

Quarry Rehabilitation Plan Guidance

August 2018



Table of Contents

Introduction	3
Background	3
Christchurch District Plan.....	3
Do I have to comply?	5
What is quarry site rehabilitation?.....	5
General principles.....	5
District Plan provisions.....	5
Quarry site rehabilitation objectives	6
Appropriate end use.....	6
Groundwater	7
Finished land contour.....	7
Landscape context	12
Methodology	16
Soil condition and fill management.....	16
Grassing/Planting	16
Surface drainage and subsoil drains.....	16
Fixed plant, machinery, equipment, buildings and haul roads.....	16
Mitigation.....	17
Landscape maintenance and management	17
Monitoring and review	17
Information requirements.....	17
Timescales.....	18
Certification process.....	19
Appendix A – District Plan definitions.....	20

Table of Figures

Figure 1: Key Christchurch District Plan Rehabilitation Provisions.....	4
Figure 2: Potential Post-Quarrying Land Use Options	6
Figure 3: Example of Post-Quarry Land Uses and Recommended Soil Depths	11
Figure 4: Quarry 3D View.....	13
Figure 5: Cross Section 1: (1v:3h slope without fill).....	13
Figure 6: Cross Section 2: (1v:1h slope with fill).....	14
Figure 7: Cross Section 3: (combination slope with fill)	14
Figure 8: Quarry Plan View.....	15

Image credits

Cover: Halswell Quarry. *Christchurch City Council*

1. Kaitorete skink. <i>Kelvin McMillan</i>	9
12. Handcrafted Christmas tree farm. <i>Eddie Dunbridge-Hunt</i>	9
13. Aviary containing juvenile black stilt. <i>The Isaac Conservation and Wildlife Trust</i>	9
17. Flax in flower. <i>Christchurch City Council</i>	10
18. Copper butterfly on native broom. <i>Kelvin McMillan</i>	10
21. McLeans Island kowhai hybrid. <i>Kelvin McMillan</i>	10
24. <i>Kunzea serotina</i> – plains kanuka. <i>Kelvin McMillan</i>	10
All other photographs: <i>shutterstock.com</i>	

Quarry Rehabilitation Plan Guidance

Introduction

This guidance document has been prepared by the Christchurch City Council (CCC) to assist quarry operators when preparing a quarry site rehabilitation plan (QSRP) and for Council administrators when assessing a QSRP for certification.

Its aim is to outline:

- The Christchurch District Plan’s requirements for quarry site rehabilitation;
- The Council’s expectations for the content of a QSRP; and
- The Council’s process for certifying QSRPs.

The guidance relates only to quarries located within the Rural Quarry Zone. It sets out the minimum requirements for *basic* quarry site rehabilitation for areas of quarrying where rehabilitation plans have not historically been required (even though rehabilitation itself has been a requirement since the 1970s). The focus on basic quarry site rehabilitation recognises the more limited range of rehabilitation options available for historical quarry sites compared with the broader opportunities available to new quarries seeking to locate outside of the quarry zones.

Quarries seeking to locate outside of the quarry zone should aim for best practice in quarry site rehabilitation and must include a QSRP as an integral part of any resource consent application. This guidance may be updated later to address quarries outside the Rural Quarry Zone.

Background

Quarrying is a temporary, albeit long term use of rural land. Inevitably quarrying comes to its natural conclusion, where the economic resource is depleted and new uses are identified for the exhausted quarry sites. In the alternative, exhausted sites may be abandoned or left in an un-remediated state; barren and unable to sustain a productive alternative land use.

Quarries have operated in the Yaldhurst and McLeans Island areas since the 1960s. Despite a requirement to rehabilitate quarry sites in successive district plans

since the 1974 Paparua District Scheme, a report in 2014¹ concluded that:

“of the fully excavated areas in recently or currently active quarries within the Council’s territorial boundaries, less than 20% has been fully rehabilitated. Apart from the conservation area at Isaacs, and a small block of forestry, completed rehabilitation has consisted of either battering side slopes with no filling or backfilling generally to or near previous land contour, followed by top-soiling and sowing with pasture grasses”.

The Canterbury earthquakes both expedited the depletion of gravel resource in the quarry zones, and provided extraordinary levels of clean fill material available for rehabilitation purposes. However, clean fill volumes appeared to have peaked in 2013² and returning to pre-earthquake levels would only see around 25 per cent of the volume of aggregate produced each year being replaced as clean-fill³. This has implications for the final rehabilitated landform achievable for existing quarries; either quarries will not be returned to their natural ground levels or it will take many decades for rehabilitation to conclude.

Christchurch District Plan

In 2014 Council commenced a review of its District Plan, including the land use rules for managing access to aggregate resources and the effects of quarrying in Christchurch. While recognising the critical role of gravel extraction for earthquake recovery and business as usual construction, a key environmental issue that the review sought to address was the pressing need for greater progress towards rehabilitation of quarries in the Rural Quarry Zone. Various options for promoting this objective in the District Plan were considered, with an Independent Hearings Panel favouring a rule promoted by the Canterbury Aggregate Producers Group (CAPG) (see Figure 1) which requires all operators of quarries within the Rural Quarry Zone to prepare a QSRP and submit it to Council for certification by 12 August 2018.

This guidance outlines the new requirements and provides guidance to those preparing a QSRP to help them achieve certification in compliance with this rule.

¹ Twelfth Knight Consulting (2014), Quarry Rehabilitation: Background Report for CCC District Plan Review.

² Ibid, s2.5.

³ Richard English (October 2015) Christchurch District Plan Evidence paragraph 10.5.

⁴ CAPG: The Isaac Construction Company Limited; Christchurch Ready Mix Concrete Limited; Fulton Hogan Limited; Harewood Gravels Limited; KB Contracting & Quarries Limited; Winstone Aggregates and Road Metals Company Limited.

Figure 1: Key Christchurch District Plan Rehabilitation Provisions**17.2.2.13****Policy – Quarry site rehabilitation**

- a. Ensure sites of quarrying activities, and sites of aggregates-processing activities, are rehabilitated to enable subsequent use of the land for another permitted or consented activity; and
- b. Require proposals for new quarrying activities, aggregates-processing activities and changes of use on existing quarry sites to demonstrate through a quarry site rehabilitation plan the objectives, methodology and timescales for achieving site rehabilitation and appropriate end use; and
- c. Ensure the final rehabilitated landform is appropriate having particular regard to:
 - i. the intended end use;
 - ii. the location, gradient and depth of excavation;
 - iii. the availability of clean fill material, including top soil, and consequent timeframes for rehabilitation;
 - iv. the surrounding landform and drainage pattern;
 - v. the ability to establish complete vegetation cover;
 - vi. the outcomes of any consultation undertaken with mana whenua; and
 - vii. any adverse effects associated with rehabilitation.

