RidleyDunphy
environmental & planning consultants

Weiti Bay Village 1

Assessment of Erosion and Sediment Control Approach

Prepared by Graeme Ridley
Ridley Dunphy Environmental Limited
Revision 3.0
Final May 2022

Quality Assurance Statement			
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Revision schedule		
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1.0	24th March 2022	First Draft / Outline for Client Comment
2.0	6th May 2022	Final Draft
3.0	25th May 2022	Final

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1. Introduction

The Weiti Bay Village 1 Development (the Project) includes undertaking earthworks and civil works in order to form 220 residential lots, a retirement village and a small commercial centre. In order to achieve this, approximately 28ha of bulk earthworks is required to be undertaken with subsequent secondary earthworks for individual lot development. The Project has access to Ara Weiti Road along the frontage.

The Project site of 36 hectares sits within the Karepiro Catchment which is part of a wider series of catchments discharging to Karepiro Bay and more generally the Long Bay-Ōkura Marine Reserve. Overall, these catchments which include the Wēiti and Ōkura rivers total 2,432 hectares meaning the Project site makes up less than 1.5% by area and is also relatively small compared to other significant development approvals such as Long Bay and Silverdale.

The Project area is currently covered by wilding pines and other regrowth following removal of the commercial forestry previously in place. There are two watercourses within the property boundary on the eastern and western sides. The project will discharge to these watercourses, the Karepiro Stream and eventually the Karepiro Bay / Marine Reserve approximately 800m away.

The Project site is steep with levels between RL 10 at Ara Weiti Road to RL 73 at the highest point of the site in the southwestern area.

Proposed activities include:

- 28ha of bulk earthworks as shown within the plan set with the remaining parts of the property subject to site revegetation; and
- Construction of erosion and sediment controls (ESC) including sediment retention ponds (SRPs) in order to minimise erosion, and sediment yields downstream.

The strategy for bulk earthworks is outlined within the earthworks memorandum from Woods which includes completion and stabilisation of open areas as quickly as possible.

The stream systems that exist at the eastern and western extent of the works will largely remain as they currently exist with proposed works limited to a culvert on the eastern watercourse in order to provide access. The construction methodology for this culvert activity is outlined within the earthworks memorandum from Woods.

This report outlines the proposed erosion and sediment control measures that will be implemented. The ESC approach for the Project earthworks will be based on the minimisation of sediment generation (erosion control) and the retention of sediment such that sediment yields are also minimised. The description of the ESC approach is split into two parts: the measures that will be employed that are considered industry best practice, and the measures that will be employed that go

over and above best practice (described as the “over and above approach”). This is also illustrated on Figure 2 below.

2. Existing Environment

2.1 Catchment description

A number of factors that form part of the existing environment for the site influence erosion, sediment generation, and eventual sediment yields. These factors include rainfall, slope angle, slope length, and geology, all of which require full consideration through the construction period. These specific details are not outlined within this memorandum as they are accepted and well-known features for this location. The steep contour is however emphasised as a key risk and will require careful risk analysis and management to ensure effective environmental outcomes.

The site discharges via the Karepiro River into the Karepiro Bay environment. This eventual saline receiving environment is a recognised sensitive ecosystem.

Figure One below illustrates the proposed cut and fill contours for the Project with these able to assist with defining the level of risk associated with ESC.

