Project Number: 5-P1472.00

Rātana WWTP Irrigation Site

Draft Erosion and Sediment Control Plan

6 November 2023

CONFIDENTIAL

wsp

150 YEARS IN AOTEAROA

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Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Rangitikei District Council ('**Client**') in relation to an erosion and sediment control plan for use in the resource consent process to provide possible methods the contractor may use to prevent erosion and mitigate suspended sediments entering a surface water environment ('**Purpose**') and in accordance with the Variation Agreement with the Client dated 14th March 2023. The findings in this Report are based on and are subject to the assumptions specified in the Report and the Ratana – Erosion and Sediment Control Plan preparation Memo dated 14 March 2023. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

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1 Introduction

WSP have been engaged to prepare a resource consent application in relation to the proposal by Rangitikei District Council (RDC) to irrigate an area of land with treated wastewater from the Ratana Wastewater Treatment Plant (WWTP).

RDC proposes to pipe treated wastewater to the irrigation site, where a combination of deficit and non-deficit irrigation will occur. A treated wastewater storage pond (WWSP) is required as part of the proposed irrigation system.

This document outlines the Erosion and Sediment Control (ESC) requirements specific to the construction phase associated with the required WWSP.

This Erosion and Sediment Control Plan (ESCP) is prepared in line with [1]relevant guidelines in support of the consent application.

2 Project Description

2.1 Site Location and Description

The proposed irrigation site is located at the end of Whangaehu Beach Road, approximately 1km from the west coast of the North Island and is located within the Foxton Ecological District (Ravine 1991). The land parcel is situated between the flowpaths of two large rivers, the Whangaehu River to the north, and the Turakina River to the south, which is located approximately 750m and 1km from the site respectively.

The proposed WWSP is situated in the Northern top corner of the irrigation site (Figure 3).

Table 1 summarises the overall description of the irrigation site. Information presented have been extracted from various reports compiled as part of the resource consent application (see Appendix B for the relevant report references).

[2]*Table 1: Summary of site description*

Legal description of site	Section 1 Survey Office Plan 574204
Total site area	± 26 ha
Water Management Catchment	The site is in the Whangaehu Catchment, approximately 750 m southeast of the Whangaehu River. It is within the Surface Water Management Zone 'Whau_4' under the Schedule A of the Horizons One Plan.
Geology	The surface geology of the land application site is predominantly active dune deposits. The deposits are a mixture of stable dune deposits, river deposits, and beach deposits.
Soil types	The soils in the Rātana area are predominantly comprised of gley and recent soil orders along the coast, with brown and palic soils further inland toward the township of Rātana. The soil textures are typically a mixture of clay, silt, loam, and sand (Manaaki Whenua, 2022). Test pits were excavated on site in March 2022 as part of the site-specific investigations for the irrigation discharge to land. The soil textures were visually inspected at that time. As expected, the most prevalent

[1] The following guidelines and resources were used in preparation for this ESCP:

1. Greater Wellington's Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region adapted from the Auckland Council's guideline "GD05 – Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region'.
2. Greater Wellington Regional Council Guidelines for preparing an erosion and sediment control plan.

[2] The following reference list is associated with the information presented in this Table:

1. Ratana WWTP Ecological Impact Assessment Report, WSP dated June 2023.
2. Ratana Wastewater Discharge Wetland Delineation Report, WSP dated 14 December 2021.
3. Draft Resource Consent Application for the Ratan Wastewater Treatment Plant, WSP dated 13 February 2023.

soil texture identified was sandy soils, specifically sandy topsoil with traces of silt is present in the first 0-0.3 m, grading into sandy soils to the bottom of each test pit (maximum depth of ~3 m).

Further investigation of the soil profiles across the site was carried out when bores were installed at the site during July 2022. The logged composition of the bores is consistent with the initial observations made during excavation of the test pits, indicating predominantly sand. Layers of sand interspersed with traces of silt were also identified in each of the five bores on site, typically occurring at depths between one and four metres depth towards the eastern side of the site.

Vegetation type

This land is predominantly farmland, being currently grazed by cattle (Figure 1). There are many exotic and non-threatened species within the farmland area and areas comprising duneland. Most of the Duneland areas have been recently cleared and planted with young pine trees.

Figure 1: Site photos (taken August 2021)

Wetlands

Several wetlands have been delineated within the proposed irrigation site. For this ESCP only information related to affected wetlands is summarised (wetland numbered as W1 to W6 in Figure 2).

The overall wetland determination has been based on the MfE (2020) wetland delineation procedure. The overall wetland determination is presented below in

Table 2.

Wetland Number	Dominance test	Hydric soils	Prevalence index	Classification
1	Pass	Pass	Pass	Natural inland wetland
2	Pass	Pass	Pass	Natural inland wetland
3, 4, 5	Pass	Pass	Pass	Natural inland wetland
6	Pass	Pass	Pass	Natural inland wetland
Wetland Number	Dominance test	Hydric soils	Prevalence index	Classification
1	Pass	Pass	Pass	Natural inland wetland
2	Pass	Pass	Pass	Natural inland wetland
3, 4, 5	Pass	Pass	Pass	Natural inland wetland
6	Pass	Pass	Pass	Natural inland wetland

Table 2: Overall wetland determination results based on the flow chart of steps for hydrophytic vegetation determination.

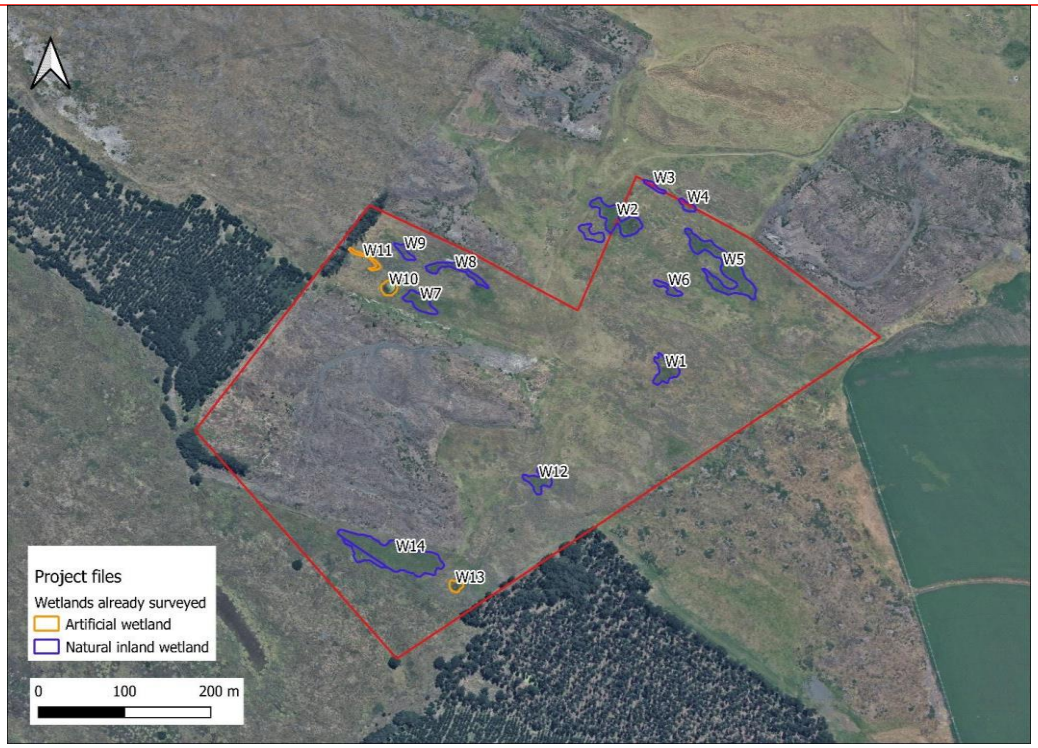


Figure 2: Location of wetlands present within the site boundary.