17.8.3.14**Quarry site rehabilitation – Quarrying activity**

- a. Quarry site rehabilitation shall be undertaken for all quarry sites in accordance with the following:

Applicable to	Standard
All quarry sites	<ol style="list-style-type: none"> a. A quarry site rehabilitation plan shall be: <ol style="list-style-type: none"> i. prepared by a suitably qualified or adequately experienced person(s), ii. certified by Council as containing methods and processes capable of achieving full quarry site rehabilitation and containing the matters listed under clause c.; and iii. implemented by quarry operators; and b. The quarry site rehabilitation plan shall be submitted to Council for certification within 2 years of 12 August 2016, or for new quarries prior to commencement of quarrying activity; and c. The quarry site rehabilitation plan shall include: <ol style="list-style-type: none"> i. The quarry rehabilitation objectives for the site; ii. A description of the proposed rehabilitation works including: <ol style="list-style-type: none"> A. The proposed final landform; B. Whether clean fill or other material will be used in the rehabilitation; C. The type of land uses that the rehabilitated quarry could support following rehabilitation; D. The patterns of surface drainage and subsoil drains; and E. Any landscaping and planting. iii. A program and reasonable timescales for progressive rehabilitation. iv. Measures to mitigate any potential effects arising from undertaking rehabilitation other than those already addressed through quarry site mitigation. v. Measures to mitigate potential ongoing adverse effects on the stability of adjoining land and its susceptibility to subsidence and erosion. vi. A process for review of the quarry site rehabilitation plan.

Do I have to comply?

Any quarrying activity that operates under the Rural Quarry Zone rules, and does not meet this requirement will no longer be able to operate as a permitted activity under the District Plan. The activity will either need to rely on (and if necessary demonstrate) existing use rights, or seek resource consent as a non-complying activity. CAPG members have indicated support for this rule and an intention to comply with it.

Any quarrying activity which has been authorised by way of a resource consent and does not operate under the Rural Quarry Zone rules, does not need to comply with this rule.

What is quarry site rehabilitation?

The Oxford dictionary defines rehabilitation as the action of restoring something that has been damaged, to its former condition.

However, in the context of the Rural Quarry Zones in Christchurch, it is defined in the District Plan as **“returning the land to a stable and free-draining landform capable of supporting light pastoral farming or an alternative permitted or consented activity”**.

This much more limited definition acknowledges that:

- Some of the older quarries may have been working to an earlier district plan policy requirement of returning the land to enable pastoral grazing; and
- That alternative land use options may be limited due to economic, physical and/or operational constraints, including a lack of clean fill material, and the implications of having finished ground levels that are now much closer to the unconfined aquifer.

This more limited approach to rehabilitation may restrict the range of productive rural activities on the site and may not be an efficient use of rural land. However given that this approach is restricted to the three longstanding Rural Quarry Zones only, it is unlikely to adversely affect the wider rural land resource.

General principles

Expert evidence presented to the proposed Christchurch Replacement District Plan hearings helped shape the need for, and nature of, rehabilitation requirements, and identified some key principles to inform rehabilitation planning⁵. The principles include:

- Rehabilitation is an integral part of quarrying activity and should not be an afterthought.
- Rehabilitation should ideally be planned and funded from the outset in accordance with a Quarry Site Rehabilitation Plan (QSRP).
- The QSRP should be based on a clear set of objectives or goals for the final finished landform that are both technically and financially sustainable and a methodology to achieve this which is deliverable, certain and timely.
- Rehabilitation should be undertaken progressively to ensure it is effective and to minimise the risk that a quarry would be left in a completely un-rehabilitated state.
- The key benefits of progressive rehabilitation are that it minimises the extent of exposed areas (with the associated dust, visual and landscape effects) and enables land to be utilised for another economic use.
- The full backfilling of a quarry site to achieve original ground levels is not generally appropriate due to a demonstrable lack of clean fill and consequently unreasonably lengthy timescales for completion of rehabilitation.
- The increased vulnerability of groundwater as a result of the reduced depth of protective material between the floor of the quarried area and the underlying unconfined aquifer must be recognised when considering future land uses.

District Plan provisions

The Christchurch District Plan (the Plan) includes a policy and rule specifically outlining the expectations for quarry site rehabilitation and the need for, and content of, a quarry site rehabilitation plan (QSRP) for both existing and new quarrying activities and aggregates-processing activities⁶ (see **Figure 1**).

The remainder of this document provides guidance on what to consider to meet the key requirements of the District Plan provisions and the process for certifying the quarry site rehabilitation plans.

⁵ Evidence of Richard English for CCC (October 2015) paragraph 10.2, 10.21 and 10.22, Robert Potts for CCC (October 2015) paragraph 7.2 and 7.19, and George Cunningham for CCC (October 2015) paragraph 9.1 and 9.6.

⁶ District Plan definitions of quarrying activity, ancillary aggregates processing activity and aggregates processing activities are set out in Appendix A.

Quarry Site Rehabilitation Objectives

Appropriate end use

The QSRP should carefully consider whether the intended end use and final rehabilitated landform objectives for the quarry are appropriate for the specific site, context and the operational needs of the site.

The end use should be compatible with the rural environment and surrounding land use context and enable a productive re-use of the land. At a minimum, light pastoral farming is expected to be possible for quarries in the Rural Quarry Zone. However there are other, potentially more economic uses of the land, which could be considered. Many of these are permitted activities in the Rural Quarry Zone⁷ (and do not require land use consent); others may be appropriate subject to consideration via a consent process, as indicated in **Figure 2**.

Note that **urban** activities such as industrial activities (e.g. general contractors yards), residential activity on lots smaller than 4ha and commercial activities,

are generally not anticipated land uses for the rural environment under the Christchurch District Plan and Canterbury Regional Policy Statement. Proposals for urban activities will generally require a non-complying resource consent or a plan change.

