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SOUTHERNSKIES ENVIRONMENTAL

# EROSION AND SEDIMENT CONTROL PLAN

## WAITAHA HYDRO PROJECT

## Prepared for Westpower Limited

## Document History and Status

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## Document Details

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**Limitations**

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# 1. OVERVIEW

## 1.1. Introduction

The applicant, Westpower Limited, is seeking Fast-track approvals to construct and operate the Waitaha Hydro Project within and adjacent to the Waitaha River, referred to as 'the Site'.

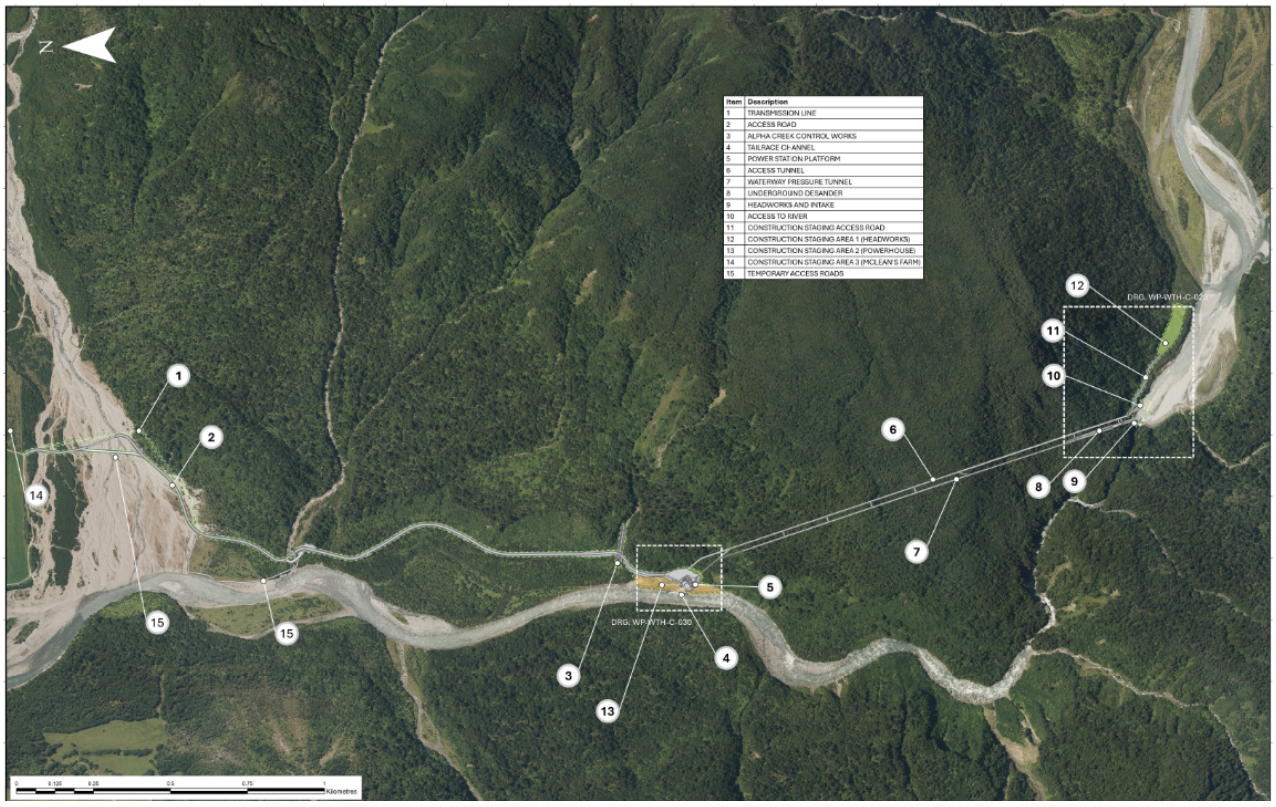
This Erosion and Sediment Control Plan (ESCP) has been prepared to support the Fast-track application and determine appropriate erosion and sediment control (ESC) measures to manage site runoff associated with the earthwork's activities.

The proposed scheme is a run-of-river design and has been chosen to avoid the need to develop large scale dam structures and in-stream and off-stream water storage lakes. It will divert up to a maximum of 23m$^3$/s of flow from the Waitaha River's main stem and retains a minimum residual flow of 3.5m$^3$/s in the "abstraction reach" between the intake and the Power Station tailrace.

The Scheme will generate an annual output of between 120-140 GWh with a peak output of 23 MW of power.

The operational footprint is approximately 5 ha from the true right of Macgregor Creek to the Headworks, and the project has been designed to minimise the footprint and potential effects on the environment within which it is located.

Figure 1 illustrates the layout of the hydro scheme and Figures 1 and 2 combine to illustrate areas to be used for its construction.



## 1.2. Scope

The scope of this ESCP covers the following construction areas and activities, the locations of which are generally shown in Figure 2:

- Pre-construction geotechnical investigations.
- Upgrade and construction of the everyday access track through McLean Farm, including stream crossings.
- Construction Staging Area 3 and Spoil Disposal Sites (noting the latter will also be used to partly source land-based gravel for access track construction) also on McLean farm.
- Access road from McLean Farm to Power Station, including stream crossings.
- Power Station Site, including Construction Staging Area 2, access ramp, tunnel portal exit road and access to portal.
- Management of water during the tunnel construction.
- Intake structure construction and associated instream works.
- Construction Staging Area 1 (Headworks).
- Construction Staging Area 1 access road from intake.

This ESCP does not cover physical works required to the local road network (e.g. installation of passing bays on Waitaha Road). Any erosion and sediment control requirements for these activities will be confirmed as part of the Corridor Access Request with Westland District Council. For the same reasons, this ESCP does not cover any minor widening or repair works that may be needed on State Highway 6.

Also, works associated with transmission line upgrade / construction works and the new re-built Waitaha Substation are also excluded from the scope of this ESCP on the basis that these works will be undertaken in accordance with Westpower's Environmental Management System (WP-310S035).

Riverbed gravel extraction activities are also excluded from this ESCP noting adequate controls associated with this activity will be achieved through specific conditions of consent proposed by Westpower (e.g. activity to be confined to dry riverbed areas and in accordance with minimum setbacks from river water).

This ESCP has been prepared in accordance with the principles of the Environment Canterbury document "*Erosion and Sediment Control Toolbox for Canterbury*" (ECAN ESC Toolbox).

In addition, the ESCP includes detail on the:

- Proposed erosion and sediment controls;
- Site establishment and enabling works;
- General earthworks, streamworks and related methodologies and treatments associated with the activities listed above; and
- Final stabilisation.

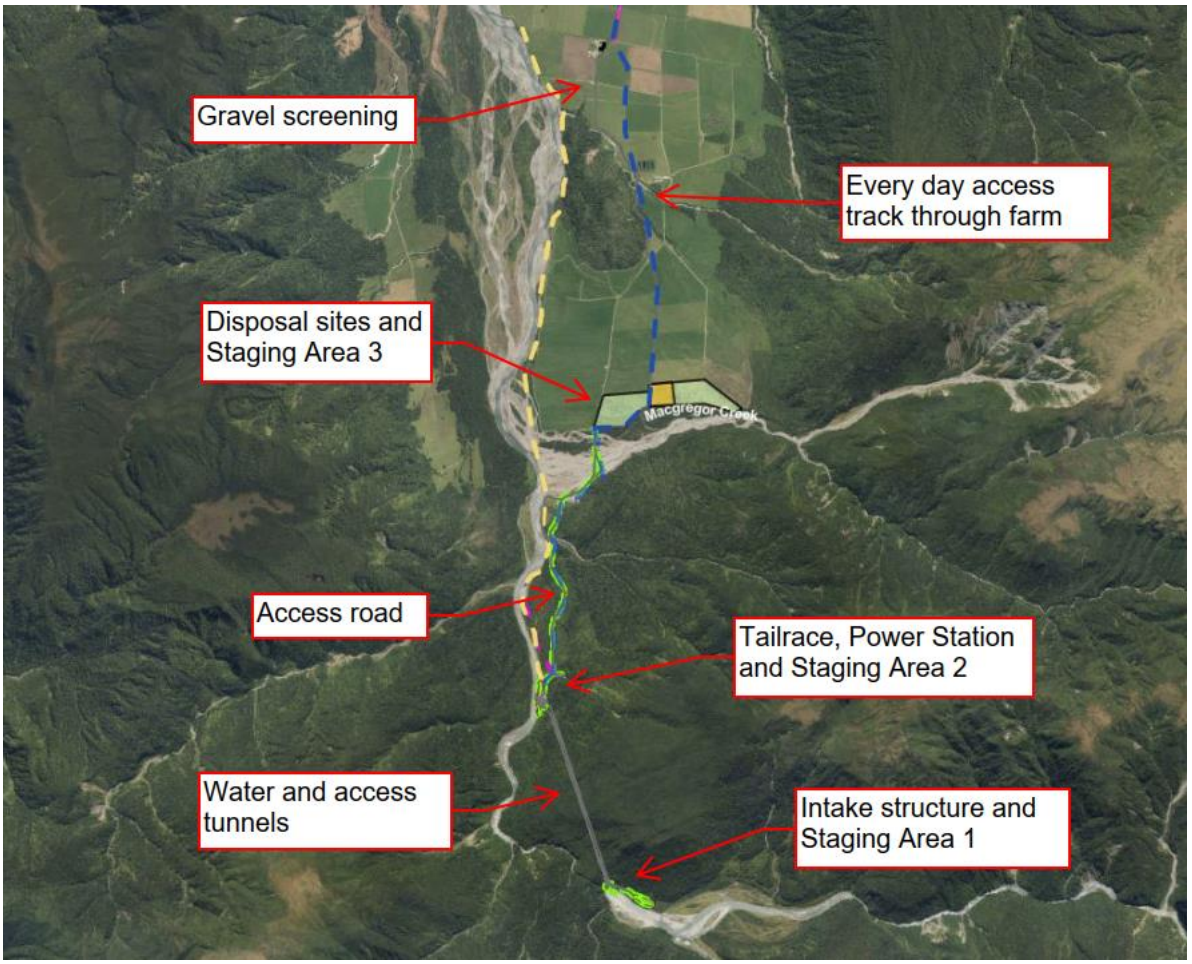



*Figure 2: Erosion and sediment control project scope.*

## 1.3. Location and Site Description

The total area of potential disturbance during the construction phase is approximately 48 hectares (includes all Construction Staging Areas, spoil disposal areas, new access track, local road upgrades and transmission line corridor).

Southern parts of the Waitaha valley in which the hydro scheme is located (i.e. south of the Alpine Fault) are very steep and mountainous with the Waitaha River confined for most of its length in deep gorges. These areas include the Broomfield and Smythe Ranges, the eastern slopes of Mount Ashmore along with numerous other peaks above 1200 m.

The topography within the northern parts of the catchment (i.e. north and downslope from the Alpine Fault) are less mountainous with the Waitaha River flattening and widening out into a more expansive braided channel. Regional topography is illustrated broadly in Figure 2.

The Project is located in the West Coast region of the South Island along the true right bank of the Waitaha River. This ESCP refers to works to be undertaken in the locations, as set out in the scope above. A brief description of each is provided below. No works are proposed within an existing scenic reserve.

**Headworks Construction Site**

The Headworks construction site comprises riparian areas on the true right bank of the Waitaha River at and upstream of the top of Morgan Gorge. At the upstream end, where the diversion intake and access tunnel portals are to be located, the terrestrial areas of construction are predominantly hard rock. Where the temporary construction staging access road will traverse, these areas comprise of both hard rock and loose

sediments of varying sizes between large bounders and sands and gravels. Construction Staging Area 1 is located on a relatively flat upper terrace of the Waitaha River which is currently predominantly covered in shrub hardwood species. Figure 3 shows the terrace level in relation to the active riverbed at the general location of Construction Staging Area 1 (Headworks).

The instream works at this location will include:

- the construction of the intake structure, including gravel bed channel shaping immediately upstream of the structure's location.
- construction of the upstream guide wall, sluice gate, training wall and main weir.

*Figure 3: Photo showing approximate location and ground level (see orange line) of Construction Staging Area 1 (Headworks).*

**Power Station Site**

The Power Station Site is located on a relatively low and young alluvial gravel surface. There is no significant old vegetation which implies that the site has been subject to regular past flooding. There is a 60-70m high vertical terrace edge approximately 50m from the proposed Power Station location. Figure 4 below shows a visualisation of the Power Station set in a background image showing actual local terrain and vegetation currently at this site. Figure 5 shows the vertical terrace edge upstream of the Power Station Site.


*Figure 4: Visualisation of the Power Station showing existing terrain and vegetation (looking downstream).*

*Figure 5: Vertical face located approximately 50m upstream the Power Station Site (looking upstream)*

**McLean Farm**

The McLean farm is on private freehold land which is predominantly semi-developed for pastoral grazing. This area is sparsely vegetated, has low level ground surface undulations associated with ephemeral fluvial processes and has a generally uniform ground surface slope from the foothills towards the east and the Waitaha River towards the west.

# 2. EROSION AND SEDIMENT CONTROL PHILOSOPHY AND PROCESSES

## 2.1. Objectives

The ESCP objectives for these works are:

- To ensure that sediment discharges from the works are minimised to the greatest extent practicable.
- To ensure that all ESC measures / methodologies are designed and approved prior to construction works.
- To ensure that all ESC measures and methodologies are implemented prior to commencement of bulk earthworks.
- To ensure that all contractual and regulatory requirements are met as a minimum standard.

Achieving these objectives will be measured by the project's ability to meet the following environmental targets.

- No environmental or regulatory breaches (compliance with consent conditions; no prosecutions, enforcement orders, abatement or infringement notices received).
- Conducting of regular environmental inspections.
- Inducting all employees and subcontractors on the relevant erosion and sediment control requirements and procedures relevant to the project.
- Including environmental matters as a topic in project meetings and toolbox talks.

## 2.2. Design

A set of ESCP design drawings are provided in Appendix A. Draft design and sizing information for these ESC measures are included in Section 4 of this report. The general principles behind the ESCP design are outlined in Section 2.3 below. More specifically, all ESC devices have been designed in accordance with the design principles of the ECAN ESC Toolbox.

It is proposed that this draft ESCP is updated following the final design of the Scheme and Westpower's engagement of the main construction contractor and that the updated ESCP be submitted to the West Coast Regional Council (WCRC) for certification in advance of construction activities commencing. Additionally, any subsequent changes to the certified ESCP that are deemed to be of a substantial nature (by agreement between the consent holder and the consenting authority), recertification of the ESCP will also be required.

As-built certification of ESC devices and an ongoing site audit programme will ensure compliance with the design requirements and guidelines. Bund catchments (both clean and dirty) will be adjusted during the construction works (this is discussed below) and regular audits and as-built revisions will be undertaken.

Areas will be stabilised as soon as practical and in a progressive manner.

## 2.3. Principles

The general principles adopted during the construction activities that have been incorporated into the ESCP are as follows:

- Minimise the necessary area of disturbance as far as practicable while meeting the development

requirements of the site.

- Stage the works and progressively stabilise exposed areas following completion.
- Divert clean water runoff away from the work site, thus reducing the contributing catchment of the exposed working areas.
- Intercept, divert and impound any sediment laden runoff from exposed working areas to either prevent site discharge to the receiving environment (via soakage) or as a minimum, provide treatment via sediment control devices prior to discharging into the downstream environment.
- Regularly inspect the ESC measures and undertake any maintenance necessary to maximise the sediment retention efficiency of the site.
- Undertake ongoing assessment of the ESC methodology and, if required, adjust as the work progresses.
- Ensure site staff are aware of the requirements of the ESCP and the relevant resource consent conditions.

## 2.4. Staging

Staging will be utilised across the three main areas of construction plus the construction of the access roads and tracks. The indicative staging is shown on the ESCP drawings provided in Appendix A. This will manage the exposed area of the construction operations. Stabilisation measures may include, but are not limited to, grass seeding, geotextile, hydroseed, and use of clean aggregate or river run material.

For the spoil disposal areas, any completed areas will be progressively re-established into pasture to minimise the extent of open area at any given time.

It is also noted that some parts of the spoil disposal areas will first be used to source gravel material for access track construction. This will be carried out by creating a shallow pit that simultaneously provides appropriate soakage and sediment treatment. These shallow gravel extraction pits will later be backfilled with tunnel spoil material and re-established into pasture as above.

## 2.5. Review

This ESCP is a live document and will be revised and confirmed prior to commencement of works in consideration of:

- Final detailed design;
- Confirmed construction methodologies to be set out in a Construction and Environmental Management Plan (CEMP); and
- Relevant conditions of any Fast-track approvals granted.

Commitment and continuous improvement to the environmental culture by management is critical to its success and continuation. As part of continuous improvement, additional changes to the ESCP may be appropriate during the course of the project.

These changes may be a result of:

- Any significant changes to construction activities or methods;
- Key changes to roles and responsibilities within the Project;
- Changes in industry best practice standards or recommended erosion and sediment controls;

- Changes in legal or other requirements (social and environmental legal requirements, Resource Consent conditions, West Coast Regional Council objectives and relevant policies, plans, standards, specifications, and guidelines);
- Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments; and
- The outcome of investigations into discharges of contaminants.

Reasons for making changes to the ESCP will be documented. Any new/updated version of the ESCP documentation will be issued with a version number and date. A copy of the current ESCP document and subsequent versions will be kept for the Project records. Superseded versions will be marked as obsolete.

Any revisions to the ESCP deemed to be of a substantial nature (by agreement between the consent holder and the consenting authority) will be submitted to the West Coast Regional Council for review and certification before becoming operational.

# 3. DESCRIPTION OF WORKS

## 3.1. Geotechnical Investigations

Geotechnical investigations are proposed to be undertaken ahead of the construction.

Each Geotech investigation site will include a drill rig flown in and out of the proposed locations. Tracks will be minimal, with vegetation removal restricted to stems </=5cm DBH[1].

Vegetation will be cleared for an area of approximately 10m by 10m to create a drill platform and pushed to the side.

Centrifuge will be used for the used water during the drilling activities. It will make it possible for the water to be contained and reused, with any material collected from the water to be disposed of appropriately.

The bore samples will be examined on site and then taken off site to be stored.

Once drilling works area complete, the vegetation will be spread back over the platform to encourage revegetation.

## 3.2. Everyday Access Road Through McLean Farm

Refer to ESCP-001.

The everyday access road will be built through McLean Farm from a new vehicle crossing off Anderson Road. The access will be a combination of upgrading existing farm tracks and constructing new.

From the entrance to the farm to the milking shed the carriageway will be 7m wide, include a 0.5m shoulder on each side and a roadside table drain on the higher side. From the milking shed to Macgregor Creek the dimensions will be similar, but the carriageway will be 6m wide.

The ESC construction methodology is largely based on a cut and cover operation. Where minor trimming of

[1] Diameter at Breast Height

existing tracks is required, material will be removed and placed directly onto trucks and taken to the disposal sites. The upgraded track will then be sheeted with aggregate. At the end of the day, and prior to rain events, the section of cut track will be stabilised against erosion.

New sections of the everyday access road will also be constructed as a cut and cover operation. All organic and unsuitable material stripped will be cut to waste (taken to spoil disposal sites). This will be followed by 300mm of bulk fill locally sourced where possible, and 300mm of aggregate (e.g. 200mm of AP65 and 100mm of AP40).

Stream crossings will be required, and draft methodologies have been provided as part of the ESC drawings. In particular, two waterway crossings will be required which will be constructed using a 4m wide, 2m high and 10.5m long concrete box culverts.

Approximately seven culverts will be installed as part of the everyday access road. Draft methodologies have been provided as part of the ESC drawings. These are generally based on a dam and overpump methodology if water is present. Each culvert is expected to be completed within one to three days, within fine weather conditions.

