



Erosion & Sediment Control Plan

Prince of Wales/Omāroro Reservoir
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APPENDICES

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5	Calculations Supporting the selection of the 5 x 150mm diameter pipe associated with cleanwater coffer dam outfall off the clean water catchment adjacent the link access track into the Papawai Stream.

1. INTRODUCTION

The Erosion & Sediment Control Plan (ESCP) is a sub-management plan of the Construction Environmental Management Plan (CEMP) for the Omaroro Reservoir construction project. The CEMP sets the overall framework for the management of the environmental aspects of the project and is supported by sub management plans focusing on the specialist environmental areas of erosion and sediment control, construction noise & vibration, landscape and ecology, and traffic management. Figure 1 illustrates the relationship between the CEMP and the sub environmental management plans.

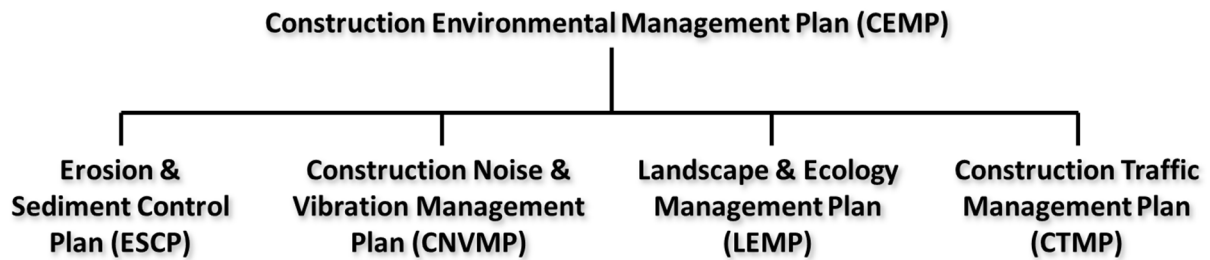


Figure 1: Management Plan relationships.

1.1. Management Plan Consolidation.

By arrangement with the Wellington City Council (WCC) and Greater Wellington Regional Council (GWRC) the ESCP shall also address the content of several other management plans required by the various regulatory permissions. A record of this agreement is shown in **Appendix 1**. The plans have been grouped under the ESCP due to the close nature of the content and the relationship between the plans. The plan consolidation will positively influence transparency, readability, and thoroughness. The ESCP consolidation process involves a reduction of plans in the following manner:

Erosion & Sediment Control Plan (ESCP) – consolidates:

- a. Flocculation Management Plan (FMP) – via GWRC consents
- b. Earthworks Management Plan (EMP) – via WCC Designation
- c. Earthworks Management Plan (EMP) – via GWRC consents
- d. Contaminated Soils Management Plan (CSMP) – via WCC NES consent.

2. PROJECT DESCRIPTION

The Project relates to the construction, operation, and maintenance of a 35,000 m³ reservoir within the Wellington Belt in the Prince of Wales Park, Mount Cook (Figures 2-5). The circular concrete reservoir will be completely buried except for two small access hatches on the roof of the reservoir and a 2.5m by 2.5m doorway and 10m wide service access area to the reservoir's buried service and pipe tunnel. The reservoir is required to service the Wellington Low Level Water Supply Zone, which provides potable water to approximately 70,000 residents and a range of significant commercial, industrial, and critical community facilities.

The Project includes approximately 3.6ha of earthworks and requires clearance of approximately 4ha of land (including approximately 1.7ha of established vegetation).

2.1. Location

The Reservoir is to be constructed within the confines of the Prince of Wales Park in suburb of Mount Cook, adjacent Wellington Central Business District (CBD).

2.2. Extent of Physical Works

The extent of physical construction activities involved in the Project is illustrated in **Appendix 2** “Final General Arrangement Plan” Drawing No. 3262332-CE-1102. The black dashed line within the drawing illustrates the construction boundary. This area is defined and covered by the various regulatory permissions (Refer Section 3).



Figure 2. Project Location within Wellington City.



Figure 3. Project Location within Mount Cook & Prince of Wales Park.



Figure 4. Project Location within Mount Cook & Prince of Wales Park.



Figure 5. Project Location within Mount Cook & Prince of Wales Park.

2.3. Schedule of Construction Activities

Listed in Table 1 is an indicative schedule physical construction activity. This will evolve during the construction period for the project as site conditions become fully understood. The estimated overall Project program time frames are from May 2020 to an expected end date of May 2023.

Table 1: Indicative Physical Construction Schedule

Start Date	Finish Date	Project Activity
October 2020	October 2022	Separable Portion 1: Works to Achieve an Operational Reservoir <ul style="list-style-type: none"> • Sediment Control establishment • Vegetation Removal • Topsoil Stripping and stockpiling • Excavation of Reservoir platform “footprint” and stockpiling of material • Construction of Reservoir • Backfilling of material around and over Reservoir • Shaping and contouring of final slopes
May 2023	May 2023	Separable Portion 2: Planting and Landscaping
March 2023	March 2023	Separable Portion 3: Reinstatement of the Playing Fields
March 2023	March 2023	Separable Portion 4: New and Reinstated Walking Tracks
April 2023	April 2023	Separable Portion 5: All Other Works

2.4. Commencement of Construction Activities – ESCP specific

Construction related activities associated with the Project may **not** commence until the ESCP requirements identified in Table 2 have been completed.

Table 2: Consent Related Prerequisites for the Commencement of Construction

GWRC Consents 35008-10		
Condition Number	Condition Description	What is Required for Construction to Commence
8(l)	The ESCP shall be to the satisfaction of the Manager prior to any works authorised by this consent commencing. Construction shall not commence until the consent holder has received the Manager’s written certification of the ESCP.	Written approval of the ESCP from WCC and GWRC.
9(c) note	The first phase-specific ESCP may be submitted to the Manager for approval at the same time as the final ESCP required by condition (8) of this consent.	Written approval of the ESCP from WCC and GWRC.
10(n)	Use of flocculant on site shall not commence prior to receiving written confirmation that the FMP is to the satisfaction of the Manager.	Written Confirmation of an Approved ESCP (consolidated FMP).

11	Prior to the commencement of works for each stage/phase of works, other than those required to establish erosion and sediment control measures which have firstly been agreed to by the Manager, a suitably experienced sediment control practitioner shall inspect the area to certify that the erosion and sediment controls have been constructed in accordance with the ESCP and the FMP approved under conditions (8) and (10) respectively of this consent, and the current version (at the time of submission of the ESCP) of the Erosion and Sediment Control Guidelines for the Wellington Region as a minimum standard	An inspection of the site and erosion and sediment controls by a suitably experienced sediment control practitioner to certify that the erosion and sediment controls have been constructed in accordance with the approved ESCP. Refer Section 4.1 of the ESCP - Appropriately experienced and qualified Sediment Control Managers.
11(c)	The consent holder is advised to complete the sediment control device as-built check sheets available on the Greater Wellington Regional Council's website and to submit these with the certification required under this condition. The certificate shall be submitted within 5 working days of completing the audit and to the satisfaction of the Manager. The works shall not commence until the written certification has been submitted to the Manager and the contractor(s) has been advised by the suitable experienced sediment control practitioner that the measures have been constructed in accordance with the ESCP and FMP.	"As Built" documents relating to erosion and sediment controls have been completed and submitted to GWRC.

WCC Designation 135

Condition	Condition Description	What is Required for Construction to Commence
DC11(a)	The following Management Plans shall be submitted to the CMO for certification either at the same time or post-acceptance of outline plans associated with the construction of the Omāroro Reservoir: <ul style="list-style-type: none"> i. Construction Management Plan ii. Earthworks Management Plan iii. Construction Traffic Management Plan iv. Site Specific Traffic Management Plan v. Construction Noise and Vibration Management Plan vi. Landscape and Ecology Management Plan vii. Playing Fields Management Plan 	Written certification of all required Management Plans has been received from WCC

DC11(b)	Works must not commence until certification of the management plans is received in writing.	Written certification of all required Management Plans has been received from WCC and GWRC.
DC12	The Requiring Authority shall submit draft copies of all management plans (as required by condition DC.11) to the CMO for comment at least 20 Working Days prior to the management plans being lodged for certification. If an Outline Plan has not been submitted prior to this occurring, or an outline plan waiver granted, a draft Outline Plan shall also be provided.	Written certification of all required Management Plans has been received from WCC and GWRC.

3. ESCP Regulatory Framework.

The Project has been issued ESC related regulatory permissions in the form of Resource Consents, and a Designation. These are identified in Table 3. The Project will be administered in accordance with the requirements and constraints imposed by these regulatory permissions. The ESCP will demonstrate how HEB will achieve compliance within these requirements and constraints. Tables 4A to 4C directs the reader of this document to the section of the ESCP that relates specifically to conditions /requirements of the various regulatory permissions.

Table 3: Regulatory Permissions.

3.1 Guide to ESCP Sections dealing with GWRC Consent Conditions

To efficiently locate where in the ESCP a particular GWRC ESC related consent condition is discussed consult Table 4A below.

Table 4A: GWRC ESC Related Consent Conditions Reference Guide.

GWRC Consents 35008-10			
Pre-construction requirements		Associated Management Plan	Specific Section of the Management Plan
2(b)	The proposed methodology, options and process for the take, use and discharge of water related to the dewatering activities;	Erosion & Sediment Control Plan (ESCP)	10. Management of Dewatering
2(d)	Confirmation of how the consent holder will achieve full compliance with all conditions of the consent and the responsible parties and contact persons, including:		
i.	Methodology and proposed trigger limits for water quality monitoring of the discharges;	Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring
8	The final ESCP shall as a minimum be prepared in general accordance with the current Erosion and Sediment Control Guidelines for the Wellington Region, and shall include, but not be limited to, the following:	Erosion & Sediment Control Plan (ESCP)	3.4 Erosion & Sediment Control Guidelines

a)	Identification of appropriately experienced staff responsible for the implementation, operation, management and maintenance of all erosion and sediment control structures, including their roles, responsibilities and contact details;	Erosion & Sediment Control Plan (ESCP)	4.1 Appropriately experienced and qualified Sediment Control Managers
b)	A detailed description of the works proposed, construction methodology and timetable;	Erosion & Sediment Control Plan (ESCP)	7 Earthworks Management
c)	Details of all principles, procedures and practices that will be implemented to undertake erosion and sediment control and minimise the potential for the discharge of sediment-laden water from the site;	Erosion & Sediment Control Plan (ESCP)	Management Plan in its entirety
d)	The design criteria and dimensions of all erosion and sediment control measures and devices;	Erosion & Sediment Control Plan (ESCP)	4. Erosion & Sediment Control Development.
e)	Plan(s) of an appropriate scale clearly identifying:		
i.	The locations of waterways and stormwater drains;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
ii.	Staging sequence of erosion and sediment control measures and devices;	Erosion & Sediment Control Plan (ESCP)	7.2 Staging of Works
iii.	Areas and cross sections of cut and fill and the inclusion of staged stripping of vegetation and cutting to ensure erosion and sediment control measures and devices are not overloaded;	Erosion & Sediment Control Plan (ESCP)	7.1 Cut to Fill Schedule
iv.	The extent of soil disturbance and vegetation removal;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
v.	Any “no go” and/or buffer areas to be maintained undisturbed, including minimum buffer strips of riparian vegetation to be retained;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
vi.	Locations of all stockpiles, stabilised access roads and stabilised construction entrances;	Erosion & Sediment Control Plan (ESCP)	9.4.5 Stockpile Management
vii.	All erosion and sediment control measures, including diversion channels;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
viii.	The boundaries and area of catchments contributing to all stormwater impoundment structures;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
ix.	The locations of all specific points of discharge to the environment, including to the stormwater network;	Erosion & Sediment Control Plan (ESCP)	Appendix 1
x.	Civil infrastructure to be constructed in relation to completed bulk earthworks areas; and	Erosion & Sediment Control Plan (ESCP)	Appendix 1
xi.	Any other relevant site information;	Erosion & Sediment Control Plan (ESCP)	Entire Plan
g)	Maintenance, monitoring and reporting procedures and frequency;	Erosion & Sediment Control Plan (ESCP) Construction Environmental Management Plan (CEMP)	11.8 Monitoring & Maintenance 7.1.2. During Construction Notifications 12. Monitoring & Review

h)	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 erosion and sediment control measures or devices;	Erosion & Sediment Control Plan (ESCP)	11.8 Monitoring & Maintenance
i)	Procedures and timing for review and/or amendment to the ESCP;	Erosion & Sediment Control Plan (ESCP)	14 Review & Revision of the Erosion & Sediment Control Plan.
j)	Decommissioning methodology for all erosion and sediment control measures and devices including the procedure for obtaining the Manager's prior approval;	Erosion & Sediment Control Plan (ESCP)	13.1.2 Removal of Sediment Controls
k)	Procedures for re-instating erosion and sediment control measures and devices at the end of each working day, where applicable; and	Erosion & Sediment Control Plan (ESCP)	11.8 Monitoring & Maintenance
l)	Reasons for any variance to the current Erosion and Sediment Control Guidelines for the Wellington Region.	Erosion & Sediment Control Plan (ESCP)	3.4 Erosion & Sediment Control Guidelines
10	The consent holder shall prepare, in consultation with a suitably qualified and experienced flocculant professional, a final Flocculation Management Plan (FMP). The FMP shall be submitted to the Manager for approval at least 20 working days prior to the commencement of earthworks.	Construction Environmental Management Plan (CEMP)	7.1.1 Pre-construction Notification Requirements
	The FMP shall include, but not be limited to:	Erosion & Sediment Control Plan (ESCP)	11 Flocculation Management
a)	Confirmation of the flocculant to be used and the dosing method of flocculation to be used;	Erosion & Sediment Control Plan (ESCP)	11.4 Chemical Testing Results and Discussion
b)	Details of how the flocculation dosage will be triggered;	Erosion & Sediment Control Plan (ESCP)	11.5 Chemical Treatment System
c)	Confirmation of the constructed shape and size of the SRP(s) and demonstration that the SRP(s) size and shape is appropriate for the relevant catchment;	Erosion & Sediment Control Plan (ESCP)	8.4.10 Sediment Retention Ponds
d)	Confirmation of the optimum dosage rate calculated from the soils in the ponds catchment, including calculation details and bench testing results;	Erosion & Sediment Control Plan (ESCP)	11.4 Chemical Testing Results and Discussion
e)	An assessment of alternative flocculants and dosing methods and an explanation as to why the flocculant system was chosen, including discussion on ensuring accurate dosing/reducing overdosing, automated systems, flow-activated dosing, theoretical SRP volume/rain-activated dosing;	Erosion & Sediment Control Plan (ESCP)	11.4 Chemical Testing Results and Discussion
f)	Procedures for changing the flocculant method if the proposed method is found to be ineffective after use onsite (including timeframes for making the change between methods);	Erosion & Sediment Control Plan (ESCP)	11.6 Chemical Treatment Review 14 Review & Revision of the

		Erosion & Sediment Control Plan.
i)	Identification of pH, dissolved aluminium, NTU and/or TSS trigger levels and procedures to be undertaken if the trigger levels are exceeded;	Erosion & Sediment Control Plan (ESCP) 10.4.2 SRP Dewatering Monitoring
j)	Details of the monitoring programme in accordance with conditions (35) to (38) including location of water quality monitoring points, frequency of monitoring, reporting of results, and testing of the following parameters: i. pH ii. Temperature (°C) iii. Turbidity (NTU) iv. Dissolved aluminium (g/m ³) if PAC to be used; and v. Suspended solids (g/m ³) k) Details of rainfall event based monitoring in accordance with condition (35);	Erosion & Sediment Control Plan (ESCP) 10.4.2 SRP Dewatering Monitoring
l)	Methods, roles and responsibilities for monitoring and maintenance of the flocculation system by the onsite contractor(s) and engineer(s) including contact details of the relevant persons;	Erosion & Sediment Control Plan (ESCP) 11.8.2 Personnel in charge
m)	Identification of a SQEP and their specific responsibilities for ensuring the operation, monitoring and maintenance of the chemical flocculation system to ensure that it is operating as outlined in the FMP; and	Erosion & Sediment Control Plan (ESCP) 4.1 Appropriately experienced and qualified Sediment Control Managers
n)	A plan for the decommissioning of flocculated sediment retention ponds.	Erosion & Sediment Control Plan (ESCP) 13.1.2 Removal of Sediment Controls
Note 1:	There shall only be one point of inflow to an SRP and that must be via the dirty water diversion which conveys flows to the SRP.	Erosion & Sediment Control Plan (ESCP) 8.4.10 Sediment Retention Ponds
Note 2:	For large multi-stage projects FMP's must be reviewed prior to commencing each new stage or as a minimum on a seasonal basis. Reviews must reference monitoring data and/or further bench testing results to determine the effectiveness of the FMP and whether it needs to be amended to ensure on-going optimal performance.	Erosion & Sediment Control Plan (ESCP) 14 Review & Revision of the Erosion & Sediment Control Plan.

