

## 5. ASSESSMENT OF ACTUAL OR POTENTIAL EFFECTS OF THE PROPOSAL ON THE ENVIRONMENT

### Section 5 Contents:

5.1	Overview .....	1
5.2	Benefits of the Proposal .....	2
5.3	Weston (Plant Site).....	6
5.4	Weston Quarries (Limestone/Siltstone/Tuff) .....	30
5.5	Ngapara (Coal) .....	49
5.6	Windsor (Sand).....	63
5.7	Transport Interconnections .....	72
5.8	Construction Effects Across all Sites.....	82
5.9	Effects Arising from the Project as a Whole.....	90

### Section 5 Summaries:

Summary of Benefits .....	5
Summary of Effects at the Weston site .....	27
Summary of Effects at the Weston quarries .....	46
Summary of Effects at the Ngapara site .....	61
Summary of Effects at the Windsor site .....	70
Summary of Transport Interconnections Effects .....	81
Summary of Construction Effects Across all Sites .....	88
Summary of Effects Arising from the Project as a Whole .....	96

### 5.1 Overview

This chapter addresses the **benefits** that would accrue from the proposal and the areas in which actual or potential adverse **effects** could arise. More detail on these benefits and effects is contained within the technical reports, which are attached as appendices to this Assessment of Environmental Effects.

This chapter is initially divided according to project site (**Weston plant site, Weston quarries, Ngapara, and Windsor**) so that it is clear what effects could relate to each site. Following this there are sections that relate to:

- **Effects from transportation** between the sites;
- **construction effects** (which would be limited in duration);
- **cumulative effects**; and
- **overall effects** of the project as a whole.

Within each section of this chapter, the topics are covered independently so that persons interested in one site only will have all key issues available without having to read the whole chapter.

## **5.2 Benefits of the Proposal**

### **5.2.1 Introduction**

It is anticipated that the Holcim project would generate a range of benefits both locally and nationally. Economic benefits would relate to the local production of cement in the New Zealand context, and this in turn would benefit the country as a whole. Holcim is proposing a range of measures which would benefit the local community within which the project would occur and the local environment.

### **5.2.2 Economic benefits**

For more information, refer to the Economic Impact Assessment (Appendix 18).

#### **5.2.2.1 Current Economic Environment**

Data from Statistics New Zealand show that the population of the Waitaki and Waimate Districts has been stagnant or falling over the past decade (falling by 6% and 5% respectfully). Statistics New Zealand is forecasting the Waitaki and Waimate District populations to continue to fall over the next 20 years (by 18% and 17% respectfully while New Zealand is projected to increase by 17%).

The Waitaki District has a high reliance on the primary sector, predominantly in the agriculture sector with around 14% employment in this grouping compared to New Zealand average of around 6%. Further, around a quarter of the Waitaki District's labour force is engaged in manufacturing (compared to the New Zealand average of around 14%). There is also a strong mining industry group, as a consequence of gold ore mining within the district. The Waitaki District is 'under represented' in the wholesale trade, transport and storage, finance and insurance, property and business services, government administration and defence, education, cultural and recreational services and personal services and other services industry groups.

#### **5.2.2.2 Construction Phase – Employment, Incomes and Expenditure**

Holcim has estimated the capital cost of the project to be around \$200 million New Zealand dollars for the cement plant related aspects. Other engineering, project construction preparatory costs, together with other non-plant related capital costs (e.g. shipping, port infrastructure, rail, depots, etc) would be in addition to the \$200 million. This would be a considerable expense. Costs would be incurred over the 3-year planning and construction period. It is estimated that \$106 million (\$35.3 million per annum) of the capital cost would be spent in the Waitaki District. The main items of construction expenditure in Waitaki would be site works, buildings, machinery installation, mine and quarry overburden clearing, railway line upgrading and the purchase of technical and other services (in addition to on-site construction workforce wages).

It is estimated that the on-site construction workforce in respect of the plant, would be up to a maximum of approximately 450 people during the 2-year construction period but with an average on-site workforce over this period of around 290 employees, whose wages and salaries would total \$29 million or \$14.5 million per annum.

In addition to these direct economic impacts of construction, there would be indirect impacts arising from:

- the effects on suppliers of goods and services provided to the site/project from within the region; and
- the supply of goods and services to employees at the site and to those engaged in supplying goods and services to the site.

As a result of these indirect effects, it has been estimated that the project would provide:

- 458 additional jobs; and
- \$22.2 million per annum in additional household income.

These significant economic impacts would benefit the Waitaki District economy for the 2-year construction period. There would also be 'spill-over' economic impacts for adjacent districts – in particular increased economic activity as a consequence of the use of a port for importing equipment and shipping cement; and the purchase of technical and other services from Christchurch, Timaru or Dunedin. Also to the extent that some construction workers 'commute' from outside the Waitaki District, the economic impacts for the local Waitaki economy would be less, but higher for the adjacent district economies.

#### 5.2.2.3 Operational Phase – Employment, Incomes and Expenditure

Once operational, the project would continue to have significant on-going direct and indirect economic benefits for the Waitaki District. The project in its first full year of operation would directly employ around 110 persons rising to around 125 persons when the plant was operating at full capacity. Holcim has estimated an initial wages and salaries bill of \$7.3 million per annum rising to \$8.3 million per annum at full capacity output.

Having considered the effect that this may have on local district employment and household income, the total (direct and indirect) impacts of the proposal are estimated to be:

- 196 additional jobs rising to 241 additional jobs by 2030; and
- \$10.7 million in additional household income rising to \$12.9 million by 2030.

The main sectors to benefit from the flow-on economic activity are expected to be personal and community services; business services; trades such as electrical, engineering, and mechanical; retail, restaurants and hotels; and road and rail transport. There would also be 'spill-over' beneficial economic impacts for adjacent districts – in particular increased economic activity as a consequence of increased rail transport in South Canterbury or Otago and increased volumes of trade through the Port of Timaru.

#### 5.2.2.4 Wider Local Economic Impacts

In addition to the significant quantifiable economic impacts of increased employment and household income within the Waitaki District economy during the construction and operation of the project, there would be a number of wider benefits from the project for the local economy as a whole. These include:

- Increasing levels of economic activity in the district would generally lead to efficiency improvements in the supply of goods and services as both private and public sector providers benefit from increasing returns to scale. This can lead to increased levels of profitability for local businesses and/or lower prices for consumers. Consumers in particular would benefit if the increased level of economic activity results in increased levels of competition in the local supply of goods and services.
- The local economy would benefit where quality and quantity of services supplied by central government agencies are a function of population levels. This may be the case in relation to education and health services.
- The potential and opportunity for new support industry to be developed locally, e.g. electrical, heavy engineering, and maintenance. New jobs would be created within these industries.
- The project would lead to greater diversity within the local economy. Economic returns and activity levels would be less dependent upon the fortunes of the agricultural sector. Also there would be a broadening of the range of employment

opportunities within the local economy, increasing the likelihood of retaining younger residents within the Waitaki District or attracting them back to the District after gaining qualifications and experience outside the District.

- The project would provide opportunities for additional skilled workers and senior management staff to be employed within the District. These persons would supplement the existing base of potential 'leaders' within the community benefiting the District's voluntary and non-voluntary organisations.
- Holcim would lend its support to a number of the District's activities and organizations in recognition of its staff being part of the local community and its responsibilities as a good 'corporate citizen'.

### 5.2.3 National benefits

Due to the national growth in demand for cement, Holcim is unable to meet the market demands from the present cement plant at Westport. Recently Holcim has had to start importing cement to provide sufficient supply to meet local demand.

The provision of a new cement plant would ensure that there is adequate supply to meet national demand into the future and would ensure that this is met locally rather than through importing. This would have a modest but measurably positive effect on the nation's current account balance.

Cement is considered a necessary economic staple of a thriving economy. It is an essential input into all forms of construction. It could be considered a 'strategic' commodity in the sense that national self-sufficiency avoids importing and the risks inherent with exchange rates, shipping, and constraints in supply from other countries.