All streamworks will also be undertaken in accordance with the Freshwater Ecology Management Plan.

A gravel screening, handling and storage operation is proposed for a 0.7ha area (approximately 30m wide and 220m long) to the west of the access road (existing airstrip). If any topsoil stripping is required, it will be used to form a perimeter bund around the area. The area will be sheeted with river rock.

## 3.3. Construction Staging Area 3 and Spoil Disposal Areas

Construction Staging Area 3 (CSA-3) and spoil disposal areas are proposed to be developed on private land (McLean Farm) leased by the Project on the true right of Macgregor Creek, outside the margin of the creek. The spoil disposal and staging area covers a combined area of approximately 20.3ha.

CSA-3 will be approximately 3.3ha. Activities occurring here will include:

- Main site administration, project management and staff facilities and buildings;
- Storage areas for vehicles, machinery, infrastructure;
- Machinery workshop;
- Concrete batching plant operations;
- Geotech assessment base; and
- Self-contained ablution facilities.

CSA-3 will be cleared and levelled for use. Exposed land will be stabilised immediately using a cut and cover methodology.

Two spoil disposal areas (two areas either side of the CSA-3) are to be established adjacent to the staging area within the private land. As noted already above, parts of the spoil disposal areas will first be used to source gravel material for access track construction. This will involve creating a shallow pit that simultaneously provides additional sediment control. Gravel screening, storage and handling will also be a part of this operation.

Four Sediment Retention Ponds (SRPs) are currently proposed to treat sediment laden runoff from the spoil disposal areas. Theses SRPs are in addition to any gravel extraction pits that may be created. Each SRP has been sized for a maximum contributing catchment area of 2ha, limiting the amount of open disposal area at any one time. At least one of these SRPs will be constructed prior to works commencing on CSA-3.

Excess spoil from excavations across the project will be carted to, and spread across, these areas (including being used to backfill gravel extraction pits). Some spoil will include vegetation material from the construction of the access roads, transmission line corridors, and other scheme components, but spoil will primarily be excavated material from the tunnel operations. The combined disposal area is approximately 16.9ha in size, with approximately 1m deep of spoil to be spread and contoured across the sites (approximately 163,000$m^3$ of spoil).

The spoil disposal activities will progress in a staged manner and will be progressively stabilised upon completion of filling in any given area as the disposal areas will be remediated to pasture in accordance with the requirements of and as part of, the farming operation.

Each active (exposed) disposal area will be staged to ensure that the worked area (excluding gravel extraction pits) is less than 2ha at any one time in each disposal area. Nevertheless, an SRP will be established in each disposal area to treat any construction sediment laden runoff from the area. The SRPs have been sized for a contributing catchment of 2ha, refer to Appendix A (ESCP-SRP-01) for design details. This provides for an active area of 1ha at all times and the progressive close out and stabilisation of the previous 1ha.

Final SRP sizing and staging details will be confirmed prior to commencement of works.

Following completion of construction works, CSA-3 and spoil disposal areas will be remediated to pasture, in accordance with the requirements of the lease.

## 3.4. Access from McLean Farm to Power Station

As a continuation of the access through McLean Farm, a new access road from the southern edge of Construction Staging Area 3, over Macgregor Creek and through Conservation land to the Power Station Site is proposed. This section includes several stream crossings, including Macgregor Creek, Granite Creek and Alpha Creek. Draft methodologies for each of these crossings and temporary crossings have been provided in the ESC drawings.

The access road will be 7.5m wide (6m carriageway and 0.75m shoulder on each side), except for the section of access road between CSA-3 and Macgregor Creek where a 3m vegetation clearance each side has been recommended, with the corridor of 10m on average. Organic material, including topsoil and unsuitables will either be cut to waste and taken to the spoil disposal sites or stripped and bunded adjacent the road alignment. The road will be sheeted with aggregate or river gravels at the end of each day and prior to forecast rainfall.

Culverts will be installed as part of the access road. A draft methodology has been provided as part of the ESC drawings. These are generally based on a dam and overpump methodology if water is present. Each culvert is expected to be completed within one to three days, within fine weather conditions.

All streamworks will also be undertaken in accordance with the Freshwater Ecology Management Plan.

Macgregor Creek – ESCP-003-02

Initially, a temporary river crossing will be constructed using in-situ river gravels.

A permanent culverted ford will be constructed formed using a precast modular system (drift-deck). Associated 'in channel' works will involve the construction of the footings (concrete foundations). Once the footings are constructed, the modular decks are lifted into place.

Granite Creek – ESCP-003-04

A permanent 18m long by approximately 6m wide bridge, plus abutments on either side and wingwalls (width including wingwalls is approximately 11m) is proposed to be constructed to cross the Granite Creek. In order

to construct the permanent bridge, a temporary Bailey Bridge or similar will be erected first on the downstream side of the permanent bridge.

The works will be located within the area of the Granite Creek stream bed that is subject to high flows, but outside of the typical flow channel. Footings and abutments will not be installed within the typical flow channel.

The main bridge will be constructed across Granite Creek with abutment piles on both sides. Each abutment is likely to require cast in-situ abutment structures. As mentioned above, the works will be outside of the typical flow channel however if required a clean water diversion may be installed to allow the works to be undertaken in a dry working environment. Where necessary, clean water will bypass the working area using a dam and overpump methodology. Once the abutments are completed, the bridge beams will then be lifted into place.

Alpha Creek – ESCP-003-08

A 4m by 2m box culvert 12m long is to be constructed to cross the Alpha Creek. Rock inlet and outlet erosion control and channel widening is also proposed. A draft ESC plan and methodology has been provided. The final staging and construction methodology will be provided prior to commencement of works within the Alpha Creek.

In order to install the culvert, a clean water diversion will be required before the channel excavation is completed. Clean water will bypass the working area using a dam and overpump methodology. This will allow the works to be undertaken in a dry working environment. The works are expected to be in river gravels and rock. Minimal unsuitable material is expected but would be removed and taken to the disposal sites if required. Aggregate or river run material will be used for backfilling around and over the box culvert. At the end of each day, and prior to rain events, the working area will be stabilised (as mostly expected to be working in rock) so that if the pump was to be overwhelmed the clean water could flow down through the existing flow path.

Once the culvert is installed, the channel control will be completed, including channel widening, formation of training structures (rock bunds and groynes). Clean water management will be maintained using a dam and overpump methodology to provide a dry working environment. As the works will be completed using rock, which is considered a stabilised material, at the end of each day and during rain events, the pump will be removed and clean water able to flow down the flow path while the works are not being undertaken. Any ecological works will be undertaken in accordance with the Freshwater Ecology Management Plan.

## 3.5. Power Station Site

The land between Alpha Creek and the upstream end of the Power Station Site is to be cleared and levelled and a portion used for Construction Staging Area 2 (CSA-2). CSA-2 will service the construction of the tunnels, Power Station, substation, and parts of the lines and access road. It will also receive water discharges from the two tunnels.

Access to the Power Station Site work areas will be via the new access road from McLean farm. Access may also be obtained via helicopter where required with landing space provided for within CSA-2.

A total area of 1.6ha of disturbance is anticipated for the Power Station site construction, including the 0.8ha required for CSA-2. Temporary site buildings will be set up within this area. Power and mobile phone services are also required to supply lighting and power including to the tunnels.

CSA-2 will be progressively cleared and stabilised with clean aggregate (or similar e.g. river run gravels). Any placed aggregate or river run gravel material will be maintained to ensure the staging area remains stabilised.

The power station platform will be excavated to design levels. Any disturbed area that is not on rock will be stabilised (aggregate or river run gravels) and then the civil operations will commence.

The Power Station is to be founded on quality bedrock which is assumed to be at an elevation of 128.50m, however this may vary. The Power Station covers an area of approximately 525m$^2$ and requires excavations to depths of 5-6m. Several smaller areas may require deeper excavations.

Machinery associated with construction activities at the Power Station Site, including heavy vehicles, will be located and used at this site.

The area will also be used for small scale stockpiling of earth and rock spoil (approximately 100m$^3$), with excess material being carted to the spoil disposal areas. Suitable spoil, including excavated tunnel material, may be repurposed as construction material and aggregate for site development purposes. Spoil will also be used to create a raised pad at the power station site.

A perimeter bund will be installed around the perimeter of the staging area to divert clean water away from the works area and to impound site runoff that does not initially soak to ground. Any site runoff from within the works area will be diverted towards the proposed sediment retention pond (SRP) device for treatment.

Tunnel Excavation

Tunnelling excavation is likely to be based on a blast and excavate methodology. Tunnel spoil will generally be carted directly to the spoil disposal areas.

The tunnelling and tunnel shotcrete processes will generate dirty and potentially high pH water that will require treatment at CSA-2 prior to discharge (discussed later). It is also expected that up to 150 to 200 L/s of groundwater may infiltrate or seep into the excavated tunnel. These clean groundwater flows will, where practicable, be captured and kept separate from any other tunnel construction discharges that may have higher pH and/or sediment (e.g. shotcrete residue). Capturing this clean diverted groundwater, and keeping it separate, allows it to be discharged directly to the Waitaha River and significantly reduces the amount of water needing pre-discharge treatment.

Some clean water may not be able to be separated and will be treated with the construction water.

All dirty tunnel construction water will be treated before being discharged to ground (soakage) or to the river.

The water treatment system will include a combination of pH treatment and sediment removal. The system will also include the construction and use of a sediment retention pond (SRP) to manage water from the working areas and water from the tunnel construction and any associated inseparable groundwater.

The SRP will likely be located to the north of CSA-2. The device will be an impoundment area to further encourage soakage within the river gravels. The SRP will be fitted with T-Bar decants as the primary outlet and an emergency spillway structure.

The inside of the tunnel is proposed to be concrete lined in sections, therefore it is likely high pH water will be encountered throughout the works. High pH water poses a risk to freshwater species that may be present in the adjacent watercourses. Any high pH water will be managed in accordance with the best practice methodology provided in Section 4.6 of this ESCP.

In summary, construction water from the tunnelling operations will be directed to the pH buffering tank(s) where any pH adjustments will occur. Once the pH is confirmed to be neutral then the water will be pumped to the sediment tank(s) or the SRP for further treatment (removal of sediment). Once treatment is complete, the water will be discharged off site (either to ground or to the river).

Ongoing water quality monitoring will be undertaken to ensure that the water meets the following discharge

standards:

- Water clarity greater than 100mm; and
- pH between 6.7 and 8.2 (as recommended by the Project Ecologist).

If water clarity improvements are required, chemical treatment processes can also be deployed (see Section 4.5 of this ESCP).

Tailrace – ESCP-004-02

The tailrace channel will be constructed with blasting and an excavator working from the true right of the river and during a period of low flow. If required, an excavator will progressively push the river gravels to the extent of the tailrace channel forming a bund. The bund would isolate the tailrace working area if not already isolated.

During rain events it is expected that the area will flood. All plant and equipment will be moved out of the flood zone and any exposed clay/silt area will be covered with aggregate/rock.

All concrete works must be completed to allow sufficient curing time before rain events. No concrete works will be undertaken in the rain.

Once the Tailrace channel is completed, the bund will be removed (if constructed).

## 3.6. Headworks and Intake Structure

Construction Staging Area 1 (CSA-1) is proposed to be constructed adjacent to and upstream of the intake headworks area. CSA-1 will be approximately 0.7ha in area and located adjacent to the Waitaha River. Access to CSA-1 will be via a Construction Staging Access Road (approximately 140m long with an average width of 9m).

There will be a permanent maintenance accessway from the access portal to the intake and will be approximately 60m long and 10m wide (12m for construction).

The access roads will be constructed using a cut and cover methodology to minimise the extent of open area at any given time. The road alignment will be stripped, geotextile laid, and clean aggregate (or similar e.g. river run (gravel) material) placed before the end of each workday or prior to rainfall. All works will be completed in a forecast dry weather window.

The toe of both access roads will likely require rock armouring to avoid damage from flood events. The roads will be graded no steeper than one in six.

Access roads will be maintained to ensure that any runoff from the works area is from a stabilised surface and therefore to minimise the potential for any sediment laden runoff from the road.

Construction Staging Area 1 is proposed to be located on a terrace, on the true right of the Waitaha River upstream Morgan Gorge well above the active riverbed. The area is considered to be outside of the flood plain. The area will be levelled and cleared to provide for infrastructure, buildings, helipad, and machinery for construction works.

During the construction any topsoil or organic material will be stripped to install a clean water diversion bund upslope of the works area to divert clean water away from the works area.

A perimeter bund will be installed downslope of the works area. The bund will impound any runoff from CSA-1 to allow time to soak to ground. The stripping of any topsoil and organic material will expose the river gravels and will provide a general “stabilised’ working environment for the levelling operations.

A vegetation buffer is proposed to be retained to minimise views of the facility from the surrounding area.

To gain access to the area to undertake the works, plant and equipment will initially be flown in via helicopter. Once the access tunnel is completed, Headworks construction can continue with less reliance on helicopters.

The Construction Staging Area 1 and the temporary access road are not required following completion of construction. Accordingly, these areas will be rehabilitated to indigenous vegetation cover upon completion of the works.

Cementitious products are required for the headworks and intake structures therefore it is likely high pH water will be encountered throughout these works. Water from areas of proposed concrete pouring will be managed in accordance with the high pH water management strategy outlined in Section 4.6. The water treatment system will include a combination of pH treatment and sediment removal.

Intake Structure

Refer to ESCP-006 for draft methodologies which are summarised below.

The intake structure will require works within the Waitaha River to form and train the river channel to provide for safe dry working areas to enable construction of the training wall, sluice gate, guide wall and main weir.

The first stage will likely involve works on the true right of the river. A bund will be formed using river gravels/rock to allow the upstream guide wall, sluice gate and training wall to be constructed. It is expected that during rain events the bund will overtop.

Once these works are complete, the river gravel beach and intake channel will be formed so that the bund could be progressively removed, and river flow begin to flow through the intake channel and over the sluice gate via the guide walls.

Works will then switch to the true left of the river with the bund assisting to divert the river flow over the sluice gate. The works on the left of the river will include the main weir.

Once these works are complete, final bund removal and river training will be completed.

## 3.7. Gravel Extraction

Gravel for the access roads will be sourced locally at the following locations:

- Beach areas within the Waitaha River – by horizontal scraping of the dry gravel above the water level and away from the edge of wet areas; and
- Spoil disposal areas on McLean farm.

Access to the gravel extraction areas will be updated/formed as required.

Gravel will be carted to designated screening areas on within McLean farm. Suitable gravel sizes will then be hauled to road construction areas and any unsuitables will be used to back-fill excavation areas.

# 4. EROSION AND SEDIMENT CONTROL DETAILS

The erosion and sediment control methodology has been designed in accordance with best practice and the principles outlined in ECAN ESC Toolbox.

Specific erosion and sediment control drawings are attached in Appendix A.

## 4.1. Soakage

High soakage rates are expected in some areas due to the underlying nature of the alluvial gravels and sands.

It is likely that the soakage rate will exceed the majority of the rainfall events and minimal runoff is expected to discharge to the sediment retention pond devices. The local high soakage will mean it is expected that any water that does discharge to a sediment retention device is likely to soak to ground within the device. It is noted that the soakage rates may decrease over time with the infiltration of fines.

## 4.2. Clean Water Diversions

Clean water diversions (excluding tunnelling operations) will be constructed to divert upper catchment clean water away from the area of works wherever practical. This will likely include a perimeter bund around the extent of works and stage boundaries and will be progressively installed (and removed) as the operation progresses.

The clean water diversions will be constructed using stripped topsoil / organic materials or river run and will be stabilised immediately following construction (as required).

To comply with ECAN ESC Toolbox, the clean water diversion bunds should be a minimum of 550mm high to provide a diversion capacity for a maximum clean water catchment area of 2ha up to the 5% Annual Exceedance Probability (AEP) storm event, plus a freeboard of 300mm. Calculations are provided in Table 2 below.

All clean water diversions will discharge to flow paths that are stabilised against erosion beyond each works site.

Note, all calculations ignore any soakage rate of the site (refer to Section 4.1 above). To this extent, the design is considered conservative.

*Table 2: Clean water diversion bunds assuming maximum clean water area for the site.*

| Clean water diversions | | | | | |
|---|---|---|---|---|---|
| 5% AEP (24 hr) | Catchment Area (maximum) | Peak Flow (m3/s) | Slope (minimum) | Minimum Design Flow Depth (mm) | Including Minimum 300mm Freeboard |
| 413mm | 5ha | 1.09 | 2% | 250 | 550 |

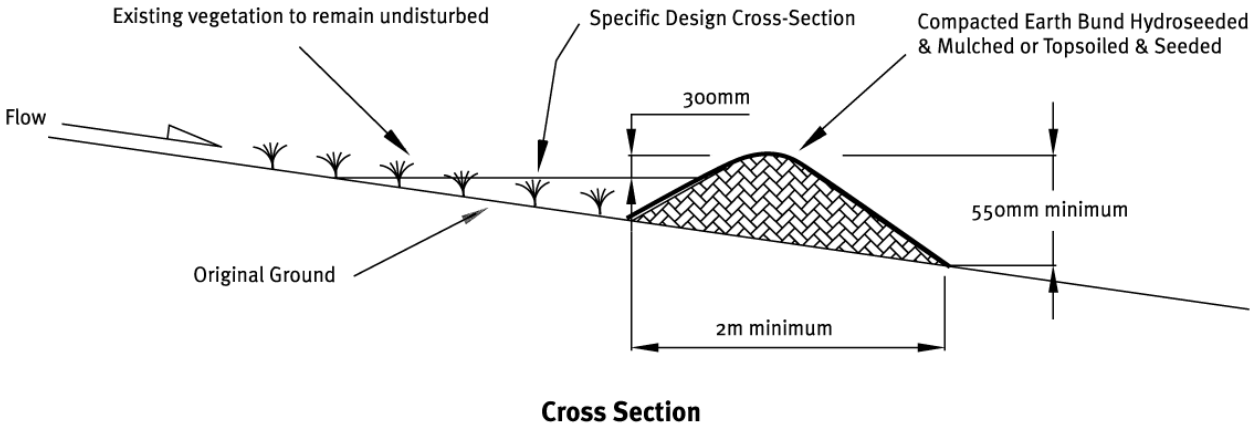



*Figure 3: Typical Cross section of a clean water diversion bund (Note, river run gravel maybe used).*

## 4.3. Dirty Water Diversions

Dirty water diversions are proposed below the construction laydown areas, power station staging area, and around the farm staging and disposal areas. Where SRPs are proposed, dirty water diversions will be used to divert any sediment laden runoff towards the SRP for treatment.

A dirty water diversion bund will be installed as the staging progresses within each works area to direct runoff into the respective SRP.

The maximum contributing catchment area for the dirty water diversions is 2ha (locations TBC). To comply with ECAN ESC Toolbox, the calculated minimum perimeter bund height installed across the project would be a minimum of 550mm to provide conveyance of the 5% AEP storm event, plus 300mm freeboard. Calculations are provided in Table 3 below.

Note, again all calculations ignore any soakage rate of the site (refer to Section 4.2 above), therefore, the design is considered conservative.

*Table 3: Dirty water diversion bunds assuming maximum dirty water area for 2ha.*

| Perimeter bunds (dirty water diversion) | | | | | | |
|---|---|---|---|---|---|---|
| 5% AEP (24 hr) | Catchment Area (maximum) | Peak Flow ($m^3/s$) | Base Width | Slope (minimum) | Minimum Design Flow Depth (mm) | Including Minimum 300mm Freeboard |
| 413mm | 2ha | 1.2 | 1m | 2% | 250 | 550 |

The minimum bund height installed across the site will be 550mm (250mm plus 300mm free board), which is designed to convey the 5% annual exceedance probability (AEP) storm.