<p>11 Prior to the commencement of works for each stage/phase of works, other than those required to establish erosion and sediment control measures which have firstly been agreed to by the Manager, a suitably experienced sediment control practitioner shall inspect the area to certify that the erosion and sediment controls have been constructed in accordance with the ESCP and the FMP approved under conditions (8) and (10) respectively of this consent, and the current version (at the time of submission of the ESCP) of the Erosion and Sediment Control Guidelines for the Wellington Region as a minimum standard. Certification shall include, but not be limited to, the following:</p> <p>a) Contributing catchments, dimensions and storage volumes of sediment retention ponds, decanting earth bunds, silt fences and diversion channels/bunds as applicable;</p>	<p>Erosion & Sediment Control Plan (ESCP)</p> <p>Construction Environmental Management Plan (CEMP)</p> <p>Erosion & Sediment Control Plan (ESCP)</p>	<p>4.1 Appropriately experienced and qualified Sediment Control Managers</p> <p>2.4 Commencement of Construction Activities</p> <p>Appendix 1</p>
<p>b) As-built plans of the key erosion and sediment controls measures; and</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.2 "As Built" Documentation.</p>
<p>c) Any other details that will facilitate assessment of compliance with the authorised ESCP, authorised FMP and the current Erosion and Sediment Control Guidelines for the Wellington Region.</p> <p>Note: The consent holder is advised to complete the sediment control device as-built check sheets available on the Greater Wellington Regional Council's website</p> <p>http://www.gw.govt.nz/assets/OurEnvironment/Land%20and%20soil/Earthworks-page-As-builtCertificationSheet.pdf and to submit these with the certification required under this condition.</p> <p>The certificate shall be submitted within 5 working days of completing the audit and to the satisfaction of the Manager. The works shall not commence until the written certification has been submitted to the Manager and the contractor(s) has been advised by the suitable experienced sediment control practitioner that the measures have been constructed in accordance with the ESCP and FMP.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.2 "As Built" Documentation.</p>

Winter works	Associated Management Plan	Specific Section of the Management Plan
<p>12 No works shall take place on site during the period of 1 June to 30 September inclusive each year unless approved by the Manager.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.1.1 Earthworks Season and Winter Works</p>

<p>13 All earth worked areas shall be stabilised during the period between 1 June to 30 September inclusive each year unless a later date is approved in writing by the Manager.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.1.1 Earthworks Season and Winter Works</p>
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Erosion and sediment control activities	Associated Management Plan	Specific Section of the Management Plan
<p>14 All erosion and sediment control measures and devices shall as a minimum be installed, operated and maintained in accordance with the latest version of the Erosion and Sediment Control Guidelines for the Wellington Region (September 2002) and the approved CEMP required by condition (7), ESCP required by condition (8) and FMP required by condition (10) of this permit.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>8.3 Management & Design Objectives</p>
<p>15 All erosion and sediment control measures and devices shall remain the responsibility of the consent holder. No erosion or sediment control measures or devices shall be removed prior to the applicant receiving written confirmation that the relevant stage/phase area is stabilised to the satisfaction of the Manager in accordance with condition (24) of this consent.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.1.2. Removal of Sediment Controls</p>
<p>16 The consent holder shall ensure that all sediment retention ponds within the site are chemically flocculated from the time the ponds are operational until the ponds are decommissioned. The exception is if flocculation dosing is temporarily stopped due to monitoring results in accordance with condition (38) of this consent.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>11 Chemical Treatment</p>
<p>17 The consent holder shall ensure that all stormwater contaminated with sediment discharged from the site is treated by erosion and sediment control measures as detailed in the approved ESCP required by condition (8) of this permit.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>8.1 Design Philosophy</p>
<p>18 Grit traps shall only be used as a secondary (interim) control to the primary devices of the sediment retention ponds. Silt fencing shall only be used where runoff cannot practically be directed to a primary control for treatment.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>8.4.6. Sediment Traps</p>
<p>19 The consent holder shall ensure that prior to the completion of operations each working day that all necessary erosion and sediment control measures are reinstated as detailed in the approved ESCP required by condition (8) of this permit</p>	<p>Erosion & Sediment Control Plan (ESCP)</p>	<p>13.1 Construction Management</p>

Discharge activities		Associated Management Plan	Specific Section of the Management Plan
20	The consent holder shall take all practicable steps to minimise sediment loading and increased turbidity of any waterbody due to the works, including by:		
a)	Ensuring all stormwater and water discharged from the dewatering activities is directed to the appropriate erosion and sediment control measure or device prior to discharge;	Erosion & Sediment Control Plan (ESCP)	10 Management of Dewatering
c)	Completing all works in the minimum time practicable; and	Erosion & Sediment Control Plan (ESCP)	8.3 Management & Design Objectives
d)	Minimising the area of disturbance at all times.	Erosion & Sediment Control Plan (ESCP)	8.3 Management & Design Objectives
22	The consent holder shall ensure that discharges to surface water bodies undertaken in accordance with this consent are carried out in a manner that does not cause erosion, scour or instability of the affected stream bed or banks. Any erosion, scour or instability of the stream bed or banks that is attributable to the works shall be remedied by the consent holder within a timeframe as specified by the Manager.	Erosion & Sediment Control Plan (ESCP)	10.3 Dewatering Methodologies

Bulk earthwork activities		Associated Management Plan	Specific Section of the Management Plan
23	The maximum area of disturbance at any one time shall not exceed the calculated capacity of the sediment treatment device required by the ESCP for that stage/phase of works as approved under condition (9).	Erosion & Sediment Control Plan (ESCP)	8.3 Management & Design Objectives
24	The consent holder shall:		
a)	Progressively stabilise any disturbed areas as they complete each earthworks stage/phase of work to minimise sediment runoff. The progressive stabilisation shall be to the satisfaction of the Manager.	Erosion & Sediment Control Plan (ESCP)	8.3 Management & Design Objectives
b)	Ensure that a method of stabilisation (e.g. hydroseeding) is applied to each disturbed area within two weeks of completion of the cut or fill works. All stabilisation methods shall be effective within one month of being applied or after a longer period if agreed in writing by the Manager.	Erosion & Sediment Control Plan (ESCP)	9.4.3. Surface Application of Polymer Stabilisers & Hydroseed
c)	Ensure that each stage of bulk earthworks shall be stabilised before any further stages are undertaken, unless otherwise authorised in writing by the Manager.	Erosion & Sediment Control Plan (ESCP)	8.3 Management & Design Objectives
25	All fill material used on site shall:		

a)	Be restricted to natural material, such as clay, soil and rock and other inert materials as detailed in the definition of cleanfill material in section 2.2 of the Ministry for the Environment publication A guide to the Management of Cleanfills, 2002; and	Erosion & Sediment Control Plan (ESCP)	7.1. Cut to fill schedule
b)	Be restricted to those materials listed as acceptable in table 4.1 of the Ministry for the Environment publication A guide to the Management of Cleanfills, 2002.	Erosion & Sediment Control Plan (ESCP)	7.1. Cut to fill schedule
26	All fill material shall be placed and compacted so as to avoid erosion and instability. Any erosion of soil including failure of cut and fill batters that is attributable to the works shall be contained, remedied and mitigated by the consent holder to the satisfaction of the Manager.	Erosion & Sediment Control Plan (ESCP)	7.4. Stability

Dewatering activities		Associated Management Plan	Specific Section of the Management Plan
29	The consent holder shall undertake the proposed dewatering of the reservoir excavation site and associated discharges from the reservoir excavation site in accordance with the methodologies described in the final CEMP to be submitted to the Manager for approval in accordance with condition (7).	Erosion & Sediment Control Plan (ESCP)	10 Management of Dewatering
No amendments to the methodology shall be made until the consent holder has received written approval that the amendments are approved to the satisfaction of the Manager.		Erosion & Sediment Control Plan (ESCP)	14 Review & Revision of the Erosion & Sediment Control Plan.
30	For the period of time when water is extracted from the reservoir excavation site, the consent holder shall record: <ul style="list-style-type: none"> a) The pump rate; b) The date and time of each pumping commencement and completion; and c) Any change in the pump rate. 	Erosion & Sediment Control Plan (ESCP)	10.4.1 Reservoir Dewatering Monitoring
31	In the event of the visible flow of any surface water body near the dewatered excavation site being depleted by the dewatering activity, the consent holder shall: <ul style="list-style-type: none"> a) Immediately cease the dewatering activity; and 	Erosion & Sediment Control Plan (ESCP)	10.4.1 Reservoir Dewatering Monitoring
No dewatering may recommence until the consent holder has received written notification that the actions established under (b) are approved to the satisfaction of the Manager.		Erosion & Sediment Control Plan (ESCP)	10.4.1 Reservoir Dewatering Monitoring

Rainfall and flocculation monitoring of SRP		Associated Management Plan	Specific Section of the Management Plan		
<p>35 The consent holder shall sample and record the following parameters for each chemically-treated sediment retention pond (SRP) at the stated locations, as soon as practicable within daylight hours after a rainfall event of greater than 7mm in 1 hour or 20mm in a 24 hour period as measured at the Greater Wellington Regional Council's 'Newtown at Mansfield Street' rainfall monitoring site.</p>		Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring		
Parameter	Location within each SRP				At the reasonable mixing zone
	Inflow	Forebay	Pond	Outlet	
pH	✓	✓	✓	✓	✓
Temperature (°C)			✓		✓
Turbidity (NTU)		✓	✓	✓	✓
Suspended solids (g/m ³)		✓	✓	✓	✓
Dissolved aluminium (g/m ³)			✓	✓	✓
Note 1:	The consent holder is only required to undertake outlet monitoring if the SRP is discharging.				
Note 2:	Dissolved aluminium only needs to be sampled for monitoring if the flocculant Poly-aluminium Chloride (PAC) is being used to treat the SRP(s).				
<p>36 In addition to the monitoring undertaken in accordance with condition (35), the consent holder shall arrange for weekly site visits to be undertaken by an independent flocculation specialist who shall sample and record the following parameters for each chemically treated SRP at the stated locations:</p>		Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring		
Parameter	Location within each SRP				At the reasonable mixing zone
	Inflow	Forebay	Pond	Outlet	
pH		✓	✓	✓	
Temperature (°C)			✓		
Turbidity (NTU)				✓	
Suspended solids (g/m ³)				✓	
Dissolved aluminium (g/m ³)			✓	✓	✓
Note:	Dissolved aluminium only needs to be sampled for monitoring if the flocculant Poly-aluminium Chloride (PAC) is being used to treat the SRP(s).				

Note:	The consent holder is only required to undertake in-stream monitoring at the reasonable mixing zone and monitoring at the SRP outlets if the SR's are discharging.		
37	The results of the monitoring undertaken in accordance with conditions (35) and (36) shall be submitted to the Manager within two working days (48 hours) of the date the sampling is undertaken.	Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring
38	Should any monitoring results required under conditions (35) or (36) indicate that the pH of any chemically-treated SRP outflow is at or below 5.5, and/or the dissolved aluminium levels increase above 0.087 mg/L, the dosing of that SRP with flocculant shall cease immediately and the SRP decants raised. In this event, the Manager shall be notified immediately, and the consent holder shall liaise with the Manager on an appropriate course of action.	Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring
Note:	This condition is only relevant if the SRP(s) is to be treated with PAC.		
39	The consent holder's requirements under conditions (35) to (38) shall cease when the catchment has been completely stabilised and the SRP(s) decommissioned in accordance with the conditions of this consent, or with the written authorisation of the Manager.	Erosion & Sediment Control Plan (ESCP)	10.4.2 SRP Dewatering Monitoring

3.2 Guide to ESCP Sections dealing with WCC Designation Conditions

To efficiently locate where in the ESCP a particular WCC ESC related Designation condition is discussed consult Table 4B below.

Table 4B: WCC ESC Related Designation Conditions Reference Guide.

WCC Designation 135			
Earthworks Management Plan		Associated Management Plan	Specific Section of the Management Plan
DC.19	The EMP must include (but not be limited to) the following matters:		
a)	An illustrated plan that records the key features of the EMP	Erosion & Sediment Control Plan (ESCP)	Appendix 1
b)	A description of measures to be used to prevent and minimise adverse effects associated with:		
i)	dust	Erosion & Sediment Control Plan (ESCP)	9 Dust Management

ii)	sediment that may track onto the road network	Erosion & Sediment Control Plan (ESCP)	9.4.6 Entranceways
iii)	sediment that may enter the stormwater system (including Papawai Stream and the Waitangi Tributary), including secondary sediment and erosion protection measures that will be provided.	Erosion & Sediment Control Plan (ESCP)	8.4.10 Sediment Retention Ponds 10 Dewatering Procedure
c)	The methodology to minimise the surface area of un-stabilised earthworks, including stockpiles. The purpose is to decrease the potential for erosion related dust and sediment generation.	Erosion & Sediment Control Plan (ESCP)	9.4.5 Stockpile Management
d)	Measures to ensure temporary and permanent excavations, fill areas, and stockpiles remain stable.	Erosion & Sediment Control Plan (ESCP)	7.4 Stability
e)	Evidence shall be provided with the EMP demonstrating that measures in condition DC.19 d) have been peer reviewed by a Geotechnical Professional, from a second geotechnical consultancy, and confirming that they are in accordance with current industry best practice and the geotechnical assessment specified in condition DC.20.	Erosion & Sediment Control Plan (ESCP)	7.4 Stability
f)	A minimum 10m setback from stockpiles to the northern and eastern boundary of the upper field and the eastern boundary of the lower field unless otherwise recommended in the peer reviewed geotechnical report required by condition DC.20	Erosion & Sediment Control Plan (ESCP)	9.4.5 Stockpile Management
g)	Measures to minimise the visual effect of stockpiles through hydro-seeding or other methods where the stockpile will be undisturbed for a period of longer than 2 months	Erosion & Sediment Control Plan (ESCP)	9.4.5 Stockpile Management
Note:	Condition 19 (b)(iii) is intended to be given effect to through an Erosion and Sediment control plan that is required as a condition of GWRC's consent ref WGN180065 [35008], [35009], [35010]. It is expected that the ESCP will detail primary and secondary sediment and erosion protection measures to protect the Papawai Stream and the Waitangi Stream tributary. The ESCP will form part of the EMP.	Erosion & Sediment Control Plan (ESCP)	8.1 Design Philosophy 8.2 Treatment Train Approach
DC.20			
a)	A geotechnical assessment of the final detailed design shall be prepared by a suitably qualified Geotechnical Professional. The assessment shall review the geotechnical hazards and risks associated with:	Erosion & Sediment Control Plan (ESCP)	7.4 Stability

<ul style="list-style-type: none"> i) Stability of existing banks or retaining walls located below the playing fields ii) Stability of the roadway between the playing fields iii) Differential settlement and potential associated erosion of the proposed fill iv) Stability of proposed fill covering the reservoir and existing slopes to the south east and north of the reservoir v) The conceptual design for the tunnel excavation and access stability b) The geotechnical report shall be peer reviewed by a Geotechnical Professional from a second geotechnical consultancy, to ensure that the methodology is in accordance with current industry best practice. c) The Requiring Authority shall either implement any recommendations in the peer review, or where any recommendations are not implemented, the Requiring Authority shall explain the reasons why – including the engineering rationale. d) The geotechnical report and the results of the peer review, including any Requiring Authority explanation for not implementing recommendations of the peer review, shall be provided to the CMO at least 15 working days prior to commencement of construction. 		
DC.21		
<p>By 6pm every working day earthwork stockpiles shall not exceed the following height limits, measured from the base of each stockpile:</p> <ul style="list-style-type: none"> a) Upper Playing field- 5.5m in height b) Lower Playing field - 7m in height. 	Erosion & Sediment Control Plan (ESCP)	9.4.5 Stockpile Management

3.3. Guide to ESCP Sections dealing with WCC NES Consent Conditions.

To efficiently locate where in the ESCP a particular WCC ESC related NES consent condition is discussed consult Table 4C below.

Table 4C: ESC Related WCC NES Consent Conditions Reference Guide.