### 5.2.4 Local community benefits

The local community surrounding the project sites would benefit in a number of ways. These benefits may accrue to individuals or to the community as a whole. The benefits include:

- Job creation (as discussed above), including the potential for locals to be employed at project sites and for young people in the community to have prospects of local jobs to return to after education.
- Possible provision of additional industry training programmes for young people and re-training of adults, in conjunction with local training and service providers.
- Flow on effects from job creation, including supporting other local businesses through household purchasing and property investment.
- Apprenticeship and scholarship opportunities for young people within the community.
- Holiday work for high school and university students.
- Use of local labour where possible, including the potential for use of local firms for activities such as construction or transport. There would be a policy of sourcing goods and services from local suppliers where practicable and possible.
- Staff involvement in and support of local community organisations.
- The establishment of a local community trust for the purpose of generating funds for promoting community-based social and environmental development and improvement in the neighbourhoods of the plant, quarries, pits, at Weston, and in the Waiareka Valley.
- Provision of a walkway/cycleway for the Weston community, in conjunction with the Waitaki District Council (details to be confirmed with community representatives and the Waitaki District Council).

Holcim has a history of being a supportive part of the many local communities in which it operates. A community liaison group is well established at Westport and similarly envisaged for Weston. This would ensure an ongoing close link to the community and

a proper understanding of its needs throughout the plant's construction period and ongoing operations.

#### 5.2.5 Environmental benefits

The project would provide some benefits to the local environment associated with some of the project sites.

At the Weston site, it is proposed to protect some of the indigenous vegetation associated with the limestone escarpment. This would be achieved by fencing off an area of the escarpment so that the native flora was protected from grazing by stock. Some active weed control is also proposed within this area. This has benefits to the environment through the protection of indigenous vegetation associated with limestone, which is becoming scarce in the area. This would benefit the biodiversity of the area and provide a seed source for local native plants.

At all sites, stormwater would be controlled and treated prior to discharge and where possible reused. This would benefit the local aquatic environment compared to the existing situation where surface water runoff from agricultural practices discharges directly into the Waiareka Creek and tributaries without any treatment. Likewise there would be a benefit to the local groundwater through good treatment of discharge water.

Another range of benefits from the pit water or quarry water management at the quarry and pit sites is the proposal to provide additional enhancement and creation of wetlands below the sediment ponds at the Weston quarry and at Ngapara. These wetlands are shown on the rehabilitation plans (Appendix 8) and are particularly discussed in the Ecology Report (Appendix 9). These wetlands would enhance the current tributary waterways, which have been highly modified through grazing practices over time and would reintroduce indigenous species into these areas.

Rock art is a scarce and fragile resource and is generally at risk from development. This proposal seeks to recognise the rock art within the site and to protect this from any adverse effects of the development or which could have occurred should the land remain in traditional rural use. The benefit both to the Runanga and the wider community from this protection is that the rock art is recognised, available to the Runanga for research and protected into the future. The rock art at the Weston site would be protected from future stock damage, and monitoring carried out to ensure ongoing protection. Further ongoing discussions regarding options relating to long-term protection are underway with Te Runanga o Moeraki.

#### Summary of Benefits

- The project would provide benefits to the local and national economy through the creation of employment opportunities, introduction of additional income, and expenditure in the local market.
- The project would also introduce environmental benefits, including protection of indigenous vegetation, protection of waterways, establishment and enhancement of wetlands, and protection of rock art.

## 5.3 Weston (Plant Site)

### 5.3.1 Air quality

The Air Report prepared by URS (Appendix 14) presents and assesses the potential effects of the operational discharges to air from the proposed cement manufacturing plant. This work is based on the CALPUFF atmospheric dispersion model. Air discharges during construction are addressed in section 5.8.

The assessment of air quality has been undertaken against air quality standards and guidelines, where they are available. These include:

- The National Environmental Standards (NES), which have been set by the Ministry for the Environment under the Resource Management Act. They cover what are considered the criteria pollutants;  $PM_{10}$ ,  $NO_2$ , CO,  $SO_2$  and Ozone ( $O_3$ ) with the primary focus being  $PM_{10}$ .
- Guidelines or targets that have been set by the Otago Regional Council in the regional Air Plan, which contains both Ambient Air Quality Guidelines (ORAAQG), targets, and goal levels (OGL).
- A number of compounds that are contained in the New Zealand Ambient Air Quality Guidelines (NZAAQG), developed by the Ministry for the Environment in 2002.

In addition, there is the potential for the proposed cement plant to discharge a number of compounds for which there are no current New Zealand or Otago guidelines.

In 2001 Holcim Limited adopted the EMR programme (Emission Monitoring and Reporting) for use in all Holcim group companies worldwide to establish a standardised system across all Holcim plants to ensure accurate data is gathered on emissions. As part of this system, Holcim requires its sites to conduct annual independent non-Holcim testing of stack emissions for a broad range of parameters including the following selected metals:

Antimony, Arsenic, Cadmium, Chromium, Cobalt, Copper, Copper, Copper, Manganese, Mercury, Nickel, Thallium, and Vanadium

URS has therefore been requested to assess potential discharges of these compounds. In doing so, it is necessary to consider assessment criteria from other jurisdictions. These criteria include:

- the 2003 Effects Screening Levels (ESL) from the Texas Commission on Environmental Quality (TCEQ); and
- the Washington State Acceptable Source Impact Levels (ASIL).

California standards have not been used because they are generally not as stringent.

URS undertook a comprehensive literature review of the potential for health effects associated with the compounds that needed to be assessed, as well as the basis for the criteria being used. As a result of this assessment, URS is able to confirm that the NES, NZAAQG, ORAAQG, and TCEQ ESL are set at levels at which effects to the environment, inclusive of human health, are expected to be no more than minor. Therefore, attaining compliance with the assessment criteria, as has been achieved for all substances, means that there are unlikely to be any effects with regard to human health.

A consolidated list of the compounds and assessment criteria used in the assessment is contained within the Air Report (Appendix 14).

#### 5.3.1.1 Particulate

$PM_{10}$  is the particulate that may be considered the most significant air pollution problem in New Zealand. It results primarily from combustion, and is mostly produced by domestic fires and vehicles.  $PM_{10}$  is also generated by natural events with some

occurring as a result of wind blown dust, although the most significant natural source in New Zealand is sea spray. URS has also assessed PM<sub>2.5</sub> emissions, which are a subset of PM<sub>10</sub>. PM<sub>2.5</sub> is primarily derived from combustion.

Table 5.1 summarises the predicted particulate (PM<sub>10</sub> and PM<sub>2.5</sub>) dispersion modelling results from the proposed cement manufacturing plant.

Species	Averaging Period	At Closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed Boundary [ $\mu\text{g}/\text{m}^3$ ]	Assumed Background [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
PM <sub>2.5</sub>	24 hour	4	2.6	2.3	2.1	25 <sup>1</sup>	NZAAQG
PM <sub>10</sub>	24 hour	32	17	24	15/23 <sup>2</sup>	50	ORAAQG/ NES
	Annual	16	15	15	15	20	NZAAQG

**Table 5.1: Maximum predicted PM<sub>10</sub> and PM<sub>2.5</sub> ground level concentrations**

The predicted concentrations are well within all of the current assessment criteria. Best available techniques in continuous monitoring systems would be used to monitor emissions of fine particulate matter (PM<sub>10</sub> PM<sub>2.5</sub>).

#### 5.3.1.2 Nitrogen Dioxide

Nitrogen oxides are products of high temperature combustion, with motor vehicles being the main contributor in most cities. Monitoring to date shows that background concentrations in the Weston area are low.

Table 5.2 summarizes the dispersion modelling results of the predicted Nitrogen Dioxide (NO<sub>2</sub>) concentrations from the proposed cement manufacturing plant.

Averaging Period	At closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed Boundary [ $\mu\text{g}/\text{m}^3$ ]	Assumed Background [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
1 hour	23	23	22	15	200	ORAAQG/NES
24 hour	12	12	11	8	60	ORAAQG
Annual	3.3	3.3	3.2	3	30	NZAAQG

**Table 5.2: Maximum predicted NO<sub>2</sub> ground level concentrations**

The assessment carried out by URS has predicted that, due to atmospheric dispersion, ground level concentrations of nitrogen oxides would be well below the criteria set out in the National Environment Standard and in Otago (ORAAQG) Guidelines.