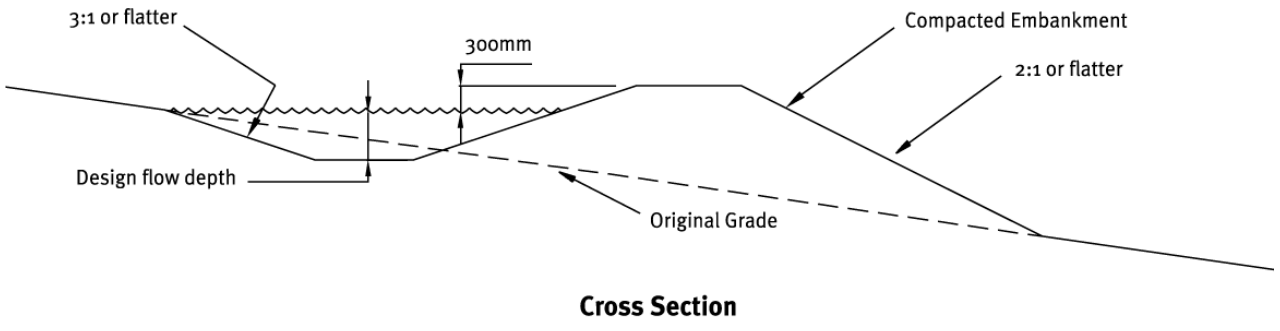



*Figure 4: Cross section of a dirty water diversion (Note, river run maybe used).*

## 4.4. Sediment Retention Ponds

Five SRPs will be constructed to manage the proposed earthworks operations.

Four 2ha SRPs will be constructed at the spoil disposal sites. The maximum exposed areas will be managed to ensure that the exposed area discharging to each SRP will not exceed 2ha. A draft design for a 2ha SRP is provided in ESCP-SRP-01.

A fifth SRP will be constructed at the Power Station Works area. This device will be used to provide treatment for discharges from the tunnelling operations. This device will used to capture runoff from the Construction Staging Area 2 as well as take pumped flow from the tunnel discharge (after initial pH treatment) during construction. The indicative size of this SRP is 900m$^3$ (if space allows). Depending on space constraints, this SRP may not have a forebay and level spreader. All other components of the SRP will be in general accordance with the ECan ESC Guidelines. A draft design is provided in ESCP-SRP-05.

The project area subsoils are an alluvial gravels and sands and sandy silts, and it is expected the soakage rates will be high and general site overland flow volumes lower than a typical site. Therefore, the SRPs have been sized with a minimum storage volume of 2% of the maximum contributing catchment area.

Sediment will be cleaned out of the SRPs before the volume of sediment accumulated within the device reaches 20% of the design volume.

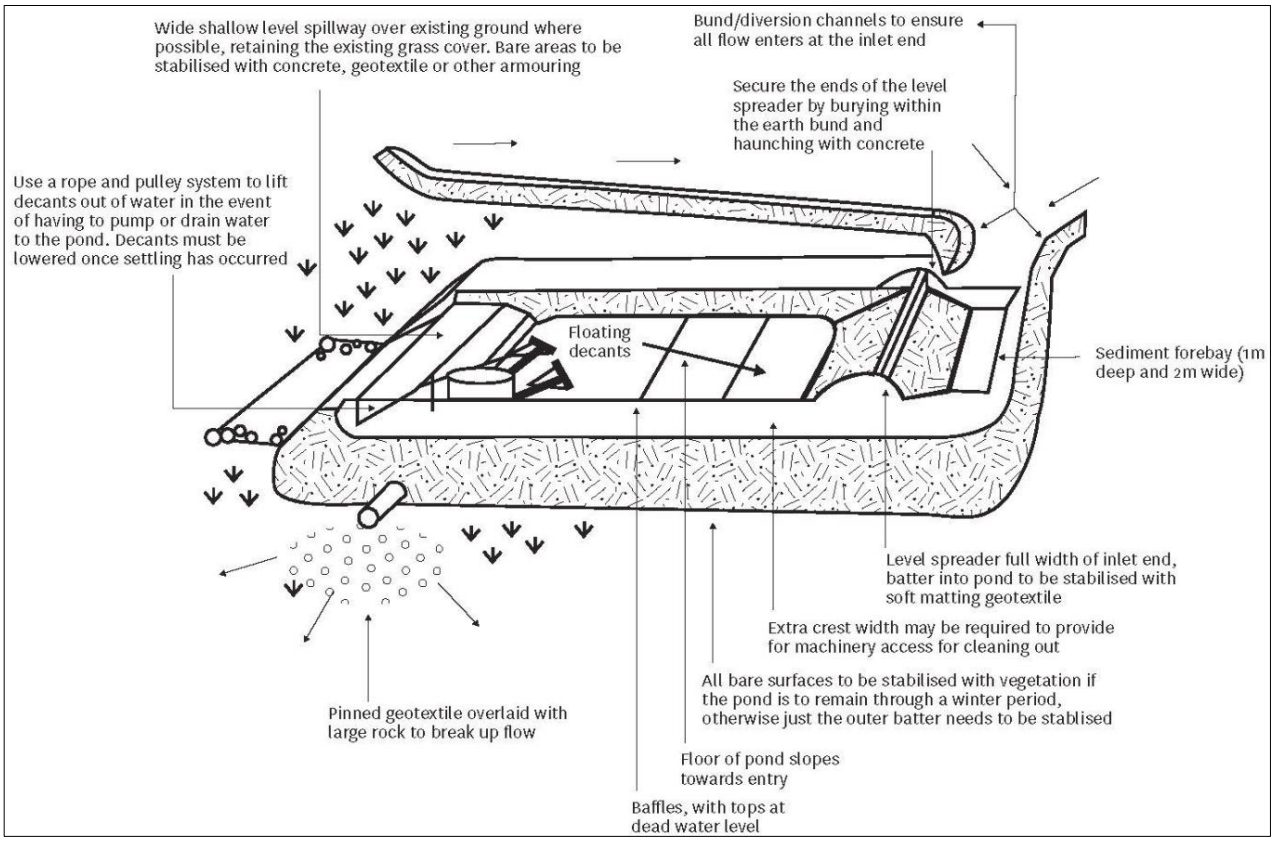



*Figure 7: Schematic of a sediment retention pond.*

## 4.5. Chemical Treatment

Chemical treatment will be employed on site to enhance the sediment removal efficiency of the SRPs should bench testing show benefits of chemical treatment, if soakage rates were not as anticipated, and water quality discharging from the SRP was not acceptable i.e., less than 100mm of clarity. Prior to consideration of any sediment related chemical treatment, chemical bench testing will be undertaken to determine the effectiveness of chemical treatment and the appropriate dose rate.

The results and management of the chemical treatment systems will be detailed in a Chemical Treatment Management Plan (ChemTMP). The ChemTMP will be provided prior to commencement of works being undertaken on site and will be monitored in accordance with the ChemTMP throughout project.

Any chemical treatment would be undertaken in accordance with the recommendations of ChemTMP.

## 4.6. High pH Water Management

The project team will ensure no concrete waste enters surface waters and all mortars, grouts, and other cement-based products used on site are fully cured prior to contact with water.

Strict measures will be in place to ensure works areas remain dry when dealing with wet cement-based products. Works in-channel or in areas where it is not possible to store and treat site runoff will require additional measures to minimise such potential effects, particularly in areas where there is less water dilution (i.e., flowing tributary waterways).

Washing of concreting tools, machinery, or formwork should be done well away from any waterway and in a contained area. The most practicable location to do this at the time of work will be used.

### Concrete Wastewater Management

Significant concrete operations are required for the tunnel operations. A significant proportion of the tunnel excavation will be concrete lined (both walls and floor) and at least 50% of the tunnel will likely require rock bolting and shotcreting during excavation.

During concrete pour operations any groundwater discharging from the tunnel operations will be contaminated and considered concrete wastewater. The water will be collected in a sump at the outlet end of the tunnel, and the following water management regime will be employed in general accordance with drawing ESCP-007-01 (Appendix A):

1. Water within the works area will be pH tested and pumped into a sediment settlement tank.
2. If the water clarity within the initial treatment tank is >100mm and the pH is within +/- 0.5 of baseline (baseline being the upstream river pH) and within the range of 6.7 and 8.2, then the water will be pumped to an area to soak into the ground (the SRP impoundment device). Alternatively, the discharge can go back into the Waitaha River provided no scour or erosion occurs at the discharge point.
3. If the water clarity is <100mm then chemical treatment will be initiated to achieve a minimum water clarity of 100mm (in accordance with the ChemTMP).
4. If the pH within the tanks is outside of the +/- 0.5 of baseline and outside of the range of 6.7 and 8.2 then the water will be pumped to the second treatment tank.
5. The second treatment tank will be set up to inject carbon dioxide gas ($C0_2$) or Citric Acid into the water to lower the pH levels. Once the pH levels are within +/- 0.5 of baseline and within the range of 6.7 and 8.2 then the water will be pumped to an area to soak into the ground, (the SRP impoundment basin).

As a contingency, if the pH cannot be lowered to within range, then the water will either be collected by a (sucker) truck and removed off site to an authorised disposal area or taken to the onsite concrete batch plant to be recycled into the concrete batching process.

The concrete trucks and pump lines will be washed out back at the batching plant where wastewater is recycled back into the batching process.

All pumped water discharging off site will meet the following water quality standards:

- Water clarity of greater than 100mm; and
- pH within +/- 0.5 of the baseline and between 6.7 and 8.2.

## 4.7. As-Built Certification

Prior to earthworks commencing within an area, as-builts for the ESCs for that area will be provided to the West Coast Regional Council. The as-built certification will confirm that the controls have been constructed in accordance with the ESCP and ECAN ESC Toolbox.

## 4.8. Stockpiles

Any stockpiling will be within the perimeter bunding and will be seeded on completion. Topsoil will be temporarily stockpiled and/or used for clean water (perimeter) bunds as the stages progress. The completed areas will be topsoiled and grass seeded.

## 4.9. Dust Management

The emphasis of the site dust strategy will be one of prevention.

Truck and vehicle movements will be limited to stabilised roads and tracks and at low speed. These areas will be covered with compacted aggregate or river gravels and maintained in a stabilised state. Restricting the truck movements to the stabilised areas and designated access tracks will allow dust control measures to be focused on the highest risk areas. This will be achieved by maintaining the quality of the designated access tracks and wetting by water cart, if required.

Vehicle movements on site will be governed by speed restrictions which will assist in preventing dust generation as well as site safety.

As areas of the site are completed, they will be progressively topsoiled and stabilised. This will minimise the works area at any one time which reduces the dust risk.

## 4.10. Stabilisation

Progressive stabilisation will be undertaken as working areas are completed. As stated above any stockpiles will be stabilised immediately upon completion. Following completion of each disposal area, topsoil will be re-spread, and the completed area re-established into pasture.

The temporary headworks access road is to be removed, and vegetation reinstated upon the completion of works.

## 4.11. Monitoring and Maintenance

All erosion and sediment control measures and methodologies will be monitored and maintained during the works in accordance with ECAN ESC Toolbox. Monitoring will be undertaken before and immediately after rain events as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

Any sediment deposits and bulges against the silt fences will be removed when sediment accumulation reaches 20% of the fabric height.

The SRP will be cleaned out before accumulated sediment volume reaches 20% of the total volume. Forebays will be cleaned out if there is any evidence of sediment deposition.

# 5. SUMMARY

This ESCP addresses the proposed erosion and sediment control measures associated with the proposed earthwork areas and activities proposed to be undertaken to establish the Waitaha Hydro Project.

The overall project is expected to take approximately three and a half to four years to construct. The specific earthworks activities associated with this ESCP will be staged and undertaken as separate operations.

The works will be carried out in accordance with this ESCP, the principles of ECAN ESC Toolbox, the Freshwater Ecology Management Plan, and the relevant conditions of the fast-track approvals if granted. The methodology proposed will ensure that any adverse effects of the construction are managed in accordance with the ECAN ESC Toolbox and consent requirements and will be acceptably minimised.

The proposed ESC methodology is the best practicable option for the proposal. It represents best-practice control measures, staged construction activities and progressive stabilisation. It is consistent with the industry-leading approach that has appropriately minimised sediment discharges and downstream effects on multiple projects throughout New Zealand.

The alluvial gravel and sandy soils within the site are expected to have high soakage rates and therefore reduce the volume of runoff entering the proposed sediment control measures. This will minimise the overall potential discharges from the project to low level and compare favourably to runoff from the existing land surface.

The efficiency of the ESC system will be further enhanced from the staging of works and progressive stabilisation, thus reducing the potential area exposed to erosion.

It is anticipated that the proposed ESC methodology will minimise the discharge of sediment from the site to an extent that is similar to the existing land use, and that will not compromise the outcomes sought by the best practice guidelines.

Overall, on a technical basis, the proposal is consistent with best practice.

# 6. APPENDICES

## 6.1. Appendix A - Erosion and Sediment Control Drawings

| Drawing number | Drawing title | Date | Revision | Sheet No. |
|---|---|---|---|---|
| ESCP-001-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Everyday Access Road | 30.05.25 | C | 1 |
| ESCP-001-02 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Everyday Access Road | 30.05.25 | C | 2 |
| ESCP-001-03 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Everyday Access Road | 30.05.25 | C | 3 |
| ESCP-001-04 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Everyday Access Road | 30.05.25 | C | 4 |
| ESCP-002-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Staging and Spoil Disposal Areas | 30.05.25 | C | 5 |
| ESCP-003-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 6 |
| ESCP-003-02 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 7 |
| ESCP-003-03 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 8 |
| ESCP-003-04 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 9 |
| ESCP-003-05 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 10 |
| ESCP-003-06 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 11 |
| ESCP-003-07 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 12 |

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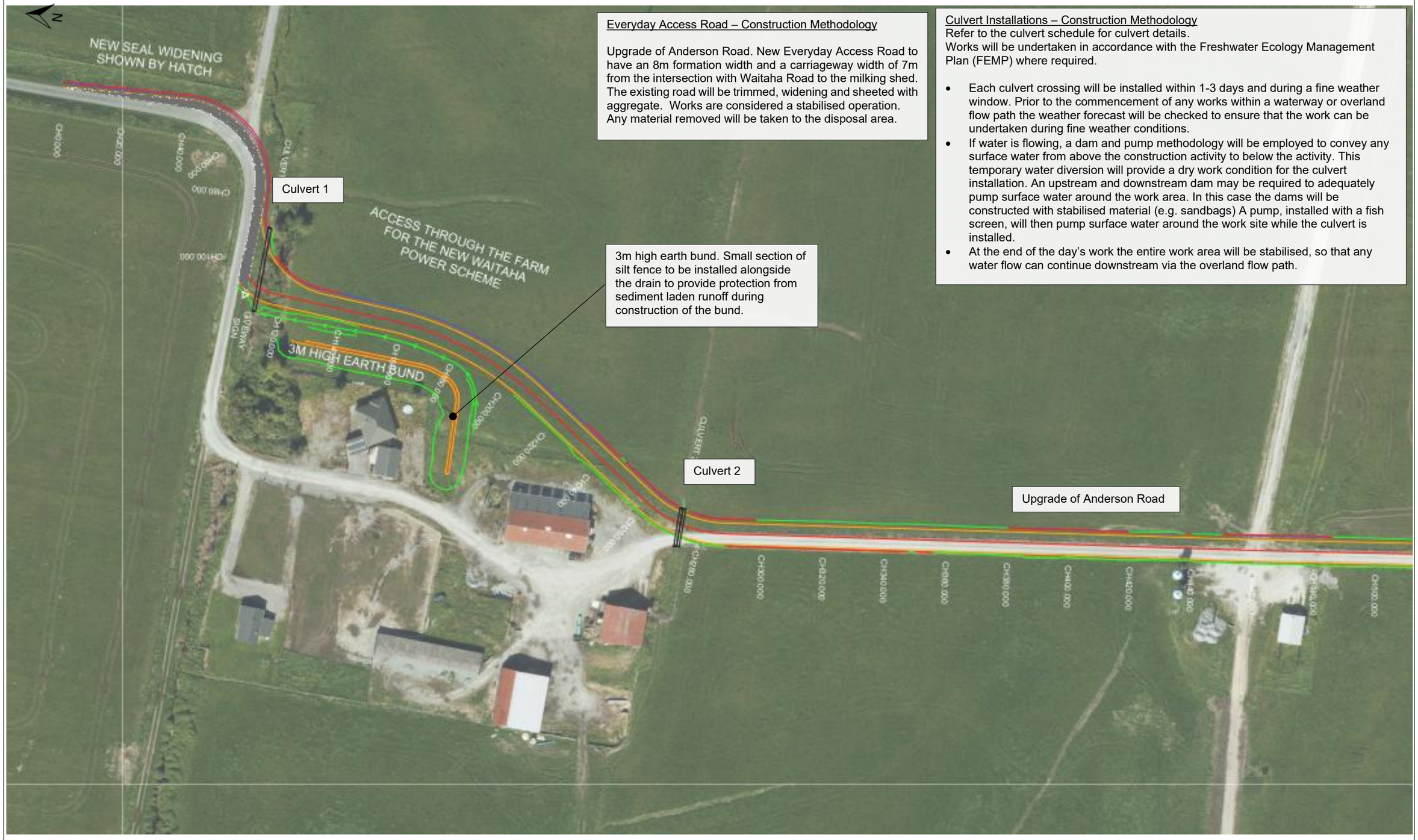
| ESCP-003-08 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station Access Road | 30.05.25 | C | 13 |
| ESCP-004-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Power Station | 30.05.25 | C | 14 |
| ESCP-004-02 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Tailrace | 12.04.25 | A | 15 |
| ESCP-005-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Kiwi Flat | 30.05.25 | C | 16 |
| ESCP-006-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Intake Structure Stage 1 | 07.07.25 | C | 17 |
| ESCP-006-02 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Intake Structure Stage 2 | 07.07.25 | C | 18 |
| ESCP-006-03 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Intake Structure Stage 3 | 07.07.25 | C | 19 |
| ESCP-006-04 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Intake Structure Stage 4 | 07.07.25 | C | 20 |
| ESCP-007-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Water Treatment System | 24.25.25 | B | 21 |
| ESCP-SRP-01 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Sediment Retention Pond 1 | 30.05.25 | A | 22 |
| ESCP-SRP-05 | WAITAHA HYDRO PROJECT Erosion and Sediment Control Plan – Sediment Retention Pond 5 | 30.05.25 | A | 23 |




Everyday Access Road – Construction Methodology

Upgrade of Anderson Road. New Everyday Access Road to have an 8m formation width and a carriageway width of 7m from the intersection with Waitaha Road to the milking shed. The existing road will be trimmed, widening and sheeted with aggregate. Works are considered a stabilised operation. Any material removed will be taken to the disposal area.

Culvert Installations – Construction Methodology

Refer to the culvert schedule for culvert details.
Works will be undertaken in accordance with the Freshwater Ecology Management Plan (FEMP) where required.

