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Mananui Mineral Sand Operation

Erosion and Sediment Control Plan

Westland Mineral Sands

Ridley Dunphy Environmental Limited
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Westland Mineral Sands

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Revision schedule		
Rev. Number	**Date**	**Description**
A	12th September 2023	Draft Overview for Application
B	31st January 2024	Draft for client review
C	21st August 2024	Draft incorporating client feedback for client review
D	22nd November 2024	Final ESCP for client review / ESC Plan
E	3rd December 2024	Final Draft

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
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).
SF	Silt fence
SRP	Sediment retention pond
SSF	Super silt fence
WCRC	West Coast Regional Council

Contents

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 sand mineral mining operation.

The proposed mining site is located 7 km South of Hokitika at the address of 713 Ruatapu Road between the inlet of Māhinapua Creek and State Highway 6.

There is a high concentration of sand minerals which are proposed to be extracted under the sand dune rolling country. There are also some remnant vegetation fragments overlaying some of the mineral deposits. A full Project description and existing environment are detailed within the wider application documents.

This ESCP supports the Project and confirms the overall approach to erosion and sediment control (ESC) and associated water management during the operation. This ESCP has a primary focus on those activities which may result in surface water discharge. The majority of the site is subject to significant infiltration within the sand profile with this detailed within the Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024.

1.2 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 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. 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 West Coast Regional Council (WCRC), and the consent holder, 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 be reviewed annually and submitted with an Annual Work Programme (AWP), reflecting the water management measures proposed for construction and mining for the following 12-month period. This will provide the detailed design, specific ESC measure location, staging and sequencing of works for that location. The SSESCP process will determine specific measures to be employed and, in this regard, will consider the alternatives that exist. It will take into account the various environmental and ecological values and will then determine the most effective and appropriate form of ESC devices and management practices required to manage erosion and sediment control.

The SSESCP will also take account of the infiltration trench[1] to be established and the effectiveness of this during operations.

The likely content of the SSESCP is confirmed in Section 1.4 below.

The SSESCP will primarily be based upon the principles detailed within this ESCP and will reconfirm the methodologies and construction sequence to be followed. 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. For the purposes of this assessment the proposed construction sequence and specific earthwork activities are all documented within Appendix A of this ESCP.

In addition, this ESCP confirms a monitoring programme that will be implemented throughout the construction earthworks and mining activity that will inform and adapt future activities and water management approaches. This monitoring programme will form a key component of the AWP which will apply to both construction and mining 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 water management approach may be determined through the AWP once works commence and these will be discussed and documented on site with WCRC as necessary.

1.3 Project description and features

The key Project elements are as follows:

1. The full application site is 140.2 ha with 112 ha of proposed mining area.

2. The site is comprised of largely improved pasture with the remnant degraded vegetation strands. Unfenced modified drains have been dug historically and discharge to ground or directly into Mahinapua Creek/Wetland.

3. The site is separated from the coast by approximately 550 m of farmland to the west of State Highway 6.

4. Site vegetation covered within the mining area totals approximately 4 ha.

5. The site is underlain by a sequence of shore-parallel to subparallel shoreline sediments. The target Sands are medium to fine grained, free flowing, laminated and the package varies in thickness from 4 to 16 m.

6. The proposed mining methodology utilises a sand dredge that sits within a mine pond initially excavated to the ground water level. Topsoil is removed ahead of the mine path

[1] *Section 6.2 and Figure 1 of Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024*

and set aside for rehabilitation. As the dredge mining face advances the void created behind is progressively backfilled with tailings sand, re contoured and top soiled. The proposed dredge path is on average 50 m wide and predominantly in a North - South direction.

7. The 4.4 ha plant site contains the main Wet Concentrator Plant (WCP), and WHIMs (Wet High Intensity Magnetic separation) associated infrastructure.

8. Due to the nature of the mining methodology, continuously moving mine void/pond and progressive rehabilitation and revegetation maximum disturbed area flexibility is required. A 27.7 ha maximum disturbance area (24.1ha excluding contingency) is sought as part of the steady state mining activity. In addition, there is 9.8ha of earthworks that forms the plant establishment phase. This excludes the 4 ha of the vegetation removal required.

9. The pre-mining sequence will commence with the removal of topsoil at the plant site. This soil will be used to construct the central 3 m high 12 m wide screening bund on the western boundary adjacent to SH6.