<sup>1</sup> URS notes that this emission also meets the Californian PM<sub>2.5</sub> standard of 12  $\mu\text{g}/\text{m}^3$ .

<sup>2</sup> Two different background concentrations have been added to the predicted 24 hour average concentrations; 15  $\mu\text{g}/\text{m}^3$  in the area around Weston and 23  $\mu\text{g}/\text{m}^3$  in the Oamaru airshed.

### 5.3.1.3 Sulphur Dioxide

SO<sub>2</sub> is normally regarded as a product of combustion. However in modern cement manufacturing, the SO<sub>2</sub> at the main stack comes almost entirely from the oxidation of pyritic sulphur in the raw materials and is thus only a product of raw material expulsion.

Table 5.3 summarises the dispersion modelling results for Sulphur Dioxide (SO<sub>2</sub>) from the proposed cement manufacturing plant.

Averaging Period	At Closest Residence [µg/m <sup>3</sup> ]	Weston Urban Boundary [µg/m <sup>3</sup> ]	Oamaru Airshed Boundary [µg/m <sup>3</sup> ]	Assumed Background [µg/m <sup>3</sup> ]	Assessment Criteria [µg/m <sup>3</sup> ]	Source
1 hour	50	22	14	5	570	NES
					350	NES
					230	ORAAQG
24 hour	10	10	5	5	80	ORAAQG
Annual	0.6	0.6	0.3	0	20	NZAAQG

**Table 5.3: Maximum predicted SO<sub>2</sub> ground level concentrations**

Neither the NES never to be exceeded guideline of 570µg/m<sup>3</sup> or the typical guideline 350µg/m<sup>3</sup> are exceeded, and the remainder of the predicted maximum SO<sub>2</sub> ground level concentrations are well below their respective assessment criteria.

It is noted that the maximum 1 hour average off-site concentration exceeds the OGL of 230µg/m. However, the affected area is limited to the edge of the limestone escarpment immediately to the east of the plant, and the farmland immediately to the west of the proposed site, on the opposite side of the Weston-Ngapara Road, both of which are unoccupied areas. An analysis of the dispersion modelling results was undertaken to determine the number of exceedences and the meteorological conditions at these times. It was found that there were only four exceedences at each site in a year, which occurred during north-by-north-westerly and south-westerly winds of speeds between 2m/s – 6m/s.

A recent update to the World Health Organisation (WHO) ambient air quality guidelines includes a proposal to work towards a 24 hour SO<sub>2</sub> guideline of 20 µg/m<sup>3</sup>, with an interim guideline of 50 µg/m<sup>3</sup>. This relates to epidemiological information on the ongoing daily pattern of exposure and chronic health effects. Currently in New Zealand annual guidelines are used to address chronic exposure. On this basis the proposed plant would still comply with this new proposed WHO value.

### 5.3.1.4 Carbon Monoxide

Ambient concentrations of CO are relatively high in highly urbanised areas and effectively zero in ambient air in rural areas away from roads or other combustion sources. Because CO readily reacts, concentrations reduce quickly and in the absence of additional combustion activity, concentrations return to zero.

Carbon monoxide is a product of incomplete combustion and therefore levels would be extremely low due to the high temperatures and excess of oxygen in the kiln.

Table 5.4 summarizes the dispersion modelling results for Carbon Monoxide (CO) from the proposed cement manufacturing plant, with background concentrations assumed to be zero.

Averaging Period	At closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed Boundary [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
1 hour	180	129	115	20,000	ORAAQG
8 hour	335	320	313	6,000	NES

**Table 5.4: Maximum predicted CO ground level concentrations**

The maximum predicted CO ground level concentrations are well below their respective assessment criteria.

#### 5.3.1.5 Volatile Organic Compounds

There is little data on background ambient concentrations of VOCs in New Zealand. VOCs are generated by all combustion processes and released from things such as spray cans, house paints, and tar seal. One of these compounds, benzene, is derived primarily from motor vehicles. Polycyclic Aromatic Compounds (PAHs) are also combustion products and like benzene, measured concentrations are highest in urban areas.

In heat (combustion) processes in general, the occurrence of VOCs are often associated with incomplete combustion. In cement kilns the emission of VOCs would be low because of complete oxidisation due to the very high kiln temperatures.

Table 5.5 summarizes the dispersion modelling for Volatile Organic Compounds (VOC's) from the proposed cement manufacturing plant, with background concentrations assumed to be zero.

VOC	Averaging Period	At Closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed Boundary [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
Benzene	Annual	0.004	0.004	0.002	3.6	NZAAQG
Benzo(a)pyrene	Annual	$3.6 \times 10^{-8}$	$3.6 \times 10^{-8}$	$1.8 \times 10^{-8}$	$3 \times 10^{-4}$	NZAAQG
Formaldehyde	30 minute	0.01	0.003	0.002	100	NZAAQG

**Table 5.5: Maximum predicted VOC ground level concentrations**

The maximum predicted VOC ground level concentrations are well below their respective assessment criteria.

#### 5.3.1.6 Metal Compounds

Metal discharges occur from any combustion process as well as natural activities such as wind erosion of metal-containing ores (metals are present in the ground). Emissions of metal compounds from cement kilns depend on the levels of those metals in raw materials and fuels and the volatility of the particular metal concerned.

Table 5.6 summarizes the dispersion modelling results for metal emissions from the proposed cement manufacturing plant, with background concentrations assumed to be zero.

Assessment of Actual or Potential Effects of the Proposal on the Environment

Metal	Averaging Period	At Closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
Antimony	1 hour Annual	0.0002 $2 \times 10^{-6}$	$7 \times 10^{-5}$ $2 \times 10^{-6}$	$4 \times 10^{-5}$ $1 \times 10^{-6}$	5 0.5	TCEQ ESL
Arsenic	Annual	$2 \times 10^{-5}$	$2 \times 10^{-5}$	$8 \times 10^{-6}$	0.0055	TCEQ ESL
Cadmium	1 hour Annual	0.0009 $1 \times 10^{-5}$	0.0003 $1 \times 10^{-5}$	0.0002 $6 \times 10^{-6}$	0.1 0.00056	ESL ASIL
Chromium	Annual	$8 \times 10^{-6}$	$8 \times 10^{-6}$	$4 \times 10^{-6}$	0.11	TCEQ ESL
Cobalt	1 hour Annual	0.0002 $2 \times 10^{-6}$	$7 \times 10^{-5}$ $2 \times 10^{-6}$	$4 \times 10^{-5}$ $1 \times 10^{-6}$	0.2 0.02	TCEQ ESL
Copper	1 hour Annual	$9 \times 10^{-5}$ $1 \times 10^{-6}$	$3 \times 10^{-5}$ $1 \times 10^{-6}$	$2 \times 10^{-5}$ $6 \times 10^{-7}$	10 1	TCEQ ESL
Lead	3 Month	$3 \times 10^{-5}$	$3 \times 10^{-5}$	$2 \times 10^{-5}$	0.2	NZAAQG
Manganese	1 hour Annual	0.003 $4 \times 10^{-5}$	0.001 $4 \times 10^{-5}$	0.0009 $2 \times 10^{-5}$	2 0.2	TCEQ ESL
Mercury <sup>3</sup>	Annual	$5 \times 10^{-6}$	$5 \times 10^{-6}$	$2 \times 10^{-6}$	0.13	NZAAQG
Nickel	1 hour Annual	0.0014 $2 \times 10^{-5}$	0.0005 $2 \times 10^{-5}$	0.0004 $9 \times 10^{-6}$	0.15 0.0021	ESL ASIL
Thallium	1 hour Annual	0.0004 $5 \times 10^{-6}$	0.0002 $5 \times 10^{-6}$	0.0001 $3 \times 10^{-6}$	1 0.1	TCEQ ESL
Vanadium	Annual	$4 \times 10^{-5}$	$4 \times 10^{-5}$	$2 \times 10^{-5}$	0.05	TCEQ ESL

**Table 5.6: Maximum predicted metal ground level concentrations**

The maximum predicted metal ground level concentrations are well below their respective assessment criteria.

### 5.3.1.7 Other Compounds

Table 5.7 summarises the dispersion modelling results for other compounds discharged from the proposed cement manufacturing plant, with background concentrations assumed to be zero.