- Each culvert crossing will be installed within 1-3 days and during a fine weather window. Prior to the commencement of any works within a waterway or overland flow path the weather forecast will be checked to ensure that the work can be undertaken during fine weather conditions.
- If water is flowing, a dam and pump methodology will be employed to convey any surface water from above the construction activity to below the activity. This temporary water diversion will provide a dry work condition for the culvert installation. An upstream and downstream dam may be required to adequately pump surface water around the work area. In this case the dams will be constructed with stabilised material (e.g. sandbags) A pump, installed with a fish screen, will then pump surface water around the work site while the culvert is installed.
- At the end of the day's work the entire work area will be stabilised, so that any water flow can continue downstream via the overland flow path.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

| REV | DATE | REVISION DETAILS | APPROVED |
|---|---|---|---|
| A | 01.04.25 | Draft for review. | |
| B | 05.05.25 | Updated route through farm. | |
| C | 30.05.25 | Updated route through farm. | |
| D | 08.07.25 | Updated base plans. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| **MD** | **CS** | **ESCP-001-01** | **1** |

Culvert Installations – Construction Methodology

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Everyday Access Road – Construction Methodology

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**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

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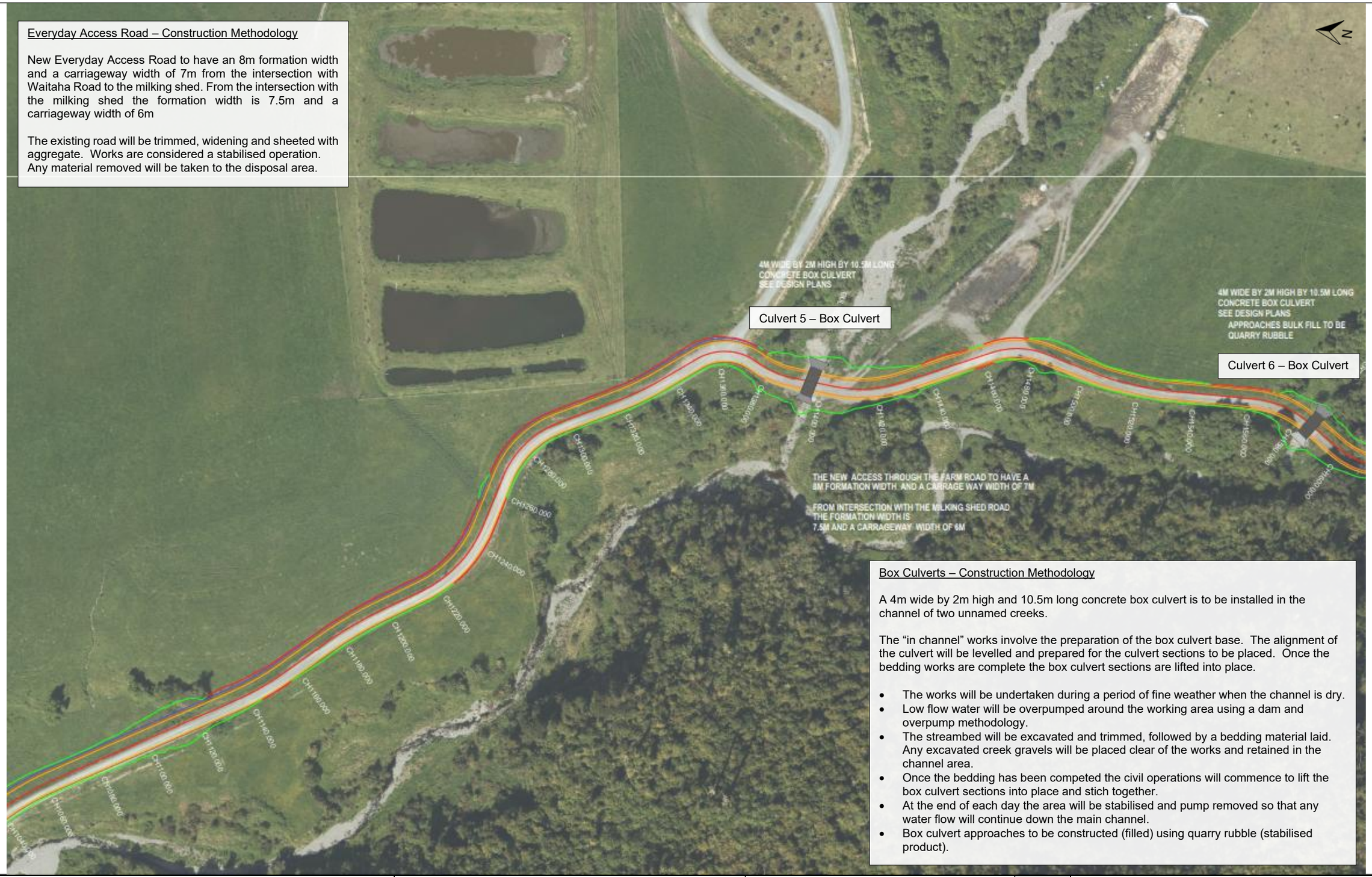


**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury’s ‘*Erosion and Sediment Control Toolbox*’.
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| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

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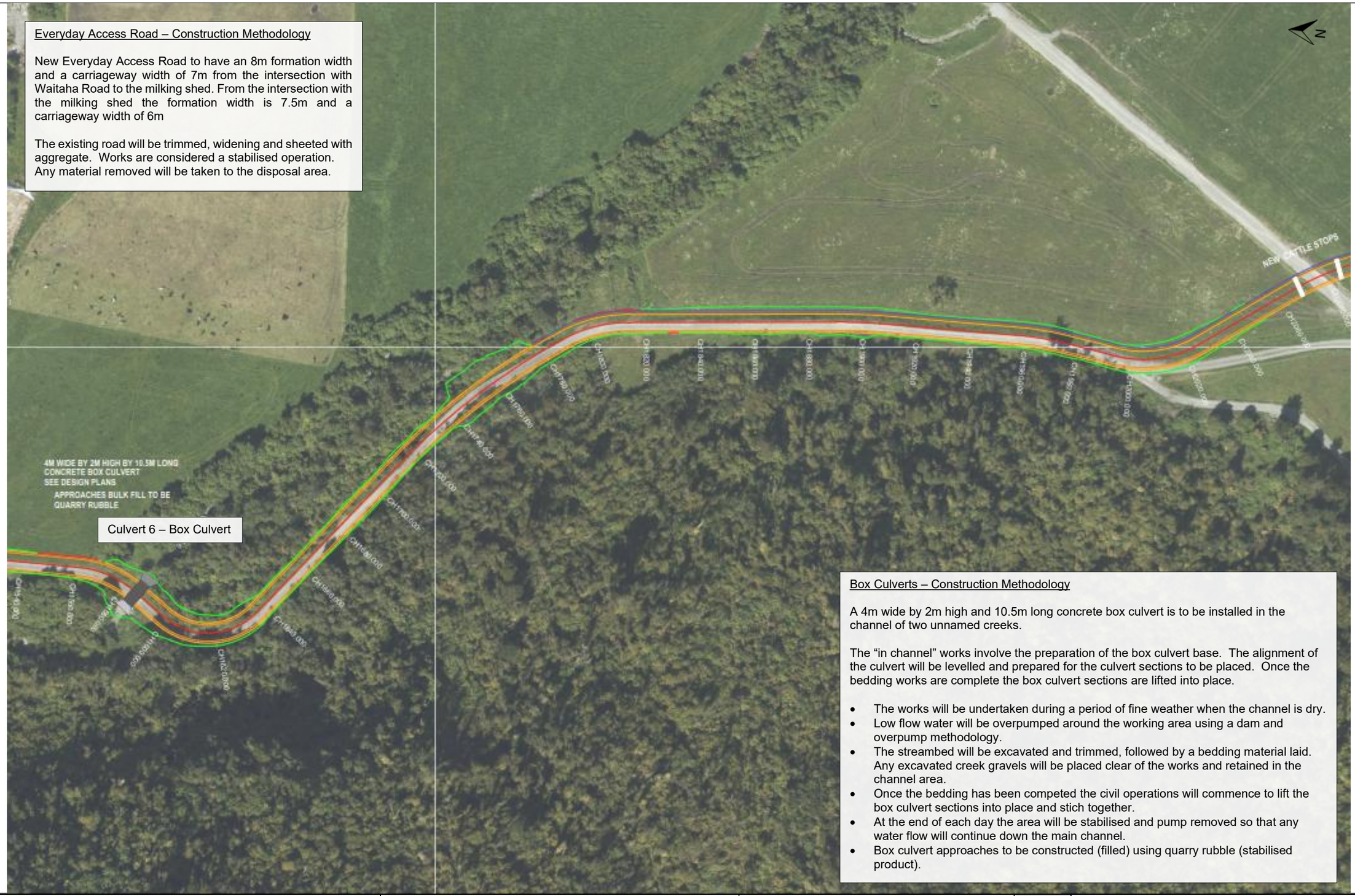
| MD | CS | ESCP-001-03 | 3 |

Everyday Access Road – Construction Methodology

New Everyday Access Road to have an 8m formation width and a carriageway width of 7m from the intersection with Waitaha Road to the milking shed. From the intersection with the milking shed the formation width is 7.5m and a carriageway width of 6m

The existing road will be trimmed, widening and sheeted with aggregate. Works are considered a stabilised operation. Any material removed will be taken to the disposal area.




Box Culverts – Construction Methodology

A 4m wide by 2m high and 10.5m long concrete box culvert is to be installed in the channel of two unnamed creeks.

The "in channel" works involve the preparation of the box culvert base. The alignment of the culvert will be levelled and prepared for the culvert sections to be placed. Once the bedding works are complete the box culvert sections are lifted into place.

- The works will be undertaken during a period of fine weather when the channel is dry.
- Low flow water will be overpumped around the working area using a dam and overpump methodology.
- The streambed will be excavated and trimmed, followed by a bedding material laid. Any excavated creek gravels will be placed clear of the works and retained in the channel area.
- Once the bedding has been competed the civil operations will commence to lift the box culvert sections into place and stich together.
- At the end of each day the area will be stabilised and pump removed so that any water flow will continue down the main channel.
- Box culvert approaches to be constructed (filled) using quarry rubble (stabilised product).

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

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| **MD** | **CS** | **ESCP-001-04** | **4** |


**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| B | 05.05.25 | Updated route through farm. | |
| C | 30.05.25 | Updated route through farm. | |
| D | 08.07.25 | Updated base plans. | |
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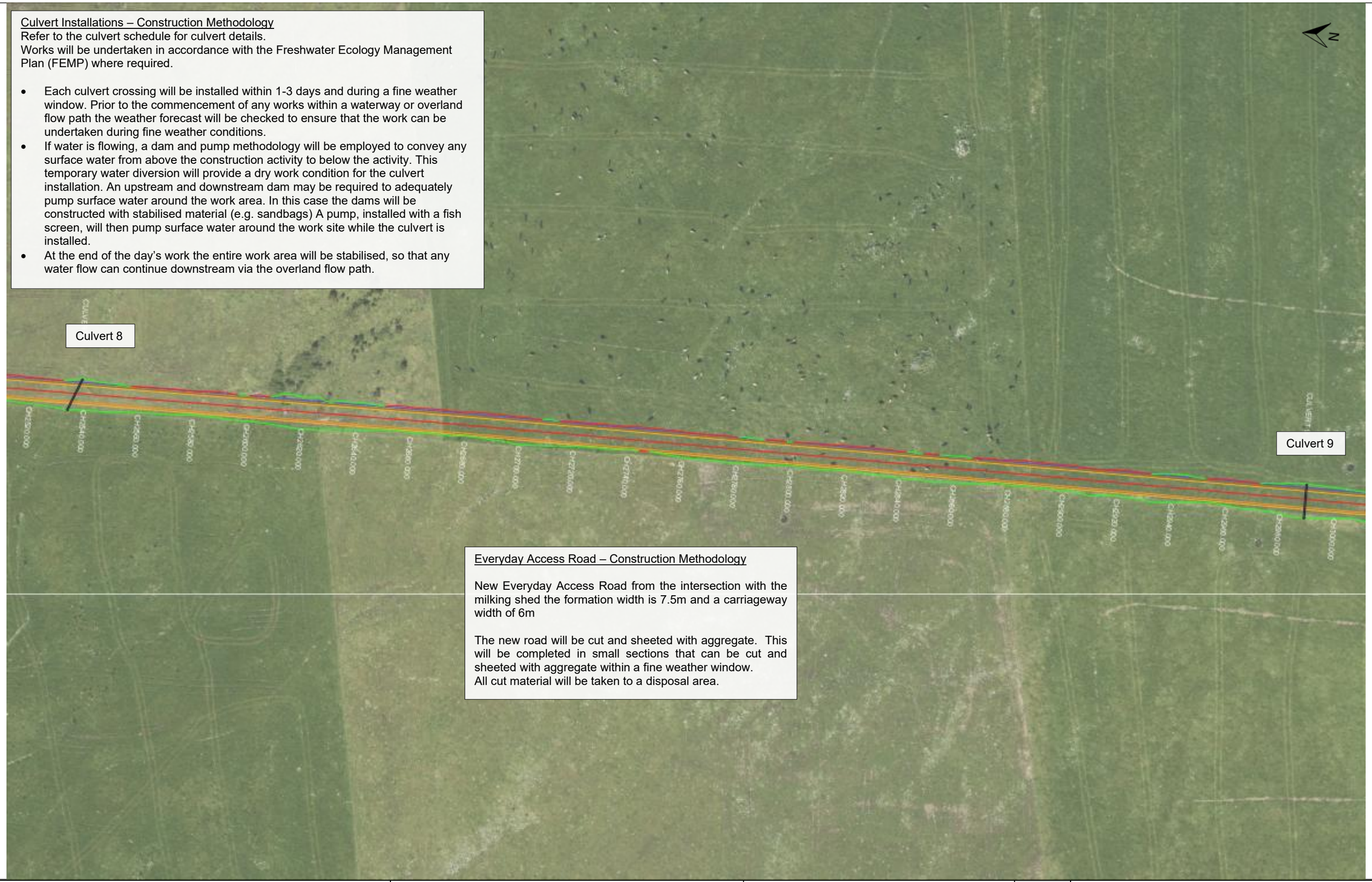
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| **MD** | **CS** | **ESCP-001-05** | **5** |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

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| C | 30.05.25 | Updated route through farm. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
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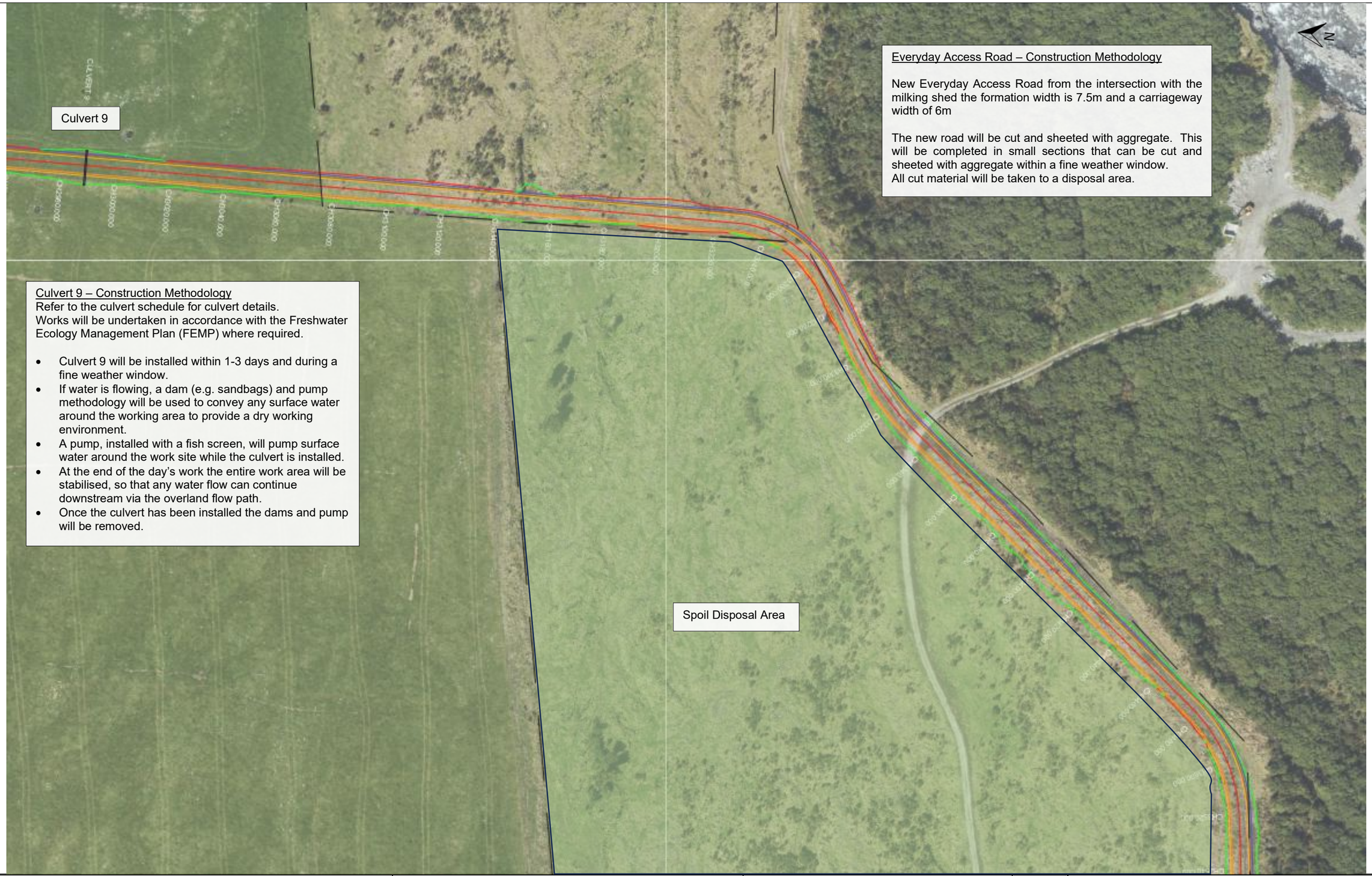
| **MD** | **CS** | **ESCP-001-06** | **6** |




Everyday Access Road – Construction Methodology

New Everyday Access Road from the intersection with the milking shed the formation width is 7.5m and a carriageway width of 6m

The new road will be cut and sheeted with aggregate. This will be completed in small sections that can be cut and sheeted with aggregate within a fine weather window.
All cut material will be taken to a disposal area.

Culvert 9 – Construction Methodology

Refer to the culvert schedule for culvert details.
Works will be undertaken in accordance with the Freshwater Ecology Management Plan (FEMP) where required.