10. The water treatment ponds (plant process water treatment) will be constructed using excavator and trucks and the excavated material will be used as additional or stockpiled to the south for plant commissioning purposes. Initial site works prior to plant construction is expected to take around 3 months.

11. Mining will commence in the SW corner with topsoil being removed to create the southern screening bund and initial topsoil stockpile. A starter pit containing approximately 60,000 m^3, will be excavated using excavator and dump trucks to expose the water table.

12. The northern bund will be built from initial tailings or material imported to the site and will occur in the first 6 month of operation.

13. The steady state mine includes topsoil (0.1-0.6 m) to be removed from ahead of the mine path using a bulldozer excavator and dump trucks. Areas of historically buried vegetation will also be removed. Topsoil will be stripped in stages ahead of the dredge path.

As noted above an infiltration trench will be established as detailed within the Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024 and illustrated below. This infiltration trench forms the key water management measure for the overall Project.

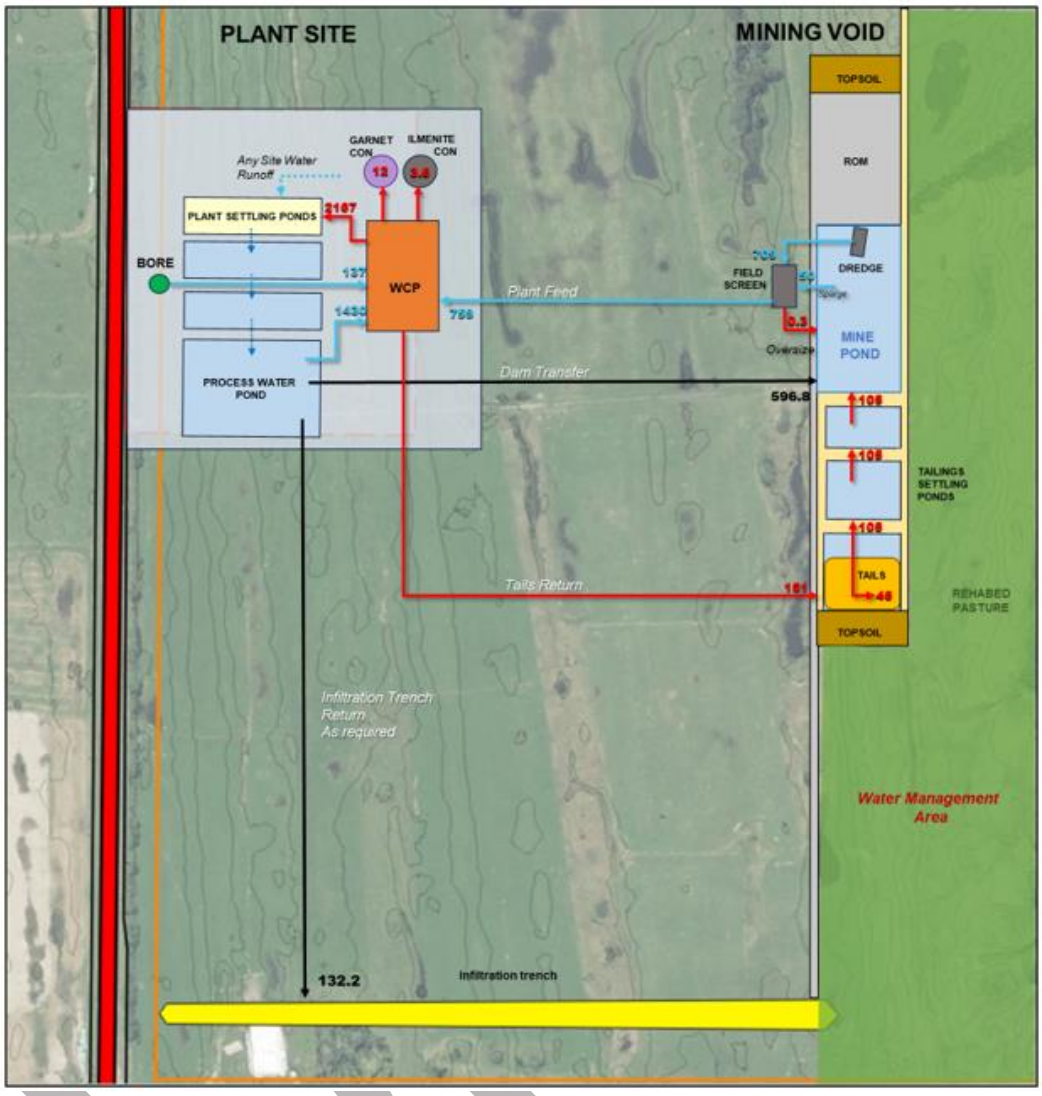


Figure 1: Infiltration Trench Location

1.4 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. 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 site;

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 any impoundment structures that may be required;

c. Works timetable and sequencing for the proposed mining activity;

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

e. Maintenance, monitoring and reporting procedures; and

f. 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.