<sup>3</sup> While the NZAAQG guideline has been used in this table, it is also noted that the predicted concentrations are also less than the TCEQ guideline value of  $0.025 \mu\text{g}/\text{m}^3$ .

Compound	Averaging Period	At Closest Residence [ $\mu\text{g}/\text{m}^3$ ]	Weston Urban Boundary [ $\mu\text{g}/\text{m}^3$ ]	Oamaru Airshed Boundary [ $\mu\text{g}/\text{m}^3$ ]	Assessment Criteria [ $\mu\text{g}/\text{m}^3$ ]	Source
Ammonia	1 hour	0.2	0.07	0.04	170	TCEQ ESL
	Annual	0.003	0.003	0.001	17	
Hydrogen Chloride	1 hour	3	1	0.6	75	TCEQ ESL
Dioxins and Furans	Annual	$5 \times 10^{-12}$ [ $\mu\text{g TEQ}$ ]	$5 \times 10^{-12}$ [ $\mu\text{g TEQ}$ ]	$2 \times 10^{-12}$ [ $\mu\text{g TEQ}$ ]	$3 \times 10^{-8}$ [ $\mu\text{g TEQ}$ ]	TCEQ ESL

**Table 5.7: Maximum predicted ground level concentrations of other compounds**

The maximum predicted ground level concentrations are well below their respective assessment criteria.

Background dioxin data for rural areas in the South Island obtained from the MfE organochlorines report<sup>4</sup> is  $9.88 \times 10^{-9} \mu\text{g TEQ}/\text{m}^3$ . Therefore there will be a negligible change in background concentrations.

#### 5.3.1.8 Water Vapour (Plume) Visibility

URS has assessed the potential for the plant to generate a visible water vapour plume on occasions. Although the proposed new plant would use a 'dry' cement manufacturing process, there would be water vapour discharged from the main stack. This visible plume consists of water vapour that is driven off the raw materials fed into the kiln, as well as water vapour formed as a combustion product.

The plume visibility is based on a number of parameters including temperature and relative humidity. Based on URS' assessment there will be a small percentage of total daylight hours (around 2.5% of time), primarily in autumn and winter during calm weather conditions (wind speeds less than 1.8 kph), when a tall vertical plume up to 300m high is visible from the stack. At times, during light wind conditions (up to approximately 7.2 kph) this plume will bend over and may remain visible as an elevated coherent plume for up to 1km. At other times shorter and lower plumes may be seen. There is no 'smoke' emitted from the stack.

#### 5.3.1.9 Acid Rain

'Acid rain' is a broad term used to describe several ways that acids fall out of the atmosphere. A more precise term is acid deposition, which has two parts: wet and dry. It is typically defined as occurring when pH drops to 2-3.

Rain in New Zealand normally has a slightly acidic pH level (between 4.6 and 6.2), as a result of rain absorbing various compounds in the atmosphere. These compounds are both naturally occurring, such as chlorides (from the sea) or carbon dioxide (from plants decomposing), and man made such as nitrates and sulphates (e.g. cars and home fires). Pure water has a pH of 7.0.

Based on URS' research, one of the most important factors influencing the degradation of rock art is the pH of the water that comes into contact with the rock. A conservative estimate of likely changes in rainfall pH as a consequence of this project, has determined that there is unlikely to be any significant increase in acid deposition or

<sup>4</sup> Ministry for the Environment, Ambient Concentrations of Selected Organochlorines in Air, December 1999

surface recession, with pH variations similar to that experienced throughout the rest of New Zealand. URS therefore considers that the effect of air emissions from the proposed cement manufacturing plant would result in no more than minor effects for rock art in the area.

As rainwater in New Zealand is already acid (measurements at Weston indicating consistent local pH of about 5.5), buildings in Oamaru will already be exposed to 'acid rain'. Based on international limestone research, removal will be around 0.15 microns per month (2 mm per 100 years) on an unprotected limestone building or structure.

Based on the available data the maximum change to pH levels as a result of the proposed Weston option cement plant (looking at a worst case scenario) would be to lower pH from 5.50 to 5.47, causing no measurable change in surface erosion to buildings or structures.

### 5.3.2 Water Management

The Water Report prepared by Kingett Mitchell Limited (Appendix 15) provides assessment of stormwater management, water supply, and treatment and disposal of wastewater.

#### 5.3.2.1 Water Management Strategy and Approach

The water management strategy for the Weston plant is based on a sustainable approach to water management, where all water (potable water, stormwater and wastewater) would be treated as a resource and recycled and reused onsite. Achieving the water management strategy will require:

- collection and storage of stormwater,
- a high level of wastewater treatment to provide opportunities for reuse in non-potable applications;
- use of recycled storm water for the truck wash, dust control, irrigation and toilet flushing; and
- minimisation of water losses (leakage from process water systems) and wastage.

#### 5.3.2.2 Stormwater Management

The stormwater management concept is based on the principle of maximising the amount of stormwater that can be captured and used around the site for truck washing, process water make up, and the irrigation of landscaped areas.

A water balance model has been developed for the site to assess the amount of stormwater that could be used on-site and where treated wastewater could be reused appropriately within on-site processes. The model also provides an estimate of how much potable water is required in addition to the reuse of treated wastewater and stormwater.

Based on the model predictions, treated wastewater and stormwater could be utilised to supply between 44% and 54% of the site's total water demand on a long term average basis. The range provided reflects some uncertainty regarding the properties of the rainfall infiltration characteristics for the undisturbed catchment above the site.

#### Conceptual stormwater system layout

Stormwater from the crusher, plant site and associated catchments would be collected and conveyed to two separate reuse and disposal systems. Each reuse and disposal system consists of piped reticulation with swales where appropriate, a holding pond and a soil adsorption basin. The soil adsorption basins are connected via an overflow from the upper basin to the lower basin during large flood including a 50 year flood.

The holding ponds and soil adsorption basins would be regularly maintained and accumulated sediments would be removed and disposed of either to quarry backfill (if of suitable quality) or to an approved offsite disposal facility.

The combined water holding pond and soil adsorption basin system would only discharge directly to surface water during events greater than a 2% AEP event of 72 hour duration (approximately once every 50 years), and would discharge to ground semi-regularly once the re-use holding ponds are full. The overflows would be via natural secondary overflow paths to the west of the site, and the flows from the site would be no greater than for the existing pre-development situation. In a situation of overflow, contributions of water from the plant site would be maintained at existing contributions and only represent part of the total over land flows conveyed by the secondary flow paths.

#### Stormwater Chemistry Modelling

A mass balance model has been used to predict the likely concentration of contaminants infiltrating to ground in the soil adsorption basins. These concentrations have been compared to New Zealand Drinking Water Standards.

The stormwater management at the plant site focuses on re-use of water onsite and as such discharge of water to ground via the soil adsorption basins is intended to be minimised. The water balance model predicts that approximately 90,000m<sup>3</sup>/year of water would be infiltrated through the upper soil adsorption basin and that approximately 12% of that volume would be from site stormwater runoff. The lower adsorption basin would only infiltrate approximately 10,000m<sup>3</sup>/year with approximately 50% of that volume resulting from site stormwater runoff.

The pH of the stormwater is likely to be slightly elevated due to the presence of limestone onsite. Rainwater in New Zealand is typically mildly acidic but it is expected that water from the limestone crusher and raw materials stores on site would have mildly elevated pH. However, the pH of the discharge is not expected to exceed 9.1 and is expected to be similar to the receiving environment.

The concentrations of all metals in the soil adsorption basins are anticipated to be below the New Zealand Drinking Water Standards and infiltration of stormwater is not likely to pose a risk to drinking water supply from the aquifer. The concentration of metals may be slightly elevated compared to the existing groundwater from samples obtained at the Weston site. However, the modelling has not accounted for removal of metals by adsorption to soil or for dilution in the aquifer, both of which would reduce metal concentrations (by 60-90% depending on the metal). Both the upper and lower infiltration basins would contain low levels of polyaromatic hydrocarbons.

The concentrations of metals and polyaromatic hydrocarbons of stormwater in the lower infiltration basin are likely to be slightly higher than those in the upper infiltration basin. However, the lower basin represents only approximately 10% of the total water infiltrated.