Some quarry owners may wish to continue to process gravels extracted from other sites once the in-situ resource on a Rural Quarry Zone site is exhausted. When imported materials make up more than 50 per cent of the total volume of aggregates processed on a quarry, land use consent is needed and may or may not be granted⁹. This is because the Plan defines this activity as 'Aggregates-processing activity', not 'quarrying' as it does not rely on the in-situ resource. This can extend the life of a quarry (potentially indefinitely) and which may not be appropriate. Even in circumstances where aggregates processing activity is to continue on a quarry site, the Plan still anticipates those parts of the property which are not required for processing to be rehabilitated within five years of the activity commencing⁹.

Figure 2: Potential Post-Quarrying Land Use Options

Reinstate to enable a permitted single or limited economic value use	Light pastoral grazing	Permitted subject to standards listed in Rule 17.8.1.1 and any other relevant district plan rules ⁸
Reinstate to enable a range of permitted rural activities	Farming Rural produce retail or manufacturing Conservation activity Recreation activity Emergency service facilities Flood protection activities Golf course and/or golf driving range	Permitted subject to standards listed in Rule 17.8.1.1 and any other relevant district plan rules ⁸
Reinstate to enable other activities that may be compatible with the rural environment	All of the above plus: Intensive farming Forestry Aggregates processing activity Residential unit on sites >4ha Rural based tourism / entertainment Activities requiring a rural location	Subject to resource consent approval ⁸

⁷ Subject to meeting relevant standards and any other district and regional plan rules.

⁸ Note also that other regulations may apply including Regional Plan rules and the CCC Cleanfill bylaw.

⁹ See District Plan Rules 17.8.1.3 (RD8) and 17.8.1.4 (D1).

The final proposed land use must comply with other regulatory requirements including any rehabilitation and end use requirements set out in regional resource consent conditions and regional plan rules. For instance, some regional consent conditions require a covenant to be registered on the land title limiting the subsequent use of the land¹⁰. Regional consents may be required for activities such as stormwater or other discharges, storage of hazardous materials, nutrient management from farming activities and deposition of clean fill.

Some of the best examples of quarry rehabilitation internationally have focused on the objective of environmental enhancement or restoration or recreation facilities. Local examples can be found at Peacock Springs, Halswell Quarry and Lake Roto Kohatu.

Quarry operators are encouraged to discuss potential land use opportunities with the Council and other interest groups (public and private sectors) to identify any mutually beneficial end uses for the land. For example, working with the Canterbury Water Management Zone Committees may help deliver recreation and amenity targets of the Canterbury Water Management Strategy. Working with manawhenua will identify cultural values which could be incorporated into rehabilitation objectives (e.g. water quality improvement, mahinga kai opportunities).

Groundwater

The quarry zones are located above the Christchurch drinking water protection zone. The potential impacts of the intended end use on groundwater must be considered, as some land uses are less suitable than others due to the reduced depth of material between the surface and groundwater and the unconfined nature of the material (i.e. permeable gravels). The risks to groundwater from pathogens (faecal bacteria), trace metals, pesticides and petroleum hydrocarbons are of particular importance. These contaminants are usually attenuated in the unsaturated zone above the groundwater table as the contaminated water drains downwards. The thickness of the unsaturated zone is important for protecting the groundwater from these types of contaminants, and is especially critical for the removal of bacteria.

Where quarrying permanently lowers the land surface, the intended future land use should take into account the increased vulnerability of the groundwater system. A lowered land surface will create a landform where discharges of stormwater or wastewater could pose a greater threat to groundwater than they do on the neighbouring properties. Some livestock operations with

high volumes of effluent disposal to land, wastewater irrigation, high density onsite wastewater systems or other land uses that discharge high loads of faecal bacteria may not be appropriate as post-quarry land uses. Nor would land uses that require irrigation over land that has been filled (particularly if the exact composition of that fill is not known).

Finished land contour

The finished land contour for the rehabilitated site will be informed by:

- a. the end use objective;
- b. the site and landscape context; and
- c. what is realistic and achievable within reasonable timescales.

Pastoral farming (grazing) for example may require slopes that are not too steep and with larger flat bases, whilst activities involving buildings will generally require flatter contours and a stable building platform. The latter may require planning or engineering to overcome any constraints due to the depth of clean fill or its often variable nature.

Some activities will require filling to greater or lesser extents as indicated in **Figure 3** on the next page. This may necessitate the importation of topsoil, particularly if the soil stored in bunds is inadequate or is proposed to be retained in the bunds to screen ongoing quarrying or aggregates-processing activities.

Unless necessary to screen ongoing processing activities, Council supports re-use of topsoil that is currently stored in bunds, because bunds are not a natural landform within the flat Canterbury Plains landscape and it is therefore inappropriate for them to remain in perpetuity once quarrying ceases.

Rehabilitation objectives should acknowledge the lack of clean fill materials available for rehabilitation purposes. Clean fill volumes may be further limited when production at a quarry ceases and consequently clean fill is no longer brought to the site by contractors looking to deposit clean fill and back load with aggregate.

Council is looking for certainty that the required fill will be available in order to ascertain that the rehabilitation objective is realistic and deliverable within a reasonable timescale. Changing market conditions will affect clean fill availability, making it difficult to predict with certainty. However reference to average clean fill rates can usefully be made through a review of records kept in relation to the CCC Cleanfill and Waste Handling Operations Bylaw 2015.

¹⁰ In some cases this specifies that the land shall be used only for light pastoral use (low stocking rates) or forestry, and not be used for irrigated pasture, intensive animal farming, any activity involving storage of hazardous chemicals and activities with high application rates for other potential contaminants (e.g. pesticides).