Topography	The topography is variable across the site, with both active and relict dunes resulting in rolling hills across much of the site. The central portion of the site has much flatter topography, with several small natural depressions.

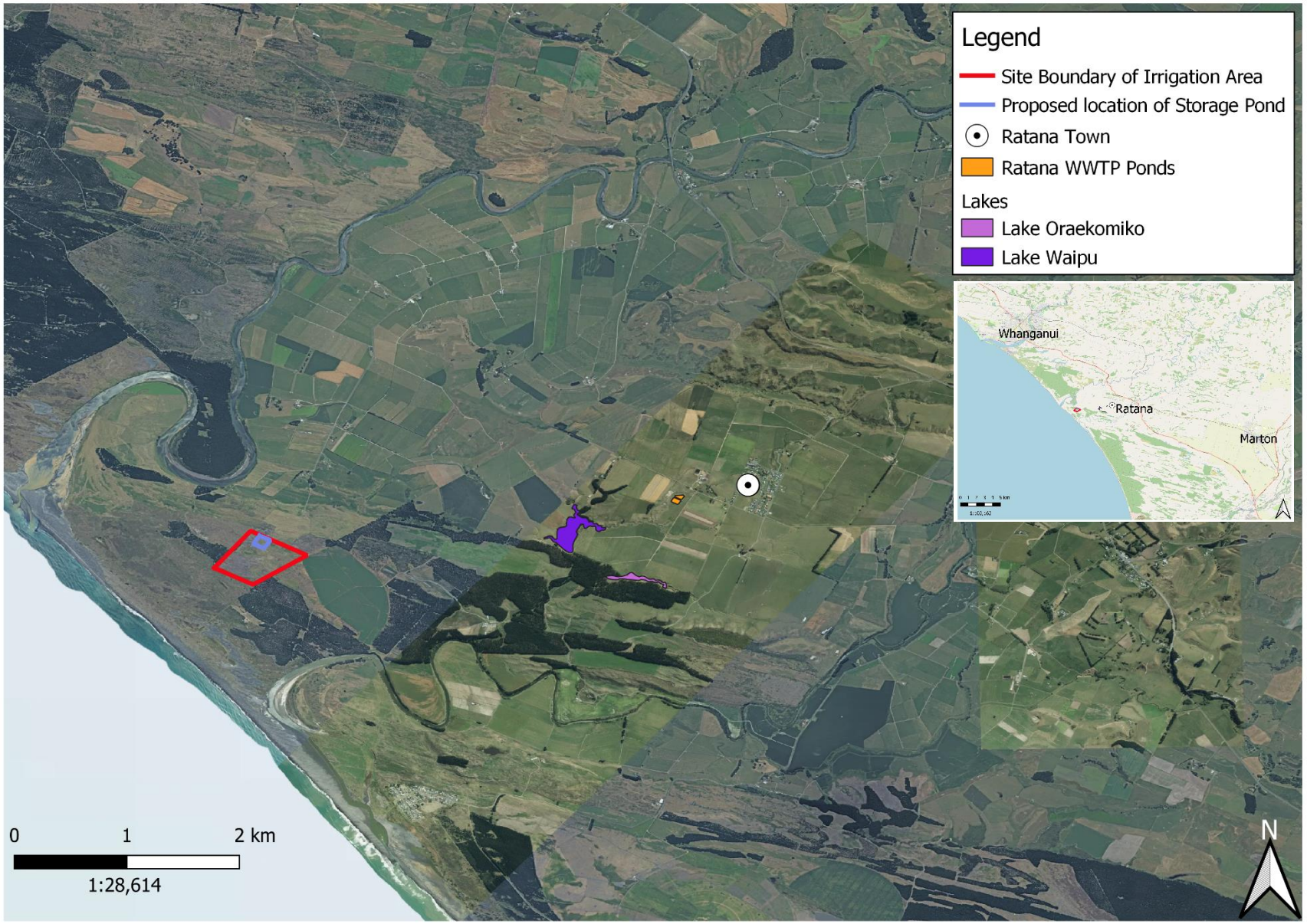


Figure 3: Site Locality

2.2 Proposed Works

The Rātana WWTP proposed irrigation site area is approximately 26 ha and approximately 2 ha of land disturbance is required for the proposed conceptual WWSP.

Final construction methodology, actual timing, and staging of works may be subject to some variation. At the time of finalising this Draft, the construction period is expected to be for a total period of 6 months. Due to the geotechnical conditions at the site, it is expected that the bulk of the construction work will be planned during the winter period.

The planned phasing of works is as follows:

Phase 1 – Pre-construction site establishment

To commence with the construction works associated with the required WWSP, site access and establishment are required.

Works related to site establishment includes:

- Contractor to notify adjacent property owners of the start date, and likely duration and provide appropriate site contacts for ESCP questions and complaints and a Council contact for escalation.
- Remove any fencing on site currently as required.
- Establish stabilised site entrance and access to construction areas. Primary access will be provided from the farm track in the northeast corner of the works site that comes off Whangaehu Beach Road in Rātana.
- Establish construction laydown areas, including stockpile yards (topsoil and imported construction material).
- The ESC devices will be in place prior to work being undertaken.

Phase 2 – Staged construction of storage pond

Due to the size of the storage pond, construction will occur in 100m segments from the northwest short side to the southeast short side to limit the extent of areas opened and earth worked (limiting exposure to natural elements).

Typical construction works includes the following:

1. Topsoil stripping and stockpiling.
2. Clear and grade the construction site to prepare it for lining of the storage pond.
3. Fill material will be required to be brought in from a suitable source. At this stage the source of suitable fill material is still required to be identified.

Phase 3 – Landscaping and Site Restoration

1. Reinstate the construction site to its original condition, including re-vegetation and landscaping as necessary. Excess material will be removed from site.
2. Implement erosion control measures to prevent any future issues.
3. Once the post-construction footprint area is finalised and is at finished levels, the topsoil will be respread and grassed. In particularly sensitive locations, straw mulching or hydro mulch may be applied to provide effective instant protection.
4. Upon completion of works all ESC devices that are no longer required will be removed.

Appropriate ESC devices and operational management procedures will be required as outlined in this document to minimise the discharge of sediments and contaminants off-site to the surrounding properties during construction.

Summary of land disturbance:

- Total disturbed land area for the pond, based on the conceptual plan, will be approximately 1.95 ha;

All of the above volumes and areas are subject to variation alongside the final pond design.

2.3 Required Resource Consents

Resource consent is required for large scale land disturbance from Horizons Regional Council (HRC) as a "Discretionary Activity" under Rule 13-2 of the Horizons Regional One Plan (One Plan). Under Rule 13-2, HRC reserves control over the *'additional content of and the standard to which the Erosion and Sediment Control Plan must be prepared, implementation of the plan, and the timing of when it must be prepared and submitted.*

3 Principles for Minimising sediment discharge

ESCP Design Standards: ESCP design standards are based on the *Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region February 2021* – Auckland Council's GD05 adopted for the Wellington Region.

Refer to *Appendix A: ESCP drawings* for the location of all ESC devices referenced in the sections below.