The various works and associated phases of activity are outlined within Appendix A of this ESCP. This confirms the plant establishment phase and a steady state mine activity. In addition, the table refers to the works that will occur along the eastern boundary of the site and the vegetation removal.

As detailed above there is reliance on a SSESCP process with the likely content of this SSESCP as follows.

- Location of the work;
- Contour information;
- ESCs;
- Infiltration design;
- Catchment boundaries;
- Details of construction methods;
- Contingency measures;
- Design details;
- A programme for managing non-stabilised areas;
- The identification staff who will manage ESCs;
- The identification of staff who monitor compliance with conditions;
- A chain of responsibility for managing environmental issues; and
- Methods and procedures for decommissioning measures.

1.5 Roles and responsibilities

Westland Minerals as the consent holder will have the overall responsibility for meeting the requirements of this ESCP. The site personnel will include an environmental management lead 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 SSESCP will be implemented for the duration of the Project, and a copy will be kept in an accessible location.

This ESCP and SSESCP 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. Erosion and sediment control and water management principles

The general principles of erosion and sediment control as set out below would remain throughout. These would be based on the following:

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 relevant ESC Guidelines (GD05 Guideline recommended) and will incorporate innovative ideas and procedures to ensure best practice applies and to match any local challenges and opportunities.

3. Based on the work to date as outlined in the AEE, infiltration rates of the soils on site are such that infiltration can be relied upon for most of the site earthworks. The *KSL Memorandum, Assessment of the Effects of High Intensity Rainfall on Active Mine Pit dated August 2023* also confirms that a reasonable and conservative value for infiltration capacity over the pit pond would be 120 mm per hour. The conclusion within the KSL memorandum confirmed that the capacity and infiltration within the pit pond itself is significantly more than a 1:100 Year Average Recurrence Interval 24 hour duration rain event.

4. Where practicable, earthwork areas can be diverted away from any natural surface water and sent to infiltration trenches. This is not discussed within this ESCP and is fully addressed within the Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024.

5. Progressive and rapid stabilisation of disturbed areas will be on-going during the mining activity. Any stabilisation alternatives (not outlined within GD05 Guideline) will first be verified as an appropriate and WCRC authorised stabilisation media.

6. 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.

7. A monitoring and management approach which allows a response to water quality (turbidity and other contaminants) monitoring outcomes will be utilised through qualitative monitoring (which will include visual surveys and recording of any discharges and the downstream environment) and quantitative monitoring where any discharges occur (which will include water quality sample collection and analysis).

In addition, the Project will rely on:

- 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 Project implementation; and
- Ensuring that all ESC and water management measures utilised are structurally sound and designed appropriately.

As part of the ESCP development it is important to recognise that of the 24.1ha (excluding contingency) of steady state earthworks for the Project, 21.1ha is to be treated through infiltration. The treatment options for the remaining 3ha related to the vegetation establishment will be confirmed through the SSESCP process.

3. Overview of erosion and sediment control and design criteria

3.1 General overview

As outlined above, for this Project 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 projects) which will be reflected in the measures adopted.

The activities which require earthworks are recognised in the activity table within Appendix A and are summarised as follows:

1. The mining activity itself will require a water budget to be developed. This will be confirmed as part of the final mine water management approach. Hydrological assessment to date confirms that runoff from the active mine area can be accommodated within the dredge pond.

2. Importantly the rehabilitation and progressive stabilisation of the pit location will occur to ensure that this area of activity minimises any potential sediment generation throughout and on an ongoing basis. Progressive rehabilitation comprises a 6.7 ha total area of which 4 ha is tails and topsoil replacement. In line with the principles of good ESC practice, the rehabilitated area will be stabilised quickly and effectively to reduce open areas.

