | Ensure Construction Avoids, remedies or Mitigates Effects | Key principle from within Final ESCP | Full Final ESCP and Section 3 |
| G.27(a)(iv) | Use Bioengineering and Low Impact Design | Detailed throughout Final ESCP with revegetation and use of infiltration and permanent stormwater devices | Full Final ESCP |
| G.27(a)(v) | In Accordance with Draft ESCP and Hearing Procedures | Addressed fully | Full Final ESCP |
| G.27(b)(i) | ESC Installed Prior to and During Construction Work | Within Final ESCP and conditions of consent. | Section 5 and 6 and Final ESCP Principles |
| G.27(b)(ii) | Identification of appropriate and experienced staff | CESCP's will detail specific details based on Final ESCP | Section 6 |
| G.27(b)(iii) | Identification of staff with clearly defined roles | CESCP's will detail specific details based on Final ESCP | Section 6 |
| G.27(b)(iv) | Chain of responsibility | CESCP's will detail specific details based on Final ESCP | Section 6 |
| G.27(b)(v) | Procedures for monitoring as per G.38A | Procedures detailed | Section 5.3 |
| G.27(b)(vi) | Site monitoring triggers for event based monitoring | Procedures detailed | Section 5.3 |

| | | | |
|---|---|---|---|
| G.27(b)(vii) | Responsibilities, procedures and response actions to ensure rapid response to continuous turbidity thresholds | Deatiled in Section 5.3 addressed within Erosion and Sediment Control Team responsibilities | Section 5.3 and 6.1 |
| G.27(b)(viii) | Monitoring methodology to confirm devices meet outcomes and standards as per G.26A and G.26B | Addressed in Section 5.3 | Section 5.3 |
| G.27(b)(ix) | Changes to ESCP and CESCPs that are considered minor and not require certification by the Manager | Addressed fully in Final ESCP and conditions of consent. | Section 3.3 |
| G.27(b)(x) | Methods and procedures for decommissioning of ESC | Addressed fully in Final ESCP and conditions of consent. | Section 3.0 |
| G.27(c) | Work shall not commence until written certification received | Addressed fully in Final ESCP and conditions of consent. | Full Final ESCP and Principles. Section 3 |

# 1 Purpose

The purpose of this Erosion and Sediment Control Plan (ESCP) is to fulfil the requirements of condition G.27 of resource consent NSP 12/01.005 associated with the MacKays to Peka Peka Project (the "Project"). The ESCP provides the framework for the Construction Erosion Sediment Control Plans (CESCPs) which will provide the site specific detail for the Alliance Construction Team.The ESCP shall describe the methods and practices to be implemented to ensure the effects of sediment generation and yield on aquatic receiving environments assocaited with the Project, shall be approrpiatey managed.

In addition, the ESCP shall:

- Outline the key ESCP principles which shall be adhered to;
- Identify areas susceptible to erosion and sediment deposition with particular emphasis on identified high risk areas;
- Ensure construction and maintenance activities avoid, remedy and mitigate effects of soil erosion, sediment runoff and sediment deposition on high value ecological areas;
- Detail procedures to ensure erosion and sediment control measures are installed prior to and during all works and procedures for decommissioning of controls;
- Identification of Environmental Management staff who are appropriately qualified and experienced, their roles and responsibilities and chain of command;
- Detail monitoring requirements and responsibilities for turbidity monitoring and triggered event monitoring as detailed in Condition G.38A;
- Identify what is considered to be a 'minor' ammendement to the ESCP or CESCPs.

Site specific Construction Erosion Sediment Control Plans (CESCPs) will be prepared prior to works starting in each section of the project and will require certification from Greater Wellington Regional Council (GWRC) prior to works starting in that area.

Each CESCP must be submitted to GWRC at least 10 working days prior to commencement of works in that area for certification and works must not commence without receipt of the written certification.

The purpose of the CESCPs is to detail how the erosion and sediment control measures will be implemented, monitored and maintained for all areas of land disturbance including stream works.

Information included for each CESCP will include:

- Contour information at suitable intervals;
- Erosion and sediment control measures including specific design details and calculations;
- The criteria for determining whether chemical treatment is required and if so, the associated design details;

- Catchment boundaries for all erosion and sediment control measures;
- Location of the works to be undertaken including cut and fill operations;
- Construction methodology including timing and durations;
- Contingency measures for streamworks to address high flow events including early warning systems and subsequent response measures;
- Design details of controls including contributing catchment areas, retention volume of structures (dead and live storage measured to the top of the primary spillway), dimensions of the structure, location of flood waters, safety and access, position of inlets, outlets and emergency spillways, stabilisation and maintenance requirements;
- A programme for managing non-stabilised areas of earthwork including progressive stabilisation considerations;
- Identification of appropriately qualified and experienced staff who will measure the erosion and sediment controls on site;
- Identification of staff who have clearly defined roles for monitoring consent and CESCP compliance;
- Details of the chain of responsibility for addressing environmental issues;
- The role of Te Ati Awa ki Whakarongotai or the Takamore Trust in observing monitoring;
- Methods and procedures for the decommissioning of erosion and sediment control measures; and
- Methods, design details and procedures for managing the discharge of contaminants with a particular focus on that associated with cement contamination.

# 2 Project description

## 2.1 Project overview

This ESCP forms part of a suite of Management Plans which form part of the Construction Environmental Management Plan (CEMP) for the MacKays to Peka Peka Expressway.

For the purposes of the construction methodology and this Final ESCP, the Project is split into 3 specific zones referred to as follows:

### South Zone

This zone includes chainage to 4500 and includes the following specific construction sections:

- Poplar Avenue (POP)
- Poplar Avenue-Raumati Road (POP-RAU)
- Raumati Road – Wharemauku Stream (RAU-WHA)
- Wharemauku Stream – Kapiti Road (WHA-KAP)
- Kapiti Road Interchange (KAP).

### Central Zone

This zone includes chainage 4500 to 11500 and includes the following specific construction sections:

- Kāpiti Road–Mazengarb Road (KAP–MAZ)
- Mazengarb Road Bridge
- Mazengarb Road– Otaihanga (MAZ–OT)
- Otaihanga Road Bridge
- Otaihanga Project Office/Yard
- Otaihanga Road – Waikanae River (OT–WAI)
- Waikanae Bridge
- Waikanae River – Te Moana Road (WAI–TEM).

### Northern Zone

This sector includes chainage 11500 to 18050 and includes the following specific construction sections:

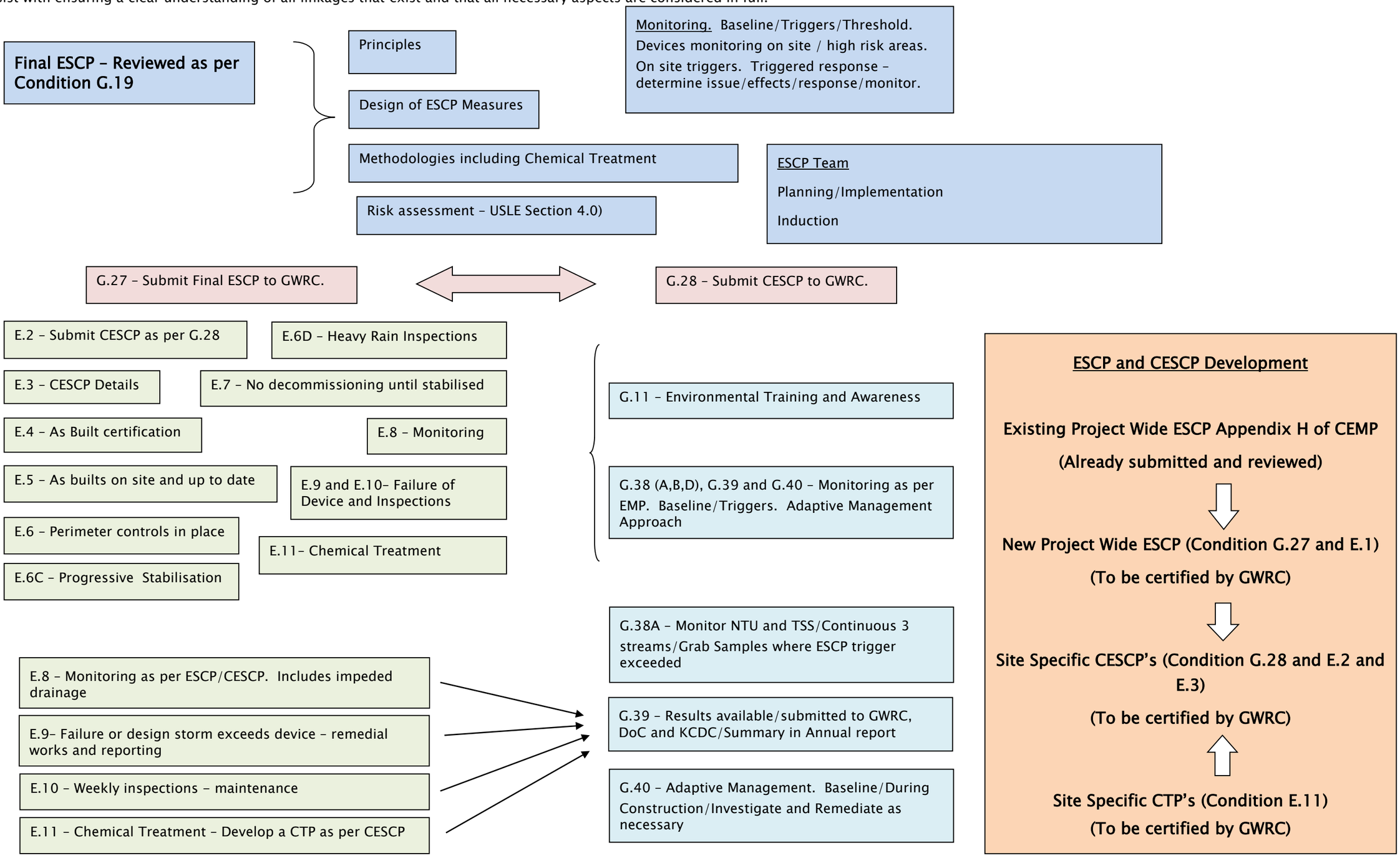
- Te Moana Interchange (TEM)
- Te Moana Road – Ngarara Road (TEM–NGA)
- Ngarara Road (NGA)
- Smithfield Road (SMI)
- Smithfield to CH15400 (SMI – 15400)
- 15400 to Peka Peka (15400 – PP)
- Peka Peka Interchange (PP).

The Project is anticipated to take five  years to construct, and will be undertaken on a number of work faces simultaneously.  Industry best practice will be implemented across the project by utilising the Greater Wellington Regional Council's Erosion and Sediment Control Guidelines for the Wellington Region, September 2002 (Wellington Guidelines) and the draft NZTA Erosion and Sediment Control Standard for State Highway Infrastructure dated August 2010 (NZTA Draft Standard).  A condition of consent (G.26A(b) requires that the more stringent of the two guidelines be complied with and this is detailed in Section 3.3 of this ESCP.  In some circumstances the specific design of the measures will be adapted to suit the project conditions, an example being rock filters in sand environments.

There are a number of construction yards proposed along the route of the Project with CESCPs being prepared for each yard to ensure all erosion and sediment control effects are adequately addressed.

## 2.2 Consent condition relationship flow chart

The flow chart below shows the relationship between the various conditions related to erosion and sediment control activities. In implementing this Final ESCP and the CESCP's, this relationship flow chart will assist with ensuring a clear understanding of all linkages that exist and that all necessary aspects are considered in full.



# 3 Design philosophy and principles

## 3.1 Existing conditions and receiving environment

The site generally has peat soils overlaying sand layers in addition to areas of sand dominant soils. Peat is essentially an accumulation of partially decayed vegetation matter that has formed when plant material is inhibited from decaying fully by the acidic conditions. Peat is soft and easily compressed and under pressure, water in the peat is forced out. The peat on the Kapiti Coast has a high water table which can limit the type of sediment controls utilised. Further, the areas of sand dominant soils in many locations along the Alignment create an environment that requires specific management from an erosion and sediment control perspective. These sand and peat areas are clearly identified within the geological plans supporting the project.

The receiving environment values associated with the site include a range of both fresh water and coastal ecological and amenity values. These receiving environments are sensitive to sedimentation effects and the subsequent impact on fish habitat and spawning. Many of these areas are also traditional food gathering areas (mahinga kai). As a result, it is important that erosion and sediment control options recognise these values and manage the discharge of sediment accordingly.

Higher risk areas are identified as those locations adjacent to, or connected to, freshwater streams. These higher risk areas are protected through the minimisation of discharges, the implementation of erosion and sediment control measures, the increased monitoring of controls and the increased awareness of risks through environmental training of staff.

These areas focus around the existing values of the freshwater stream systems along the Project and in particular focuses on the Waikanae River and the Te Harakeke/Kawakahia Wetland. As per Condition G.27, the El Rancho Wetland, Raumati Manuka Wetland (between Poplar Avenue and Raumati Road), Southern Otaihanga Wetland, the Northern Otaihanga Wetland (adjacent to Otaihanga Landfill), Waikanae River, Wharemauku Stream and the Kakariki Stream are all acknowledged as high value, and therefore higher risk, areas of the project. During the development of the CESCP's, particular attention will be given to ensuring that the erosion and sediment controls in these locations are robust and provide the necessary protection.

Stream diversion and culvert installation activities are considered to be high risk from a construction perspective and as a result attract a high degree of monitoring (Condition G.38A) with continuous telemetered turbidity loggers for diversions. It is further acknowledged that the Te Harakeke/Kawakahia wetland is the ultimate receiving environment for any discharge from the Paetawa Drain, Ngarara Ngarara Drain, Kakariki Stream and Ngarara Stream with this wetland considered to be ecologically important nationally. The Waimeha Estuary and Wharemauku Stream Estuary are also recognised as high value receiving environments. The Waikanae River is recognised as interacting with

the underlying gravel aquifer where there are large flow losses to groundwater and gains from groundwater along certain reaches.

Sediment generation arises from the bulk earthworks phase of earthworks operations because of the area exposed and the time required to undertake the works. For this Project the soil types and the construction methodology are both considered to be of significant influence to the sediment generation potential.

## 3.2 Erosion processes

Erosion is the process whereby the land surface is worn away by the action of water, wind, ice or other geological processes. The resultant displaced material is known as sediment with sediment yields being the sediment which leaves a particular control measure. Sedimentation is the deposition of this eroded material. Accelerated erosion is primarily caused by human activities and is a much more rapid process then natural erosion.

Through the erosion process, soil particles are dislodged, generally by rainfall and increased surface water flow. As rain falls, water droplets concentrate and form small flows. The combined energy of the rain droplets and the concentrated flows has the potential to dislodge soil particles. The amount of sediment generated depends on the erodibility of the soil, the amount of energy created by the intensity of the rainfall event and the site conditions, for example the slope angle and the slope length of the site. In general, the steeper the site and the longer the flow lengths, the more energy will be created. Any reduction of energy will reduce the erosion and sediment generation.