The principles of this ESCP are to identify proactive approaches that reduce the potential for erosion and sedimentation effects of the construction phase (i.e., site establishment, construction and post-construction stabilisation and rehabilitation) to:

Minimise disturbance:

Fit land development to land sensitivity. Some parts of a site should never be worked, and others need very careful working. Watch out for and avoid areas that are wet (streams, wetlands, and springs), have steep or fragile soils or are conservation sites or features. Adopt a minimum earthworks strategy (low impact design) – ideally only clear areas required for structures or access.

Site specific detail:

The Assessment of Environmental Affects (AEE) conducted as part of the resource consent application process, the effects of the proposed WSP on the receiving environment were considered. An Ecological Impact Assessment (EiA) and a Wetland delineation was conducted as part of the AEE. Figure 4 provides an overview of the identified land sensitivities.

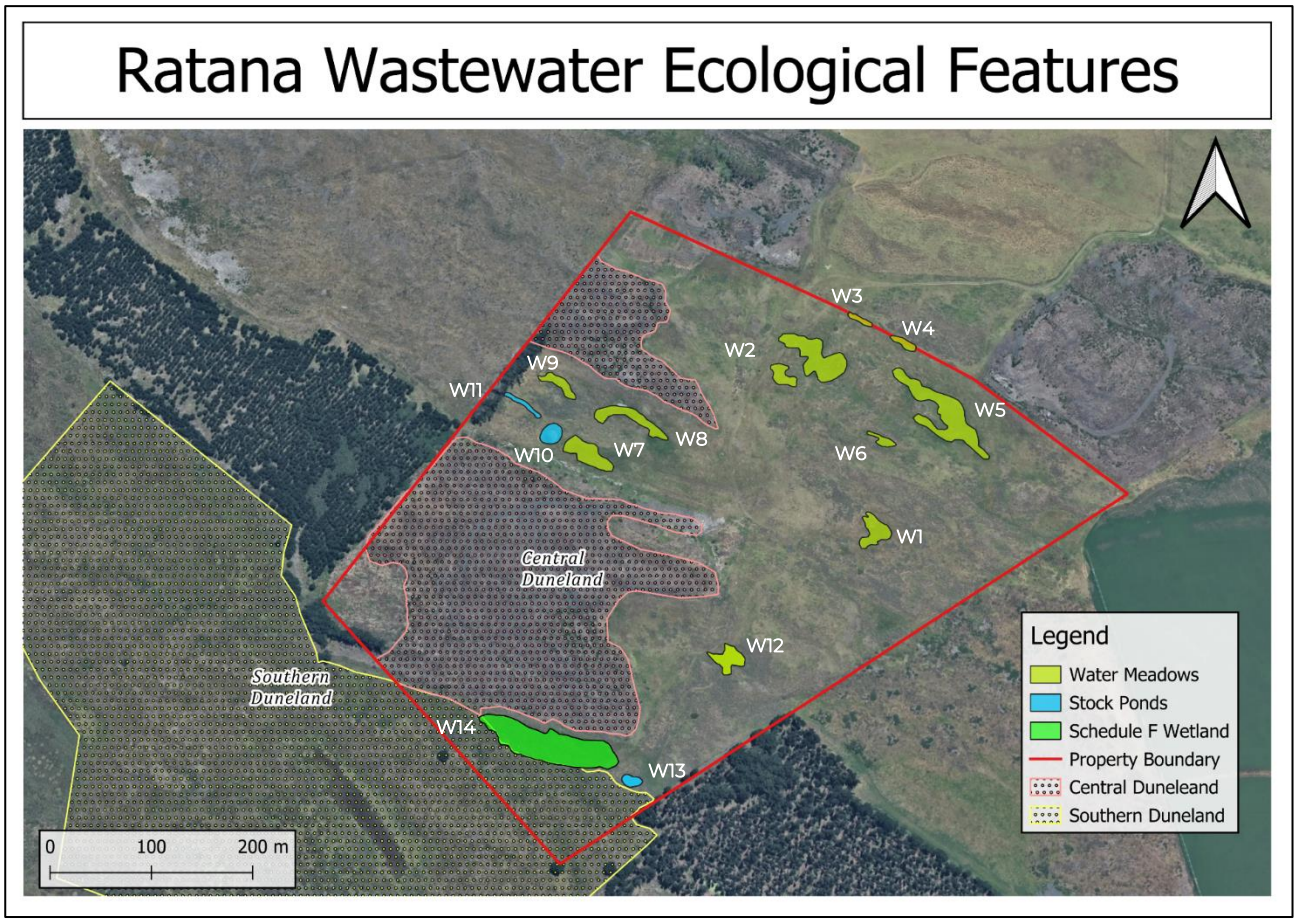


Figure 4: Ecological features associated to the irrigation site.

The proposed WWSP is situated within the proximity of several wetlands (see Figure 4 wetlands numbered W1 to w14). The wetlands that will be directly affected and will require offsetting includes W2,4,5 and 6.

To further minimise disturbance, the following strategies will be used during the construction period:

- Work site areas will be opened as required in accordance with a staged construction sequence.
- No ground disturbance will take place outside the designated access, construction haul routes or work site areas, which can be marked out by flagging or similar means.
- All person working on site will be made aware of specific sensitive areas that requires to be avoided during construction.

Staged construction:

Carrying out bulk earthworks over the whole site maximises the time and area of soil that is exposed and prone to erosion. "Construction staging", where the site has earthworks undertaken in small units over time with progressive revegetation, limits erosion. Careful planning is needed. Temporary stockpiles, access and utility service installation all need to be planned. Construction staging differs from sequencing. Sequencing sets out the order of construction to contractors.

Site specific detail:

As per the construction methodology discussed earlier, the construction phase is proposed to be divided into different Phases:

- Phase 1 – Pre-construction site establishment. During this Phase site access and preparation for construction will be addressed. The requires ESP measures will be installed prior to Phase 2 Construction.
- Phase 2 – Staged construction of the WWSP. All works are intended to be undertaken during the winter construction period via a staged approach. The timeframe for construction is estimated to be 6 to 9 months. Due to the size of the storage pond, construction will occur in 100m segments from the northwest short side to the southeast short side to limit the extent of areas opened and earth worked (limiting exposure to natural elements).
- Phase 3 – Landscaping and restoration. The final phase of the project will include landscaping and site restoration, which will include revegetating the disturbed footprint.

Pending the development of a final construction methodology, the actual timing and staging of work may be subject to some variation.

Protect steep slopes:

Existing steep slopes should be avoided. If clearing is absolutely necessary, runoff from above the site can be diverted away from the exposed slope to minimise erosion. If steep slopes are worked and need stabilisation, traditional vegetative covers like top soiling and seeding may not be enough. Special protection is often needed.

Site specific detail:

Runoff from slopes will generally be managed as follows:

- Clean water (CW) diversions will divert stormwater flows from discharging over the works area where possible during earthworks.
- All stormwater that falls within the site will be captured and directed to the Sediment Retention Pond (SRP).
- Embankment slopes will maintain level surfaces during fill placement and at completion to minimise surface flow.

Protect watercourses:

Existing streams, watercourses and proposed drainage patterns need to be mapped. Clearing may not be permitted adjacent to a watercourse unless the works have been approved. Where undertaken, works that cross or disturb the watercourse are also likely to require resource consent.

Site specific detail:

In addition to the mitigation measures protecting defined wetlands within the footprint of the WWSP discussed in earlier section, the following measures shall protect watercourses:

- The site drains to the south-west away from the existing streams and bore located to the north.
- Sediment laden water/runoff from the works will be treated by the SRP device before discharge from the works site onto a rock scour and being diverted onto land.

