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Barrytown Mineral Sand Operation Southern Resources Block

Erosion and Sediment Control Plan

Tāiko Critical Minerals Limited

Ridley Dunphy Environmental Limited
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Glossary of terms

Report relevant terms	Definition
Earthworks	The disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil or earth, or by excavation, or by cutting or filling operations.
Erosion control	Methods to prevent or minimise sediment generation, in order to minimise the adverse effects that land disturbing activities may have on a receiving environment.
Land disturbing activity	Any disturbance to the ground surface that may result in soil erosion through the action of wind or water.
Sediment control	Capturing sediment that has been eroded and entrained in overland flow before it enters the receiving environment.
Sediment generation	That sediment that is generated on the site of earthwork activity prior to treatment through any sediment retention device.
Sediment load	Mass of sediment carried in suspension within rivers and marine waters.
Sediment retention pond	A detention structure that is used during the construction phase of earthworks activity to treat any sediment laden runoff and retain sediment.
Sediment yield	That sediment which leaves the sediment retention devices and enters the receiving environment can be expressed in many ways including suspended sediment concentration or a mass load on a time basis or an aerial basis.
Stabilisation	An area inherently resistant to erosion such as rock, or rendered resistant by the application of aggregate, geotextile, vegetation, mulch or an approved alternative. Where vegetation is to be used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once an 80% vegetation cover has been established.

Glossary of abbreviations

Report relevant abbreviations	Definition
AWP	Annual Work Programme
BPO	Best practicable option
CB	Central Resource Block
ESC	Erosion and sediment control
ESCP	Erosion and sediment control plan
GD05 Guidelines	Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland region. June 2016 incorporating Amendment 3 (August 2023).
HMC	Heavy Mineral Concentrate
NRB	Northern Resource Block
SF	Silt fence
SB	Southern Resource Block
SRP	Sediment retention pond
SSESCP	Site Specific ESCP
SSF	Super silt fence
WCP	Wet Concentrator Plant
WCRC	West Coast Regional Council

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1. Introduction

1.1 Purpose and scope of this report

This Erosion and Sediment Control Plan (ESCP) is prepared in support of land disturbance and associated mining activity relating to a proposed mining operation for mineral sand mining and processing to obtain ilmenite, garnet and other minerals. The Southern Resource Block (SB) has an area of 408ha with mining activity proposed to be undertaken on approximately 280ha in addition to a further 72ha of earthworks associated with sourcing fill for the purpose of rehabilitation activities. Importantly, consents for the establishment, operation and maintenance of a centralised Wet Concentrator Plant (WCP) adjacent to the SB, associated water management infrastructure (known as the Mine Water Facility (MWF)) and access road, is subject to a separate consent process and therefore has not been considered further within this ESCP. A Mineral Separation Plant (MSP) at Rapahoe is also the subject of a separate consenting process.

The previous Central Resource Block (CB) has recently been consented and as part of that process an ESCP was developed and confirmed. For this SB the ESCP reflects the same principles, process and approach to the construction activity of the CB with the key differences highlighted and confirmed within this ESCP. As described above, the MSP and WCP will process material from the SB.

Within this ESCP the overall mining operation is referred to as the Project.

A full project description is provided for within the application documentation with Figures 1 and 2 below showing the general project location of the SB.

Figure One: General Mining SB Project Location

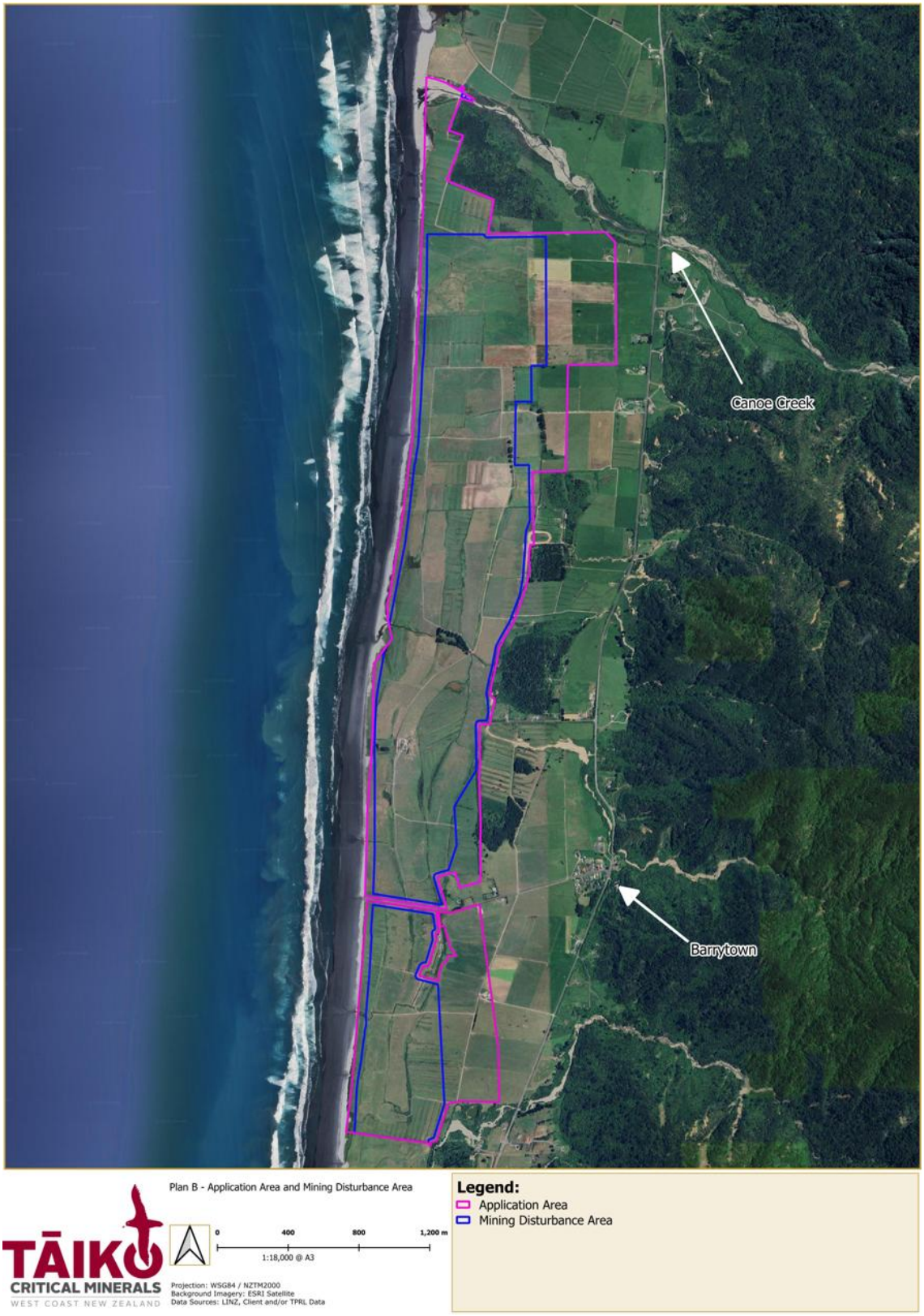

Figure Two: SB Application and Mining Disturbance Area

This ESCP supports the overall Project and confirms the overall approach to erosion and sediment control (ESC) and associated water management during the mining operation. This ESCP primarily focuses on the set up and construction phase of the Project with the operational mining phase assessed by others. It is noted that there are "cross overs" between these 2 phases with these addressed as necessary within this ESCP.

1.2 ESCP objectives and outcomes

The objective of this ESCP is to establish procedures and design criteria in relation to earthwork and streamwork activities to be implemented during the Project construction to minimise sedimentation of waterbodies adjacent to the mining area and assist with compliance with the water quality parameters. The ESCP has the following outcomes:

1. Minimise to the extent practicable the area and volume of earthworks required for construction of the Project;

2. Maximise the effectiveness of erosion and sediment control measures and processes associated with earthworks and streamworks by minimising sediment generation and consequential sediment-laden runoff and discharges;

3. Through the implementation of the ESCP and ensuring that discharges from earthworks and streamworks are minimised, protect receiving environments to the greatest extent practicable;

4. Monitor all erosion and sediment control measure implementation and any associated discharges to allow for ongoing continuous improvement of erosion and sediment control implementation and effectiveness; and

5. Undertake progressive rehabilitation and stabilisation as works proceed to ensure open exposed areas are minimised, to a maximum of 16ha at any one time and consequently achieve a reduction in the risk of sediment generation and discharges.

1.3 Erosion and sediment control and SSESCP development process

Our assessment of the ESC and practices likely to be required for the Project is based on the detail within this ESCP and also the supporting information supplied as part of the overarching consent application. This ESCP outlines the principles that will need to be applied throughout the adopted approach for all construction activities and associated water management.