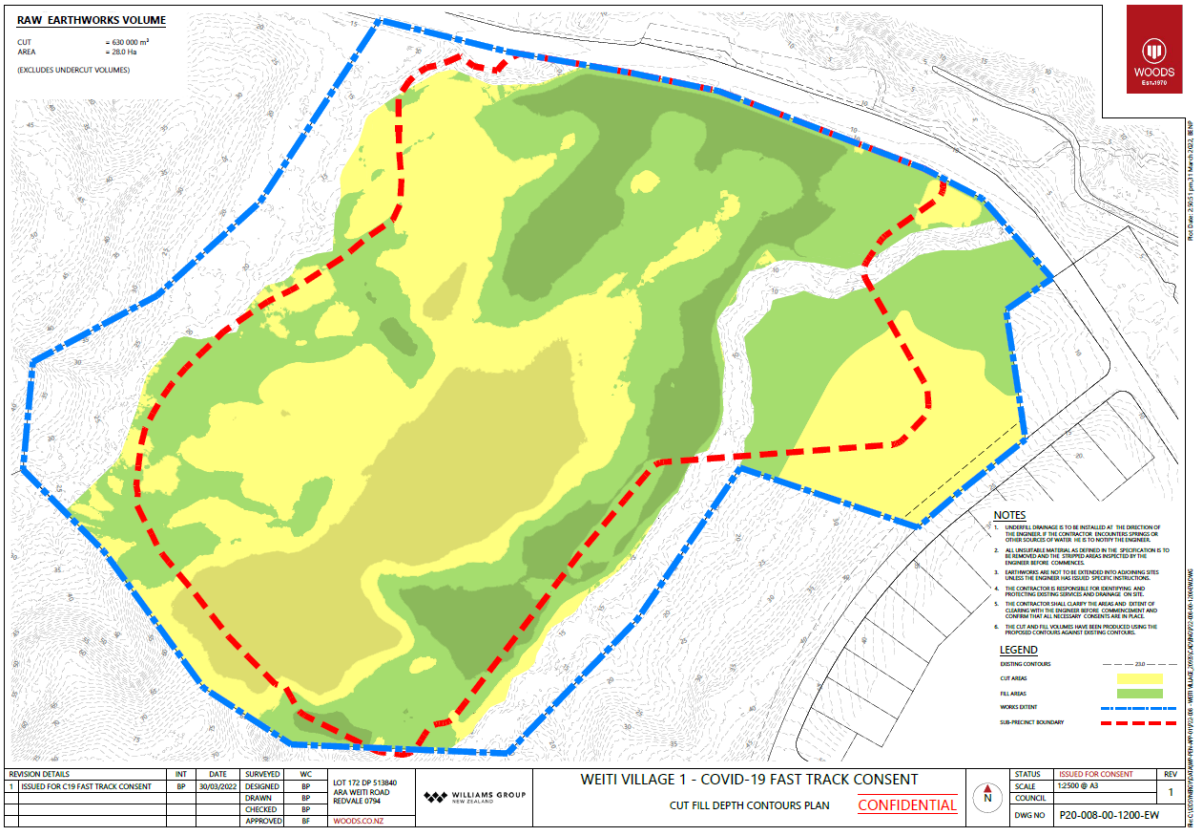


Figure One – Cut and Fill Contours Village 1

2.2 Previous earthworks

Previous earthworks have already been completed associated with an earlier stage of the overall development. These earthworks were undertaken over the period 2015 to 2018 and have been the subject of an intensive monitoring and erosion and sediment control (ESC) programme.

It is important to confirm that these earthworks were subject to an Adaptive Environmental Monitoring and Management Response Plan (AEMMRP) process. The AEMMRP was approved by Auckland Council (Council) in February 2015 in response to a consent condition. The AEMMRP also had a primary purpose of identifying issues and opportunities as the earthworks progressed, with associated identification of continuous improvement of the ESC to ensure effects are managed appropriately.

This existing AEMMRP included:

- Rainfall recording;
- Flow monitoring – Continuous discharge flow monitoring on the outflow from selected SRPs;
- Sediment discharge monitoring – Automatic sediment sampling to measure the suspended solids concentration through storm events from the outfall of selected SRPs; and
- Additional manual monitoring – Manual monitoring of both inflow and outflow where practicable, receiving environment upstream and receiving environment downstream.

Triggered monitoring was also defined in the AEMMRP and included results from activities or events that may trigger:

- Greater than 25mm of rainfall over any 24-hour period;
- Greater than 15mm of rainfall with any one-hour period;
- Spillage/accident reports that cause a discharge of sediment or contaminants to the aquatic environment; or
- Obvious degradation of the receiving environment immediately downstream of devices such as accumulation of sediment, conspicuous oil/grease, scums/foams, floatable matter, fish kills, discolouration of water or significantly increased growth of nuisance algae.