Stabilise exposed areas rapidly:

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

Site specific detail:

Measures to prevent unnecessary disturbances and to manage sediment from disturbed areas, includes:

- Topsoil will be stripped as required or borrowed topsoil will be stockpiled in the designated area enough for each 100m increment of storage pond to be constructed. Topsoil will be re-spread promptly following being stripped and as required for the construction of the storage pond in 100m increments. Following the completion of all earthworks and the construction of the storage pond, any leftover topsoil will be promptly respread. All disturbed area will be over sown with suitable grass seed and/or if necessary, straw mulch or have landscape plantings established.
- Any steep cut embankments will be hydroseeded as soon as practicable.

Install perimeter controls:

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

Site specific details:

The following perimeter controls are proposed:

- Perimeter controls will include silt fences, dirty water diversions, clean water diversions, and a stabilised construction entrance and staging area.
- The clean water diversions will be set up to divert clean water away from the work sites.
- The clean water and dirty water diversion channels are likely to require channel linings, and these should be assessed by the contractor during construction due to some areas velocities possibly exceeding 1 m/s and gradients exceeding 2%.
- Silt fences will be placed along three sides of the topsoil stockpile location of the site works area.
- Any sediment loss onto adjacent properties will be removed by the contractor and any damage corrected to the original pre-works condition.

Employ detention devices:

Even with the best erosion and sediment practices, earthworks will discharge sediment-laden runoff during storms. Along with erosion control measures, sediment retention structures are needed to capture runoff so sediment generated can settle. The presence of fine-grained soils means sediment retention ponds are often not highly effective. Ensure that other control measures used are appropriate for the project and adequately protect the receiving environment.

Site specific details:

Detention devices included as part of the ESCP includes:

- Silt fences will be placed on contour downslope of stockpile areas and fill slopes if required.
- An SRP will be constructed in the north-western area of the works site, with a minimum volume of 1223.4 m^3 (3%, 122 m^3 forebay).
- The SRP has been designed with a volume of 3% of contributing catchment instead of 2% to accommodate any additional rainfall and sediment loading during the winter works period.
- In accordance with the Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region (*GWRC, February 2021*) the emergency spillway has been sized to accommodate 1% AEP event for a 10min storm event between 2081-2100.

Experience and training:

A trained, and experienced contractor are an important element of an ESCP. These people are responsible for installing and monitoring erosion and sediment control practices. Such staff can save project time and money by identifying threatened areas early on and putting into place correct practices.

Site specific details:

Contractor selection process to consider experience with the implementation and maintenance of ESCP or prior works conducted within a river or a stream. The contractor should be able to demonstrate their experience as part of the procurement process.

This ESCP to be provided to the selected Contractor to comment or raise concerns prior to the pre-construction meeting. A pre-construction meeting will take place with the contractor and a representative from Horizons Regional Council (HRC). This meeting is to ensure that the requirements of HRC in terms of the implementation of the ESCP are understood and met by the contractor.

Assess and adjust:

An effective ESCP is modified as the project progresses from bulk earthworks to project completion. Factors such as weather, changes to grade and altered drainage can all mean changes to planned erosion and sediment control practices. An intense storm may leave erosion and sediment controls in need of repair, reinforcement or cleaning out. Assessment of controls and making repairs without delay reduces further soil loss and environmental damage.

Site specific details:

This ESCP is the first draft as part of the consenting process and provides the overall concept that needs to be adapted by the appointed contractor. At the time of compiling this ESCP no contractor has been appointed and it is recommended that a copy of this ESCP be provided to the contractor during the procurement process. An onsite pre-approval meeting with the compliance team from Horizons, the appointed contractor and a representative from the engineering team are required to work through the implementation ESCP before finalisation.

As part of this ESCP a contingency plan has been developed should an intense storm be experienced during the works period. It is recommended that earthworks be avoided during the winter. Should it be required, additional consents or approvals are applicable.

Section 8 of this document provides for the procedure to review or amend the ESCP.

In addition to the above the following:

- It will be the responsibility of the contractor to ensure that all ESC devices are maintained.
- ESC measures are to be regularly monitored to identify maintenance and repair requirements, and sediment build-up will be cleared and disposed of in a suitable manner.
- The effective management of materials will have a substantial effect on the transportation of sediment from the site.

Management of materials:

The effective management of materials on site will have a substantial effect on the transportation of sediment from site.

Site specific details:

The earthworks associated to the WWSP includes cutting and filling of material during all stages of construction. A designated stockpile area will be required to place the topsoil, excavated material and clean fill material brought in from an external source.

The area designated for stockpiling the material will have the required “clean water” channels and “dirty water” will be contained and managed within the footprint of this area.

The following additional measures to be considered:

- Topsoil and material stockpiles should be located on vegetated areas within topsoil bunds to provide runoff buffers or silt fences will be erected to manage any runoff.
- Stockpiles will have a maximum height of 1.5 m, be surface compacted to reduce the risk of wind erosion and be graded to ensure any dirty water is diverted to the SRP.

4 Design for Erosion and Sediment Control (ESC) Devices

This section provides the details regarding identified methods and ESC device types required to effectively manage erosion and sedimentation potential associated with the earthworks associated with the proposed WWSP.

See Appendix A for the ESCP Drawings ad designs.

Approximately 35,000 m^2 disturbance is required (20,000 m^2 pond construction) for the proposed work associated with the construction of the storage pond. Note, the amount of land disturbed is subject to variation alongside the final pond design.

4.1 Design details

All ESC devices will be installed and maintained in accordance with the ***Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region*** *(GWRC, February 2021).* Other authoritative guidelines may also be referenced (IECA) for additional ESC measures.

The following ESC Devices are defined by this ESCP:

4.1.1 Erosion Control Measures

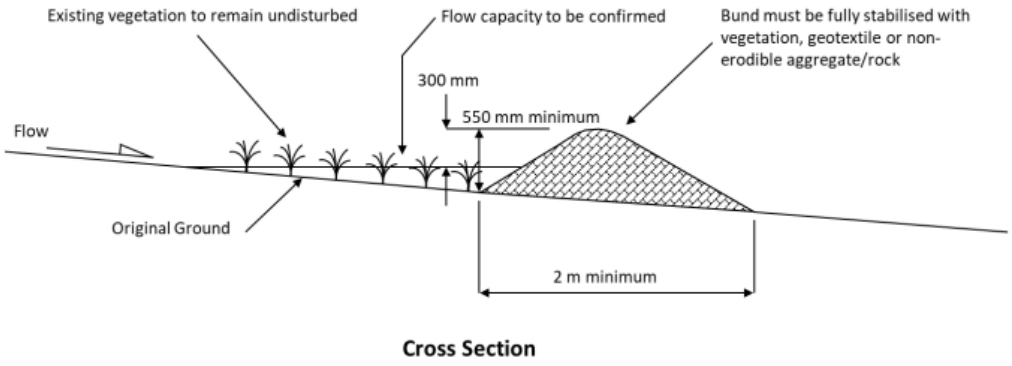
4.1.1.1 Water management controls

As stated earlier in this document, the early on separation of "clean water" and "dirty water" catchments will be done by installing non-erodible "clean water" (CWDC) and "dirty water" (DWDC) diversion channels around the perimeter of the earthwork's areas.

The purpose of these channels is to intercept and convey runoff to stable outlets at non-erosive velocities. It will double up as a physical perimeter boundary to isolate the site and manage dirty water within the construction footprint.

Site entrance to be stabilised by ensuring one single entrance point used at a time. Two access points depending on the construction stage is proposed.

Table 3: Design criteria for identified water management controls.