As the Project works have the potential to result in sediment yields downstream, the focus during earthworks remains on best practice erosion and sediment control implementation.

This ESCP provides the overarching approach to water management on site. Similar to the CB, prior to any work activity, a detailed Site Specific ESCP (SSESCP) will be established for the Project which

will include specific design details and will also provide the ability for the various parties to have further input into the methodologies implemented to ensure enhanced outcomes and the opportunity for other innovative practices to be implemented.

The SSESCP will primarily be based upon the principles detailed within this ESCP and will reconfirm the methodologies and construction sequence to be followed to ensure that the ESCP outcomes are achieved at all times. The benefits of allowing this management plan approach to be confirmed at implementation time is to ensure ongoing innovation and flexibility remains and enables the Project team and the consent authority to have further input into the methodologies implemented.

In addition, this ESCP confirms a monitoring programme that will be implemented throughout the mining and rehabilitation earthworks that will inform future activities and water management approaches. This monitoring programme will form a key component of an Annual Work Programme (AWP) which will apply to both establishment, mining and rehabilitation phases and will confirm the outcomes from the previous 12 months and confirm the approach for the upcoming 12-month period.

Some amendments to the ESC approach may be determined through the AWP process once works commence and these will be discussed and documented on site with West Coast Regional Council (WCRC) as necessary.

Figure 3 below confirms this management plan approach.

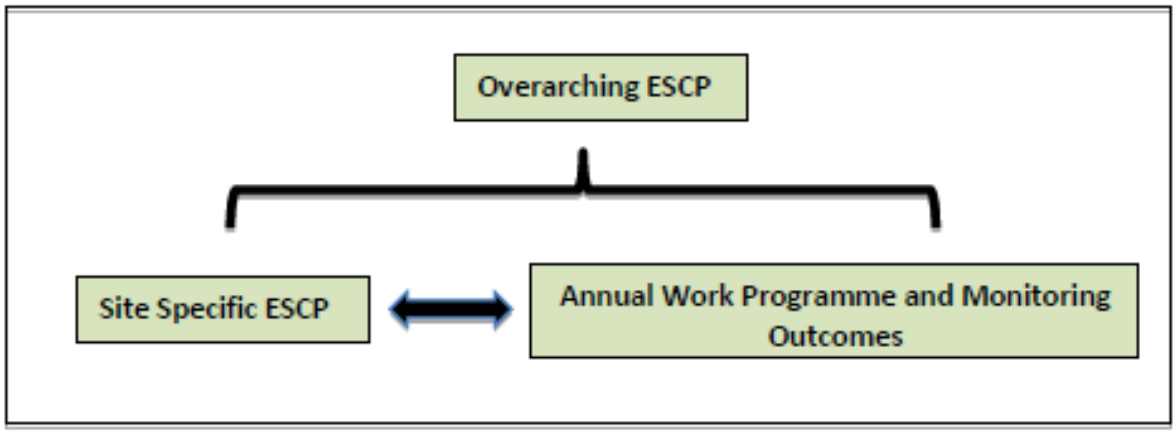

Figure Three: ESCP Management Plan Approach

1.4 Project description and features

1.4.1 SB Mining and Rehabilitation Activity

The SB is currently utilised for dairy/dairy support activities and is highly modified humped and hollowed pasture of farmland located adjacent to State Highway 6. Canoe Creek Scenic Reserve is situated on the northern boundary of the site.

Granite Creek and Little Granite Creek flow through the mining area along with several smaller tributaries. Many small springs and farm drains are located throughout the site and are currently utilised for stock water supply. Figure 4 below provides an overview of the application area and the creek systems and receiving environments.

The proposed mining area is to all occur within the identified Mining Disturbance Area and occupies the coastal strip between Canoe Creek and Fagan Creek. In addition, several smaller creeks traverse the proposed mining area, including those of the Granite catchment. These creeks have their headwaters in the Paparoa Range.

The Barrytown Flats are crossed by several creeks and flowing farm drains that conduct water from the Paparoa Range watershed in the east into Tasman Sea in the west. Among these in the vicinity of the SB are Canoe, Little Granite, Granite and Fagan creeks, plus two unnamed creeks nearer Canoe Creek.

From a mining perspective, smaller creeks and farm drains would be re-routed around the active mining dredge pond as it passes. The Little Granite Creek main stem would not be disrupted by mining, instead the water course would interrupt the mine path, and Little Granite Creek would remain in its current form throughout the Project. This approach would also maintain the floodway of the Granite catchment across the coastal plain throughout the period of mining and restoration.

The Barrytown Flats also host a shallow groundwater system within in situ mineral sands and coarser alluvium. The water table is generally shallow under the coastal strip, augmenting several wetlands and in close hydrological connection with the creek systems. The Barrytown area is also a high rainfall zone, receiving moisture laden airstreams from the Tasman Sea.

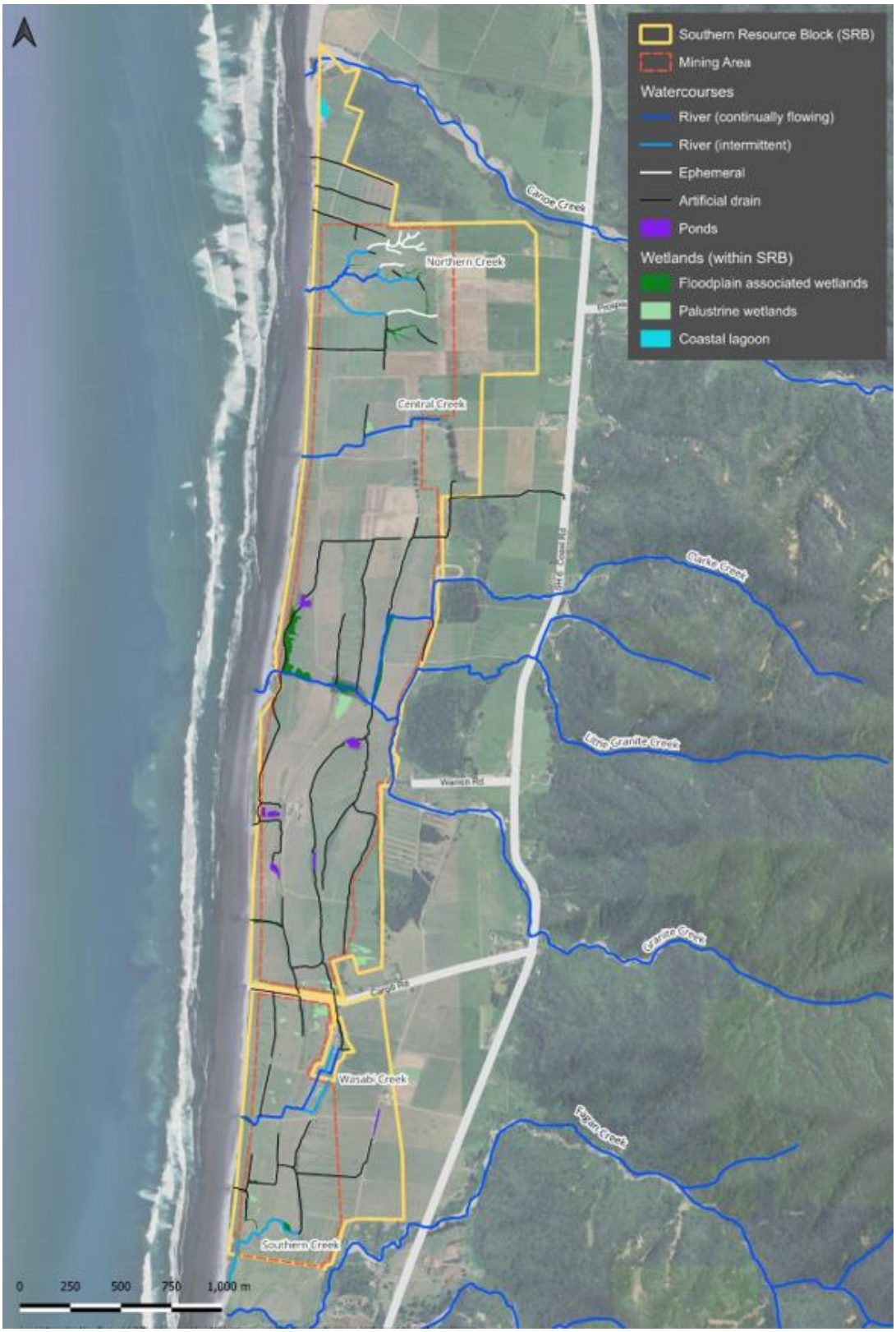

Figure Four – SB Creek Status

Granite Creek and Little Granite Creek have their headwaters in the Karamea granitic batholith rocks. In the far south of the foothills encompassing the landward flank of the coastal flats, the basement strata are primarily the Ordovician age Greenland Group indurated greenish-grey bedded sandstones and mudstones.