- Culvert 9 will be installed within 1-3 days and during a fine weather window.
- If water is flowing, a dam (e.g. sandbags) and pump methodology will be used to convey any surface water around the working area to provide a dry working environment.
- A pump, installed with a fish screen, will pump surface water around the work site while the culvert is installed.
- At the end of the day's work the entire work area will be stabilised, so that any water flow can continue downstream via the overland flow path.
- Once the culvert has been installed the dams and pump will be removed.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox'*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

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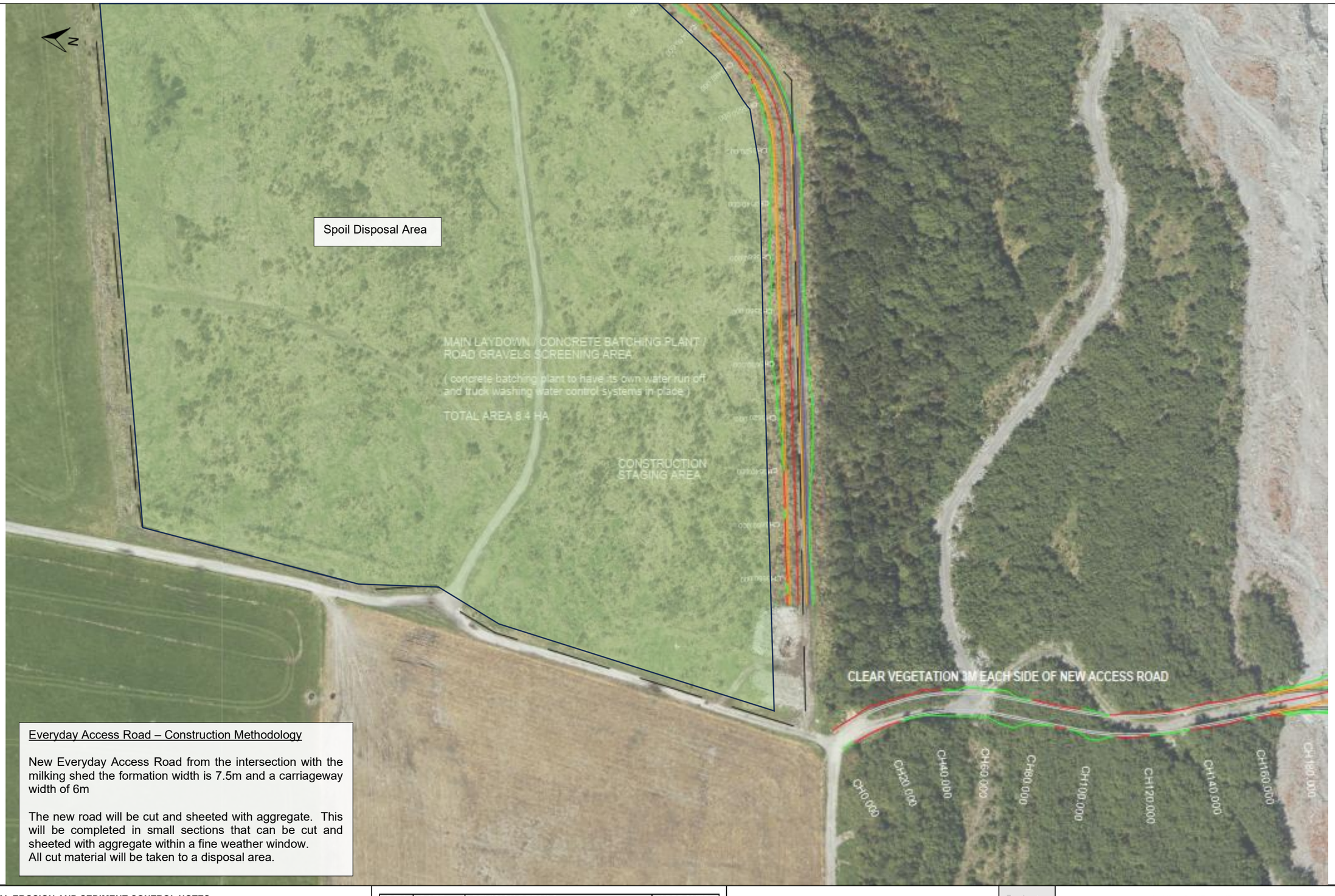
| **MD** | **CS** | **ESCP-001-07** | **7** |




Everyday Access Road – Construction Methodology

New Everyday Access Road from the intersection with the milking shed the formation width is 7.5m and a carriageway width of 6m

The new road will be cut and sheeted with aggregate. This will be completed in small sections that can be cut and sheeted with aggregate within a fine weather window.
All cut material will be taken to a disposal area.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox'*.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Everyday Access Road** |

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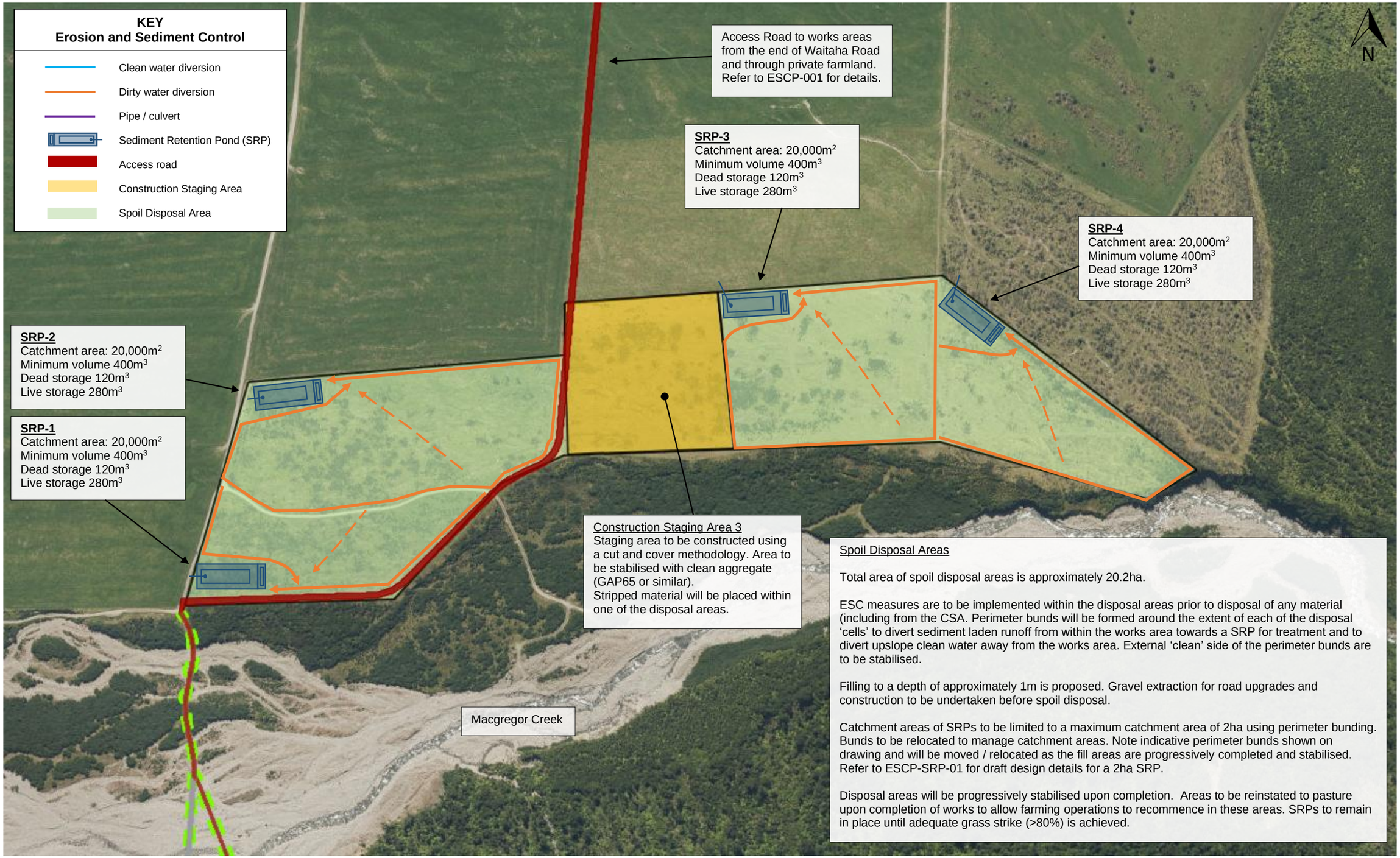
| **MD** | **CS** | **ESCP-001-08** | **8** |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
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| A | 20.12.24 | Draft for review. | |
| B | 24.02.25 | Update following client review. | |
| C | 30.05.25 | Updated footprint. | |
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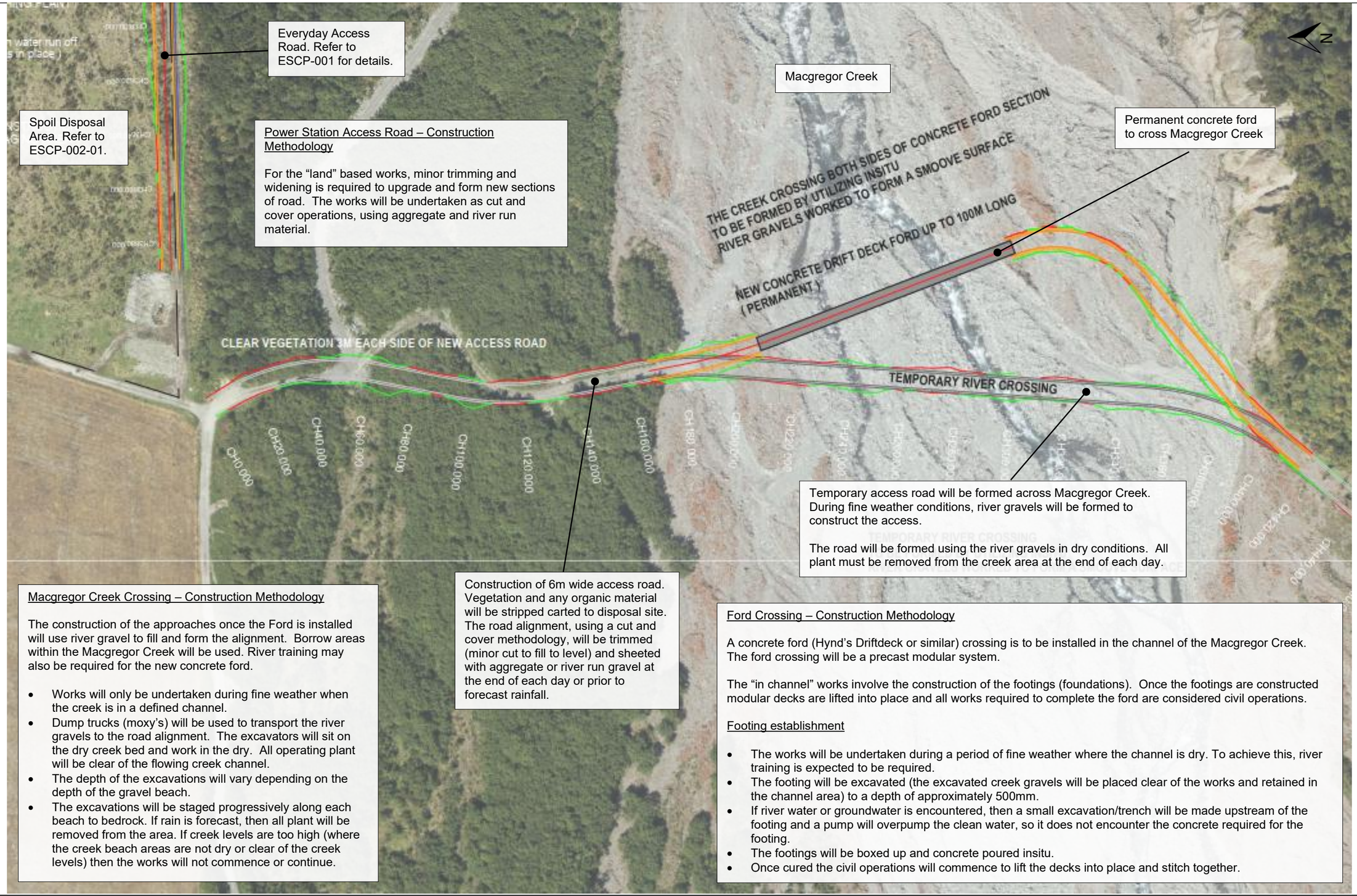
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Staging and Spoil Disposal Areas** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| **MD** | **CS** | **ESCP-002-01** | **5** |




Power Station Access Road – Construction Methodology

For the "land" based works, minor trimming and widening is required to upgrade and form new sections of road. The works will be undertaken as cut and cover operations, using aggregate and river run material.

Temporary access road will be formed across Macgregor Creek. During fine weather conditions, river gravels will be formed to construct the access.

The road will be formed using the river gravels in dry conditions. All plant must be removed from the creek area at the end of each day.

Construction of 6m wide access road. Vegetation and any organic material will be stripped carted to disposal site. The road alignment, using a cut and cover methodology, will be trimmed (minor cut to fill to level) and sheeted with aggregate or river run gravel at the end of each day or prior to forecast rainfall.

Macgregor Creek Crossing – Construction Methodology

The construction of the approaches once the Ford is installed will use river gravel to fill and form the alignment. Borrow areas within the Macgregor Creek will be used. River training may also be required for the new concrete ford.

- Works will only be undertaken during fine weather when the creek is in a defined channel.
- Dump trucks (moxy's) will be used to transport the river gravels to the road alignment. The excavators will sit on the dry creek bed and work in the dry. All operating plant will be clear of the flowing creek channel.
- The depth of the excavations will vary depending on the depth of the gravel beach.
- The excavations will be staged progressively along each beach to bedrock. If rain is forecast, then all plant will be removed from the area. If creek levels are too high (where the creek beach areas are not dry or clear of the creek levels) then the works will not commence or continue.

Ford Crossing – Construction Methodology

A concrete ford (Hynd's Driftdeck or similar) crossing is to be installed in the channel of the Macgregor Creek. The ford crossing will be a precast modular system.

The "in channel" works involve the construction of the footings (foundations). Once the footings are constructed modular decks are lifted into place and all works required to complete the ford are considered civil operations.

Footing establishment

- The works will be undertaken during a period of fine weather where the channel is dry. To achieve this, river training is expected to be required.
- The footing will be excavated (the excavated creek gravels will be placed clear of the works and retained in the channel area) to a depth of approximately 500mm.
- If river water or groundwater is encountered, then a small excavation/trench will be made upstream of the footing and a pump will overpump the clean water, so it does not encounter the concrete required for the footing.
- The footings will be boxed up and concrete poured insitu.
- Once cured the civil operations will commence to lift the decks into place and stitch together.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

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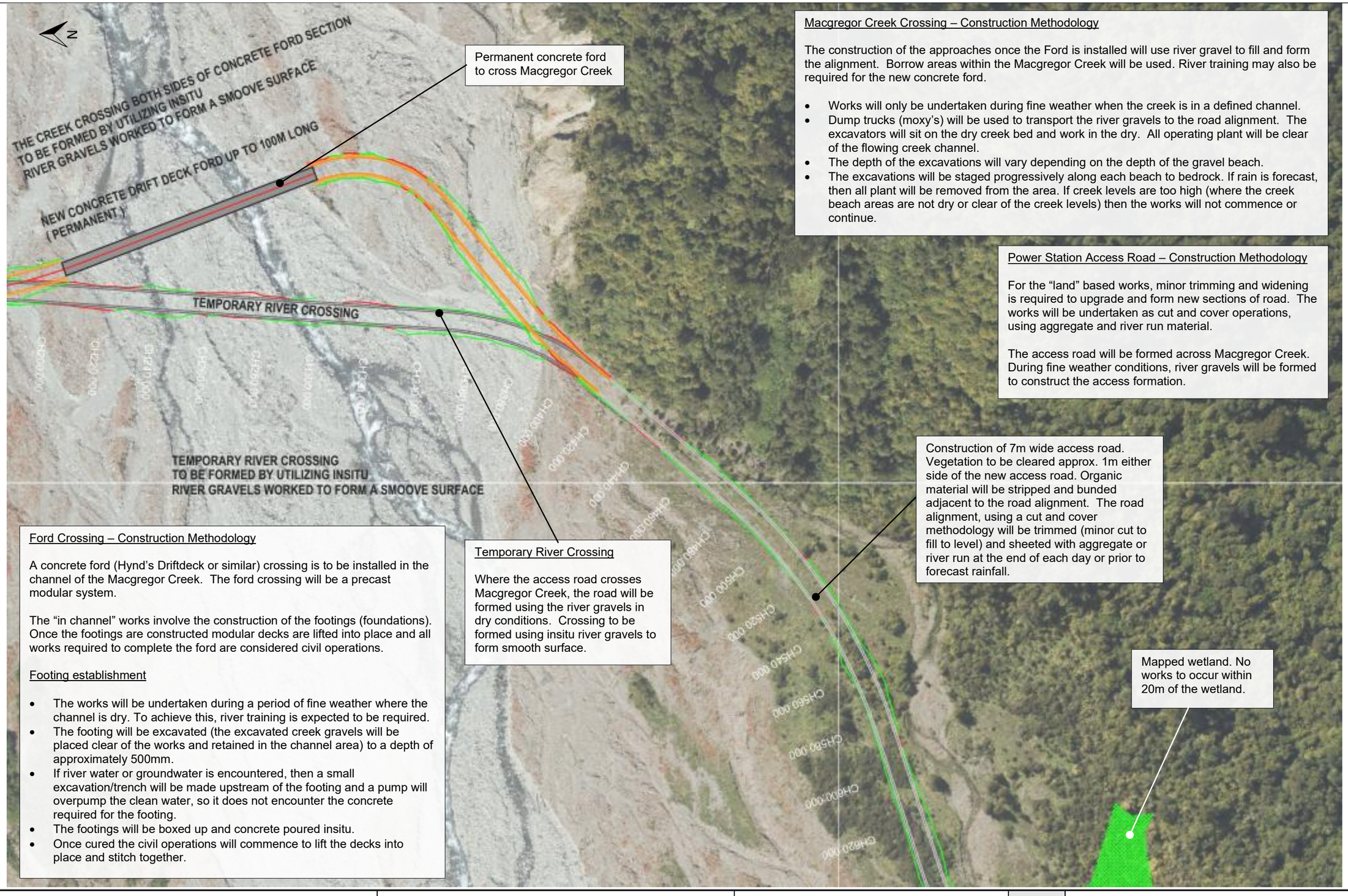
| MD | CS | ESCP-003-01 | 9 |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