Design criteria considered	
Up-slope clean water diversions:	• Catchment does not exceed 5 ha. • Designed to sufficiently carry the flow safely from a 5% annual exceedance probability (AEP) storm (1:20 year flood event), plus freeboard of 300 mm. • Be able to manage 1% AEP floodplain. • Stabilising measures with no exposed surfaces. • Design velocity does not exceed 1 m/sec add channel liner. • Internal sides of bund not steeper than 3:1 and external sides not steeper than 2:1. • In steep areas (as indicated on design drawings) diversion drains constructed parabolic or trapezoidal channel with geotextile stabilisation used.
 *Figure 5: Typical cross section of CWDC*	
Dirty water diversions:	• Catchment does not exceed 5 ha. • Standard dirty water diversion arrangement as per Figure 6. • Sufficient capacity to safely carry the flow from a 5% AEP storm (1:20 year flood event), plus freeboard of 300 mm. • Gradients greater than 2% to be lined to prevent erosion. • A "drop-out-pit" installed between the inlet and dirty water channel (±500 to 1,000 mm deep and 1,000 mm wide). • Outlet from all dirty water diversion channels will discharge to the DEB for treatment.

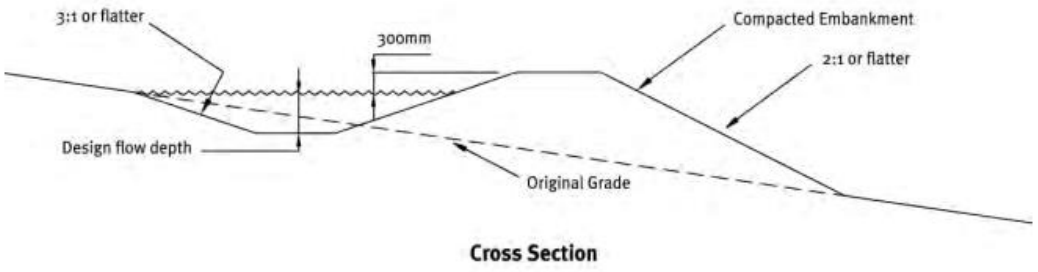


Figure 6:Typical cross section of a dirty water diversion

Stabilised entranceway:	• Entrance way draining back onto site. • See Figure 7 and Table 4 for specification regarding a typical stabilised entranceway.

Table 4: Stabilised entranceway specifications

Design parameter	Specification
Aggregate size	50 - 150 mm washed aggregate
Minimum thickness	150 mm
Minimum length	10 m
Minimum width	4 m

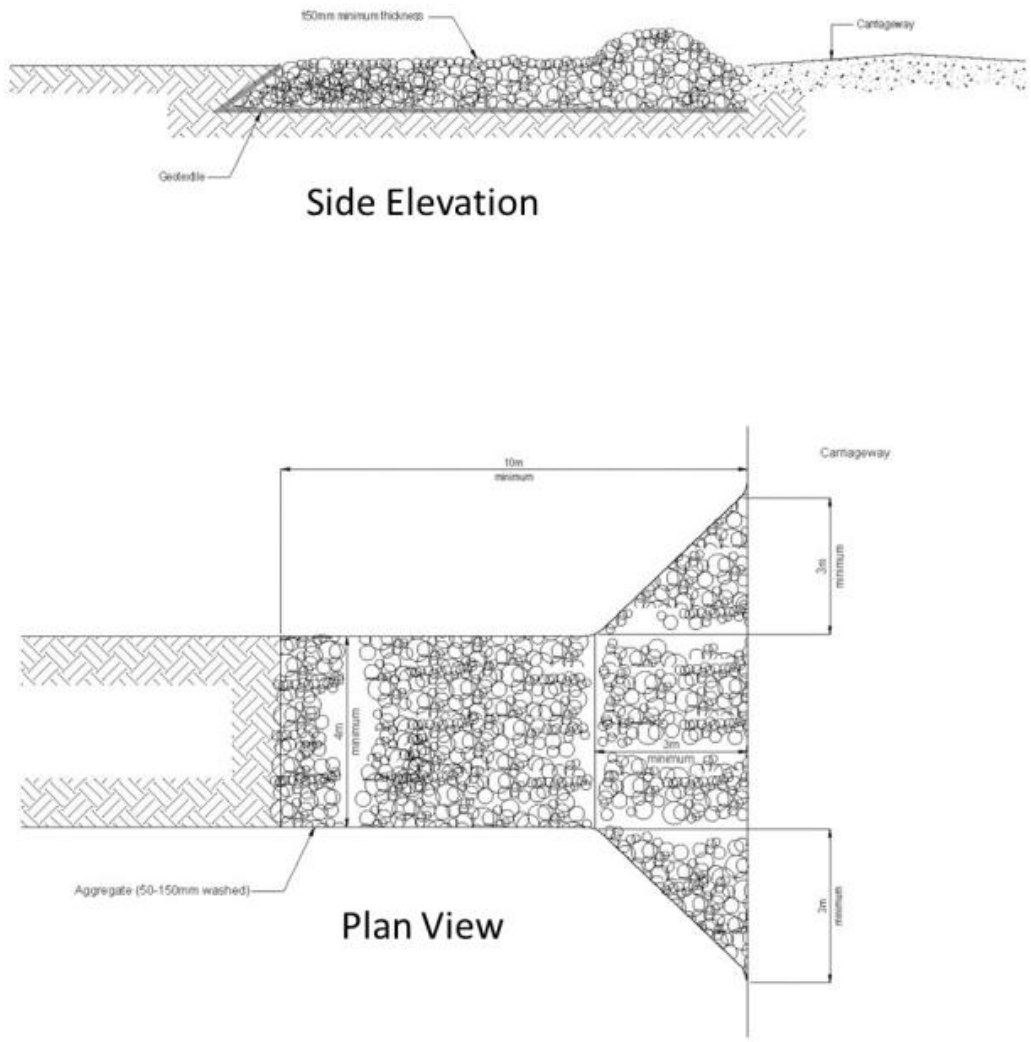


Figure 7: Typical design criteria of a stabilised entranceway

4.1.1.2 Soil and surface stabilisation

This ESCP allows for concurrent stabilisation throughout all stages of construction. It includes taking measures to temporarily stabilise exposed areas where works cannot immediately be completed.

Table 5: Soil and surface stabilisation practices to be implemented.

Soil and surface stabilisation practices	
Topsoiling and grass seeding:	• Topsoiling and grass seeding will be implemented as permanent stabilisation once construction works has been completed (construction works not expected to exceed a 3-month period). • Before placement of topsoil all potential contaminants are required to be removed. • Topsoil should be applied at a minimum depth of 100 mm. • Fertiliser to be applied as per the rate specified by the supplier. As guidance refer to the Greater Wellington ESCP guideline or guidelines published by Horizons. • Seed mixes will vary, and a seeding contractor should be consulted before purchasing seeds. Apply seed uniformly across the site. • Ensure site conditions and time of year are appropriate for germination and vegetation establishment, prior to seeding (autumn and soring). • As works are expected to occur during the summer and be completed before the winter. Once seeding has been completed the

<table>
<tr><td></td><td>use of mulch or geotextiles to maintain soil temperatures, and irrigation will be required.
• 80% vegetation grass cover are required to ensure stabilisation.

Table 6: Typical seed and fertiliser application rates.