WCC NES Consent SR447741		
General conditions	Associated Management Plan	Specific Section of the Management Plan
<p>(a) The proposed activity as shown on Beca plan 'Overview Plan' Drawing No. 3262332- DA-1001 Rev A dated 29/05/2019, must be undertaken in accordance with the Beca Limited Contaminated Soils Management Plan dated 7 August 2019 (CSMP) and the information provided with the application Service Request No. 447741.</p> <p>Note: The conditions relating to the Omaroro Reservoir Designation Number 135 need to be met and an outline plan(s) submitted as necessary.</p>	<p>Erosion & Sediment Control Plan (ESCP)</p> <p>No specific section of the CEMP addresses this condition. Compliance with this condition by HEB Construction is bona fide.</p>	7.5. Contamination
Contamination	Associated Management Plan	Specific Section of the Management Plan
<p>(b) The consent holder must be consistent with the following standards and guidelines: i. Contaminated Land Guidelines No.1 – Reporting on Contaminated Sites in New Zealand (Revised 2011), Ministry for the Environment</p>	Erosion & Sediment Control Plan (ESCP)	7.5. Contamination
<p>(d) In the event of unexpected contamination and hazardous materials discovery at the site, the Engineer's Representative shall consult with the SQEP who must comply with the procedure outlined in Section 3.2.3 of the Contaminated Soils Management plan.</p>	Erosion & Sediment Control Plan (ESCP)	7.5. Contamination

3.4. Erosion & Sediment Control Guidelines.

The nature and design criteria for all erosion and sediment controls used within the administrative boundaries of the Greater Wellington Regional Council are prescribed within the "Erosion and Sediment Control Guidelines for the Wellington Region" (September 2002) reprinted in June 2006. These Guidelines are prescribed by GWRC resource consent conditions 8 and 9(l). Condition 8 sets the Guidelines as a minimum standard and condition 9(l) seeks to identified variations from these Guidelines. Variations that GWRC must approve.

HEB Construction is a member of the International Erosion & Sediment Control Association and recognises that Regional Councils across New Zealand have their own Guidelines which are all relatively similar and originally based on an old Auckland Council Document known as TP90 or Technical Publication 90. Following extensive industry consultation in 2016 Auckland Council

replaced TP90 with a revised document – Guidance Document 05 (GD05) (**Refer Figure 6**). It is best and most up-to-date erosion and sediment control technical document available and provides industry best practice that is current. Recognising that Condition 8 sets the older Wellington Guidelines as a minimum standard HEB Construction will conform to GD05 with the view that it is a higher standard and seek to have this accepted via Condition 9.

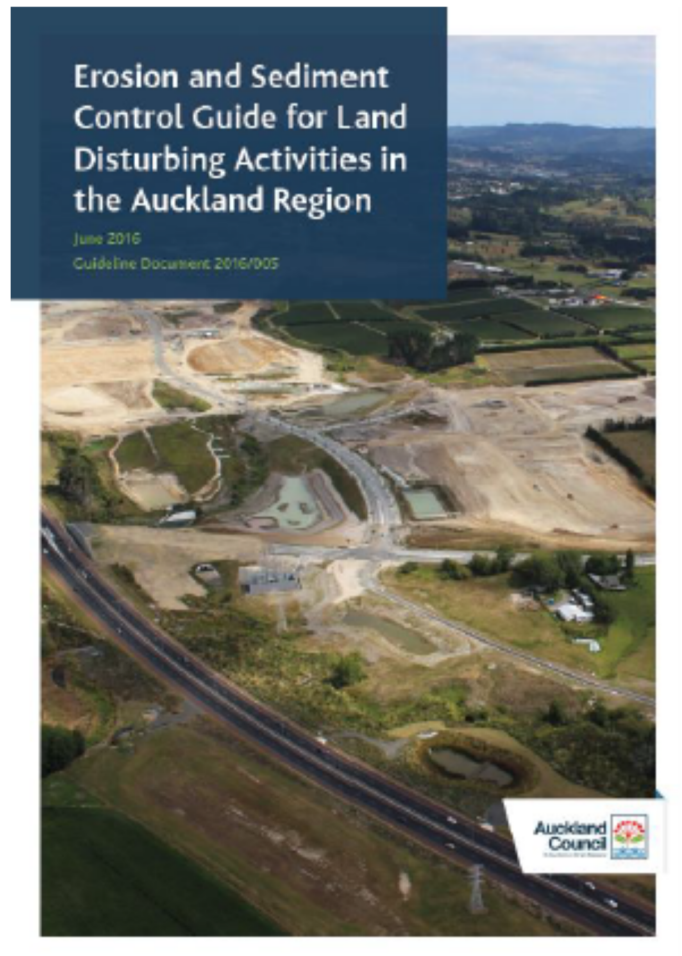


Figure 6: Guidance Document 05 (GD05)

4 Erosion & Sediment Control Development.

The development of effective erosion and sediment control requires a combination of experience and training for the team who will lead the Projects compliance with ESC conditions.

4.1. Appropriately experienced and qualified Sediment Control Managers

Pursuant to Condition 10 and 11 of GWRC resource consent the Project nominates Elisa Chillingworth, Dr Chris Wilcox, and Simon Cathcart as “suitably qualified and experienced professionals” for compliance, management and advice of ESC and chemical treatment for the Project. As such HEB Construction take all responsibility for the implementation, operation, management and maintenance of all erosion and sediment controls.

4.1.1. Elisa Chillingworth (HEB Construction Ltd)

The management of all onsite environmental controls will be overseen by Elisa Chillingworth, the Environmental Advisor for the Project. Elisa has most of the last 3 years as an Environmental Advisor and Seal Handler Team Leader on the North Canterbury Transport Infrastructure Recovery (NCTIR), Kaikōura Earthquake Rebuild; Kaikōura. Elisa’s responsibilities included:

- ensuring compliance with all resource consent conditions;
- preventing prosecutions, abatement notices or fines;
- advising Environmental Systems Manager on resolutions of environmental issues;

- promoting achievement of environmental targets and objectives;
- preparing information for consent related approvals;
- assisting with new consents and archaeological authorisations and associated variations;
- Advising on environmental issues such as erosion and sediment controls, cultural heritage and archaeological matters, ecology, dewatering, contaminated sites, vegetation clearance, demolition, storm-water quality, landscaping, noise and vibration;
- Undertaking or coordinating environmental monitoring requirements including archaeological, noise, vibration, dewatering and erosion and sediment control.

Elisa has a Bachelor of Science Degree (BSc (Hons)), from Nottingham Trent University, England (2013) and has 4 years' experience working in the environmental management and compliance field. Elisa has in recent years spent most of her time working on multidisciplinary infrastructure projects. Her recent roles have been providing environmental management support, planning, and Erosion and Sediment Control management for large infrastructure projects including NCTIR, Ahaura Bridge Replacement (NZTA), and Tunnel 21 (KiwiRail).

Elisa will provide regular monthly specialist onsite environmental advice to the Project team.

4.1.2. Chris Wilcox (HEB Construction Ltd)

Water treatment and dewatering design will be overseen by Dr Chris Wilcox. He will also provide advice around ESC. Chris is part of HEB Constructions environmental team and while primarily based in Auckland is available to offer his specialist chemical and water treatment expertise throughout NZ.

Chris has a PhD in Chemistry from the University of Auckland and has been in the environmental and water treatment space for construction and earthworks since before he finished his PhD (4 years). Chris has been with HEB Construction since 2019 and prior to that worked for an erosion control company developing their water treatment chemical plant.

4.1.3 Simon Cathcart (HEB Construction Ltd)

The management of all onsite environmental controls will be supported by Simon Cathcart, the HEB Construction National Environmental Manager. Simon has been HEB Constructions National Environmental Manager for the last 4 years and worked as the Environmental Manager on 3 Sections of the Waikato Expressway (Roads of National Significance), Te Rapa Section, Cambridge Section and then the Huntly Section where he was also responsible the planning, design, implementation, operation, and monitoring of all environmental controls.

Simon has a Master of Science Degree (MSc (Hons)), Environmental Science from the University of Auckland (1995) and has over 20 years' experience working in the environmental management and compliance field. Like Elisa, Simon has in recent years spent most of his time working on multidisciplinary infrastructure projects.

5. Environmental Management Personnel

5.1. Organisational Chart

The Project's organisational structure environmental staff and specialists for the Project is illustrated in Omaroro Project Organisational Chart (**Refer Appendix 2**).

5.2. Erosion & Sediment Control Key Staff Contact Details.

Position	Contact Details	Principal Responsibilities
Full Time / On Site		
Project Manager	James Lake HEB Construction Ltd E: james.lake@heb.co.nz M: 027 450 7239	<ul style="list-style-type: none"> • Principal Project contact for Wellington Water, WCC, GWRC, CRG and DoC. • Responsible for all day-to-day construction operations on the Project.

		<ul style="list-style-type: none"> • Overall responsibility for ensuring environmental compliance is maintained onsite and all actions identified by onsite inspections are completed. • Ensure that the site is available to the Compliance Manager or other Council representatives for inspections if required subject to receiving the appropriate site induction and health and safety briefings. • Implementation of the CEMP and sub management and mitigation plans onsite.
Project Engineer	Mark O'Hare HEB Construction Ltd E: mark.ohare@heb.co.nz M: 027 306 6341	<ul style="list-style-type: none"> • Principal Earthworks Management. • Collation of Project environmental monitoring data.
Routinely On Site / Based Remotely		
Environmental Advisor	Elisa Chillingworth HEB Construction Ltd E: elisa.chillingworth@heb.co.nz M: 027 488 8151	<ul style="list-style-type: none"> • Specialist Environmental Advisory and support. • Project Ecologist and Landscape support. • Provision of Environmental Training (Erosion and Sediment Control, Management of Hazardous Substances, Archaeological site Management, Emergency Spill Response). • Completion of monthly project environmental management reports. • Completion of routine monthly environmental inspections. • Completion of routine monthly construction noise monitoring. • Priority on-site compliance assistance as required.
On-call/ Based Remotely		
Chemical Treatment Specialist	Dr. Chris Wilcox HEB Construction Ltd E: chris.wilcox@heb.co.nz M: 021 181 9105	<ul style="list-style-type: none"> • Provision of Chemical Treatment/Dewatering Training for Project team. • Completion of routine 6 monthly chemical treatment audits. • Priority on-site compliance

<p>National Environment Manager</p>	<p>Simon Cathcart HEB Construction Ltd E: simon.cathcart@heb.co.nz M: 027 838 5127</p>	<p>assistance as required.</p> <ul style="list-style-type: none"> • Principal Project liaison with Heritage NZ. • Completion of routine 6 monthly environmental audits. • Completion of routine 6 monthly environmental management system reviews. • Priority on-site compliance assistance as required. • Specialist Resource Management and Planning assistance as required.
<p>Project Ecologist</p>	<p>Stephen Fuller Boffa Miskell Ltd E: Stephen.fuller@boffamiskell.co.nz P: (04) 385-5798</p>	<ul style="list-style-type: none"> • Specialist Ecological (Avifauna, Lizards) assistance as required.

6 Environmental Conditions

6.1. Soil & Geotechnical Information

The Geological Map of New Zealand¹ shows the site to be underlain by grey sandstone-mudstone sequences and poorly bedded sandstone with minor coloured mudstone, conglomerate, basalt chert and rare limestone of the late Triassic/early Jurassic Rakaia Terrane.

6.2. Hydrology

The Papawai Stream is a perennial stream which flows in a northerly, then easterly direction adjacent to the lower playing field along its western edge and exits the site into the city stormwater at the top of Papawai Terrace. The stream is separated from the lower field by an earth bund, constructed some years ago to prevent on-going flooding of the field.

A tributary of the Waitangi Stream, known as the Waitangi Tributary, flows down a gully to the west of the site and exits the site into the stormwater network at the top of Rolleston Road. This unnamed tributary is perennial in its lower reaches near the upper playing field but reduces to intermittent pools upstream and eventually becomes ephemeral close to the southern end of the proposed designation.

Both identified streams have perennial flows and aquatic fauna (the Papawai stream being the most diverse habitat of the two streams) containing native fish (banded Kōkopu). The Waitangi Tributary is one of the last remaining fragments of the original Waitangi Stream, as the bulk of the Waitangi Stream is now diverted and culverted beneath Wellington City and the surrounding suburbs. The ultimate receiving environment for all discharges to Papawai Stream is Wellington Harbour some 2km north of the site

6.3. Groundwater

There are no wells/bores within 100m of the site boundary. The nearest is Bore BQ3 1/0040 which is located 300m to the east of the lower playing field, on Hanson Street.

7 Earthworks Management

The philosophy of the earthworks management and staging will to minimise the environmental impacts of the Project while ensuring efficiency is maximised. All fill material used on site will be excavated from the reservoir footprint, should it prove suitable. The specifications for this material will follow the guidelines set out in section 2.2 of the Ministry of Environment publication “A Guide to the Management of Cleanfills” 2002.

To ensure the implementation of this plan the Project nominates James Lake (Project Manager).

7.1 Cut to fill schedule

The following table 5 outlines the geotechnical profile of the site as outlined in C2HM Beca report “Hospital Prince of Wales Reservoir Geotechnical Basis of Design” appendix E “Geotechnical Basis of Design”:

Table 5: Geotechnical profile of the site

Unit	Description	Depth to top (m)	Thickness (m)
Topsoil	Soft to firm clayey organic silt; dark brown; medium to high plasticity	0	0.2
Residual soil/completely weathered Greywacke/Argillite	Stiff, clayey silt; orange-brown; low to high plasticity	0.2	0.2-1.6
	Extremely weak to very weak Greywacke/Argillite	0.4-1.8	0.3-1.0
Highly weathered Greywacke/Argillite	Weak to very weak Greywacke/Argillite	0.7-2.5	0.5-5.4
Moderately weathered Greywacke/Argillite	Weak to moderately strong Greywacke/Argillite	1.2-8.0	1 m+

The total excavation will result in 43,400 m³ of material excavated from the reservoir footprint. This will be stockpiled in one of the two stockpile locations on the Upper and Lower sports fields.

Of the excavated material the residual to highly weathered material will be primarily stockpiled with some moderately weathered material stockpiled to fill the remainder of the required balance. Stockpiles of different weathered material will be kept separate. Any excess moderately weathered material will be cut to waste.

The Upper Sports field is estimated to hold a compacted volume of backfill of 11,100 m³ while the Lower Sports field has an estimated compacted volume of 32,300 m³ resulting in a total volume of 43,400 m³ (compaction rate of 1.25).

The total volume of fill material required is expected to be 41,000 m³.

As previously stated, all fill material will be won from the site except the following:

- ~1,500 m³ Gap65 for haul roads and site facilities
- ~2,500 m³ drainage chip for the drainage trenches
- ~3,200 m³ of topsoil for the new playing fields
- ~4,000 m³ of topsoil to cover the backfill of the reservoir

7.2 Staging of Works

The following sequence of activities describes the anticipated earthworks schedule:

1. Sediment Controls including Perimeter silt fences, bunding, and sediment ponds will be installed on the playing fields. “As Built” documentation will be completed and submitted to GWRC to certify these controls prior to works commencing.
2. The upper and lower playing fields will have their topsoil (~200 mm) stripped to waste.
3. The erosion and sediment controls will be installed.
- 4A. The reservoir excavation will begin with the topsoil being stripped to waste. Material will initially be stockpiled on the lower playing field. (**Refer Figure 8**)
- 4B. Water main installation will occur concurrently on the upper field. (**Refer Figure 7**)

5. When stockpiling begins on the upper field a ramp will be constructed to allow access from the excavation to the south western side of the stockpile location.
6. When the reservoir excavation reaches the base floor, the tunnel earthworks will occur. Depending on stockpile levels and requirements this may be cut to waste.
7. The stockpiles will be stabilised once they are complete to cut down on sediment produced and visual pollution. This will occur in stages prior to the stockpiles being completed to minimise sediment production.
8. Once the reservoir is constructed the backfill operation will occur. Selected materials from the stockpiles will be blended together then mixed with cement to produce cement stabilised backfill which will backfill a portion of the excavation. The remainder of the backfilling will not be cement stabilised. Once the excavation backfill is complete the overland surface will be shaped to the design level.
9. A portion of the highly weather material will be kept and used as a capping on the reservoir.
10. Imported topsoil will then complete the covering of the reservoir.
11. After the stockpiles have been exhausted any remainder material will be cut to waste.
12. Topsoil will be imported for the reinstatement of the playing fields.

