Original

Steatite Limited

Steatite Quarry Project

Tasman District Council Resource Consent Application and Assessment of Effects on the Environment

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PART TWO — ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

1 Introduction

Steatite Limited (STL) is applying for Resource Consent to quarry steatite (talc magnesite), magnesium and associated ore from the Steatite Quarry Project (SQP) area as depicted in Appendix 2. The SQP is located approximately 1 kilometre north of the Cobb Dam and is situated on the north-east slope of the Cobb Valley.

STL owns Mining Permit (MP) 50-799 which covers approximately 53.620ha as shown in Appendix 1.

There are three proposed quarries which focus on three outcrops within the MP. Further details with respect to the proposal is described in Section 1.1 and in Section 3

A substantial portion of the MP will not be disturbed under this application.

Technical reports to support this AEE are included in Volume 2. These reports cover quarrying design, flora, fauna and water quality.

The land required for the SQP area is classified as Conservation Park as set out under S.19 of the Conservation Act 1987. The land unit is termed *North-west Nelson Forest Park*. It is located entirely outside the Kahurangi National Park.

1.1 Overview of the Proposed Quarrying

The SQP resource is within a deposit known as 'Lens 4'. The total resource within Lens 4 has been estimated at 1,239 million tonnes of magnesite, and the mineable resource at 298 million tonnes of magnesite. A large proportion of this is estimated to be Steatite (talc magnesite).

Interpretation of diamond drilling cores that were undertaken in 1964 combined with a geological site visit in 2009 was used to define the quarrying zones in the outcrops outlined in Appendix 2. This area is focused and has been selected to enable resource extraction with the least amount of environmental disturbance.

The resultant area that will be disturbed is shown on the same plan. The disturbed area will enable appropriate benching to occur to prevent rock fall, and will also provide access to the pit floor and space for the associated activities listed in Part 1 of this application. It is proposed at this stage to quarry the outcrops together in order to provide for variations in market demand with regard to quality of material.

The estimated production rate will vary depending on such matters as start up time, market demand and seasonal conditions (it can get very cold for example and extraction may not be possible in winter).

On average, the production rate will range between 5,000 to 15,000 tonnes per annum which will give at least 38 years of quarrying over the three sites.

Quarrying will be via surface bench mining. Rock will usually be cut from the quarry area by drilling and with rock cutting equipment, forming blocks that are approximately 3 cubic metres in volume, and weighing approximately 9 tonnes each. Hence, approximately 555 to 1,666 blocks will be cut per annum. Blocks will be loaded on to flat deck trucks and removed from the quarry via the existing access roads, as discussed below. At the peak production rate there would be about 32 truck movements per week.

Minimal overburden is anticipated, as the drilling log and geological mapping indicates that Steatite is available at or near the surface. However, some overburden will be

generated as the Steatite is interspersed with other material such as magnesium ore and quartz. This overburden will be used to create the flora rehabilitation bunds.

The existing road network will be used to access the Old Quarry Outcrop site and to haul steatite to a handling facility (off the quarry site). A new road will be constructed to the Southern Outcrop and South-West Outcrop as discussed in more detail in Section 3.

Access to the site will be via the road to the Cobb Dam and the existing gravel track to the quarry, which will be upgraded where necessary.

2 Existing Environment

The existing environment is outlined in detail in each of the technical reports contained in Volume 2 of this application. The description below includes a summary of the existing environment as described in the technical reports as well as additional information.

2.1 General Location and Context

The following sections discuss the Cobb Valley, including the Kahurangi National Park, history of mining and climate.

2.1.1 The Cobb Valley

The SQP area is situated on the north-east slope of the Cobb Valley. The Cobb Valley is generally bounded by Lockett Range to the north and Peel Range to the south with the Cobb Reservoir located in the middle of the valley. There are several lakes surrounding the SQP (albeit a substantial distance away) such as Lake Sylvester, Diamond Lake, Lake Lockett and Lake Lillie to the west and the Cobb Reservoir to the south.

The general topography of the Cobb Valley ranges from approximately 820m above sea level at the Cobb Reservoir to 1695m above sea level at the summit of Iron Hill to the west of the SQP area.

Two small unnamed streams flow through the Mining Permit area, one to the immediate north (which is in fact the boundary of the permit area) and the other in the middle of the permit area (hereinafter denoted as Streams N and S) - these streams flow into the Cobb River approximately 1.2 km below the Cobb dam, although most times the southern stream is in fact dry. The water bodies in the SQP area are discussed below in Section 2.4.

The Cobb Valley contains a diverse assemblage of habitats and fauna. Flora and Fauna more specific to the SQP area are discussed further in Section 2.3 below.

2.1.1.1 Kahurangi National Park

The MP site is surrounded by the Kahurangi National Park (KNP) which is widely regarded as a significant area for tramping and hiking. However, the SQP area is not a significant area for tramping and hiking.

Created in 1996, the KNP is one of New Zealand's newest and second largest national park. There are more than 570 kilometres of walking and tramping tracks in the park. The more popular longer walks include the Heaphy Track (one of New Zealand's Great Walks) and the Wangapeka Track. Kahurangi also contains the Tasman Wilderness Area. Vast, untracked and without huts, it is suitable for experienced trampers.

The KNP is located in an area of particularly high floristic diversity including approximately 1,200 species of indigenous vascular plants. The alpine meadows above the brush line are among the richest floristically in New Zealand.

Among the threatened birds in the Park are great spotted kiwi[1], blue duck (whio), western weka, Kea, South Island kaka, bush falcon, rock wren and rifleman. Within the last decade weka numbers have dramatically declined in the Golden Bay, North-west Nelson area but recent reports indicate that numbers may be slowly increasing. Of particular note is the presence of rock wren, thinly scattered in alpine parts of the National Park.

[1] Scientific names and threat status of birds are given in Appendix 1 of the Fauna Report found within Volume 2 of this application.

2.1.2 History of Mining

The site selected for the SQP has been used for mining in the past as outlined in Section 2.5. Hence, the site is significantly modified and importantly has an existing quarry access track which STL will utilise.

2.1.3 Climate

Mean annual air temperature at the Cobb Dam is 8.2°C, with February and July averages of 13.8°C and 3°C respectively. Hence, it is a relatively cold climate compared to the Takaka plains.

Precipitation in the region is strongly influenced by altitude, resulting in a large precipitation gradient which decreases down the Cobb Valley with approximately 2400mm/yr at the Cobb Dam.

2.2 Geology

The main magnesite deposits in New Zealand occur within the ultramafics of the Cobb Igneous Complex in the Tasman region.

Magnesite has been reported from several other localities, mainly in the northern part of the South Island, but these deposits are small and impure. The Cobb magnesite deposits are considered a suitable source of magnesium metal, and are New Zealand's only magnesite deposits that have potential to supply magnesium.

The Cobb magnesite deposits occur within the Cobb Igneous Complex, located in the Cobb Valley and upper Takaka Valley. They comprise several large lenses of talc-magnesite and quartz-magnesite, formed by dehydration and carbonation of serpentinite along thrust faults.

Steatite ($Mg_3Si_4O_{10}(OH)_2$) is a metamorphic rock known as talc-magnesite. It is largely composed of the mineral talc and is rich in magnesium. It is produced by dynamothermal metamorphism and metasomatism, which occurs at the areas where tectonic plates are subducted, changing rocks by heat and pressure, with influx of fluids, but without melting. Steatite has been a medium for carving for thousands of years.

There are four main magnesite lenses in the Cobb area, which have been previously explored, and two of these have been previously mined. The main magnesite quarry is located in Lens 4, near the Cobb dam and this is the lens of interest with respect to the SQP. Another magnesite quarry is located in Lens 2 near Magnesite Creek. Lens 4 can be seen in Appendix 3.

2.3 Terrestrial Ecosystems

2.3.1 Vegetation and Flora

A study was conducted prior to the lodgement of this application to assess the indigenous vegetation and flora within the SQP area. A detailed description of the vegetation and flora on site is outlined in Martin, T., Lloyd, K. (2010) *Ecological Assessment of Vegetation and Flora at a Proposed Steatite Quarry, Cobb Valley, North-West Nelson* in Volume 2 of this application. A summary of the vegetation and flora is described below.

2.3.1.1 Overview

Most of the permit area is covered in indigenous forest dominated by mountain beech. Scrub, shrubland, and rockland vegetation is present in the dewatered bed of the Cobb River, at the site of the disused quarry, on the remaining rock outcrops, on landslides, and along the access road from the Cobb Reservoir dam to the quarry (Figure 1). The vegetation has been modified by previous quarrying and pest animal effects, but is relatively intact.

2.3.1.2 Mountain Beech Forest (50.0 ha)

Most of the license area is covered in mountain beech forest. Mountain beech trees form a canopy 10-15 m tall, with trunks up to 30 cm diameter. Silver beech is frequent, particularly in the south-west, and red beech is occasional throughout. Canopy trees are 60-200 years old over most of the site. The subcanopy is very sparse, with occasional kanuka (*Kunzea ericoides*), kaapuka (broadleaf; *Griselinia littoralis*), mountain toatoa (*Phyllocladus alpinus*), *Raukaua simplex*, *Coprosma foetidissima*, and weeping mapou (*Myrsine divaricata*). The shrub layer, where present, is dominated by *Leptecophylla juniperina*, with occasional small leaved *Coprosma* species (*C. microcarpa*, *C. propinqua*, *C. pseudocuneata*) and lawyer (*Rubus cissoides*). Ground cover species include a wide range of indigenous herbs, shrubs, sedges, orchids, ferns, and lycopods, including *Adenochilus gracilis, Pittosporum rigidum*, *Lycopodiella varia*, kiwakiwa (*Blechnum fluviatile*), *Blechnum procerum*, pohuehue (*Muehlenbeckia australis*), *Arthropodium candidum*, and *Gahnia procera*.

Under the forest canopy there are several areas with small outcrops and large boulders. These shaded rocky substrates are habitat for blue tussock (*Poa colensoi*), *Asplenium hookerianum*, *Cardamine* "magnesite", *Hebe albicans, Lycopodiella varia*, and kaapuka. Within 10-20 m of the base of the outcrops, and where boulders and areas of exposed bedrock are still common on the forest floor, the forest canopy is 8-12 m tall and more open. Kanuka and mountain beech are common, with occasional silver beech. Mountain toatoa (*Phyllocladus alpinus*) and haumakaroa (*Raukaua simplex*) in the subcanopy, with *Dracophyllum ophioliticum*, *Gahnia procera*, *Leptecophylla juniperinum*, and *Coprosma microcarpa* in the shrub tier. Ground cover includes a procumbent form of *Leucopogon fasciculatus*, *Gaultheria antipoda*, *Astelia nervosa* 'broad', *Lycopodium volubile*, and a moss: *Dicranoloma robustum*.

To the east of the access road, and to the south of the old quarry outcrop, a former access road to the quarry has regenerated naturally to a canopy dominated by mountain beech. The route of this former road is partly visible on the aerial photographs.

2.3.1.3 Shrubland on Rock Outcrops (1.1 ha)

Within the mining permit area, there are three areas where rock outcrops protrude through the forest canopy. From north to south, these are hereafter referred to as the "old quarry outcrop", the "southern outcrop" and the "south-west outcrop". It should be noted that the old quarry outcrop described here is adjacent to the quarry, but has not been modified by previous quarry operations.

Shrubland on Old Quarry Outcrop (0.6 ha)

The Old Quarry Outcrop lies to the east and south of the area previously quarried. Most of the northern and eastern faces of the outcrop are steep bluffs, with taller forest around the base of the outcrop shading the lower faces of the bluffs. The southern side of the outcrop has relatively complex topography, and includes bluffs, steep slopes, overhangs, deep crevices, ledges, and caves.

Most of the outcrop is exposed bedrock. Where the presence of flatter ground, ledges, or cracks has allowed the accumulation of finely broken rock and humus, woody species such as manuka (*Leptospermum scoparium*), *Dracophyllum ophioliticum*, and mountain beech are common, with occasional weeping mapou and *Coprosma microcarpa*. Some of the mountain beech are trees to 5 metres tall, but in most places, woody species form a low shrubland only 1.5-2 metres tall.

Complex topography and vegetation structure creates a wide range of microhabitats that are each characterised by differing vegetation communities.

On exposed rock beneath a shrubland canopy, *Dicranoloma robustum* and blue tussock are common, with frequent *Colobanthus* aff. *wallii*, occasional *Gahnia procera*, and a procumbent form of *Leucopogon fasciculatus*.

Carex devia (10 plants) and *Uncinia viridis* (17 plants) occur occasionally on well-lit ledges.

Notothalspi australe (27 plants) occur occasionally on ledges regardless of sun or shade.

Myosotis brockiei (133 plants) occur occasionally on sheltered ledges.

Kiwakiwa and *Blechnum procerum* occur occasionally in shaded, damp crevices.

Asplenium hookerianum is frequent on damp ground under rock overhangs and in cave entrances, along with *Cardamine* 'magnesite' (53 plants), on damp, shaded lower rock faces that are covered in moss.

Korthasella salicornioides, a dwarf mistletoe, is occasionally present on manuka throughout the outcrop (with at least 150 plants).

Photographs of many of these species can be seen in Volume 2 of this application.

Shrubland on Southern Outcrop (0.3 ha)

The Southern Outcrop juts out of a steep, east-facing hillside, with steep bluffs on its eastern, northern, and southern faces. Where the summit of the outcrop merges with the hillside, the vegetation comprises shrubland dominated by manuka, kanuka, mountain toatoa, and weeping mapou. *Korthalsella salicornioides* is present on the manuka on the summit of the outcrop.