Plate One: Flat Contour

Plate Two: Typical SB Creek

Plate Three: Granite and Little Granite Confluence

Plate Four: Little Granite Creek Downstream from Confluence

Plate Five: Typical Pakiroa Beach Environment

Mining on the SB will be undertaken using a floating dredge with mining undertaken in three sections as below with only one section to be mined at a time. Mining of the SB is expected to commence in approximately year 2034 - 2035 once the mineral resource on the existing consented CB has been exhausted.

(a) Section 1: Granite Creek North;

(b) Section 2: Granite Creek South;

(c) Section 3: Cargill Road.

A mine starter pit is required in each of the three sections to establish the initial dredge pond in which the floating dredge will operate. The mine starter pit will be developed by excavating into the water table. An area of approximately 100m wide x 300m long, and up to 10m deep will be excavated using an excavator and trucks, removing approximately 270,000m^3 of material. Material extracted from the starter pit will be used for the construction of the noise control bunds. This starter pit design allows for:

(a) A dredge pond (mine void) of approximately 100m x 100m;

(b) A 100m x 50m area behind the dredge for the deposition of tailings following processing; and

(c) A 100m x 100m area in front of the dredge pond at various stages of excavation, ready to be mined

The dredge will extract ore in strips (each strip will be approximately 100m wide and excavated up to a depth of 10m below ground) with the indicative mining sequence, progressing in a north/ south direction, although there will be some mining in an east/west direction where the dredge turns to commence a new strip.

A key part of the mining process is the proposed mining set backs, including rehabilitation activities, from key environmental features and boundaries as follows:

(a) 20m from the consent boundary;

(b) 20m from Granite Creek;

(c) 20m from Fagan Creek;

(d) 50m from Mean High Water Springs (MHWS);

(e) 20m from the proposed SNA PUN-049, which is adjacent to Section 2 (Granite Creek South);

(f) 20m from all private property boundaries not within the consent area; and

(g) 200m from dwellings other than where noise bunds are proposed.

Mined mineral sand material will be pumped from the mine pit to the WCP, and excess tailings material will be pumped back to the active mine area following processing. Tailings will be deposited behind the dredge as it advances via dewatering cyclones. Overburden and topsoil will be placed back over the tailings periodically completing the mining sequence. A total of 16 ha of disturbed area at any one time is sought as part of the application which allows for all associated activities and contingencies.

Figure 5 below illustrates a representative cross-section of the active dredge pond, excavating face, and tailing back-fill zones.

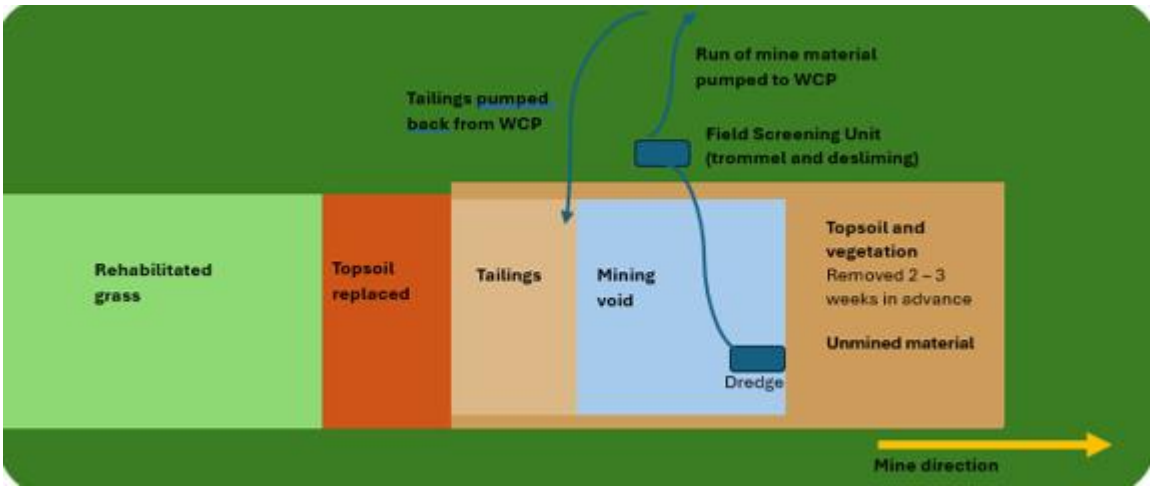

Figure Five: Schematic representation of the dredge pond and dredge in plan view

Once the pre-mining activities are complete, mining will progress as follows:

- Approximately 0.2 - 0.6 metre in depth of topsoil and overburden in advance of mining will be removed and stockpiled for rehabilitation. The area of this activity will be approximately 1 ha.
- Some of the removed material will be used to create safety and diversion bunds along either side of the full mining void which will have the effect of ensuring mine related water is all diverted back into the mining void and any offsite waster is diverted away from the mining void. The remainder of the material will be used for rehabilitation.
- Approximately 1 ha of sand ore will be exposed as a bench where the mining field unit and desliming unit are located on skids. The rate of mining advance will be approximately 6 metres per day.
- The sand ore will be mined via a floating dredge in a 1 ha pond.
    - The slurry will pass through a trommel and desliming circuit before being pumped to the WCP.
    - Reject large material from the trommel and slimes will be returned to the mine pit for rehabilitation.
- Mined mineral sand will be pumped to the WCP to extract Heavy Mineral Concentrate (HMC). As mined mineral sand will be collected at a faster rate than it can be processed, it will be stored at the WCP and processed overnight. This will result in the WCP running continuously.

- HMC will be separated from the mined sand ore using a water and gravity circuit, drained of excess moisture and stored at the WCP for dispatch to the MSP located at Rapahoe.

The mining pit will be progressively filled as the mine pit progresses forward with 1 ha of the mining void actively receiving tailings pumped back from the WCP following processing. The material to be returned to the excavated area includes un-mineralised sand, clay slimes less than 53 micron diameter, and gravel and rock greater than 2 mm diameter. These tailings are dewatered and transferred to the mining void via cyclone and will naturally spread in this location. The cyclone will be moved as required to distribute the tailings evenly across the area. Tailings will be levelled and contoured with the use of excavator(s) and bulldozer(s) ready to receive the pre-stripped overburden and soil.

Mined strips will be progressively rehabilitated as the mining void advances. The material identified above, will be levelled and contoured to reinstate the land to an improved, landform of contoured dairy grazing pasture or other land uses to be determined. Approximately 5.6 million tonnes (equivalent to 2.6 million cubic metres at a bulk density of 2.2 g/cm^3) of HMC will be removed from the mining disturbance area over the life of the Project. To achieve the proposed post-mining contours, material will also be required to be sourced from areas located outside the mining disturbance area (but within the application area). This will occur over approximately 72ha of this location outside of the Mining Disturbance Area however earthworks will all be managed within the 16ha maximum exposed limit. When balanced against the available redistribution material, the final change in landform equates to an average reduction in land height of approximately 0.63m across the entire 408ha application area. Importantly at the western extent of the Project the landform will be returned to the current contours and levels.

Any other stockpiled topsoil will be spread out and used as a growing medium. Mined land will be removed from the disturbed area calculation once vegetative cover (i.e. sowing of grass) has reached 80 % vegetative cover.

To achieve a smooth landform and minimise ground level reduction, initial vegetative cover will be established as soon as practicable (potentially using mulch and hydroseeding) to minimise any erosion potential. This will be followed by the establishment of longer term, permanent pasture species.

The final contoured landform will also include a constructed wetland along the eastern boundary of the SB and will be established as part of the progressive rehabilitation.

As detailed above, the WCP has been consented in the new SB location with all the associated pond configurations and volumes. These aspects are therefore not further assessed within this ESCP.

The table below and associated figure illustrate the extent of expected earthworks to occur for the overall Project.