When a triggered rainfall event occurred, the actions within the AEMMRP were implemented and a formal report collated and sent to AC that summarised the water quality results for that event. From the start of the 2015/2016 earthworks season to June 2018, 38 trigger rain events occurred with 38 separate reports sent to AC.

These reports reflect the water quality at the time of the sampling and also, with the automated sampling equipment utilised, reflect actual sediment yields from a specific part of the earthworks catchment. The water quality results are based on an accredited laboratory analysis of samples collected with these samples collected by independent companies. In addition to the above, a further independent ecological survey of the receiving environment was also undertaken and reported to AC on an annual basis by independent companies.

Overall and in conclusion it is noted:

a) That the Karepiro River catchment is relatively large and has multiple sediment sources from within the wider catchment. While we have a reasonable understanding of sediment discharged from the previous earthworks areas, the wider catchment has not been assessed in the same detail. As demonstrated through this previous AEMMRP sampling programme it is assessed that the wider catchment does however have a significant contribution and accounts for the majority percentage of the overall downstream sediment load;

b) That the AEMMRP trigger event sampling was based on a robust, independent and scientific process that provided accurate water quality results from both manual sampling and automated devices at the time of sampling. These can be relied upon and used for analysis purposes;

c) That the previous earthworks from Weiti development would have contributed to some sediment load that discharges from the Karepiro River to the coastal environment; and

d) That the AEMMRP was based on ongoing improvements to the ESC approach for the site over time as earthworks progressed. These improvements were based on sampling results, visual observation, independent audits and utilisation of best practice techniques. It is expected that ongoing improvements will continue with future earthworks and further AEMMRP outcomes.

3. Erosion and sediment control overview

3.1 Erosion and sediment process

The ESC approach for the Project earthworks will be based on the minimisation of sediment generation (erosion control) and the retention of sediment such that sediment yields are also minimised. ESCs are either structural controls (physical measures) or non-structural controls (management practices) such as methodologies and works sequencing and staging. Based on my experience on other earthworks projects, the greatest benefit and most ESC outcomes are achieved when focus is also placed on the non-structural elements. Non-structural methodologies include items such as sequencing of works, limitation on areas of exposed earthworks, having an appropriately experienced ESC team, and working in appropriate "weather windows".

The emphasis for ESC for the Project will therefore be placed on the non-structural methodologies in avoidance of erosion, prior to implementation of structural control measures.

Councils "*Erosion and Sediment Control Guide for Land Disturbing Activities*" Incorporating Amendment 1, updated June 2016, 2016/005 (GD05) provides an ESC guideline for the Auckland region. GD05 also sets out minimum criteria to be used for ESC.

3.2 ESC philosophy

The overarching philosophy for the ESC approach is based on full compliance with the identified industry best practice provisions from within GD05 and in addition to this undertaking a range of "over and above" measures as identified.

3.3 Industry best practice (Council compliant) erosion and sediment control measures

Onsite ESC measures make up the 'structural' aspects of the ESC methodology. These measures are designed to minimise the extent of erosion and discharge of sediment to the freshwater and marine receiving environments.

Erosion control measures are proposed to dissipate energy, reduce the sediment generated within the exposed area and decrease the volume of sediment transported to the sediment control devices. The key industry best practice erosion control measures proposed for the Project earthworks are:

- Lining of diversion drains – lining of diversion drains to reduce sediment generation and erosion of the drains;
- Contour drains –spaced at minimum 30m centres within the exposed area to be installed when rain is forecast or in areas where works are not anticipated in the next 24 hours;

- Drop out pits – Drop out pits within dirty water diversions at $2m^3$ per drop out pit and will be placed a minimum of every 50m along the length of dirty water diversions;
- Stabilised entranceways – these can reduce the transportation of sediment off-site;
- Earthworks will be staged with only those areas that need to be open and exposed open at one time. No earthworks areas will be open if works are not to occur in these locations; and
- Progressive and rapid stabilisation.