On steeper slopes and bluffs, blue tussock is common, with frequent *Hebe albicans* and *Colobanthus* aff. *wallii*.

Asplenium hookerianum and *Cardamine* "magnesite' are frequent in shaded crevices and on moss-covered overhangs, and one population of 54 plants of *Myosotis brockiei* was found on a ledge on the southern edge of the outcrop.

Carex devia (6 plants) and *Uncinia viridis* (1 plant) were found on sunny ledges near the base of the outcrop.

Shrubland on South-West Outcrop (0.2 ha)

The South-West Outcrop has steep bluffs on the southern side, with a more broken face on the northern side, with bluffs, overhangs, crevices, and steep slopes. Similar to the Southern Outcrop, the summit merges with the hillslope, but at this location smaller rocky outcrops continue further uphill under the forest canopy. The summit and less steep faces are covered in shrubland dominated by mountain beech, with frequent *Coprosma propinqua*, *Leucopogon fasciculatus*, *Leptecophylla juniperinum,* and occasional mountain toatoa, kapuka, and kanuka. Scattered throughout the shrubland there are occasional kanuka and mountain beech to around 5 metres tall and 20 cm diameter at breast height (dbh).

On exposed rock faces, blue tussock is common, with frequent *Lycopodiella varia* and *Dicranoloma robustum*, and occasional *Hebe albicans*.

In crevices and on ledges, kiwakiwa is common, with occasional hanging spleenwort (*Asplenium flaccidum*), *Notothlaspi australe* (14 plants) and *Myosotis brockiei* (9 plants).

Cardamine "magnesite' is common on the lower faces of the bluff and on rocks in the surrounding forest and the total population at this outcrop is at least 300 plants.

2.3.1.4 Manuka-mountain Beech Shrubland (0.1 ha)

Immediately to the west of the old quarry, natural shrubland covers a convex slope of exposed ultramafic bedrock. The canopy is 4-6 m tall, and comprises manuka and mountain beech, with kanuka up to 25 cm dbh. The shrub layer is dense in areas where soil has accumulated in rock crevices, with *Dracophyllum ophioliticum*, mountain toatoa, *Leptecophylla juniperinum,* weeping mapou, kaapuka, *Leucopogon fasciculatus, Hebe albicans*, *Coprosma microcarpa*, *Gahnia procera*, *Exocarpus bidwillii*, *Thelymitra longifolia*, and *Astelia nervosa* 'broad'. Mosses are abundant, including *Dicranoloma billiardierei*, *Dicranoloma robustum,* and *Racomitrium pruinosum*. The height of the scrub and abundance of mountain beech both increase with distance south-west from the quarry, eventually merging with surrounding forest as the ultramafic influence declines.

2.3.1.5 Vegetation in Old Quarry (0.3 ha)

Old Quarry Floor (0.2 ha)

The site where the rock outcrop was formerly quarried is now an open expanse of quarrying overburden with sparse vegetative cover. Finer sediments around the road way and car park are mostly bare, with smaller areas dominated by exotic herbs and grasses, particularly *Festuca rubra*, sweet vernal (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*), and *Plantago lanceolata*. Coarser deposits of rock fragments, sometimes in piles or forming a toe slope at the foot of the quarry face, have a sparse covering of *Colobanthus* aff. *wallii* and blue tussock with occasional *Hebe albicans*, manuka, *Dracophyllum ophioliticum*, and *Chionochloa defracta.* The quarry face itself is near vertical, and is largely devoid of vegetation.

Around the margins of the old quarry and at the lip of the overburden deposit, manuka forms patches of shrubland to 3 metres tall, with an understorey of kiwakiwa and turutu (*Dianella nigra*). *Korthalsella salicornioides* is present on older manuka that have started developing a more mature, rounded-crown form.

Existing Overburden Deposit (0.1 ha)

An overburden deposit of rock fragments forms an extensive area of scree to the north of the former quarry. Scattered shrubs of manuka, *Hebe albicans*, and kanuka have established on the overburden deposit, with occasional indigenous and exotic grasses, herbs, orchids and ferns. The indigenous species include blue tussock and *Colobanthus* aff. *wallii*, which are common, and occasional *Thelymitra longifolia*, *Microtis* sp., *Coprosma microcarpa, Chionochloa defracta*, toetoe (*Cortaderia richardii*), kaapuka, bracken (*Pteridium esculentum*), and *Coriaria sarmentosa*.

The exotic species centaury (*Centaurium erythraea*), browntop (*Agrostis capillaris*), wall lettuce (*Mycelis muralis*), and hawkbit (*Leontodon taraxicoides*) are also present. On the margins and tail of the overburden deposit, the vegetation is 2-6 m tall and dominated by kanuka, which is transitional to forest dominated by mountain beech. The regeneration of indigenous and exotic species on this overburden deposit illustrate how any future overburden deposits might be colonised.

2.3.1.6 Cobb Riverbed (2.1 ha)

The eastern boundary of the permit area is marked by the bed of the Cobb River. This section is permanently dewatered by water take for the Cobb dam hydropower station, except during floods, or deliberate releases from the dam during high inflows. The bed consists of large cobbles and boulders, with occasional small pools of water.

Vegetation within the riverbed is sparse, comprising scattered indigenous and exotic shrubs, grasses, and herbs. Buddleia (*Buddleja davidii*) and *Coriaria sarmentosa* are the most common woody species, with occasional broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), *Hebe albicans*, manuka, and *Olearia avicenniifolia*.

Ferns occur occasionally in shaded cracks between the boulders and on the river banks, including *Blechnum chambersii*, *B. vulcanicum*, *B. penna-marina*, kiwakiwa, and shield fern (*Polystichum vestitum*). Tall fescue (*Schedonorus phoenix*) is occasional, and a range of exotic herbs is present including ragwort (*Jacobaea vulgaris*), narrow-leaved plantain (*Plantago lanceolata*), wall lettuce, hawksbeard (*Crepis capillaris*), Mexican daisy (*Erigeron karvinskianus*), and oxeye daisy (*Leucanthemum vulgare*).

2.3.1.7 Existing Access Road (0.5 ha)

A rough gravelled road leads from the road-end near the north-western end of the Cobb Reservoir to the old quarry. The road is infrequently used and the sides are overgrown with a range of indigenous and exotic herbs and grasses. An indigenous grass (*Deyeuxia* sp.) is abundant, forming a low sward, with localized patches of Hell's bells (*Anaphalioides bellidioides*) and occasional browntop, sweet vernal, hawkbit (*Leontodon taraxacoides*), *Lagenifera pumila*, selfheal (*Prunella vulgaris*), *Linum catharticum*, and lotus (*Lotus pedunculatus*).

Seedlings and saplings of kanuka, silver beech, and mountain beech are common along road sides, with local *Hebe albicans.*

About six plants of the nationally-threatened tree species *Pittosporum dallii* are present on the edge of the access road (Simpson 2009). Several seepages pass under the road, via small culverts. These sites are characterized by a dense groundcover of mosses and liverworts, with frequent kiokio (*Blechnum novae-zelandiae*).

2.3.1.8 Landslides (0.1 ha)

Two landslides are present on a steep hillslope to the west of the Southern Outcrop. Most of the landslide surfaces are covered in mobile scree, with smaller areas of exposed bedrock on the upper faces.

Vegetation on the landslides is sparse, comprising scattered plants of indigenous herbs, orchids and ferns, and seedlings and saplings of trees present in the adjacent forest. Species present include manuka, kanuka, mountain toatoa, *Gaultheria antipoda*, *Chionochloa defracta*, *Gentianella* sp., kiokio, *Lycopodiella scabra*, *Adenochilus gracilis*, turutu, and *Colobanthus* aff. *wallii* "serpentine". On the margins of the landslide scars, saplings of manuka and kanuka coalesce to form shrubland.

2.3.2 Fauna

A study was conducted prior to the lodgement of this application to determine the number and extent of fauna within the SQP area. A detailed description of the fauna and their habitat on site is outlined in Buckingham, R. (2009) *Steatite Quarry Project, Terrestrial Ecosystems: Survey for Birds and Powelliphanta Snails, May 2009* in Volume 2 of this application. A summary of the fauna and their habitat is described below.

2.3.2.1 Avifauna

A total of 22 bird species, including 14 indigenous species were recorded during the survey. Of the indigenous species, four are listed as threatened. In order of threat concern, these species are South Island kaka ('Nationally Endangered'), western weka ('At Risk: Declining'), South Island rifleman ('At Risk: Declining') and kea ('At Risk: Naturally Uncommon'). Riflemen were the only threatened species not specifically recorded at the proposed quarry areas.

Kaka and kea were heard from this area while wekas were seen within the area. Typical feeding sign of kaka (damage to bark on a dead standing tree) was observed within the proposed quarry area. Yellow-crowned Kakariki that were formerly classified as a threatened species (Hitchmough *et al.* 2007) were relatively commonly recorded in the survey area during May 2009.

While the mean numbers of indigenous individual birds per count were high, the mean species counts were relatively low. Counts of bellbirds probably highly influenced the counts of indigenous individuals. The mean introduced individual bird and species counts were considerably lower than mean indigenous counts.

2.3.2.2 Nocturnal Birds

Relatively few species of birds were heard after sunset other than the dusk chorus of several diurnal species such as tui, bellbird, robin and blackbird. No kiwi were heard in 12 person-hour counts from two locations, and no kiwi were heard to respond to call playback after counts and along the road from the Cobb Dam to the old quarry on the night of 05th May 2009. Three threatened species were heard at night being South Island kaka, western weka and kea.

2.3.2.3 Powelliphanta Land Snails

Only three empty *Powelliphanta* shells were found within the survey area in approximately 25 person-hours of searching (approximately 19 hours intensively searching for snails). The shells varied considerably in colour and morphological sculpturing but were all presumed to be *Powelliphanta hochstetteri hochstetteri* (brown-based form) as the adult shells showed a distinct brown base, and these are the only *Powelliphanta* taxa known to be present in the general area (Walker 2003).

All shells were found in the search area near the Cobb River below the dam (both sides of the river). No sign of *Powelliphanta* was found at the proposed quarry sites (the closest shell c. 200m below the Old Quarry Outcrop) in approximately 12 hours of focused search. One of the three shells (the shell closest to the quarry) was found in ultramafic vegetation (transition to beech forest).

2.3.2.4 Other Fauna

No specific search was made for other fauna such as lizards and invertebrates (other than *Powelliphanta* snails), and the time of year was not considered appropriate for carrying out scientifically acceptable surveys for these fauna. Bat detectors were used at the old quarry site during the first night (2nd May 2009) but temperatures were very cold, and this could be the reason no bats were recorded. Temperatures became progressively colder during the week thus surveys for bats were discontinued.

Sign of introduced mammals was found throughout the area. Mammals recorded included hares seen near the Cobb Dam village, possums (droppings, calls heard at night, and browse sign), deer (footprints, faeces, and browse sign), and goats (droppings). Deer, possum, and goat sign was found within the proposed quarry areas. Both red deer and fallow deer are reported within the area but most of the sign found was considered likely to be made by red deer.

2.3.3 Habitat

Faunal habitats in the KNP range from lowland to subalpine forest, alpine grasslands and herbfields, lakes and mountain tarns and numerous rivers and streams. The large size and continuous forest areas of the Park support a wide range of fauna including over 30 species of indigenous birds, several species of lizards, and abundant species of invertebrates.

2.4 Water Bodies

A detailed description of the water bodies (including quality, flows and aquatic ecosystems) associated with the SQP is outlined in the following technical report in Volume 2:

- Patrick, M. (2010) *Steatite Limited – Cobb Quarry: Aquatic Ecosystems Assessment of Effects* (Aquatic Ecosystems Report).

Two small unnamed streams flow through the Mining Permit area, to the immediate north (which is in fact the boundary of the permit area) and south of the proposed Old Quarry Outcrop site (hereinafter denoted as Streams N and S) - these streams flow into the Cobb River approximately 1.2 km below the Cobb dam, although most times the southern stream is in fact dry.

2.4.1 Water Quantity

Stream N has a catchment area of 0.365 km^2 (36.5ha) and Stream S 0.047 km^2 (4.7 ha). On the basis of three visits to the area Stream N is considered to be a permanently flowing stream, while Stream S is ephemeral, flowing on only two of the three occasions. The gauging results are shown in Table 1 below.

Table 1: Gauging Results

Date	Time (NZST)	Stream N Flow (l/sec)	Stream S Flow (l/sec)
30/04/09	1130	6.8	2.0 est
02/09/09	1200	48.0	8.3
04/11/09	1004	4.9	0

Table 2: Low Flow Summary

Statistic	Stream N (l/sec)
Mean annual low flow (MALF)	3.4
5-year, 7-day low flow	3.3
10-year, 7-day low flow	3.2

Table 2 shows the Stream N low flow summary.

2.4.2 Water Quality

As with hydrology, some work was done in relation to the renewal of resource consents for the adjacent Cobb power scheme in the early 2000's, but nothing specifically on Stream N and Stream S.

The Cobb Dam forms a complete barrier to water flow downstream except "*... during spills, and other than minor leakage through and around the dam of around 2 L/s.*" (Young *et al*, 2000). As a consequence, the Cobb River below that dam is basically dry

for a considerable distance (previously reported as ~ 500-1000 m but has been reported as longer, and certainly variable), until the input from tributaries establish a permanent flow regime.