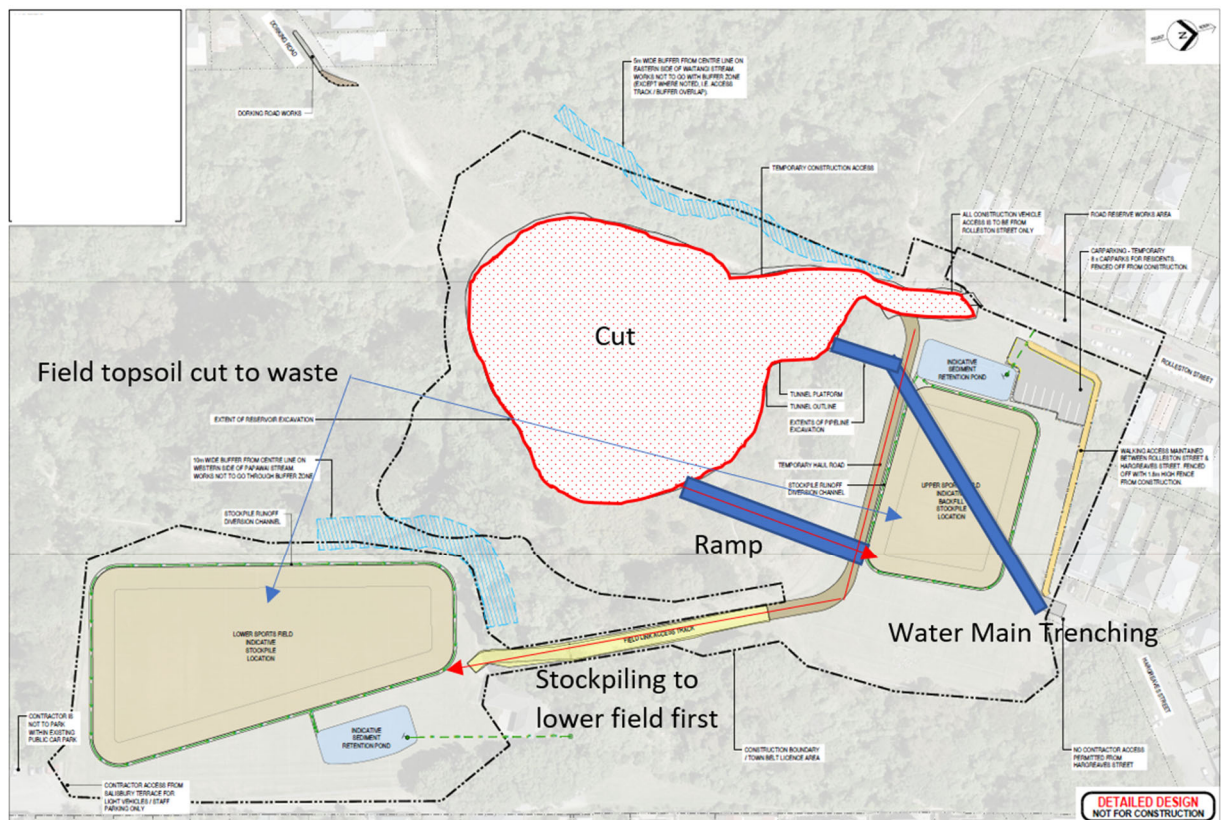


Figure 7: Steps 4A and 4B of the anticipated earthworks schedule.

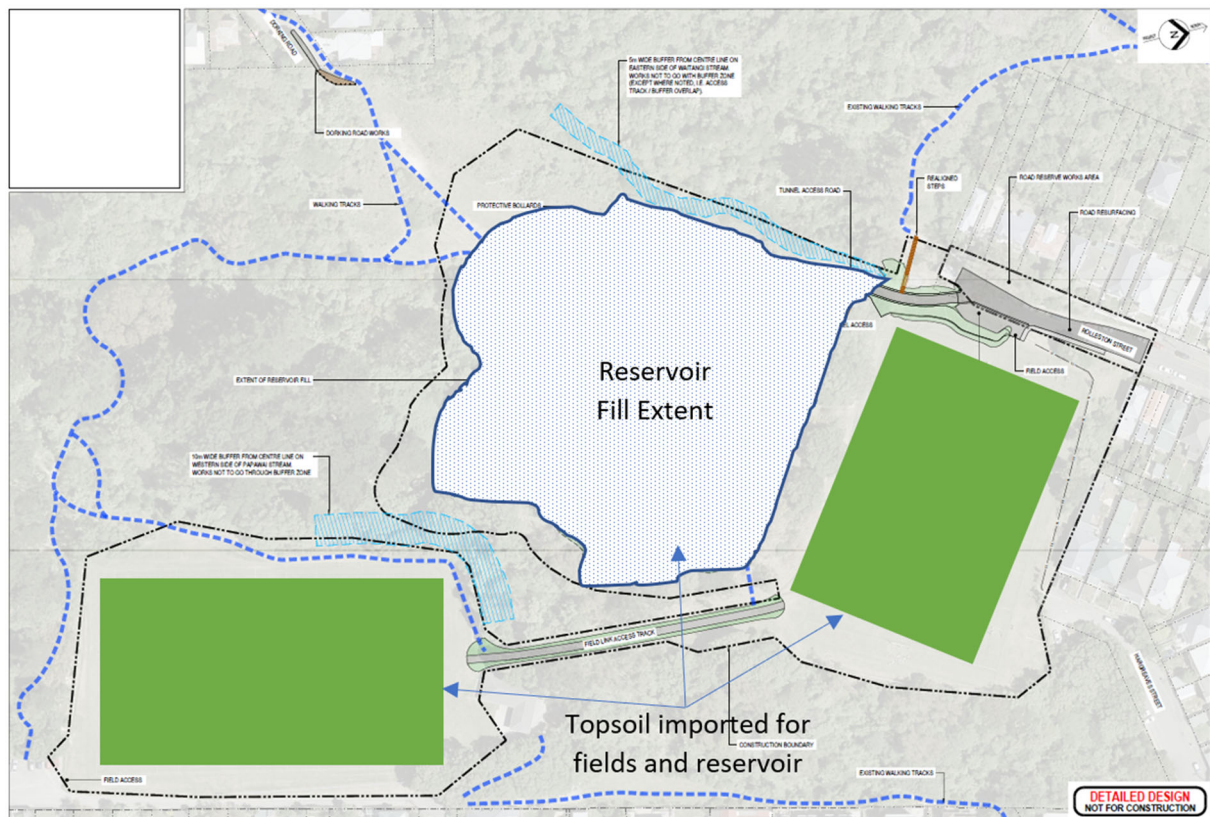


Figure 8: Steps 4A and 4B of the anticipated earthworks schedule.

7.3 Slopes and batters

Slope batters will be designed by a geotechnical engineer to ensure stability. The geotechnical engineer will monitor the batter slope construction to ensure they are in accordance with the design. While the final design is not yet complete a minimum setback of 10 m of the stockpiles from the northern and eastern boundary of the upper field and the eastern boundary of the lower field will be maintained if possible. If it is not possible then the recommendation will be completed by a suitably qualified geotechnical professional and outlined in his/her assessment.

7.4 Stability

A geotechnical assessment will be conducted by Lars Schmidt who is a suitably qualified geotechnical professional. This assessment will include (but not limited to):

- Stability of existing banks or retaining walls located below the playing fields;
- Stability of the field link access track between the playing fields;
- Differential settlement and potential associated erosion of the proposed fill;
- Stability of the proposed fill covering the reservoir and existing slopes to the south east and north of the reservoir;
- The conceptual design for the tunnel excavation and access stability;

This report will be seconded by a suitably qualified geotechnical professional from a third-party consultancy to ensure best practice.

The methodology and design however are not yet finalised and will be added to this plan once completed at least 15 days prior to construction. The methodology and design to ensure stability of temporary and permanent excavations, fill areas and stockpiles will be completed in consultation with a qualified geotechnical engineer and peer reviewed by a third party geotechnical professional to ensure that the methodology and design are in accordance with current industry best practice.

7.5 Contamination

7.5.1. Background Investigations.

Wellington Water commissioned Beca Ltd (Beca) to undertake a Detailed Site Investigation (DSI) for the Prince of Wales Playing Fields for works associated with the construction of the Omaroro Reservoir. The DSI was undertaken to characterise contamination present in materials beneath the playing fields as a result of current and historical activities. The DSI was prepared following two Preliminary Site Investigation (PSI) reports, one for the upper field (prepared by CH2M Beca Ltd, dated Oct 2012) and one for the lower field (prepared by Beca Ltd, dated October 2017). The PSI reports identified that the sites have generally been used for recreational purposes since being incorporated within the Wellington Town Belt in the early 1890's. The following findings and MfE Hazardous Activities and Industries List (HAIL) activities were identified for the site (as having occurred or potentially occurred at a 'more likely than not' level of certainty):

- A10 persistent pesticide use associated with the maintenance of the sports turf.
- The PSI for the upper playing field reported that the site may have been the location of a clay brick manufacturing facility or was potentially used for the disposal of waste material or products associated with the operation. The HAIL codes for the upper playing field have therefore been identified as A10 and G5 (waste disposal to land).

While the PSI for the lower field does not identify any historic works prior to the 1890's (when the site was incorporated within the Town Belt), it is assumed that the site has been subject to earthworks in the past to form the current flat topography. The results of the ground investigation work indicate that the risk of contaminants from any previous earthworks is low; however, it should be noted that the source and depth of any materials imported to the site are unknown. As the investigation only extended as deep as two metres below ground level, there is a possibility deeper fill material or material in areas not directly sampled by this investigation contain contaminants inconsistent with the results of this investigation.

Ground investigation works were undertaken in February 2019 and comprised 14 test pits which were excavated to a maximum extent of 2m bgl, from which 29 samples (plus two duplicate samples) were taken. Soil analytical results showed low levels of heavy metals, PAH and organochlorine pesticides in a number of samples across the site at varying depths. However, no contaminant concentrations exceeded the NESCS criteria for 'commercial / industrial outdoor worker (unpaved)', or 'recreational' criteria based upon the site's continued future use as a sports turf, nor did they exceed the adopted environmental protection criteria. There was evidence of a weathered orange brick within one of the upper field test pits along with further fragments of brick in this test pit.

Soil analytical results do not indicate that the site has been significantly impacted as a consequence of historical landuse activities, such as pesticide application and potentially disposal of clay works products, and the human health and environmental risk is considered low. Overall, recorded soil contaminant conditions should not prohibit the proposed development of the site for the use of material stockpiling associated with the construction of the reservoir. The exposure pathway assessment has identified no potentially complete exposure pathways.

Due to low level concentrations of heavy metals, PAH and organochlorine pesticides above published background concentrations it is likely that the classification of managed fill will apply. It is recommended that acceptance of soil should be confirmed with the disposal site operators prior to the commencement of any future earthworks.

7.5.2. WCC NES Consent

Based on the results of this investigation, the works required a controlled activity resource consent under Regulation 9 of the NESCS which was obtained (**Refer Table 4C for Conditions**). The low level of contaminants mean that the land disturbance works will not trigger the requirement for consent under the contaminated land provisions in the Greater Wellington Proposed Natural Resources Plan.

Condition (a) of the consent requires that activity as shown on Beca plan 'Overview Plan' Drawing No. 3262332- DA-1001 Rev A dated 29/05/2019, must be undertaken in accordance with the Beca Limited Contaminated Soils Management Plan dated 7 August 2019 (CSMP) and the information provided with the application Service Request No. 447741 (Refer Appendix 3).

Should any signs of contamination be discovered then the CSMP will be implemented.

8 Erosion & Sediment Control Toolbox

This section of the ESCP discusses the range of different tools that will be employed by HEB Construction to control and manage erosion and sediment control on the Project.

8.1. Design Philosophy

The following statements have been established to assist with understanding the philosophy that HEB Construction have applied to the Project's ESCP.

- Erosion control will be considered as much as sediment control in the design of treatment options with an overall goal of high-quality discharges of treated water.
- The ambient ground Infiltration capacity will be encouraged wherever possible.
- A "treatment train" approach shall be adopted.
- As a priority clean water will be isolated from dirty water.
- Perimeter controls will be employed at a minimum height of 0.55m.
- Disturbance of soil within the Designation boundary will be staged and limited wherever possible to reduce the risk of sediment generation through erosion.
- Areas of disturbed soil will be stabilised either temporarily or permanently as soon as practicable to limit sediment generation through erosion.
- Creation of long approaches or pathways to sediment treatment devices greatly improves their performance.
- Over design or "super-sizing" sediment treatment devices greatly improves their ability to remove sediment, with a target of 6% design volume being a minimum standard for SRP capacities.
- Chemical treatment will be used on sediment ponds and decanting earth bunds where required.
- Large particle drop out structures will be utilised prior to dirty water being delivered into sediment ponds and decanting earth.
- 24 hour, 7 days a week, 365 days a year maintenance access to all devices will be a priority.

8.2. Treatment Train Approach

A "treatment train" comprises a series of best management practices and/or natural features, each planned to treat a different aspect of pollution prevention, or in this instance sediment prevention, that are implemented in a linear fashion to maximise the sediment removal. Erosion and sediment controls will be linked together each performing a specific role in terms of either surface water management, soil protection and stabilisation, and sediment capture. This approach will see a combination of structural and non-structural practices.

8.3. Management & Design Objectives

The management and design objectives of the ESCP are to:

- To operate in full compliance with the designations and resource consent requirements and demonstrate this through reporting procedures and third party compliance monitoring.
- To operate in full compliance with the Greater Wellington Regional Plan permitted activity rules related to soil disturbance.

- To operate in full compliance with the Resource Management Act 1991.
- To liaise closely with the Greater Wellington Regional Council and Wellington City Council and its agents during construction over matters of erosion and sediment control.
- To provide the methods that will be employed to avoid, remedy or mitigate adverse effects of sediment on the environment due to construction activities.
- To provide a safe and healthy working environment for all staff on, or near the site.
- Not to create any discharges of sediment from the construction site.
- To target a no discharge outcome through enhancement/encouragement of infiltration.
- To facilitate the very best environmental outcome through innovative, practical, and pragmatic means.

8.4. Sediment Controls

The Guidelines identify a large number of sediment treatment devices/techniques available to be used as part of erosion and sediment control. For the Project a reduced number of controls will be used. These include:

- Silt and filter socks
- Hay mulching
- Perimeter and clean water diversion bunds
- Check dams
- Sediment pits
- Stabilised entranceways
- Haul Roads
- Standard silt fences
- Super silt fences
- Sediment retention ponds
- Rapid cut and cover
- Road Sweeping
- Water Carts and Dust Suppression.

The use of these sediment controls on the Project will be discussed hereafter.

8.4.1. Silt Socks

Silt socks will be used as a secondary control within larger treatment areas. They are particularly useful for controlling the velocity of stormwater or sediment laden water on route to treatment devices such as sediment retention ponds. Silt and filter socks will be frequently positioned in roadside swales adjacent entranceways, around storm water inlets and cesspits, and along perimeters of flat or near flat sections of exposed material. Socks will frequently be used in series to provide a stronger accumulative treatment than when used in isolation.



Photo 1 & 2: Silt or Filter Socks used as edge protection.

8.4.2. Hay mulching

The use of meadow hay to stabilise the surfaces against erosion will be a strong feature of the Project. Application of hay mulch will be achieved either by hand, blower, and broadcast using larger machinery. The 4000kg/ha application rate identified within the guidelines will be used as a minimum, however HEB Construction recognise that frequently mulch needs to be replenished either to replace lost coverage due to wind shifting the mulch from where it was applied or due to the hay breaking down over time. HEB Construction will use the simple rule of thumb that exposed bare soil should not be visible where mulch has been applied as a measure of whether sufficient coverage has been achieved. Where wind is identified as an issue the mulch maybe supplemented with polymer additive in order to secure the mulch in place. Fertiliser and grass seed will not be added to the mulch unless the mulch is being used to close out an area and the final surface is intended to be grass.



Photo 3: Hay Mulch applied to large surfaces following completion to stabilise.

8.4.3. Perimeter Bunding & Clean Water Diversions.

0.55m high and 2m wide perimeter bunds will be installed in almost all areas of the Project acting with a dual purpose. Firstly, as a physical barrier to sediment laden water trying to leave the construction area and secondly as a physical barrier for clean water attempting to enter the site. Keeping these two types of water separate is a key component to this plan. The bunds will encompass a treatment area for devices such as sediment ponds. The bunds will be compacted by an excavator using the bucket to shape and strengthen the bund. In some areas the bunds will also be track rounded to further enhance compaction. Both sides of the bund will be progressively stabilised using hay mulch or geotextile fabric. Clean water diversion bunds may also have additional armouring such as geotextile fabric layers and/or check dams of aggregate or silt socks

where there is a likelihood of scouring. Where scouring is identified in an area not originally thought to be at risk of scour then the additional armouring options will be retrospectively installed. The typical construction of the clean water diversion bunds is illustrated in Figure 9 below.

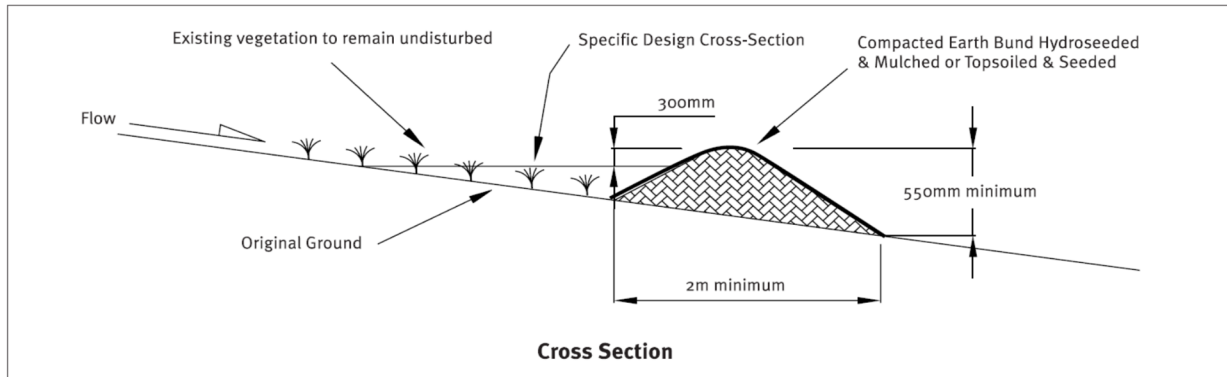


Figure 9: Minimum standard for the construction of perimeter and clean water diversion bunds.