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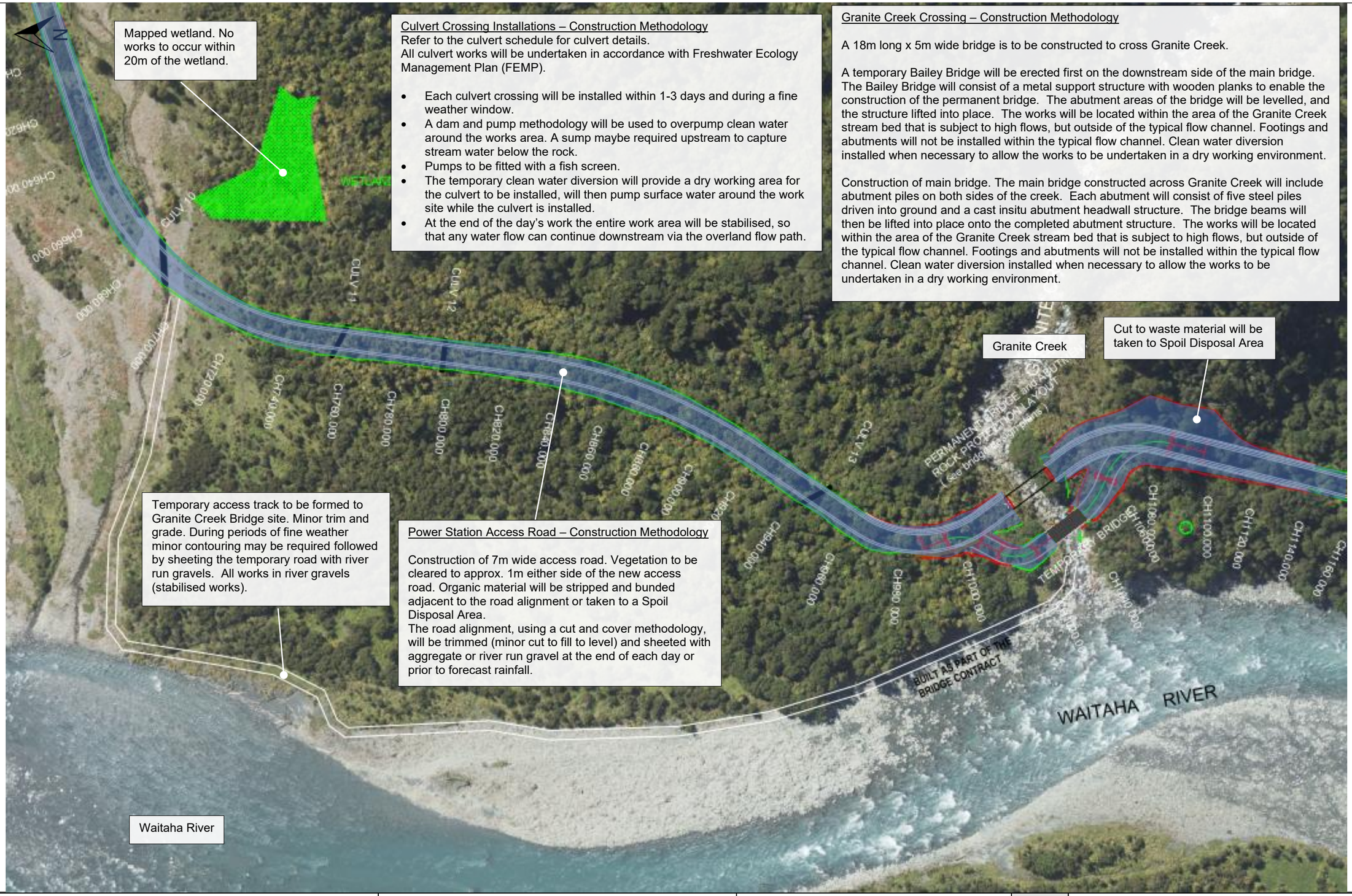
| **MD** | **CS** | **ESCP-003-02** | **10** |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
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| Project | **WAITAHA HYDROPOWER PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
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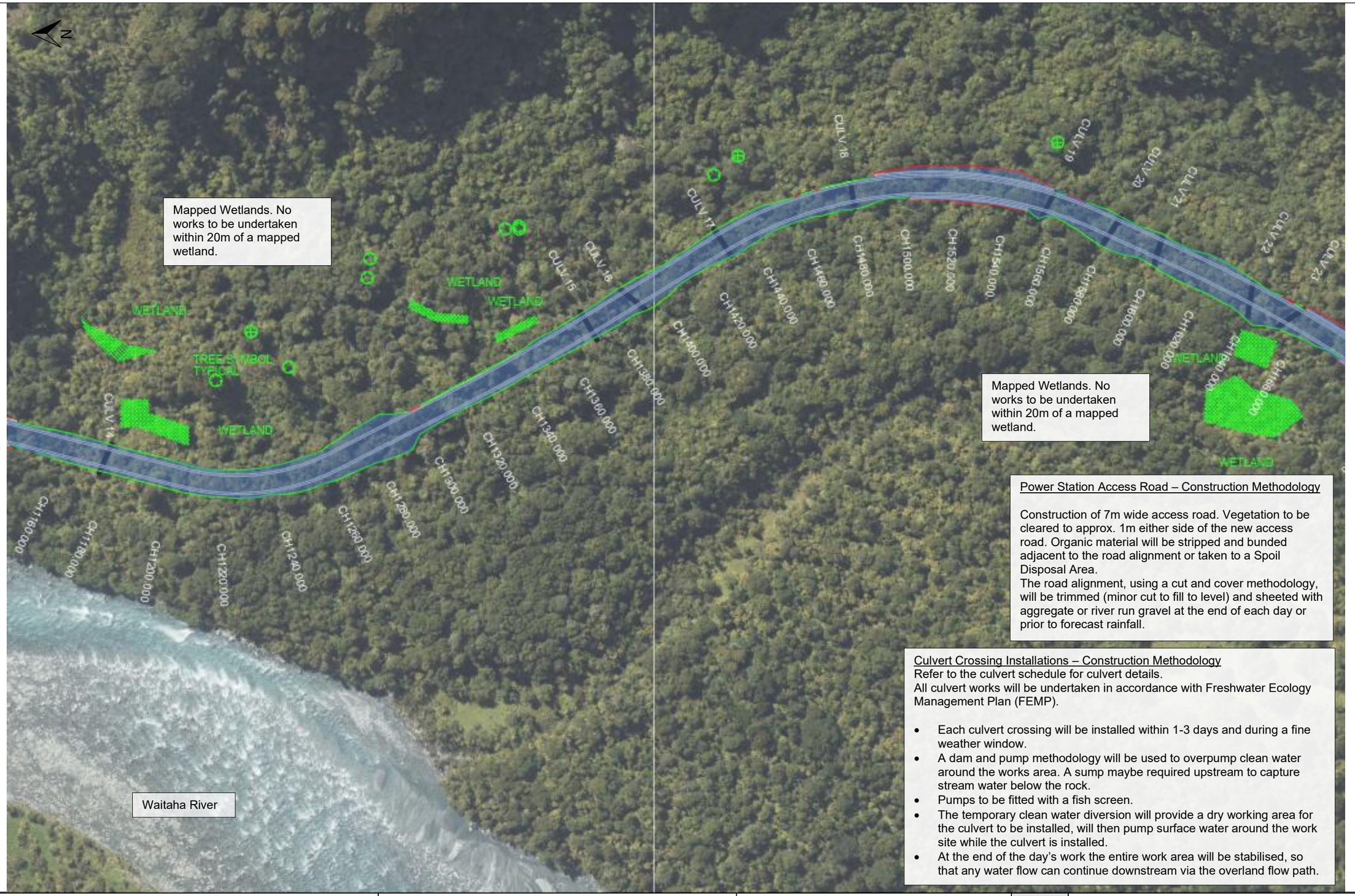
| MD | CS | ESCP-003-03 | 11 |




Power Station Access Road – Construction Methodology

Construction of 7m wide access road. Vegetation to be cleared to approx. 1m either side of the new access road. Organic material will be stripped and bunded adjacent to the road alignment or taken to a Spoil Disposal Area.
The road alignment, using a cut and cover methodology, will be trimmed (minor cut to fill to level) and sheeted with aggregate or river run gravel at the end of each day or prior to forecast rainfall.

Culvert Crossing Installations – Construction Methodology

Refer to the culvert schedule for culvert details.
All culvert works will be undertaken in accordance with Freshwater Ecology Management Plan (FEMP).

- Each culvert crossing will be installed within 1-3 days and during a fine weather window.
- A dam and pump methodology will be used to overpump clean water around the works area. A sump maybe required upstream to capture stream water below the rock.
- Pumps to be fitted with a fish screen.
- The temporary clean water diversion will provide a dry working area for the culvert to be installed, will then pump surface water around the work site while the culvert is installed.
- At the end of the day's work the entire work area will be stabilised, so that any water flow can continue downstream via the overland flow path.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

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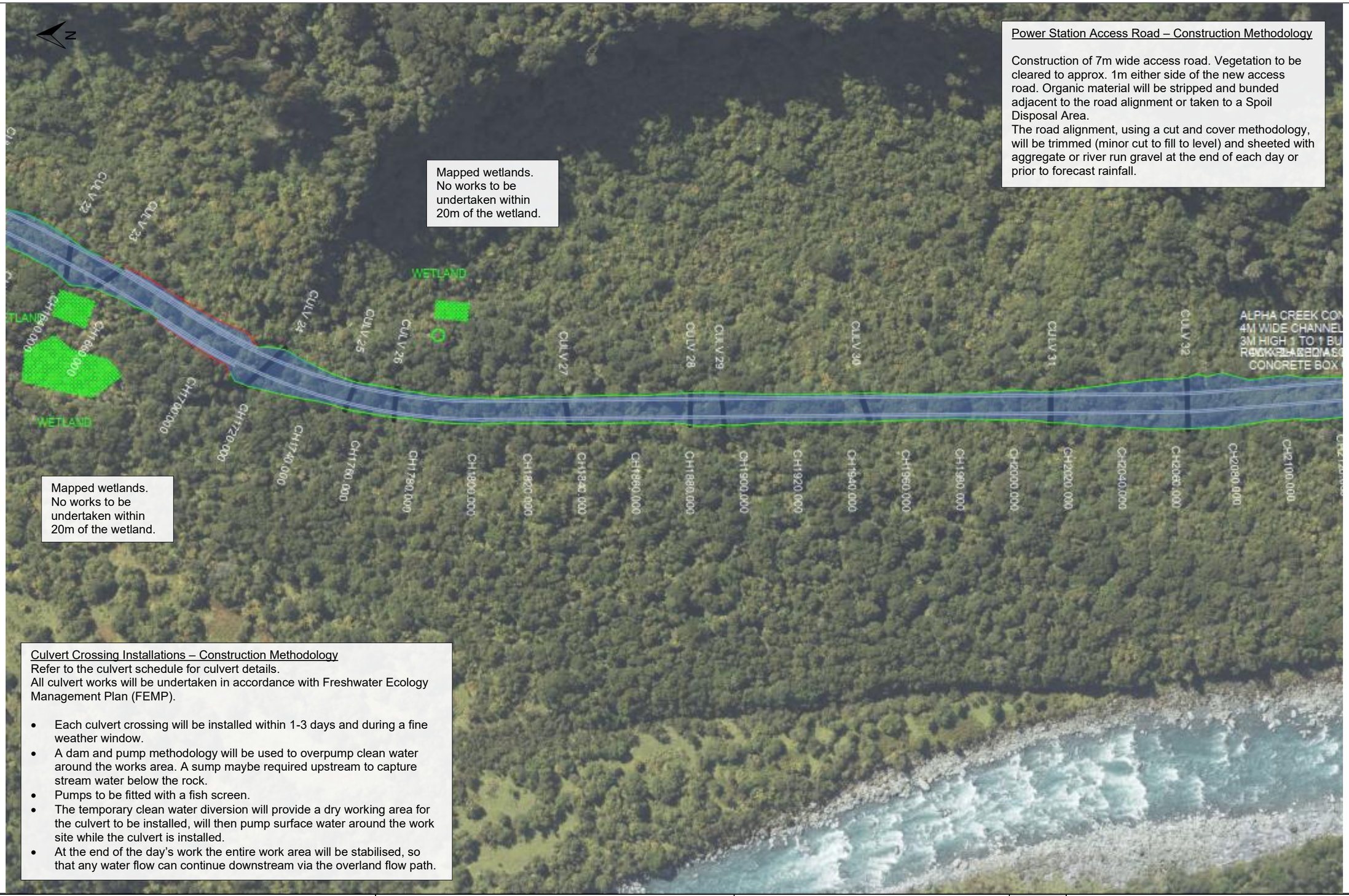
|---|---|---|---|
| **MD** | **CS** | **ESCP-003-04** | **12** |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
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## Power Station Access Road – Construction Methodology

Construction of 7m wide access road. Vegetation to be cleared to approx. 1m either side of the new access road. Organic material will be stripped and bunded adjacent to the road alignment or taken to a Spoil Disposal Area.
The road alignment, using a cut and cover methodology, will be trimmed (minor cut to fill to level) and sheeted with aggregate or river run gravel at the end of each day or prior to forecast rainfall.

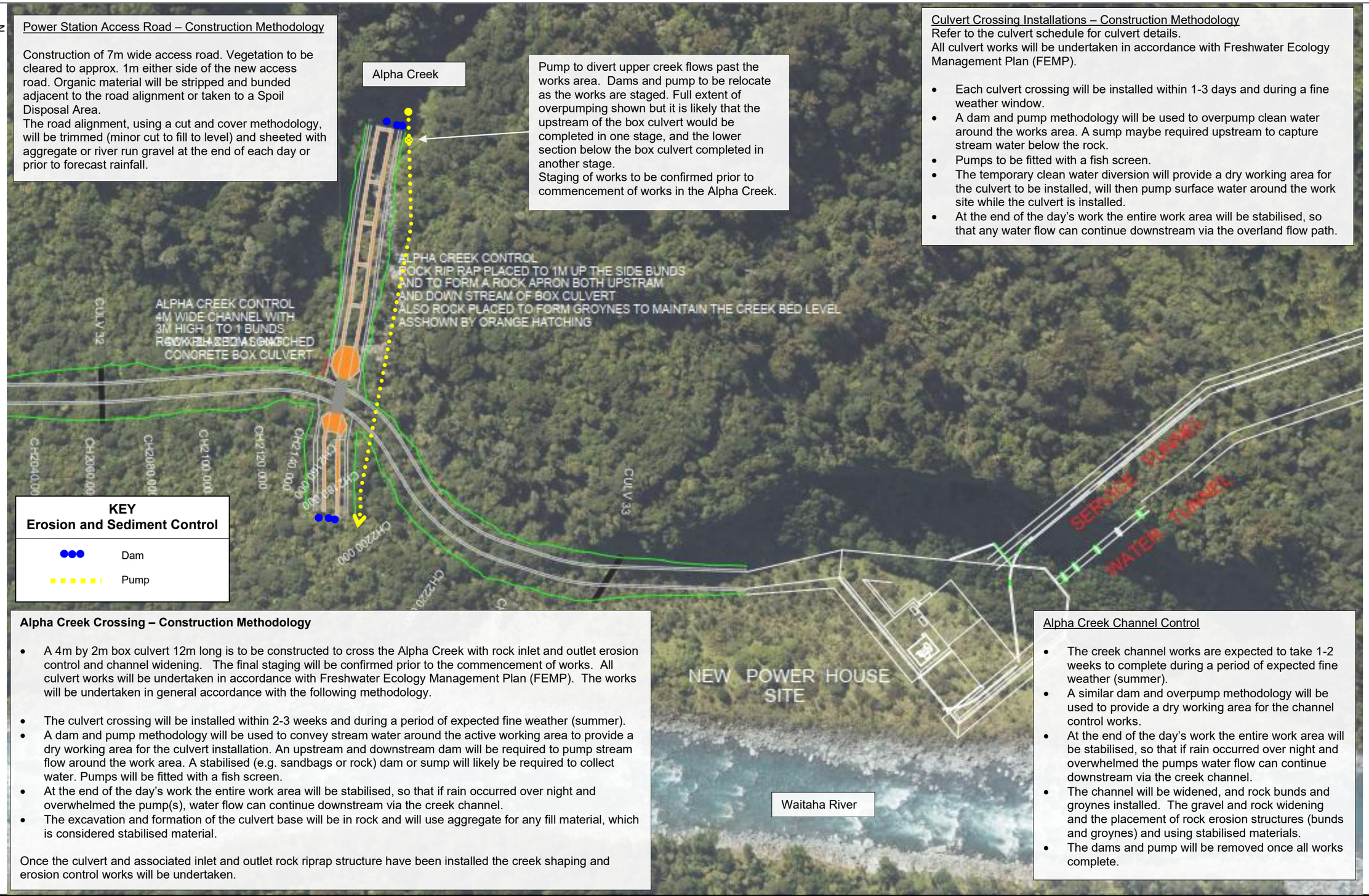
Alpha Creek

Pump to divert upper creek flows past the works area. Dams and pump to be relocate as the works are staged. Full extent of overpumping shown but it is likely that the upstream of the box culvert would be completed in one stage, and the lower section below the box culvert completed in another stage.
Staging of works to be confirmed prior to commencement of works in the Alpha Creek.

## Culvert Crossing Installations – Construction Methodology

Refer to the culvert schedule for culvert details.
All culvert works will be undertaken in accordance with Freshwater Ecology Management Plan (FEMP).

- Each culvert crossing will be installed within 1-3 days and during a fine weather window.
- A dam and pump methodology will be used to overpump clean water around the works area. A sump maybe required upstream to capture stream water below the rock.
- Pumps to be fitted with a fish screen.
- The temporary clean water diversion will provide a dry working area for the culvert to be installed, will then pump surface water around the work site while the culvert is installed.
- At the end of the day's work the entire work area will be stabilised, so that any water flow can continue downstream via the overland flow path.




**KEY**
**Erosion and Sediment Control**

- Dam
- Pump

## Alpha Creek Crossing – Construction Methodology

- A 4m by 2m box culvert 12m long is to be constructed to cross the Alpha Creek with rock inlet and outlet erosion control and channel widening. The final staging will be confirmed prior to the commencement of works. All culvert works will be undertaken in accordance with Freshwater Ecology Management Plan (FEMP). The works will be undertaken in general accordance with the following methodology.

- The culvert crossing will be installed within 2-3 weeks and during a period of expected fine weather (summer).
- A dam and pump methodology will be used to convey stream water around the active working area to provide a dry working area for the culvert installation. An upstream and downstream dam will be required to pump stream flow around the work area. A stabilised (e.g. sandbags or rock) dam or sump will likely be required to collect water. Pumps will be fitted with a fish screen.
- At the end of the day's work the entire work area will be stabilised, so that if rain occurred over night and overwhelmed the pump(s), water flow can continue downstream via the creek channel.
- The excavation and formation of the culvert base will be in rock and will use aggregate for any fill material, which is considered stabilised material.

Once the culvert and associated inlet and outlet rock riprap structure have been installed the creek shaping and erosion control works will be undertaken.

## Alpha Creek Channel Control

- The creek channel works are expected to take 1-2 weeks to complete during a period of expected fine weather (summer).
- A similar dam and overpump methodology will be used to provide a dry working area for the channel control works.
- At the end of the day's work the entire work area will be stabilised, so that if rain occurred over night and overwhelmed the pumps water flow can continue downstream via the creek channel.
- The channel will be widened, and rock bunds and groynes installed. The gravel and rock widening and the placement of rock erosion structures (bunds and groynes) and using stabilised materials.
- The dams and pump will be removed once all works complete.

## GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

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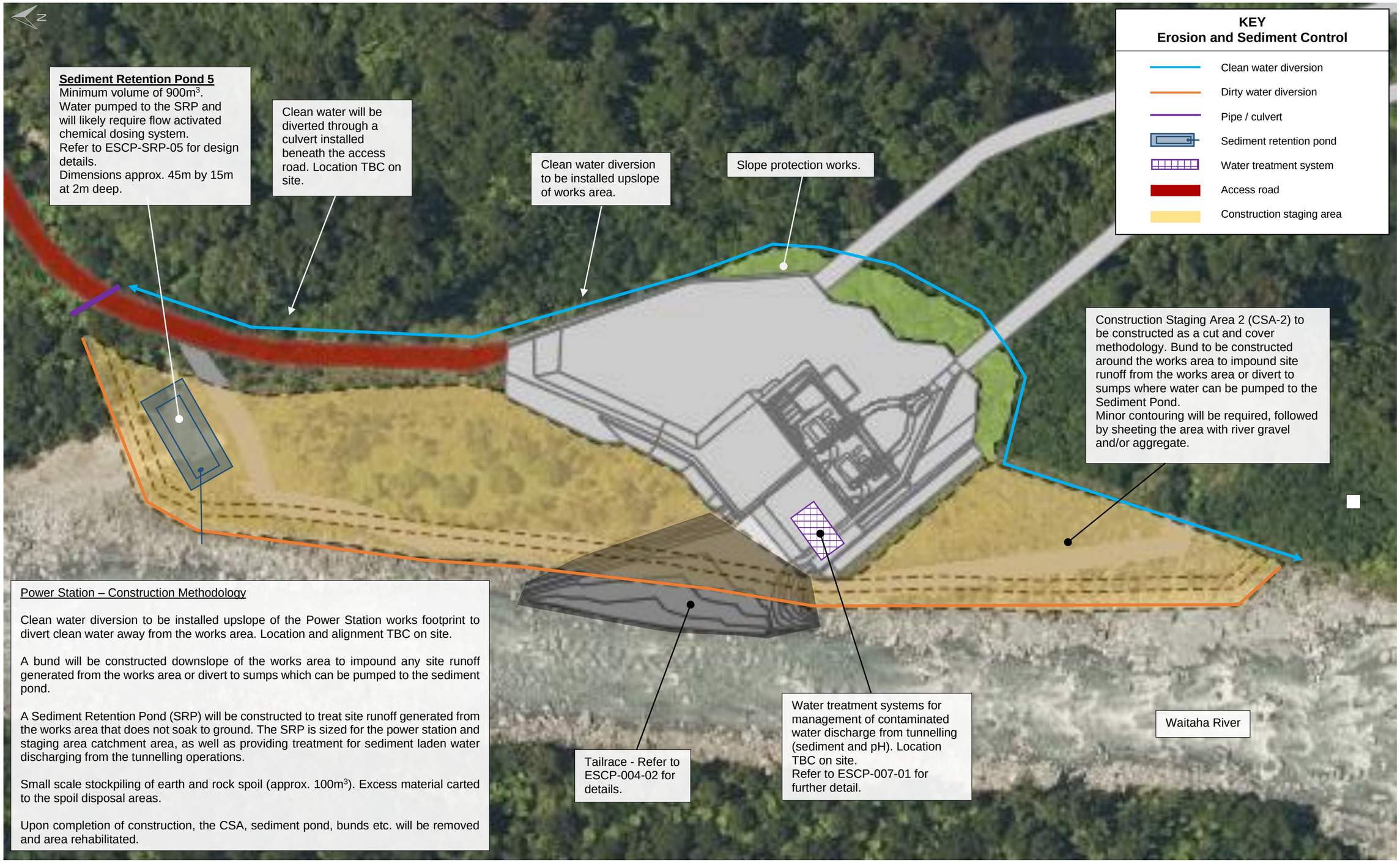
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station Access Road** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| MD | CS | ESCP-003-06 | 14 |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
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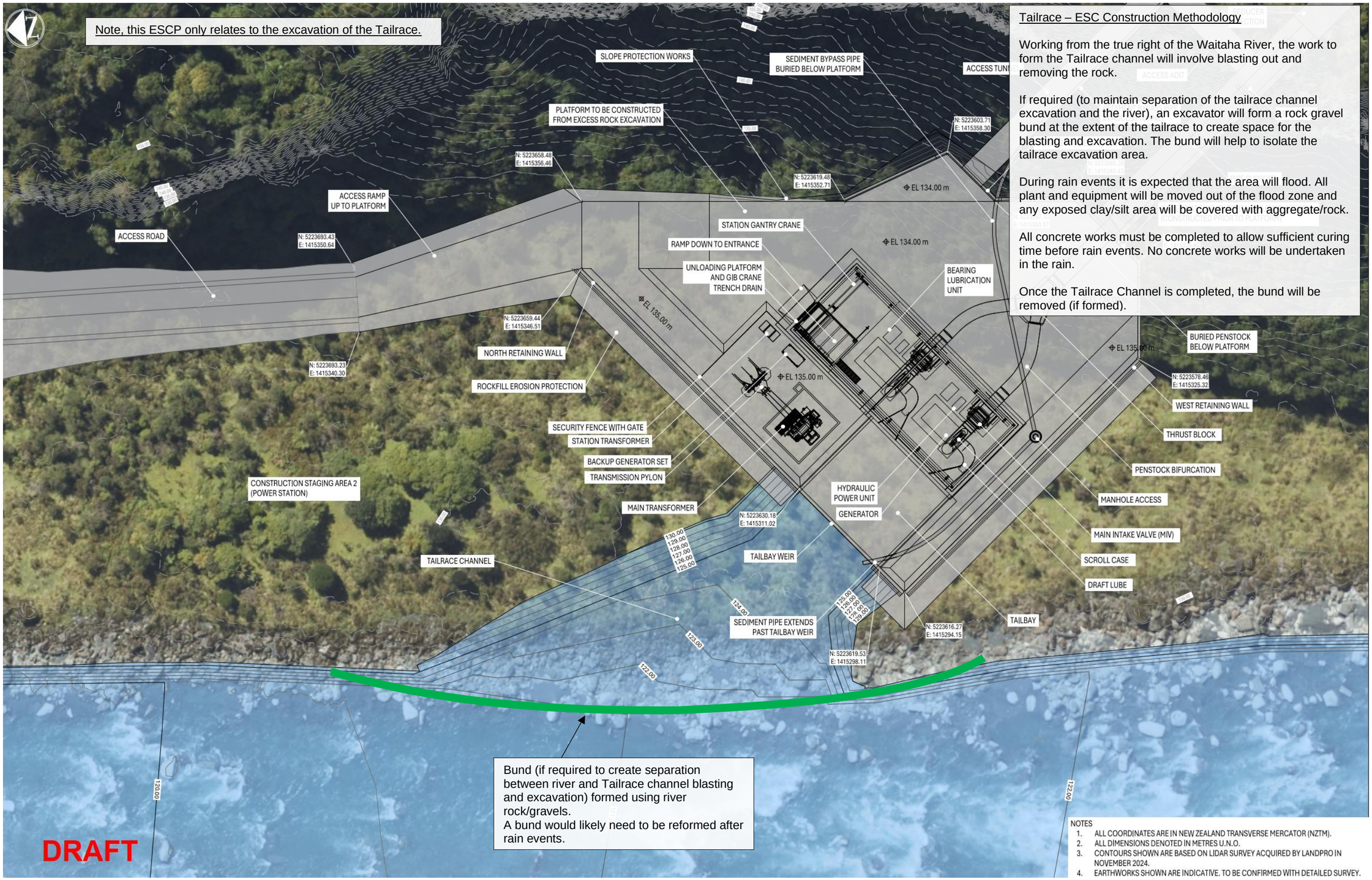
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Power Station** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| MD | CS | ESCP-004-01 | 14 |




Tailrace – ESC Construction Methodology

Working from the true right of the Waitaha River, the work to form the Tailrace channel will involve blasting out and removing the rock.

If required (to maintain separation of the tailrace channel excavation and the river), an excavator will form a rock gravel bund at the extent of the tailrace to create space for the blasting and excavation. The bund will help to isolate the tailrace excavation area.

During rain events it is expected that the area will flood. All plant and equipment will be moved out of the flood zone and any exposed clay/silt area will be covered with aggregate/rock.

All concrete works must be completed to allow sufficient curing time before rain events. No concrete works will be undertaken in the rain.

Once the Tailrace Channel is completed, the bund will be removed (if formed).

NOTES
1. ALL COORDINATES ARE IN NEW ZEALAND TRANSVERSE MERCATOR (NZTM).
2. ALL DIMENSIONS DENOTED IN METRES U.N.O.
3. CONTOURS SHOWN ARE BASED ON LIDAR SURVEY ACQUIRED BY LANDPRO IN NOVEMBER 2024.
4. EARTHWORKS SHOWN ARE INDICATIVE. TO BE CONFIRMED WITH DETAILED SURVEY.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
2. Earthworks are to be programmed to ensure rapid stabilisation in accordance with the guidelines.
3. Sediment control measures will be cleaned of sediment when the volume of sediment approaches 20% of the total storage volume.
4. Site monitoring will be undertaken before and immediately after rain as well as during heavy rainfall events. Any required maintenance or improvements to control measures will be undertaken immediately.

| REV | DATE | REVISION DETAILS | APPROVED |
|---|---|---|---|
| A | 12.04.25 | Draft for review. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Tailrace** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| CS | | ESCP-004-02 | 15 |


**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox'*.
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| REV | DATE | REVISION DETAILS | APPROVED |
|---|---|---|---|
| A | 20.12.24 | Draft for review. | |
| B | 24.02.25 | Update following client review. | |
| C | 30.05.25 | Updated footprint. | |
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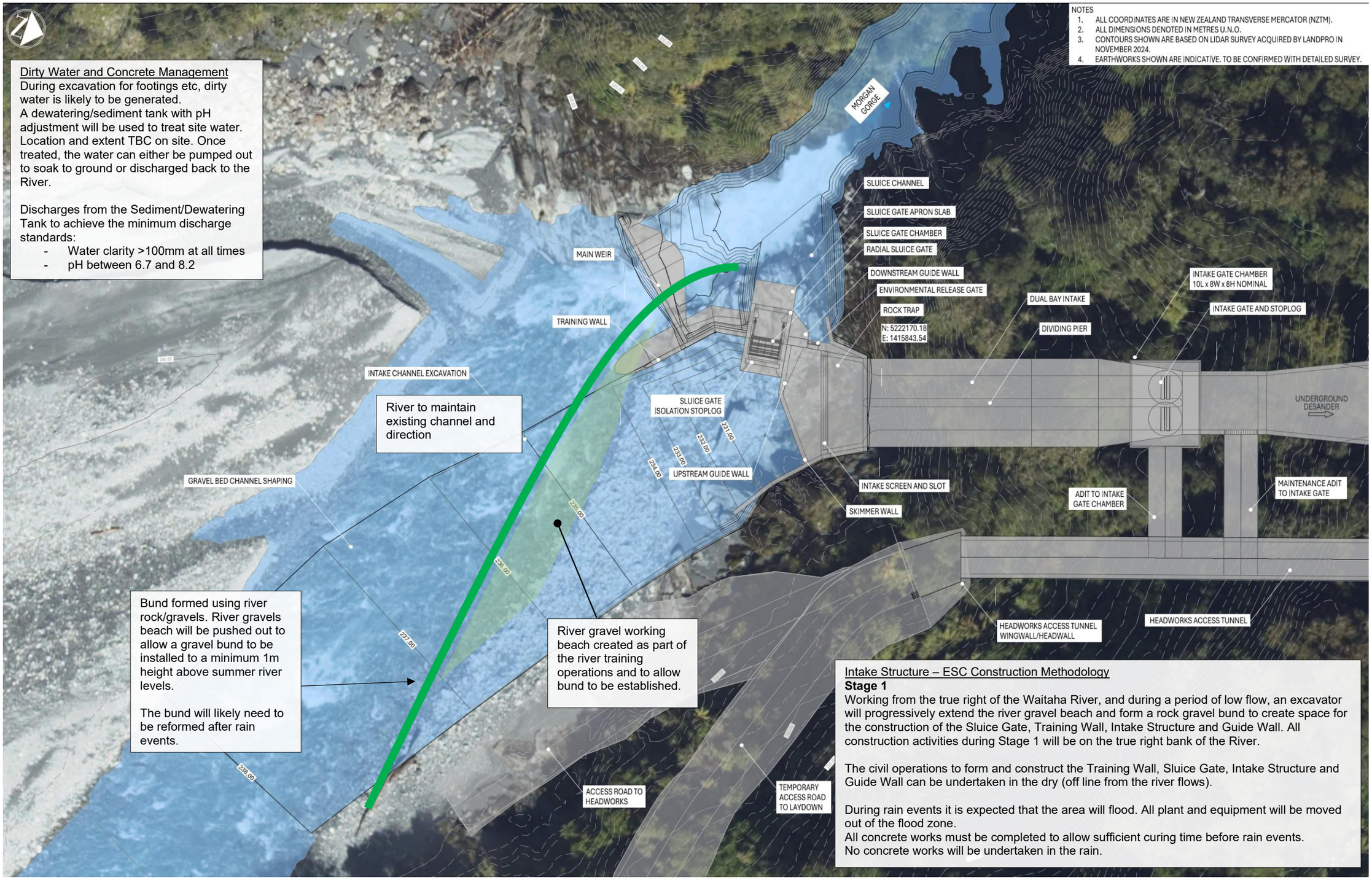
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Kiwi Flat** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| **MD** | **CS** | **ESCP-005-01** | **16** |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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|---|---|---|---|
| A | 12.04.25 | Draft for review. | |
| B | 30.05.25 | Updated following client review. | |
| C | 07.07.25 | Updated base plan. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Intake Structure Stage 1** |

| Drawn | Checked | Drawing No. | Sheet No. |
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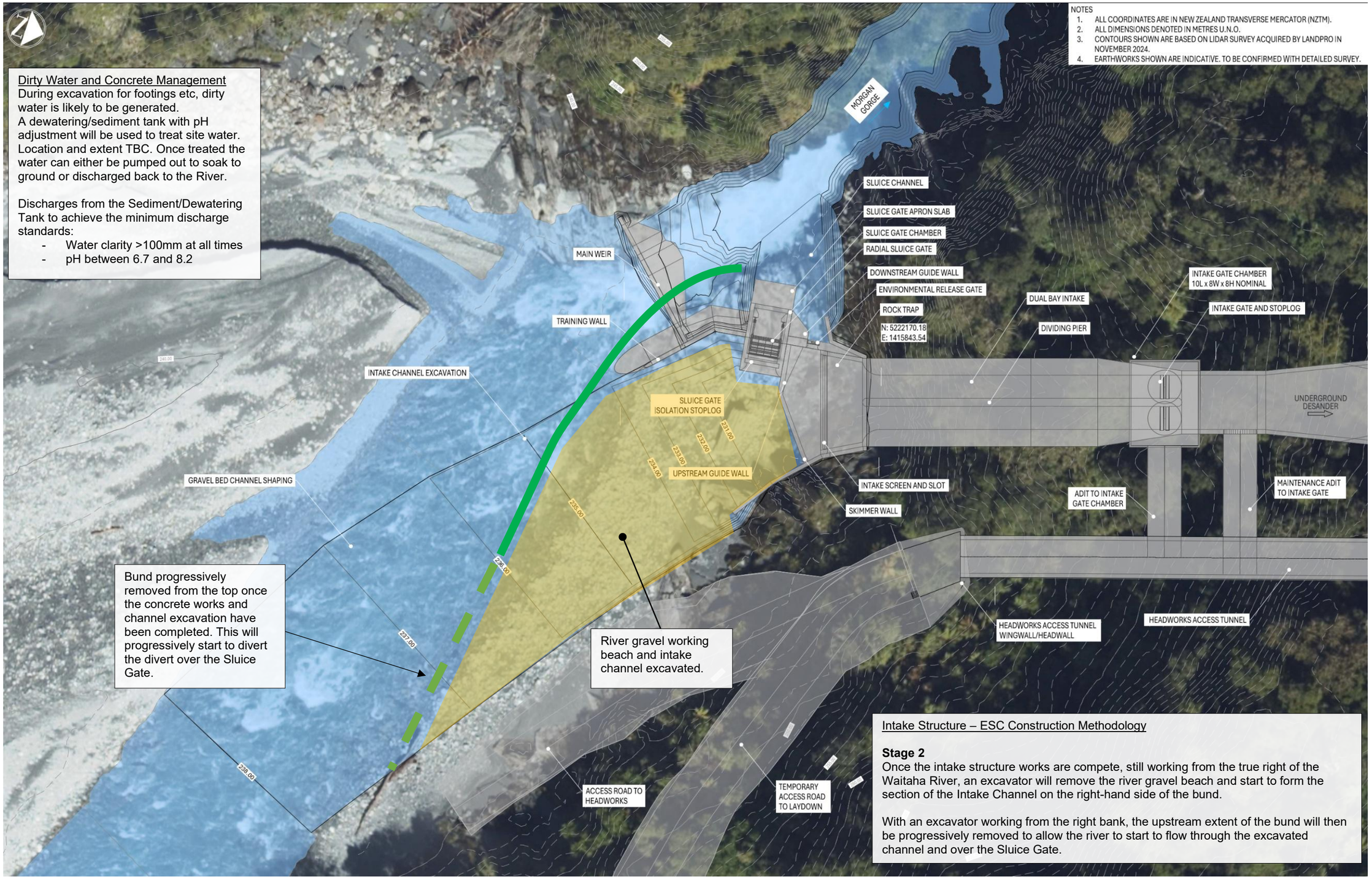
| CS | | ESCP-006-01 | 17 |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| B | 30.05.25 | Updated following client review. | |
| C | 07.07.25 | Updated base plan. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Intake Structure Stage 2** |

| Drawn | Checked | Drawing No. | Sheet No. |
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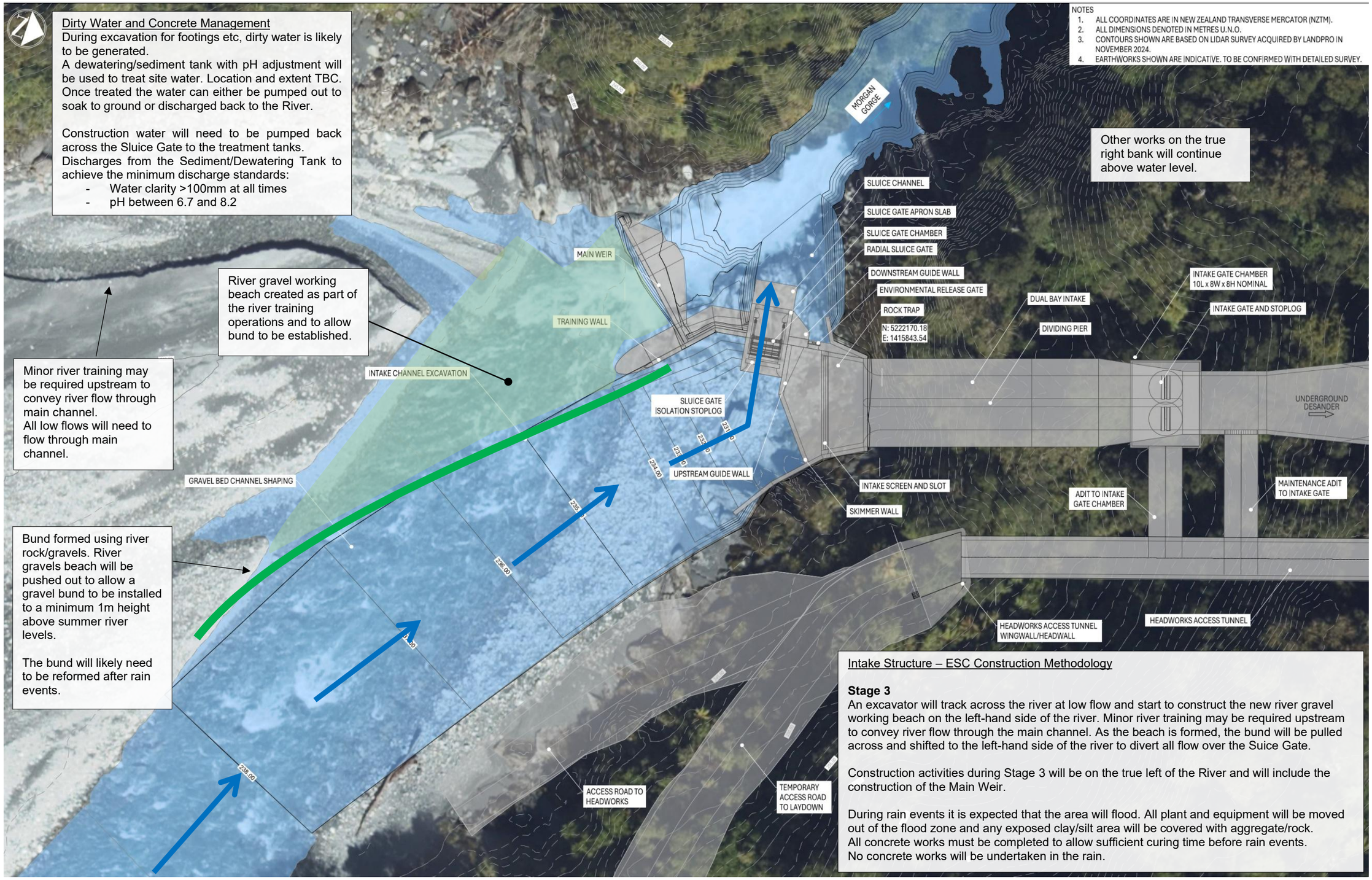
| CS | | ESCP-006-02 | 18 |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
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| A | 12.04.25 | Draft for review. | |
| B | 30.05.25 | Updated following client review. | |
| C | 07.07.25 | Updated base plan. | |