Kim & Hunter (1997) undertook an analysis of major ions and trace metals of the Cobb/Takaka River system, but with no sites between the Cobb Dam and power station. Overall, water quality was excellent, reflecting in the main differences in the complex geology of the two river catchments – for example, higher Zn, Cu and Cd, and lower Ca^{2+} concentrations in the upper Cobb catchment compared with the upper Takaka catchment. The authors noted that the concentrations of trace metals *"....fall within the range of concentrations found both within New Zealand and elsewhere..... within the concentration ranges observed globally for relatively uncontaminated river systems."*

Brown (1998) undertook monitoring for the basic water quality parameters in her work investigating the effects of the power scheme on stream macroinvertebrate fauna, and noted the following with regard to a site on the Cobb River immediately above its confluence with the discharge from the powerhouse into the Takaka River:

- This site demonstrated the highest water clarity and conductivity. Conductivity peaked in Autumn;
- There was no seasonal trend at this site or others for pH;
- This site, and others on the Cobb and Takaka Rivers above the powerhouse discharge showed far wider temperature fluctuations over the year compared with the discharge from the powerhouse and sites immediately downstream, caused by the more stable temperatures at the bottom on the Cobb reservoir from where water is taken for generation.

The most recent and comprehensive water quality work done in and around the Cobb River catchment was that undertaken by the Cawthron Institute in August 2000, as part of the assessment of environmental effects of the Cobb hydroelectric power scheme on the lower Cobb River and in particular the Takaka River below the power station discharge (Young et al., 2000). Only one site below the Cobb Dam (just above the power station, denoted "Remnant Cobb"), was sampled during these investigations. The water at this site was, for most water quality parameters, the best of all sites sampled, particularly in terms of clarity, turbidity and suspended solids, most nutrient species, and dissolved oxygen. It however had the highest levels on NO_3-N and the second highest specific conductivity measured of all sites sampled. Overall, water quality at this site was excellent.

The Tasman District Council's (TDC) regular state of environment surface water monitoring sites do not include a site on the Cobb River, but do on the Takaka but out of the area of interest for the purposes of this application.

Two sampling runs were undertaken for water quality in the two streams of interest, as well as the Cobb River immediately downstream of its confluence with Stream N.

Results show that water quality in Stream N is excellent, and would be suitable for water supply to the quarry, including for potable use but with some form of treatment to prevent microbiological contamination from *Giardia* and/or *Cryptosporidium* derived from animal faecal matter in the catchment.

Water in Stream S is of lower quality, mainly in terms of turbidity and Total Suspended Solids (TSS), but is still considered to be excellent.

2.4.3 Aquatic Fauna

2.4.3.1 Fish communities in the northern tributary

Existing information on fish distributions in the Takaka River catchment indicates that koaro, longfin eels, upland bullies, brown trout, and rainbow trout have been recorded in the catchment upstream of the confluence of the northern tributary and the Cobb River.

However, the electric-fishing survey of two sites in the northern tributary on 4 November 2009 did not record any fish species in the tributary.

The absence of fish from Stream N is not surprising given that most species recorded from the catchment are migratory and require access to and from the sea to complete their life-histories. For much of the time, the Cobb River between the dam and the power station discharge is reliant on tributary inflows to provide habitat and a pathway for migrating fish.

In addition, the steep gradient of Stream N would limit access to those species with good climbing ability such as longfin eels and koaro.

Furthermore, apart from the steep gradient, there are other features of the habitat in Stream N that render it unsuitable for some species of fish. Upland bullies, for example, are found in a wide variety of habitats including small streams but they prefer more gentle flow than Stream N provides.

2.4.3.2 Macroinvertebrate communities in the northern tributary

Single hand-net samples collected from the Stream N contained 33 (Site N1) and 23 (Site N2) different macroinvertebrate taxa. Although 14 – 32 taxa per site were recorded from the Cobb River, sampling effort was greater. The single hand-net samples collected by Cawthron contained an average of 16 taxa per site (range 7 (Site C4) – 26 (Site C2) taxa). Stream N, therefore, provides habitat for a greater variety of macroinvertebrate taxa than the Cobb River.

Overall, true flies (Diptera) dominated community composition at Site N1 (34.91%) with caddisflies (24.85%) and stoneflies (24.26%) also well-represented. At Site N2, caddisflies were dominant (22.96%) with mayflies (20.00%), true flies (16.30%), stoneflies (15.56%), and snails (13.33%) all contributing more than 10% to community composition.

2.5 Historic Heritage

The Cobb area is the only site in which magnesite has been mined in New Zealand. Magnesite has been mined from the Cobb Valley since 1943.

The main quarry near the Cobb dam (Lens 4) was opened in 1966 following a regional survey and drilling programme. Lime and Marble Ltd (now L&M Group Ltd) mined between 500 and 1000tpa from this quarry. The magnesite was mainly used as a fertiliser to correct magnesium deficiency, and was also used as filler and in pottery.

The most recent mining tenement over this deposit was Mining Licence 32 2407 held by Lime and Marble Ltd, which was granted on 30/7/86 for a term of 21 years. The licence was later sold to Mintech, who surrendered it on 25/1/94.

There are no structures that predate 1900 and hence there are no archaeological sites as defined by the Historic Places Act 1993.

The Tasman District Plan contains a Schedule of Historic Buildings and Sites. None of these are within the SQP area or indeed the MP area.

It is considered that the MP area including the SQP areas has very limited historic values.

2.6 Landscape and Natural Character

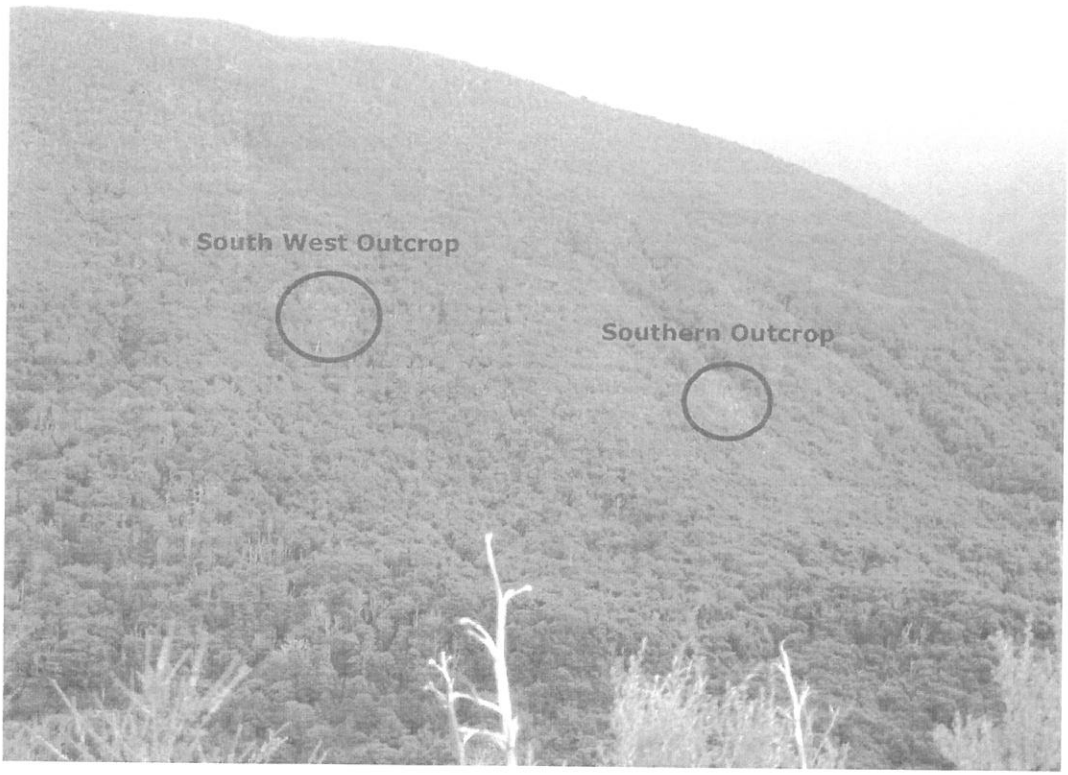
Several site visits of the area have been undertaken by Resource and Environmental Management Nelson Limited (REM). This has allowed an understanding of the topography, vegetation, outcrops, drainage systems and other features, to assess the quality of landscape and natural character, and whether this quality would be adversely affected by the SQP. Adverse effects are discussed in Section 6.7.

The TDC Plan does not classify the SQP area as an outstanding natural feature or landscape nor does it identify the area as being significant in terms of natural character. As discussed in Section 2.1.2, the site has been heavily modified from past quarrying. It is also modified by pest incursion, mainly mammals.

The natural character of the area surrounding the SQP has been significantly modified with regard to the Cobb Dam and Reservoir and associated roading and working camp housing etc. The amount of disturbance from development is even more pronounced when the lake is at low levels as the bare margin of the lake is a predominant exposed feature. The area has also been modified by other quarries and an aircraft runway.

The natural character of the SQP site is considered to range from moderately low (in already disturbed areas) to moderately high (in areas that have not had direct disturbance, but are nevertheless changed by presence of mammals). This is discussed further in the flora and fauna reports in Volume 2 of the application.

There is one main public view point with regard to the SQP. This is located above the Cobb Dam, at the DoC information shelter on the road into the Cobb Dam (at or about NZMS 260 M26: 841-113). Most other views to the SQP area are fettered by road alignment, vegetation and topography. Figure 1 shows the location of the SQP outcrops that are to be quarried over time from this view point.



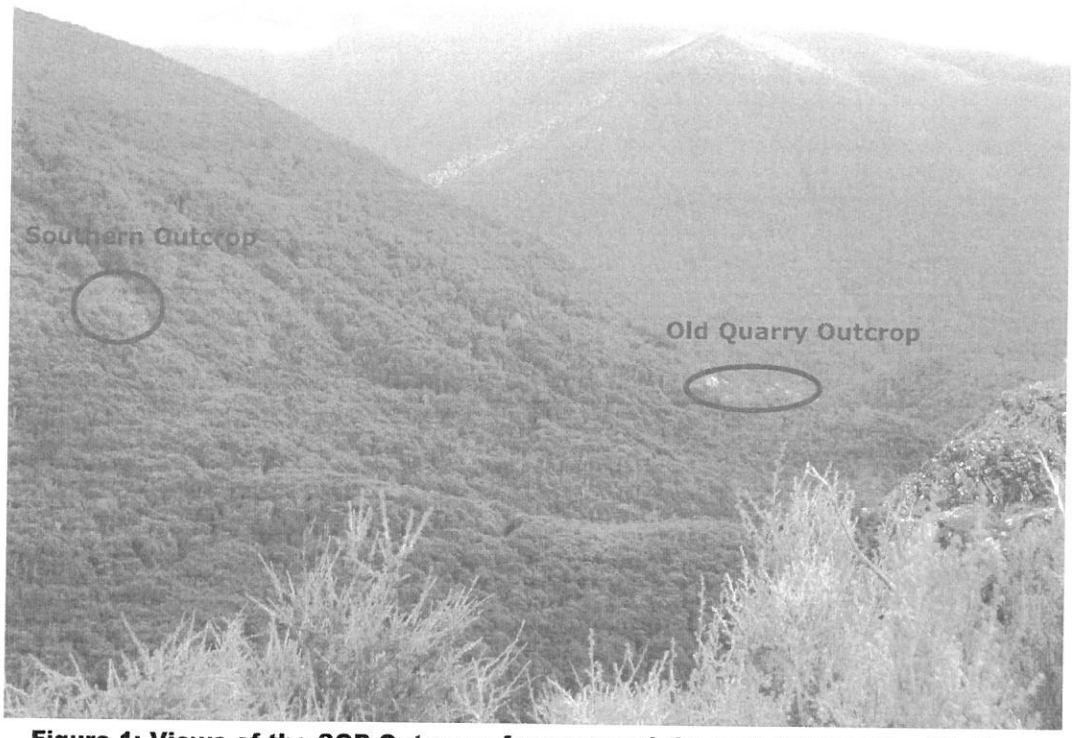


Figure 1: Views of the SQP Outcrops from around the DoC Information Shelter.

When viewed from the vicinity of the Information Shelter, all three of the outcrops are visible and sections of the access road as well as exposed land in the Old Quarry are visible. Dominant features in terms of landscape are the mountain ranges, extensive vegetation, the Cobb Reservoir and Dam and roading.

The existing development discussed above with regard to natural character; combined with natural slips have changed the landscape and exposed earth is a common feature. Other rock outcrops outside the SQP are also noticeable.

Each outcrop in the SQP is small when compared to the overall vista of the mountains and associated vegetation within which they are set, including the Lockett Range. The existing road is not as apparent as the other roads surrounding the lakes, as it is hidden by the trees on site.

The Old Quarry Outcrop is located on a ridgeline, but this is set against the Lockett Range backdrop. The proposed road and Southern and South-West Outcrop are set well below the ridgeline and amongst the beech forest.

2.7 Recreation and Amenity Values

There are numerous tracks starting from the Cobb Valley, including tracks leading to and from the Asbestos Cottage and along the ridges above the Cobb Reservoir. There is a car park which services the Sylvester Huts located adjacent to the road into the SQP site. The public that use this car park will share road access with STL up to the car park.

Limestone and marble karst areas, containing extensive cave systems, attract a high level of interest from spelaeologists and cavers from throughout the world and local caving groups are also active. The cave systems of Mt Arthur and Mt Owen are of particular interest to cavers because of their length and depth. The Nettlebed cave

system under Mt Arthur has at least 24km of passages and is New Zealand's deepest known cave at 889m.