8.4.4. Check Dams

Check dams will be constructed along flow paths and adjoining bunds seeking to lengthen the approach paths water has to travel along in order to reach the different treatment devices. By reducing the runoff speed water will have an increased opportunity to soak into the ground prior to arriving at a control and also drop out the heavier particle sizes behind these dams. Check dams may also be constructed using staked silt socks. Figure 10 below illustrates the construction guideline to be followed.

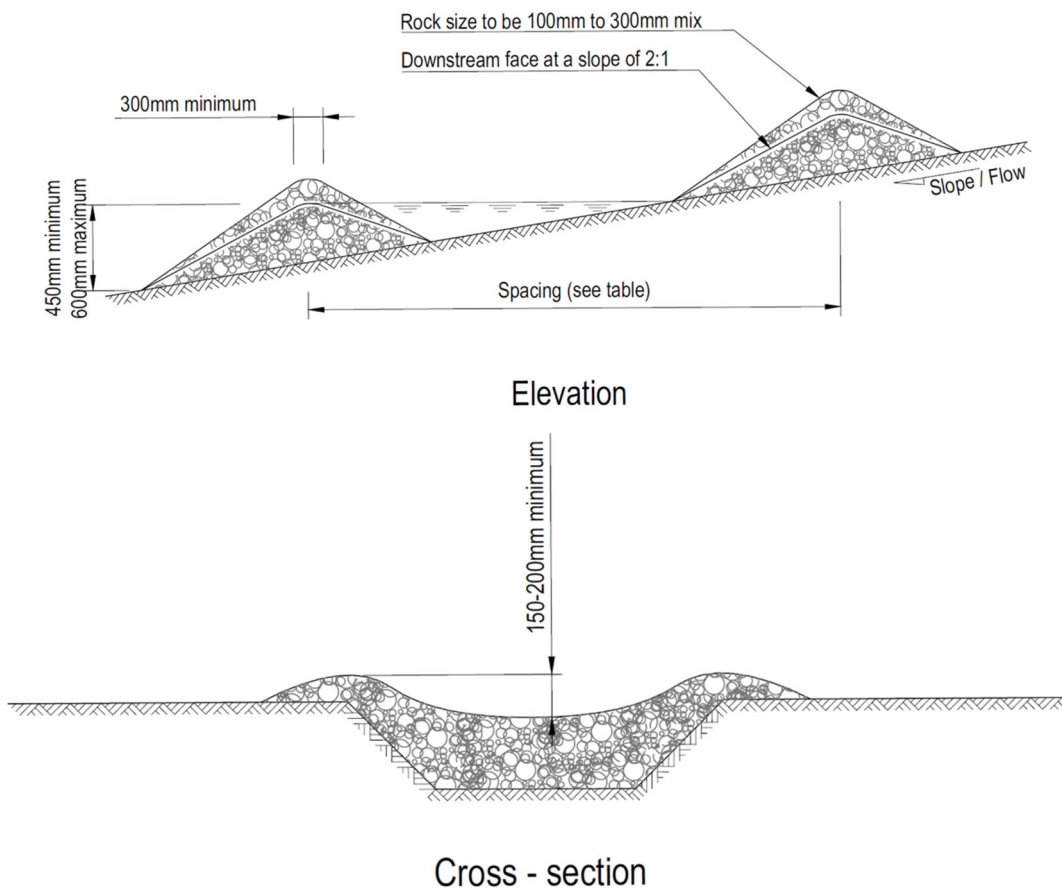


Figure 10: Check dam typical construction.

8.4.5. Sediment Traps

In steeper areas with high velocity runoff being generated, sediment pits are a useful tool for trapping and reducing the suspended sediment content of the stormwater. These controls are to be established as secondary control features to compliment the larger controls such as decanting earth bunds and sediment ponds. Sediment pits will also be used closely with stabilised entranceways where wheel washing may take place to capture dirty water resulting from the cleaning of vehicles. Silt socks may be used in conjunction with sediment pits to enhance their ability to trap fine sediment. Figure 11 below illustrates the typical use of a sediment trap adjacent to a track or road.

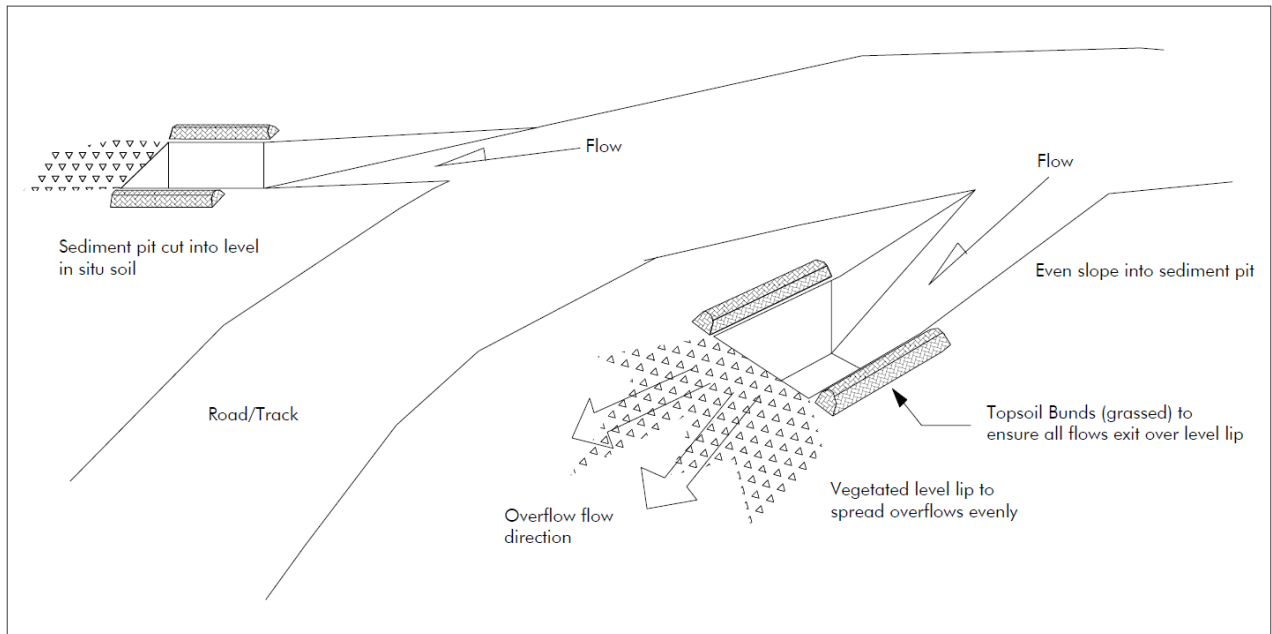


Figure 11: Sediment Pit use adjacent a track or road.

8.4.6. Stabilised Entranceways

Stabilised entranceways will be used to access the construction site. It is anticipated that at least 2 such entrances will be constructed to provide a strong surface for construction traffic to cross local roads and enter/exit site (refer to photo 3 below). Figure 12 below illustrates a generic entranceway/crossing arrangement.



Photo 3: Typical appearance of a stabilised entranceway.

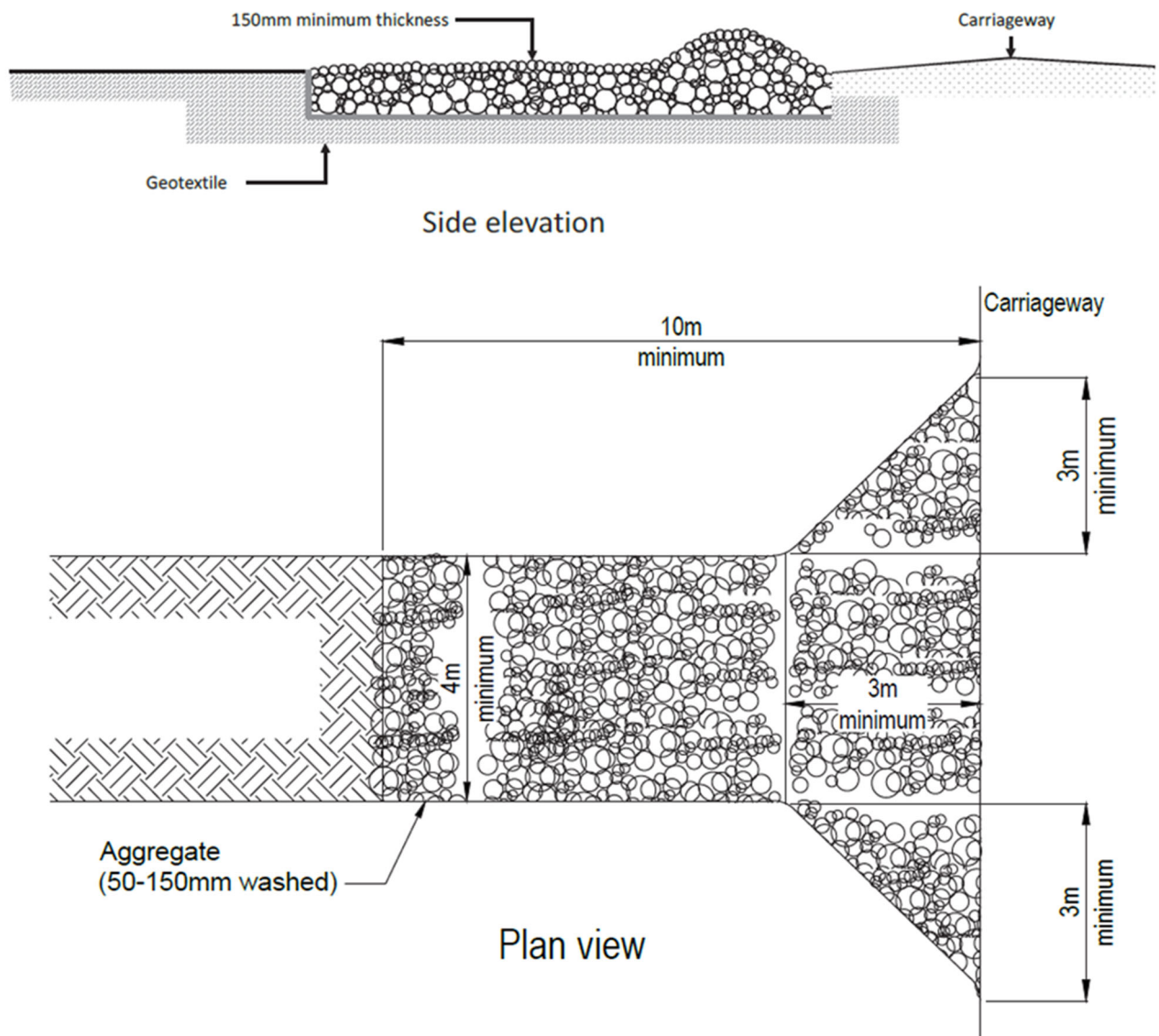
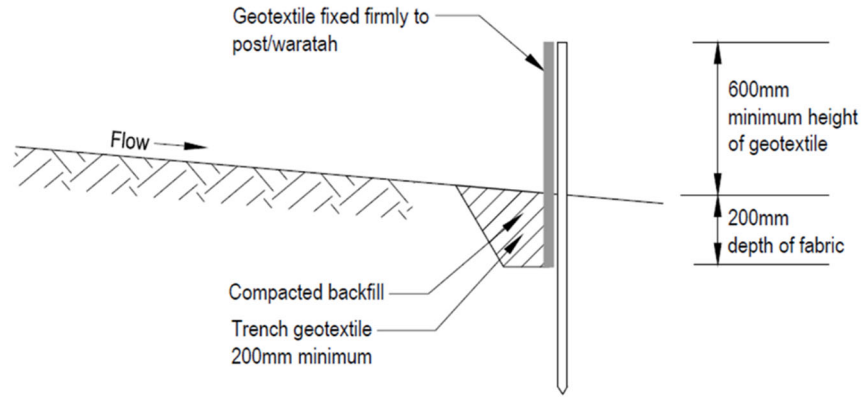


Figure 12: Typical Construction of a Stabilised Entranceway.

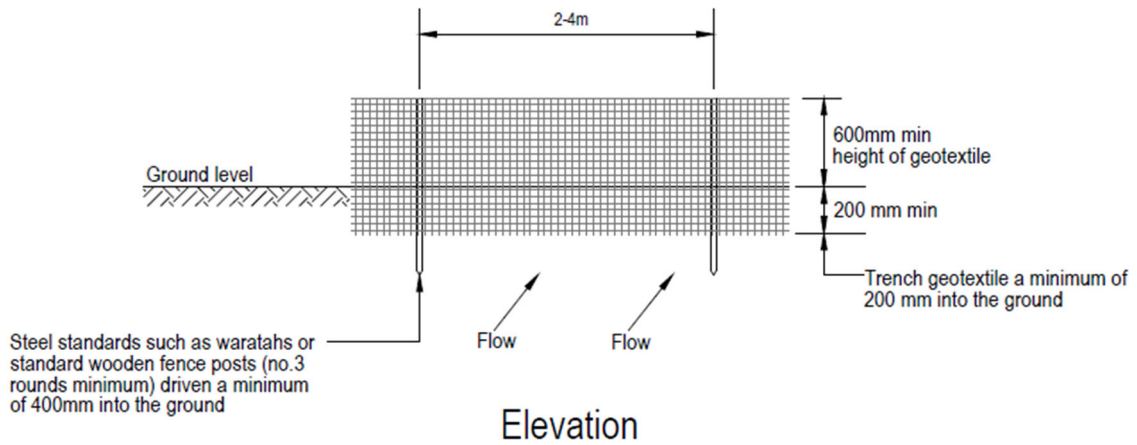
8.4.7. Silt Fences

The use of silt fences on this Project will be limited as HEB Construction recognise the ability of silt fences to treat sediment laden water is inferior in terms of the percentage of sediment that they are able to remove to that of controls such as sediment ponds. Silt fences are also a vulnerable control within a construction site environment as they are very easily damaged and rendered non-compliant. Despite these limitations silt fences do have their place and provided they have a sufficient detention area behind the fence for dirty water they can operate successfully. HEB Construction's use of silt fences will be limited to smaller discrete areas where space is limited and a superior control such as a Sediment Retention Pond is unable to be constructed either safely or at all. Figures 13 and 14 below illustrates the construction details for a standard silt fence.

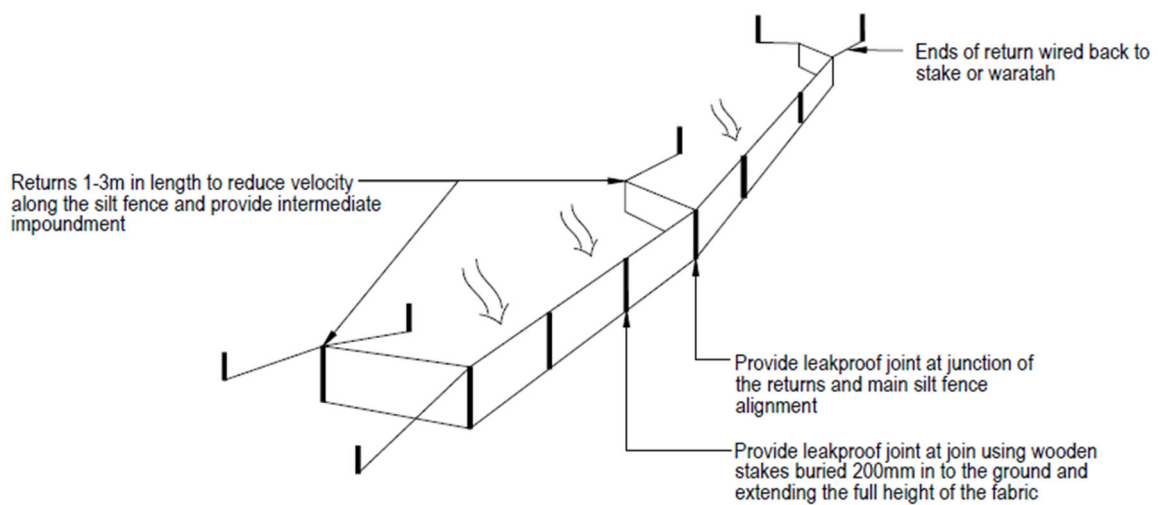


Cross - section

Figure 13: Standard Silt Fence Construction Cross-Section Detail.