The slopes along the proposed Expressway are considered very “gentle” and do not represent a significant issue from an erosion perspective. The Universal Soil Loss Equation (USLE) calculations and supporting plans within the application documents highlight the Project slope classifications. The peat soils contain a relatively high proportion of clay and silt particles and therefore once in suspension can take long periods to settle out. With respect to the sand soils, while they can erode easily, due to their larger particle size, they settle within the water column relatively quickly. The sand soils also have a significantly high infiltration rate and this in itself will prevent erosion occurring. It is important for both of these soil types that erosion is minimised in the first instance to ensure sediment generation and yield is also minimised.

Erosion and sediment control measures are used to minimise the effects of earthworks on receiving environments. Erosion control is based on the practical prevention of sediment generation in the first instance. If erosion control is effective and sediment generation is consequently minimised, then the reliance on the sediment control process is not as significant.

Sediment control, on the other hand, refers to management of the sediment after it is generated. It is inevitable that some sediment will be generated through earthworks, even with erosion control measures in place. Sediment control is designed to capture this sediment and minimise any resultant discharge.

Rather than relying on sediment control measures alone, a significant reduction in erosion on site will result in far less sediment being generated and subsequently treated and discharged from the control measures.

The erosion and sediment control measures for the Project are designed to minimise the extent of soil erosion and any resultant sediment yield. The proposed erosion and sediment control measures have been designed in accordance with the Wellington Guidelines. These measures are detailed later within this report with the erosion and sediment control measures adapted for the soil types that will be encountered. The NZTA Draft Standard outlines the issues associated with wind erosion and dust management and these have been considered, and incorporated as relevant, for the management of the sand soils. The approach taken with the erosion and sediment controls is that in many circumstances, innovative measures are proposed to be suitable for the project conditions and where there is a greater perceived or recognised environmental risk associated with undertaking the works.

## 3.3 Erosion and sediment control principles

### 3.3.1 General principles

a. Erosion and sediment control measures will be undertaken and implemented with a hierarchy and priority order as follows:
   - Avoidance of effects as a first priority. Any discharge locations will be carefully selected and any streamworks will only be undertaken where they are a necessary component of the Project construction.
   - Erosion control will be a priority in all circumstances by preventing sediment generation through a range of structural (physical measures) and non structural (methodologies and construction sequencing) means.
   - While Sediment Retention Ponds (SRPs) will be utilised, given the nature of the Project, the soil types, the flat contour and the generally high groundwater table, other alternative devices will provide viable and effective solutions. Chemical treatment using polyacrylamide contained within flocculant socks will be utilised as required where the required discharge quality cannot be achieved naturally.

b. The earthwork methodologies are based on two key activities being peat replacement and peat preload. These two activities have specific methodologies and processes which will be followed and will be detailed in CESCPs.

c. The erosion and sediment control methodologies to be used are based upon methodologies and measures using the Wellington Guidelines, but also incorporate some innovative procedures and facilities that surpass these standards including items such as pumping and peat replacement methodologies.

d. The default guideline will be the Wellington Guidelines as the more stringent of the two. (The alternative being the NZTA Draft Guidelines). Decanting Earth Bunds will

include floating decants as per the NZTA guidelines as the more stringent of the two in this case.

e. The development of CESCPs will ensure that any sediment yields, and associated effects of the earthworks activities, are negligible and are all managed within the earthworks footprint of the Project.

   The implementation of CESCPs will allow for future innovation, flexibility and practicality of approach to erosion and sediment control and in doing this will ensure that the Project continues to adapt appropriately to changing conditions. With the implementation of the CESCPs, the construction related sediment controls must remain in place until all earthworks for that sub catchment are stabilised.

f. Greater Wellington Regional Council places emphasis on a number of principles that apply to erosion and sediment control. While not forming part of the specific principles within the Final ESCP they are acknowledged and are included within Appendix A (Greater Wellington Regional Council and NZTA ESCP Principles) of this Final ESCP for reference purposes. The erosion and sediment control principles from the NZTA Draft Standard are also included within this Appendix.

g. The discharges from the Project to the receiving environment shall not cause a conspicuous change in the colour or visual clarity of the receiving water after reasonable mixing. Reasonable mixing is defined as within 20m of the discharge point.

h. All erosion and sediment control devices should be located outside the 5% AEP flood level unless no other viable alternative exists. During construction activity and where it is considered to be the only option and devices are required within this flood level, then the placement of such a device will be undertaken with consideration of minimising catchment areas and ensuring more regular maintenance activities. All stock will be excluded, through fencing, from the area of works and the erosion and sediment control measures.

i. Peat removed will be temporarily stockpiled as part of the peat replacement process and will be utilised within the final Project footprint or transferred to off site peat disposal areas.

### 3.3.2 Erosion control principles

a. Cleanwater diversion channels have not been anticipated for the Project. However, if necessary, the CESCPs may specify cleanwater diversion channels, designed to cater for the 1% AEP rainfall event or of a lesser design if approved by Council. The topographic nature of the site is such that there are very few areas where specific upslope cleanwater catchments are required to be diverted away from the works area. This will, however, be subject to ongoing monitoring and checks. The 1% AEP design standard exceeds that recommended by the Wellington Guidelines and provides a level of

certainty and risk management for these diversion channels which will operate to a much larger storm event.

b. Progressive and rapid stabilisation of disturbed areas utilising top soil (where necessary) and seed, mulch and geotextiles will be ongoing throughout the Project. Mulch will include hay/straw and wood which will be generated on site through the removal and mulching of existing vegetation as necessary. Stabilisation will apply particularly with respect to stockpiles and batter establishment. Stabilisation is designed for both erosion control and dust minimization.

   Where dust generation is the predominant issue, water carts will be utilised as the initial treatment option. Pre load activities will have a final layer of clean granular material, sub base course or mulch (straw, hay or wood) applied to ensure no wind disturbance of the surface. For final cut slopes stabilisation using topsoil and grass from the top of the slope as the cut progresses will occur wherever practicable.

c. Flumes will be utilised in accordance with the Wellington Guidelines to safely transfer runoff from the top of batters to the bottom of the batter slopes and to ensure no scour of these batters occurs.

d. While most site access will be from existing roads, stabilised entrance ways will be established at all ingress and egress points of the site. No vehicles will leave the site unless tyres are clean and will not contribute excessive sediment, such as deposited sediment (not dust), onto road surfaces. Wheel wash facilities will be established only if necessary.

### 3.3.3 Sediment control principles

a. All Sediment Retention Ponds (SRP) to be implemented will be based on a minimum 2% volume criterion applied in relation to catchment size (i.e. 2$m^3$ SRP volume per 100$m^2$ of contributing catchment). This criterion is consistent with the Wellington Guidelines and is assessed as appropriate given the project conditions, in particular the sand soils and flat contour.

b. Through the flocculation testing, it was recorded that the peat soils had fine colloidal particles which remained in suspension long enough to potentially create settling issues during treatment of sediment laden runoff. Flocculants were tested with effective results noted with the use of polyacrylamide which will be dosed via a “floc sock”. Sediment laden water is passed over the sock to dissolve product and the floc sock size/number is customised for the flow rates. While this flocculant is proven to be successful, other chemical treatment options and design will continue to be explored throughout the Project as different conditions and in particular soil types are encountered. It should be noted that the use of flocculation is considered to be the exception (where the required visual clarity in the recieivng environment cannot be met naturally) rather than the rule.

c. Pumping of sediment laden runoff and groundwater during construction will be required during excavation works. These flows will be pumped to SRP's, to grass buffer zones or to temporary sediment retention devices such as turkey nests which will assist with retaining any sediment contained within the runoff. These practices have proven successful on similar operations in this location and also within the field trial undertaken. Further pumping will also be required with associated activities such as bridge construction. This pumping activity will also ensure discharges are to treatment devices. At all times the Alliance will follow the "Permit to Pump system" as outlined in Appendix B (Permit to Pump System) of this Final ESCP. This is based on a standard audit process that ensures any dewatering and/or pumping is undertaken in accordance with appropriate procedures and environmental consideration.

d. Where established, SRP's for the treatment of construction related sediment laden runoff will be established as independent devices. The Project also includes the installation of a number of permanent stormwater wetland features (for permanent stormwater treatment from impervious surfaces). Where practicalities allow, such permanent devices will be installed early in the Project and will be utilised to assist with the management of runoff from the Project. Where the permanent features are utilised, consideration will be given to pond depth and configuration to ensure that the eventual conversion of these to long term stormwater features can be undertaken appropriately. No existing natural wetlands will be used for primary treatment of construction related sediment discharge.

e. Any decanting earth bunds established will be based on a volume of 2% of the contributing catchment area with an ideal length to width ratio of 1:3. All spillways from the decanting earth bunds will be installed to ensure that they safely pass the 1% AEP rain event (through the emergency spillway provisions). Decanting earth bunds for the pre load activities will discharge to a stabilised area in the first instance or to a watercourse if this is not practical. Decanting earth bund catchments will be defined within the CESCP's.

f. All SRP's and decanting earth bunds will be fitted with floating decants, both with a mechanism to control (or cease) outflow during pumping activities to these structures. This mechanism could take the form of a manual decant pulley system or plug. In the circumstance where decants are manually plugged, discharge will cease and only once the standard of discharge quality, as per Principle 7 above, can be achieved will discharge occur. Pumping will be such that pump volumes will only be to the same level as that able to be fully captured within the retention structure.

g. All super silt fences and silt fences will be based upon the design criteria within Wellington Guidelines. Super silt fence will be used in those areas of work adjacent to, or in the immediate vicinity of watercourses. As a risk management tool for super silt fences the fabric will be installed with a minimum 200mm of fabric placed upslope at the base of the trench. In circumstances where silt fences or super silt fences are proposed next to active roads, they will be installed only after traffic barriers have been

installed, to ensure safe installation and also to provide further protection of the silt fence or super silt fence material from accidental damage.

h. Dirtywater runoff diversion channels will be sized to cater for the 1% AEP rainfall event (or of a lesser design if approved by Council through the CESCP's) which will ensure that all storm events up to this design will be diverted to control measures without overtopping. This will prevent uncontrolled runoff within the site boundaries. Dirtywater runoff diversion channel design will be based on the tables provided within section 6.3 of this Final ESCP. While, for risk management purposes, these dirtywater runoff diversion channels are "oversized" there remains the potential for deposition within them, and where this is noted to be an ongoing issue, excavated pits or sumps will be positioned along the channels to retain sediment bed load.

### 3.3.4 Streamwork principles

a. Stream works activities are considered high risk due to the potential for sediment generation and yield and will be undertaken in a manner that recognises this risk and the sensitivity of the receiving environment. At all practical times these activities, and any associated works within these environments will be undertaken in a "dry" environment. This will be based upon diversion of flows around the area of works or working directly above the stream with no formal stream diversion required. Consultation with the project ecologist during the planning of stream diversions will ensure that potential impacts on fish spawning is minimised as far as practicable. In addition, a preconstruction meeting with GWRC will be undertaken prior to implementing the diversion to ensure all risks have been considered and appropriately mitigated.

**Summary of Design Criteria and Methodology**

| Device / Methodology | Criteria |
|---|---|
| Device Location | All erosion and sediment control devices should be located outside the 5% AEP flood level unless no other viable alternative exists. |
| Cleanwater Diversions | Cleanwater diversion channels have not been anticipated for the Project. However, if necessary, the CESCPs may specify cleanwater diversion channels, designed to cater for the 1% AEP rainfall event. |
| Dirty Water Diversions | Dirtywater runoff diversion channels will be sized to cater for the 1% AEP rainfall event. |
| Stabilisation for Erosion and Dust Management Purposes | Progressive and rapid stabilisation of disturbed areas utilising top soil (where necessary) and seed, mulch and geotextiles will be ongoing throughout the Project. |
| Flumes | Flumes will be utilised in accordance with the Wellington Guidelines to safely transfer runoff from the top of batters to the bottom of the batter slopes. |

| Device / Methodology | Criteria |
|---|---|
| Stabilised Entrance Ways | Stabilised entrance ways will be established at all ingress and egress points of the site. |
| Sediment Retention Ponds | All Sediment Retention Ponds will be implemented based on a 2% volume criterion applied in relationship to catchment size (i.e. 2m$^3$ SRP volume per 100m$^2$ of contributing catchment. |
| Pumping Activities | Pumping of sediment laden runoff and groundwater during construction will be to SRP's, to grass buffer zones or to temporary sediment retention devices such as turkey's nest.<br>A Permit to Pump is required for each pumping activity. |
| Decanting Earth Bunds | All decanting earth bunds established will be based on a volume of 2% of the contributing catchment area. |
| Decant Systems | All SRP's and decanting earth bunds will be fitted with floating decants. These decants have a mechanism to control (or cease) outflow during pumping activities to these structures and in the event discharge standards are not being met. |
| Super Silt Fences and Silt Fences | All super silt fences and silt fences will be based upon the design criteria within Wellington Guidelines. SSF fabric will be installed with 200mm of fabric upslope at the base of the trench. |
| Streamworks | Streamworks and any associated works within these environments will be undertaken in a "dry" environment, as far as practical. Streamwork diversions will be sized for the 1 in 20 year event where practical. |
| CESCPs | To be submitted to GWRC for certification at least 10 working dyas prior to construction starting in that area. |
| Non Structural Measures | These elements include:<br>▪ Manually raised decant devices on SRPs and DEBs or alternative plug systems when pumping to controls or when discharge standards are not being achieved;<br>▪ Chemical treatment utilising polyacryamide in the event discharge standards cannot be achieved naturally.<br>▪ Proactive monitoring programme;<br>▪ Risk identification and management accordingly;<br>▪ Progressive stabilisation as works progress ;<br>▪ Weather response; and<br>▪ Ensuring Alliance staff are aware of the erosion and sediment controls employed and do not remove them without seeking appropriate approval. |

| Device / Methodology | Criteria |
|---|---|
| Minor Changes to Measures | Minor changes are considered to be:<br>▪ Repositioning or implementing silt fences and super silt fences;<br>▪ Installation of diversion bunds, check dams and inlet protection,<br>▪ Bund construction;<br>▪ Mulching, topsoiling, stabilisation; and<br>▪ Changing the dimensions of a sediment retention pond or decanting earth bund (ie to fit the practicalities of site) where the CESCP objectives remain unchanged.<br>These minor changes will be further defined within the CESCP's but with no formal GWRC certification required. |
| Decommissioning of Devices | Erosion and sediment controls will not be removed without approval from the Environmental Manager. Removal will be in accordance with the CEMP or the CESCP and the GWRC informed not less than 2 days prior to the activity. |

# 4 Assessment of risk

Estimating sediment yields for the Project has generally followed procedures within the Universal Soil Loss Equation (USLE). The primary purpose of the USLE is to provide a measure of the risk of sediment generation and yields, and to assist in identifying controls required for managing this risk to the environment. The key erosion and sediment control risks for the Project are:

- exposure of bare land;
- receiving environment locations and their associated values;
- works within and adjacent to watercourses and wetlands such as culvert placement and extensions, stream diversions and bridge works;
- pumping of sediment laden water from excavations; and
- stockpiling of excess spoil material.

The Project is unique from the perspective that it is of flat contour and is predominantly of sand and peat geology. Sand consists of large size particles and, while it erodes relatively easily it also settles very quickly in water, reducing potential discharge quantities. These soil and contour factors are critical in concluding that the sediment generation and eventual sediment yields will be low as a result. Three key aspects of erosion and sediment control are related to the risk of sediment yield.