Examples of quarry rehabilitation



Ōtukaikino Wildlife Management Reserve. Managed as a 'living' memorial, funds are donated to DOC to purchase NZ native trees which are planted to commemorate the passing of a loved one. *Department of Conservation*

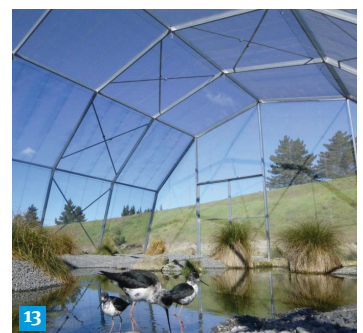


Lake Roto Kohatu. *Pete Barnes*



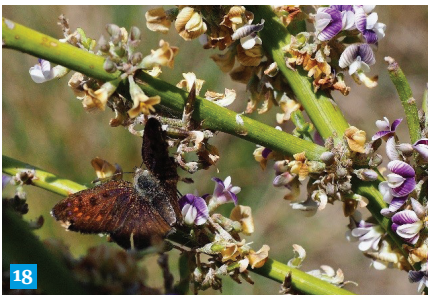
Halswell Quarry. *Christchurch City Council*

Examples of possible land uses



See image credits, page 2

Examples of possible land uses



See image credits, page 2

Figure 3 – Examples of Post-Quarry Land Uses and Recommended Soil DepthsSource: Adapted from Lowe Environmental Impact¹¹

Land Use Type	Activity	Details	Fill Depth and or Topsoil Depth Needed for the Activity (*)
Recreational	Golf	Earthworks (Creation of bunkers); landscaping (incl. tree/bush planting); clubhouse (incl. Wastewater Treatment Plant (WWTP) and Land Treatment); car park (incl. stormwater collection)	1m of inert material above highest recorded groundwater level, plus 0.3m–0.5m of topsoil
	Park	Landscaping; tree/bush planting; light Earthworks	1m of inert material above highest recorded groundwater level, plus 0.3m–0.5m of topsoil
	Natural / Ecological Reserve	Tree/bush planting; light landscaping	Depending on the vegetation (see Forestry land use)
	Ponds / Wetlands	Earthworks	Impervious layer
	Nature trails	Light landscaping	1m on inert material above highest recorded groundwater level, plus 0.3m of topsoil
	Paintball Park	Landscaping; Clubhouse (incl. WWTP and Land Treatment; Car Park; Stormwater collection	1m of inert material above highest recorded groundwater level, plus 0.3m of topsoil
	Racing track	Landscaping; Clubhouse (incl. WWTP and Land Treatment; Car Park; Paddocks; Stormwater collection	1m of inert material above highest recorded groundwater level, plus 0.3–0.5m topsoil
	Rock Climbing Facility	Creation of vertical walls; Car park	1m of inert material above highest recorded groundwater level, plus 0.3m of topsoil
Agriculture	Pasture (light sheep)		1m of inert material above highest recorded groundwater level, plus 0.3m topsoil
	Crops	Ploughing (and other earthworks); fertilisation; use of pesticides; irrigation ¹²	1m of inert material, plus 0.5–1m of topsoil, depending on crops
	Organic/Low Chemical input produces	Tree/bush planting	1m of inert material, plus 0.5–1m of topsoil, depending on crops

¹¹ Robert Potts (2015) Christchurch District Plan Review, Rural Hearing, Evidence in Chief, Table 1¹² Note that irrigation over filled land may pose a risk to groundwater

Land Use Type	Activity	Details	Fill Depth and or Topsoil Depth Needed for the Activity (*)
Other	Biomass production	Tree/bush planting	Depending on the vegetation. Ranges from 1–4m of material. Pine and Fir trees 3m; Birch, Beech, Spruce and Willow trees 2m; fruit trees 3m, plus 0.3–0.5m of topsoil
	Forestry	Tree planting	As above
	Stormwater management	Earthworks (infrastructures)	Impervious layer
	Energy production (Wind Turbines)	Earthworks	Variable depth of soil to ensure structure stability

(*) under optimal topsoil conditions

The ultimate plan form and depth of a quarry will have a significant impact on rehabilitation options. In some cases areas where excavations are shallow, relatively little, if any fill will be required, and simple low angled batters would readily integrate the excavated areas into the surrounding land. A layer of suitable top soil and grassing is generally only then required to return the area to light pastoral use (as has occurred at Isaacs Quarry near McLeans Island). As a minimum, when an area is returned to light pastoral use, a suitable top soil layer would be one that has a settled depth of 300mm (350mm unsettled). However, as indicated in **Figure 3** above, different activities may require a greater depth of topsoil more appropriate to that particular use.

However in the case of small, irregular shaped, relatively deep, isolated excavations, significant amounts of fill would be required to return the area to, or near to, its original form. In the alternative, rehabilitation in the form of reconstructed side slopes only would result in an effectively unusable, narrow area at the base of the excavation which could pond. This could present a contamination risk to the underlying aquifer from sources such as avian faecal matter and in some locations, create a bird strike risk for Christchurch International Airport.

Significant partial or full back-filling of large deep quarry areas is generally not considered to be a viable

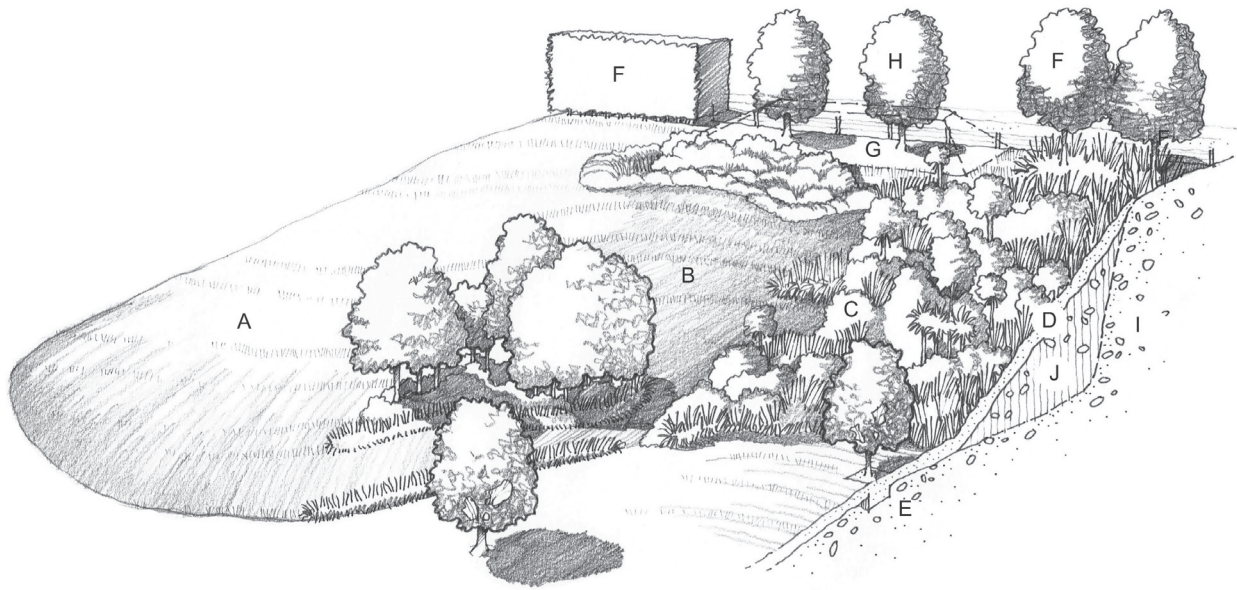
or appropriate option due to the lack of appropriate clean fill material and the consequent implications for rehabilitation timescales. The majority of sites are likely to be only partially refilled, focusing on ensuring all slopes achieve a minimum grade of 1v:3h, unless a lesser slope would not unduly extend the timeframes for rehabilitation or is necessary to facilitate a particular end use of the land. In some instances, steeper slopes (or a mix of gradients) may be more appropriate as discussed further below.