Based on this assessment, Kingett Mitchell Limited anticipate that any effects on groundwater from discharge of site stormwater would be less than minor. Consideration of effects on aquatic ecology have been addressed in section 5.3.4 below. A routine monitoring program would be developed for the site to assess any effects resulting from operations.

#### 5.3.2.3 Wastewater Management

##### Wastewater Characteristics

The site wastewater would be generated predominantly by toilet flushing, cafeteria wastewater (via a grease trap), washing and shower facilities. As the cement plant process does not involve any industrial or process type water discharges, the wastewater characteristics in terms of quality would therefore be consistent with domestic wastewater.

The wastewater treatment system would be established prior to other site works, so that it was available to process wastewater generated during the construction period.

The treated wastewater would be partially used for toilet flushing during construction. Any excess treated wastewater would be disposed of in a sub-surface irrigation disposal field to be installed in grassed landscape areas adjacent to site construction activities, with the disposal field installed at the start of the construction phase.

#### Treatment Method - Membrane Bioreactor

A number of options for wastewater treatment and disposal have been considered. A Membrane Bioreactor (MBR) option has been selected as it provides high quality treated wastewater, with the wastewater suitable for reuse for toilet flushing, water make up for the process water requirements, and irrigation of landscaped areas.

The MBR process is known to offer benefits over the other on-site options in terms of reduced operational and maintenance costs, reduced sludge production, and high levels of reliability combined with high levels of contaminant removal. In terms of treated wastewater quality they outperform all other treatment options.

Typical MBR effluent values for BOD<sub>5</sub>, TSS and TN<sup>5</sup> are likely to be under 5mg/L respectively. Typical faecal coliform concentrations in the discharge water are likely to be less than 0.1 coliform forming unit per 100mL, well below the primary contact guideline values from the Ministry for the Environment or ANZECC.

Disposal of the treated wastewater would only occur in the event that on-site demand is not sufficient to re-use all of the treated wastewater. In this unlikely event, the high quality of the treated effluent will mean disposal to ground via sub-surface irrigation of landscaped areas could occur with no more than minor environmental effects.

During the temporary and short term occasions when there was discharge of treated wastewater to land, low concentrations of soluble organics, suspended material and nitrogen would be discharged to land. The concentrations of these would be less than 5g/m<sup>3</sup> and in conjunction with the low hydraulic loading rate, the discharge contaminants would be retained and/or bioremediated by the surface soils, or taken up by plants.

#### 5.3.2.4 Water Supply Demand and Use

The site water supply requirements are small when considered in relation to the large scale and nature of the site activities. The low water demand is a result of the advanced cement process technology, which entails a dry process for producing cement.

#### Water supply from Bores

The preferred option for potable water supply is to abstract the cement plant water requirements from the underlying Waiareka Volcanic Aquifer. This option has been the subject of feasibility assessments into the potential groundwater volumes available and the acceptability of environmental impacts were the aquifer to supply the cement plant needs from three bores located within the plant complex.

The combined borefield capacity would be 6L/s as an instantaneous flow rate and a daily production up to 420m<sup>3</sup>/d (5L/s equivalent).

The water supply borefield abstraction effects assessment considered the following effects:

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<sup>5</sup> BOD<sub>5</sub> is Biochemical Oxygen Demand measured over a 5 day period, TSS is Total Suspended Solids, and TN is Total Nitrogen.

<p><b>The magnitude of any diminution of flow in Waiareka Creek.</b></p>	<p>The closest perennial surface water body is Waiareka Creek. The distance between the nearest part of Waiareka Creek and the investigation bore is 690m.</p> <p>The calculated long-term stream depletion is 1.8L/s out of the 6L/s abstracted. Regional Councils in Canterbury and Southland have adopted a 5 litre per second threshold in determining whether depletion requires recognition of surface water management in the allocation of groundwater to a well. As such the calculated depletion of creek flow of 1.8L/s would tend to diminish flow in Waiareka Creek by approximately 0.5% of mean creek flow. Such a diminution is practically infeasible to detect or quantify by any other means.</p>
<p><b>Drawdown in surrounding bores screened in the Waiareka Volcanic Aquifer or connected aquifer.</b></p>	<p>An adverse effect on a surrounding bore is defined in the Otago Regional Plan: Water as allowable water level decline of 2m of drawdown per 1,000m<sup>2</sup>/day of aquifer transmissivity.</p> <p>The tested aquifer transmissivity in the investigation bore was 15m<sup>2</sup>/d, and the allowance for acceptable drawdown is therefore 0.03m or 3cm.</p> <p>To test whether there would be a measurable effect greater than 3cm, calculations were carried out giving a radius of 1,320m, beyond which any drawdown is less than 3cm. The closest registered well in the ORC database is 450m away. However, every indication from its record is that the well is shallow and disused. The next closest well record is 500m away. Once more, this well is noted as disused. An irrigation bore located at the Parkside Quarry is approximately 1,000m from the investigation bore site. Effects on this bore are expected to be only a few centimetres (&lt;3cm).</p> <p>There are no known springs within the calculated radius of influence from the investigation bore.</p>
<p><b>Drawdown or other effect on the availability of the Groundwater Take Restriction Zone of either the Waiareka or Deborah Volcanic Aquifers.</b></p>	<p>The ORC Regional Plan: Water delineates a Groundwater Take Restriction Zone over the Waiareka and Deborah Aquifers. However, the Restriction Zone does not extend to cover all of the areas of the Waiareka Volcanic Aquifer. Areas outside the Restriction Zone include the Airedale Road area north of Weston.</p> <p>The same evaluation of the radius of no net effect as in assessing drawdown on surrounding bores was applied to assessing whether the Waiareka Groundwater Take Restriction Zone would be impinged on by the water supply well-field as though it lay at the position of the investigation bore.</p> <p>The resulting distance from the investigation bore is 1,320m, whereas the closest approach of the Waiareka Groundwater Take Restriction Zone is 1,400m from the investigation bore. The Deborah Groundwater Take Restriction Zone is a similar distance away. Therefore, no drawdown is expected to exert itself on the Waiareka Groundwater Take Restriction Zone as a result of plant water supply abstraction.</p> <p>The known groundwater flow pattern in the Waiareka Volcanic Aquifer is sub-parallel to the northern boundary of the Waiareka Groundwater Take Restriction Zone and towards Waiareka Creek. This pattern precludes the possibility of significant groundwater flow across the northern boundary of the Waiareka Groundwater Take Restriction Zone. Therefore, the interception of recharge by the water supply borefield would not have any potential to reduce the aquifer flow within the Waiareka Groundwater Take Restriction Zone.</p>

**Table 5.8: Borefield abstraction effects**

**5.3.3 Hazardous Substances**

A range of substances, classified as Hazardous Substances, would be stored and used on the Plant Site. These are listed in Section 3.2.13. In some cases (such as diesel) the quantities proposed fall within the levels permitted by the Waitaki District Plan, while others (such as ammonia) exceed these levels.

In all cases and with all substances, Holcim would ensure that the necessary primary and secondary containment systems are employed. This would involve a range of

measures appropriate to the specific substances and would be designed to ensure that there is no risk of hazardous substances gaining uncontrolled entry to the surrounding environment. There would also be relevant segregation of chemical storage.

All primary and secondary containment systems would be custom designed and built to control the substances, as they are at other Holcim sites. This design and control would be coordinated with the control mechanisms under other legislation e.g. the Hazardous Substances and New Organisms Act (HSNO).

Specialist training would be given to all employees using chemicals and handlers of hazardous substances would be appropriately certified under the HSNO regulations. Holcim would use a software package called ChemAlert to list all chemicals used at each site, their quantities, and storage locations. Material safety data sheets would be available for all chemicals at their dispensing points and also in a central location.

Spill kits, fire extinguishers, and other safety equipment would be suitably located around hazardous substance areas with appropriate signage. There would also be a trained emergency response team in case of accidents and fires.

Holcim currently have site contingency plans for all sites. These include emergency procedures and relevant training. All sites for this proposal would have applicable site contingency plans as per Holcim policy.