<table>
<tr><th>Typical seed mix</th><th>Application rate</th><th></th></tr>
<tr><td>Temporary seeding</td><td>Annual ryegrass</td><td>100-250 kg/ha</td></tr>
<tr><td>Permanent seeding</td><td>• Perennial ryegrass - 70%
Fescues/cocksfoot - 20%
• Clover/lotus - 5%
• Browntop - 5%</td><td>200-400 kg/ha</td></tr>
<tr><td>Fertiliser application</td><td>N:P:K (15:10:10)</td><td>200-800 kg/ha</td></tr>
<tr><td>Maintenance fertiliser</td><td>N:P:K (15:10:10) and Urea</td><td>As required</td></tr>
</table>
Note: In all circumstances, ensure that the seed and fertiliser application rates and mix is appropriate for your site. Always discuss with your seed and fertiliser supplier prior to utilisation.</td></tr>
<tr><td>Hydroseeding:</td><td>• Hydroseeding to be used on the steep slopes stabilising the alignment channel.
• 80% vegetation grass cover are required to ensure stabilisation.
• Refer to Table 6 for seed and fertilisation rates.</td></tr>
<tr><td>Mulching:</td><td>• In areas where mulching is possible, straw or hay mulch must be unrotted material and be applied at a rate that provides a completed cover of the soil surface (typically in the order of 4,000 – 6,000 kg/ha). Mulch material to be free of weeds and not contain noxious weed species (obtain list form Horizons Council).
• If difficulties with mulch material on site is experienced, it will require to be anchored (i.e. crimping or binders).</td></tr>
<tr><td>Geotextiles and erosion control blankets:</td><td>• Non-woven geotextiles are to use a temporary erosion control measures. To be used as bund stabilisation, batter stabilisation, stockpile stabilisation and low velocity channel stabilisation.
• Woven geotextiles (high flow conditions) to be used within the temporary diversion channel with outfall and as part of stabilising the alignment channel:
o Material should be woven polypropylene fabric with a minimum wide width tensile strength ≥ 14 kN/m (AS, ASTM or ISO test methods allowed).
o Fabric used to comply with a flow rate under 100 mm head of <20 l/m^2/sec (AS, ASTM or ISO test methods allowed).
o Retained strength at 500h UV = 70% minimum.
o Geotextiles to be secured in place with ground staples, pins or sandbags and keyed into the tops of slopes and edges to prevent infiltration of surface water under the geotextile.
o See Figure 8 and Figure 9 for installation specification.
o Geotextiles to be pinned down on a 500 mm (min) grid.
o Ensure that pins are suitable for geotextile and soil type.
• Refer to the W\Greater Wellington ESCP Guide for design criteria for erosion blankets.</td></tr>
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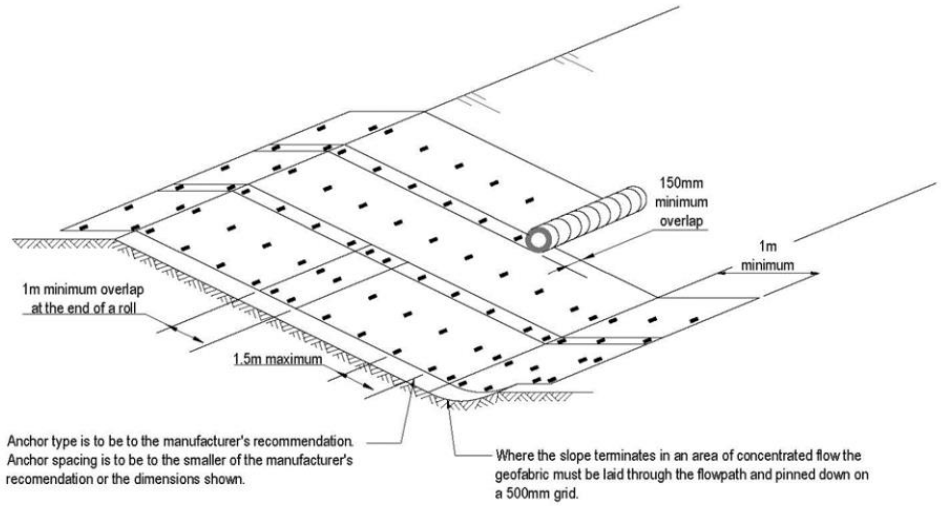

Figure 8: Geotextile design – outfalls

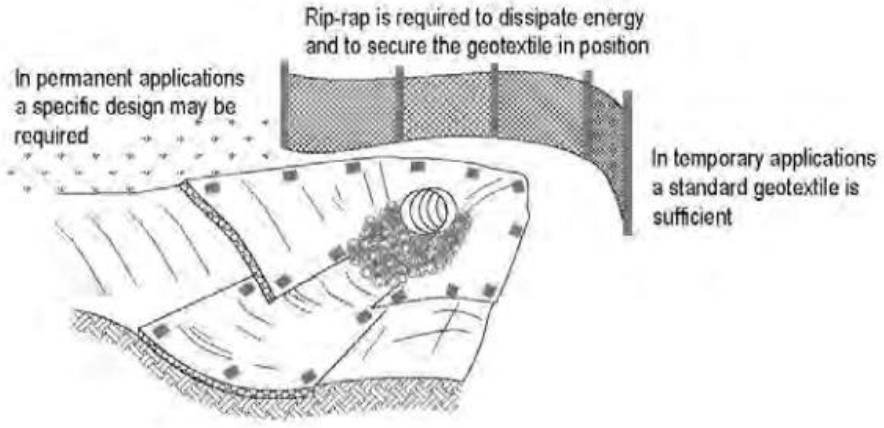

Figure 9: Geotextile design – on slopes

4.1.2 Sediment Control Measures

Sedimentation control measures selected as part of this ESCP includes installing silt fences at strategic locations and the installation of an Sediment Retention Pond (SRP).

Silt fences will be constructed along three sides of the topsoil stockpile location of the works area. The silt fences will be erected in accordance with the GWRC ESC Guidelines. Silt fences will not be removed until vegetation cover has achieved 80%. Where additional silt fencing is required in other areas of the site, it has been identified that standard silt fences will be appropriate where the site is relatively low gradient, around short batter fills, or stockpiles.

These control measures are to be installed before commencement of construction.

4.1.2.1 Silt fencing

Silt fencing will be installed under the following conditions:

- Need to control sediment by intercepting sheet flow.
- Around watercourses.
- Delineate the limit of disturbance along the riparian areas.

Silt fences will not be installed under the following conditions:

- Across watercourses or in areas of concentrated flows.
- Used as check dams in channels.

Table 7: Typical design criteria for silt fences

	Design criteria considered

Silt fence:	• Silt fence height to be 600 mm above ground level and 200 mm below ground level.
	• Maximum slope lengths, spacing of returns and angles for silt fences as per Table 8.
	• Locate supporting posts/waratahs for silt fences 2-4 m apart with support provided by tensioned wire (2.5 mm HT) along the top of the silt fence.
	• Where strong woven fabric is used in conjunction with a wire support, the distance between posts can be up to 4 m. Double the silt fence fabric over and fasten to the wire with silt fence clips at 500 mm spacings.
	• Supporting posts to be embedded a minimum of 400 mm into the ground.
	• To be installed along the contour.
	• Join lengths of silt fence by doubling over fabric ends around a waratah or by stapling the fabric ends to a batten and butting the two battened together (Figure 11).
	• Install silt fence returns at either end of the silt fence, projecting up-slope to a sufficient height to prevent outflanking.
	• Where water may pond regularly behind the silt fence, provide extra support for the silt fence with tie-backs from the silt fence to a central stable point on the upward side.
	• As a minimum, the silt fence cloth must meet the following criteria for geotextile fabric:
	  o Wide width tensile strength ≥14 kN/m minimum.
	  o Retained strength at 500h UV = 70% minimum.
	  o Opening size (EOS) 0.2 – 0.4 um.
	• See the greater Wellington ESCP Guideline for construction methodology.