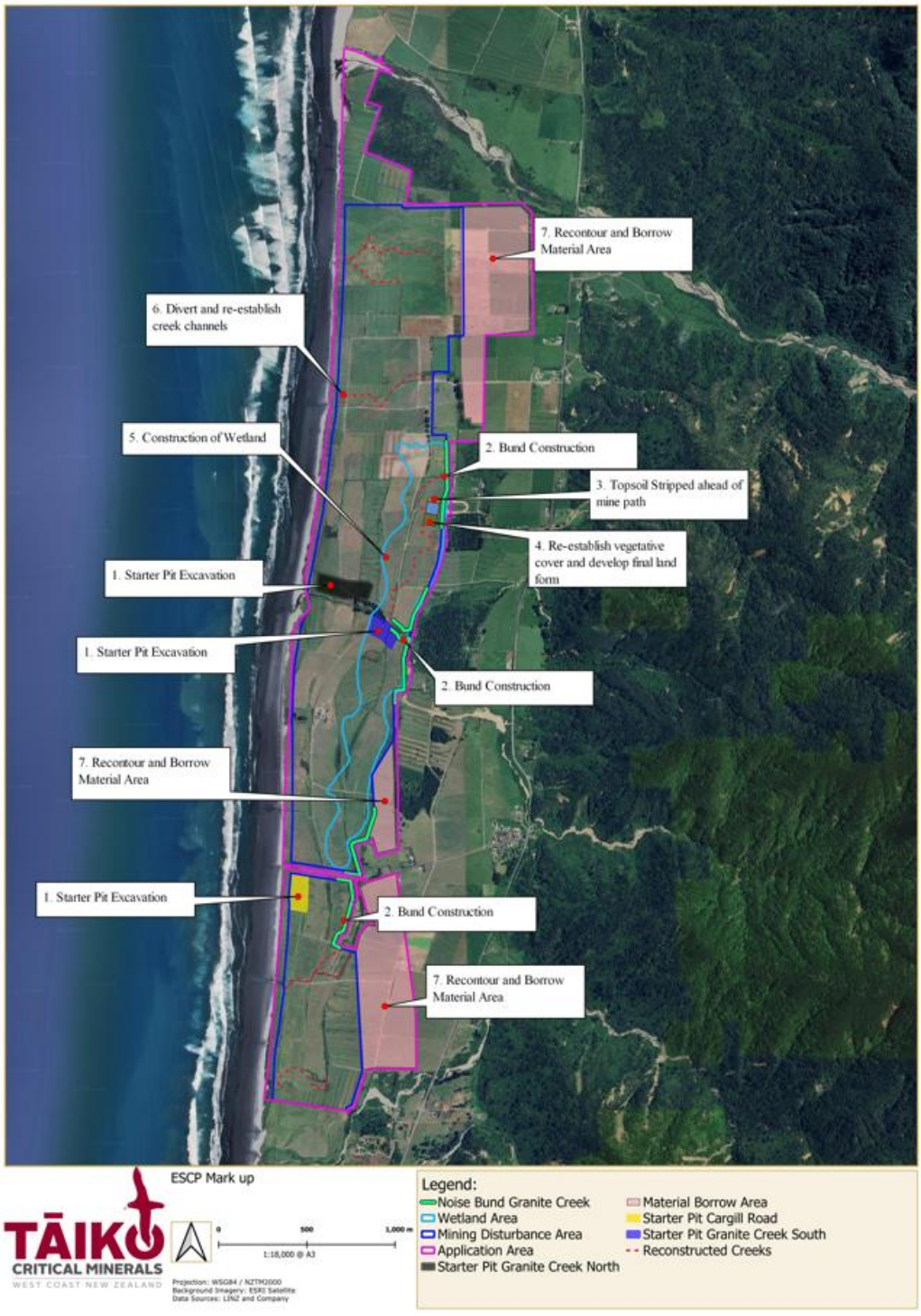

Figure Six: Project Earthwork Locations

Activity	Earthworks Area (ha)	General Approach to Works	Water Management
1. Mine Starter Pits	• 2 to 3 ha areas	This involves stripping the topsoil, overburden and mineralised sand and then placement of aggregate. Material will be used in bunds. Will occur over a short period then fully stabilised.	Water captured within the mining void and infiltration to ground water.
2. Bund establishment	• South Access 1.2 ha. • Granite Creek 2.2 ha • Cargil North 1.1 ha • Cargil South 1.05 ha	Material transported to bund site and stacked in location. Material sourced from starter pit or borrow areas. Material recovered and used in rehabilitated land form at completion of works.	Re-vegetation and planting. Silt fences installed during bund establishment
3. Stripping of topsoil and overburden	1 Ha	Material excavated placed on tailings behind and recontoured and vegetated.	Infiltration to mining void, cut of drains directed to the mining void with the void bunded to ensure no offsite "clean water" can enter the mining void location.
4. Rehabilitation behind mining	1ha-4ha	Deposition of tailings (pumped) and placement of topsoil with use of truck and excavator and other machinery.	Infiltration to mining void, cut of drains directed to the void. Silt fences can be used if required. Areas are stabilised as works progress with grass seed and also mulch if required to get an instant stabilised surface.

Activity	Earthworks Area (ha)	General Approach to Works	Water Management
5. Construction of wetland.	Forms part of rehabilitation.	Landform developed progressively as part of rehabilitation.	Sown in grass initially or mulch if required to get instant stabilised surface. Ponds within this area can be created to hold water. Wetland planting over time.
6. Temporary and permanent diversion and establishment of creek channels	0.8 -1ha	Diversion channel established. Excavated material placed in mine path/stripped overburden area or stockpile. Recreated channel established as part mining rehabilitation.	As per ESCP with stream creation in dry environment and ensuring fully stabilised prior to any re-entry of water flow.
7. Re-contour and borrow material	2ha maximum at any one time within a 72ha area within application area but outside mining disturbance area	Potential source of material for bunds where required. Source of material for distribution for final land form. Excavated and truck. Potential for use of bulldozer	Progressive revegetation including mulch in locations to ensure stabilised surface. Exposed areas gravity fed to mining void, pumped to MWF and treatment pond system or treated through sediment retention ponds with discharge to land. All haul roads will be bunded and diverted back to mining void.
Service roads		Utilise existing farm tracks/roads where possible. Short extensions required to mining void and other areas of the site.	Bund and impound areas as possible. Utilise mining void as a discharge location. Silt fences in some locations will be required.
Total EW Area at any one time including contingencies	**16ha**		

Table One: Project Earthwork Activities

1.5 ESCP content and project specific construction activities

As part of the development of this ESCP, consideration has been given to WCRC expectations with respect to the erosion and sediment control design and ESCP content. The concepts of this ESCP are consistent with the CB which were discussed with WCRC and generally confirmed as appropriate. Importantly the principles and practices from within Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region. June 20016 incorporating Amendment 3 (August 2023) (GD05 Guidelines) have been applied.

This ESCP therefore has been developed with consideration of the following detail:

a. Details of all principles, procedures and practices that will be implemented to minimise the potential for sediment discharge from the SB;

b. The design criteria, supporting calculations, dimensions and contributing catchments of all key ESC and water management structures, including (but not limited to) diversion bunds/channels and impoundment structures;

c. Timetable and nature of progressive site rehabilitation and re-vegetation proposed;

d. Maintenance, monitoring and reporting procedures; and

e. Rainfall response and contingency measures including procedures to minimise adverse effects in the event of extreme rainfall events and/or the failure of any key ESC structures.

1.6 Roles and responsibilities

The consent holder will have the overall responsibility for meeting the requirements of this ESCP. The contractors and sub-contractors who are yet to be formally engaged and will be located on site, will include an environmental manager (or equivalent) that will implement this ESCP (and subsequent SSESCPs) including all required monitoring, management and necessary communication to the regulatory agencies including WCRC.

This ESCP and the SSESCPs will be implemented for the duration of the SB construction activity, and where relevant the ongoing mining works, and a copy will be kept in an accessible location for the duration of the Project.

This ESCP and SSESCPs will also continually be reviewed during works and will be subject to amendments as necessary in consultation with WCRC as part of the AWP process.

2. Existing environment

2.1 Rainfall

Punakaiki is reported to experience approximately 2800mm rainfall per year, with the rainfall relatively consistent throughout the year. Figure 7 below illustrates this rainfall pattern which is assessed to be similar for the Project site. On average October is the wettest month and February is the driest month.

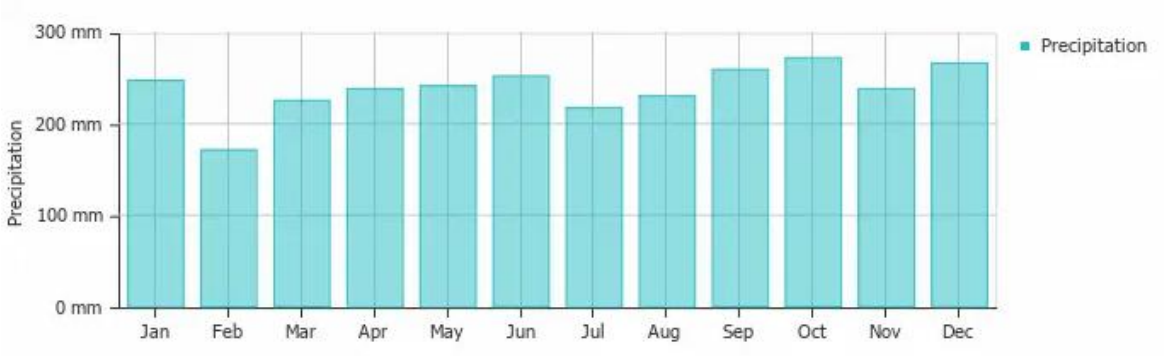

Figure Seven: Punakaiki Annual Rainfall Patterns

2.2 Water quality

The proposed mining area encompasses a shallow, but stratified, coastal groundwater system replenished by soil drains in overlying farmland and creek infiltration. Groundwater traverses the coastal groundwater system from east to west and discharges into the Tasman Sea via submarine seepage. The chemical composition of groundwater in the Barrytown Flats coastal strip is fresh but enriched with dissolved metals possibly as a result of low oxygen content of the water.