1. Sediment generating potential – this highlights the generation potential of the area in question and is based on slope, slope length, soils, rainfall and erosion control factors.

2. Sediment delivery – this relates to the amount of eroded material that is retained on site in depressions and within the site's natural contours prior to it entering any sediment treatment devices.

3. Sediment yields – the amount of sediment that actually leaves the site and enters the receiving environment. It is well recognised that this is the key area of interest.

The USLE allows for greater consideration to be given to the areas of higher sediment yields and for these areas to be targeted with more comprehensive control methodologies to reduce this potential. The USLE can provide for this risk assessment and specific USLE calculations have been included within the original application documents.

These USLE figures highlight that, based on a range of assumptions, the pre earthworks yields from the site equates to approximately 4.2 tonnes of sediment over the Project footprint. During the earthworks phase, this is estimated to increase to a total yield of 16.64 tonnes of sediment.

When considered on a catchment wide basis, the USLE allows for a comparative analysis to be undertaken which demonstrates pre earthworks a yield of 753 tonnes and during earthworks an increase to 766 tonnes.

**Table 1 – Sediment Yield Estimates for Risk Assessment**

| Sediment Yield (tonnes) Over a 2 Month Period | Project Footprint Pre Earthworks | Whole Catchment Pre Earthworks | Project Footprint During Earthworks | Whole Catchment Less Project Footprint Pre Earthworks | Whole Catchment Including Earthworks Area | % Increase – Pre Earthworks to Earthworks Whole Catchment |
|---|---|---|---|---|---|---|
| **Whareroa** | 0.11 | 18.17 | 0.58 | 18.06 | 18.64 | 2.6 |
| **Wharemauku** | 0.87 | 38.02 | 4.50 | 37.15 | 41.65 | 9.5 |
| **Waikanae** | 1.16 | 644.72 | 3.96 | 643.57 | 647.53 | 0.4 |
| **Waimeha** | 0.16 | 2.37 | 0.77 | 2.20 | 2.97 | 25.3 |
| **Ngarara** | 1.90 | 50.56 | 6.83 | 48.66 | 55.49 | 9.8 |
| **Totals** | **4.21** | **753.84** | **16.64** | **749.63** | **766.28** | **1.7** |

Areas of greater slope present a higher risk of sediment yield and during earthworks these slopes will be reduced and batter slopes progressively stabilised. To minimise risk, these steeper areas will receive a focus to ensure the slope lengths are reduced and progressive stabilisation occurs on a proactive basis.

The primary control measures to be utilised are based on non structural methodologies. These are outlined in Section 3.3 of this Final ESCP. Structural measures in some locations include the use of:

- diversion channels;
- decanting earth bunds;
- super silt fences; and
- sediment retention ponds.

A distinctive feature of the Project from an earthworks perspective is the significant amount of sand and peat material and as a result traditional erosion and sediment control methodologies are not always practical with alternatives available. Emphasis will be placed upon the monitoring and maintenance of all controls installed and the methodologies utilised with particular attention paid to areas of higher risk prior to, during and after rain events.

It is recognised that some earthworks areas will be open for only very short periods of time, for example peat excavation locations will be backfilled with a high infiltration sand layer on a daily basis. Best practice techniques will be employed during all works with particular emphasis on higher risk activities and locations.

With respect to the streamworks activities, the methodologies have taken risk into account and this is reflected in all works being undertaken in a "dry" environment wherever practicable. Careful consideration of weather patterns prior to and during the works period, and regular monitoring and auditing of these activities will be undertaken to minimise the risk.

# 5 Overall erosion and sediment control approach

The following section outlines the measures that will be implemented as part of the erosion and sediment control methodology and builds on the principles outlined in Section 2.0 of this Final ESCP. These will be further developed in the site specific CESCPs.

## 5.1 Specific erosion and sediment controls

The focus of the erosion and sediment control measures is based on:

1. Viewing the proposed Project works such that all construction activities, and the full effects of these construction activities, are considered as a package.

2. Minimising potential adverse effects by utilising measures which meet or exceed industry best practice guidelines. In many circumstances due to the high water tables and soil composition, standard erosion and sediment control measures will not be suitable and innovative concepts will be required.

3. Implementation of an integrated approach (as outlined in Section 5.2 below) for design, implementation, maintenance and disestablishment of erosion and sediment control measures. This will ensure "ownership" of the erosion and sediment control measures by the site team and therefore better implementation and maintenance.

4. Undertaking pre-construction meetings for specific sections of work and having regular weekly meetings (toolbox meetings) on site with relevant personnel as part of the construction phase.

5. Maintaining a register of control measures and "As Built" information of key controls such as diversion bunds and sediment retention ponds to allow for quick referencing and understanding of erosion and sediment control measures. Appendix C of this Final ESCP contains a series of Checklists which will be adapted for this Project.

6. Including both structural and non-structural elements within the methodologies to be employed such as:

   - Manually raised decant devices on SRPs and DEB's or alternative plugs;
   - Chemical treatment utilising polyacryamide where required;
   - Proactive monitoring programme;
   - Risk identification and management accordingly;
   - Progressive stabilisation as works progress;
   - Weather response; and
   - Ensuring Alliance staff are aware of the erosion and sediment controls employed and do not remove them without seeking appropriate approval.

The specific construction erosion and sediment control plans (CESCPs) will follow the principles and details outlined within this ESCP. This enables the Alliance and the consent authority to have further input into the methodologies implemented.

## 5.2 Integrated approach

The approach taken for erosion and sediment control includes a concept whereby planning and implementation of all the erosion and sediment control methodologies and measures are undertaken by an experienced and involved environmental team to ensure that all relevant aspects of the Project are taken into consideration as part of these decisions. The environmental team will have a close working relationship with the construction team to facilitate this.

Table 2 below outlines the responsibilities expected for erosion and sediment control.

**Table 2 - Erosion and Sediment Control Responsibilities**

| Organisation | Responsibilities |
|---|---|
| M2PP Alliance | Preparation of CESCPs.<br>Implementation of CESCPs.<br>Installation of E&SC devices.<br>Asbuilting devices.<br>Inspection and Maintenance of E&SC devices.<br>Auditing devices.<br>Record keeping.<br>Stabilisation activities.<br>Training.<br>Reporting. |
| Greater Wellington Regional Council | Certification of CESCPs.<br>Certification of revised CESCPs.<br>Auditing to ensure compliance with CESCPs. |
| Te Ati Awa ki Whakarongotai & Takamore Trust | Iwi monitoring |

All people working on site will be required to undertake a formal induction and training process as detailed in the CEMP. The importance and location of wahi tapu areas and the significance of streams, waterways and wetlands from a cultural perspective will also be addressed during the induction process. Those with site management responsibilities will be required to attend additional environmental awareness training. This is detailed within the CEMP. In addition, ongoing training opportunities will be identified throughout the course of the Project in response to issues or challenges identified. This training will take the form of an outside expert being utilised or skills already in existence within the projects resources being utilised.

In terms of identification of specific staff with defined roles, this is defined in the CEMP and will be confirmed through the provision of the CESCP's (Condition E.3).

The following staffing structure will be implemented.

The Environmental Team will consist of an Environmental Manager supported by an Environmental Specialist and Environmental Officer.

The Environmental Manager and Construction Manager will have a close working relationship to ensure the effective implementation of CESCPs. An experiencedCivil Foreman with a passion for erosion and sediment controls will be appointed to ensure

erosion and sediment controls are installed and maintained as necessary and in accordance with the statutory approvals.

Key staff roles as they relate to Erosion and Sediment Control implementation are detailed below. Full details of all their responsibilities can be found in the CEMP.

a. Project Manager

- Demonstrates commitment to the highest standards of environmental management;
- Takes ultimate responsibility for compliance with the specification and resource consent conditions;
- Ensures staff are adequately inducted and trained in site environmental procedures including emergency procedures; and
- Ensures adequate resources are provided to staff to enable environmental issues to be appropriately managed.

b. Environmental Manager

- Provides leadership to ensure staff are motivated to achieve environmental standards, and comply with all consent conditions and environmental management plan requirements including SSMPs;
- Develops, implements and reviews environmental management plans for the project;
- Coordinates environmental management interfaces with external agencies and stakeholders;
- Manages and co-ordinates all environmental monitoring required by consent conditions and maintains and submits relevant reporting and records to the Greater Wellington Regional Council and Kāpiti Coast District Council as required;
- Coordinates all environmental auditing functions and ensures relevant records are maintained;
- Notifies Alliance Project Manager and Regulatory Authorities of any significant non compliances;
- Ensure the CESCPs are prepared prior to the commencement of construction activities;
- Ensures the timely closeout of all environmental incident reports and audit reports;
- Ensures employees are trained in environmental procedures.
- Monitors the implementation of the environmental management plans and the achievement of objectives;
- Responds to and investigates all environmental complaints, issues or incidents;
- Investigates all environmental complaints and incidences;
- Reports on environmental performance, incidents and issues;
- Coordinates environmental emergency responses; and
- Has responsibility for resolving issues of environmental non compliances.

c. Environmental Specialist(s)/Officer(s)

- Supports the Environmental Manager and provides leadership to ensure all staff comply with environmental management systems;
- Coordinates the preparation of Construction Erosion and Sediment Control plans (CESCPs) in conjunction with the Site Engineers;
- Coordinates as-builting of environmental controls and lodging of as-builts certification to GWRC 2 working days prior to works commencing in that area;
- Conducts weekly site inspections/audits of erosion and sediment control devices and co-ordinates maintenance where necessary;
- Manages maintenance and monitoring of Chemical Treatment Systems;
- Undertakes environmental monitoring (following the completion of appropriate training) for water quality (turbidity), and dust monitoring;
- Monitors site controls during rain storms during working hours;
- Ensures staff on-site are aware of environmental requirements at all times; and
- Trains staff in site specific environmental procedures.

d. Superintendent(s)/Supervisor(s)

- Provides leadership to the site construction team to achieve project environmental objectives and targets to ensure high performance is consistently achieved;
- Ensures environmental controls including erosion and sediment control works are protected and maintained on a day to day basis;
- Ensures that the CEMP and the CESCPs are implemented appropriately by the construction team;
- Leads the emergency response crew;
- Reports all environmental incidents, and complaints to the Environmental Manager; and
- Reviews the need to use a water cart or sprinklers to control dust.

e. Environmental Foreman/Foremen

- Implements elements of environmental management plans including the CESCP's;
- Manages the construction of critical erosion and sediment control devices, temporary stormwater ponds and removal of vegetation;
- Co-ordinates daily informal site inspections of environmental controls including erosion and sediment control devices and co-ordinates maintenance where necessary;
- Ensures environmental control works are protected and maintained;
- Follows environmental procedures in all activities undertaken; and
- Leads the emergency response crew in the absence of the superintendent.
- Monitors the site during rainfall events and high wind events during working hours and after hours if safe and practical to do so; and
- Ensures staff on site are aware of environmental requirements at all times.

f. Iwi Monitors

- Observe monitoring of erosion and sediment controls as agreed with the Alliance
- Work with Environmental Manager to identify areas of cultural significance which may require additional monitoring and works located within identified waahi tapu areas

g. All Employees and Subcontractors will

- Understand resource consent conditions and requirements and how they relate to the specific activities being undertaken;
- Attend and actively participate in toolbox talks and environmental training including CESCP briefings;
- Be responsible for reporting incidents, defects and other problem areas to senior site staff as they arise on site;
- Ensure that required processes and procedures for environmental management are followed;
- Carry out routine maintenance and emergency work when directed; and
- Care for all environmental works and controls.

Any modifications to the erosion and sediment control drawings originally approved as part of the consent process will be approved through the preparation and approval process of the site specific CESCPs. An on-site pre-construction meeting with Greater Wellington Regional Council will be undertaken prior to the installation of erosion and sediment control measures, signalling the start of the bulk earthworks. Appendix C contains the checklist that will form part of this pre construction process. Additional pre construction meetings will be held prior to construction activities considered to be high risk eg stream diversions. This will be confirmed in consultation with GWRC as the project progresses.

As defined within Condition G.27( b)(ix) minor changes to erosion and sediment control measures and CESCP's will not require certification from Council. If the change is considered more than minor a request will be made to Council for such an amendment and to ensure the Final ESCP objectives are not compromised.

Minor changes are considered to be:

- Amendments which will not materially change the manner in which the works are undertaken or the way in which the outcomes sought by the consent are achieved. This includes:
- Repositioning or implementing silt fences and super silt fences;
- Installation of diversion bunds, check dams and inlet protection,
- Bund construction;
- Mulching, topsoiling, stabilisation; and
- Changing the dimensions of a sediment retention pond or decanting earth bund where the Final ESCP objectives remain as previously.

While no formal certification process is required for such changes, they will be discussed on site during regular site inspections with GWRC where an opportunity arises for consultation over the nature of the amendment and any technical issues that arise.

Erosion and sediment controls will be installed prior to and during all construction activities. Once installed, as-built certification plans will be provided to Council two days prior to works starting in that area.

Erosion and sediment controls will not be removed without approval from the Environmental Manager who will check compliance with condition E.7. This requires removal to be in accordance with the CEMP or the CESCP and the GWRC informed not less than 2 days prior to the activity.

The Site Engineer for the area will discuss with the Environmental Manager removal proposals as they are developed. Plans to remove controls will be discussed with the GWRC representative during site visits. Controls will generally only be removed upon completion and appropriate stabilisation of an area or due to staging of works and subsequent changes in controls being required to facilitate construction.

## 5.3 Monitoring

### 5.3.1 Site monitoring

As part of the erosion and sediment control methodology, ongoing site monitoring by the Environmental and Construction Team will occur to ensure that the proposed erosion and sediment control measures have been installed correctly, methodologies are being followed and are functioning effectively throughout the duration of the works.

Informal visual monitoring will be on going during construction with foremen responsible for making daily checks of the controls in their areas. Any repairs required will be noted in their daily diaries and actioned accordingly.

Visual inspections will include checking:

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

A recorded weekly site inspection will be undertaken by the Environmental Specialist, checking controls for compliance and maintenance requirements. Actions required as a result of these inspections will be identified and close out dates and responsibilities assigned.

Target timeframes for closing out actions are as follows:

| Issue | Timeframe for Close out |
|---|---|
| Construction of device is not in accordance with consent standard or does not conform to approved CESCP. Site not operating in an environmentally effective manner. Lack of maintenance on controls. Despite these failures there is no unauthorised discharged occurring. | Closed out within 24 hours |
| Poor construction of device or device not installed leading to an unauthorised discharge or the potential for a discharge to occur. Poor maintenance or poor performance of control device which could result in an uncontrolled discharge to the environment. | By close of business the same day |
| Very poor construction of device or device not installed which results in an uncontrolled discharge resulting in significant environmental harm. Negligence or lack of maintenance resulting in an uncontrolled discharge and subsequent significant environmental harm. | 2 hours |

Prior to construction commencing, photographs will be taken in the vicinity of the proposed discharge outlet points and any streams in the vicinity of the works by the Environmental Specialist. These records will show the visual state of the receiving environment at and within the vicinity of the discharge point. This photographic record will be compiled into a log book and will allow a visual comparison of before, during and at completion of the construction of the Expressway.