Landscape context

The QSRP should consider the wider site and landscape context. Council encourages operators to identify a final land form that considers and integrates with adjoining land and if possible reinstates attributes that are not too incongruous in the wider landscape context. This may include for example a concept design that breaks up the hard engineered slopes of side batters and / or backfilling to achieve an undulating landscape running with the grain of the landscape (i.e. in an east-west direction).

The finished form of the rehabilitated pits may also be altered to create more natural, organic topography, which responds to the wider landscape context and helps offset the loss of the pre-existing topography and rural character (**Figure 4**). This can be achieved by the placement of clean fill, or by adjusting the batter gradients and planting (see **Figures 5–7**).

Figure 4 – Quarry 3D View



Legend

A – Gentle slope: 1 in 6 to 1 in 10. Can be grassed and mown / grazed.

B – Medium slope: 1 in 3 to 1 in 6. Can be combination of mown / grazed and planted areas.

C – Steep slope: 1 in 1 (max). Must be planted in dense vegetation (trees, shrubs and groundcover species).

D – 0.5m-1.0m topsoil cover over clean fill where slopes are vegetated other than mown lawn (mown lawn slopes to have 0.3m min. topsoil)

E – Minimum 1.0m x 1.0m tree pit filled with topsoil.

F – Retain existing shelterbelts and other quarry mitigation planting around boundaries where possible.

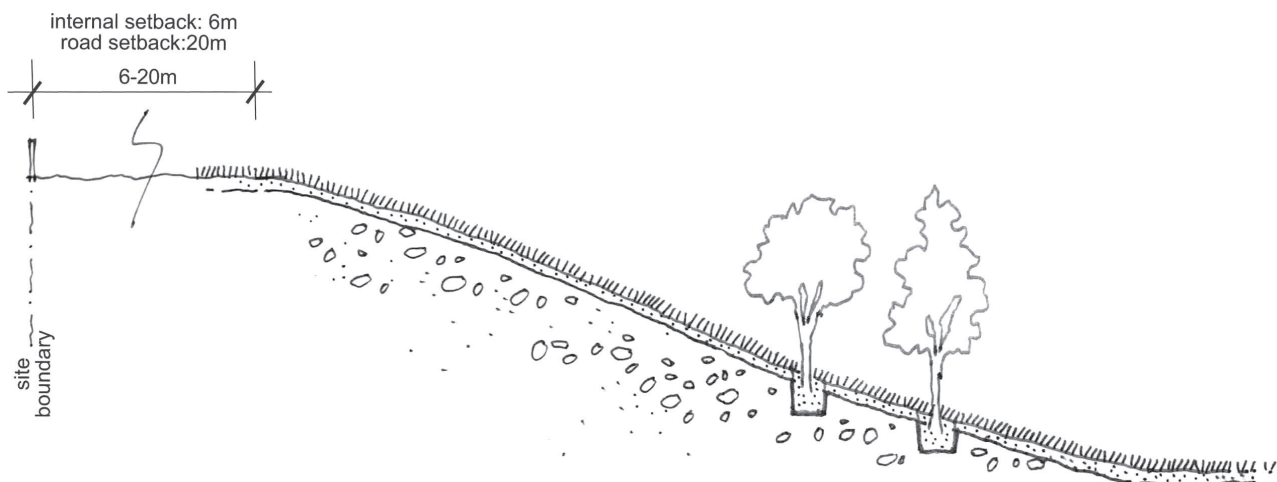
G – Remove mitigation bunds and reuse soil (where appropriate).

H – Plant trees around upper parts of rehabilitated quarry to provide amenity, shelter and habitat.

I – Former quarry headwall.

J – Placed clean fill to form batter slopes.

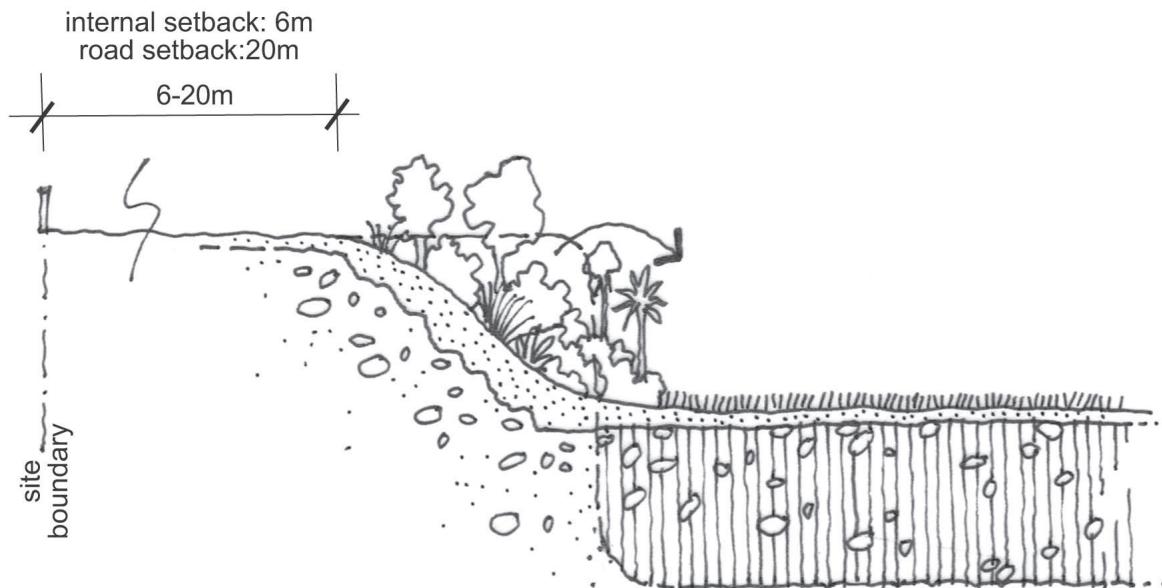
Figure 5 – Cross Section 1: (1v:3h slope without fill)



Quarry not backfilled and left at full depth of 10-11m.