#### 5.3.3.1 Used Oil

Used oil, as a supplementary fuel to coal, would be transported to the Port of Timaru aboard a Holcim ship. All equipment for handling used oil would have high level, active and passive systems, to ensure both operator safety and prevent losses. The oil would be loaded into road tankers and transported to the plant site. Systems set up for the transport, handling and storage of used oil would be similar to that currently being employed at Westport.

The collectors filter the oil and remove water before it is delivered to Holcim, so that it has less than 10% water by volume. Testing is also carried out beforehand to ensure the quality is acceptable.

Used oil would be stored at the plant site in ten 200,000 litre tanks (7.2m high by 6m diameter). These tanks would be bunded as per the current HSNO requirements, including the ability to contain the entire contents of the largest container plus 10%. Adjacent to these tanks would be a tanker unloading facility comprising a pump house, truck shelter and control room.

The operation of the oil storage facility would be highly automated to ensure the minimum opportunity for operator error. On arrival the tanker driver would connect to the discharge pump and start the unloading sequence. The used oil would be filtered on arrival as it was being pumped a tank, and then again prior to the burners on the kiln.

All stormwater runoff from the tank compound and the tanker unloading building drains to a sump, which then passes through an oil/water separation and treatment system before discharging to the site stormwater system. All storage tanks would be provided with foam injection in the event of any fire, and a 350,000 litre water reservoir would be established on-site specifically for tank cooling and fire control.

All unloading operations would be carried out using a 'deadman' system, which will automatically shut down all operations in the event of an operator becoming distracted or incapacitated. The storage, handling and firing systems would be continuously monitored 24 hours a day by the kiln operators as is currently the case at Westport.

#### 5.3.4 Aquatic Ecology

The Ecology Report prepared by Boffa Miskell Limited (Appendix 9) covers aspects of Aquatic Ecology and Terrestrial Ecology (see section 5.3.5 below).

It is predicted that the groundwater take at Weston (by a borefield) may cause a depletion of creek flow up to a maximum of 1.8L/s. This equates to a diminishment of flow to the Waiareka Creek of approximately 0.5% of the mean flow and is in effect a withholding of water 'draining' to the Waiareka Creek rather than a draw down. Such depletion in relation to surface flow would not be discernible, or have any observable change to the aquatic habitat quantity or quality and therefore no faunal response.

Foreseeable contaminants in stormwater run-off associated with increased vehicle presence and hard surface parking areas at the Weston plant include polycyclic aromatic hydrocarbons, zinc, nickel, cadmium, copper and lead. These heavy metals are 'standard' results of urbanisation and industrial development. USEPA<sup>6</sup> criteria have been developed for these contaminants and are expected to be met by the proposal.

The risk of an increase in discharge of these contaminants related to the proposed development is small, especially where stormwater is managed onsite appropriately. Most metals in suspension bind rapidly with suspended sediments and would fall-out early from suspension in sediment traps. The effects on aquatic systems, should high levels be discharged, is generally slow and accumulative. The Ecology Report (Appendix 9) notes that research by the National Institute of Water and Atmospheric Research shows that raised levels of zinc and copper accumulated over many years in an urban area, but the adverse effects on benthic fauna remained difficult to detect.

In the Waiareka Creek there are no sensitive or particularly susceptible fauna remaining. This means that the consequence of stormwater discharges would be minimal as only the most tolerant species are present. However, the strategy proposed by Holcim is to avoid the discharge of untreated hard surface run-off.

The approach to stormwater management proposed for the Weston plant site is to maximise the amount of stormwater that is captured and available for reuse around the site. Stormwater exceeding the plant storage and use capacity would be stored in two soil adsorption basins and discharged slowly to ground. These infiltration basins present an opportunity on site to establish indigenous wetland features, promoting function as well as local indigenous biodiversity gains.

Wastewater, from human effluent, at the plant site would be treated on site via a membrane bioreactor system and reused for the majority of the time, with little discharge to ground. From an ecological point of view this system would achieve good water quality and a secure system. Total nitrogen has been estimated to be in the order of 5g/m<sup>3</sup> in the treated wastewater, which is very low and will therefore have no effect on a surface water system with existing high nitrogen levels.

Direct water modification would not be required within the 30-40ha Weston plant area as there are no water bodies present.

### 5.3.5 Terrestrial Ecology

The Ecology Report prepared by Boffa Miskell Limited (Appendix 9) covers aspects of Aquatic Ecology and Terrestrial Ecology (see section 5.3.4 above).

Vegetation would be removed at the Weston plant site as a result of access, stormwater treatment and works associated with the construction and operation of the processing plant. Almost all of this vegetation is pasture and crops, with no specific habitat for indigenous fauna.

The cement processing at Weston would result in emissions of a range of compounds. Of relevance to terrestrial ecology are two phytotoxic gases, nitrogen dioxide and sulphur dioxide.

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<sup>6</sup> The Australian and New Zealand Environment and Conservation Council and the United States Environmental Protection Agency.

The emissions of sulphur dioxide and nitrogen dioxide are predicted not to have adverse effects on vegetation in the vicinity of the cement plant because:

- the predicted emissions are below the short and long term published guideline critical levels and loads for plant damage; and
- the meteorological and soil conditions of the receiving environment further reduce that risk.

The dispersion modelling (URS Air Report, Appendix 14) indicates that at Weston the maximum predicted SO<sub>2</sub> ground level concentrations (annual average) are below the critical levels for lichen (a susceptible organism to SO<sub>2</sub>), and therefore also of higher plants. The 24 hour average concentrations are also predicted to be well below accepted guidelines. Critical loads generally relate to the acidifying effect of the pollutants on soils and are not expected to occur at the Weston site for the following reasons:

- Rain acidity, through wet deposition of sulphur dioxide in the form of sulphuric acid or sulphates, is a major mechanism for ecosystem acidification in humid regions subject to significant sulphur dioxide discharges. Rain acidity however reflects large region wide emissions of sulphur dioxide rather than local emissions (as will occur at Weston) as considerable distances are required for local emissions to mix to typical cloud heights.
- The nature of the soils at Weston reduce the likelihood of acidification of the soils. The soils on and near the site are mapped as melanic soils and these soils are by definition associated with lime rich rocks, and have high base saturation with particularly high exchangeable calcium and magnesium. This makes these soils particularly resistant to acidification through sulphate uptake.
- Most of the land in the vicinity of the proposed plant is managed for agriculture where fertiliser additions and nitrification will have a much greater effect on soil acidity than the predicted pollutant levels from the plant.

Nitrogen dioxide has only been demonstrated to have significant toxic effects on plants if sulphur dioxide (and ozone) is present at close to critical values. The dispersion modelling (URS Air Report) predicts the nitrogen dioxide levels would be well below the guideline levels, and with sulphur dioxide also being below the recommended levels there is not expected to be any phytotoxic effects from nitrogen dioxide.

The Air Report identifies several metals, which could be included in particulate discharges from the proposed manufacturing plant. The levels of emission are all predicted to be well below guideline levels (URS Air Report) and therefore will not affect vegetation or the wider ecosystem.

### 5.3.6 Landscape/Visual Amenity

The Landscape Report prepared by Boffa Miskell Limited (Appendix 8) analyses the direct effects of the plant site development on the landscape, and the visual effects from a range of distances and viewpoints. Additional photomontages are currently being prepared and will be available for public viewing as part of ongoing community consultation.

#### 5.3.6.1 Direct Effects on the Landscape

The proposed cement manufacturing plant would be a large-scale operation covering 30-40 ha in its extent and incorporating vertical elements averaging 40m and a main stack at 104m. This size and form of operation is in contrast to the existing small-scale industrial activities within the local landscape, and therefore has the potential to alter existing rural agricultural character and values over an extended area.

The proposed plant has been sited to maximise topographical and logistical benefits. It is of some significance that in the District Plan the plant site and surrounding land encompassing the proposed limestone/siltstone and tuff quarry areas are zoned a Cement Policy Area. This identification has been in place for some time and is an important consideration in terms of reasonable expectations for future change to the

plant/quarry site landscape. It is improbable that there is an alternative viable location that would be preferable in terms of modifications to the local rural landscape. Landscape impacts would nevertheless result from the change in land use, as well as the introduction of a number of large-scale structures into the existing rural landscape. The proximity of the plant to the Whitstone escarpment means it would indirectly impact upon that feature.