The proposed mining area occupies the coastal strip between Canoe Creek and Fagan Creek. In addition, several smaller creeks traverse the proposed mining area, including those of the Granite catchment. These creeks have their headwaters in the Paparoa Range with its summit at an elevation of 1,220 metres above mean sea level (AMSL) and steep bed gradients. Hydrological characterisation has established that the catchment central creeks have moderate base flow retention, but southern, granitic rock creeks are subject to flash flows with negligible base flow in any extended periods between rainfall.

As reported within the Ecology Effects Assessment, water quality analysis has indicated that the creek systems exhibited near neutral pH, low to moderate electrical conductivity and total dissolved solids (TDS) concentrations, and generally low turbidity and total suspended solids concentrations.

2.3 Overall sensitivity of the receiving environment

Based on the knowledge of the receiving environment and the extent of the SB Project works, while the Project works are assessed as low risk due to soil types and flat existing contours, it is important that the minimisation of surface water discharges from earthwork activities occurs at all times. It is also important to recognise, and account for, that due to frequent heavy rainfall at the Project location, creeks in the area experience frequent high turbidity events, and that following these events water returns to low turbidity relatively quickly.

From a water management perspective, in particular during the mining phase of the SB, best practice erosion and sediment control measures will need to be designed, implemented and maintained with a BPO approach to ensure appropriate environmental outcomes can be achieved overall.

3. Erosion and sediment control and water management principles

This ESCP outlines the ESC and water management measures to be utilised for the Project with these based on:

- Viewing the SB in a holistic manner. The combined effects of the pre mining, mining and rehabilitation activity on the receiving environment, are considered as a whole and not in isolation from each other;
- Minimising the potential adverse effects on the receiving environment, by using measures, both structural and non-structural that meet industry best practice and GD05 Guideline;
- Having regular 'toolbox' meetings onsite with relevant personnel in attendance as part of the ongoing mining activity;
- Ensuring that any water and associated sediment discharges are considered and assessed as part of the SB implementation;
- Ensuring that all ESC and water management measures utilised are structurally sound and designed appropriately; and
- The implementation of an adaptive monitoring programme, to inform the effectiveness of the ESC and water management measures on site and to adapt and amend these as necessary to minimise the discharge of sediment (and other contaminants) into the receiving environment.

The Project will adopt a set of key principles that apply to all work activities. Appendix A of this ESCP contains the erosion and sediment control principles as reflected within the GD05 Guideline with the specific SB principles outlined in Section 3.1 below.

3.1 SB ESC principles

1. ESC measures will be based on a range of structural (physical measures) and non-structural (methodologies and construction sequencing) measures.

2. ESC measures will, where practicable, meet the minimum criteria as detailed in this ESCP and will incorporate innovative ideas and procedures to ensure best practice applies and to match any local challenges and opportunities.

3. Progressive and rapid stabilisation of disturbed areas (including using hydro mulch and mulch products) will be on-going during the mining and rehabilitation activities to ensure that no more than 16ha of exposed area exists at any one time. Any stabilisation alternatives (not outlined within GD05 Guideline) will first be verified as an appropriate and WCRC authorised stabilisation media.

4. Stabilisation will need to be appropriate to the soil surface geology with the intent of achieving an 80% vegetative cover or non-erodible surface over the exposed area. Stabilisation is designed for both erosion control and dust minimisation and will be progressively implemented.

5. A monitoring and management approach which allows a response to water quality (turbidity and other contaminants) monitoring outcomes will be utilised for the mining and rehabilitation activity through qualitative monitoring (which will include visual surveys and recording of any discharges and the downstream environment) and also quantitative monitoring (which will include water quality sample collection and analysis for creek diversion activities and any surface water discharges that may eventuate from the earthworks required to source material for rehabilitation).

4. Overview of erosion and sediment control and design criteria

4.1 General overview

As outlined above, for this SB we have adopted a BPO approach which reflects the current state of knowledge (as per the GD05 Guideline), the specific physical conditions to be encountered on the site and the previous knowledge of the Project team (from other similar mining projects) which will be reflected in the measures adopted.

In terms of water management measures for the SB the following applies:

Construction Phase Activities

1. There will be land disturbance activities associated with bund establishment, access provisions and ancillary works. These activities are also to be addressed in full through the SSESCP process and are subject to the principles and practices as outlined within this ESCP.

Mining Phase and Rehabilitation Activities

2. Water generated in the WCP will be captured and directed to, via pumping, consented treatment ponds. While no further discussion in this ESCP is therefore required around this treatment system it is important to note that there are no designed surface water discharge locations from the WCP process (and associated treatment ponds) and any excess water will be pumped from the WCP back to the mining void location.

3. The mining void itself including the establishment of the mine location and rehabilitation stages of this area are self-contained systems with a bund established (from the initial topsoil stripping) to fully isolate the area of disturbance from surrounding runoff. It also fully contains any water within the area of disturbance where groundwater infiltration can occur and also pumping of the run of mine material back to the WCP for processing.

4. As the mining of each section is completed, the section will be rehabilitated to its final landform which includes establishment of a proposed wetland of at least 51.7ha. Outside of the Mining Disturbance Area and within the Application Area earthworks will occur over 72ha for the purpose of sourcing material for rehabilitation. This earthworks activity will be subject to the following criteria:

    - The earthworks will form part of the Project maximum 16ha limitation and will also be subject to a maximum 2ha at any one time;

    - To achieve the 2ha maximum open area the borrow locations will be progressively stabilised throughout the Project lifetime;

- No creeks or wetlands will be diverted or removed as part of the earthworks borrow activity with buffer zones applying as specified above;
- If borrow earthworks are immediately adjacent to the mining void (or it remains practicable to do so) then the 2ha cut location will be fully bunded and all runoff diverted via diversion channels or pipes into the mining void;
- If not adjacent to the mining void (or it is impracticable to do so) the 2ha area will be independently managed and a sediment retention pond (as per GD05) established for each area which will discharge to land;
- As an alternative the 2ha borrow area will be fully bunded to impound any runoff and then pumped to the mining void or to the MWF treatment ponds as required;
- Any associated haul roads from the borrow area to the location of rehabilitation will be bunded on either side to contain any dirty water that eventuates and divert this to the mining void; and
- Progressive stabilisation of all exposed areas will occur.

5. Where creek diversions are required as part of this mining phase, they are subject to a detailed methodology and specific ESC measures, with these discussed below in Section 4.8.

6. Wetland establishment will occur as part of the rehabilitation process and will be undertaken as per Section 4.7 below.

Overall Earthworks

7. A total of 16ha of disturbed area at any one time is being sought as part of the application to ensure 80% vegetative cover in the area of rehabilitation can be achieved to address any periods of slow growth that may occur e.g. winter or a cold wet spring. The Project has therefore committed to having a maximum area open at any one time of 16ha within which a maximum 2ha will be exposed as part of the wider borrow cut area. This includes all the bund establishment and road access provisions. This has the effect of ensuring, including through site establishment phases, that progressive stabilisation is implemented and the risk of sediment generation and discharges are greatly reduced.

4.2 Key erosion control measures

In general, the erosion control measures to be applied to the Project are as below.

4.2.1 Construction staging and stabilisation

As a general approach to all land disturbance, but with specific reference to the construction phase and the rehabilitation proposed, the SB will minimise soil exposure and undertake progressive rehabilitation and stabilisation as areas of the mine are completed. As detailed above, rehabilitation will be ongoing at all times following the mine advancement to ensure that the maximum 16ha area is achieved at all times.

The WCP itself is subject to a separate consent for the construction of the associated infrastructure and the ongoing operation. These aspects are not assessed within this ESCP.

Stabilised is defined as:

> *An area inherently resistant to erosion such as rock, or rendered resistant by the application of aggregate, geotextile, vegetation, mulch or an approved alternative. Where vegetation is to be used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once an 80% vegetation cover has been established.*

Typical revegetation will include seeding and fertiliser application on topsoiled areas and hydroseeding, however where instant stabilisation is required (for example to ensure the 16ha exposed area limitation is achieved), hydro mulch and / or hay and/or straw mulch is likely to be utilised.