Quarry excavated to max. 1 in 3 grade permitted by Rule 17.8.3.9 with 300mm (min) soil to facilitate the ongoing maintenance of mowing grass and or grazing animals.

Figure 6 – Cross Section 2: (1v:1h slope with fill)

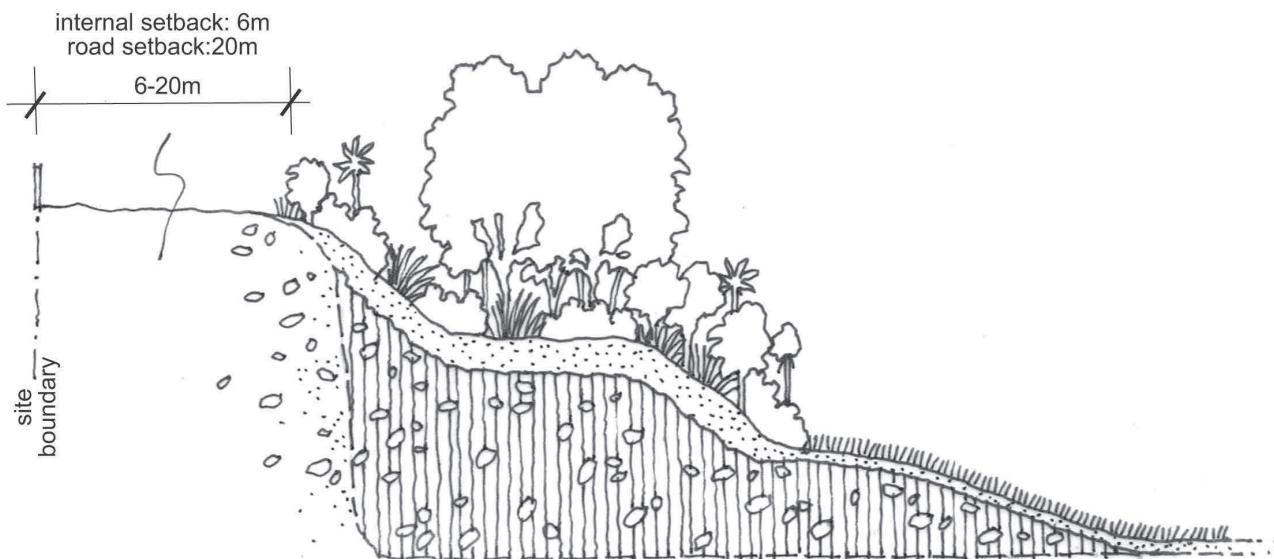


Quarry pit shown partially back filled with clean fill and top soil for grazing and/or low shrubland vegetation (shallow rooting).

1 in 3 internal batter slope required by Rule 17.8.3.9 is excavated back to 1:1 grade (subject to resource consent approval) and left in a roughened state to prevent additional topsoil slumping.

Topsoil at appropriate depths to support grass, shrubs and trees.

Figure 7 – Cross Section 3: (Combination slope with fill)



Subject to resource consent:

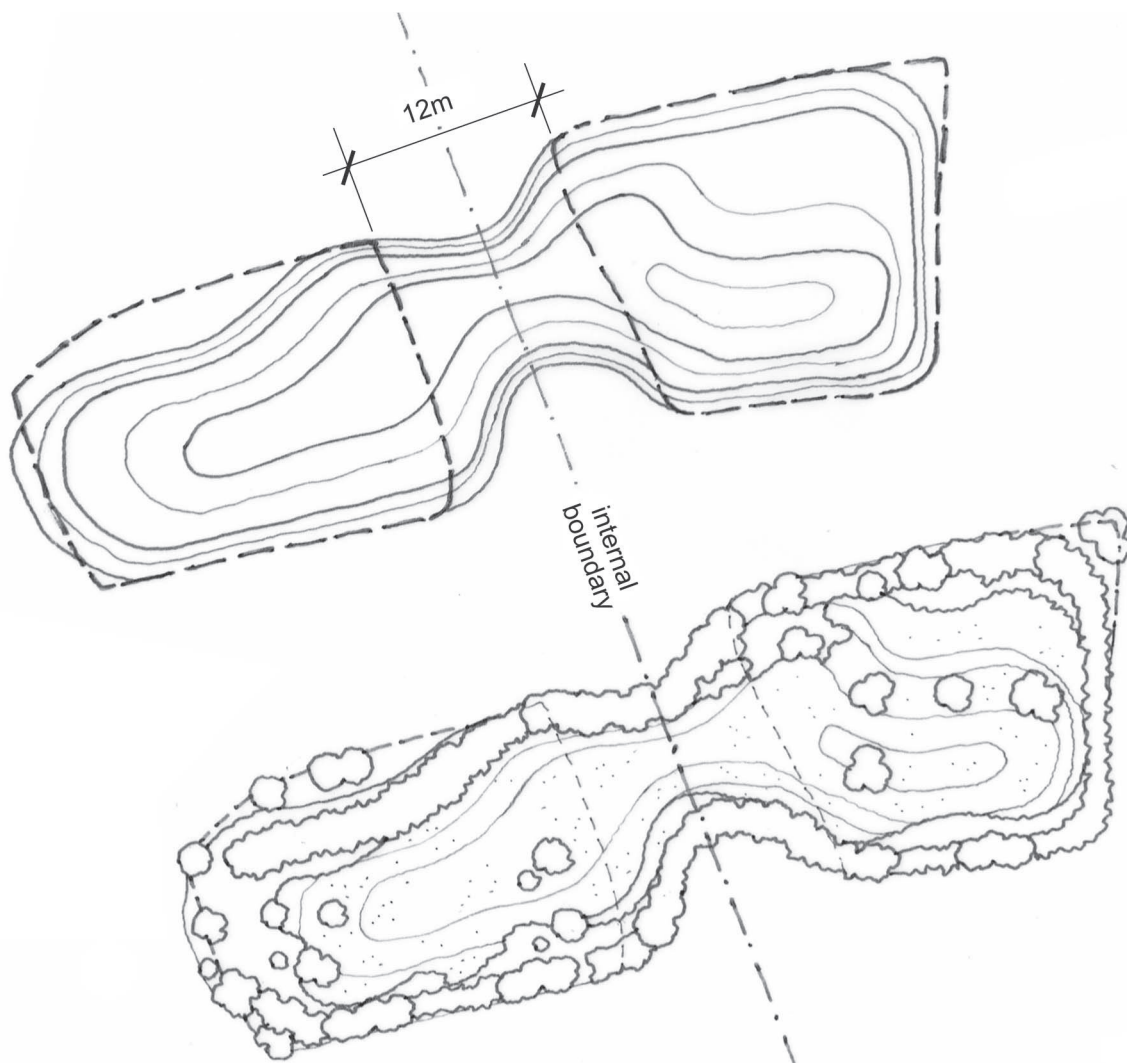
Excavate back quarry edge and place cut material and / or clean fill in pit to achieve combination of 1:1 planted slopes, 1:3 mowed/grazed slopes and level benches to support large trees (increased ecosystem type and variety).