Table 8: 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

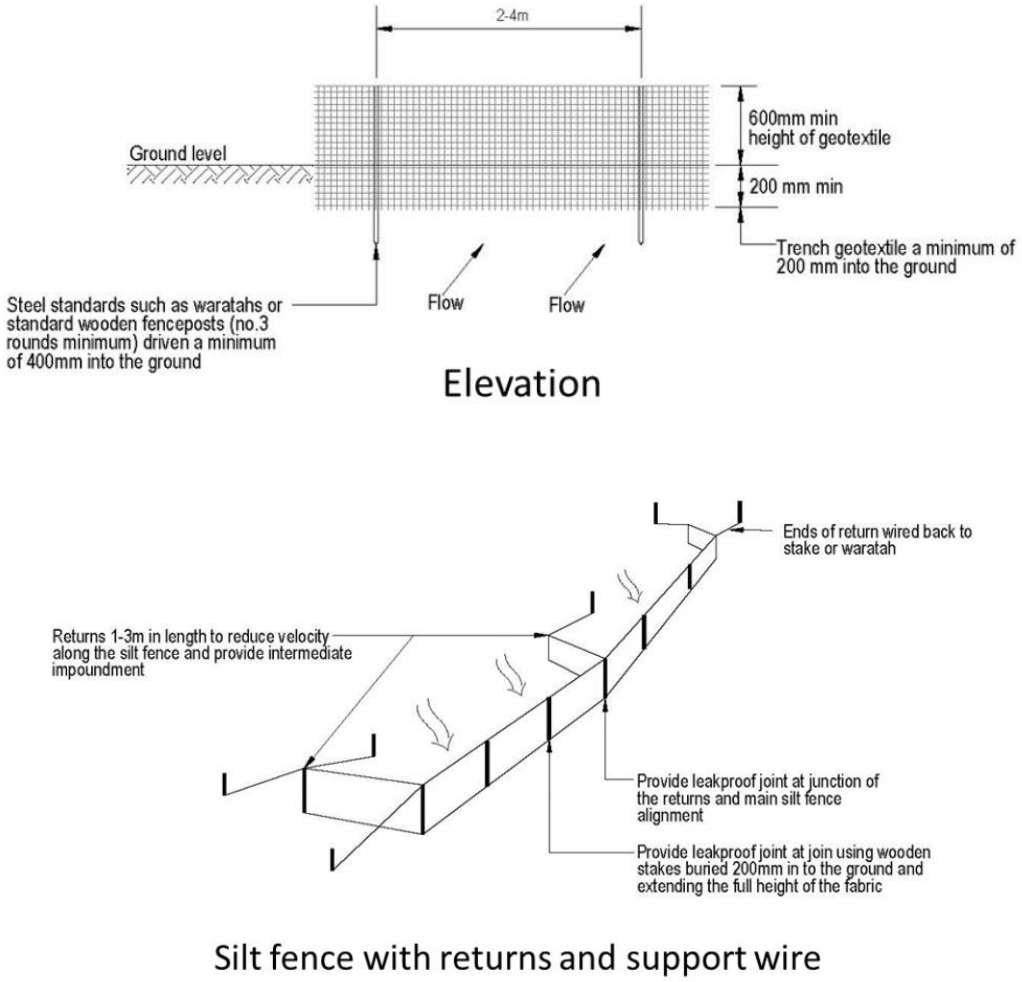

Figure 10: Typical schematic of a silt fence.

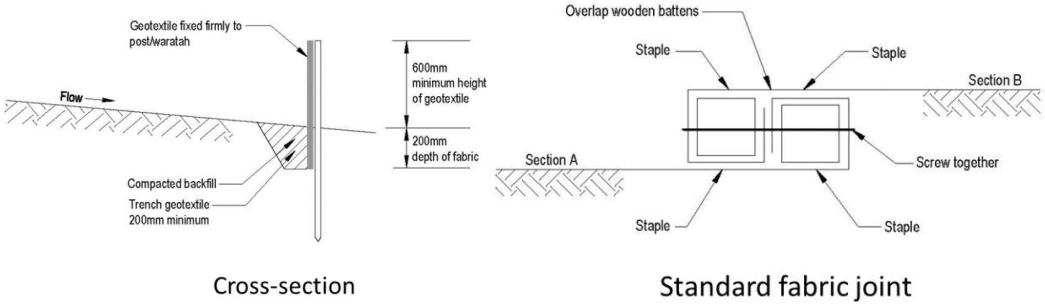

Figure 11: Typical cross section of a silt fence and fabric joint.

4.1.2.2 Sediment Retention Pond

An SRP is recommended to be installed and will be situated in the southeast bottom corner of the WWSP indicated in Appendix A. A Total storage volume of 3% of the contributing catchment area has been used to accommodate additional rainfall if winter works is required. This is a contingency measure and also caters for the potential heavy rainfall events experienced within the recent summer seasons.

During each construction phase, water from the excavations will be pumped into the SRP. The SRP will discharge as indicated on the ESCP plan. Erosion measures discussed in previous sections will be implemented to ensure erosion control at the point of discharge.

Table 9: Design criteria for SRP.

Design criteria considered	
SRP:	• Construct based on the guidelines for slopes <18% and < 200 m in length with a minimum volume of 2% of the contributing catchment area. • The distance between the inlet and the outlet (including the emergency spillway) should be maximised to reduce the risk of short-circuiting and to promote quiescent (inactive) conditions. • Ensure the length-to-width ratio of the SRP is no less than 3:1 and no greater than 5:1. The length of the pond is measured as the distance between the inlet and the outlet (decant system). • The length-to-width ratio is measured at the height of the primary spillway. • Ensure even and gradual dissipation of the heavier inflow water across the full area of the pond. • Construct the SRP invert with a reverse slope. • If considering batters, ensure batters are installed in a manner to prevent creating concentrated flows within the SRP. • SRP depth to be no more than 2 m deep. Depth is measured from the invert to the top of the primary spillway. Deeper ponds are more likely to cause short-circuiting problems during larger storm events. • Maximum live storage range of 1.5 m. • Dead storage should be retained at 30% of the total SRP storage by positioning the lowest decant 0.4 – 0.8 m above the invert of the pond. • Live storage volume capacity should be 70% of the total SRP storage. • The forebay should extend the full width of the pond, be a minimum of 1 m in depth and 2 m in width and be located upstream of the level spreader. • The decanting/outlet dewatering device to be installed as per the ESCP guideline. • The primary spillway should be a minimum 600 mm lower than the top of the SRP embankment and a minimum 300 mm lower than the emergency spillway crest. Ensure the riser and the discharge pipe connections are all completely watertight. • Emergency spillway must be capable of accommodating the 1% AEP event without eroding. • The emergency spillway level should be a minimum 300 mm lower than the top of the SRP embankment. • Emergency spillway to be constructed as per the ESCP guideline. • Level spreader and anti-seep collar to be installed as per the ESCP guideline.