Sediment control measures reduce the sediment yield into the receiving environment by allowing the sediment to settle before it is discharged. The key industry best practice sediment control measures proposed for the earthworks are:

- SRPs with probable maximum catchment size of 5ha. The potential location of these SRPs is reflected in the drawing P20-008-00-9060-SK Rev 1 (Figure 2 below);
    - Storage based on the 3% criteria (i.e. $300m^3$ of storage per 1ha of contributing catchment).
    - Side slopes no steeper than 1 in 2.
    - Compacted clay sides certified by the Geotechnical Engineer.
    - Rain Activated Chemical Dosing Systems.
    - A floating nova coil boom will be established across SRPs when needed to trap any floating material (such as mulch) to minimise blockages of decants; and
    - Manual decant raising devices within SRPs, or stop valves on the outlet pipe, to increase live volume attenuation for smaller storm events and also enabling further chemical batch dosing as necessary to enhance suspended solid removal efficiencies.
- Decanting earth bunds (DEBs) – The DEBs generally can accommodate catchments of $3000m^2$. If DEBs are utilised for this Project, they will consist of an excavated pond with 1:3 to 1:5 width to length ratio and a flocculation device in accordance with a Chemical Treatment Management Plan; and
- Grass buffer zones between open earth areas and the receiving environment will be established where practicable.

The ESC measures reflect and support the expected construction methodology. All ESC measures will be installed and as-builts provided before earthworks commence.

A focus on treatment at source and minimisation of erosion will occur when designing ESC measures so that they are not overloaded and can operate at their peak efficiencies. This is achieved by installation of drop out pits, stabilisation of drains, minimising steepness of catchments which will reduce erosion and limit the quantity of material reaching the sediment controls.

In addition to the above, and while not fully reflected in GD05 but considered as an industry best practice, monitoring of water quality from construction related discharges will include provision of an automated water quality sampler based on either turbidity or suspended solids. This is a key step and acts as a check and balance to ensure that what ESC measures are implemented on site are satisfactory. This also allows an informed adjustment and adaption of ESC measures as necessary. This can build on previous stages of earthworks and will include wider receiving environment checks. Water quality and other management thresholds will be developed within the monitoring programme. This includes setting specific thresholds during the monitoring process with associated responses.

3.4 Enhanced "over and above" erosion and sediment control measures

In the context of the required earthworks for the Village 1 area, best practice ESC is represented by understanding and implementing GD05 criteria, site experience and site methodologies as outlined above in Section 3.3. The key ESC measures and associated implementation for the Project earthworks, that exceed industry best practice (over and above), will include the following:

Diversion drains

- Clean water diversions – these are to be upsized to the 100-year storm (1% AEP) from the 20-year storm (5% AEP). These divert clean water away from earthwork areas reducing sediment generation within the works areas; and

- Dirty water diversions – the main dirty water diversions are to be upsized to the 100-year storm (1% AEP) from the 20-year storm (5% AEP) to accommodate storm flows from the 100-year storm (1% AEP) and transport dirty water flows to a sediment control device;

Sediment retention ponds

- Pre forebay impoundments of the same volume as the forebay itself will be established for all SRPs to assist with velocity reduction and pre settlement of sediments prior to the formal forebay;

- SRP forebay volumes will be increased to 15% criteria and will have access at all times over all weather conditions for maintenance. This will also ensure that settled sediment particles are captured to the maximum extent possible before entering the main body of the SRP;

- Reverse sloped SRP invert to ensure that sediment not deposited in the forebay is impounded adjacent to the SRP forebay for convenient removal. This will also help maintain the working volume of the device;

- Dual flocculation sheds for SRPs to increase the time between restocking with flocculant and to also reduce the risk of flocculation shed maintenance issues; and

- Super silt fence baffles in SRP's to assist with drop out of sediment during low flow rain events.