Allow roughened surface to slopes to retain soil (at various depths) and support vegetative cover.

Resource consent would be required for slopes greater than 1v:3h, however, Council is likely to view this favourably where the overall landscape (and other environmental outcomes) are improved. The finished batter gradients will also be dependent on the end use of the quarry, the intended vegetation cover, and the aspect of the slope. A fully vegetated slope may be steeper than a grassed slope for example. North facing slopes may require irrigation to establish vegetation other than pasture grass.

Operators are encouraged to work with surrounding quarry owners to ensure compatible rehabilitation strategies and to identify any opportunities and economic benefits to working collaboratively. As **Figure 8** below shows, adjacent rehabilitated areas may be contoured to form a continuous landform.

Figure 8 – Quarry Plan View



Combine neighbouring quarry pits together to form long, sinuous shapes that better replicate ancient Waimakariri channel and bar patterns by ‘pushing’ and ‘pulling’ in edges.

(Dashed lines denote extent of two neighbouring quarries. Minimum 6m setbacks off each internal boundary indicated).

Methodology

The QSRP should set out how and when rehabilitation will be undertaken and how progress can be measured. Council wishes to see demonstrable staged progress to better manage dust and visual effects, and minimise risk that rehabilitation will not be achieved.

Successful rehabilitation will require active management from the operator and active compliance monitoring from Council, particularly for fill management and establishing vegetation.

Soil condition and fill management

Rehabilitation needs to be actively managed to ensure the soil can be used for agriculture and other purposes. When quarrying operations end, their sites have generally been deprived of topsoil, vegetation is scarce and sites tend to become sterile and prone to erosion. Re-installation of topsoil is therefore the most important pre-requisite for any post quarry land use.

Re-installing the topsoil on certain backfill material does not guarantee that the original fertility or the former environment will have been restored. Topsoil that has been stockpiled for too long is prone to lose its original structure; its micro flora and micro fauna and/or some of its nutrients may have leached. The soil profile is likely to be different and, due to the loss of topsoil structure, is unlikely to have the same filtration and/or purification capabilities. In order to restore these capabilities, the topsoil to be re-installed may need to be mixed with organic matter and/or soil conditioner and/or acceptable grade bio-solids and worked (i.e. ploughed or cultivated) in order to recreate a favourable environment. Time will also play a major role in the recovery of those capabilities. It is acknowledged that extensive soil improvement over very large sites may be uneconomic and therefore such sites would not lend themselves to post-quarrying land uses that require deep, fertile soils.

The re-installation of topsoil at existing quarries generally happens after some backfilling with “clean fill” although some shallower excavations do not require any fill other than topsoil. Evidence presented to the district plan hearings identified that there has been a lack of recording of the type and suitability of past fill material on many sites and the uniformity of filling across existing quarries. In addition, the amount of compaction, the percentage of fines, and the infiltration characteristics of the filled material will be very variable. For existing quarries, it may not be easy to ascertain exactly what lies underneath the topsoil layer, and depending on

the desired final land use, an assessment may require infiltration tests and, eventually, soil testing.

It may be necessary to engage the input of a hydrological and/or agricultural expert to inform the QSRP and confirm that the proposed methodology is appropriate for achieving the final land use objective and protection of the underlying unconfined aquifer.

Grassing/Planting

Landscaping details should include identification of vegetation cover to be used, planting methodologies (depth of tree pits, irrigation etc.) and a planting programme.

Grass seed should be selected to support the end use and minimise other effects such as bird strike risk (in the vicinity of the airport). It should ideally be of a type that can sustain drought conditions.

The timing of top-soiling and redressing should be undertaken during the spring (Sept-Nov) or autumn (March-May) when grass strike is optimal.

Tree and shrub planting should take place during the planting season of May to September.

Surface drainage and subsoil drains

The QSRP should cover the following:

- The post-quarrying nature of soils/gravel (including any topsoil or fill materials) across the site and how this may affect drainage;
- Ability of the site to be free-draining and the potential for ponding (and associated risks to groundwater and / or airport safety from birdstrike);
- Slope stability and erosion potential;
- Possible effects (or lack thereof) on nearby surface water bodies and groundwater;
- Ability of land to support the establishment of vegetation cover.

Fixed plant, machinery, equipment, buildings and haul roads

All fixed plant, machinery, equipment and buildings should be removed from the quarry site at the conclusion of gravel extraction, unless resource consent has been granted for other activities and the machinery is used for that purpose or the machinery/equipment is being used

to rehabilitate the site. If machinery/equipment is being used for rehabilitation, it should be removed once it is no longer required for that purpose.

Once gravel extraction, clean fill placement (if any) and rehabilitation work is complete, any haul roads should be rehabilitated in accordance with the QSRP.

Mitigation

The visual screening mitigation used for quarrying activity (whether that is bunding or tree planting) will be of similar benefit to screen rehabilitation works and may be an integral part of the post-quarrying landscape. It will remain important to continue to maintain their appearance through mowing, grazing or planting.

Landscape maintenance and management

The QSRP should also consider timeframes for monitoring and maintenance (generally a two year establishment period is helpful), replacement planting for diseased, damaged or dead plants, and weed control.

Monitoring and review

Monitoring / compliance should be undertaken regularly in accordance with the staging plan.

The QSRP should be reviewed to ensure it remains fit for purpose, ideally every five years from August 2018.