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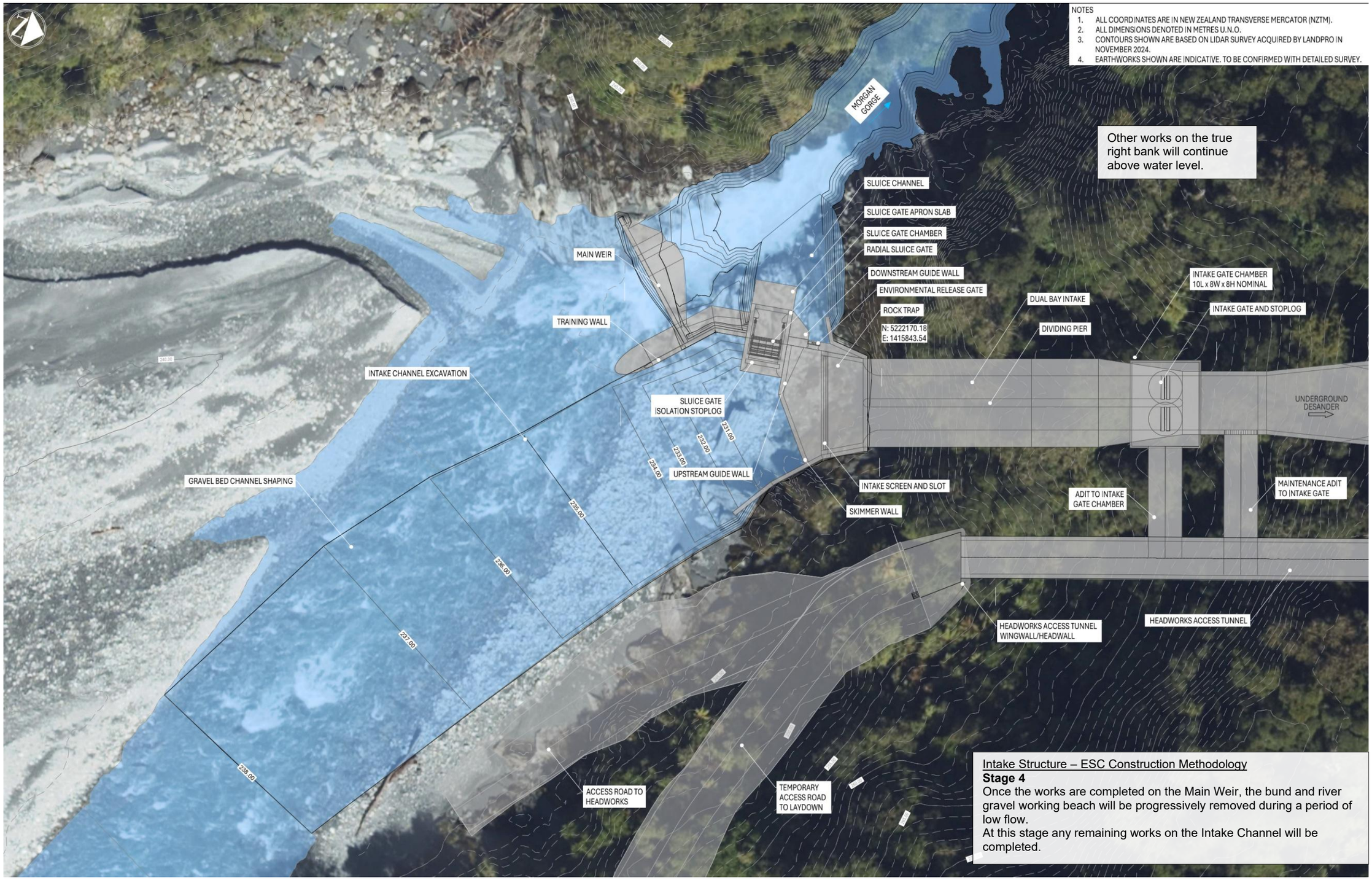
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Intake Structure – Stage 3** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| CS | | ESCP-006-03 | 19 |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| C | 07.07.25 | Updated base plan. | |
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Intake Structure – Stage 4** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| CS | | ESCP-006-04 | 20 |

Water from the water collection areas can be discharged off site if the following conditions are met:
- water clarity when checked with a black disc is >100mm or equivalent to receiving water; and
- pH is within the range of 5.5 and 8.5.

If the water clarity within the initial treatment tank is >100mm and the pH is within +/-1 of baseline and within the range of 5.5 and 8.5 then the water can be discharged off site.

If the water clarity within the treatment tank is >100mm and the pH is within +/-1 of baseline and within the range of 5.5 and 8.5 then the water can be discharged off site.

Water in works area to be pH tested and pumped into the first settlement and chemical treatment tank.




**Sediment Settlement Tank**

If the water pH within the initial treatment tank is >9 then it will be pumped into the secondary treatment tank to lower the pH.

**pH Treatment Tank**

To lower the pH of the water $CO_2$ or Citric Acid (TBC) will be added until the pH is below 8.5.
Water to be discharged must be within the range of 5.5 and 8.5.

Initial treatment by settlement and chemical treatment tank. If the water clarity is less than 100mm then chemical treatment will be initiated.

Secondary treatment by treatment tank. If, after secondary treatment, the water quality is still outside of the criteria to discharge then the water will be recirculated back through the treatment tanks.

**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

1. All erosion and sediment controls will be installed and maintained in accordance with Environment Canterbury's '*Erosion and Sediment Control Toolbox*'.
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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Water Treatment System** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| **MD** | **CS** | **ESCP-007-01** | **21** |

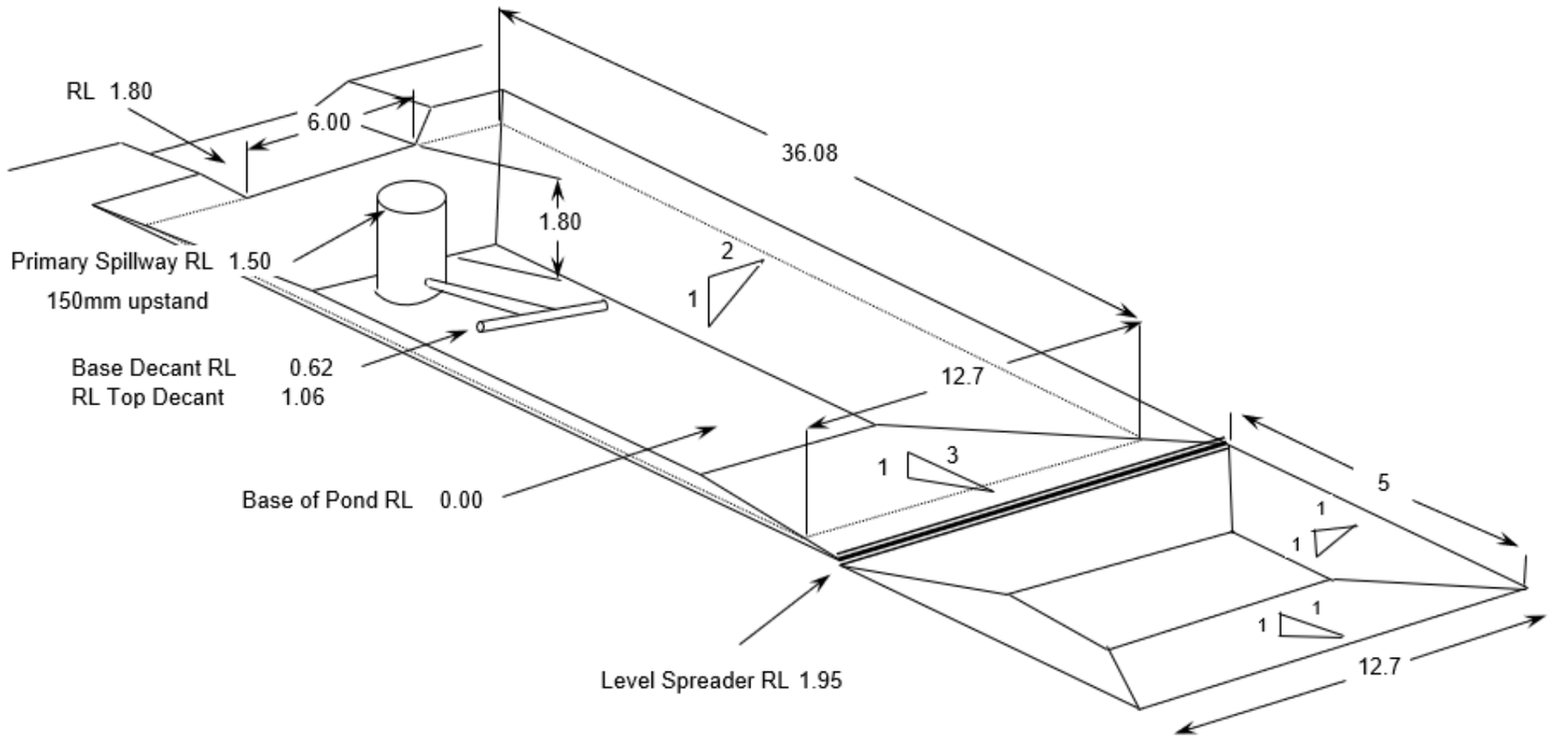
# SRP-01

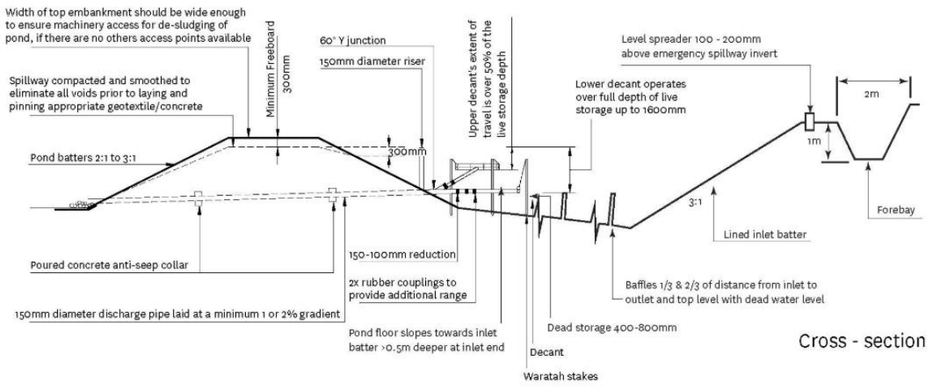
| Size criteria | Length Ratio | Side slopes | Depth from Emergency Spillway | R.L. of Pond Base |
|---|---|---|---|---|
| Auto | 3:1 | 2:1 | 1.80 | 0.00 |

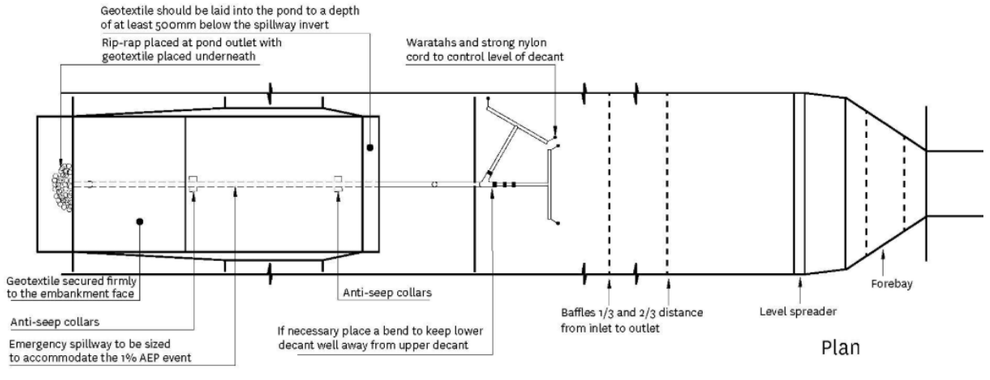
| | |
|---|---|
| Storage Volume Criteria | 2% |
| Contributing Catchment (ha) | 2.00 |
| Minimum Storage Volume (m3) | 400 |
| Dead storage (m3) | 120 |
| Live storage (m3) | 280 |
| Length at Spillway Level | 36.08 |
| Width at Spillway Level | 12.73 |
| Spillway base width (300mm deep) | 6.00 |
| Primary Spillway diameter (min) | 150mm |
| Number of decants | 2 |
| Number of holes per decant | 133 |
| Minimum outlet diameter | 150mm |
| RL Emergency Spillway | 1.80 |
| RL Primary Spillway | 1.50 |
| RL Level Spreader (min) | 1.95 |
| RL Base Decant | 0.62 |
| RL Top Decant | 1.06 |
| | |
| Length at Base | 27.08 |
| Width at Base | 5.53 |

**Forebay**

| | | |
|---|---|---|
| Depth | 1 m | min. depth |
| Width | 12.73 m | full width of pond |
| Length | 5 m | min. length |
| Volume | 40 m3 | min. volume |




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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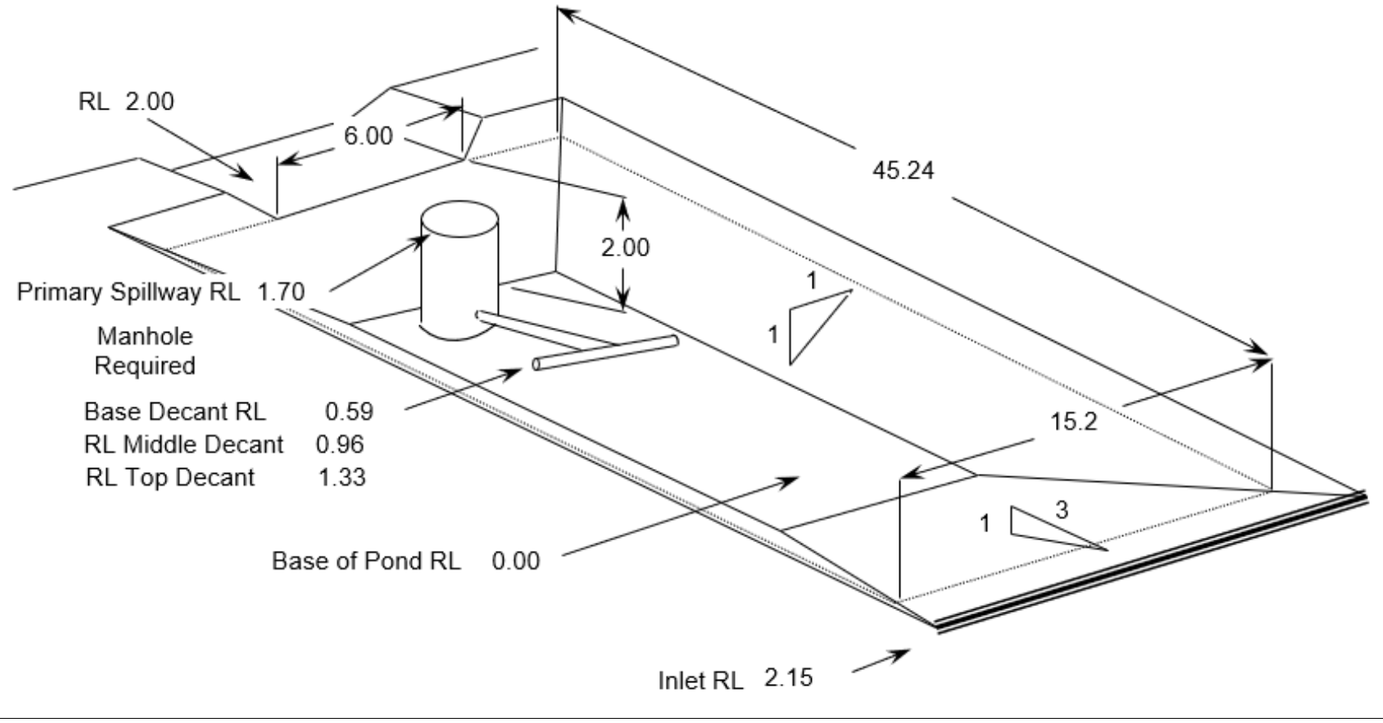
| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Sediment Retention Pond** |

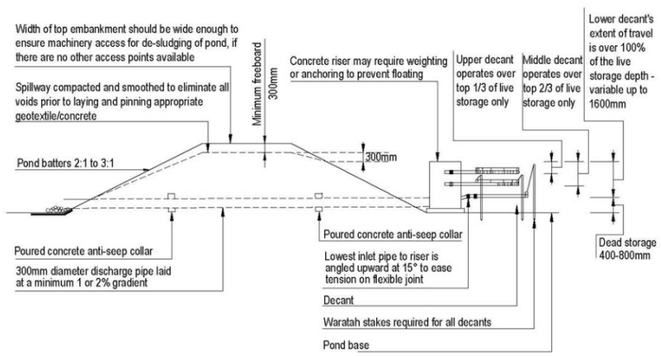
| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| ZW | CS | ESCP-SRO-01 | 22 |

# SRP-5

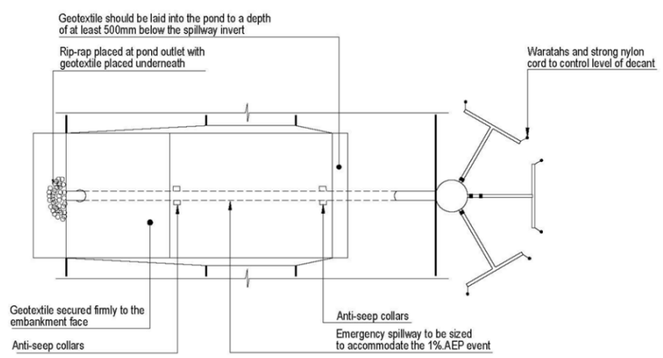
| Size criteria | Length Ratio | Side slopes | Depth from Emergency Spillway | R.L. of Pond Base |
|---|---|---|---|---|
| Auto | 3:1 | 1:1 | 2.00 | 0.00 |

| | |
|---|---|
| Storage Volume Criteria | 3% |
| Contributing Catchment (ha) | 3.00 |
| Minimum Storage Volume (m3) | 900 |
| Dead storage (m3) | 270 |
| Live storage (m3) | 630 |
| Length at Spillway Level | 45.24 |
| Width at Spillway Level | 15.28 |
| Spillway base width (300mm deep) | 6.00 |
| Primary Spillway diameter (min) | Manhole Required |
| Number of decants | 3 |
| Number of holes per decant | 133 |
| Minimum outlet diameter | 300mm |
| RL Emergency Spillway | 2.00 |
| RL Primary Spillway | 1.70 |
| RL Level Spreader (min) | 2.15 |
| RL Base Decant | 0.59 |
| RL Middle Decant | 0.96 |
| RL Top Decant | 1.33 |
| Length at Base | 37.24 |
| Width at Base | 11.28 |

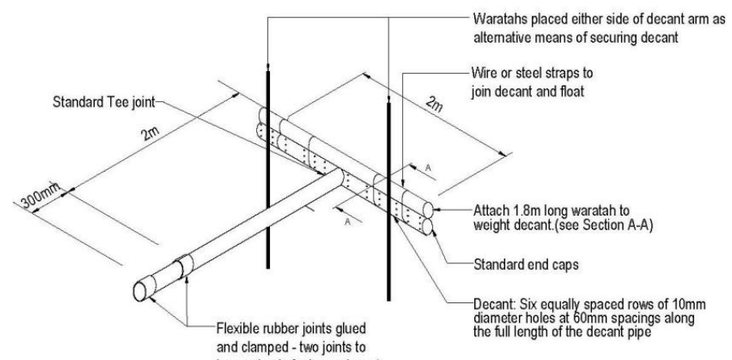



Cross-section




Plan view




**GENERAL EROSION AND SEDIMENT CONTROL NOTES**

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| Project | **WAITAHA HYDRO PROJECT** |
| Title | **Erosion and Sediment Control Plan**<br>**Sediment Retention Pond 5** |

| Drawn | Checked | Drawing No. | Sheet No. |
|---|---|---|---|
| ZW | CS | ESCP-SRP-05 | 23 |