Elevation



Silt fence with returns and support wire

Figure 14: Standard Silt Fence Construction Elevation Detail.

8.4.8. Super Silt Fences

Super silt fences will almost certainly be used on the Project, particularly in areas with smaller treatment catchments that are unable to be directed to Sediment Retention Ponds **and where a standard silt fence is not appropriate**. Photo 4 shows a typical super silt fence. Figure 15 below illustrates the typical super silt fence construction detail to be used.

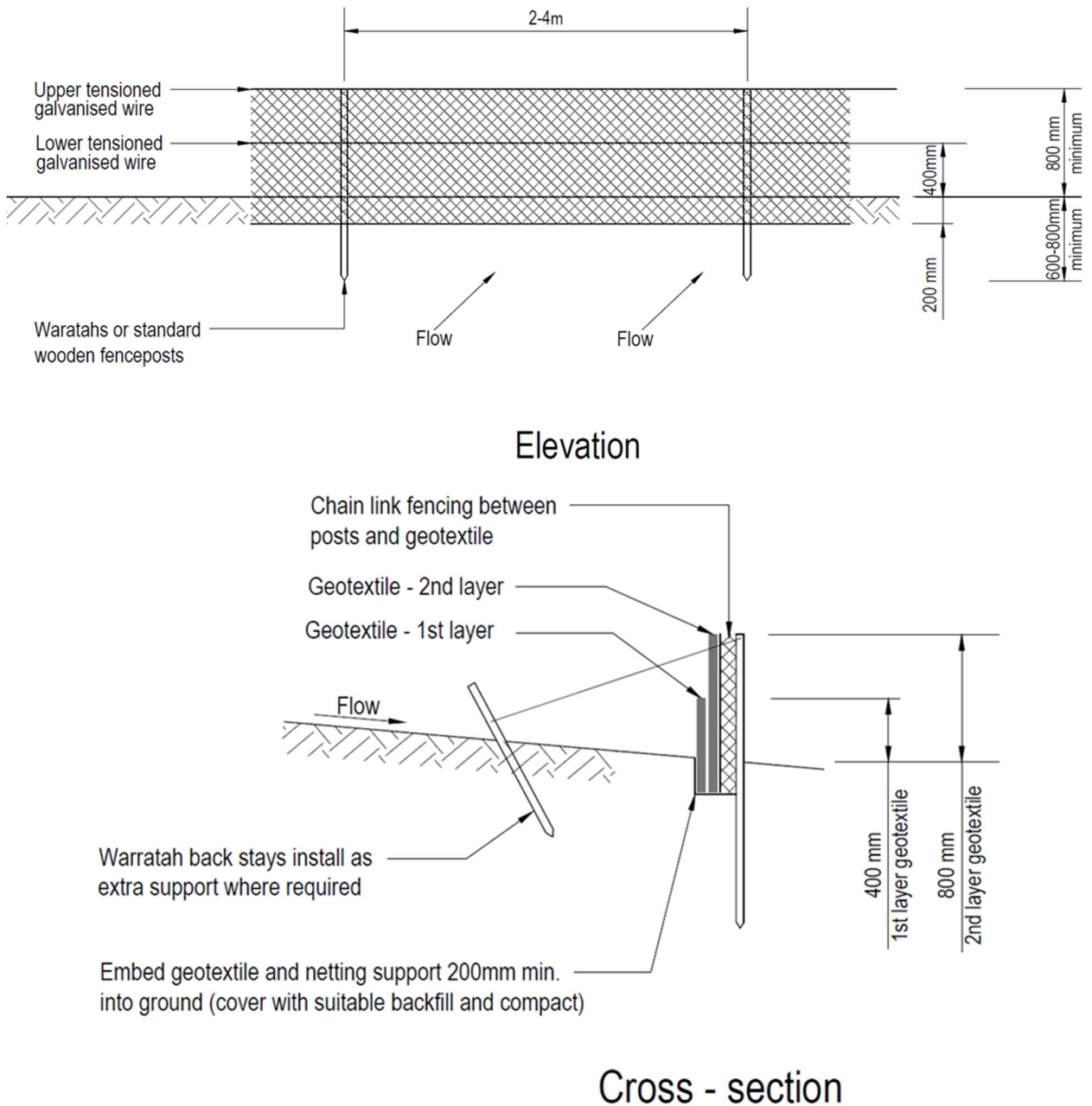


Figure 15: Super Silt Fence Construction Detail.



Photo 4: Super Silt Fence

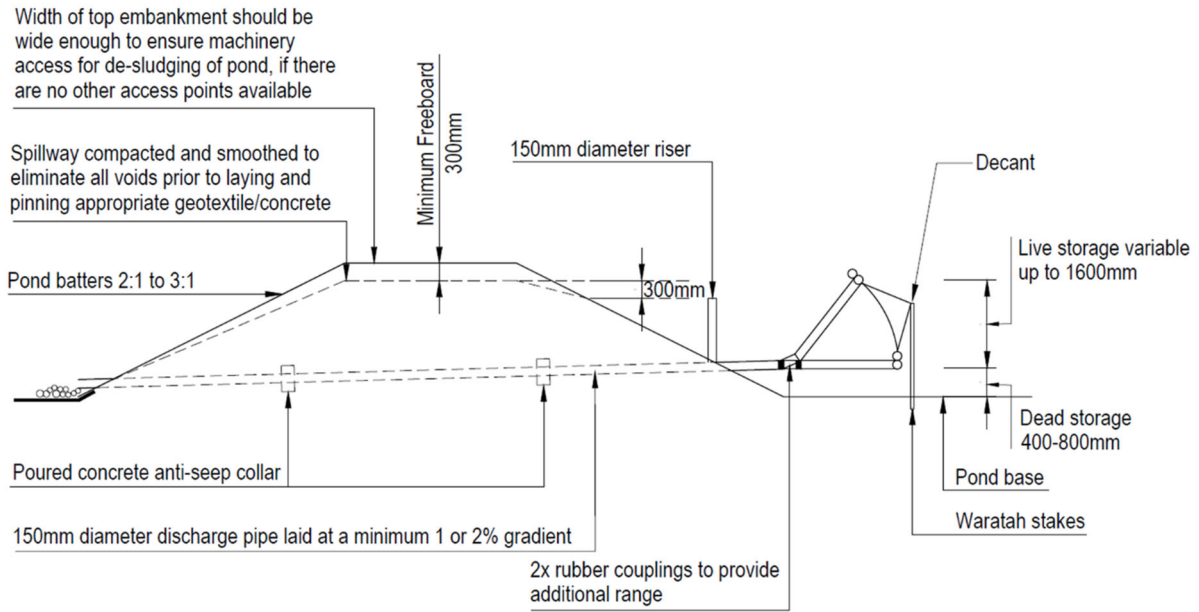
8.4.9. Sediment Retention Ponds

Two sediment retention ponds (SRPs) are proposed on the Project. The construction of one the ponds will be traditional and follow the guidelines closely (Refer Figures 16 and 17) while the other pond will be a non-traditional design (in shape) due to physical site constraints associated with buried utilities. The details of these controls can be reviewed in Section 8.5.

HEB Construction do not intend to operate the SRPs in the traditional manner where stormwater begins to decant from the pond as the water level in the pond reaches the lowest decant. Instead the intention is to over design the ponds in terms of their capacity (volume) in relation to the construction area that they treat and capture and detain stormwater within the ponds by raising the decants. Chemical treatment will be utilised. This approach will mean that sediment laden water is afforded a much longer time to settle out and consequently water quality improvements will be enhanced along with a reduction in the frequency of the discharge of treated water. Despite this approach the SRPs will still be able to function in a traditional capacity should the need arise.

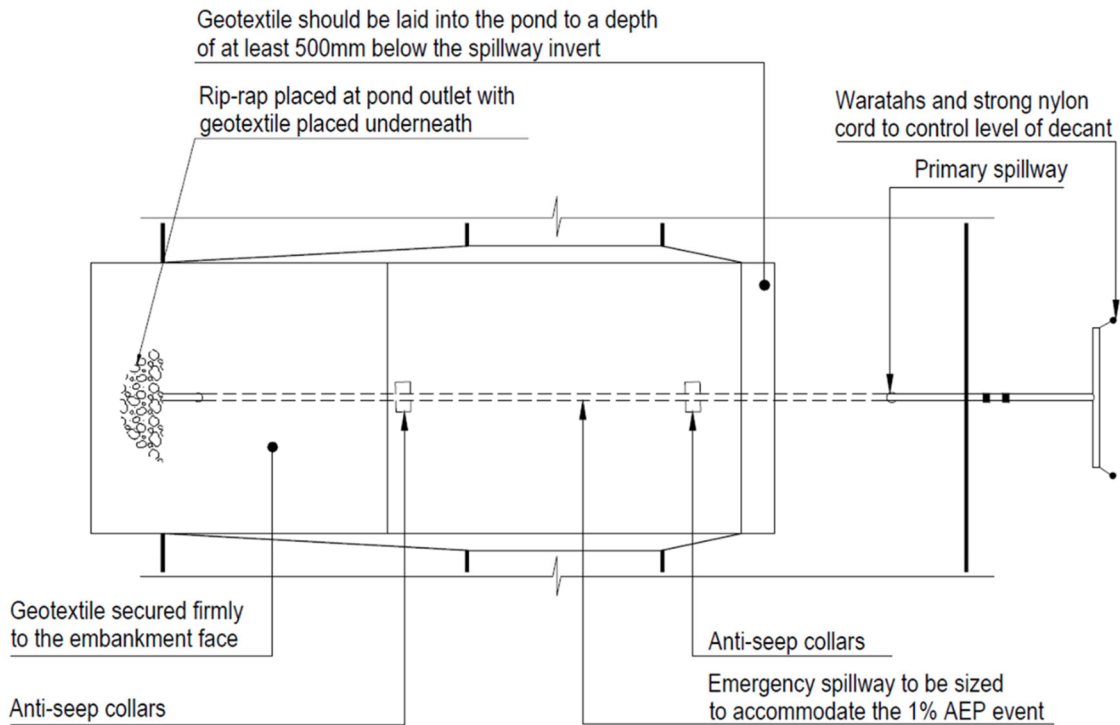
While the general design of the ponds will be in keeping with the guidelines a number of additional features will be included for each of pond to enhance the performance. Those features include:

- The ponds significantly exceed the minimum standard of 2% of the catchment. The target is to achieve a 6% capacity.
- The floor of the pond will be tilted slightly toward the inlet of the pond to enhance the residence time within the pond.
- Silt fences will be installed approximately 1/3 and 2/3s of the way along the pond floor across the entire width of the pond. The silt fence acts as a baffle and enhances the actions of flocculants used.
- Each decant will be attached to rope lines to enable them to be lifted out of the water to stop them from decanting. This will allow the pond to settle, or be batch dosed with flocculant should the need arise.



Cross - section

Figure 16: Sediment Retention Pond Cross-Sectional Detail.



Plan

Figure 17: Sediment Retention Pond Plan View.

8.4.10. Cut and Cover

Rapid cut and cover is a process of rapid same day construction during fine weather. The concept in terms of sediment control is that exposed dirt is not left uncovered overnight and involves small areas being worked on quickly and covered or stabilised either immediately or after several hours. The stabilisation of these surfaces will either involve aggregate, geotextile fabrics, or hay mulch.

8.4.11. Road Maintenance

The site will be regularly swept with a combination of tractor mounted road broom and sucker truck to maintain a clean road surface leaving the site. This will mitigate any spilt material that may end up on the road as a consequence of material and debris being tracked out onto the road on the wheels and tracks of vehicles. Sweeping will be carried out in a manner that ensures that material being swept is directed into zones controlled by sediment controls, for example road side swale protection in the form of silt socks or sediment pits. Photos 5 and 6 provide examples of the machinery to be used.



Photos 5 & 6: Examples of the proposed road sweeping vehicles.

8.5. Location of Sediment Controls

The site-specific details of the deployment of sediment controls is shown in Appendix 1

9 Dust Management

9.1. Dust Sources & Generation

This Dust Management Section of the ESCP has been prepared as construction of the Project involves large scale earthworks and civil construction, both activities have the potential to generate dust.

9.1.1. Potential Dust Sources Influencing Dust Generation

The construction activities that will take place throughout the Project that may generate discharges of dust to air are:

- Earthworks, including vegetation removal, stripping of topsoil.
- Vehicle movements on unpaved surfaces.
- Loading and unloading of materials.
- Wind generated dust from dry exposed surfaces such as stockpiles and yard areas
- Rehabilitation of pavements including use of cement and lime.
- Pavement construction

9.1.2. Factors Influencing Dust Generation

The major factors that influence dust generation are:

- Wind speed across the surface;
 - The critical wind speed for pickup of dust from surfaces is 5 m/s (18km/h).
 - Pickup increases rapidly above 10 m/s (36km/h).
- The percentage of fine particles in the material on the surface.

- Moisture content of the material on the surface.
- The area of exposed surface.
- Disturbances such as traffic, excavation, loading and unloading of materials.
- The height of the source above the surrounding ground level.

The smaller the particle size of the material on the surface of a road or an exposed surface, the more easily the particles are able to be picked up and entrained in the wind. Moisture binds particles together preventing them from being disturbed by wind or vehicle movements.

The larger the area of exposed material the more potential there will be for dust emissions. Vehicles travelling over exposed surfaces tend to pulverise any surface particles. Particles are lifted and dropped from the rolling wheels and the road surface is exposed to strong air currents due to turbulence between the wheels and the surface. Dust is also sucked into the turbulent wake created behind moving vehicles.

9.2. Dust Monitoring.

Due to large areas of the Project footprint being in close proximity to sensitive receivers HEB Construction recognises that nuisance dust is priority risk. As such dust monitoring and mitigation will be a focus for the construction teams. Monitoring will consist of visual checks made by the Project Manager during the day.

9.3. Sensitive Receivers

A number of neighbouring properties have been identified as sensitive receivers due to their proximity to the construction works. These properties are identified in Figure 18).



Figure 18: View of site and closest surrounding properties. The approximate location of the Reservoir site is shown in red. (Reference: Rp 001 R05 2016849W –Construction Noise Assessment, Marshall Day Acoustics).

9.4. Dust Management Toolbox

The following dust management and mitigation measures will be undertaken as required to minimise overall dust emissions and nuisance.

9.4.1. Water Resources

The Project will utilise the water held within the Sediment Retention Ponds as a primary source and will use water from the WCC water supply hydrants.

9.4.2. Water Carts

Water carts will act as the primary method for controlling dust on site (Refer Photo 7). The number of carts required, and the frequency of watering will be determined by the Construction Manager who will consider vehicle movements, weather conditions, and the proximity of the nearest sensitive receiver.



Photo 7: Water Cart in operation

9.4.3. Surface Application of Polymer Stabilisers & Hydroseed

Polymer stabilisers may be used to protect the high-risk areas and be applied to surfaces where dust has been identified as a significant risk. The inert nature of these products makes them ideal as an environmentally friendly application. The decision as to whether a polymer stabiliser will be utilised rests with Project Managers. Polymer stabilisers will only be used to treat dust nuisance issues and not be used to stabilise areas of exposed soil for erosion control purposes as this practice is not recognised by the guidelines.

Hydro-seeding of earth surfaces will also provide protection against nuisance dust. The specification for hydroseeding is contained in Section 8.4.1. Planting Species and Planting Specifications of the Landscape & Ecology Management Plan (LEMP)

9.4.4. Hay Mulch Stabilisation

Perimeter bunds established for sediment control will be hay mulched as they are established as will top soil stockpiles upon their completion. This will eliminate them as sources of sediment and dust. Hay mulch may also be used to stabilise finished areas adjacent sensitive receivers or neighbours to mitigate as much dust nuisance as possible.

9.4.5. Stockpile Management

Topsoil and spoil stockpiles will all be located on the Upper & Lower Playing Fields (Refer Appendix 1) and the surface of the stockpile stabilised with hay or straw mulch upon their

completion. Topsoil stockpiles will also be constructed with a low profile wherever possible to reduce the height of the bund and thus further reduce the stock piles ability to generate dust as it has a lower profile exposed to wind.

9.4.6. Entranceways

Stabilised entranceways will be constructed at all site entrances to minimise the tracking of material out of the construction areas and onto local roads where it would dry and become a source of dust. The standard of the construction for these entranceways is described in the guidelines.

Portable water blasters and water carts will be available to wash vehicles adjacent to the entranceways in the event of construction vehicles might be dirty and track material onto local roads. Road sweeper vehicles and sucker trucks will routinely maintain the roads around the site entrances in order to keep fine material accumulating on the road surface where vehicle movement might generate dust.