Any nominal loss of any existing scrub vegetation in the construction of the plant (and its associated infrastructure) would be effectively mitigated through amenity planting in association with the final plant layout. Furthermore, the creation of stormwater treatment ponds and basins in the northwest corner of the site would result in the introduction of potentially positive landform and waterbody features.

The proposal is assessed to have moderate effects on the plant site landscape, although the alteration to the underlying landform would be minor.

#### 5.3.6.2 Visual Effects

##### General

The tallest components of the plant are the stack at 104m and the pre-heater tower at 84m, which would be located in the south eastern portion of the site. The raw material storage areas (at a maximum height of 22m) would be located in the north western half. From distant views the tower and stack would be the most prominent features, particularly if associated with a visible water plume. From close views, the plant components would appear as a large single industrial complex.

The level changes and earth bunds within the plant site would provide some visual screening for low-level components of the plant, with boundary earth mounds and mitigation planting at least partially screening a number of the lower elements of the plant from key viewpoints. The manufacturing plant would take an estimated two years to construct, after which time it is expected that the potential visual impacts of the operational plant upon surrounding viewing audiences (rural residents, local farmers and road users) would remain relatively constant.

The air discharge report prepared for Holcim by URS sets out the likely appearance and visibility of the visible water plume from the main plant stack. It is anticipated that a white steam plume would, at times, occur above the stack. The plume size and shape would vary with the meteorological conditions - air temperature, relative humidity, wind speed and wind direction. The plume is likely to be at its most visually prominent during fine, cold, still conditions. In these conditions the plume may be very visible against a blue sky and rise to as much as 300 metres above the stack.

##### Immediate Range

Immediate views of the plant would be obtained from the Weston-Ngapara Road. The plant would first come into view from the junction of Weston-Ngapara Road with Kia Ora Road (northbound) and after the junction with Coal Pit Road (southbound). The approach to the Weston-Ngapara Road from Whitstone Five Forks Road, travelling eastwards, is directly focused on the escarpment. Both passing road users and residents would have substantial views of the proposed manufacturing plant at this close range, and it would have a high visual impact in this context. The component plant structures would obscure part of the escarpment face and would significantly occupy the foreground from some views, resulting in an associated reduction in visual amenity values. Roadside bunding however would assist in screening the lower components of the manufacturing plant in its northern sector, particularly in association with amenity planting.

Residents of Kia Ora Road, located 1.5km southwest of the proposed plant, would also experience a change in their current elevated northeast outlook across the Waiareka Valley in the direction of the escarpment. Whilst intermittent shelter-belts would screen portions of the plant, the proximity to Kia Ora Road means that the plant would be a prominent component within the outlook of most northeast views towards the

escarpment. In some views the top of the vertical stack of the proposed plant would be viewed above the height of the escarpment and any water plume would add to this visibility. The scale and geometry of the plant would contrast with the natural backdrop and the effects of the plant upon these views would remain high within this viewing range.

#### Middle Range

Elsewhere within the Waiareka Valley, views at lower elevations within a 2-5km range of the proposed plant would be locally restricted by intervening undulating topography, streamside vegetation and agricultural shelter-belts. Consequently the visual effects upon residents and road users located within the valley are assessed to be generally low. The plant would cease to be visible in views to the north of the Waiareka Stream and the Weston-Ngapara Road, although the water plume may be visible at times from a wider area, even when the plant buildings are out of sight.

#### Long Range

The plant would be visible in more elevated views (over 100m asl) from a distance of approximately 5.5km due west along the remote Round Hill Road. From the open vantage of this shallow ridge the proposed plant would be seen face-on in the context of the entire escarpment, between Teaneraki Cliff and Fortification Hill. Both the existing Parkside limestone quarry on Airedale Road, and the fertiliser plant located to the south on the Weston-Ngapara Road are also visible in this context. At similar elevations in the vicinity of Burnside (3-4km to the north of Round Hill Road) views of the proposed plant would become increasingly oblique. The substantial mitigation and amenity planting proposed to the north of the plant site, would further assist in both screening and providing a setting to the lower plant structures. However, in views from this direction the plant buildings and water plume, when visible, would be apparent.

#### Remote Range

The taller elements of the proposed plant would remain visible from elevated viewpoints up to 15km to the west and southwest of the site (including glimpses from SH1) at times. When a large water plume was present, the visibility may extend over a greater distance. However, from those distant views the impact of the plant would be considerably reduced and is likely to be negligible.

#### 5.3.6.3 Landscape Character

The Whitstone escarpment, along with Teaneraki Cliff, have been identified as prominent features within the Waiareka Valley landscape. The proximity of the plant at Weston to both of these landforms and the associated land use, landform and land cover changes would inevitably influence the existing landscape character of the wider area, which is historically dominated by farming. However, the site of the proposed plant is already zoned as a Cement Policy Area, for the specific purpose of manufacturing of cement.

Agricultural intensification within the Waiareka Valley and recent rural residential subdivision in the vicinity of Weston are evidence of the changing landscape. Nonetheless, the proposed scale of the cement manufacturing operations would alter the landscape character of the Whitstone escarpment area.

The significance of effect on landscape character is assessed to be moderate-high.

#### 5.3.6.4 Visual Amenity

The current visual amenity values of the local landscape are partly focused on the Whitstone escarpment and similar limestone features occurring within the wider Oamaru area. The proposed operations would undoubtedly affect these values. The contrast of the large-scale industrial plant structures with the rural landscape is the main source of adverse visual effects and associated loss of visual amenity values.

The water plume, when visible, would potentially add to awareness of the plant's presence. The effect of the plume on visual amenity is likely to vary with plume characteristics and with the viewer. Plumes may be used for orientation (if the stack is obscured) or act as a weather vane (wind direction) and therefore be seen as beneficial or benign by some. However, others are likely to see the existence of a plume as adverse to their amenity and a large plume would potentially extend the area from which the plant would be apparent.

Although having some positive effect, proposed amenity planting and earth bunding would not substantially reduce the effects of the plant structures upon local visual amenity values, and such effects would remain whilst the plant continued to operate. The design of the proposals however means the main escarpment face would be visually 'protected' through the use of a conveyor tunnel, as opposed to alternatives such as a cutting or haul road connection. The siting of the plant, towards the southern end of the escarpment face, is also beneficial in protecting the most impressive part of the landform.

### 5.3.7 Traffic

The Transport Report prepared by Traffic Design Group (Appendix 7), sets out the arrangements proposed for access to the plant site and internal traffic circulation routes, including car parking areas. The effects of these arrangements have been assessed to ensure the safety and efficiency of the adjacent Weston-Ngapara Road.

#### 5.3.7.1 Site Access

Two site accesses are proposed, both of which will link to Weston-Ngapara Road. Based upon the requirements for sight distance set out in the Waitaki District Plan, and the Austroads Guide to Traffic Engineering Practice, appropriate sight distances would be achieved from both site accesses, but works to the grassed bank on the northeast side of the roading corridor would be required to accomplish this. Detailed designs for the accesses prior to construction would be able to ensure that suitable sight distances are provided.

In respect of the appropriate form of the accesses, an evaluation of traffic flows (passing the site as well as turning into and emerging from it) shows that the volume of vehicle movements anticipated are within the Austroads criteria for a Basic Right Turn design for both accesses.

The frequency of turning vehicles is not considered to justify the provision of either an acceleration or a deceleration lane at either access location.

At the southeast access, when the maximum number of vehicle movements which may use the access is considered, a Channelised Right Turn arrangement may be required in the future, based on the number of turning vehicles. It is therefore proposed that the design of this access is reviewed when the cement plant is operating at full capacity in order to ensure that it remains appropriate for the traffic flows.

#### 5.3.7.2 Internal Design and Layout

In view of the size of the site, the opportunity has been taken to ensure that all vehicles would be able to easily enter the plant, manoeuvre within it, and exit again with no need for reversing.

At the northwest access to the site a distance in the order of 40m has been provided between the nearest traffic lane of Weston-Ngapara Road and the first point within the site where a vehicle may manoeuvre, which allows for at least two trucks to wait without affecting through traffic on Weston-Ngapara Road. Given that the expected frequency of vehicle arrivals is in the order of 6 to 9 per hour (one every 6 to 10 minutes), this distance is considered appropriate.