The vast network of waterways in the KNP attracts an increasing number of kayakers from around the country, as well as international visitors.

Backcountry and wilderness fishing in the Park is both highly valued and popular, with a significant proportion of fishers coming from outside the region or from overseas. Brown trout occur in many of the Park's major rivers. Rainbow trout occur in the Cobb Reservoir and upper Cobb River.

However, the Cobb River which the SQP will drain into has limited surface water recreation values (kayaking, fishing, etc) as it has been dammed by the Cobb Power Project. At the time of the site visit there was no water flowing out of the Cobb Reservoir and into the Cobb River.

Recreational hunting is popular in the Cobb area and hunters play a significant role in the control of animal pests, particularly deer and pigs. Fallow deer hunting occurs in the Cobb Valley and Mt Arthur Tablelands, which was previously managed as a Recreational Hunting Area in the former Forest Park.

The main recreational activity carried out in the MP area is four-wheel driving within the Old Quarry and immediate surrounds including the proposed accommodation block. Overall, it is considered that the recreational values associated with the SQP are low due to its remote location, and lack of facilities. It is not a popular recreational destination and a significant number of alternative recreational venues exist in the KNP and surrounding areas.

2.8 Cultural Values

STL and REM visited the site with Chris Hemi the Resource Management representative for the Executive Committee of Manawhenua Ki Mohua on 12 March 2010 to discuss the project and potential issues that needed to be addressed. The issues discussed were noise, water management and flora and fauna values. Also, Chris was keen on predator control tying in with current controls on site (stoats). Each of these matters is discussed in detail in Section 6 of the application.

2.9 Existing Infrastructure

Apart from the road to the quarry area there is no infrastructure present within the SQP or in the immediate surrounds within the MP area.

2.9.1 Cobb Power Scheme

The most notable infrastructure and land use activity in the Cobb Valley is the Cobb Power scheme which was completed in 1955. It was the first New Zealand dam to incorporate instruments for measurement of internal water pressures. It was also the first hydro dam to be built using modern soil control methods and is also the highest hydro water storage in New Zealand with the lake at 808 metres above sea level.

There is a transmission line to service the Cobb Dam and surrounding residences but this stops at the Cobb Dam approximately 1km east of the quarry site. There is also a gravel quarry and airstrip located to the east of the SQP area.

2.10 Air Quality

Currently, there are minimal activities near the site that would influence air quality. Dust from traffic movements and the occasional fire from the old workers houses are the main discharges in the area. Due to the lack of activities within the SQP area, there are currently no discharges to air in the SQP area.

3 Proposal Description

STL seeks authorisation to operate a 15,000 tonne per annum quarry for 38 years, which matches the term of the mining permit.

Quarrying is likely to be seasonal as the area experiences heavy snow falls and icy conditions in the winter. To cater for seasonality in production, a stockpile area may be provided off site on private land in Upper Takaka. However, this is outside the scope of this application.

The sections outlined below describe various facets of the SQP and include:

- Quarry overview;
- Rehabilitation Bunds;
- Proposed quarrying method;
- Access;
- Services;
- Amenities;
- Water take;
- Discharges; and
- Waste Processing.

3.1 Quarry Overview

The SQP comprises three quarries based around three outcrops shown in the project overview plan in Appendix 2 and the more detailed quarry plans in Appendix 3. The quarries include:

- Old Quarry Outcrop. The total disturbed area including the flora rehabilitation bund is 1.61 Ha;
- Southern Outcrop. The total disturbed area including the flora rehabilitation bunds is 1.75 Ha; and
- South-West Outcrop. The total disturbed area including the flora rehabilitation bunds is 1.82 Ha.

The quarrying will progress slowly over 38 years across all areas at the same time. Hence, the annual average quarrying disturbance will be about 0.13Ha. This will vary from year to year depending on market demand and site requirements (such as benching, rehabilitation etc).

The three outcrops are located at between 845m-880m a.s.l. (Old Quarry Outcrop); between 912m-942m a.s.l. (Southern Outcrop); and between 960m-1026m a.s.l. (South-West Outcrop).

New access roads will be constructed to the Southern and South-West Outcrops. Access to talc-magnesite rock in the Old Quarry Outcrop is readily available via existing roads but later in the quarry life access to the west from the south will be required to accommodate leaving critical Flora areas intact. More detail with respect to roads is provided below.

A key feature in the design of each of the proposed quarries is the construction of a rehabilitation bund around the perimeter of each quarry. These bunds are described in more detail below.

The total disturbed area will be 5.9 hectares including the flora rehabilitation bunds around the perimeter of each quarry, infrastructure areas and the road to the Southern and South-West Outcrop and Old Quarry Outcrop.

3.2 Rehabilitation Bunds

It is proposed that any overburden and rock unsuitable for sale will be stored in Flora Rehabilitation Bunds surrounding the quarry. These bund areas are proposed to be between 5m and 15m wide, and are expected to have a maximum height of 5m.

These bunds will achieve two primary goals:

i) Minimising the area of disturbance by providing overburden storage areas close to the quarry;

ii) Providing a stable platform for rehabilitation (including direct transfer) of flora in the immediate vicinity of the current location of the flora, hence minimising environmental change for these flora species.

Construction of the bunds will commence at the farthest point around the perimeter of the quarry in the Plans shown in Appendix 2. This will ensure that machinery used to construct the bunds does not need to re-travel over the bund at a later stage.

The bunds will be constructed to ensure stability during seismic events. Given that there is very little soil or clay overburden, and the expected "broken bouldery" nature of reject rock, stability of bunds and dumps is not thought to be of concern as the rock will interlock to form a stable rock mass.

Where bunds are placed uphill from the pits (e.g. Southern Outcrop) they will also assist with prevention of water entering the quarry area.

A narrow flat area will be provided on the crest of the bunds where practicable to provide access for flora rehabilitation monitoring.

3.3 Proposed Quarrying Method

Quarrying will be via surface bench mining. Rock will usually be cut from the quarry area by drilling and with rock cutting equipment, forming blocks that are approximately 3 cubic metres in volume, and weighing approximately 10 tonnes each. Hence, approximately 1,666 blocks will be cut per annum. Blocks will be loaded on to flat deck trucks via an excavator and removed from the quarry.

Hence, the quarrying equipment will primarily comprise:

- A drill;
- Wire saw;
- General purpose excavator;
- Flat deck truck.

The SQP will be carried out as follows:

- Construction of water management structures;
- Removal of vegetation;
- Stripping of topsoil;
- Stripping of overburden and creation of rehabilitation bunds (including landscaping for direct transfer);
- Winning of Steatite;
- Rehabilitation of final landforms (including pits, rehabilitation bunds, topsoil and vegetation replacement).

The final pit designs will be considered in consultation with the Department of Conservation and Council, but they will be free draining voids that will maximise opportunities for recolonisation by species disturbed by the quarrying.

A Diamond Wire Saw is the preferred rock cutting equipment (refer Figure 2 and 3).

The Diamond Wire Saw consists of a continuous strand of steel wire cable fitted with diamond impregnated beads. Holes are firstly drilled along the edges of the face to be cut, and the cable is threaded through the holes to form a loop.

The loop is then driven by an electric motor under tension. As the tension is increased and maintained, the wire passes around the rock, eventually cutting through the entire block. Wire Saws can perform both vertical and horizontal cuts.

Figure 2 below illustrates the Wire Saw cutting through rock, and Figure 3 illustrates the arrangement cutting a block of stone in a quarry situation.

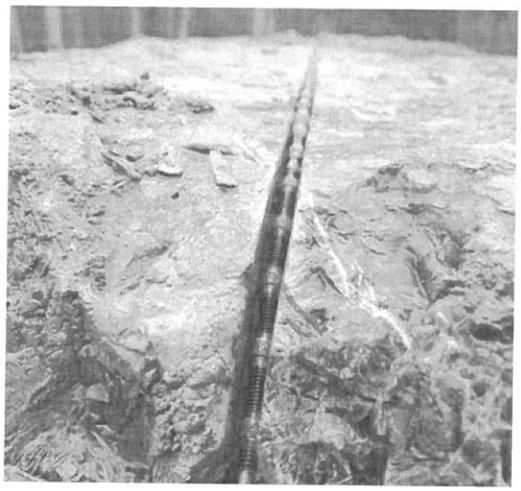


Figure 2: Diamond Wire Saw Cutting Rock

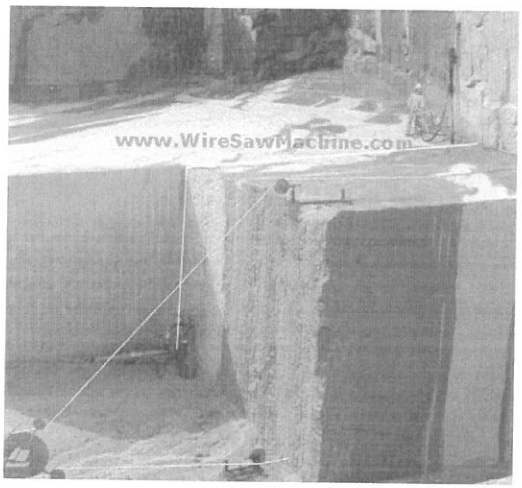


Figure 3: Diamond Wire Saw cutting a block of stone in a quarry

At times a rock saw (circular saw) may need to be mounted on the arm of an excavator. This will primarily be used to facilitate cutting whole rocks from the quarry face for direct transfer of flora, but could be utilised from time to time for other reasons (e.g. to safely remove certain areas of rock). Therefore, flexibility is required with respect to cutting method.

Use of a Diamond Wire Saw as the main extraction method will produce less waste than other methods. It is relatively quiet (you can hold a conversation within 5 metres of the saw) and will produce only small amounts of dust that can be easily managed. Generally the Diamond Wire Saw has a higher efficiency than the alternative Rock Saw method.

A Diamond Wire Saw is less versatile in certain situations than other methods and will require a planned and methodical approach to quarry development. In addition to being beneficial to the quarrying operation, this methodical approach to quarrying will also enable flora rehabilitation to be undertaken in a well-planned manner.

Either cutting method will require cutting water on site which will minimise dust issues.

3.4 Access

It is anticipated that only light vehicles and road trucks of a size and type permitted on public roads without any special dispensation, will operate outside of the MP area.

Truck movements will vary seasonally and with market demand. An annual production rate of 1,666 blocks will result in about 32 truck movements per week. Quarrying and truck movements are unlikely to occur over the winter months for reasons outlined above.

Access to talc-magnesite rock in the Quarry Outcrop is readily available via existing roads but later in the quarry life access to the west side of the pit from the south will be required to leave critical Flora areas intact.

Access to the Southern Outcrop and South-West Outcrop will require development of a new road. This road will need to be approximately 200m long to reach the Southern Outcrop (0.16Ha disturbance), and a further 450m to reach the South-West Outcrop (0.41Ha disturbance). The later road to the Old Quarry Outcrop will disturb about 0.14Ha.

Depending on exactly where the roads are developed (to meet DoC requirements with regard to specific trees etc.); a gradient up to 1:5 may be required. An indicative access road is shown in Appendix 2. Nominal width of the road is 8m with gradient between 1:7 and 1:10.

The Southern and South-West Quarry road will require vegetation clearance, earthworks, gravelling and surface water control structures including drains and culverts. A full road survey from the existing quarry floor to these outcrops will be undertaken during detailed design to confirm engineering works.

The Cobb Dam road is sealed until the powerhouse; the remaining road up until the Cobb Dam is gravel. It is considered suitable for the proposed operation without any significant upgrade as the road is currently used by another contractor to cart gravel from a different site (Solly's) which uses the same vehicle size as proposed in the SQP.

The access road from the Cobb Dam to the quarry site is gravel and is also considered suitable for the proposed operation (as the road was initially designed to service the Old Quarry). However, the road will need to be upgraded as it has not been maintained for a considerable period of time. This will primarily focus on improving the running surface. Some shoulder work will be required to provide for efficient drainage and vehicle safety.

Pittosporum dallii (Threatened – Nationally Vulnerable) has been reported previously as being present in the Cobb riverbed and beside the access road. The road upgrade will not disturb these plants as they are outside the carriage zone and road widening is not required in the areas where they have been found.

The environmental effects and proposed mitigation measures associated with this road are discussed in Chapter 5 and in each of the technical reports in Volume 2 as applicable.

3.5 Services

Power and telecommunication services are not needed at the site. Any power requirements that may be needed (for example for water management pumps) will be provided by generator.

3.6 Amenities

The infrastructure requirements for the SQP include approximately 3 well-insulated containers to provide a site office, sleeping quarters, a kitchen with dining and living and a shower/washroom. These will be transportable containers which require minimal earthworks. A gravel pad will be constructed for these containers and will include car parking space. Port-a-loos will also be on site.

3.7 Water Takes and Weir

It is proposed to take approximately 3 l/s from Stream N to use for potable water and cooling etc. The potable water will be treated to prevent contamination from *Giardia* and/or *Cryptosporidium* derived from animal faecal matter in the catchment.

The SQP will have a small water storage tank or pond which will provide for a residual flow of at least 1 l/s for Stream N.

Once quarrying operations are underway, it is proposed to install a small concrete weir structure in the upper part of the catchment of Stream N to provide electricity on site. This small amount of electricity that will be generated from Stream N will be used for charging batteries etc.