During storm events (>15mm of rain per hour), visual inspections reviewing the integrity of the controls and how they are withstanding the storm will be undertaken where practical. Viusal inspections of any discharges and associated turbidity levels will also be undertaken. A secchi disk will be used to measure whether the discharge is of the required standard to meet the discharge standard of ' no conspicuous discharge after reasonable mixing'. This will require calibration depending on the receiving environment and will be worked through as the project progresses.

Feedback from these inspections may result in changes to controls if required to improve sediment treatment levels being achieved.

The Environmental Specialist will be responsible for sending out the daily weather report including the five day look ahead to all project staff to facilitate project planning. This will

be reviewed in detail prior to undertaking high risk activities such as stream diversions. Reference should be made to the Construction Environmental Management Plan which clearly details all monitoring and the frequency of monitoring undertaken across the projct.

### 5.3.2 Turbidity loggers

Water quality monitoring of the receiving environment will be undertaken to ensure discharges from sediment controls to water bodies do not have adverse effects on the environment.

Continuous turbidity loggers have been installed in the Waikanae, Wharemauku and Kakariki Streams upstream and downstream of the proposed discharge locations.

| Location | Usptream | Downstream |
|---|---|---|
| Kakariki Stream | 100m upstream of the Smithfield confluence | Up to 150m downstream of the works |
| Waikanae River | 150m upstream of the road foot print | Upto 300m downstream |
| Wharemauku Stream* | Upto 900m upstream (under SH1 crossing) | 520m downstream (under the footbridge at the Airfield) |

These are telemetered with the Environmental Team viewing the data each work day to identify any changes in turbidity. A rainfall alert once rainfall exceeds 7mm/hr will require staff to look at the data and identify any changes which could be attributable to the project's sediment controls.

The monitoring trigger for the turbidity loggers has been set at a 20% increase in NTU levels between the downstream and upstream (control) logger.

*Due to the distance between the upstream and downsteam locations of the loggers on the Wharemauku Stream and the resulting potential for other water quality influences over this distance, it has been agreed that a series of calibration grab samples will occur between the upstream and downstream loggers. These grab samples will be taken over three rain events with a minimum intensity of 4mm/h. The location of the grab samples will be taken at the end of Ihakara Road just below the input from a side tributary and at the end of Kiwi Road. These samples will be checked for sediment levels to confirm the influences of other sources and ensure that the 20% threshold can be accurately utilised. This is primarily to ensure the accuracy of the upstream (control) NTU levels.

### 5.3.3 Triggered event monitoring (grab samples)

Triggered event monitoring (grab samples) will occur in the following situations:

- When a 20% increase in NTU levels between upstream and downstream continuous turbidity loggers are recorded (and the NTU level is greater than 5);

- In the event of a failure of an erosion or sediment control device (with a 'failure' being a device which is overtopped or gives way as a result of poor construction);
- A storm event in exceedance of the design volume of a device; or
- In the event of a conspicuous change in colour at the discharge point.

The collection of data will be undertaken as soon as practicable once the alert or event has occurred and preferably within 2 hours.

Within 24 hours of a triggered event monitoring episode (NTU changes or sediment control failure), a recorded audit will be made of the erosion and sediment control measures in the contributing catchment. The source of the discharge will be identified and remedial actions undertaken. The Manager will be notified by email within 1 day of the breach, identifying the actions which were undertaken to remedy the situation.

In the event that NTU levels remain elevated (>20%) for more than 48 hours, benthic macroinvertebrate sampling will be triggered. This will be undertaken by the Project Ecologist within two working days at or near the the baseline sampling position. (Refer Attachment 1 of Attachment 4: Aquatic Monitoring and Management Plan of the EMP for a map identifying these locations).

Within ten working days of the macroinvertebrate sampling, a report shall be provided to the Manager detailing the results of the sampling, the cause of the discharge, the response made to the discharge and measures proposed to avoid a recurrence of the discharge and an assessment on the adverse effects (refer EMP and condition G.38Ac)v)3.i and ii for further details).

A decline in the QMCI of more than 1.5 or a decline of greater than 20% in sensitive invertebrate taxa (taxa with an MCI score of $\geq$ 5) compared to upstream or the baseline (or control sites for a comparison), will trigger the requirement for mitigation works. These mitigation works are to be established in consultation with the Manager.

### 5.3.4 Triggered ecological inspections

Condition E.9 requires that an inspection by a suitably qualified ecologist will also be triggered in the event of a sediment control device failure or a storm in excedance of the design volume of the device, resulting in a discharge to a waterway, wetland or estuarine environment. A 'failure' constitutes a device being overtopped or giving way as a result of poor construction.

The condition requires that the ecologist inspect the receiving environment within 2 working days of the event occuring (unless a longer timeframe is otherwise agreed by the Manager). The ecologist shall determine and prepare a written report on whether significant adverse effects are likely to have occurred in the receiving environment.

This inspection will involve macroinvertebrate sampling as detailed in Section 5.3.3 above.

The Alliance, in conjunction with Te Ati Awa ki Whakarongotai and the Takamore Trust will consider the report on the effects of the failure and recommend in writing, measures that are proposed to remedy or mitigate the effects. The recommendations shall be submitted to the Manager for certification within 5 working days of the event occuriing.

The remedial and mitigation measures that are approved by the Manager shall be implemented within 10 working days of receiving approval from the Manager (unless an extended timeframe is otherwise approved by the Manager).

#### 5.3.5 Stream diversion monitoirng

The monitoring of sediment discharges upon reconnection of a diversion channel to the parent stream is required by Condition G.38A d). An upstream control logger and a downstream NTU logger located not more than 20m downstream of the reconnection is to be installed prior to the reconnection occurring. These will remain in place for a week post connection and will record data at 15 minute intervals.

Within 24 hours of the reconnection, the NTU logger comparison between upstream and downstream should be $<$20% difference where the NTU level is $>$5. Where it is not, remedial actions are required which may include disconnection of the diversion.

Within 24 hours of the 20% threshold breach, a full written audit of the condition of the diversion works area and all erosion and sediment controls in the area will be prepared, including remdial actions required which may be contributing the the elevated turbidity levels.

The Manager is to be notified within one working day of the 20% threshold breach including the percentage change in turbidity and any remedial measures being undertaken.

Where closure has not occurred and after remedial actions have been undertaken, a further test 24 hours later will be undertaken to establish that the NTU difference between upstream and downstream is less than 20%.

In the event that the NTU threshold remains elevated above 20% for more than 48 hours, macro invertebrate sampling will be undertaken as detailed above (Triggered Event Monitoring) and at or below the logger monitoring position.

The same macroinvertebrate thresholds for Triggered Event Monitoring apply with the same resultant management and remedial actions (including closure of the diversion while issues are addressed).

In addition, sediment monitoring of the Waikanae River in relation to the deposition of sediments associated with the opening of the diversion at the confluence of the Muaupoko Stream and the Waikanae River is to be undertaken as per Condition G.38Ae). Baseline monitoring has been undertaken on the Waikanae River for habitat, fish, macroinvertebrate and periphyton and this will be repeated six months after completion of the instream works.

### 5.3.6 Adaptive management for erosion and sediment control

Adaptive management for erosion and sediment control during the works is defined by the turbidity monitoring and any subsequent recorded effects. In the event that turbidity monitoring is triggered during construction, the required processes detailed above will be undertaken.

Triggered event monitoring and 48 hour raised sediment events indicating adverse effects will require additional monitoring to confirm the persistence of any adverse effects. The resultant adaptive management will include visual monitoring of reaches further downstream to establish whether there is a noticeable increase in benthic deposition of sediments. Discovery of new or obvious sediment depositions will trigger further macroinvertebrate sampling and a comparison with baseline data.

In addition, a review of the existing erosion and sediment control devices on site will be undertaken. This review may result in the implementation of additional controls such as sediment ponds or silt fences, the use of flocculation and a review of existing on site procedures such as rainfall alert responses.

In the event that the adverse effects on the benthic fauna persist beyond six months, additional mitigation will be required. While this will be agreed to in consultation with the Manager, mitigation activites may include machine clearance or raking of sediments to promote flushing in the subsequent rain event and allow re-establishemnt of the benthic community.

Should such remedial measures be considered inappropriate, additional instream mitigation such as riparian planting will be considered in consulatation with GWRC.

The other aspect of adaptive monitoring is the trigger levels and where they are currently set. In the event that the trigger levels are being reached regularly but sampling has indicated that no effects are occurring, discussions will be undertaken with GWRC to review and revise these trigger levels.

### 5.3.7 Flocculation monitoring

Chemical treatment of sediment retention pond, DEB or pump discharges to watercourses will be utilised in the event that the discharge water quality is still conspicuous in a water body after reasonable mixing (approximately 20m).

It should be noted that the use of chemical treatment is expected to be the exception rather than the rule as the testing of soils has confirmed natural settling of soil particles will achieve the required discharge standards.

If flocculation is used, application will be carried out in accordance with best practice principles.

In addition, the following monitoring will be undertaken to ensure no adverse effects of the flocculation use or to further improve the system:

- Discharge and receiving environment pH levels at weekly intervals and during nominated storm events. It is expected that with the use of polyacrylamide no pH influence will result; and
- Visual checks of final discharge suspended solids concentration, particularly during storm flows. Initially, these checks will be undertaken on an hourly basis and will reduce as the effectiveness of the flocculant is confirmed.

This monitoring will be undertaken by suitably trained members of the Environmental Team.

### 5.3.8 Other checks and inspections

In addition to the devices and flocculation monitoring, other on-site activities such as storage of hazardous chemicals, refuelling facilities and practices, site offices, haul roads, stock-piles, dust control, and construction activities will also be visually checked as the Environmental Team go about their work on the site. Identified issues will be included in the weekly site inspection sheets. The intention underlying these checks is to ensure that they are being properly maintained at all times, and that they remain within the specified standards including consent conditions.

## 5.4 Dust

Due to the peaty and sandy nature of the soils on the project, earthworking activities on the Project have the potential to generate dust that may be considered as a nuisance in times of dry and windy weather. Dust is the product of wind erosion, much as sediment is the product of erosion by water. Repeated tracking of soils with machinery not only breaks down the soil particles but also aerates the soils so that they become suspended as particulate material in the air. As the strength of the wind increases, the potential for dust problems increases exponentially. The rate of soil movement is proportional to the cube of the wind velocity.

Dust from problem sites can travel for kilometres and cause a range of problems to health and property. The proximity of residents to the construction works will mean dust management will be critical to the success of the project.

For each area of works, consideration will be given to the following elements:

- The potential effects of any site dust nuisance;
- The soil characteristics of the site and whether the timing of operations will help or hinder dust control. This may influence undertaking works on sandy soils during wetter periods of the year.
- Considerations to the operational methodology to reduce the dust problems such as progressive stabilisation of batters and stockpile area as necessary.

Measures for controlling dust will include:

- The use of water carts or sprinklers to keep soil moisture content high enough to prevent dust generation and sand blow. Water supply is to be provided by a number of bores and associated groundwater take consents;
- Minimising exposed areas as far as practicable (progressive stabilisation);
- The use of stabilised haul roads where possible;
- Use of mulch, top soil, grassing, clean metal, hydro seeding and geotextile as appropriate

# 6 Proposed erosion and sediment control devices

## 6.1 Overview

This section provides an overview of the types of erosion and sediment control practices which may be used throughout the project. The actual devices to be used on site and the technical details and dimensions will be detailed in the CESCPs. Erosion and sediment control practices and devices will be undertaken in accordance with the Wellington Guidelines as the most stringent of the Guidelines (compared with the Draft NZTA Guidelines). The only exception to this will be the use of floating decants on Decanting Earth Bunds (DEBs) which are a requirement of the draft NZTA Guidelines and are the more stringent option in this case.

| Erosion Control Practice | Controls |
|---|---|
| Minimise open/ unstabilised areas | Reduce source for dust nuisance and erosion resulting in reduced sediment generation.<br>Stabilise as works progress as far as practicable.<br>Stabilisation practices may include mulching, metalling, hydroseeding, bidum.<br>Stage construction works as far as practicable. |
| Bench slopes | Reduce slope length and subsequent erodiability |
| Rock check dams | Reduce velocity of water in channels |
| Stabilised construction entrances | Reduce generation of sediment |
| Water Carts/Sprinklers | Used to ensure moisture in sands minimises sand mobilisation by wind |

| Sediment Control Practice | |
|---|---|
| Sediment Retention Pond | Treatment and discharge of sediment laden water for catchments in excess of 3ha. |
| Decanting Earth Bunds | Treatment and discharge of sediment laden water for areas less than 3 ha. |
| Silt Fence | Barrier for sediment laden sheet flow to encourage silt to drop out |
| Super Silt Fence | Reinforced silt fence |
| Turkey's Nest | Used to treat sediment laden water often from pumped discharges |
| Flocculation Sock | Used to remove any sediment in discharged water |
| Topsoil Bunds | Containment of dirty water onsite, exclusion of clean water from entering site |
| Permit to Pump | Designed to prevent the uncontrolled discharge of sediment laden water without appropriate treatment |
| **Construction Activity** | **Possible Controls** |
| Service relocations | Silt fences, DEB's, cut and cover |
| Cycleway construction | Cut and cover, silt fences |
| Peat removal | Bunds |
| Pre-load | Silt fences, stabilisation, DEB's |
| Stream Diversions | Working in dry, over pumping, construction of temporary diversions |
| Expressway Construction | Sediment Retention Ponds |
| Dewatering | Permit to Pump, turkey's nest, DEBs, SRPs |

## 6.2 Sediment Retention Ponds (SRPs)

A number of Sediment Retention Ponds are proposed. As far as practicable, these SRPs are all sized on the following criteria:

- volume of 2% of the catchment area;
- length to width ratio of 3:1;
- side slopes of 2:1; and
- depth of 1.0m.

Finalised designs will be provided in the CESCPs. It should be noted that depending on area available on the site for the construction of the SRP, actual size dimensions may vary from those indicated above. The detail provided in the table below is provided as guidance for the design of the ponds in the CESCPs. Full justification for actual sizing will be provided in the CESCP.