In addition to the mine rehabilitation process, the visual and acoustic bunds to be established will also be planted with species for the purpose of achieving the landscape and noise objectives while at the same time achieving a stabilised surface to minimise erosion.

Importantly, utilising traditional grass sowing methodologies is not considered stabilised until such a time as 80% vegetative cover is established on site however the use of hydro-mulch / hay or straw mulch and as well as hardfill with clean aggregate is confirmed as immediately creating a stabilised surface. If alternatives, such as polymer/soil binder products or hydroseeding are to be utilised for stabilisation, they will need to be verified by WCRC as achieving a stabilised surface prior to on-site use.

The use of stabilisation is designed with 2 key purposes being dust suppression and also erosion control.

4.2.2 Stabilised construction entranceway

Stabilised construction entranceways are a stabilised pad of aggregate placed on a filter base and are located where construction traffic will exit or enter a construction site. They help to prevent site entry and exit points from becoming a source of sediment and also help to reduce dust generation and disturbance along public roads. On this Project stabilised entrances will be utilised with all public roads. GD05 Guideline will assist with the provision of the design criteria.

No vehicles will be allowed to leave the SB unless tyres are clean and vehicles will not contribute to sediment deposition on public road surfaces. The WCP location and associated access roads will all be aggregate stabilised and as such will in themselves act as stabilised entrance ways.

4.3 Key sediment control measures

Sediment control on the SB will involve the treatment of sediment-laden runoff from pre mining phase activities and also mine process water from the various areas of the SB but in particular the active mining area. Sediment control will be established through the use of best practice sediment control measures and site management practices.

The sediment control measures to be applied to the SB are as follows:

4.3.1 Sediment impoundment and mining void locations

Treatment of surface runoff and sediment contaminated groundwater from the mining area will occur to ensure that sediment is removed to the maximum extent possible from the construction runoff. There are no designed surface discharge locations from the mining void with the mining void locations fully bunded with topsoil as the mining void progresses. This bunding achieves a self-contained area which ensures that and runoff from outside the area is diverted away from the mining void and any water within the mining void remains in this location.

The only material to leave the mining void location is the run of mine material which is pumped to the WCR where a series of treatment ponds and devices are located. These devices have been assessed through a separate consenting process and are not part of this ESCP.

Overall, therefore for this ESCP and the mining operation no formal sediment impoundment locations are required.

For the rehabilitation borrow cut locations, one option that exists for treatment of any runoff water from these locations is utilisation of Sediment Retention Ponds (SRPs) which provide a very robust and effective measure in achieving sediment removal from construction runoff. If this option is adopted there is assessed to be adequate room available for any such construction and associated discharges. They will be designed and operated in accordance with GD05. There is also the ability

to centralise the location of any such SRP construction and utilise the same SRP device for several 2ha borrow cut locations.

4.3.2 Silt fence (SF) and Super silt fence (SSF)

SF and SSF are fabric fences reinforced with waratahs / stakes and a chain-link backing (SSF only) to allow a physical barrier to sediment laden flows leaving the area of earthworks. This barrier acts as a detention and filter for these flows to ensure sediment yield is minimised. Their design and placement will be based upon the criteria contained within the GD05 Guideline.

SFs will be utilised during the pre mining phase as part of all of the visual and acoustic bund establishment along eastern extent of the Project access road establishment and adjacent to any creek systems. These SFs and SSFs will be complemented with progressive stabilisation.

In addition, where stockpiles are to be established, they will avoid direct placement over creek systems, will be stabilised as they progress and will be protected with SFs and SSFs installation.

The GD05 Guideline notes that design criteria as below which will be adopted.

Table 13: Silt fence design criteria

Slope steepness %	Slope length (m) (maximum)	Spacing of returns (m)	Silt fence length (m) (maximum)
Flatter than 2%	Unlimited	N/A	Unlimited
2 – 10%	40	60	300
10 – 20%	30	50	230
20 – 33%	20	40	150
33 – 50%	15	30	75
> 50%	6	20	40

Table Two: GD05 2023 Guideline Table 13 Silt Fence Criteria

4.4 Decommissioning of devices

All ESC measures will remain in place until such a time as the construction activity or mining operation has ceased or the circumstance where the catchment contributing to that device is stabilised. Once the contributing catchment is considered stabilised, or other measures are in place as agreed with WCRC, the measure will be decommissioned in consultation with WCRC.

For the mining activity itself, as described above the ESC measures will remain for the full operation and duration of SB.

4.5 Pumping

Pumping will be necessary in some parts of the Project. Pump intakes will be fitted with floating intakes and while the run of mine material will be pumped to the WCP that contains a separate treatment system, if there is any excess water from this WCP location it will be pumped back to the mining void with no surface water discharge.

There will be no pumping of any on site water directly to the receiving environment.

The contractor may also wish to initiate a permit to pump system whereby pumping can only occur with a specific "internal" permit in place which confirms all the necessary criteria, including water quality, have been achieved prior to the pumping itself.

4.6 Rehabilitation

Outside of the Mining Disturbance Area and within the Application Area earthworks will occur over 72ha for the purpose of sourcing material for rehabilitation. This earthworks activity will be subject to the following criteria:

- The earthworks will form part of the Project maximum 16ha limitation and will also be subject to a maximum 2ha at any one time;
- To achieve the 2ha maximum open area the borrow locations will be progressively stabilised throughout the Project lifetime;
- No creeks or wetlands will be diverted or removed as part of the earthworks borrow activity with setbacks applying as specified above;
- If borrow earthworks are immediately adjacent to the mining void (or it remains practicable to do so) then the 2ha cut location will be fully bunded and all runoff diverted via diversion channels or pipes into the mining void;
- If not adjacent to the mining void (or it is impracticable to do so) the 2ha area will be independently managed and a sediment retention pond (as per GD05) established for each area which will discharge to land;
- As an alternative the 2ha borrow area will be fully bunded to impound any runoff and then pumped to the mining void or to the MWF treatment ponds as required;

- Any associated haul roads from the borrow area to the location of rehabilitation will be bunded on either side to contain any dirty water that eventuates and divert this to the mining void; and

- Progressive stabilisation of all exposed areas will occur.

4.7 Wetland establishment

The wetland covers approximately 51.7ha north and south of Granite Creek. The wetland will be developed as part of the rehabilitation process in sections as mining advances. This includes a series of shallow ponds and wetland features. The earthworks associated with this wetland profile development therefore forms part of the same mining void rehabilitation earthworks and all water and any associated runoff will be managed within the mining void.

Importantly while an indicative mine path has been prepared, these mine paths can be adjusted operationally to be wider or narrower to enable landforms associated with the wetland form to be established.

In circumstances where creek systems intersect the mine path, and as a general approach as mining moves into an area to be incorporated into the wetland, the following steps will be undertaken:

1. Creeks will be diverted around the mining activity as detailed in Section 4.8 below to allow mining to continue.

2. Once mining is completed, Creek channels will be constructed in the permanent diversion location and developed at the same relative level as that existing prior to mining activity. This also enables full stabilisation of these creek diversions including riparian vegetation planting.

3. Surrounding the creek formation (at a variable, but generally lower level based on the rehabilitation process) the wetland ponds and shape will be established. These areas will be fully stabilised as part of the rehabilitation vegetation establishment.

4. As the mine path progresses and the wetland formation advances, the final wetland infill planting programme will also continue to advance.

Overall, from a water management perspective the wetland establishment will utilise the mining void to divert any dirty water runoff and will ensure that there is minimal, if any, surface water discharges. At all times the wetland establishment earthworks form part of the maximum 16ha exposed area limit.

4.8 Creek diversions

For the mining activity the location of the various creek systems is confirmed in Figure 4 above. The mining activity will intersect these creeks in places and as such creek diversions will be ongoing throughout. Little Granite Creek runs along the eastern boundary of the site before joining Granite Creek. These two creeks, Little Granite Creek and Granite Creek, will remain undisturbed and are not proposed to be diverted as part of the mining operation. Canoe Creek and Fagan Creek will also remain unaffected by the activity. A 20m mining setback will be established for each of these creek systems.

Diversions to the creeks would be required to facilitate mining and as each mine path intersects a creek a diversion will be required. The intent of this approach is that the mine path will always operate in a "dry" environment with no flowing water entering the mine void. Further to this the creek diversions could be temporary to allow a mine path to progress or permanent, where the diversion remains as a permanent location post mining in a completed rehabilitated location. The decision as to either temporary or permanent will be confirmed within the SSESCP process and will be subject to ecological and hydrological considerations at that time.

In both temporary and permanent cases, the creek diversion will be necessary in order to establish an 'off-line' environment to allow mining works to be completed outside of active creek channels.