3. The plant during construction will also be managed through infiltration, however "traditional" erosion and sediment control measures can also be implemented, if necessary, likely to be in the form of bunds, decants and silt fences. This will be assessed in detail and confirmed in the SSESCP process. These sediment controls will either discharge to a grass paddock environment which will infiltrate to ground or to localised infiltration basins/settling ponds.

4. The operation of the plant is to be managed through a water treatment area. This detail is assessed outside of the ESCP and within the mine water management design process.

5. Establishment of bunds and activities such as roading and access will all be managed through the provision of infiltration and traditional erosion and sediment control measures. These will be assessed in detail and confirmed and will be further supported through a progressive stabilisation process.

6. The drains as identified within the ecological report supporting the application will require specific management as part of any modification or removal. In particular the current discharge points from the site will require careful consideration, with minimal discharge of runoff from disturbed land. The specific methodology for this will be detailed within a

SSESCP and will be based on diversion of flows from undisturbed land around the area of works and/or provision of a sediment retention pond (SRP) downstream. The key will be ensuring that minimal discharge from disturbed areas occurs, working within fine weather windows and enforcing buffer zones. In addition, the recommendations of the ecological assessment (in particular fish recovery) will also be required to be accounted for within the methodologies adopted.

7. The eastern extent of the mining area is identified as the highest risk location. The SSESCP process will identify specific implementation and monitoring methodologies to ensure this area is robust and resourced appropriately to reflect the risk.

8. Rehabilitation and timing are key, with the wetland and stream establishment on the eastern extent of works an early activity to allow for a buffer zone and also for water management. The SSESCP will need to detail the stream establishment process and measures to be implemented throughout (super silt fence on eastern edge of works, coir matting in channel and stabilisation of tracking and stockpiles as the stream progresses.)

3.2 Key erosion control measures

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

3.2.1 Construction staging and stabilisation

As a general approach to all land disturbance, but with specific reference to the construction phase and the rehabilitation of the mine pit, the Project will minimise soil exposure and undertake progressive rehabilitation and stabilisation as areas of the mine are completed.

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, hay and/or straw mulch or aggregate may be utilised.

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

3.2.2 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 SH6. GD05 Guideline will assist with the provision of the design criteria.

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

3.3 Key sediment control measures

Sediment control on the Project will involve the treatment of sediment-laden runoff from construction phase activities and also mine process water from the various areas of the Project. Sediment control will be established through the use of recognised sediment control measures and site management practices. Infiltration remains as the primary sediment control measure implemented on the Project.

The "traditional" sediment control measures to be applied to the Project are as follows:

3.3.1 Dirty water diversions (DWD)

DWDs transfer sediment laden water to treatment devices and / or infiltration locations. They are effectively a conveyance device and are designed to cater for the 20-year ARI rain event with a 1-hour duration (plus a 300mm freeboard) effectively having the same capacity as a 100-year rainfall event and therefore is assessed as providing a robust and best practice approach. DWD will be required for the Project to transfer dirty water flows to the infiltration locations.

A maintenance programme will be implemented during Project construction activity to remove any resultant sediment deposited within the DWD. The DWD will also have drop out pits with a $2m^3$ volume capacity established at 50m intervals along the channel itself to assist with the capture of the heavier particle size sediments that are generated.

3.3.2 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 construction phase as part of the bund establishment along SH6 and access road establishment. These SFs will be complemented with progressive stabilisation.

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 One: GD05 Guideline Table 13 Silt Fence Criteria

3.4 Stream diversion

As part of the mine progression in the eastern extent of the Project some vegetation removal will be required. This will be undertaken in stages as the mine progresses. Vegetation will be removed in stages with advancement of the mining void. Trees are dropped and stumps and soil and organic matter removed and placed in a rehabilitation area behind mining. Drainage channels with the vegetation will be bunded off at the end of removal works. It is assessed that a decanting earth bund or a sediment retention pond (SRP) would be located at the lower end of the "drain" and then works undertaken above this location. Vegetation will only be removed immediately ahead of the mine path.

The methodologies for the construction of any stream diversion will be determined on site and confirmed within a SSESCP. With respect to this ESCP however, potential stream diversion locations have been viewed and assessed as to the appropriateness of the methodologies. It is likely that the stream subject to diversion in the eastern location of the Project will be "dry" during the activity and hence there will be no formal diversion required. If required, the methodology will be based on establishing the diversion "offline" and ensuring we have a fully stabilised flow path prior to reintroducing flows. This will then isolate the existing channel and allow for fish recovery and associated Project works.