3.8 Discharges

There are two types of discharge associated with the SQP which are listed below and are dealt with separately:

- Grey Water; and
- Quarry Pit Water.

All grey water will be discharge to land which will be "polished" by natural vegetation cover prior to entering any tributaries.

Where practicable, any water that ponds within the quarry pit will be pumped out and discharged into Stream S. It is anticipated that approximately 3 l/s will be discharged. The discharge will be via a settling pond system to provide for treatment prior to discharging into Stream S.

However the pit floor may be fractured at different depths as quarrying progresses and any rainfall into the pit floor and side walls will, in these circumstances, discharge to land (underground). In addition there will be some general working area runoff, and run-off of water from rehabilitation bunds and roads to land in a way that may enter water.

3.9 Waste Processing

Domestic and industrial waste will be stored in "skip" bins on site and removed by a contractor for appropriate disposal off-site. Organic waste will be stored in sealed containers to reduce the potential for scavenging and contamination by rodents or other wildlife.

Effluent will be stored within the port-a-loos and will be removed by a contractor when required.

Waste fuels and oils will be placed in appropriate containers, sealed and stored in a concrete floored area, bunded with an appropriate sump. Waste containers will be removed from site by a licensed contractor for off-site disposal.

A fuelling bay will be established which will also be appropriately protected to reduce the potential for uncontrolled spillage.

6 Assessment of Environmental Effects

The assessment of environmental effects outlined in this section addresses a number of matters including the following:

- Positive effects;
- Terrestrial ecosystems (flora and fauna);
- Water quality;
- Water quantity;
- Aquatic flora and fauna;
- Natural hazards (subsidence);
- Landscape and natural character;
- Recreational values;
- Cultural values;
- Historic Heritage;
- Amenity values (visual, noise, vibration, lighting);
- Soil;
- Air quality;
- Hazardous substances and waste management;
- Fire Management; and
- Plant and animals pests.

A detailed Assessment of Environmental Effects and associated Mitigation Measures with respect to flora, fauna, water quality, water quantity and aquatic flora and fauna is outlined in the technical reports contained in Volume 2 of this application. The assessment below includes a summary of the findings in each of the technical reports.

6.1 Positive Effects

There are a number of social, cultural, economic and environmental benefits associated with the project as outlined in this section. These benefits include:

- Efficient energy use and reduction of carbon footprint;
- Enhancement of flora and fauna values and natural character;
- Increased knowledge of magnesite dwelling flora and rehabilitation techniques; and
- Growth driver for the local economy.

6.1.1 Efficient Energy Use and Reduction of Carbon Footprint

One of the proposed uses of Steatite would be creating wood fire burners. Steatite is an extremely efficient rock with solid soapstone being able to radiate heat for 3 to 6 hours after the fire has gone out. Steatite can also be incorporated into other heating devices such as gas burners and electric store heaters.

This allows the users of a steatite heating device to use less fuel to generate the same amount of heat (radiant) from the device. Subsequently, the users of a steatite heating device would lower their carbon footprint as their heating requirements would be met with less fuel.

6.1.2 Enhancement of Flora and Fauna Values and Natural Character

6.1.2.1 Pest Plant Control

Pest plants have become established throughout the area, including the dried up Cobb River bed, the existing access road and the old quarry. STL will eradicate pest plants within the existing access road, and the old quarry, and the section of Cobb Riverbed that adjoins the Mining Permit area as part of the project. This will enhance the natural character of these sites.

6.1.2.2 Mammal Pest Control

The flora and fauna surveys conducted as part of this AEE shows that introduced mammals are affecting the natural character of the area. Animals such as deer, goats and possums affect the vegetation through browsing and trampling (and this is likely to extend to rare plants), whilst pig rooting turns up the ground which affects ground cover plants, plant roots and soil structure. Carnivores such as rats and stoats prey on native fauna (primarily birds).

STL considers that onsite mammal pest control within the Mining Permit area is an effective mitigation measure that will enhance flora and fauna values as well as natural character.

The extent of mammal pest control will be discussed with Council through the process of determining this application. It will be coordinated with existing efforts by Friends of the Cobb to control stoats on the site.

6.1.3 Increased Knowledge of Flora Associated with Magnesite Outcrops and Rehabilitation Techniques

STL undertook a flora survey of the magnesite lens to the north of the Old Quarry Outcrop on the opposite bank of the Cobb River. This survey revealed a number of plants associated with the Old Quarry Outcrop. There as a substantial number of magnesite lens in the Cobb area (refer Appendix 3), which outcrop in several areas.

As a part of the SQP, STL would continue to explore these other magnesite outcrops which will increase the knowledge of magnesite dwelling flora.

Also, STL will undertake rehabilitation trials as part of the SQP. This will enhance the knowledge of rehabilitation techniques in regards to flora associated with magnesite outcrops.

Any further magnesite surveys and rehabilitation trials will be undertaken in consultation with the Department of Conservation and Council as required.

6.1.4 Growth Driver for the Local Economy

The SQP will be a growth driver for the local economy which will provide social, cultural and economic benefits to the local, district and regional economy. These benefits will be most noticeable within the local area, and the district. The discussion below focuses on the local communities.

The proposal will generate employment opportunities for the local community during the quarrying, transportation, processing (off site) and rehabilitation phase. The commercial and industrial sector will benefit from supplying infrastructure, plant and equipment needed.

The SQP will provide a boost to the retail and service sector, as the demand for such items as food, clothing, accommodation, transportation, and entertainment increases.

The extra income generated from employment and within the commercial, industrial, retail and service sectors will have flow on effects to the economy due to the multiplier effect associated with increased income and expenditure.

Workers employed on the quarry site will gain new skills and experience which they will be able to utilise elsewhere or when the quarrying ceases.

The stability of the local economy will be improved with an increase in the diversity of local industry. Hence, the local economy and society will be better able to withstand shocks associated with cyclical downturns in any particular economic sector.

6.2 Terrestrial Ecosystems (Flora and Fauna)

6.2.1 Vegetation and Flora

6.2.1.1 Potential Effects

Loss of vegetation and habitat types within the footprint of the quarries

Shrubland on Ultramafic Rock Outcrops

The proposed quarry operations will remove most of the three ultramafic rock outcrops within the mining permit area. This will result in the loss of 1.0 ha (91%) of the 1.1 ha of known rock outcrop vegetation remaining within the mining permit area. Additionally, approximately 0.03 ha (30%) of the 0.1 ha of manuka-mountain beech shrubland within the permit area will be removed to create a working area by the old quarry. This shrubland forms a sparse canopy over an area of exposed ultramafic bedrock.

Mountain Beech-Kanuka Forest on Base of Outcrops

Mountain beech-kanuka forest within the mining permit area is restricted to the bases of the outcrops, where it occurs partly within the proposed quarry footprint. Neither mountain beech or kanuka are threatened species, but mountain beech-kanuka forest on ultramafic rocks is an uncommon ecological unit.

Kanuka is usually associated with areas that have been modified by human activity or other disturbance, as kanuka is an early-successional species that establishes following forest disturbance.

Forest around the base of the outcrops is likely to remain as mountain beech-kanuka forest, in perpetuity, as shallow, mineral-rich soils induce an open canopy that allows for continuous regeneration of light-demanding species. The growth of kanuka at a site that fails to develop into other vegetation types, also means that the kanuka die of old age, rather than as a result of eventual overtopping by shade- tolerant species.

Mountain Beech Forest

Mountain beech forest covers approximately 4.8 ha of the 6.3 ha within the proposed footprint of the quarries. Mountain beech forest is one of the most extensive vegetation types in the Cobb Valley, and within the mining permit area, covering approximately 50 ha.

The approximate centre line of the road was walked from the existing road to the southern outcrop. No 'Threatened' or 'At Risk' plant species were seen along the route within the likely footprint of this road.

However, the annual work plan should specify that prior to construction, the footprint of the quarries and new roading should be marked, using flagging tape, and the area should be carefully rechecked for threatened species. The species of potential concern is red mistletoe (*Peraxilla tetrapetala*) on mountain beech. The survey should be undertaken in December or January, when flowering markedly increases the visibility of red mistletoe species.

Loss of 'Threatened' or 'At Risk' plant species within the footprint of the proposed works

The mining permit area is habitat for one plant species classified as 'Threatened', eleven plant species that are classified as 'At Risk', and one species that is under review and likely to be classified as 'At Risk' (de Lange *et al.* 2009).

Potential adverse effects on these species are largely determined by the specificity of their habitat requirements (for example, whether they are restricted to rock outcrops or if they also occur in forest, areas previously quarried, or riverbed habitats), whether they are present or absent within the 0.1 ha of the quarry outcrop that is to be retained, and whether they are present elsewhere in Kahurangi National Park (or at other locations).

Assessment of effects on a habitat basis

During the survey for this proposal, four 'At Risk' plant species were only found on the rock outcrops within the mining permit area:

- *Carex devia;*
- *Myosotis brockiei;*
- *Notothlaspi austral;* and
- *Uncinia viridis*.

These species have very specific habitat requirements, growing on ledges on the ultramafic rocks, and are the species most at risk if quarrying is permitted.

Korthalsella salicornioides (At Risk) was found on manuka on rock outcrops and on the margins of the formerly quarried area. Removal of the Old Quarry Outcrop and the Southern Outcrop will result in the loss of the largest known populations of this species within the mining permit area.

Four 'At Risk' plant species were found in a range of habitats within the mining permit area, including sites that were formerly quarried: *Chionochloa defracta*, *Colobanthus* aff. *wallii* "serpentine", *Dracophyllum ophioliticum*, and *Hebe albicans*. These species have naturally recolonised quarried surfaces, and if quarrying was staged to allow for progressive recolonisation, these species would be unlikely to be lost from the site.

One 'At Risk' plant species and one species under review were found within forest in the mining permit area: *Peraxilla tetrapetala* and *Cardamine* 'magnesite'. Forest habitat not affected by quarrying operations or the construction of the access road are likely to retain viable populations of these species if quarrying is permitted.

One 'At Risk' species, *Nematocerus* aff. *trilobus* "Rimutaka", was found in manuka scrub. Scrub areas not affected by quarrying operations or the construction of the access road are likely to retain viable populations of this species.

Pittosporum dallii (Threatened – Nationally Vulnerable) has been reported previously as being present in the Cobb riverbed and beside the access road. The population of this species could potentially be adversely affected by inadvertent road upgrading activities that stray from the current road formation, despite no road widening being planned.

Effects of Quarrying and Benefits of Retaining a Non-quarried Area

Of the four species restricted to the rock outcrops, the South-west Outcrop supports populations of two species, the Southern outcrop supports populations of three species, and the Old Quarry Outcrop supports all four species.

The Old Quarry Outcrop also supports the largest populations at the site for each of these four species (Figure. 4a). Within the mining permit area, the part of the Old Quarry Outcrop that is to be retained provides habitat for 118 (62%) of the 190 known plants of *Myosotis brockiei*, 18 (44%) of the known plants of *Notothlaspi australe*, one (6%) of the known plants of *Carex devia*, and 16 (89%) of the known plants of *Uncinia viridis* (Figure 4b).

With the protection of 1.0 ha of the south-western edge of the quarry outcrop, but without site rehabilitation within quarried areas (i.e worst case), the proposed quarrying operations would probably result in the loss of *Carex devia* from the site.

Uncinia viridis and *Notothlaspi australe* have small populations at the site and are vulnerable to demographic effects, which could be exacerbated by quarry operation, particularly for *Notothlaspi australe* which has just under half of its total population in the 'no quarry zone'. Due to its larger population size, *Myosotis brockiei* is likely to persist at the site, albeit within a much reduced area of potential habitat.

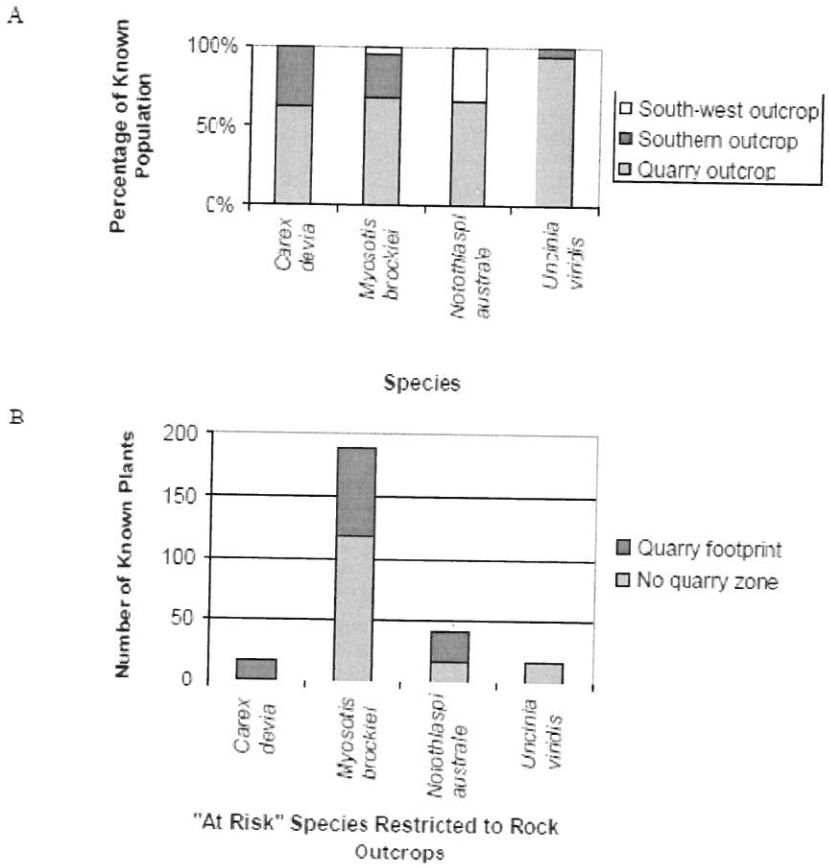


Figure 4 -

Distribution of rock outcrop species found in the Steatite mining permit area, Cobb Valley. (A) distribution of each population across the three outcrops. (B) number of plants within and outside quarrying areas.