**Table 3 – Sediment Retention Pond Volume and Size Analysis**

| Sediment Retention Pond | Maximum Catchment Area (ha) | Minimum Pond Volume ($m^3$) | Forebay Volume ($m^3$) | Top Dimension (m) 1.0m depth – all based on 3:1 length to width ratio except SRP # 4 | Number of Decants | Side Slopes | Inlet Slope |
|---|---|---|---|---|---|---|---|
| SRP # 1 | 2.92 | 584 | 55 | 46.0 by 17.0 | 2 | 2:1 | 3:1 |
| SRP # 2 | 2.12 | 424 | 45 | 39.5 by 15.0 | 2 | 2:1 | 3:1 |
| SRP # 3 | 1.01 | 202 | 20 | 28.5 by 11.5 | 1 | 2:1 | 3:1 |
| SRP # 4 – L:W = 5:1 | 3.35 | 670 | 70 | 62.0 by 14.0 | 3 | 2:1 | 3:1 |
| SRP # 5<br>To utilise proposed perm S.Water Wetland | 1.36 | 272 | 25 | 32.5 by 13.0 | 1 | 2:1 | 3:1 |
| SRP # 6<br>To utilise proposed perm S.Water Wetland | 1.89 | 378 | 40 | 37.5 by 14.5 | 2 | 2:1 | 3:1 |
| SRP # 7 | 0.84 | 168 | 15 | 26.5 by 10.5 | 1 | 2:1 | 3:1 |
| SRP # 8<br>To utilise proposed perm S.Water Wetland | 2.43 | 486 | 50 | 42.0 by 16.0 | 2 | 2:1 | 3:1 |
| SRP # 9<br>To utilise proposed perm S.Water Wetland | 2.34 | 468 | 45 | 41.5 by 15.5 | 2 | 2:1 | 3:1 |
| SRP # 10<br>To utilise proposed perm S.Water Wetland | 2.72 | 544 | 55 | 44.5 by 16.5 | 2 | 2:1 | 3:1 |
| SRP # 11<br>To utilise proposed perm S.Water Wetland | 4.15 | 830 | 80 | 54.0 by 20.0 | 3 | 2:1 | 3:1 |
| SRP # 12<br>To utilise proposed perm S.Water Wetland | 0.38 | 76 | 10 | 19.0 by 8.5 | 1 | 2:1 | 3:1 |
| SRP # 13<br>To utilise proposed perm S.Water Wetland | 3.92 | 784 | 80 | 52.5 by 19.5 | 3 | 2:1 | 3:1 |

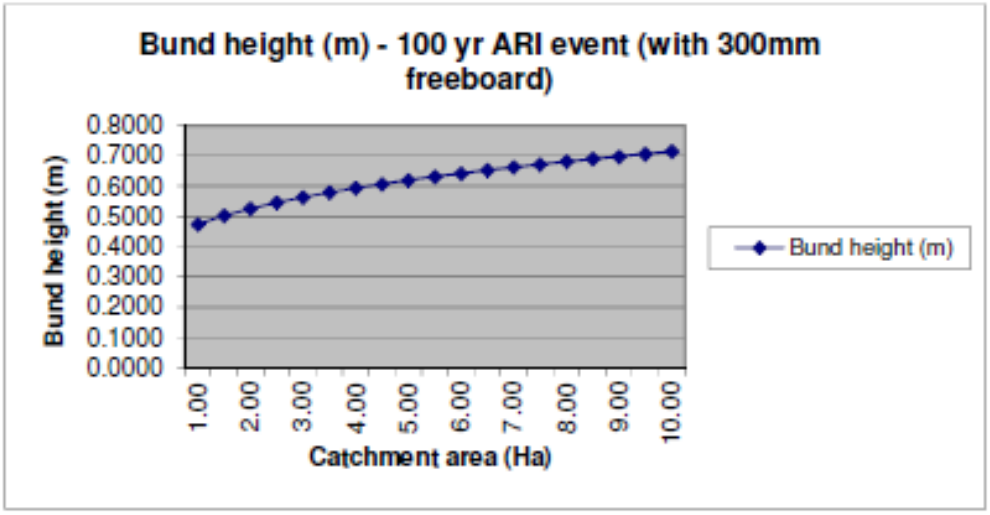
## 6.3 Diversion channels

Diversion channels will be sized to convey the 1% AEP event. Table 4 below provides guidance on the sizing of diversion channels. Sizing details including identification of contributing catchments will be provided with the CESCPs.

**Table 4 – Dirty Water Diversion Channel Design**

| Catchment Areas | 100yr ARI<br>Q (m3/s) | 100yar ARI<br>Site Slope (5%)<br>Depth (m) | 100y ARI<br>Site Slope (5%)<br>Bund Height (m) (D+300mm) |
|---|---|---|---|
| 0.50 | 0.1124 | 0.1520 | 0.4520 |
| 1.00 | 0.2248 | 0.1971 | 0.4971 |
| 1.50 | 0.3372 | 0.2295 | 0.5295 |
| 2.00 | 0.4496 | 0.2556 | 0.5556 |
| 2.50 | 0.5620 | 0.2779 | 0.5779 |
| 3.00 | 0.6744 | 0.2976 | 0.5976 |
| 3.50 | 0.7867 | 0.3153 | 0.6153 |
| 4.00 | 0.8991 | 0.3315 | 0.6315 |
| 4.50 | 1.0115 | 0.3465 | 0.6465 |
| 5.00 | 1.1239 | 0.3604 | 0.6604 |
| 5.50 | 1.2363 | 0.3736 | 0.6736 |
| 6.00 | 1.3487 | 0.3860 | 0.6860 |
| 6.50 | 1.4611 | 0.3977 | 0.6977 |
| 7.00 | 1.5735 | 0.4089 | 0.7089 |
| 7.50 | 1.6859 | 0.4196 | 0.7196 |
| 8.00 | 1.7983 | 0.4299 | 0.7299 |
| 8.50 | 1.9107 | 0.4398 | 0.7398 |
| 9.00 | 2.0231 | 0.4493 | 0.7493 |
| 9.50 | 2.1354 | 0.4585 | 0.7585 |
| 10.00 | 2.2478 | 0.4674 | 0.7674 |

Figure 1 - Dirty Water Diversion Channel Design




## 6.4 Peat replacement

Peat replacement will be undertaken extensively across the project. A standard methodology will be prepared for inclusion in the relevant CESCPs.

Generally, the methodology will involve stripping the topsoil from the area to be replaced. This topsoil will form a stabilised bund which will form either a clean or dirty water diversion depending on it's location. Peat will then be removed and stockpiled in identified areas with approrpirate controls in place. Dewatering will occur concurrently as required to keep the water level below the depth of excavation. Sand will then be placed within the excavated area. All excavations will be backfilled with sand prior to the end of works each day to prevent water infiltrating and creating uneccesaary saturation.

Pumping activities undertaken during peat replacement will require a valid Permit to Pump.

## 6.5 Haul road

Sand backfilled areas will then be utilised as an all weather haul road providing access throughout the Alignment as works progress without unnecessary sediment generation created by tracking activities. While this area may not be considered fully stabilised it is of a sand environment with associated infliltration, will have erosion and sediment control devices throughout and will be subject to dust management.

## 6.6 Pre load

Sections of the proposed Alignment will be subject to pre load activities to assist with ground settlement and ensure that future settlement is minimised. This activity essentially involves the placement of sand or granular material over the position of the Alignment. A standard pre-load methodology will be prepared and detailed in the relevant CESCP.

## 6.7 Working in sand

Sand soils present a unique situation whereby they have a very high infiltration rate and while they can be subject to scour and erosion issues, the sand particles are of such a size that they settle very quickly within depressions and/or detention devices. However, sands are subject to significant wind blow erosion particularly when they are subject to drying and in windy conditions.

Soils dominated by sands are generally non-cohesive and are more susceptible to erosion than silts and clays. However, sands settle out easily and can be controlled using simple management practices on site. For the proposed Alignment there are many locations where sand soils will be the dominant material within which works are occurring. This material is very difficult to form water tight and compact diversion channels and detention facilities and as a result these types of devices are not proposed in such areas.

The primary device to be used will include the use of formed diversion bunds which will act as an infiltration device and in combination with the high infiltration rates of the sand soils themselves will act as an appropriate control device. The bunds will also have a series of rock filters installed within them which assist with slowing water flow and hence minimising erosion and also capturing any movement of sand downstream. While it is unexpected, in circumstances where peat and/or other soil layers are encountered within the sand soil profile, then the devices will be amended and decanting earth bunds and formal runoff diversion channels can be created.

## 6.8 Culverts

Culvert installation, both temporary for construction purposes and permanent, are required in a number of locations. Where culvert installation or extension is required within a stream channel this can be undertaken by two main methodologies, pumping around the area of works or establishment of a temporary diversion around the culvert footprint. For the methodology associated with a full stream diversion reference should be made to Section 6.10 below.

Specific methodologies including sizing details will be presented in the relevant CESCP. Generally, the methodology will involve the pumping of water from upstream around the works to discharge below the worksite. This will allow works to be undertaken in the dry.

If flows are larger or the works are programmed to last a number of weeks, a temporary diversion may be required. The sizing of the temporary diversions and the capacity required in any pumping diversions will be determined at the time of the development of CESCPs. The sizings will be based upon stream flows, contributing catchment areas, time of year the works are undertaken and the length of time the diversion or pumping will occur.

For all culvert works:

- Prior to any works commencing with the culvert installation, a suitable weather window will be confirmed, the proposed methodology will be discussed with Greater Wellington Regional Council's Compliance Officer during their regular site inspection. Culverts are expected to be installed in sections with that particular section fully completed and stabilised within the day's work programme.
- Any water within the works area will be pumped to a treatment device which will be located away from the stream environment.
- On completion of the culvert extension, all plant and resources will be demobilised and the site will be permanently stabilised as per the design.
- In the event of high rainfall (> 15mm/hour) during the course of construction, or leaving the site for more than 24 hours (weekends, public holidays and Christmas shutdown), the Project team will ensure that:
- Any lose material that could enter the watercourse is removed;
- Any downstream sand bag barriers are checked for stability and removed for heavy discharge events;
- All existing and additional sediment control measures will be inspected and maintained where required.

## 6.9 Rip rap placement

Rip rap will be placed below culvert outlets to avoid erosion of these areas and to ensure that undercutting of the culvert headwall does not result. The placement of this rip rap material is such that it will be undertaken at the same time as the culvert placement itself and therefore can be undertaken during a period when flows are fully diverted around the work area. This will also apply to any concrete works that may occur associated with the rip rap placement. Appropriate curing times will ensure that the concrete is dry prior to flows being reintroduced through the culvert.

## 6.10 Temporary or permanent stream diversions

Stream diversions are required for either the establishments of a dry environment within the original stream channel to facilitate works or for the establishment of a new channel alignment. It is proposed that the stream diversion will be constructed in a dry environment isolated from the existing stream flows.

The general methodology (which will be confirmed in the CESCP) is as follows.

The excavation of the diversion channel will occur, to design drawings, leaving a clay plug at each end so that the stream does not breach the diversion. The diversion channel will then be stabilised using materials such as geotextile and rip rap. Once the diversion channel is stabilised, the downstream plug will be removed to allow stream flows to flow up the diversion channel, keeping some water within the channel to reduce scour

problems when the upstream plug is also removed. The upstream plug can also then be removed allowing stream flows through the diversion channel.

A non erodible dam will be immediately placed in the upstream end of the original channel. This dam may be created from sand bags with an impermeable lining to avoid seepage. A similar dam will be constructed at the downstream end of the original channel to prevent backflow into the construction area. Any fish recovery from the original stream will be undertaken by the Project Ecologist and transferred into the new diversion or downstream as per the Ecological Management Plan. Any remaining water in the channel will be pumped to a suitable control (turkey's nest, DEB or sediment retention pond) for treatment prior to discharge. A current Permit to Pump will be in place prior to this dewatering occurring.

Due to the high risk nature of stream diversions, where possible works will be undertaken at low flow times of the year. In addition, works will only take place during predicted fine weather periods. A close eye on the weather forecast will be kept as the works proceed so that contingency plans can be enacted if required. Contingencies may include the use of geotextile to stabilise exposed areas.

Temporary stream diversions will be established with a design capacity of a 20 year return period rain event unless otherwise defined within the CESCP.

In the event of high rainfall (> 15mm/hour) during the course of construction, or leaving the site for more than 24 hours (weekends, public holidays and Christmas shutdown), the Project team will ensure that:

- Any lose material that could enter the watercourse is removed;
- Any exposed areas will be stabilised;
- All existing and additional erosion and sediment control measures will be inspected and secured and maintained where required.
- Additional mulch and geotextile / polythene will be kept on site at all times.
- Extended working hours will be considered if it is believed significant benefit with regard to programme and environmental impact is either required or possible.

## 6.11 Permit to pump

A Permit to Pump will be required prior to any pumping activities. A copy of this permit is to be attached to the pump in operation.

A copy of the Permit to Pump form is attached at Appendix B. This system is designed to ensure that careful consideration and planning goes into any dewatering activities to prevent the discharge of untreated, sediment laden water. All Permits to Pump must be approved by the Environmental Manager and be current.

## 6.12 Chemical treatment

Peat soil samples were collected during the AEE preparation to confirm soil particle size and undertake bench testing with a number of different flocculants. The purpose of the sampling was to confirm whether chemical treatment was required to improve water quality. The testing confirmed that unassisted soil particle assessment was satisfactory and that chemical treatment would not be required as a primary erosion and sediment control technique.

As a result of this testing, the use of chemical treatment is not expected to be required extensively through out the project. In the event that the discharge from treatment devices creates a conspicuous discharge after reasonable mixing (approximately 20m downstream of the discharge point), floculant will be required. This decision will be made by the Environmental Specialist and a revision to the CESCP will be prepared accordingly. As required by Condition E.11, a Chemical Treatment Plan (CTP) will be prepared at least 5 working days prior to the commencement of works in that stage. Chemical treatment shall not commence until the certification of the Manager is received.

The soil samples on the project, generally have a low pH so an aluminium based coagulant is not recommended due to the effect it will have on lowering the pH of any discharged water further.

As a result, polyacrylamide is the proposed floculant for use on the project. This will be via 'floc socks' which are laid out so the discharge from a treatment device runs over the socks for final 'polishing' treatment. Regular maintenance of the socks will be required to prevent a build up of sediment within the sock. This maintance will be the responsibility of the foreman associated with the area and will be recorded in the associated floc check sheet.

## 6.13 Construction yards

Establishing the construction yards will typically involve stripping topsoil, contouring and placement of hardfill dependent upon the use of the yard area. Construction yards will be required to have adequate erosion and sediment control and due to the temporary nature of the exposed area, will be based upon super silt fences during construction followed by a progressive cover of hard fill material. This hard fill will consist of clean granular metal compacted with a track roller. A CESCP will be prepared for the construction yards.

# 7 Summary

The earthworks on the project will be undertaken on sand and peat soils which mean that traditional erosion and sediment control measures may not always be appropriate. As a result, opportunities for innovation will be available during the development of the site specific CESCPs.

Key risks for erosion and sediment control include:

- Proximity to sensitive stream systems,
- Values of the receiving environments adjacent to, or downstream of, the Project, and
- Areas of exposed soils, particularly in respect to the potential for wind erosion.

These items have been considered in full in developing this Final ESCP and are reflected in the overall approach taken.

The following key points are noted for the erosion and sediment control methodologies for the Project.

- The statutory framework and policy guidance from Greater Wellington Regional Council and the NZTA require the Alliance to be aware of, and ensure, implementation of appropriate erosion and sediment controls including construction and maintenance of these devices.
- A range of erosion and sediment control measures are proposed to be employed on the Project. These will be implemented and maintained and will at all times follow the key principles of the Wellington and NZTA Guidelines. Innovative design will be utilised as necessary for the project conditions.
- Chemical treatment will be utilised where discharge occurs that does not met the required discharge standards.
- With these measures in place it is considered that overall, any adverse effects on the receiving environment will be no more than minor.

Appendix A

# Greater Wellington Regional Council and NZTA ESCP Principles

# 4. Erosion and sediment control concepts

## 4.1 Key principle of erosion and sediment control

The overarching principle of erosion and sediment control on earthworks sites is to limit sediment transport and deposition. As a number of factors (e.g. rainfall intensity, soil composition) are beyond our control, it therefore falls to applying the most appropriate solution for the circumstances. As there are numerous devices at our disposal, the integration of as many concepts as possible provides the most effective erosion and sediment control on site (Georgetown County, 2006).