For all stream works the following will be required:

- Prior to any works commencing a period forecast of dry weather will be confirmed through an appropriate weather monitoring system;
- Any stream diversions are expected in stages and each stage will be fully constructed and stabilised prior to moving to the next stage;

- Any water present within the work area will be pumped to a treatment device or infiltration and then to an existing grass environment which will be located a minimum distance of 20m from, and discharge away from, the stream environment; and

- On completion of the diversion works, all plant, materials and labour will be demobilised, and the site will be permanently stabilised in accordance with the SSESCP for that work area.

In the event of high rainfall during the course of construction of the diversion, or prior to leaving the site for more than a 24-hour period, the following will occur:

- That any loose material that could enter a watercourse is to be removed from the flood plain of the stream;

- All existing sediment control measures will be inspected and secured and maintained where required should a significant rain event be forecast. The streambed in the location of the diversion will be fully stabilised and this will be achieved through geotextile; and,

- Extend the working hours subject to compliance with relevant consent conditions, if it is believed to have significant benefit with regard to programme, forecast weather events and environmental impacts.

We consider that the above process, methodology and controls can be effectively implemented on the Project.

3.5 Decommissioning of devices

All ESC measures will remain in place until such a time as the construction activity 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.

3.6 Pumping

Pumping will be necessary in some parts of the Project. Pump intakes will be fitted with floating intakes and all pumping will only be to infiltration devices. There will be no pumping of any on site water directly to the receiving environment.

4. Monitoring

An adaptive monitoring programme will be implemented for the Project. 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. This will also directly inform the AWP for the Project.

Monitoring results that eventuate will also be used to identify future risks to the environment and will identify any continuous improvement opportunities that should be considered by the Project.

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 Project.

4.1 Qualitative monitoring

4.1.1 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.

This monitoring will include visual observations of all pump discharge locations, the infiltration locations and the receiving environment. This will occur a minimum of once per day 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 earthworks activity 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 infiltration ponds and any requirement for maintenance;
- Construction and 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 proposed discharge outlet points and any streams in the vicinity of the works.

These records will illustrate the visual state of the receiving environment at and within the vicinity of the discharge point. This photographic record will allow a visual comparison of before, during and at completion of the Project.

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.

4.1.2 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.

We note the extensive use of weather forecasting that now occurs with most land-disturbing activities and the value that it provides in informing projects of upcoming weather systems. 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.

4.2 Quantitative monitoring

Reference should also be made to the Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024 which confirms the following monitoring objectives.

- Specification of a monitoring programme which can robustly define baseline conditions and validate the water quality effects assessment findings and identify where water management adjustments are required to avoid adverse effects.
- Definition of action thresholds and an associated set of activities which can be implemented within a suitable timeframe to achieve the objectives of the WMP.
- Setting out reporting procedures for environmental monitoring data and consent compliance

Mananui Mineral Sand Project Water Management, Monitoring and Mitigation Plan, KSL Limited dated 2nd July 2024 also confirms the following monitoring schedule, parameter suite and monitoring site locations.

Monitoring schedule

Monitoring site	Parameters	Minimum frequency
Top up well	Pumping rate – daily volume	Daily when mining in Dredge Pond Water Level Management Zone
Top up well	Electrical conductivity	Daily for at least 30 days prior to the start of operational pumping and weekly when pumping thereafter.
Infiltration trench	Discharge rate, water level	Daily when mining in Dredge Pond Water Level Management Zone
WQM piezometers – northwest boundary	Monitoring Suite A	Monthly for at least 12 months prior to mining in Area A in northwest boundary or other suitable piezometers and weekly when mining in Area A
WQM piezometers – southeast boundary	Monitoring Suite A & B + groundwater levels	Monitoring Suite A & B: monthly for at least 12 months prior to mining in Area A and monthly when mining in Area A Groundwater levels: daily from commencement of mining

Monitoring suites

Suite A	***Suite B***
Dissolved aluminium	Dissolved chromium
EC	Dissolved copper
pH	Dissolved zinc
Turbidity	Dissolved nickel

5. Recommendations and conclusions

The following key points are noted for the Project.