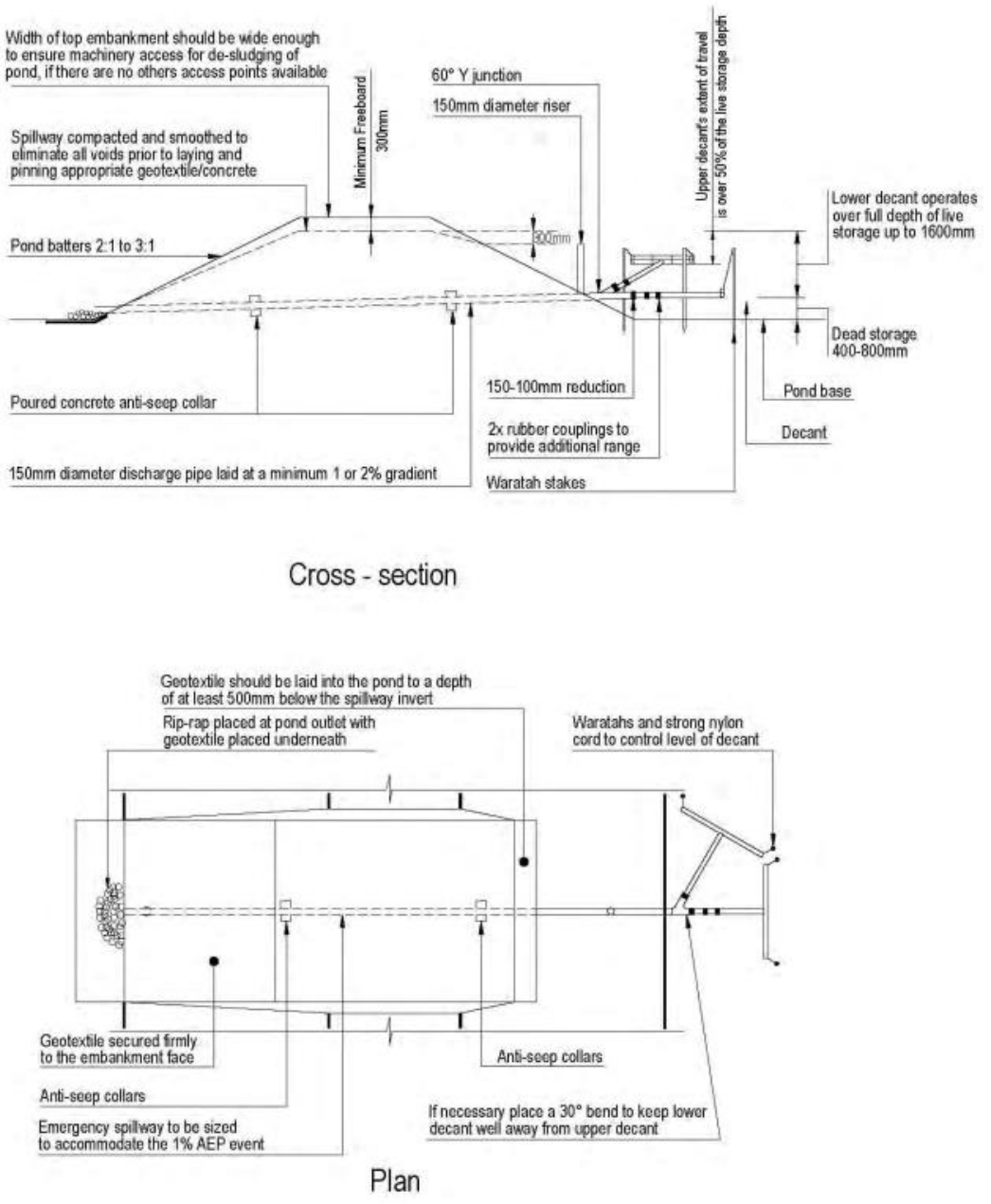

Figure 12: Typical cross section of an SRP for 1.5 to 3 ha catchment.

4.1.2.3 Chemical Treatment

Before the finalisation of this ESCP, samples of the soil will be required to be taken to calculate the rate and product specification of the required flocculant treatment. The appointed contractor must develop a Flocculation Management Plan and submit it as part of the final ESCP.

All ESC devices will be installed and maintained in accordance with the ***Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region*** *(GWRC, February 2021).* Other authoritative guidelines may also be referenced (IECA) for additional ESC measures.

5 Timetable and Nature of Site Stabilisation

Construction works are proposed to for the earthworks season. However, there is a possibility that works may continue into the winter works period and allowance has been made within the mitigation measures outlined in this document.

The contractor shall be responsible for maintaining all top-soiled and grassed areas until a strong, stable covering of grass has been established, and in any event, until the conclusion of the defect's liability period for the contract.

The contractor shall be responsible for ensuring dust risk is managed until the conclusion of the defect's liability period for the contract. Straw mulching will be utilised to stabilise surfaces where appropriate.

6 Maintenance, Monitoring and Reporting

All ESC devices will be inspected each morning for any obvious damage. A general inspection will be undertaken weekly on all sediment control measures to ensure they are effective, and after any significant rainfall event.

The Site Manager will register with NZ MetService to receive sever weather and thunderstorm warnings, and all ESC measures and devices will be inspected prior to any forecast significant rainfall event (≥ 15 mm/hr).

All weather access will be maintained to the site at all times.

Sediment will be removed from the SRP before the volume of accumulated sediment reaches 20% of the total volume. It can be disposed of in any non-structural fill site where it will be contained in a bunded area.

Maintenance will be recorded on a Sediment Control and Maintenance Sheet. The performance of ESC measures will be reported monthly to the client, along with other contractual issues through normal contract reporting requirements.

7 Heavy Rainfall Response and Contingency Measures

The contractor will register with NZ MetService for severe weather warnings. Following any heavy rainfall warning, the ESC measures will be inspected, cleaned, and repaired. Exposed surfaces will be prepared by removing loose material and surface roughing/compacting the fill slopes and stockpiles.

The following contingency measures are proposed:

- Proposed construction sequencing can be varied depending on the likelihood of rainfall.
- Ensure any stockpiled material is located away from drainage paths.
- Ensure that machinery is not parked in overland flow paths.
- Storage volumes can be increased if the ESC devices cannot cope.
- Contingency measures will be recorded on a Sediment Control and Maintenance Sheet.

8 Procedures for Review and/or Amendment to ESCP

The ESCP will be monitored and reviewed monthly by an HRC representative. The performance of controls will be monitored regularly during the operation. Any controls that are not performing adequately to satisfy the resource consent conditions will be discussed with the Site Supervisor.

Any minor updates or amendment to the ESCP will be discussed with the HRC representative. Any major changes will be documented and an amended ESCP will be submitted to HRC for approval.

9 Site Responsibilities

The contractor shall have a nominated person for the works who will be responsible for the implementation and maintenance of the ESC measures and updating the ESCP as required during the works.

The Site Supervisor and Foreman will likely be responsible for the day-to-day maintenance of the ESC measures. Implementation and performance of the ESCP will be monitored by the HRC representative.

10 Contractor Input

Prior to start of the main construction works, the contractor will prepare an Environmental Management Plan (EMP), and to include requirements as highlighted in the Greater Wellington ESCP Guideline, to address:

- Dust Control.
- Erosion and Sediment Control.
- Accidental Discovery Protocol.
- Any other measures necessary to meet all conditions laid down within the Project Specification and resource consent conditions.

Dust control measures should include:

- Retaining existing vegetation cover where possible.
- Staging of earthworks to limit areas of exposed soil.
- Setting a defined Limit of Works area.
- Use of water carts where necessary and straw mulching will be applied if required.

Before commencing with the construction activities, it is the responsibility of the contractor to organise a pre-start meeting with the HDC's compliance and monitoring officer to finalise the ESCP. The final ESCP should then be submitted and kept up to date.

This ESCP report and drawings may be optimised by the contractor before the start of any activity on site. Any proposed changes to the documents must be approved by the Engineer and HRC prior to works commencing.

It is anticipated that the environmental controls, including Erosion and Sediment Controls, on site will be subject to periodic environmental audit by the Engineer.

Appendix A
Erosion and Sediment Control Plan Drawings

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