9.4.7. Restriction of Work

Where wind conditions are severe enough then construction activities may cease or be restricted to mitigate any potential dust issues. The decision to restrict or cease work all together will be made by the Construction Manager and the Environmental Manager.

To assist in making the decision the following criteria shall be reviewed:

- Wind Speed and direction currently prevailing.
- The construction activity currently being performed, and the length of time that activity is to continue.
- The distance to the nearest sensitive receptor and the nature of their sensitivity.
- The presence of historical complaints and the outcome of investigations into those complaints.
- The existence of a current complaint.
- The mitigation measures currently being applied and the additional measures that might be utilised.

9.4.8. Site Wide Communication of Dust Risk

On site delineation of the dust sensitive zones will be marked with Dust Risk signs (Refer Photo 8) to prompt and remind construction staff that they are operating in a sensitive area. Site wide text message warnings will be issued by the Construction Manager to staff when environmental conditions reach a point where a dust nuisance is possible.



Photo 8: Dust risk signs will assist with communicating the risk to construction staff.

9.4.9. Complaints

Dust complaints will be managed pursuant to Section 10 of the Construction Environmental Management Plan (CEMP).

10 Management of Dewatering

For the Project, dewatering is defined as the movement of water within the site to the controls as well as the movement of water through the controls to outside the perimeter of the Project. There are two main dewatering procedures on site:

- 1) Dewatering of the reservoir excavation to the SRPs.
- 2) Dewatering of the SRPs.

The dewatering process will involve applying for permission to dewater from one of the SQEP's outlined in the table below, with the full process outlined further in the next section. No dewatering will occur without written permission from the SQEP's:

- Mark O'Hare (Project Engineer) Mobile: (027) 306 6341
- James Lake (Project Manager) Mobile: (027) 450 7239
- Elisa Chillingworth (Environmental Advisor) Mobile: (027) 488 8151

10.1 Dewatering Procedure

In order to manage the dewatering of ponded water and sediment controls on the Project the following procedure will be followed:

- 1) The personnel managing the dewatering will request permission to dewater. The request will be made to one of the SQEP outlined previously.
- 2) The SQEP will consider the criteria listed in section 10.2 and the water quality parameters outlined in section 10.4.2.
- 3) In requesting permission, the following information will be provided to the SQEP.
 - A) The personnel to whom the permission is to be issued;
 - B) The date and time for which the permission will be valid for;
 - C) The location where the dewatering is to take place and the construction activity that it is associated with;
 - D) The receiving environment into which the water is to be disposed of i.e. one of the SRPs or the stormwater system (if dewatering SRP);
 - E) The method of dewatering to be used including detail on the inlet and outlet protection if required;
 - F) The required level of monitoring and whom will be responsible for the monitoring (see section 10.4);
 - G) The water quality standard required to be measured and recorded prior to the dewatering taking place as per section 10.4.2;

10.2 Dewatering Considerations

The SQEP will consider the following criteria before granting permission to dewater:

- The quality of the water to be discharged;
- The area into which the water is to be discharged;
- The weather conditions at the time of the proposed discharge;
- The volume of water to be discharged;
- Measures to be employed to treat or improve the water quality prior to it being discharged;
- Measures to be employed to stabilize the discharge point against erosion;
- Measures to be employed to prevent the intake from picking up dirty water;
- Potential impacts on neighboring properties associated with the discharge.

10.3 Dewatering Methodologies

The following will always be implemented when dewatering:

- The inlet of any pump will always be elevated/protected to prevent the pump sucking the bottom of the area to be dewatered;
- Where any pump outlets will be protected against erosion;
- All pumped water will always be sent through a control to be treated prior to dewatering off site;
- When dewatering into one of the SRPs the decants will be fully raised;

No amendments to the dewatering procedures will be implemented until written confirmation is received from the Greater Wellington Regional Council.

10.3.1 Reservoir Dewatering

Dewatering of the reservoir will need to occur for groundwater that seeps into the excavation, as well as rainwater that falls within the footprint of the excavation. In both instances this water will be pumped from the excavation into one of the two SRPs.

At the lowest point in the excavation a sump (approx. 1 x 1 x 1 m) will be excavated. The sump will act as a collection point for all the water within the excavation. A pump will be installed within the sump to pump any water from the excavation into one of the SRPs.

Prior to any dewatering occurring from the reservoir, the procedure outlined in section 10.1 will be followed.

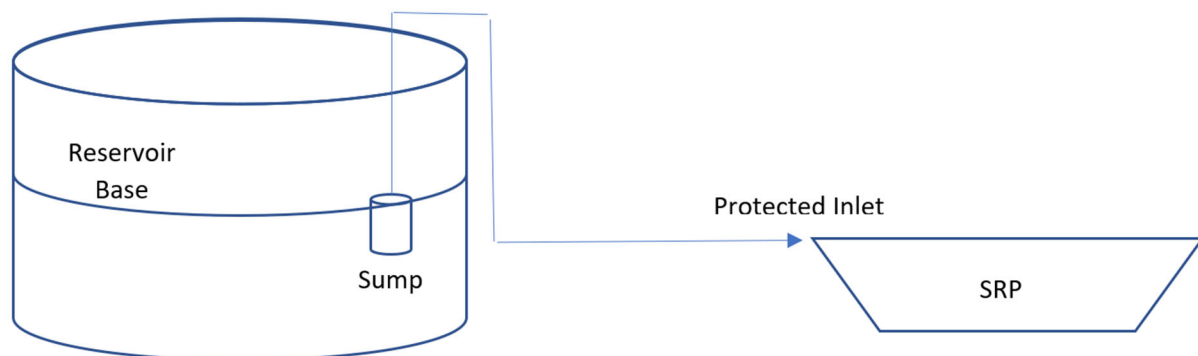


Figure 19: Reservoir Dewatering Arrangement.

10.3.2 SRP Dewatering

For this Project the ponds will not be utilized as flow through devices. Because majority of the dewatering on site is to be pumped, which will be manually controlled, the ponds will be utilized as detention basins where water will be detained, treated then discharged once the water quality parameters set out in section 10.4.2 are met.

A staff gauge will be installed in both ponds and surveyed to display the pond volumes. Whenever the pond volume goes above 50 % or the weather forecast shows that a significant rainfall event is incoming (assuming there is water in the pond) this will trigger the dewatering procedure for the SRP(s).

During normal operation the decants will be lowered to ensure that any runoff from storm events can be discharged. When dewatering of the reservoir into either SRPs occurs the decants will be raised. It is noted that the SRPs may discharge in certain extremely large storms and as such the stockpile runoff will be treated with rainfall activated treatment devices.

The SRPs will discharge through temporary stormwater drains directly into the existing stormwater network.

10.4 Dewatering Monitoring

The following sections outline the monitoring requirements for any dewatering process on the Project.

10.4.1 Reservoir Dewatering monitoring

The following parameters will be recorded and kept available when water is to be pumped:

- The pump rate;
- The date and time of each pumping commencement and completion;
- Any change in the pump rate;

These monitoring records will be kept and submitted to at the end of each calendar month. If, during reservoir dewatering, the visible flow of any nearby water body is depleted the dewatering shall immediately cease and contact made with GWRC to obtain further instructions. Dewatering will not recommence until written notification is received with permission to proceed.

In the event of unexpectedly high volumes of groundwater within the reservoir footprint that meets the discharge quality requirements set out in section 10.4.2 discussions will occur to explore the possibility of direct discharge of this water to the stormwater system. The stormwater system that will be discharged into will also need to be shown to be able to handle the anticipated discharge.

10.4.2 SRP dewatering monitoring

The water quality parameters for water discharged from the Project are outlined below. Water discharged while there is water inflow (i.e. during storm events):

- The turbidity (NTU) of the outflow of the SRPs must be 70 % less than the inflow.
- The pH of the outflow must be between 5.5-8.5.

Water discharged while there is no water inflow (after excavation dewatering and treatment):

- The turbidity of the outflow of the SRPs must be less than 170 NTU.
- The pH of the outflow must be between 5.5-8.5.

Water quality sampling of the two SRPs are to be undertaken in three different instances. Monitoring will be undertaken while the SRP is dewatering, routinely and in set trigger events. Routine monitoring shall occur weekly at a minimum. The parameters and location to be sampled for each of these three instances are set out in the tables below:

Dewatering	Location			
Parameter	Pond Inflow	Pond Forebay	Pond*	Pond Outlet**
pH				
Temperature (°C)				
Turbidity (NTU)				
Total Suspended Solids (g/m ³)***				

*Measurements taken from the pond will be analyzed prior to dewatering to ensure that the water quality parameters outlined in section 10.4.2 are met.

**The outlet will be visually observed in 15 minutes intervals during dewatering.

***TSS will only be recorded until a satisfactory turbidity correlation is created.

Routine Monitoring	Location			
Parameter	Pond Inflow	Pond Forebay	Pond	Pond Outlet*
pH				
Temperature (°C)				
Turbidity (NTU)				
Total Suspended Solids (g/m ³)				

* only to be taken if the pond is discharging.

Routine monitoring sampling will be conducted by trained personnel on site. These personnel will be trained by the SQEP outlined in 4.1.

Further sampling will be undertaken if a significant rainfall event occurs. A significant rainfall event is defined as an event greater than 7 mm in 1 hour or 20 mm in 24 hours as measured at the Greater Wellington Regional Councils "Newtown at Mansfield Street" rainfall monitoring site. This monitoring will occur as soon as practicable within daylight hours after the event. The parameters and location to be sampled are set out in the table below:

Trigger Monitoring	Event	Location			
Parameter		Pond Inflow*	Pond Forebay	Pond	Pond Outlet*
pH					
Temperature (°C)					
Turbidity (NTU)					
Total Suspended Solids (g/m ³)					

* only to be taken if the pond is discharging.

The reasonable mixing zone is defined as a point 50m downstream from any point of discharge into a waterbody. The analysis of all samples will be conducted by one of the SQEP outlined in section 4.1. If any of the parameters measured above are outside the allowable values or if there is any formation of:

- conspicuous oil or grease films
- scums or foams
- floatable or suspended materials
- conspicuous change in the color or visual clarity
- emission of objectionable odor
- any adverse effects on aquatic life

Dewatering of the SRPs will be immediately ceased by raising the decants. No dewatering will occur until the variables that are outside the allowed parameters are brought back into the allowable range. This will be done in consultation with the SQEPs outlined in section 4.1. The effect on the aquatic environment will be assessed, see section 7.4 Stream Discharges in the Landscape and Ecology Management Plan for further information.

Total Suspended Solids will be monitored in the outflows to create a correlation between the turbidity readings and TSS. This correlation will allow the turbidity reading to give a reasonable TSS reading. This will be an ongoing process until a satisfactory correlation is produced. Dissolved aluminum will not be measured due to the risks involved in holding the water in the ponds for long periods of time while awaiting lab turnaround times. Instead the pH, which is the primary factor in determining the speciation of aluminum in water, will be utilized to estimate any potential toxicity arising from the use of aluminum-based coagulants. It has been shown that so long as the pH is between 5.5-8.0 that the major form of aluminum species in water samples are aluminum hydroxides, which have negligible toxicity, whereas below 5.5 the more toxic Al³⁺ cation begins to dominate. Therefore, based on the pH requirements for discharge the concentration of dissolved Al will be at a minimum.

The results of the monitoring shall be provided to GWRC within 2 working days of the date the sampling was undertaken.

10.5. Water Quality Sampling Methodology

10.5.1 pH

The following procedure is outlined for the measurement of pH:

1. Ensure the pH meter has been calibrated and that the calibration has not expired.

2. Use the water that is to be measured to rinse out the small container. This will be discarded, and a fresh sample taken from the source to be measured.
3. Immerse the pH meter in the sample water and gently shake until the reading stabilizes.
4. Record the pH reading given on the meter along with the date, time and source of the water (e.g. SRP, outlet).

10.5.2 Temperature

The following procedure is outlined for the measurement of temperature:

1. The pH meter used above will also provide a temperature reading.
2. This measurement will be recorded along with the date, time and source of the water.

10.5.3 Turbidity

The following procedure is outlined for the measurement of turbidity:

1. Ensure the turbidity meter has been calibrated and that the calibration has not expired.
2. Use the water that is to be measured to rinse out the small container. This will be discarded, and a fresh sample taken from the source to be measured.
3. Place the container in the meter and allow the reading to stabilize.
4. Record the turbidity reading given on the meter along with the date, time and source of the water (e.g. SRP, outlet).

11 Chemical Treatment

The Project will use chemical coagulants and flocculants to improve the quality of water discharged from the sediment controls (SRPs) into the stormwater system. The use of chemical will reduce the amount of sediment discharged into the receiving environment. In deciding which chemical to use several considerations have been taken into account:

- Different soil conditions and how different chemicals perform in relation to them.
- The effect of the treated waters on pH.
- The amount of chemical (dose rate) required to achieve optimal discharge results.
- The improvement in water quality achieved.
- The overall environmental effect of using the chosen chemical

11.1 Soil types and geological factors

Section 6.1 discusses the soil and geology in the catchment of the Project. How the soil types and geological factors affects the chemical requirements will be shown empirically in the following sections.

11.2 Bench Testing Results

11.2.1 Sampling

Samples of soil from the site which will form the two stockpiles and ultimately contaminate stormwater on site have been taken from the location as shown on the map. ~~Samples were taken at a depth up to 1 m with a hand auger.~~ TP1 was taken from the reservoir footprint with two samples, one at 1.0 m and one at 0.2 m deep. TP2 was taken at 0.2 m from the location shown.

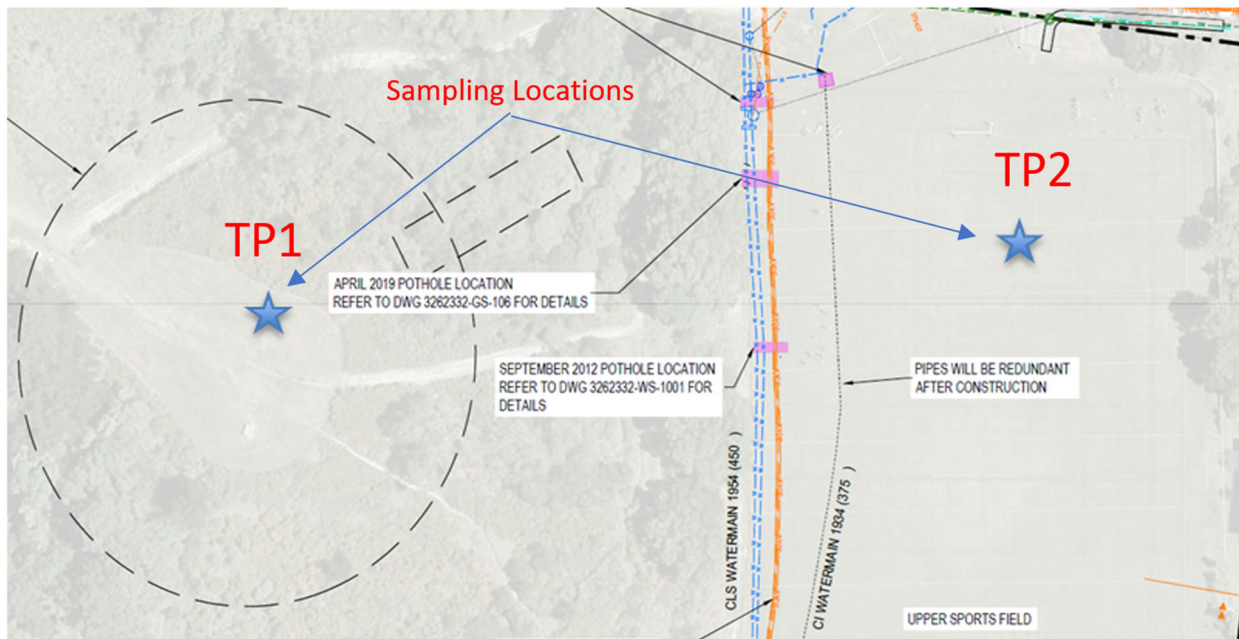


Figure 20: Sampling Locations

11.2.2 Sample Preparation

A representative water sample was prepared by taking approximately 1 kg of the soil sample and mixing with 20 L of rainwater. The soil is mixed vigorously with the water to prepare a representative runoff sample.

11.3 Experimental

To the soil sample prepared above various concentrations of water treatment chemicals were added. These samples were then briefly stirred and allowed to settle. Photographs and clarity measurements were taken at 0, 5, 10 and 30 minutes to show the sedimentation. The turbidity and pH were taken on all samples after 30 minutes.





Bench testing results after 30 minutes settling.