- Due to the controlled nature of the mining phase works and the staged approach, infiltration rates and progressive stabilisation of rehabilitated areas, the risk of erosion and consequential sediment discharges is low.
- All land disturbance activities outside of the mining phase are assessed as 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 eastern works and vegetation removal due to the proximity and sensitivity of the receiving environment.
- A range of ESC and water management measures are proposed on the Project that meet the GD05 Guideline criteria or provide an alternative best practice measure. A focus will be placed on the use of infiltration. ESCs 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.
- Based on the proposed management practices to be implemented as outlined within this ESCP, the effects of the earthworks associated with the proposal are expected to be no more than minor.

6. 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)

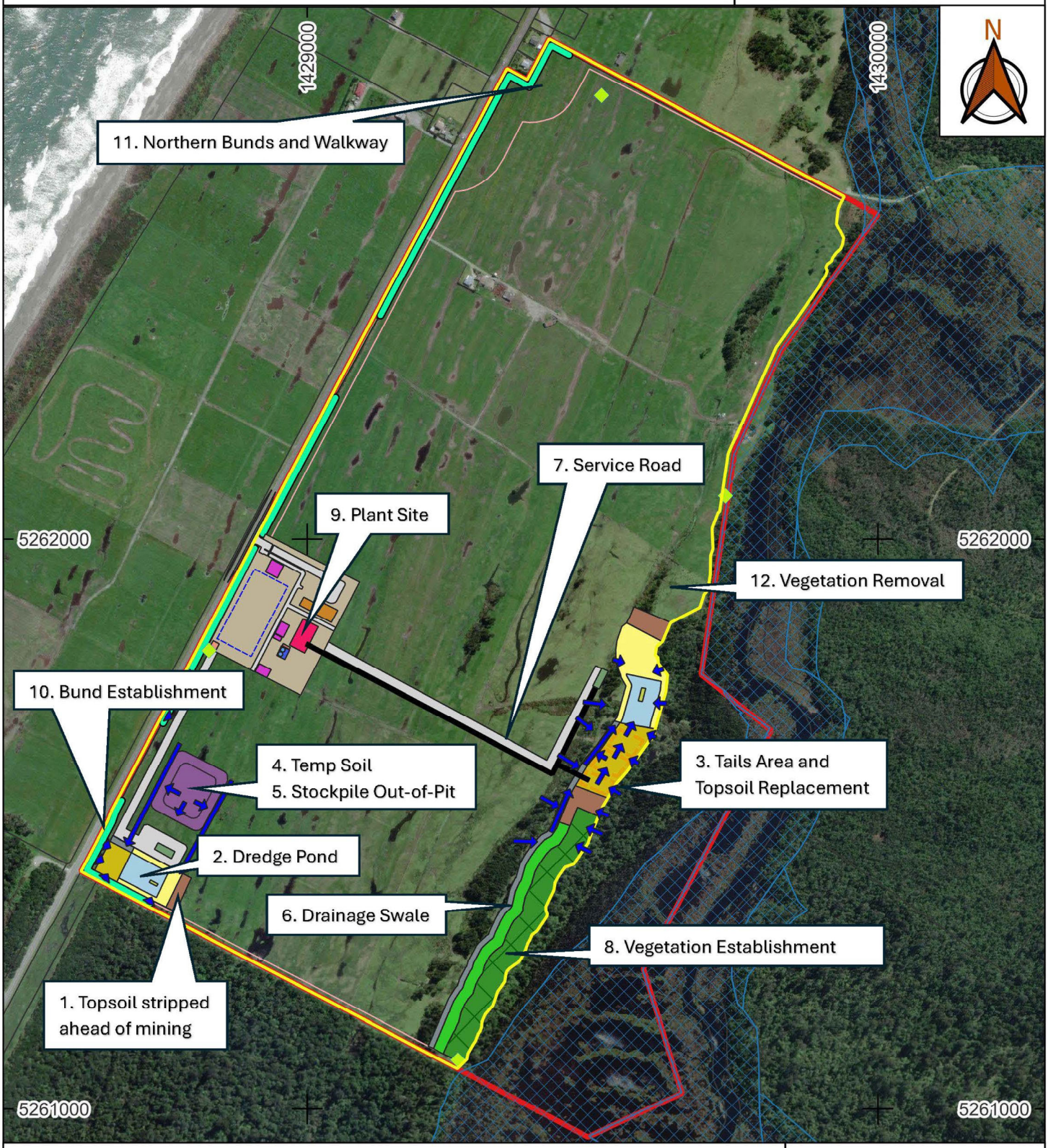
Appendix A. Overview Project Site Plan and Construction Sequence