Additional Flow Impoundment / Secondary polishing devices

- Utilisation of secondary impoundment areas below the SRP discharge points (and prior to discharge into the freshwater environments) to allow for impoundment of storm flows and subsequent "polishing" of the flows before discharges to the environment. The secondary impoundment/polishing areas provide significant additional defence compared to standard ESC measures and work in tandem with the last line of defence described below.

Last line of defence

- Super Silt Fence (SSF) – to be utilised as a 'Last Line of Defence'. The 'last line of defence' approach has been formulated as a backup to the proposed ESC measures. While the primary ESC measures will minimise the discharge of the sediment to the receiving environment, an extra line of defence is proposed. For all earthworks within 50m of a watercourse, a super silt fence will be erected between the earthworks and the stream. The super silt fence will provide a backup protection in the unlikely event that the primary ESC measures fail. For areas that are further than 50m of a watercourse, a vegetated filter strip will remain in place whereby uncontrolled discharges can be remediated should they occur.

Stabilisation and Risk

- Progressive stabilisation will be a key element and if areas of earthworks are not actively worked after a period of time (7 days) then stabilisation of those areas will occur. This ensures that areas not earthworked are not left to generate sediment and also will minimise the opening of new areas that are not subject to planned earthworks; and

- Works will be undertaken within a robust risk management framework. This will mean identifying areas of risk (likely to be related to slope and vicinity to the two streams) and then identifying management of this risk accordingly. As part of this, a stabilisation facility (mulching capability) will be available on site at all times providing confidence that stabilisation can occur at short notice and with appropriate quality.

Chemical Treatment

- A comprehensive flocculation management system will be initiated based on the provision of a chemical treatment management plan. This will include flocculation with double shed rainfall activated systems on all SRPs (and any DEBs) but also "within earthworks

flocculation" at drop out pits and pre forebays (using both rainfall activated sheds floc socks and batch dosing).

Secondary earthworks

- On completion of bulk earthworks and civil infrastructure there will be secondary earthworks associated with building work on individual lots. While Council has rules governing ESC measures that must be implemented as individual dwelling sites are developed, there can be issues with inappropriate ESC measures implemented which can be due to a lack of resource for sufficient compliance officers.

- It is proposed to work with Council to address this earthworks phase and the associated ESC measures through funding opportunities and/or specific consent requirements. The consent process could be used to mutually agree to conditions whereby, for example;

    1. Separate funds are provided by the consent holder (in addition to normal contributions) specially to help fund compliance during secondary earthworks, de-risking that part of the development process, or

    2. There is a requirement to appoint an independent erosion control specialist to monitor building activities for a suitable period after lots a delivered.

Resourcing

- The earthworks memorandum from Woods notes in particular the ESC team approach and ensuring that adequate resources, commitment, and expertise are provided to support the ESC methodology from start to finish. This includes the appointment of a specialist who will provide daily ESC direction and advice to all site personal, in particular the contractors. The role will also include ongoing monitoring of devices installed, attend Council inspections representing the principal, checking as-builts, confirming maintenance requirements and acting as the key site contact for all environmental aspects of the proposed works. It is considered that this role alone is a significant advancement and provides further confidence in outcomes. This "over and above" resourcing is reflected in Table One below.

Drawing P20-008-00-9060-SK Rev 1 (Figure 2 below) confirms all the key ESC measures to be implemented on site and within this illustrates the "over and above" best practice ESC measures to also be implemented as detailed above. This drawing is also included within Appendix A of this assessment at a scale that provides appropriate clarity.