Any rehabilitation not in accordance with the certified QSRP, including the staging, will result in quarrying no longer being a permitted activity. A new QSRP or amendment thereto will therefore be needed.

Once rehabilitation has been completed, CCC will monitor the site over a two-year establishment period to ascertain whether or not rehabilitation efforts have been successful.

Information requirements:

It is anticipated that Rehabilitation Plans will:

- a. Provide a sectional plan showing finished rehabilitated levels.
- b. Outline the depth and quality of topsoil to be replaced (including factors such as how long topsoil is stored in bunds);
- c. State the required depth of unsaturated material (non-excavated material and fill material) between the topsoil layer and groundwater; and
- d. Manage the use of building demolition material and other clean-fill to ensure it is not over crushed or over compacted.
- e. Provide a landscape or planting plan (depending on the end use). As a minimum, for pastoral farming, this should include details about the grass types and planting seasons.
- f. Provide evidence from an appropriate expert¹³ that the rehabilitation plan will enable a permitted economic use of the land.
- g. Include a staging plan that includes defined areas/ stages and associated dates for completion.

¹³ As a minimum, evidence from an agricultural consultant which demonstrates that land can sustain light pastoral grazing should be provided. However, depending on the proposed end land use, appropriate experts may include, but are not limited to: landscape architects, hydrogeologists and ecologists.

Timescales

Extraction and rehabilitation should be undertaken in a planned, systematic and progressive manner and not left to be completed at the conclusion of quarrying. However, many quarries in the Rural Quarry Zone have extracted much more quickly than any rehabilitation has occurred; resulting in significant areas of exposed land. Rehabilitation should:

- Prioritise areas where exposed land may be having adverse effects on surrounding land uses (such as dust or visual amenity) or would enable part of the site to be fully rehabilitated and potentially reused.
- Be fully completed within one to three years of extraction of each stage being completed or where quarry operations have ceased or reduced to a nominal amount¹⁴.
- Where the site is being used for Aggregates Processing Activity (subject to consent under Rule 17.8.1.3 RD8 or 17.8.1.4 D1) be completed within five years from the start of Aggregates Processing Activity for those parts of the property which are not required for processing and be fully rehabilitated no later than three years after the processing ceases¹⁵.

Proposals should aim to mitigate any adverse effects of rehabilitation on surrounding land uses including as a result of traffic, noise and dust by seeking to minimise the timescales associated with rehabilitation activities.

The importance of preparing a QSRP that achieves, as a minimum, a landform capable of achieving light pastoral grazing (or another permitted or consented activity) as quickly as possible, is emphasised.

Determination of the end use of land should not be left to subsequent review periods or towards the end of a quarry's life, notwithstanding that the regulatory framework for the land use may change over the lifetime of the quarry.

¹⁴ The latter being important to ensure that past practices of seeking to avoid full rehabilitation on account of there being a small amount of resource left at the site are not continued.

¹⁵ Consistent with Christchurch District Plan Rule 17.11.2.16.

Certification Process

The rehabilitation plan is required to be certified by Council (Rule 17.8.3.14 of the Christchurch District Plan). This will ensure a consistent standard of QSRPs that include the necessary level of detail. The certifier will be a Council Senior Planner or Planning Team Leader. The certification process is outlined below.

Step 1. Applicant submits QSRP to Council

For existing quarries in the Rural Quarry Zone, this is required prior to the 12th August 2018.

For new applications, this is required to be provided with the application for resource consent. For new consents the QSRP may be in draft form, with the final document refined through the resource consent process (if necessary), and then certified at the time of decision.

Applicants may submit the QSRP through email to **resourceconsentapplications@ccc.govt.nz** OR via Online Services (if a registered user).

Please note that there is a fee for processing the QSRP certification. A deposit for 'Other District Plan certificates' (as per fees for certification under the District Plan¹⁶) is required at the time of lodgement unless submitted with a resource consent application.

Step 2. QSRP assessed by Council Planner

The rehabilitation plan will then be allocated to a Council Planner who will assess the QSRP to determine the extent to which the QSRP meets District Plan criteria.

The Council Planner will then make two decisions:

- (1) Does the QSRP meet the criteria of 17.8.3.14?
- (2) Is specialist/expert input required?

Step 3. Progress QSRP

If the QSRP does not meet criteria, the Council Planner will inform the applicant in writing of the additional information or amendments required before the QSRP can be certified (this may include the need for specialist/expert input). The Council Planner will place the certification request on hold while awaiting the amended QSRP. Once any necessary information has been received, the Council Planner will resume the assessment of the QSRP.

If the QSRP meets the criteria, the Council Planner will prepare the certificate and arrange for it to be signed by a delegated officer.

Step 4. Applicant notified of outcome

Once the QSRP certificate is signed, it will be sent to the applicant. For new quarry applications the certificate will be issued as part of the resource consent decision.

Step 5. Quarrying commences

Quarrying may commence once the QSRP is certified (if not an existing quarry) and Resource Consent granted.

¹⁶ Fees – Resource Consents : <https://www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/long-term-plan-and-annual-plans/fees-and-charges/fees-resource-consents/>

Appendix A – District Plan definitions

Term	Definition
Ancillary aggregates processing activity	means the processing, and associated storage, sale and transportation of natural sand, gravel, clay, silt and rock and/or recycled/recovered aggregates brought in from other properties provided that at least 50% of the total volume of aggregates processed on the property originates from that property.
Aggregates processing activity	in relation to the Rural Quarry Zone, means the processing, and associated storage, sale and transportation, of natural sand, gravel, clay, silt and rock and/or recycled/recovered aggregates brought in from other properties where 50% or more of the total volume of aggregates processed on the property is imported from another property or properties.
Quarrying activity	<p>means the use of land, buildings and plant for the purpose of the extraction of natural sand, gravel, clay, silt and rock, the associated processing, storage, sale and transportation of those same materials and quarry site rehabilitation. It may include:</p> <ol style="list-style-type: none"> a. earthworks associated with the removal and storage of over-burden; b. extraction of natural sand, gravel, clay, silt and rock materials by excavation or blasting; c. processing of those extracted materials by screening, crushing, washing and/or mixing them together; d. the addition of clay, lime, cement and recycled/recovered aggregate to extracted materials; e. ancillary aggregates-processing activity; f. workshops required for the repair of equipment used on the same property; g. site management offices; h. parking areas; i. landscaping; and j. quarry site rehabilitation and any associated clean-filling.

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