Assessment of Effects in Relation to Protected Populations in the Wider Area

Several outcrops of ultramafic rocks occur to the north and south of the mining permit area, within Kahurangi National Park. These outcrops have previously been surveyed by the Department of Conservation (Moore 2001) and the outcrop *c.* 600 m to the north of the old quarry outcrop was surveyed in December 2009 by Gion Deplazes from Steatite Ltd, (only ultramafic outcrops within the mining permit area were surveyed by Wildlands Consultants Ltd in 2009).

During the December 2009 Steatite Ltd survey of the outcrop *c.* 600 m to the north of the old quarry, photographs were obtained of six 'At Risk' species, and the identity of these species was confirmed by a Wildland Consultants Ltd botanist.

The outcrop provides habitat for *Carex devia*, *Colobanthus* aff. *wallii* "serpentine", *Dracophyllum ophioliticum, Korthasella salicornioides*, and *Notothlaspi australe*. The sizes of the populations on this outcrop are unknown. However the presence of these species indicates that this outcrop does provide good ultramafic habitat.

The Department of Conservation survey of ultramafic vegetation in the Cobb and Takaka River valleys in 2000 (Moore 2001) found that the outcrops within the mining permit area are part of a larger chain of outcrops within Kahurangi National Park that support ultramafic vegetation.

Of the species that are restricted to outcrops and classified as being 'At Risk', large populations of *Carex devia* are present within Kahurangi National Park. Information on the remaining three species – *Myosotis brockiei*, *Notothlaspi australe*, and *Uncinia viridis* is relatively deficient.

Myosotis brockiei is also present in the area of *Chionochloa defracta* tussockland *c.*1.6 km to the north of the old quarry, and near Asbestos Hut, with each of these populations being described as "a couple of patches/clumps" (Moore 2001). *Notothlaspi australe* was only recorded as being present on the same outcrop that was surveyed by Steatite Ltd, and *Uncinia viridis* was not found during the Department of Conservation survey (Moore 2001).

Summary

For most, if not all, of the four species restricted to rock outcrops, the populations within the mining permit area are probably part of a larger metapopulation.

However further survey is required to determine the size and significance of these populations within the context of the Cobb-Takaka Valley ultramafic belt. Current knowledge suggests it is possible that the mining permit area contains the largest populations of *Myosotis brockiei*, *Uncinia viridis*, and *Notothlaspi australe* within the Cobb-Takaka Valley ultramafic belt. Effects on populations of these species within the permit area have; therefore, been given particular consideration in the mitigation measures including rehabilitation measures.

Edge effects on forest adjacent to quarry activities

Vegetation clearance often causes increased exposure to light and wind for the areas of vegetation retained. These edge effects, which are most significant in forested environments, can cause further loss of vegetation due to wind exposure, changes in vegetation composition, and increased invasion by pest plant and animal species.

Trees on the edge of the road that were previously sheltered by the trees to be removed will be exposed to wind. Some further toppling of trees on the edge is likely, especially of trees that lose parts of their root systems due to earthworks.

The forest understorey alongside the newly created road will be subject to increased light and wind exposure. The likely result of this environmental change is an increase in the density of the understorey, through increased regeneration of light-demanding, and exposure-tolerant species.

Increased invasion by plant and animal pests

The creation of new forest edges, and construction of gravelled access ways, can also increase invasion by both pest plants and animals. The edges of the road, and the forest edge where light levels are elevated, will provide potential habitat for light-demanding weed species that are currently excluded by the forest canopy.

The movement of machinery and roading substrates to the site can also provide a potential vector for invasive species that are presently absent. The movement of some pest animal species, such as mustelids (stoats, ferrets, weasels), feral cats, and possums, is facilitated by the presence of roads, and these species may become more frequent within the site.

6.2.1.2 Mitigation Measures

The following mitigation measures are available for the SQP area with regard to the actual or potential effects on vegetation and flora. They will be discussed with Council as part of consideration of the application. Rehabilitation is discussed in more detail in Section 7.

- Rehabilitation of ultramafic vegetation, including:

- Cultivation of at risk plants to establish self-sustaining populations of at least the equivalent number of plants as to be removed. The key species for which this mitigation should be undertaken are the four species that are classified as 'At Risk', and which, within the permit area, only occur on rock outcrops: *Carex devia*, *Uncinia viridis*, *Myosotis brockiei*, and *Notothlaspi australe*.;
- Creation of new areas of ultramafic rock and soils to ensure there is no net loss of ultramafic habitat within the permit area. This will be achieved by creating rehabilitation bunds around the perimeter of each quarry;
- Following the cessation of quarrying, ultramafic vegetation will be rehabilitated within each of the three quarries;

- When the quarrying operation ceases, mountain beech forest will need to be restored to disturbed areas that are not on ultramafic habitat (e.g. the access track);
- Monitoring of rehabilitation activities, e.g. to assess whether planted ultramafic species naturally colonise the surrounding rehabilitation landforms. This has not been undertaken for these species before, so nursery stocks of each plant species should be propagated and maintained to ensure that additional plantings can be undertaken if required;
- Biosecurity measures and control of pest plants within the site; and
- Control of pest animals. This could include extending the network of trapping that is currently undertaken by Friends of the Cobb.

6.2.2 Fauna

A detailed assessment of effects on the SQP on fauna and their habitat, including mitigation measures, is outlined in the following technical report in Volume 2:

- Buckingham, R. (2010) *Steatite Quarry Project, Terrestrial Ecosystems: Survey and Assessment of Environmental Effects for Birds, Powelliphanta snails and Bats, May and December 2009* in Volume 2 of this application.

The following is a summary of the detailed assessment of effects.

6.2.2.1 Potential Effects

Avifauna:

The proposed quarry site is located in a relatively rich area for birds that includes at least four threatened species. However, no bird species were found to be exclusively occupying, or focused in distribution, at the proposed quarries or other outcrops of ultramafic rock in the area. One threatened species, the rifleman, appeared to prefer taller beech forest outside the outcrop areas.

The relatively high densities of birds in the area may be related to the high diversity of plant species and associated rich food source provided by the combination of ultramafic and non-ultramafic habitats. Thus the removal or modification of ultramafic vegetation may affect avifauna over time by reducing the availability of some food species. However, it is anticipated that ultramafic vegetation that is disturbed can be rehabilitated (refer Flora report Volume 2).

Loss of habitat may also cause direct death (e.g. nesting birds) or stress due to birds having to find alternative territories and habitats. Displaced birds may have to compete with neighbours for territories, or nearby habitats may not be as suitable.

These effects may be largely negligible though given the small size of the proposed quarry footprints, and the staged method of removing rock (i.e. relatively small amounts of rock and habitat removed over time with ongoing rehabilitation on disturbed areas).

Removal of large-diameter trees (living or dead-standing) and specific food trees such as podocarps or rata may affect birds such as kaka, kea and kakariki that favour them (O'Donnell & Dilks 1987). Such trees are also important for hole-nesting birds such as

kaka, kakariki and rifleman. Generally, these larger trees are found around the periphery of the magnesite outcrop areas (which won't be disturbed), but they may also be common in beech forest elsewhere in the area. Thus the proposed quarrying should have minimal impact on these trees.

Despite these adverse effects, the footprint size and representativeness of the area proposed to be developed need to be considered. Removal of vegetation in a proposed area of c. 6.6 ha within a very large contiguous forest area containing several other isolated ultramafic outcrops is very unlikely to cause any noticeable difference to overall bird numbers and diversities including those of threatened birds. The results of a relatively wide coverage on the current survey found no indication that birds in general, or even specific species other than perhaps silvereyes and bellbirds seasonally, were particularly concentrated at the proposed quarries.

Other potential effects on birds are from noise, dust and artificial light. Birds are known to habituate to noise and artificial light disturbances, and these effects tend to be very local. Nonetheless, these effects are likely to be greatest during breeding seasons when birds are especially vulnerable to disturbance. To some extent these forms of disturbance are already present in the area given the road access to hunters, trampers and other recreational users.

STL propose to use methods of processing rock that result in minimal production of dust. Dust may affect bird habitat along forest edges but the effects would be localised.

Weka was the only ground bird encountered that would potentially be vulnerable to road deaths, and weka may also be at risk around vehicles and machinery at the quarry site due to their naturally curious habits. Riflemen were observed in low roadside vegetation in May, and also may be at some risk from road traffic. However, the risk of road deaths to birds is likely to be less than minor given the slow vehicle speed possible in this terrain.

The proposed development is unlikely to exacerbate the current adverse effects on birds by introduced pests and predators. In any case, STL can mitigate for such effects by carrying out effective pest/predator control. The existing roads and tracks, and the open nature of the Cobb Riverbed provide excellent opportunities for carrying out pest/predator control (bait stations being maintained by Friends of the Cobb were observed along the 4x4 vehicle road to the old quarry in December).

Powelliphanta Snails:

The effects on *Powelliphanta hochstetteri hochstetteri* snails in the proposed quarry areas are considered nil to negligible due to the fact that they are absent or rare in this area, and yet widespread and locally common in other parts of their range (though they are locally threatened by a range of causes, particularly predators). *P. h. hochstetteri* has been subject to severe predation by possums, particularly the southern part of its range (e.g. Flora and Riwaka catchments) and in the Cobb area since the late 1980s (Walker 2003). Rats also appear to be locally impacting on snails. The Department of Conservation are carrying out regular possum control operations to attempt to reverse the decline of this snail.

The absence of this snail near the proposed quarry may be due to a slow migration from the east after the Cobb River was converted to a dry riverbed below the dam. Given this hypothesis, the proposed quarry may block further spread of snails (but only on a very local scale) as the snail requires the protection of vegetation cover, and food provided within the deep litter layers.

As the effects on snails are negligible no specific mitigation is offered with regard to snails. The predator control measures outlined below inside the Mining Permit may have positive effects for snails (as predators would migrate between the Permit area and the other side of the Cobb riverbed where snails are present).

Other Fauna:

The potential effects of the proposed development on other fauna would vary according to specific fauna. Adverse effects are likely to be greatest for specialized fauna (e.g. flightless, sedentary, or invertebrates that may have specific requirements for ultramafic habitat), and of lesser concern for generalist fauna such as lizards, most spiders and winged insects. However geckos, spiders etc may favour the outcrop areas for roosting because of the abundance of crevices provided by that habitat.

These habitats will be provided by the rehabilitation bunds and new pit walls.

The proposed quarry would also adversely affect any sub-fossil remains such as moa bones found within the rock fissures and caves of the outcrop. It is not known to what extent sub-fossil remains are found in other ultramafic outcrops in the general area. Hence, there is opportunity for the project to add value to the knowledge of fossil remains in the area.

The removal of large-diameter trees or trees with abundant bark crevice habitat (e.g. mature kanuka) would affect species such as lizards and invertebrates that use such trees for shelter or food (also these trees are important for bats and some species of birds as mentioned earlier). Generally these larger trees are found outside or on the margins of the magnesite outcrop areas. Thus the proposed quarrying would have minimal to no adverse effect on these values. The potential adverse effects listed in 'Avifauna' also apply to other fauna. Habitat removal and disturbance is the major adverse effect while effects such as dust deposits may affect a range of invertebrates or lizards living within the disturbance periphery. However, it is noted that the quarrying operation will be a "wet-operation" that does minimise dust generation. Predation by introduced fauna may be limiting numbers of lizards and invertebrates within the general area. Overall adverse effects may be offset to some extent by appropriate predator control in the MP.

6.2.2.2 Mitigation Measures

The following mitigation measures are available for the SQP area with regard to the actual or potential effects on fauna. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Avoid where possible the removal of large-diameter trees (>60 cm dbh), dead standing or fallen large trees, podocarp or rata trees, as these forest components have a disproportionately high value to fauna;
- Where possible, establish new roads or building infrastructure within already modified areas;
- Quarrying and associated activities that result in removal or modification of habitat should be designed carefully to minimize adverse effects, and to ensure impacts are contained within a minimal area of disturbance;
- Selecting overburden sites which minimise impact on fauna and faunal habitat to the fullest extent practicable – this has been implemented through the design of the flora rehabilitation bunds;
- Ensure to the extent practicable, that development doesn't result in flow-on effects, for example wind exposure damage to adjacent habitat, or drainage effects offsite, etc. For example, retaining walls may be required to contain the spread of overburden or planting shrubs or trees to buffer exposed forest edges. The flora rehabilitation bunds will be constructed to avoid flow on effects;
- Development of roads, infrastructure etc should not be carried out during the peak weka breeding season (September to January) to reduce impacts on this threatened species (i.e. reduce disturbance of nesting females and chicks);
- Reducing noise of machinery and vehicles that would otherwise disturb wildlife;

- Reducing the effects of waste products and dust that could damage habitat or impact on fauna directly;
- Reducing the effects of light (e.g. use of shields or reflectors) if operations are carried out at night, as excess light may adversely affect some fauna;
- Keeping road speeds to minimum to reduce the risk of killing birds such as weka;
- Rehabilitation of disturbed faunal habitats within the MP area;
- Carrying out pest and predator control to best practice management protocol (as documented by the Department of Conservation); and
- Targeting deer, goats, possums, stoats and rats to improve the quality of vegetation (deer, goats, possums) and reduce impacts on terrestrial fauna (possums, stoats and rats).