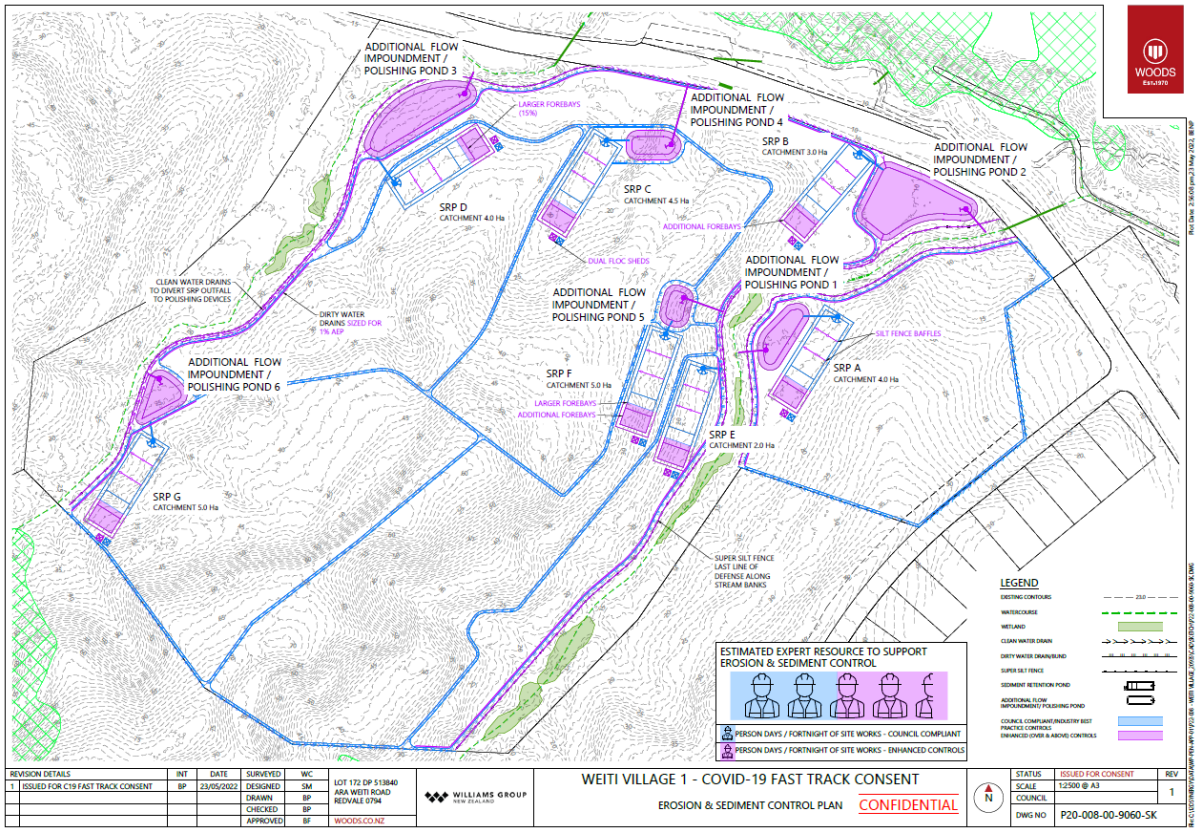


Figure Two – Erosion and Sediment Control Plan

Weiti Village 1 ESC Resourcing – Fortnight Period based on a 55hour week		
Resource Task	**Industry Best Practice Expectations – Council Compliant**	**Enhanced Over and Above approach (figure in brackets shows cumulative resourcing)**
Fine Weather ESC Monitoring (1 hr per day standard and 2 hrs per week specific)	6	0(6)
Wet Weather Monitoring (Assume conservatively rain event every 2 weeks – pre rain 2 hrs, during rain 4 hours, post rain 2 hours – includes monitoring results)	8	0(8)
Council Inspection (accompanied by site staff – 3 hrs every 2 weeks)	3	0(3)
Specialist advice and input specific to ESC implementation (3 hrs per week)	0	6
Formal independent audit of site and ESC (audit every 2 weeks)	0	8
Response to adaptive monitoring outcomes and consideration of improvements and details (4 hours per week)	0	4
Totals	**17 Hours**	**35 Hours**

Table One – Resourcing

4. Conclusion

All ESC measures that will be used for the Village 1 area earthworks will be based around erosion control in the first instance, through minimising the area of earthworks exposed, and minimising sediment laden discharge to receiving environments through the provision of sediment control devices. Significant innovation, advancements and learning from other earthwork sites can be applied and fully utilised within the development. It is assessed that there is no reason why such innovation cannot also be applied to these Village 1 earthworks with these represented as enhanced "over and above" ESC measures.