These concepts are typically formalised through the use of erosion and sediment control practices detailed in an Erosion and Sediment Control Plan (ESCP) prepared for the land disturbing activity.

## 4.2 Advantages of erosion and sediment control

With careful pre-planning, erosion and sediment controls usually result in many on-site advantages in addition to protecting the environment.

Environmental benefits include:

- Reduced risk of damage to aquatic ecosystems,
- Improved appearance of the site and downstream waters,
- Reduced water treatment costs,
- Reduced blockage of drains, and
- Less mud dropped or washed onto roads.

On-site benefits can typically include:

- Improved drainage and reduced site wetness as a result,
- Less dust problems,
- Improved working conditions,
- Reduced downtime after rain,
- Less stockpile losses,
- Reduced clean-up costs,
- Earlier works completion, and
- Less chance of public complaints.

## 4.3 Concepts and principles of erosion and sediment control

Implementation of erosion and sediment controls is required to avoid, remedy or mitigate the effects of earthworks on the receiving environment. To ensure that erosion and sediment controls are effective and cost efficient, an understanding of the basic principles of erosion and sediment control is required, as is ensuring that erosion and sediment control practices are considered and carefully managed throughout the project's planning, design and construction phases (Environment Canterbury, 2007).

State highway project's construction timeframes may take longer to construct than other types of construction projects, and the resulting longer operational life of many erosion and sediment controls, requires a stronger emphasis on some management concepts (Department of Environment and Climate Change NSW, June 2008), particularly:

- The control of upper catchment water,
- Separation of clean from dirty water,
- Protecting the land surface from erosion, and
- Preventing sediment from leaving the site.

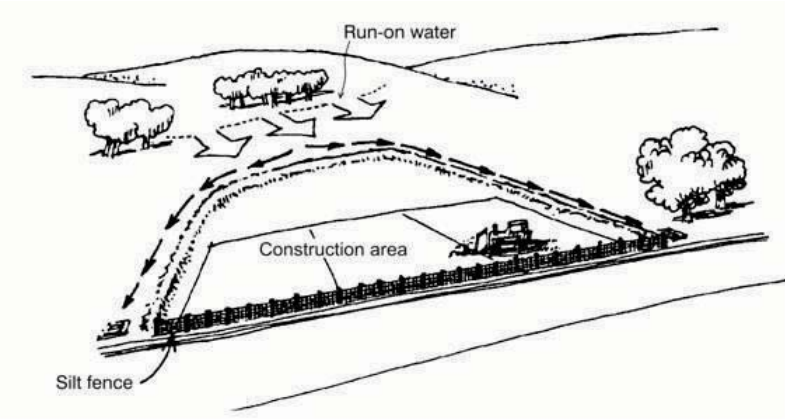
The following concepts are therefore relevant when designing an erosion and sediment control plan for a state highway project site.

### 4.3.1 Control upper catchment water

Upper catchment water is runoff from above the area of disturbance that would normally flow through the site. The key consideration in reducing the contributing catchment is to control this clean water by interception, diversion and safe disposal to a location below the area of disturbance as shown in Figure 4.1.

Reducing the area of the catchment contributing to water flowing through the site will reduce the volume of water to be treated thereby minimising the sizing of any controls.

**Figure 4.1**
**Diversion of clean water from above the site (Goldman et al 1986)**




### 4.3.2 Separate clean from dirty

Clean water is water that has not flowed through disturbed areas whilst discharges from disturbed areas are considered to be dirty water. Minimising the volume of water that is required to be treated by a sediment control device saves space and money. Furthermore clean water (upper catchment water that does not flow through the disturbed area) has not been contaminated by sediment, therefore does not require treatment. Practices to achieve this are outlined in Section 7 of this standard.

**Diversion separating the clean water from the dirty water**

### 4.3.3 Reduce the area available for erosion

To minimise the rates of soil loss, techniques as outlined in section 8 of this standard will assist however, protecting the land surface from erosion can be as simple as:

- Project design taking into account terrain limitations,
- Project scheduling to known climatic and soil variations,
- Minimising land clearance,
- Limiting areas of disturbance, and
- Progressively stabilising disturbed areas (e.g. grassing and mulching)

**Erosion Control – Mulching**

### 4.3.4 Minimise sediment from leaving the site

Sediment laden water (dirty water), as discussed in previous sections, can have a variety of impacts if not managed in accordance with best practice. Therefore it is imperative that a suite of controls are used on state highway construction projects. Sediment controls should be selected taking into account the site constraints and receiving environment, and steps should be taken to ensure that the controls are integrated with the permanent features of the project. Refer to the practices outlined in section 8.

**Sediment Control Practices**

## 4.4 The role of erosion and sediment controls

Erosion and sediment controls have different roles on an earthworks site. Erosion controls seek to minimise any sediment from being mobilised whilst sediment controls attempt to remove sediment from suspension once entrained. The analogy of erosion controls (fence at the top of the cliff) whilst sediment controls (ambulance at the bottom of the cliff) is applicable in describing their roles.

Any ESCP should place initial emphasis on erosion control although in many circumstances this may not be achievable.

### 4.4.1 Efficiency vs effectiveness of practices

The ability of an erosion and sediment control practice to prevent sediment from being transported or to remove sediment once entrained is a measure of its efficiency. This efficiency (as a %) can be represented as the volume removed when measured against the volume of sediment that arrives at the practice. Depending on a range of factors the removal efficiency can range from 50% to 75%.

Efficiency should not be confused with effectiveness. The effectiveness of a specific practice takes into consideration other factors such as the timing, cost, sensitivity of receiving environment and placement location of the device. For example, a sediment retention pond placed in an area that receives little or no water is still an efficient practice but is not an effective measure for that particular site.

## 4.5 The treatment train

A treatment train comprises a series of best management practices and/or natural features, each planned to treat a different aspect of pollution prevention, that are implemented in a linear fashion to maximise pollutant removal. This approach is directly applicable to the control of sediment on state highway projects.

Erosion and sediment control measures should generally be planned to link functionally to form a "treatment train" with each measure having a

specific role within the framework of surface water management, soil protection and stabilisation, and sediment capture. This approach can be a combination of structural (e.g. sediment ponds, hydroseeding) and non-structural (e.g. earthworking season) practices.

This approach needs to be considered during the early phases of project planning, and followed through to the completion of the project. Section 5 of this document will detail how to select the appropriate tools to ensure that this approach occurs.

## 4.6 Principles to follow

These ten principles (best practice principles) build upon the previous concepts and provide guidance for erosion and sediment control through the planning, construction and maintenance phase of a project

### 4.6.1 Minimise disturbance

Fit earthworks, construction techniques and methodologies to land sensitivity. This may be difficult from a state highway perspective where space is limited but the concept should always be considered.

Some parts of a site should never be worked and others need very careful working. Watch out for and, if practicable, avoid areas that are wet (streams, wetlands and springs), have steep or fragile soils or are conservation sites or features.

Bear in mind a minimum earthworks strategy and only clear areas required for structures or access.

Show all limits of disturbance on the ESCP. On site, clearly show the limits of disturbance using fences, signs and flags.

**Highway Construction Site – Minimising Disturbance**

### 4.6.2 Stage construction

Carrying out bulk earthworks over the whole site maximises the time and area that soil is exposed and prone to erosion. "Construction staging", where the site has earthworks undertaken in small units over time with progressive revegetation, limits erosion.

Careful planning is needed. Temporary stockpiles, access and utility service installation all need to be planned. Construction staging differs from sequencing. Sequencing sets out the order of construction to contractors. Detail both construction staging and sequencing in the ESCP.

**Flume Installed to Protect Steep Slope**

### 4.6.3 Protect Steep Slopes

Where possible avoid existing steep slopes. If clearing of steep slopes is necessary, runoff from above the site can be diverted away from the exposed slope to minimise erosion. If steep slopes are worked and need stabilisation, traditional vegetative covers like

topsoiling and seeding may not be enough - special protection is often needed.
Highlight steep areas on the ESCP showing limits of disturbance and any works and areas for special protection.

## 4.6.4 Protect watercourses

Existing streams and watercourses, and proposed drainage patterns need to be mapped. Resource consent may be required for clearance works adjacent to a watercourse.

Map all watercourses and show all limits of disturbance and protection measures in the ESCP. Also, the ESCP should show all practices to be used to protect new drainage channels. Indicate crossing or disturbances and associated construction methods in the ESCP.

**Sediment Discharge as a Result of Not Protecting the Watercourse**

## 4.6.5 Stabilise exposed areas rapidly

An important objective is to fully stabilise disturbed soils with vegetation after each stage and at specific milestones within stages. Methods are site specific and can range from conventional sowing through to straw mulching. Mulching is the most effective instant protection.

In the ESCP clearly define time limits for grass or mulch application, outline grass rates and species and define conditions for temporary cover in the case of severe erosion or poor germination.

**Rapid Stabilisation**


## 4.6.6 Install perimeter controls

Perimeter controls above the site keep clean runoff out of the worked area - a critical factor for effective erosion control. Perimeter controls can also retain or direct sediment laden runoff within the site. Common perimeter controls are diversion drains, silt fences and earth bunds.

Detail the type and extent of perimeter controls in the ESCP along with the design parameters for those controls.

**Types of Perimeter Controls**

## 4.6.7 Employ detention devices

**Sediment Retention Pond**

Even with the best erosion and sediment practices, earthworks will discharge sediment laden runoff during storms. Along with erosion control measures, sediment retention structures are needed to capture runoff so sediment generated can settle out. Sediment retention ponds are often not highly effective in areas with fine grained soils. In those areas it is necessary to ensure the other control measures used are appropriate for the project and adequately protect the receiving environment.

Include sediment retention structure design specifications; detailed inspection and maintenance schedules of structures and conversion plans for permanent structures, in the ESCP.

## 4.6.8 Experience and training

A trained and experienced contractor is an important element of an ESCP. Contractors are individuals responsible for installing, maintaining and decommissioning erosion and sediment control practices.

Critical on-site staff should go through an erosion and sediment control training programme that may be available either locally or elsewhere in New Zealand. The NZTA also has an e-learning module on erosion and sediment control in development. Better knowledge can save project time and money, by allowing for identification of threatened areas early on and putting into place correct practices.

Making arrangements for a pre-construction meeting, regular inspection visits, and final inspection is also important.

### 4.6.9 Make sure the plan evolves

An effective ESCP is modified as the project progresses from bulk earthworks to permanent drainage and stabilisation. Factors such as weather, changes to grade and altered drainage can all mean changes to planned erosion and sediment control practices.

Update the ESCP to suit site adjustments in time for the pre-construction meeting and initial inspection of installed erosion and sediment controls, and make sure it is regularly referred to and available on site.

### 4.6.10 Assess and adjust

Inspect, monitor and maintain control measures.

Assessment of controls is especially important following a storm. A large or intense storm will leave erosion and sediment controls in need of repair, reinforcement or cleaning out. Repairing without delay reduces further soil loss and environmental damage.

Assessment and adjustment is an important erosion and sediment control practice -make sure it figures prominently in the ESCP.

Assign responsibility for implementing the ESCP and monitoring control measures as the project progresses.

**Undertaking Maintenance of a Sediment Retention Pond**

The ESCP should also be integrated with the Contractor's Social and Environmental Management Plan, therefore, reducing duplication in the site specific environmental aspect management plans.

## 4.7 Bibliography

Auckland Regional Council, Erosion & Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region, Technical Publication No. 90, March 1999.

Department of Environment and Climate Change NSW, Managing Urban Stormwater - Soils and Construction, Volume 2D Main Road construction, June 2008

EPA Victoria, Environmental Guidelines for Major Construction Sites (480), February 2006

Environment Bay of Plenty, Erosion and Sediment Control Guidelines for Land Disturbing Activities, September 2001.

Environment Canterbury, Erosion and Sediment Control Guidelines, 2007

Environment Waikato, Erosion and Sediment Control - Guidelines for Soil Disturbing Activities" (Technical Report No.2002/01), January 2009.

Georgetown County, Storm Water Management Design Manual, November 2006.

Goldman S J, Jackson K and Bursztynsky T, Erosion and Sediment Control Handbook, 1986.

Appendix B

# Permit to Pump System

# PERMIT TO WORK – PUMPING

**JSEA Nº:** **Permit Nº:**

## Permit Request

Name of Contractor/Subcontractor: ……..

Person in Charge of Work: …… Position: ……

Description of proposed work: ……

Area/Location of proposed work: ……..

Volume of water to be pumped (estimated) : ……$m^3$

Any impurities other than sediment? : *(e.g. contaminated groundwater, contact with fresh cement, concrete dust, fuels, oils, chemicals?)*

……

Receiving area of pump discharge: *(attach additional information as required)*

……

Planned controls to be in place during pumping: *(attached additional information as required)*

……

Estimated duration of pumping: ……hrs Proposed commencement date and time: …../…../….. ……am/pm

## Permit to Work - Pumping

Approval is subject to the following conditions/procedures/precautions *(include any additional safety and environmental requirements):*

Environmental Procedure ENV-10 Waste Concrete and Grout

Environmental Procedure ENV-11 Dewatering Discharge

……

……

Time period during which pumping is to be undertaken :

From (Time): …….. Day: ……..…. Date: …../…../…..

To (Time): …… Day: ……..…. Date: …../…../…..

Authorised by Environmental Manager (Signature): …….. Date: …../…../…..

*If appropriate, request a briefing from the Environmental Manager prior to commencement of work*

*This Permit to Pump becomes invalid and must be returned to the Environmental Manager if the scope of work or the work area changes or unauthorised discharges to waterways occur.*

## Receipt of Permit

As the Person In Charge of Work I understand that I am responsible for informing the personnel under my control of the content and limits of this Permit.

I confirm that the specified environmental requirements have been taken and authorise this Permit to go into effect.

Name: ……..Signature: ……..Date: …./…./….

## Permit Closeout

As the Person In Charge of Work I confirm that pumping activities described in this Permit have now been completed

Name: ……..Signature: ……..Date: …./…./….