6.3 Water Quality

6.3.1 Potential Effects

6.3.1.1 The Streams

Road Construction and Quarry Operations Effects

Sediment runoff from road construction will drain to land and should cause no adverse effects on the water quality in Stream N or Stream S (the main streams draining the site). All quarry water will be captured and discharged to Stream S which is discussed below.

Water Take - Stream N Effects

Water quality in Stream S and N is excellent; Stream N would be suitable for all proposed uses including potable water, with the proviso that unless specific testing proves otherwise, some form of filtration or treatment should be provided to ensure that there would be no health problems associated with *Giardia* and/or *Cryptosporidium*.

Because of the proposed extraction of water from Stream N, there will be a concomitant reduction in flow, but this will have no detrimental effect on water quality.

Quarry Discharge - Stream S Effects

Proposed quarrying operations would need to include appropriate measures and possibly treatment systems to ensure that water quality, particularly in Stream N, remains high. To this end, it is proposed that any water arising from its use in mining operations, and stormwater from quarry floors, be treated if necessary to remove any suspended sediment, and discharged into the Stream S watercourse and thence to the dry stretch of the Cobb River. Given that this is an ephemeral stream, with minimal ecological values, the detrimental effects of such a discharge on water quality in the stream (should it be flowing) will be minimal. In fact there may be a benefit to the aquatic environment of S Stream should such a discharge become permanent during the lifetime of quarrying operations insofar as it will provide a continuous flow of water and hence habitat suitable for colonisation by macroinvertebrates.

6.3.1.2 The Cobb River

The Cobb River below the site was not able to be sampled. However it is confidently expected that proposed quarrying operations, including road construction, use and maintenance and water takes and discharges to water would have no detrimental effect on water quality, given that this stretch of the river is generally dry, but when it does flow, flows are very large (i.e. spills from the dam).

6.3.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on the water quality:

- Treatment of water post-use, if requiring to be discharged to surface waters, to minimise suspended sediment concentrations prior to discharge to the environment. Discharging water post-use down the channel of S Stream is the preferred and adopted option, to avoid any potential adverse effects on the aquatic macroinvertebrate communities of N Stream. This option would not have any negative effect on stream communities, as the stream is ephemeral (dry most of the time) and discharges into the dry stretch of the Cobb River. Another option would be to pipe any discharge downhill to the dry stretch of the Cobb River itself but at this stage this is not the preferred option.

6.4 Water Quantity

6.4.1 Potential Effects

6.4.1.1 The Streams

Road Construction and Quarry Operations

Quarry operations themselves including the construction, maintenance and use of the road will have no effect on the hydrology of Stream N or Stream S except as noted below.

Water Take - Stream N

Water abstraction at an assumed rate of 3 L/s is able to be undertaken from Stream N at all but the lowest of flows, and hence on-site storage will be required to cater for such times. It is recommended that in order to satisfy the requirements of the Tasman Resource Management Plan (TRMP), a residual flow of 1 L/s be retained in this stream. Subject to this residual flow, the adverse effects of the water take on the hydrology of Stream N will be minor.

It is proposed that any water from the site and operations which requires to be discharged, should it occur (rather than disappearing through the fractured rock characteristic of the outcrops), will be treated if necessary to remove suspended sediment, and discharged into S Stream and thence to the dry reach of the Cobb River. The maximum rate of discharge is expected to be in the order of 3 L/s.

Quarry Discharge - Stream S

The discharge from the quarry into Stream S, should it occur, may change the hydrology of Stream S as it will introduce water into the system during times when the stream would normally be dry. However, there will be no adverse effects on the hydrological regime of this stream.

6.4.1.2 The Cobb River

There will be minimal if any effect of the proposed quarry operations, road construction, water abstraction or discharge on the Cobb River hydrology.

6.4.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on the water quantity:

- Maintaining a residual flow of 1 L/s in N Stream below the site of water abstraction, and having the abstraction point as close as practicable to the old quarry site but retaining sufficient head to be of use for quarrying;

- Provision of onsite storage to cater for quarrying during times of low flow; and
- Any opportunity to re-use or recycle water during quarrying operations would be of benefit to the aquatic environment, in particular by minimising the abstraction rate.

6.5 Aquatic Flora and Fauna

6.5.1 Potential Effects

6.5.1.1 Macroinvertebrate Communities – the Streams

Road Construction and Quarry Operations

Sediment runoff from road construction will drain to land and will cause no adverse effects on macroinvertebrates in Stream N. All quarry floor water will be captured where practicable (i.e. water that does not drain through fractures) and discharged to Stream S which is discussed below.

Water Take – Stream N

Macroinvertebrate communities in Stream N were dominated numerically by species of mayflies, stoneflies, caddisflies, and true flies. They were indicative of excellent stream health.

Provided that the abstraction from N Stream occurs as near to the existing quarry site as practicable, so that natural flows and undisturbed habitat remain in the stream upstream of the abstraction point, the impact of the take on macroinvertebrate communities is unlikely to be significant. A residual flow of 1 L/s downstream of the abstraction from Stream N is proposed. This should maintain habitat of sufficient quality for aquatic macroinvertebrates to persist. Higher water temperatures are sometimes associated with reduced flows in such situations, however given the current cold water temperatures (suggestive of spring or groundwater fed contribution) and the shaded nature of the stream channel, this is unlikely to be an issue here.

Quarry Discharge - Stream S

There are no macroinvertebrate species present in Stream S. Hence, there will be no adverse effects on macroinvertebrates in Stream S. However, permanent discharges to Stream S will likely result in the colonisation of this stream by aquatic macroinvertebrates.

6.5.1.2 Macroinvertebrate communities – the Cobb River

It is confidently expected that proposed quarrying operations, including road construction, use and maintenance and water takes and discharges to water would have no detrimental effect on macroinvertebrates given this stretch of the river is generally dry, but when it does flow, flows are very large (i.e. spills from the dam).

As a consequence it is proposed that any water requiring to be discharged will be treated to remove suspended sediment (if in fact necessary) and discharged into the S Stream watercourse, and thence to the dry stretch of the Cobb River.

6.5.1.3 Fish populations – the Streams

There is no evidence that fish populations exist in Stream N and none exist in Stream S. Consequently there will be no adverse effects on fish in the streams from any aspect of the proposal.

Consequently, provision of minimum flows for fish habitat or passage is not considered necessary.

6.5.1.4 Fish populations – the Cobb River

There will be no adverse effects on fish populations in the Cobb River. A small flow will be abstracted from Stream N and, if required, discharged into Stream S and thence to the dry stretch of the Cobb River below the dam. This flow, even if totally used consumptively on the Quarry site, is so small as to be insignificant in terms of effects on fish, when compared with the other far more significant factors detrimentally affecting fish in the River (dry stretch, massive flood releases from the dam).

6.5.2 Mitigation Measures

Due to the minor adverse effects there are no specific mitigation measures required with respect to aquatic flora and fauna.

6.6 Natural Hazards

6.6.1 Potential Effects

The main natural hazards (as defined by the Resource Management Act 1991) identified with regard to this project are:

- Fire;
- Landslip from the flora rehabilitation bunds;
- Rock fall - in the new pit walls;
- Rock fall on the exterior of the quarries caused by working in the pit; and
- Earthquakes – the area is subject to earthquakes. However there are no active faults in the vicinity of the project area (GNS Active Faults Database July 2010).

The project will not change the probability of an earthquake occurring. However, the risk of landslip and rock fall could be exacerbated or caused by earthquakes.

The effects of these hazards are considered to be minor due to the small scale nature of the activities and due to the mitigation measure outlined below.

As the quarry will be open cast, there will be no risk of subsidence (i.e. ground collapse from roof failure). Erosion and sedimentation issues are considered to be minor as outlined in Section 2.4.

The SQP will not exacerbate flood risk within the permit area and risks of flooding on the project are negligible, as the quarries are located on outcrops away from streams in the area. Cut-off drains will be created around each site to assist with minimising water ingress into the pit floors.

6.6.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the natural hazard effects of the SQP. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Fire risks can be mitigated through quarrying and vehicle management techniques and a fire management plan will be developed to address this potential issue;
- The rock in the quarrying zone is solid and relatively stable and any fractures in the rock are highly visible – hence quarrying method can be adjusted to manage rock fall;
- The quarrying process is slow moving and will involve the construction of benches to aid stability;
- The toe of the rehabilitation bunds will be retained where necessary to prevent movement of the bund;

- The perimeter of flora rehabilitation bunds will be armoured and appropriate perimeter drains will be constructed to prevent under-mining of the toe by rainfall runoff;
- Bunds will be compacted as they are constructed and stable batter slope angles will be utilised.

6.7 Landscape and Natural Character

6.7.1 Potential Effects

Section 2.6 contains a description of the existing landscape and natural character values of the site. Aspects of natural character are assessed elsewhere in the application, in particular vegetation and flora (Section 6.2.1), fauna (Section 6.2.2) and aquatic ecosystems (Sections 6.3-6.5). Section 6(a) requires the preservation of the natural character of wetlands, lakes or rivers and their margins. As none of these features will be disturbed by the project, the effects on matters outlined in Section 6(a) require no further assessment.

Natural character matters associated with visual matters are covered in regard to the discussion on landscape below.

It is considered that the project will have minor adverse effects on landscape values for several reasons. These are:

- The changes in the profile of the outcrops will not be noticeable on a daily or even weekly basis – the changes will be very slow moving and cover a small area. As outlined in Section 3.1, the quarrying will progress slowly over 38 years across all areas at the same time. Hence, the annual average quarrying disturbance will be about 0.13 Ha;
- As noted in Section 2.6, the site is only visible from one public vantage point at the DoC information shelter on the road into the Cobb Dam. The quarries will not be visible from the public walking tracks in the area;
- The area surrounding the SQP has been significantly modified –which is particularly noticeable from the public viewpoint discussed above (refer to Section 2.6 for discussion on modifications – including the Cobb Dam and reservoir, dry riverbed, existing road and quarry on site;
- The site is small when compared to the existing developments and the overall vista of the mountains and associated vegetation within which they are set, including the Lockett Range;
- The rock will be extracted from pits – hence most of the activities will be in a pit that is not visible from vantage points due to the pit walls remaining intact (the outcrops will be quarried in the form of an amphitheatre);
- Exposed earth from the new road will not be visible from the vicinity of the shelter as the height of the trees compared to the width of the road (taking into account the topography) will mask the earthworks. The swath of vegetation that is removed will be visible; however it will not be prominent compared to the existing roads around the Reservoir;
- The SQP is not listed as an outstanding natural feature or landscape;
- The Old Quarry Outcrop is located on a ridgeline, but this is set against the Lockett Range backdrop – hence it is not prominent. The proposed roads for the Southern and South-West Outcrop are set well below the ridgeline and amongst the beech forest.

6.7.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on landscape and natural character values. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Careful placement of buildings and structures to avoid adverse effects, in particular these should be placed away from the ridgeline;
- Recessive colour scheme for building and structures;
- Tactful removal and stockpiling of soils and vegetation;
- Progressive rehabilitation of the flora bunds;
- Implementation of a Rehabilitation Management Plan.

6.8 Recreational Values

6.8.1 Potential Effects

As outlined in Section 2.7, the main recreational activity carried out in the MP area is four-wheel driving within the Old Quarry and immediate surrounds including the proposed accommodation block. This pursuit is not considered suitable for the area and establishment of the quarry will remove an activity that causes conflict with more passive recreational pursuits in the area (noise, traffic hazards etc.).

Overall, it is considered that the recreational values associated with the SQP are low due to its remote location; it is not a recreational destination and a significant number of alternative recreational venues occur in the KNP and surrounding areas. Hence, it is considered that the SQP will have minor adverse effects on recreational values within the Mining Permit area.

There are two potential adverse effects that could arise from the SQP with respect to recreational values in the wider National Park area. These are:

- Conflicts between recreational traffic and quarry traffic as they share the same road into the site up to the Sylvester Hut car park;
- Amenity effects from generation of noise and dust.

Conflicts between traffic can be managed through such measures as sensible signage, keeping speed down and training of quarry drivers. The numbers of trucks using the road on a daily basis will be low – an average of five trips. Subject to the mitigation measures outlined below it is considered that the adverse effects from traffic will be minor.

Adverse effects from noise and dust are considered minor for reasons outlined in Section 6.11.

6.8.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on landscape and natural character values. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Avoiding traffic issues through placement of warning signs, keeping haulage speeds low, and ensuring that quarry haulage drivers are sufficiently qualified;
- Adoption of the mitigation measures outlined with respect to amenity values.

6.9 Cultural Values

6.9.1 Potential Effects

As discussed in Section 2.8, Manawhenua Ki Mohua visited the site on 12 March 2010. No specific cultural issues were raised with respect to the project; however, it was noted that noise, water management and flora and fauna values were of interest as well as mammal pest control. An assessment of these matters is outlined elsewhere in this Section of the application.

A copy of the application will be provided to Manawhenua Ki Mohua in order for any cultural issues to be identified and considered.