Chemical	TP1 1.0 m				Final pH	Final Turbidity (NTU)
	Clarity					
Volume added (mL)	0	5	15	30 min		
0	0	0	0	0	5.8	>1000
30	>100	>100	>100	>100	5.7	61
60	>100	>100	>100	>100	5.7	72
90	>100	>100	>100	>100	5.6	73
120	>100	>100	>100	>100	5.7	64
150	>100	>100	>100	>100	5.7	66

Chemical	TP1 0.2 m				Final pH	Final Turbidity (NTU)
	Clarity					
Volume added (mL)	0	5	15	30 min		
0	10	10	10	10	6.8	325
30	>100	>100	>100	>100	6.6	96
60	>100	>100	>100	>100	6.5	85
90	60	60	60	60	6.4	123

120	40	40	40	40	5.3	210
150	20	20	20	20	6.2	195

Chemical	TP2 0.2 m				Final pH	Final Turbidity (NTU)
	Clarity					
Volume added (mL)	0	5	15	30 min		
0	10	10	10	10	7.1	212
30	>100	>100	>100	>100	6.9	85
60	>100	>100	>100	>100	6.7	64
90	>100	>100	>100	>100	6.6	93
120	>100	>100	>100	>100	6.5	147
150	40	40	40	40	6.3	186

11.4 Chemical Testing Results and Discussion

Based on the bench testing results in the previous section the following chemical and dose rate is recommended below:

Chemical	Optimal Dose Rate
Polyaluminium chloride (PAC)	30 mL/m ³

Based on this and the treatment system that will be employed (section 11.5), PAC has been chosen as the recommended water treatment chemical. The reason PAC was chosen is outlined below:

- Works well in rainfall activated treatment systems
- Effective for batch dosing

11.5 Chemical Treatment System

There will be two main sources of sediment laden water that will be requiring treatment on the Project, reservoir excavation groundwater and stormwater runoff from the reservoir and stockpiles.

11.5.1 Stockpile treatment

The treatment system recommended for the stormwater runoff from the stockpiles are rainfall activated dosing systems (i.e. Floc Box or Floc Shed Refer Figure 21). The stockpile runoff is expected to be relatively consistent and will only occur during rainfall. It will also be stabilized during the Project with the aim to reduce runoff from the stockpile to a point where the treatment of stormwater runoff may become unnecessary. The calculations for the rainfall treatment systems are provided below however these may change as the catchment areas of the stockpiles change:

Catchment	Maximum Catchment Area	Roof Tray Area	Low Flow	High Flow
Upper Field (SRP2)	4000m ²	0.15m ²	1.8L	3.6L
Lower Field (SRP1)	5000m ²	0.19m ²	2.3L	4.5L

Table 6: Catchment designation and areas associated with rainfall treatment systems.

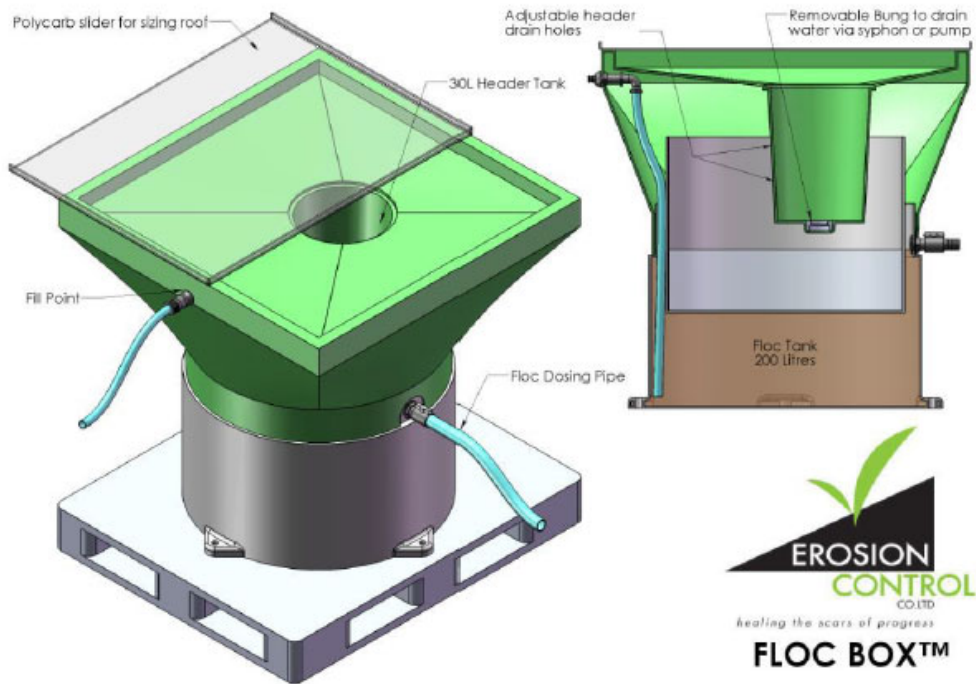


Figure 21: Example of rainfall activated dosing systems.

11.5.2 Reservoir Dewatering treatment

For the dewatering of the reservoir excavation this water will be pumped to the SRPs, therefore rainfall activated treatment systems are unsuitable. The reservoir excavation and the SRPs will be designed to retain water, allowing a batch dosing methodology to be utilized followed by discharging the water. The batch dosing will occur either (a) directly in the excavation followed by pumping of the treated water to the SRP or (b) pumping of the water and treatment in the SRP, whichever is more applicable at the time. The procedure outlined in section 11.6 Batch Dosing will be followed. To calculate the correct volume to batch dose the nominated suitably qualified and experienced professional (SQEP) will be trained to conduct jar tests on site. This will minimize the chances of over and underdosing of chemical. The SQEP's for this process are outlined below:

Name	Role	Contact Number
Mark O'Hare	Site Engineer	0273 066 341
James Lake	Project Manager	0274 507 239
Elisa Chillingworth	Environmental Advisor	0274 888 151

11.6 Batch Dosing

Batch dosing will be used to treat reservoir water that requires treatment. It will also be used after storm events if the water quality in the SRPs are not within the required levels. The batch dosing procedure will be as follows:

1. The water to be discharged will be tested for turbidity and pH. If the turbidity is outside the levels outlined in 10.4.2 SRP Dewatering Monitoring, then batch dosing will be required.
2. A jar test will be completed on the water. The total volume of chemical required will therefore be calculated.
3. The required volume of chemical will be added either to a bucket or a spray pack. If added to a bucket it will be cast over the pond with the aim to spread the chemical over the surface as much as possible. This will be thrown down wind to ensure the chemical isn't swept back into the caster. If dosing occurs from a spray pack it will be sprayed in such a way to contact as much of the pond surface area as possible.
4. If the level of chemical required is large, then the dose may be split over a number of casts or spray routines. The full dose must be done in one batch dosing session.

It is believed this batch dosing methodology will provide better control and results than an electronic dosing system. The entire procedure will be supervised on site by an SQEP to ensure that no unwanted discharges occur. The batch dosing methodology also compliments the catch and treat methodology that will be employed for the SRPs allowing their strict management.

11.7 Sediment Retention Ponds

Dewatering activities on site will be serviced by two SRPs. The location and design of the two SRPs are found in section 8.4.10. For the decommissioning procedures of the SRPs please see section 13.1.2 Removal of Sediment Controls.

11.8. Site Monitoring and Maintenance

11.8.1. Personnel in charge

The monitoring and maintenance of the chemical treatment system will be undertaken by the personnel outlined below to ensure compliance is maintained throughout the Project. They will follow the procedures outlined in section 10.4 Dewatering Monitoring as well as section 11.7.1 Chemical Treatment System Monitoring. The person(s) in charge are tabulated below:

Name	Role	Contact Number	Contact Email
Mark O'Hare	Site Engineer	0273 066 341	Mark.o'Hare@heb.co.nz
Elisa Chillingworth	Environmental Advisor	0274 888 151	Elisa.chillingworth@heb.co.nz

11.8.2. Chemical Treatment Systems Monitoring

The processes for SRP water monitoring and sampling are outlined in section 10.4.2 SRP Dewatering Monitoring. An inspection of the treatment system should be undertaken prior to and following every rainfall event. If the rainfall event is exceptionally heavy and/or prolonged, then it is recommended that it is also inspected during the event if possible. Outside of rainfall events the system will be inspected weekly. The following aspects will be inspected that:

- The chemical reservoir on the rainfall activated treatment system(s) are structurally sound and has no damage or leaks;
- There is sufficient chemical available in the chemical tanks of the rainfall activated treatment system(s);
- The chemical dosing pipe is securely attached, clear of debris and correctly positioned on the rainfall activated chemical treatment system(s);
- The header tank of the chemical treatment system(s) is clear of debris;
- The roof of the chemical treatment system(s) is secured properly and clear of debris;
- The overall chemical treatment system(s) structure is properly secured to the ground and not at risk of tipping over in strong winds;

If there is an imminent severe storm it will be ensured that the SRPs on site are inspected and that all rainfall activated treatment systems are topped up with chemical in preparation. The above chemical treatment system monitoring procedure will also be carried out along with any maintenance that is required.

After a severe storm the SRPs will be inspected and all chemical treatment systems topped up with chemical as soon as practicable. The visual clarity of the ponds will be inspected and if it appears batch dosing may be required then the procedure outlined in section 11.5.2 Reservoir Dewatering Treatment.

11.8.3. Flocculant Storage

For information regarding the storage of water treatment chemical see Section 7.10 Hazardous Substance Management in the CEMP.

11.8.4. Emergency Spill Contingency

For information regarding the emergency spill contingency of water treatment chemical see Section 7.10 Hazardous Substance Management in the CEMP.

11.9. Chemical Treatment Review

In the event that chemical treatment provides significantly different results from the observed in testing, resulting in uncompliant water from the treatment of stockpile runoff or batch dosing of reservoir excavation water, the following procedure will be followed:

1. If after 24 hours of treatment the SRP water has shown little to no change in quality, then advice will first be sought from one of the nominated SQEPs as outlined in section 4.1.;
2. The recommendations will be implemented to the satisfaction of the SQEP;
3. Should the recommendations result in no change to the water quality after a further 24 hours then further testing on alternative chemicals or dosing regimens will be investigated in consultation with the SQEP.

12 Stream Works

No stream works are planned in relation to the Project, however riparian enhancement through planting is to take place. This work is covered in Section 8.2 of the Landscape & Ecology Management Plan (LEMP).

13 Compliance Management

Erosion and sediment control will be administered by the Environmental Advisor together with the Project Manager. The Project Manager will have the responsibility of ensuring that the site specific ESCPs are complied with in terms of site operations while the Environmental Advisor together with the Earthworks Project Engineer will be responsible for administration associated with ESCP compliance and development. A current and approved copy of the ESCP will be on site at all times.

13.1. Construction Management

The construction of the sediment controls, specifically the SRPs, will be closely managed as follows:

- The Environmental Advisor will issue an approved site specific ESCP to the earthworks supervisor responsible for the establishment.
- The construction of the controls will be overseen by the supervisors and members of the HEB Construction environmental team.
- A pre-construction meeting will be held by the Environmental Advisor where the sediment controls to be built will be discussed and specific direction given on construction.
- The location of the control will be confirmed onsite with the construction team prior to commencement of works.
- Hold points for construction will be established for each control whereby the supervisor will inspect the work completed, for example the installation of anti-seep collars or the installation of primary outlet.
- Each control will be 'as built' by the Environmental Advisor.

13.1.1. Earthworks Season and Winter Works

The season for earthworks, as determined by resource consent, is from the 1st of October to the 31st of May each year. Construction activities within this period are permitted by resource consent. The period between the 1st of June and the 30th of September each year is considered to be winter and consequently earthwork activities are highly restricted. If the Project Manager wishes to carry out any earthworks activities during the winter then an application will be submitted to the –GWRC by the 1st of May outlining what activities are proposed and what measures will be put in

place to achieve a satisfactory environmental outcome. The application will be drafted in conjunction with the Environmental Advisor. No works will be undertaken unless specifically permitted by the GWRC through a written winter works approval.

From the 1st of June to the 30th of September each year the construction site must be 100% stabilised.

13.1.2. Removal of Sediment Controls

No ESCP amendments or removal of sediment controls will take place without the written approval of the GWRC. The Environmental Advisor will be responsible for liaising with the GWRC regarding the ESCP and will provide all decommissioning applications and plan amendment applications in writing. Copies of all GWRC sediment control decommissioning approvals and plan amendment approvals will be kept on site. The process of decommissioning of the SRPs will be as follows:

- Permission to proceed with the removal of control will have been received from the GWRC in writing.
- The weather conditions will be dry or no more than light showers.
- The water contained within the control will be of a quality that can be discharged. Where it is not it will need to be treated in order to remove sediment.
- The control will be dewatered under the supervision of the Environmental Advisor.
- The “pipe work” and emergency spillway fabrications will be dismantled.
- The pond or storage area will be filled in and the surface landscaped.
- The surface will be grassed and stabilised with hay mulch.
- A decommissioning report will be given to the GWRC by the Environmental Advisor confirming the control has been removed.

13.1.3. Training

The Environmental Advisor will provide Project staff with environmental training and technical advice on all matters relating to erosion and sediment controls. Project staff need to be trained and up skilled to be aware of the potential impact their role can have on environmental performance and compliance of the Project. By providing all staff associated with the Project a fundamental understanding of Guidelines it goes a long way toward improving compliance. Staff will be educated on local rules and regulations. It is important to conduct training sessions for the “constructors” around the conditions of the consent and permitted activity rules and the processes associated with gaining approval to install and decommission the sediment controls associated with resource consent conditions. Training needs to align itself both with the HEB Construction corporate or company environmental strategy and with the level of understanding of the trainee. There is no point in training the operator of an excavator about the calculation criteria for sediment pond design but there are huge rewards to be gained from spending some time training such a person in sediment pond construction, maintenance, and decommissioning approval requirements. Equally it is extremely beneficial to up-skill site engineers and “prosecutors of programme” in the approvals process for ESCP alterations, additions and decommissioning.

13.1.4. Plant and Machinery

The management, repair and maintenance of sediment controls requires plant and machinery. These routinely include excavators, loaders, light trucks, water carts and road sweepers. Having these on site primarily, but not necessarily exclusively, for the use environmental staff enables work to be carried out without delays associated with machinery needing to come available from other site works or being brought in from outside.

13.1.5. Materials

Delays with supply and delivery of materials can put Project Team under pressure to deliver compliance. There are substantial time savings to be gained from having onsite the materials that

are regularly utilised in sediment control available at any time. HEB Construction will establish onsite supply of materials. Having material resources immediately available on site for geo-textile fabrics, wire, piping, safety fences, waratahs, ground staples etc. increases the speed at which the Project Team can respond to maintenance and repair requirements along with installation or new controls, and the decommissioning of controls.

13.2. “As Built” Documentation.

Any “As Built” documentation will be completed by the Environmental Advisor and supplied to GWRC. Copies of the “As Built” documentation will also be kept of site. All SRPS will be labelled clearly with their identification number to aid with quick identification of controls and effective communication both with internal communications and external.

13.3. Compliance Monitoring

The Environmental Advisor and Supervisors will conduct routine inspections of the site. These inspections will take place with adequate time allocated and will be thorough and systematic. Members of the construction team including the Construction Manager will accompany the Environmental Advisor or Supervisor on these inspections so that the Environmental Advisor or Supervisor can better understand the work that is going on at present and the work that is programmed to take place. It is also useful for the construction teams to be reminded of their obligations regarding ESC and for both parties to recognise where matters have fallen through the gaps due to a lack of communication. Communication, both official and unofficial is critical to the successful operation of ESCPs.

Internal inspections will cover all areas of the Project, even those that may have been dormant for some time, to ensure that the controls are still operating properly. They will be viewed in the same light as a Warrant of Fitness (WOF) or a Certificate of Fitness (COF) for a vehicle. This process also shares another similarity with a vehicle inspection in that a written record of the inspection will to be kept and actions are recorded. Identifying actions is the first step but is meaningless unless these actions are prioritised and delegated to someone to fix and then reviewed frequently until they are resolved and the action completed. Detail is also important to avoid confusion about either what is required or where the work is required. A once a week inspection of the site will not be sufficient as it does not permit follow up on whether the actions have been completed until the following week. Inspections may become as frequent as twice daily at the height of construction activities. By adopting an approach that looks to fix ESC issues by dealing with them properly once and not just “patching them up” HEB Construction will avoid resource intensive and costly occurrence of rework.

HEB Construction will ensure that ESC work is completed as soon as practicably possible and not deferred only to be completed immediately before an external inspection. A thorough and systematic audit will identify the gaps between the primary controls and where the site intersects with aspects of the physical world such as streams, roads, and where at least 80% of compliance issues are generally found.

14 Review & Revision of the Erosion & Sediment Control Plan.

The ESCP will be reviewed routinely by the Environmental Advisor. These reviews will be carried just prior to the beginning, and immediately following, the official earthworks season, being September and May each year. Within 20 working days of the end of the review a revised ESCP will be issued to GWRC for review and approval if changes are required.