North–south oriented creeks will be diverted into a previously mined area before mining reaches the creek system. This is expected to require adjustments (widening or narrowing) of the mine path to facilitate this. A permanent reconstructed channel will be built in advance as part of the rehabilitation of the mined land, and the creek flow will then be redirected into it.

East–west oriented watercourses will also be diverted into previously mined areas (behind the mining void) and into the adjacent mine path (to the east as mining moves inland), prior to mining progressing through the creeks existing alignment. This requires a temporary diversion of the creek around the active mining area. Once mining has advanced beyond the temporary diversion, a permanent reconstructed channel can be constructed and the creek reinstated.

We also note that to minimise the potential harm to native fish in creeks before they are diverted (either into temporary or permanent channels) it is proposed that fish relocations be carried out. A Native Freshwater Fish Capture and Relocation Plan (NFFCRP) will be prepared and implemented prior to any works in a creek system. The NFFCRP would outline how fish will be captured and where they will be relocated to prior to works.

The following outlines the sequence of works required to complete both temporary and permanent diversions:

- Excavation of the new diversion channel (likely to be through the completed mine path that has been rehabilitated) will be carried out offline from the existing creek, so that

excavation works can be carried out in a dry environment. A solid plug will be left in place at each end of the diversion channel to ensure that the existing creek cannot breach and flow through the new channel prior to it being stabilised:

  - For temporary diversions the dimensions and design of the diversion will be such that it replicates the existing channel profile. This will be detailed within the SSESCP; and

  - For permanent diversions the dimensions and design of the diversion will be confirmed in the SSESCP process and will take account of ecological and hydrological function.

- Material excavated from the diversion channel will be placed in the mine path location or in stockpiles away from the creek diversion and will be managed as detailed above with flows to silt fences installed as per Section 4.3.2;

- Stabilisation of the newly constructed diversion channel will be carried out to ensure it does not become a source of sediment. This may be achieved using natural material, coir matting, rip rap material or rock armour;

- Once the diversion channel is fully stabilised, the downstream plug will be removed to allow creek flows to enter the diversion channel. The upstream plug can then be removed allowing creek flows through the diversion channel;

- Removing the downstream plug first helps to reduce scour in the diversion channel by keeping some water within it when the upstream plug is removed;

- A non-erodible dam (such as sandbags with an impermeable liner) will then be placed within the original channel immediately downstream of the inlet to the diversion channel in order to divert flows into it. A non-erodible dam will also be immediately placed at the downstream end of the original channel, upstream of the diversion channel outlet to prevent backflow into the mining area. Once the flows have been diverted and the dams placed, fish removal from the original channel can be completed. Mining activity associated with the mine path can then take place within the original channel location as required;

- There will remain a buffer zone between the creek systems and the mining activity and in some circumstances, there will be the requirement to place silt fences between these 2 locations to ensure no dirty surface water runoff enters the creek. In addition to this the mine void will continue to have bunding around the perimeter which will ensure all mine void water is fully enclosed;

- Once the mining and rehabilitation has been completed and the surrounding area stabilised then the channel can be reinstated back within its original position or remain in the new location as a permanent creek.

It is also noted that where the mine path will intersect wetland features the mine path will continue through these features, and groundwater and seepage that enters the mine void will be treated as detailed above.

While the creek diversion activities themselves will be programmed for fine periods of weather, if rainfall occurs during the process of the diversion creation, this will be managed as below. In the event of forecast rainfall, or before leaving the work area for more than 24 hours the following will occur:

- Any loose material that could enter a “live” creek system is to be removed from the work area, depending on the quality of the material this will be to a stockpile area;
- Where possible, all exposed areas will be covered with geotextile to ensure no flows overtopping the creek banks create scour issues. It is expected that this will be achieved through geotextile with the geotextile appropriately trenched in at the head and toe of the area;
- All existing and additional erosion and sediment control measures will be inspected, secured and maintained where required;
- Additional mulch and geotextile / polythene will be kept onsite at all times to cover exposed areas and stockpiled material; and
- Extended working hours will be considered if it is of significant benefit with regard to programme and environmental impact.

4.9 Dust management

It is recognised for the mining and rehabilitation processes that dust nuisance can eventuate in the circumstance when earthworks activities, including machinery movement, are undertaken without appropriate management. These activities can include:

- Earthmoving activities, such as the creation of bunds, site levelling and material transfer, excavation and trenching;
- Clearing of pasture and topsoil;
- Load and haul operations of material around the site;
- Vehicle movement on tracks; and

- Wind erosion of exposed areas and stockpiles.

Stockpiles in particular can become a source of dust and will need to be carefully managed to ensure there are no environmental effects resulting from these areas. Any vehicle transporting materials to be stockpiled, that may produce dust, will be managed to minimise dust during transportation, and water will be sprayed on stockpiles from water carts to suppress dust during the construction period as necessary.

A critical part of this dust management measure is identification of a sufficient water supply at the Project site for this purpose with adequate volume. This has been confirmed for this Project with the water take location confirmed from the Canoe Creek.

In addition to water application, progressive and rapid stabilisation of disturbed areas will be ongoing throughout the Project to ensure that open areas are minimised. This stabilisation has a direct effect of minimising dust generation.

Overall, it is assessed that there must be no offensive or objectionable discharge of dust into air from the minerals extraction, processing, loading and rehabilitation operations that result in an adverse effect beyond the legal boundary of the site. To achieve this a dust management plan will be confirmed which confirms:

a. Potential sources of dust that may be created during the mining project;

b. Sensitive receptors in the vicinity of identified potential sources of dust for targeted dust management;

c. Dust management and mitigation methods;

d. Dust monitoring methods;

e. Training of staff in relation to dust management; and

f. Methods for managing complaints regarding discharges of dust; and

g. Keeping of compliance records.

While not within my specific area of expertise, experience from the CB and other earthwork operations on a New Zealand wide basis, this dust management approach is suitable and confirms a practical and effective approach.

5. Monitoring

An adaptive monitoring programme will be implemented for the SB. This monitoring programme will involve ongoing site monitoring to check that the ESC water management measures have been installed correctly and that methodologies are being followed and are functioning effectively throughout the duration of the works. For the SB this will also directly inform the AWP.

Monitoring results that eventuate, as defined below, will also be used to identify future risks to the environment and will identify any continuous improvement opportunities that should be considered by the construction team.

Water management measures and methodologies may be identified as requiring modification or improvement, including those causing raised levels of sedimentation.

The monitoring programme will include risk assessment to determine what further measures are required to reduce construction discharges. The adaptive monitoring will include a continual feedback loop until it has been verified that the implemented responses have been successful in minimising discharges from the mining activity.

5.1 Qualitative monitoring

5.1.1 On-site visual assessments

Visual assessments of the receiving environment will be undertaken regularly throughout the works period with particular attention paid before, during and after periods of rainfall.

In the context of visual assessment, the receiving environment is defined as any discharges to surface water including the downstream coastal location.

This monitoring will include visual observations of any discharges from the mining void (if they occur), all pump discharge locations, all creek diversions, any surface water discharges from the borrow cut locations and the downstream receiving environment. This will occur a minimum of once per day for creek diversion activities and also after rainfall with a record kept of these inspections.

Any noticeable change in water clarity from the water clarity prior to the rainfall event, or the water clarity upstream of the site of works, as a result of the mining activities will result in a review of the water management measures and practices and additional measures will be implemented, and changes made as necessary under the adaptive management process.

In addition, inspections of the devices themselves will include qualitative monitoring of the following:

- The integrity and effectiveness of all construction related water management devices with a focus on the mining void and rehabilitation areas and requirement for maintenance;
- Mining activities onsite;
- General site conditions and other land disturbing activities occurring within the catchment; and
- General status of the immediate receiving environment.

To ensure a full understanding of the area of works is available, prior to construction commencing, photographs will be taken in the vicinity of potential discharge locations and any creeks in the vicinity of the works.

These records will illustrate the visual state of the receiving environment prior to mining. This photographic record will allow a visual comparison of before, during and at completion of the mining activity.

The monitoring data will help to determine whether any further action is necessary. Where issues with the integrity and/or effectiveness of the devices and/or methodologies are observed these will be rectified immediately.

5.1.2 Weather forecasting during Project implementation

Weather forecast monitoring will form an important part of the Project implementation to ensure that these higher risk periods are proactively managed appropriately.

Weather forecasting will be a key component of the monitoring programme and Metvuw is assessed as an appropriate tool in this regard and within this tool, utilisation of a red rainfall warning will allow for proactive pre rain inspections to occur. This is a qualitative assessment as above and is to ensure that all measures are fully functional prior to the rain event.