6.9.2 Mitigation Measures

The mitigation measures outlined with regard to noise (refer Section 6.11.1.2), water quality (Section 6.3), flora (Section 6.2.1) and fauna (Section 6.2.2) are recommended to mitigate the effects of the SQP on cultural values. They will be discussed with Council as part of consideration of the application.

6.10 Historic Heritage

6.10.1 Potential Effects

It is considered that the MP area including the SQP area has very limited historic heritage values as outlined in Section 2.5. Hence, adverse effects on historic heritage values will be negligible.

6.10.2 Mitigation Measures

It is considered that no mitigation measures are required with regard to historic heritage.

6.11 Amenity Values (Visual, Noise, Vibration and Lighting)

6.11.1 Potential Effects

6.11.1.1 Visual

The visual effects on the amenity value of the area will be minor. This is due to the factors listed in the landscape assessment in Section 6.7, particularly the heavily modified nature of the main public view, the small scale and low rate of production of the SQP.

6.11.1.2 Noise

Wire Saw machines produce very little noise, it would be possible to easily hear a conversation with another person while standing 10ft from the machine while it is in use (pers comm. Richmond Industries Limited – who sell the saws). Given this fact, and the remote location of the quarry it is considered that the effects of noise from the saw will be minor.

The main source of noise on site will be from the excavator. However, the excavator will be used intermittently, and they do not generate significant noise. Again noise will be attenuated by the remote location of the quarry.

There will be no blasting on site and the quarry will only operate during daylight hours. Hence, it is considered that the noise standards in the District Plan will be able to be complied with.

Fauna will not be adversely affected by noise for reasons outlined in Section 6.2.2.

Overall it is considered that the effects of noise will be minor.

6.11.1.3 Vibration

The quarrying operation will not generate vibration as there will be no blasting on site, and truck speed will be low due to the terrain in which they will operate.

6.11.1.4 Lighting

Generally, the quarry will only operate during daylight hours. However, from time to time it may be necessary to extent working hours into dark (e.g. to catch up after periods of bad weather). At such times a generator will provide localised lighting to the working area (primarily the pit). There will be lighting in the staff accommodation areas, however, the effects of this will only be localised and this lighting will not affect fauna or the public as it is tucked behind a ridge.

6.11.2 Mitigation Measures

The following measure is recommended to mitigate the effects of the SQP on amenity values. This will be discussed with Council C as part of consideration of the application.

The mitigation measure is:

- Lighting should be focused on working areas and the accommodation block to minimise light spill; and
- No blasting should occur on site.

6.12 Soil

6.12.1 Potential Effects

It is considered that the potential adverse effects of quarrying on soil will be minor. This is primarily due to the fact that the project will be removing rock not soil. The flora rehabilitation bunds will be constructed of rock; hence there will be no loss of soil associated with the bunds.

There will be soil removal and stockpiling required to construct the roads into the quarry areas as discussed in Section 3.4. However, the area of disturbance is small and the construction of the roads can be undertaken in a manner that mitigates adverse effects to the extent that effects will be minor.

6.12.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on soil. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Retention of soil quantity to the fullest extent practicable by stockpiling top soil separately to overburden;
- Stockpiling soil and slash from road construction alongside the road corridor and compacting it as required to form stable batters using the excavator bucket;
- Utilisation of erosion prevention measures in quarry, and road design; and
- Avoid overburden being placed on top of soil.

Also refer to the rehabilitation outlined in Section 7.

6.13 Air Quality

6.13.1 Potential Effects

The SQP will discharge engine emissions and dust to air.

Vehicle related emissions can occur both on and off site. Given the small scale release of emissions and the distance from the SQP area to the nearest residential property, it is considered that the effects of vehicle emissions will be negligible.

Dust emissions have the potential to occur from any construction related activity. For this project, the activities that have the greatest potential to generate dust are:

- Upgrading of the access road;
- Construction of new roads;
- Quarrying (drilling, wire saw, excavator);
- Extraction, handling and stockpiling of overburden to create flora rehabilitation bunds;
- Vehicle movement on access roads.

The levels of dust emission will vary depending on the weather conditions and the type of activity. The diamond wire saw will utilise water to keep dust emissions to a minimum, as will the excavator mounted saw if it is used.

The majority of dust generated on site will deposit within the site. Therefore, the emissions will not be offensive or objectionably beyond the boundary of the quarry pit or road as applicable.

The effects of the dust emissions associated with this application are lessened due to the climatic conditions of the area; the high amount of rainfall will suppress the dust generated by this quarry operation. No residential dwellings will be affected due to the remote location of the site.

The effects on flora and fauna from dust emissions beyond the boundary of the SQP site are also considered to be minor.

6.13.2 Mitigation Measures

The following measures are recommended to mitigate the effects of the SQP on air quality. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Ensure that the equipment used on site is well maintained;
- Imposition of an appropriate speed limit on haul roads. This will significantly reduce dust generation, as dust from roads is directly proportional to vehicle speeds;
- Use of dust suppression systems in cutting tools.

6.14 Hazardous Substances and Waste Management

6.14.1 Potential Effects

All waste generated will be collected on site and transferred offsite for disposal. For the purpose of this application hazardous substances on site include petrol, diesel fuel and oils. STL will not use other chemicals on site for quarrying, except where these may be required for pest plant control. No explosives will be stored on site.

The mitigation measures outlined below will ensure that the adverse effects from storage and use of hazardous substances are less than minor.

6.14.2 Mitigation Measures

The following measures are recommended to mitigate the effects of hazardous substances and waste. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Ensure that all fuels and oils stored or used at the site are contained in appropriately bunded facilities and that all fuel/oil dispensers are fitted with non-return valves. Storage areas shall be located at least 10 metres from any waterbody;
- Refuelling, lubrication and any mechanical repairs shall be undertaken in an area that provides sufficient mitigation measures to ensure that any accidental spillages onto the land surface are contained;
- All waste generated on site will be collected and disposed of in appropriate landfill.

6.15 Fire Management

6.15.1 Potential Effects

Due to the low risk of fire, the fact that work will be undertaken in rock pits, the high annual rainfall and the mitigation measures outlined below, it is considered that the potential for fire to occur is low and therefore that the potential adverse effects of fire are not significant.

6.15.2 Mitigation Measures

The following measures are recommended to mitigate the effects of fire. They will be discussed with Council as part of consideration of the application.

The mitigation measures are:

- Preparation of a fire contingency plan before commencing operations, including listing safety codes, providing secure storage for fuels and ensuring adequate precautionary measures are in place (e.g. fire extinguishers and access to water, no-smoking within 10 m of stored fuels).

6.16 Plant and Animal Pests

6.16.1 Potential Effects

Management of plant and animal pests needs to be addressed by STL as part of establishment and normal operation of the quarry, and during rehabilitation. The project provides an opportunity to eradicate plant and animal pests on site, and careful management of the project should prevent the introduction of further pests.

Subject to the mitigation measures it is considered that the adverse effects of plant and animal pests will be minor.

6.16.2 Mitigation Measures

Plant and animal pest mitigation measures are discussed in Section 6.2 (terrestrial ecosystems) and in the rehabilitation Section 7.

7 Restoration and Rehabilitation

Site restoration and rehabilitation is a critical component of mitigating the effects of the SQP on the environment. The following is a summary of measures to restore and rehabilitate the site.

Rehabilitation of the quarry areas will primarily be focused on maintaining and enhancing flora values as outlined in Section 3.2 and Section 6.2.1.2. These measures are expanded on below.

STL will commence rehabilitation when quarrying starts and will continue to undertake rehabilitation throughout the life of the project.

STL anticipates that rehabilitation will be undertaken in close coordination with the Department of Conservation and Council, and that valuable knowledge will be gained with regard to successful rehabilitation methods. The rehabilitation techniques associated with the Dolomite quarry on Mount Burnett will be utilised where practicable.

7.1 Rehabilitation of Ultramafic Vegetation

7.1.1 Cultivation of threatened plants

As quarrying proceeds, propagules will be collected from parent plants within areas to be quarried, and these propagules will be used to establish self-sustaining populations of at least the equivalent (or greater) number of plants as to be removed.

The key species for which this mitigation should be undertaken are the four species that are classified as 'At Risk', and which, within the permit area, only occur on rock outcrops. These are:

- *Carex devia;*
- *Uncinia viridis;*
- *Myosotis brockiei; and*
- *Notothlaspi australe.*

The establishment of other species, such as *Dracophyllum ophioliticum*, manuka, and mountain beech, will assist with the provision of shelter and the development of habitat complexity.

Plants can be transferred directly, but should also be propagated by a nursery to provide stock for later planting in rehabilitation sites. Nursery stock should be grown in ultramafic substrate to avoid raising the fertility of ultramafic habitat when replanted.

7.1.2 Rehabilitation Bunds and Direct Transfer

New areas of ultramafic rock and soils will be created, to ensure there is no net loss of ultramafic habitat within the permit area. This will be achieved by creating rehabilitation bunds around the perimeter of each quarry.

The bunds will be created early in the quarrying process from overburden and interburden removal, and will extend progressively as each quarry is developed. Broken rock and soil will be piled on the bunds to form artificial 'outcrops'.

Rehabilitation bunds will be designed with varying height and widths, with some areas where height is maximised as much as possible, whilst still ensuring stability. This is important so as to provide microhabitat diversity.

To successfully create substrates and microhabitats suitable for all of the ultramafic plant species present at the site, large rocks will be required, with placement to create crevices, ledges, and overhangs.

Plant species of particular concern, including but not limited to *Myosotis brockiei*, *Uncinia viridis*, and *Notothlaspi australe*, will, wherever practical, be relocated from the outcrops to the bunds by direct transfer. Whole rocks or rock sections from the exterior of the outcrops will be shifted, with plants attached.

This method, if undertaken carefully, should result in the survival of the above "At Risk" species, as all of these are small herbs and sedges. The key to the survival of transferred plants will be placement of the 'habitat' rock at a similar orientation to its original position.

7.1.3 Rehabilitation of Quarry Walls and Floor

Following the cessation of quarrying, ultramafic vegetation will be rehabilitated within each of the three quarries.

To facilitate recolonisation of the quarry walls and floor by ultramafic plants, surfaces will be formed (where practicable and safe) to include ledges, overhangs, crevices, and caves. The focus will be on the creation of a wide variety of aspects, slope angles, and surface characteristics (e.g., cracks, unbroken faces, shattered faces, rubble, fine tilth) to provide microhabitat diversity.

The pit floors will be free-draining on completion so that the pits do not flood. This will be achieved through quarry design.

7.2 Restoration of mountain beech forest

When the quarrying operation ceases, mountain beech forest will need to be restored within disturbed areas that are not on ultramafic habitat (e.g. the access tracks). The location of these restoration sites within a large tract of forest means that an adequate seed source is in close proximity to the rehabilitation areas, which will help to ensure natural colonisation by mountain beech.

The key to success of natural establishment will be the restoration of a suitable substrate. Hardened or compacted surfaces will require shallow ripping to reduce soil compaction, whilst not damaging the root systems of existing trees. Topsoil removed during quarry development will be reinstated at the original depth. If practical, the logs of felled trees should be placed back within the rehabilitated areas. Rotting logs provide an excellent germination and establishment site for a range of forest species, including mountain beech.

7.3 Flora Rehabilitation Planning

A rehabilitation management plan will be developed, detailing:

- The location of rehabilitation and 'no quarry' sites;
- Preparation of rehabilitation landforms;
- Propagation and replanting of indigenous species;
- Techniques for direct transfer of vegetation;
- Rehabilitation site maintenance requirements; and
- Closure criteria that when met will demonstrate that rehabilitated vegetation is self-sustaining.

7.4 Biosecurity and Weed Control

Biosecurity measures and control of pest plants within the site will occur to ensure that quarrying within the area doesn't lead to an increase in the abundance and impacts of invasive plant species.

A weed management plan should be prepared covering:

- Biosecurity implementation measures;
- Surveillance for weeds;
- Control strategies in the event of new invasions.

Quarrying and earthmoving machinery used on the site will be water-blasted or steam-cleaned prior to transport to the site to ensure that it is free of weed propagules. This does not apply to trucks as this will not be practicable.

Any gravel or rock that is transported to the site for road upgrading and construction will come from an inspected and approved weed-free source. No plant species not already present at the site will be cultivated within the site. Weed control activities will be undertaken until the quarry closes.

7.5 Control of Pest Animals

Control of stoats (*Mustela erminea*) is being undertaken by Friends of the Cobb, using Fenn traps along the existing access road. Extending this network of traps could be considered, although the potential for rebound of rat populations should be assessed, as rats are a major prey item of stoats.

Goats (*Capra hircus*), deer (*Cervus elaphus scoticus*), and pigs (*Sus scrofa*) are known to utilise the site and will be controlled to reduce adverse browse effects on forest understorey species, and of palatable "At Risk" plant species such as *Pittosporum dallii* and *Peraxilla tetrapetala*.

Control of these pest animals will be coordinated with Department of Conservation pest control activities adjacent to the mining permit area. Possums have been controlled at the site using the placement of poison bait bags on tree trunks. This control will be extended using a network of poison lines throughout the site, and undertaken biannually.

Targeted control of possums using Timms traps will occur where *Peraxilla tetrapetala* is present. Consideration will be given to banding host trees so that possums have difficulty accessing mistletoe plants. To avoid killing weka, traps will be mounted vertically on tree trunks at least 900 mm above the ground, with the entrance hole facing downwards.

An animal pest management plan will be developed to ensure that pest management is carried out efficiently and effectively.