Plan Ref #	Activity	Approx Area (ha)	Approx Vol (m3)	Approx Duration of Activity (Months)	General Approach to Works	Water Management
Steady State Mining						
1	Topsoil Strip ahead of mine path	2	NA	Ongoing for consent duration 0-10 years	Stripping of topsoil ahead of mine path will occur on a just in time basis and will be stored in temporary stockpiles or in rehabilitation.	Infiltration Trench/Dredge Pond Infiltration
2	Dredge Pond	0.7	NA	Ongoing for consent duration 0-10 years		
3	Tails area & topsoil replacement	4	NA	Ongoing for consent duration 0-10 years		
4	Temp Topsoil Stockpiling	2	40,000	0-10 years	Material excavated from the starter pit and first mining sequence to enable a tailings deposition.	Infiltration Trench.
5	Temp Out of Pit Dump	3	60,000	0 – 5 years	Material excavated from the starter pit and first mining sequence to enable a tailings deposition.	Infiltration Trench.
6	Drainage Swales	6.4	64,000	0-10 years	Drain swale on either side of the dredge pond and topsoil stripping/replacement.	Discharge to infiltration trench.
7	Service roads etc	3	30,000	0-10 years	Strip topsoil and place geotextile and aggregate for road establishment. Once initial earthworks are completed the road surface will be stabilised.	Infiltration Trench.
8	Vegetation establishment.	3	NA	6-36 months	Related to the eastern area vegetation removal operation	SSESCP Detail ESC measures.
Total Steady State Area (ha)		24.1				
Mining Contingency						
	15% Contingency	3.6				
Maximum Disturbed Area Steady State (ha)		**27.72**				

Plan Ref #	Activity	Approx Area (ha)	Approx Vol (m3)	Approx Duration of Activity (Months)	General Approach to Works	Water Management
Plant Establishment Phase						
9	Plant site	4.4	NA	0 – 3 months	This involves stripping the topsoil and then placement of aggregate. Will occur over a short period then fully stabilised.	Surface water to be treated in infiltration trench. Traditional controls can be implemented if required.
10	Bund establishment	2.5	30,600m^3	0 – 3 months	As per project description, material will be sourced from the site and consist of top soil overburden and potentially washed tailings. The placement involves strip topsoil and then place fill. Stabilise (plant) as bund reaches height.	Eastern side of the bund will utilise infiltration and the western side (roadside) we will place a silt fence (or similar) between the bund earthworks and the water table drain.
11	Northern Bunds and Walkway	0.4	12,000m^3	0 – 3 months	As per project description, material will be sourced from the site and consist of top soil overburden and potentially washed tailings. The placement involves strip topsoil and then place fill. Stabilise (plant) as bund reaches height.	Infiltration utilised.
Eastern Boundary						
12	Vegetation removal and required diversions etc during this process.	4	NA	6-36 months	Vegetation will be removed in stages with advancement of the mining void. Trees are dropped and stumps and soil and organic matter removed and placed in rehabilitation area behind mining (VDT) Drainage channels with the vegetation will be bunded off at the end of removal works. we would place a decant or SRP at the lower end of the “drain” and then undertake these works above this location. Vegetation only removed immediately ahead of the mine path	Stream diversion may not be required but will assess in detail. Establish a SRP at lower end of the 4ha area. Undertake during a period of no flow and in summer months only.
13	Eastern boundary Drainage channel	2.5	N/A	6-12 months	Mining in close proximity to two existing drainage points.	Diversion channels, sediment control methods and infiltration.
Total EW Area Establishment Phase		**9.8 ha excluding vegetation removal**				

MANANUI ESCP MAP

Westland Mineral Sands Co.



- Property Boundary
- Total Consent Area
- 12 m Bund
- Topsoil
- In Situ Sand
- Dredge Pit
- Dredge
- Tailings
- Vegetation Establishment
- Grassed
- Drainage Swale
- Temporary Stockpile
- Plant Site
- WCP Plant
- Stockpile
- Building
- Tanks
- Water Pond
- Service Road
- Power
- Screen
- Pump Line
- Surface Water Flow
- Dust Deposition Gauges

0 150 300 m

Coordinate Reference System:
GD2000 NZTM (EPSG: 2193)

DATA SOURCE	Bing, LiNZ
DATE	02/12/2024
AUTHOR	WMSC

Appendix B. 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.