***Return closed out Permit to the Environmental Manager***

Appendix C

# Checklists

# ENVIRONMENTAL INSPECTION CHECKSHEET

**ZONE: ……..**

**INSPECTED BY: ……..**

**LOCATION: …….. DATE ……**

**INSPECTION No: ……**

| | ☑ | ☒ | COMMENTS |
|---|---|---|---|
| **GENERAL** | | | |
| Toolbox talks include environmental issues | | | |
| Site environmental inductions up to date | | | |
| Spill kits onsite and fully stocked | | | |
| | | | |
| **SEDIMENT CONTROL** | | | |
| Sediment treatment controls maintained | | | |
| Road exit points free from dirt / debris | | | |
| Site surrounds tidy | | | |
| Wheel wash maintained | | | |
| Exposed areas minimised (e.g. mulched) | | | |
| Dewatering controls maintained | | | |
| Catchpits protected | | | |
| Permit to pump maintained | | | |
| **WASTE CONTROL** | | | |
| Concrete washout area OK | | | |
| General site tidiness | | | |
| Bins being emptied | | | |
| Recycling in place (as appropriate) | | | |
| Site wastewater disposed appropriately | | | |
| | | | |
| **CHEMICAL CONTROL** | | | |
| Bulk fuels and oils stored safely / bunded | | | |
| No leaky equipment | | | |
| No visual evidence of spills | | | |
| | | | |

# ENVIRONMENTAL INSPECTION CHECKSHEET

| OTHER | ☑ | ☒ | COMMENTS |
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| ☒ | Corrective action required | Action by (Initials) | Closeout Req'd by | Date Closed out |
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Environmental Inspection Corrective Actions Completed:

Name: _____ Date: _____

Position: _____

# ACTIONS FOR CLOSEOUT

Issues identified must be prioritised and actioned within the stated timeframe by the assigned owners and signed off. The *Actions for Closeout* must be closed out by the foreman, signed off by the Zone Manager and returned to the Environmental Specialist before the next weekly inspection.

| No. | Issue | Evidence (Photo) | Close out | Sign off |
|---|---|---|---|---|
| 1 | **Comments:** | | **Comments:**<br><br>**Timeframe for Closeout:** | **Foreman:**<br><br>**Date:** |
| | | | **Name:** | **Zone Manager:** |
| | | | **Signature:** | |
| | **Owner:** | | **Date:** | **Date:** |
| 2 | **Comments:** | | **Comments:**<br><br>**Timeframe for Closeout:** | **Foreman:**<br><br>**Date:** |
| | | | **Name:** | **Zone Manager:** |
| | | | **Signature:** | |
| | **Owner:** | | **Date:** | **Date:** |

# ACTIONS FOR CLOSEOUT

Issues identified must be prioritised and actioned within the stated timeframe by the assigned owners and signed off. The *Actions for Closeout* must be closed out by the foreman, signed off by the Zone Manager and returned to the Environmental Specialist before the next weekly inspection.

<table>
<tr><td rowspan="3">3</td><td>Comments:</td><td rowspan="3"></td><td>Comments:<br><br>Timeframe for Closeout:</td><td>Foreman:</td></tr>
<tr><td rowspan="2"></td><td>Date:</td></tr>
<tr><td>Name:</td><td rowspan="2">Zone Manager:</td></tr>
<tr><td>Owner:</td><td>Signature:</td></tr>
<tr><td rowspan="3">4</td><td>Comments:</td><td rowspan="3"></td><td>Comments;<br><br>Timeframe for Closeout:</td><td>Foreman:</td></tr>
<tr><td rowspan="2"></td><td>Date:</td></tr>
<tr><td>Name:</td><td rowspan="2">Zone Manager:</td></tr>
<tr><td>Owner:</td><td>Signature:</td></tr>
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Appendix D

# Independent Review Comment Table

**INDEPENDENT REVIEW OF Erosion and Sediment Control Plan (ESCP)**
**Independently Reviewed by: Mike McConnell - McConnell Consultancy Ltd**
**Date of Independent Review: 23 April 2013**
**Signature of Independent Reviewer:**

| *Condition Reference* | *Independent Reviewer's comment* | *Page/paragraph/section reference within Management Plan* | *Management Plan Author's response* |
|---|---|---|---|
| G.9 b) | As detailed in *G.27 (b) vii)* below the management of the monitoring and response to any monitoring is unclear and appears to be spread across two Management Plans, the ESCP and EMP. This should be clarified and possibly restricted to one document with adequate cross document reference. | Page 7 - paragraph 5, Section 6.2 Monitoring. | Section 6.2 covers the monitoring that will be undertaken from on site staff. The EMP is a separte document and needs to be considered in this context. The EMP outlines the specific water quality monitoirng and the triggers etc that will apply to the project. A summary of compliance monitoring is now included in the CEMP. |
| G.11 | This conditions details relatively specific site staff training requirements, while it is noted that this is required by the CEMP, it would be appropriate to include a summary of this training in the ESCP. | Page 19 - paragraph 3. | Section 6.1 outlines the tarining requirements and refers to the CEMP and condition G.11 |
| G.19 | This peer review has been undertaken in accordance with this Consent Condition. | | OK |
| G.19A | It is noted in several locations throughout the ESCP that Site Specific Management Plans (SSMPs), in particular Construction Erosion and Sediment Control Plans (CESCPs) will be developed and submitted. No specific details of what will be included in these documents is included, nor any defined process including timeframes etc. Such information is likely to be of benefit to those using the ESCP as a management tool. | Throughout ESCP | The CESCP process is defined within the conditions of consent. Condition G.28 and E.3. Table now also included. |
| G.26A (a) | This condition details a number of environmental outcomes that are to be achieved by the Consent Holder while undertaking the construction of the project. It is considered that compliance with the final ESCP will ensure compliance with these outcomes. | | OK |
| G.26A (b) | This section specifies that *"the Consent Holder shall, at the least, comply or be consistent with whichever is the more stringent of the following standards and guidelines: i) The Erosion and Sediment Control Guidelines for the Wellington Region; ii) NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure; iii) Draft Field Guide for Contractors."* It is appropriate that the ESCP is the document with justifies and defines which of these guidelines, and sections of these guidelines, is to be adopted as the more stringent and used as the minimum standard for site controls. In the absence of this being clarified and defined in this document this is likely to be a justification that may need to be made in each CESCP. | Page 3 - paragraph 2, Section 3 Design philosophy and principles | Text amended to make it clear that GWRC Guidelines apply due to the most stringent of the 2 guideline documents. |

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| G.27 (a) | This ESCP has been prepared to meet this consent condition, it is considered that this section of the condition has been met. However it is to be noted that as the content of this ESCP is essentially the same as the draft ESCP that was submitted with the original application documents, it includes additional information that will be of limited use for the intended audience (the construction team). The removal of this additional information, required by the application, may improve the usability of this Management Plan. It is also noted that some formatting / reference corrections are required and that the Appendices are noted as "to be Updated and Confirmed". | | Noted - document of specific interest for the construction team will be the CESCPs not the ESCP - the ESCP is designed to give confidence to GWRC that the conditions can be met. |
| *G.27 (a) i)* | This subsection requires that the Management Plan "O*utline the principles that the ESCP shall adhere to".* While the document does detail the principles to be followed, these principles are relatively high level principles. It is considered appropriate that this document should include specific design criteria to be followed, including justification of this design criteria. In particular this Management Plan should summarise the minimum design standards to be followed, as commented in G.26A above. This minimum set of design standards will then define the standards by which the future specific Construction Erosion and Sediment Control Plans (CESCPs) are prepared. Where innovative procedures or facilities are proposed which surpass the minimum standards (Wellington & NZTA Guidelines) these should also be identified. This should reduce approval times for these plans. It is recommended that a table of minimum design standards be developed and included in this document. | Page 3 - paragraph 2, Section 3 Design philosophy and principles | Noted - table of key criteria included |
| *G.27 (a) ii)* | This subsection requires the identification of high risk areas and the implementation of appropriate erosion and sediment control measures in these areas. It has been noted in section 3 of the ESCP that the areas detailed in this condition subsection are high risk, however no specific increased design criteria are identified. While it is accepted that this information will be included in the CESCPs it would be considered beneficial to include any increased design criteria within this document. As above this is expected to minimise approval times for these CESCPs. | Page 7 - paragraph 4. | Within CESCPs and Table. |
| *G.27 (a) iii)* | This subsection relates to the implementation of the erosion and sediment controls. Compliance with the final ESCP will ensure compliance with this condition. | | OK |

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| *G.27 (a) iv)* | This subsection requires the use of bio-engineering and low impact design practices where practical. During the construction phase of the project the options for bio-engineering are limited and are typically limited to revegetation. Additionally low impact design practices are typically associated with the project design and, other than staging, are not applicable to erosion and sediment control. It is considered that the requirements of this subsection have been met. | | OK |
| *G.27 (a) v)* | This subsection requires that the ESCP be prepared in accordance with the draft ESCP supplied with the application and subsequent information. Notwithstanding the comments in G.27 (a) above it is considered that the requirements of this subsection have been met. | | OK |
| *G.27 (b)* | This section details the information which is required to be included in the ESCP. While some of the information could be included in the CESCPs it is more appropriate to include it in the ESCP to minimise the repetitive detail within those specific plans. | Throughout ESCP | CESCPs expected to be developed as per condition E.3 |
| *G.27 (b) i)* | This subsection requires provision that appropriate erosion and sediment control measures are installed prior to and during all works. It is considered that compliance with the final ESCP will ensure compliance with this condition. | Throughout ESCP | OK |
| *G.27 (b) ii)* | This subsection requires the identification of appropriately qualified and experienced staff to manage environmental issues on site. Roles and responsibilities have been defined however specific staff have not. | Section 6.1 Integrated Approach | As funding for the project beyond the 2012/2013 financial year has not been confirmed yet, no staff have been identified with the exception of the skeleton construction staff currently working on the project. This will be updated as soon as specific staff have been confirmed in approximately July 2013. |
| *G.27 (b) iii)* | This subsection requires the identification of appropriately qualified and experienced staff to monitor compliance with consent conditions and the ESCP. As above specific staff have not been identified. | Section 6.1 Integrated Approach | See note above |
| *G.27 (b) iv)* | This subsection requires the details of a chain of responsibility for environmental issues. It is considered that this has been addressed within the identified roles. | Section 6.1 Integrated Approach | |
| *G.27 (b) v)* | This subsection requires details of the approach and procedures for monitoring and response to requirements outlined in G.38A. The details contained within this ESCP are relatively generic and it is noted that further details are included in the Ecological Management Plan (EMP). This EMP has not been reviewed, however on the assumption that it provides appropriate details of the approach and procedures for monitoring and response to monitoring, the EMP should be appended to this ESCP. | Throughout ESCP | The EMP and ESCP are appendicies to the CEMP. A summary of compliance monitoring has been included in the CEMP. |

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| *G.27 (b) vi)* | This subsection requires the details of site monitoring triggers for undertaking event based monitoring (grab samples). No specific triggers for grab samples are identified, as above reference is made to the EMP. | Throughout ESCP | The EMP specifies this reference. Further to this condition G.38A applies and needs to be considered in the context. |
| *G.27 (b) vii)* | This subsection specifically requires details of the responsibilities, procedures and response actions should a continuous turbidity monitoring threshold be exceeded. Generic details have been given and as above reference is made to the Ecological Management Plan and CESCPs. It may be appropriate, in the interests of clarity, to clearly define which Management Plan will contain the monitoring details and limit the inclusion of those details to that Management Plan. | Throughout ESCP | The EMP specifies this reference. Further to this condition G.38A applies and needs to be coinsidered in the context. |
| *G.27 (b) viii)* | See above | Throughout ESCP | OK |
| *G.27 (b) ix)* | This subsection requires details of how minor changes to the ESCP and CESCPs which would not require certification by the Manager prior to implementation are to be addressed. It is considered that the details given in Section 6.1 of the ESCP are appropriate for the physical controls. The method of recording or documenting these changes should be defined, in particular with reference to Condition G.19A c). It is also noted that minor changes will be further defined within the CESCPs, it is considered that it is more appropriate to retain this definition within the ESCP as an overarching document. Details of what is considered to be a minor change to the ESCP should also be defined. | Page 21 & 22 | Note G.27 b(ix) overrides G.19A c). The minor chnages are identified in Section 6.1 and the method for recording / documenting changes are identified. |
| *G.27 (b) x)* | This subsection requires details of methods and procedures to be undertaken for decommissioning of erosion and sediment control measures. It is considered that this information is more appropriately contained within the CESCPs as it is device specific. Details of the approval process should however be included in the ESCP, in particular reference to Condition E.7. | Page 22 - paragraph 4 | Reference now made and text amended |
| G.28 | As detailed in G.19A it is suggested that details of the CESCP development and submission process should be included in the ESCP. | Throughout ESCP | Included in table |
| G.31 | Details of how the requirements of the ESCP are addressed or included within the CSGMP should be included within the ESCP. This should include brief details of how contaminated areas will be identified and when the requirements of the CSGMP will be implemented. | Not detailed within ESCP | G.31 dosn't make reference to ESCP. Text related to contamination now included for completeness. |
| G.38A | As detailed in G.9 b) and G.27 (b) vii) above the management of the monitoring and response to any monitoring is unclear and appears to be spread across two Management Plans, the ESCP and EMP. This should be clarified and possibly restricted to one document with adequate cross document reference. | Throughout ESCP | As above |
| E.2 | As detailed in G.19A and G.28 above it is suggested that details of the CESCP development, content and submission process should be included in the ESCP. | Throughout ESCP | Within table in Section XX |

| | | | |
|---|---|---|---|
| E.3 | As detailed in G.19A, G.28 and E.2 above it is suggested that details of the CESCP development, content and submission process should be included in the ESCP. | Throughout ESCP | Within table in Section XX |
| E.4 | It is noted within the ESCP that the 'as builting' of completed controls will be undertaken by the Environmental Specialist / Officer, the requirement for this certificate to be submitted to the Manger at least 2 days before commencement of works should also be highlighted. | Section 6.1 Integrated Approach | Included. |
| E.5 | This requirement to update as builts should be included, possibly with the details of how minor changes will be recorded. See G.27 (b) ix) above. | Not detailed within ESCP | Included |
| E.6 | This condition will be met by compliance with the final ESCP and subsequent CESCPs. | | OK |
| E.6C | This condition will be met by compliance with the final ESCP and subsequent CESCPs. | | OK |
| E.6D | Notwithstanding previous comments regarding the documentation of monitoring requirements, this specific Erosion and Sediment Control Monitoring Trigger should be included in the ESCP. | Not detailed within ESCP | As above |
| E.7 | See G.27 (b) x) | Section 6.1 Integrated Approach | |
| E.8 | Details of the proposed monitoring of erosion and sediment controls are generally considered appropriate, however it is considered that specific information should be included detailing how the sediment discharge implications of any impeded drainage to ground will be monitored and remedied. | Section 6.2 Monitoring | As above |
| E.9 | The requirements of this Condition are considered to have been adequately included in the ESCP. | | OK |
| E.10 | The requirements of this Condition are considered to have been adequately included in the ESCP. | | OK |
| E.11 | It is understood that it is considered unlikely that Chemical Treatment will be required due to the high occurrence of ground soakage on site. It is noted however that the use of Polyacrylamide was found to significantly reduce turbidity levels. It is therefore recommended that a generic Chemical Treatment Plan be developed as a contingency in the event that it is noted that a specific catchment would benefit from Chemical Treatment. It is also noted that the intended use of Chemical treatment is reactive rather than proactive, it is suggested that a proactive consideration of the use of Chemical Treatment for all earthwork areas be undertaken as part of the CESCP development. | Page 11, page 18, page 58, page 60. | As part of the CESCP development the use of chemical (and the need for a CTP) will be established. As detailed in G.11. A proactive approach pre earthworks activity. |
| WS.2 | This condition requires that "all construction work authorised by this consent is undertaken and completed in the dry bed of the stream as far as practicable". As streamworks are inherently high risk it is expected that any streamworks would be the subject of a CESCP. | Page 13, page 17, page 41 - 45 | Agreed and confirmed |
| | | | |