Adaptive monitoring and associated continuous improvement are key management techniques that provides a backstop and insurance and will ensure that ESC measures and methodologies are fully effective and remain this way. This adaptive monitoring programme is robust and considered very comprehensive while also reflecting the values of the receiving environment that will be subject to any discharges that result.

Overall, from a construction management and sediment yield perspective, I assess the proposed Village 1 earthworks are appropriate and the earthworks can occur with very effective ESC systems in place as outlined above.

Graeme Ridley
Ridley Dunphy Environmental Limited
25th May 2022

APPENDIX A

EROSION AND SEDIMENT CONTROL PLAN

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 3

LARGER FOREBAYS (15%)

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 4

SRP B
CATCHMENT 3.0 Ha

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 2

SRP C
CATCHMENT 4.5 Ha

SRP D
CATCHMENT 4.0 Ha

ADDITIONAL FOREBAYS

DUAL FLOC SHEDS

CLEAN WATER DRAINS TO DIVERT SRP OUTFALL TO POLISHING DEVICES

DIRTY WATER DRAINS SIZED FOR 1% AEP

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 1

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 5

SILT FENCE BAFFLES

SRP A
CATCHMENT 4.0 Ha

ADDITIONAL FLOW IMPOUNDMENT / POLISHING POND 6

SRP F
CATCHMENT 5.0 Ha

LARGER FOREBAYS

ADDITIONAL FOREBAYS

SRP E
CATCHMENT 2.0 Ha

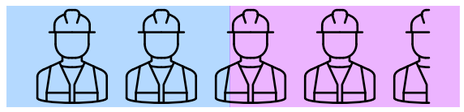
SRP G
CATCHMENT 5.0 Ha

SUPER SILT FENCE LAST LINE OF DEFENSE ALONG STREAM BANKS

LEGEND

- EXISTING CONTOURS — 23.0
- WATERCOURSE
- WETLAND
- CLEAN WATER DRAIN
- DIRTY WATER DRAIN/BUND
- SUPER SILT FENCE
- SEDIMENT RETENTION POND
- ADDITIONAL FLOW IMPOUNDMENT/ POLISHING POND
- COUNCIL COMPLIANT/INDUSTRY BEST PRACTICE CONTROLS
- ENHANCED (OVER & ABOVE) CONTROLS

ESTIMATED EXPERT RESOURCE TO SUPPORT EROSION & SEDIMENT CONTROL



- PERSON DAYS / FORTNIGHT OF SITE WORKS - COUNCIL COMPLIANT
- PERSON DAYS / FORTNIGHT OF SITE WORKS - ENHANCED CONTROLS

REVISION DETAILS		INT	DATE	SURVEYED	WC
1	ISSUED FOR C19 FAST TRACK CONSENT	BP	23/05/2022	DESIGNED	SM
				DRAWN	BP
				CHECKED	BP
				APPROVED	BF

LOT 172 DP 513840
ARA WEITI ROAD
REDVALE 0794

WOODS.CO.NZ

WILLIAMS GROUP NEW ZEALAND

WEITI VILLAGE 1 - COVID-19 FAST TRACK CONSENT

EROSION & SEDIMENT CONTROL PLAN CONFIDENTIAL

N

STATUS	ISSUED FOR CONSENT	REV
SCALE	1:2500 @ A3	1
COUNCIL		
DWG NO	P20-008-00-9060-SK	

Plot Date: 2:56:08 pm,23 May 2022, BENP

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P22-008 - WEITI VILLAGE_20935\CAD\SKETCH\P22-008-00-9060-SK.DWG