As noted above, the creek diversion activities are identified as higher risk activities whereby fine periods of weather will be required prior to undertaking these works to minimise risk.

5.2 Quantitative monitoring

As part of the mining phase for the Project, and as documented within the proposed conditions of consent, quantitative sampling for sediment discharge will occur. This includes:

- Manual sampling for turbidity using field meters or grab samples on a weekly basis and also during a rainfall event (defined as 25mm in a 24hour period) within Northern, Central,

Little Granite Creek, Wasabi and Southern Creeks upstream of the mining activity during mining in those mine sections;

- Manual sampling for turbidity using field meters or grab samples on a weekly basis and also during a rainfall event (to be confirmed within the SSESCP) within Northern, Central, Little Granite Creek, Wasabi and Southern Creeks downstream of the mining activity during mining in those mine sections; and
- Other manual grab water quality sampling of turbidity on a SSESCP basis dependent upon the activity and the discharge location; and
- Specific monitoring downstream of all creek diversions on a daily basis for turbidity; and.
- Specific monitoring downstream of any surface water discharges during a rainfall event (defined as 25mm in a 24hour period) from the borrow cut locations for turbidity.

While no specific discharge water quality standards are recommended within this ESCP for the mining or rehabilitation activities it is assessed that a trigger turbidity level will be established and that this act as a trigger to determine further investigation and assessment of the ESC measures on site. This trigger is assessed as a 30% increase in turbidity from upstream to downstream of the discharge location (or creek works activity) at the reasonable mixing zone.

All monitoring results will be recorded and available for analysis of the water quality outcomes and will form an important part of the AWP process.

6. Recommendations and conclusions

The following key points are noted for the SB.

- Due to the managed nature of the mining phase works and the staged approach and progressive stabilisation of rehabilitated areas, the risk of erosion and consequential sediment discharges is low.
- The WCP and associated infrastructure including treatment ponds are subject to separate consents and discharge conditions. While not addressed within this ESCP they are based on no discharge and have a direct linkage with the mining void location via pumping.
- The land disturbance activities (pre mining phase) are short term and will be managed with ESC measures that are compliant with GD05 Guideline.
- The highest risk of sediment discharge is associated with the creek diversions. These are to be managed with a robust ESC approach, sequencing of works and a monitoring programme to inform and reduce this risk profile.
- The borrow cut locations for the rehabilitation process are also identified as higher risk activities however will be managed through full containment, treatment and progressive stabilisation with maximum open areas of 2ha.
- A range of ESC and water management measures are proposed on the SB that meet the GD05 Guideline criteria or provide an alternative best practice measure. ESCs will be confirmed through a SSESCP process and will be based on both structural and non-structural measures with an emphasis placed on the non-structural management techniques.
- An adaptive monitoring programme will be implemented which will allow for ongoing continuous improvement of the ESC and water management measures and will allow for annual reporting and adaptations all detailed within the AWP for the SB mining and rehabilitation activities. The monitoring regime includes construction phase qualitative monitoring and also specific quantitative monitoring.

7. References

Auckland Regional Council (1994). Storm Sediment Yields from Basins with Various Land-uses in Auckland Area.

Auckland Council 2020. Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland region. June 2016 incorporating Amendment 3.

Goldman, Steven J, Jackson, Katharine, Bursztynsky, Taras A. Erosion and Sediment Control Handbook. (1986)

Appendix A. ESC Principles

A2.0 Fundamental principles of erosion and sediment control

An awareness of where water goes and the sensitivity of the receiving environments are fundamental to determining requirements for erosion and sediment control for land disturbing activities. The following ten fundamental principles of ESC provide best-practice guidance for minimising the adverse effects of erosion and sedimentation through the planning, construction and maintenance phases of a project. These should be followed when preparing and implementing an ESC plan.

1. Minimise disturbance

Consistent with the concepts of water sensitive design (WSD – formerly referred to as low impact design) in Auckland Council guideline GD04, the identification and retention of existing site attributes should be incorporated into project designs, and earthworks should be minimised to the greatest practicable extent.

Land development should be fitted to land sensitivity and where possible, disturbance should avoid steeper slopes and other features such as streams and wetlands.

For any development, the total area of earthworks should be the minimum necessary to achieve the design outcome (including temporary works). The area of earthworks exposed to erosion at any given time should also be minimised through staging and progressive stabilisation.

2. Stage construction

Carrying out bulk earthworks over the whole site maximises the time and area that soil is exposed and prone to erosion. By only exposing those areas that are required for active earthworking at any one time, the duration of exposure and risk of erosion/sediment discharge can be minimised. ‘Earthworks staging’, where the site has earthworks undertaken in smaller units over time with progressive revegetation, limits erosion.

Careful planning is needed. Temporary stockpiles, access and utility service installation all need to be planned. Earthworks staging needs to be planned in conjunction with the overall construction sequencing to ensure that it accommodates the contractor’s requirements.

3. Protect slopes

If slopes are worked and require stabilisation, simple vegetative covers such as topsoiling and seeding may not be immediately effective and additional measures may be required. These are described in Section E3.0 of Part 2 - Practices. Disturbance of existing slopes should be avoided wherever possible, particularly steep slopes which have a higher risk of erosion. To minimise erosion, clean water runoff from above the site must be diverted away from the exposed slopes.

4. Protect receiving environments

Receiving environments including sensitive receiving environments[2], existing streams, watercourses and proposed drainage patterns need to be mapped. Earthworks and the removal of vegetation beside or within streams (including intermittent streams), wetlands and the coast, typically require consents from Auckland Council. Auckland Council should be consulted on these matters prior to finalising project designs.

All receiving environments, limits of disturbance and protection measures should be mapped on the ESC Plan. In addition, all practices to be used to protect new drainage channels should be marked, as well as crossings, disturbances and associated construction methods.

5. Rapidly stabilise exposed areas

Disturbed soils should be progressively stabilised with vegetation, mulch, grassing or other stabilising methods after each earthworks stage and at specific milestones within stages. Available stabilisation methods are site-specific and are described in Section E3.0 of Part 2 - Practices.

6. Install perimeter controls and diversions

Perimeter controls and diversion measures help separate ‘clean water’ from outside the area of disturbance from ‘dirty water’ that has flowed through the disturbed area. Minimising the earthworks catchment by diverting clean runoff away from the works area is a critical erosion control measure. It also reduces the size of sediment control devices required for any given works area. Perimeter and diversion controls can also retain or direct sediment-laden runoff within the site. Common controls are diversion drains and earth bunds. These are detailed in Section E2.0 of Part 2 – Practices.

7. Employ sediment retention devices

Even with the best ESC practices, earthworks will discharge sediment-laden runoff during and immediately following storms. Along with erosion control measures, sediment retention devices are needed to capture runoff so generated sediment can settle out and be retained on site. These are detailed in Section F1.0 of Part 2 – Practices.

The fine-grained nature of Auckland soils means sediment retention ponds will usually require flocculant treatment (flocculation) to maximise their efficiency. All sediment retention devices must be sized and maintained in accordance with this guideline, and must be appropriate for any given location within a site.

[2] Sensitive receiving environment are defined within Section J1 of the Auckland Unitary Plan (operative in part) as an ‘area where wastewater, stormwater or other discharges have the potential to have adverse impacts on important natural or human uses or values in marine, freshwater, and terrestrial environments.’ Overlays D4 – D9 within the plan identify lakes, rivers, streams and wetlands that are especially vulnerable to the adverse effects of development.

8. Get trained and develop experience

As contractors are generally responsible for installing and maintaining ESC practices, a trained and experienced contractor is an important element of an ESC Plan. Trained and experienced staff can save projects time and money through proactive construction and maintenance of ESCs. Staff should be encouraged to become experienced in ESC. Key staff should also be assigned to provide that role, so that the appropriate level of experience and supervision is available for each new project.

9. Adjust the ESC Plan as needed

An effective ESC Plan is modified as a project progresses from bulk earthworks to a fully developed site. Factors such as weather, changes to grade, altered design including drainage and formation of roads can require changes to initial ESC design.

The ESC Plan should be updated to suit site adjustments in time for the pre-construction meeting and initial inspection of installed ESCs. The Plan must also be regularly referred to and available on site. Prior to works commencement, consideration should be given as to how the site will change throughout the project, and how the ESC Plan will need to evolve to reflect this.

Note: For consented sites, adjustments to the ESC Plan may require sign-off from Auckland Council.

10. Assess and adjust your ESC measures

ESC measures need to be inspected, monitored and maintained.

Inspection and maintenance of controls is especially important prior to and following a storm event. A large or intense storm can leave ESC measures in need of repair, replacement, reinforcement or cleaning out. Maintaining and repairing measures as soon as possible after a storm event will maximise the ongoing efficiency of the measures and minimise adverse environmental effects.