Appendix E

# GWRC Review Comments

**GWRC REVIEW OF Erosion and Sediment Control Plan (ESCP)**
**Reviewed by: Richard Percy & Dr Ian Boothroyd**
**Date of Review: July 2013**
**Signature of Reviewer:**

| *Condition Reference* | *Condition Details* | *GWRC Reviewer's comment* | *Page/paragraph/section reference within Management Plan* | *Management Plan Author's ( Kylie Eltham) response* |
|---|---|---|---|---|
| N.A | N.A | Turbidity loggers. I assume these are the same site locations as agreed with BML following discussions. The distances downstream suggest they are. One thing is that we agreed to was that because of the distance between up and downstream was a calibration for the *Wharemauku Stream Upto 900m upstream (under SH1 crossing) 520m downstream (under the footbridge at the Airfield)* . This is to calibrate for the '20%' difference that of course may be recovered by the time it reaches downstream. I don't see the calibration component included anywhere. | 5.3.2 | Section 5.3.2 of the ESCP has been reworded to address the calibration issue. It now reads: **Due to the distance between the upstream and downsteam locations of the loggers on the Wharemauku Stream and the resulting potential for other water quality influences over this distance, it has been agreed that a series of calibration grab samples will occur between the upstream and downstream loggers. These grab samples will be taken over three rain events with a minimum intensity of 4mm/h. The location of the grab samples will be taken at the end of Ihakara Road just below the input from a side tributary and at the end of Kiwi Road. These samples will be checked for sediment levels to confirm the influences of other sources and ensure that the 20% threshold can be accurately utilised. This is primarily to ensure the accuracy of the upstream (control) NTU levels.* |
| | | Para 4 of Section 5.3.3. of the ESCP mentions 'sampling macroinvertebrates at sites to be agreed with the manager' whereas the EMP ((Attachment 4, page 30) mentions sites to 'be sampled at or near to baseline' (for obvious comparative reasons). | 5.3.3 | Agreed with the manager has been removed and replaced with 'to be sampled at or near to baseline' in Section 5.3.3. Reference also made to (Refer Attachment 1 of Attachment 4: Aquatic Monitoring and Management Plan of the EMP for a map identifying these locations). |
| | | The EMP (Attachment 4, page 30) also has macroinvertebrate indicator thresholds (EPT and QMCI) which are not reflected in the ESCP. | 5.3.3 | Thresholds have been included in Section 5.3.3 |
| | | The ESCP (Section 5.3.6) does not reflect the more indicative adaptive methods as outlined in the EMP (Attachment 4, section 6.2). | 5.3.6 | Section 5.3.6 has been updated to reflect the inidcative adaptive methods as outlined in the EMP. |
| | | Section 5.3.5 of ESCP does not specifically reflect the 15 min recording interval for the turbidity logger (specifically agreed amongst experts). | 5.3.5 | Line has been added to reflect this. It now reads: These will remain in place for a week post connection and will record data at 15 minute intervals. |
| | | Section 5.3.5 of the ESCP does not reflect the expectation that after 24 hrs there should <20% difference between upstream and downstream (EMP Attachment 4, section 6.3) – nor does the ESCP go on to reflect the continuing 24 hour requirement. Rather it follows the standard sediment triggered events which was not the intention. | | Section 5.3.5 updated to reflect section 6.3 of the EMP. Section now reads: ...*Where closure has not occurred and after remedial actions have been undertaken, a further test 24 hours later will be undertaken to establish that the NTU difference between upstream and downstream is less than 20%.*<br>*In the event that the NTU threshold remains elevated above 20% for more than 48 hours, macro invertebrate sampling will be undertaken as detailed above (Triggered Event Monitoring) and at or below the logger monitoring position....* |

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|---|---|---|---|---|
| | | THE ESCP makes reference to specific monitoring of the Waikanae River in relation to the deposition of sediments associated with the opening of the diversion at the confluence of the Muaupoko Stream and the Waikanae River. This is not specifically mentioned in Section 6.3 of the EMP (Attachment 4, Section 6.3) as referenced and is not clear on intention. | | Consent condition G.38Ae) requires this monitoring to be undertaken. The reference to the EMP has been removed and the section reworded. It now reads: *In addition, sediment monitoring of the Waikanae River in relation to the deposition of sediments associated with the opening of the diversion at the confluence of the Muaupoko Stream and the Waikanae River is to be undertaken as per Condition G.38Ae). Baseline monitoring has been undertaken on the Waikanae River for habitat, fish, macroinvertebrate and periphyton and this will be repeated six months after completion of the instream works.* |
| | | Not clear what visual standard of discharge is deemed acceptable. Kylie mentioned using disk at meeting which would give everyone a bit more guidance re acceptable clarity | Pg 22, para 2 | Comment regarding the use of a secchi disc to help with decision making regarding discharge standards has been included. However, it is noted that this will require calibration depending on location of discharge and will be worked through as the project progresses. |
| | | Adaptive management will be defined by more than just the turbidity monitoring and subsequent recorded effects, this statement should encompass all the triggers for adaptive management (eg device inspections, grab sampling results etc). | Pg.25 para 4 | issue addressed above as per Ian Boothroyd's comments. |
| | | The trigger for use of flocculant is somewhat ambiguous and doesn't necessarily correspond with the requirements of E3 which requires bench testing and inclusion of floc plan well ahead of works. Prefer a measurable trigger for floc after work started and clarification re preworks actions that will determine need for floc in the first place. | Pg 25, para 7 | This is clarified in Section 6.12. It is noted that the use of chemical treatment will be the exception rather than the rule. A sentence regarding the requirements of condition E.11 has also been included. It now reads: *Peat soil samples were collected during the AEE preparation to confirm soil particle size and undertake bench testing with a number of different flocculants. The purpose of the sampling was to confirm whether chemical treatment was required to improve water quality. The testing confirmed that unassisted soil particle assessment was satisfactory and that chemical treatment would not be required as a primary erosion and sediment control technique.* An additional sentence has been included in Section 5.3.7 to further clarify the situation and now reads: It should be noted that the use of chemical treatment is expected to be the exception rather than the rule as the testing of soils has confirmed natural settling of soil particles will achieve the required discharge standards.<br>*As a result of this testing, the use of chemical treatment is not expected to be required extensively through out the project.* |

Appendix F

# KCDC Review Comments

**KCDC REVIEW OF Erosion Sediment Control Plan**
**Reviewed by: Jane Gunn**
**Date of Review: 17/04/2013**
**Signature of Reviewer:**

| *Condition Reference* | *Condition Summary* | *KCDC Reviewer's comment* | *Page/paragraph/section reference within Management Plan* | *Management Plan Author's response* |
|---|---|---|---|---|
| G.27 | Consent conditions specifically asked that the ESCP identify areas susceptible to erosion and sediment deposition … particular emphasis on … including El Rancho Wetland, Raumati Manuka Wetland, Southern and Northern Otaihanga Wetland, Waikanae River, Wharemauku Stream and Kakariki Stream, and ensure activities avoid, remedy or mitigate effects of sediment and erosion on valued ecological areas/habitat. | We are not sure whether it does 'build' on areas of significance as identified within the Ecological Impact Assessment. We would like to see these areas clearly identified on plans (together with their catchments) and mitigation measures – the assessment of risk outlined in section 5 should relate directly to these areas. The catchment titles given in table 1 of section 5 is of little benefit when trying to relate risk assessment back to identified areas susceptible to erosion and sediment deposition. | Pg 7 '… This final ESCP builds on the areas of significance as identified within the Ecological Impact Assessment'. | With respect to the ESCP risk is mainly related to sediment yields. USLE calculations are provided and are related direct to risk. Can refer to EMP for areas identified. ESCP also identified innovation and specific measures to be used. The CESCPs provide another opportunity for review and approval from GWRC. |
| N/A | N/A | during the BOI process we had some questions about the use of USLE (Universal Soil Loss Equation) i.e. had it over estimated the efficiency of the sediment retention devices (from memory 95% efficient), and USLE also based on Q2 (6 hour duration) rainfall event – we are not sure whether the numbers presented on pg 17 are the same as those presented in the application. We would expect, however, that this assessment would have been tailored to the areas identified as susceptible to erosion and sediment deposition in consent conditions, i.e. El Rancho Wetland, Raumati Manuka Wetland, Southern and Northern Otaihanga Wetland, Waikanae River, Wharemauku Stream and Kakariki Stream? | Section 5, Assessment of risk | The USLE is as per the BOI and evidence as presented. CESPs will further discuss risk management as necessary |
| N/A | N/A | Should also include need to get endorsement from Kapiti Coast District Council as these streams pass through urban areas and (with the exception of the Waikanae River) are managed by KCDC (their management is an integral part of our flood management planning) | Pg 41 – Prior to works commencing, the specific methodology will need to be determined and will be detailed within the CESCP for the location. This determination, including specific culvert sizing, will be undertaken with endorsement of Greater Wellington Regional Council | Detailed as per consent condition requirement |
| N/A | N/A | The plan is silent on the contaminated land component of Sediment and Erosion Control | All | Brief reference now mentioned. Groundwater and Contaminated Soils Management Plan should be referred to. |

| | | | | |
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| N/A | N/A | Dirty water runoff diversion channels sized to 1% AEP (Q100) rainfall event but devices based on Greater Wellington guideline (i.e. 50% AEP – Q2) – no discussion of overflow – should be picked up in Section 5, Assessment of risk (particularly for areas identified as susceptible to erosion and sediment deposition? | Section 5, Assessment of risk | Diversions are based on 1% to ensure no overtopping up to this level and sediment retetnion devices are based on accepting the 1% flow and passing these safely through the devices with no overtopping. |
| N/A | N/A | Section 8 refers to several subsections under section 7.8. Section 7 only goes up to 7.3? Similarly within Section 7 – reference is made to sections 7.11, 7.16, 7.7 – these sections do not exist? Check all cross-referencing. | Section 8 | Noted |
| N/A | N/A | Pg 18 – anything that requires 'manually' raising decant devices need careful consideration? | Page 18 | Standard approch for SRP devices - unsure of exact context |
| N/A | N/A | It would be good to see the details of monitoring methodology from the Ecological Management Plan that will be employed reproduced in an appendix | Appendix list | Detailed in EMP |
| N/A | N/A | Where sediment retention pond (or swale) has same footprint as the permanent stormwater pond (or swale) more detail around de-commissioning to ensure permanent features are fit for purpose | | See principle # 5 |
| N/A | N/A | Generally, the absence of any of the appendices or drawings, and reference to other documents not currently available, makes assessment difficult. | | Noted. |

Appendix G

# Iwi Review Comments

**Takamore Trust Review of Erosion and Sediment Control Plan (ESCP)**
**Reviewed by: Ben Ngaia**
**Date of Review: 08/05/2013**
**Signature of Reviewer:**

| *Condition Reference* | *Condition Details* | *TAA Reviewer's comment* | *Page/paragraph/section reference within Management Plan* | *Management Plan Author's response* |
|---|---|---|---|---|
| N.A | N.A | Proposed sediment control measures to be consistent with GWRC standards – strongly supported | Through out | None required |
| N.A | N.A | Alliance monitoring re: installed devices for proper functioning and maintaining of environmental quality standards – strongly supported | Through out | None required |
| N.A | N.A | Design philosophy and principles – supported i.e. river, stream and wetland protection | Through out | None required |
| N.A | N.A | Principles for erosion and sediment control is supported | Through out | None required |

| | | | | |
|---|---|---|---|---|
| N.A | N.A | Stream work principles – support for commentary regarding the sensitivity of streams to sedimentation, streams provide habitat for native fish species and migratory/spawning locations. It is important that these sites are managed appropriately. It should also be noted that stream systems such as the Muaupoko are also wahi tapu and will need to be treated with care. TAA must be advised of any works to be undertaken within areas or locations of a wahi tapu nature. This also applies to wetlands which are traditional food gathering areas (mahinga kai); | Various | Additional commentary added regarding sensitivity of receiving environments and wahi tapu areas noted. Action required for list of wahi tapu areas to be be received from TAA and placed on Environmental Maps for ease of reference. Request noted for TAA to be advised of any works within wahi tapu areas. |
| N.A | N.A | Sediment yield risk – Table 1 identifies the quantum of sediment to be generated it is noted that there will be significant increases within the footprints of a number of TAA traditional food gathering areas. The locations in table 1 are sensitive ecological areas that support a number of important native fish species. Alignment between this plan and the EMP is strongly recommended | Section 5 | The authors of the ESCP and the EMP have worked closely together. Additional detail on monitoring from the EMP has been added to the revised Final ESCP. |
| N.A | N.A | The location of sediment retention ponds and the management of sediment within these locations is important, TAA should be provided with the proposed locations of these sites during the construction phase | Table 3 | These comments are noted. While there is not much flexibility in where SRPs are sited due to construction footprints and topography, a meeting with TAA is to be arramged to work through concerns raised during this ESCP review. |

| | | | | |
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| N.A | N.A | Specific erosion and sediment controls – measures are supported TAA should be provided the register of control measures for comment | Various | Noted. To be discussed at meeting to discuss ESCP concerns. |
| N.A | N.A | Recommendations re: induction for staff to the CEMP is supported, TAA should be provided the opportunity to discuss the significance of streams, waterways, and wetlands from a cultural point of view also | Section 6.1 | Noted. Due to frequency of inductions (2 -3 x per week) this may not be practical. However, thoughts on how this could be achieved are being formulated. |
| N.A | N.A | Integrated approach – the list of responsible parties to include iwi monitors; | Section 6.1 | Iwi monitors added |
| N.A | N.A | Monitoring – iwi monitors role and function to be included | Section 6.1 | Iwi monitors added |
| N.A | N.A | The results of monitoring devices to be provided to TAA periodically – provision of iwi monitors to be considered at specific locations of cultural significance | Section 6.2 | Noted. To be discussed at meeting to discuss ESCP concerns. |
| N.A | N.A | Dust suppression is important particularly in respect of the Takamore cultural heritage precinct, Takamore Trust is to be engaged where dust suppression measures are proposed particularly in proximity to the Takamore Urupa | Section 6.3 | Noted. To be discussed at meeting to discuss ESCP concerns. |
| N.A | N.A | The precise location, sizes and operation of the proposed sediment retention ponds in the southern zone are to be provided to TAA for comment | Section 7 | These comments are noted. While there is not much flexibility in where SRPs are sited due to construction footprints and topography, a meeting with TAA is to be arramged to work through concerns raised during this ESCP review. |

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| N.A | N.A | The locations of the total 13 sediment retention ponds to be provided to TAA, this should include detail on location, sizes and operation | Section 7 | These comments are noted. While there is not much flexibility in where SRPs are sited due to construction footprints and topography, a meeting with TAA is to be arramged to work through concerns raised during this ESCP review. |
| N.A | N.A | Planning re: stream diversions, realignments i.e. Muaupoko Stream is to be conducted in coordination with TAA, methodologies will be discussed and measures to ensure cultural values are protected is strongly recommended | Section 7 | Noted. To be discussed at meeting to discuss ESCP concerns. |
| N.A | N.A | Waikanae River is a significant water body to TAA and the Takamore Trust, it is critical that appropriate measures are in place to mitigate erosion and sediment risks. Early engagement with TAA and the Takamore Trust is recommended | Section 7 | Noted. To be discussed at meeting to discuss ESCP concerns. |