A parking/waiting area is to be provided for up to seven (inbound) trucks around 60m from the site access, with a weighbridge located around 80m to the northwest of these. The parking is to be positioned in such a way that other vehicles entering and

exiting the site are not obstructed, and there are additional lanes proposed on either side of the weighbridge such that a truck on the weighbridge does not block access into the site for others.

The access towards the southeast would be used by staff and visitors, meaning that the majority of vehicles would be cars and light vehicles, although in the event that a staff bus is operated it would also use this access. The proposed design provides for a distance in excess of 60m has been provided between the nearest traffic lane of Weston-Ngapara Road and the first point within the site where a vehicle may manoeuvre, which is sufficient for a queue of around 11 cars.

Allowing for the maximum figure<sup>7</sup> and for all vehicles to arrive over the course of 30 minutes, this equates to one vehicle arrival every 14 seconds. That being the case, it is extremely unlikely that the queue of vehicles waiting to enter the car park (and which are temporarily prevented from doing so by a manoeuvring vehicle) would exceed 11 vehicles. As a result, it is considered that any queuing vehicles would be easily accommodated within the site. Similarly, in the evening peak all queues of vehicles waiting to exit the car park would be contained wholly within the site.

Detailed designs have not yet been produced for the car parking area. However the physical size of the site is such that there are few restrictions on achieving a suitably practical design which meets the needs of its users.

### 5.3.8 Noise

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). The basis for the assessment of the noise level predictions is the set of noise rules for the Rural General Zone, as contained within the Waitaki District Plan. These noise rules set out maximum noise limits during different parts of the day (distinguishing 'daytime' from 'night time') and different days of the week. As these noise levels have been developed by the District Council for the area and are used consistently across all activities within the Rural Zone, they are considered to represent an acceptable level of noise within the rural environment.

In addition to the District Plan noise limits, the Marshall Day Acoustics report also considers:

- the New Zealand Environmental Noise Standards;
- response curves from international studies;
- World Health Organisation Guidelines; and
- Transit New Zealand Traffic Noise Guidelines.

At the nearest neighbouring residential units, during a typical day, the continuous cement plant noise should be just noticeable within the general ambient noise. During the night and on calm quiet days the cement plant would be clearly audible, but at a level which should not be disturbing. A level of 40dBA L<sub>10</sub> outside a residential unit would not interfere with any domestic activities and corresponds to a noise level inside bedrooms significantly below the threshold for sleep disturbance. Unlike all other existing noise sources the cement plant would be a continuous noise, which would cause a change to the noise character of the area around the cement plant.

#### 5.3.8.1 Noise sources and modelling

The potentially most significant element of the overall project in relation to noise is the cement plant itself. Other than occasional shutdowns for maintenance, the manufacturing process would operate continuously 24 hours a day for seven days a week. Therefore, for the majority of the cement plant, compliance with the stringent

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<sup>7</sup> Allowing for all workers to travel to the site in the morning and depart in the evening, as well as around a fifth of couriers, company vehicles and visitors, this suggests that around 70 - 130 vehicle movements could be generated in the morning and evening peak periods.

night-time noise limit (40dBA  $L_{10}$ ) from the Waitaki District Plan has been assessed at the notional boundaries of neighbouring residential units<sup>8</sup>.

Noise modelling has been undertaken based on noise data obtained from other similar cement plants plus an analysis of a range of appropriate attenuation measures. The cement plant noise levels would be substantially below the noise limits at all locations in Weston itself and the cement plant would generally not be audible in Weston. With the type of attenuation measures evaluated in the Noise Report, the cement plant can comply with the 40dBA  $L_{10}$  night time noise limit at the notional boundary of all neighbouring residential units.

There are no frequent meteorological conditions at this site which would significantly enhance noise levels at the nearest residential units. Therefore the noise control design and all noise predictions have been made for neutral meteorological conditions. This issue can sometimes be significant if there are frequent temperature inversions, which can increase propagation of noise as sound waves are diffracted down towards the ground, however URS data (Appendix 14) shows that this would only occur rarely. On rare occasions when there are strong inversions, Marshall Day Acoustics predict that the noise levels inside bedrooms of the nearest occupied residential units would still be significantly below the World Health Organisation threshold for sleep disturbance and residents would not be adversely affected.

To ensure that the noise levels from the cement plant comply with the 40dBA  $L_{10}$  night-time noise limits, a range of enhanced mitigation measures would be applied. The appropriate package of noise attenuation measures would be developed during the detailed design of the cement plant but are likely to include:

- Noise screening around all areas of the cement plant site containing significant noise sources.
- Orientation of buildings on site to provide localised screening of individual sources.
- Equipment or groups of equipment, which are often external in other cement plants, enclosed in buildings.
- Incorporation of vibration isolation measures.
- Fitting fans with attenuators.

#### 5.3.8.2 Noise budgets and limits

Marshall Day Acoustics has been responsible for the noise control of numerous large industrial sites. For most of these sites they have structured the noise control design using a 'noise budget'. The 'noise budget' takes the overall noise emissions from the cement plant site and divides these into allowable noise emissions from individual cement plant elements or groups of elements. Marshall Day Acoustics has prepared a draft noise budget for the cement plant. When the cement plant detailed design is developed, this budget would be amended according to the specific components. This process would be overseen by a suitably qualified acoustician.

The majority of the cement plant would operate over 24 hours and therefore would be designed to comply with the 40dBA  $L_{10}$  night-time noise limit. However, there would also be some activities at the site which only occur during the daytime period as defined by the District Plan. This daytime only activity includes trucks delivering coal, sand, used oil and gypsum to the site, conveyors coming from the limestone quarry, and loaders working around the additives and correctives stockpiles. For all of these noise sources the daytime noise limit of 55dBA  $L_{10}$  would be achieved.

As for night-time activities, with daytime activities the noise limit applies at the notional boundary of nearby residential units. However, as the daytime noise limit is less restrictive than the night-time limit, for fixed noise sources the aim would be to achieve the daytime noise limits at the site boundary where practicable. This should

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<sup>8</sup> Appendix 2, reference 4600 and 5816.

then result in noise levels at the notional boundaries of nearby residential units well within the daytime limits. For moving sources such as trucks and loaders, which are more difficult to attenuate, the daytime limit may only be met at the nearest notional boundary. The same noise budget approach used for sources operating over 24 hours is proposed for daytime sources. Again, this would be developed during the detailed design of the cement plant in the same manner as for 24 hour sources.

A noise budget for loading of the cement train is included in both daytime and night-time calculations. It is intended that generally the train would be at the plant site only during the daytime hours defined by the District Plan, and therefore the more lenient noise limit would be applied. However, if it proves necessary to operate outside these hours, additional attenuation measures such as high screening would be installed. With additional attenuation measures the more stringent noise budget would be achieved and the train loading would then be able to operate within the District Plan night-time noise requirements.

Primarily on the basis of the moving noise sources, calculations have been conducted to determine the extent of noise screening required around the cement plant site to achieve the daytime noise limits. Such screening would be incorporated into the cement plant and final landscaping. There would be a substantial earth bund along the entire length of the cement plant site by Weston-Ngapara Road. In other areas buildings have been orientated to provide localised screening. A fence/wall may need to be constructed along the railway siding to screen train wheel/brake/coupling noise and the bunding/screening would also attenuate many of the low height fixed noise sources around the cement plant site.

### 5.3.9 Community/Social

The Social Impact Assessment (SIA) (see Appendix 10) has considered site related social impacts for each site and addresses the perceived social consequences for local people to potential local environmental changes. In each neighbourhood, people put different emphases on these various perceived effects depending upon their location and individual perspective.

A considerable number of the potential effects are expressed as fears, annoyances, and uncertainty or unease (which can be referred to as anticipated or planning effects). There has also been anticipation of benefits. While the concerns or anticipated impacts may not eventuate, some fears and concerns could eventuate into actual long-term adverse effects, which may or may not be able to be mitigated.

The issues raised in relation to the plant site are varied and are set out in detail in the SIA. These include:

- Impacts on health and social and psychological wellbeing. This includes fears and anxieties as well as actual effects arising from the proposal e.g. potential for annoyance and stress from intrusive plant noises especially in evening, night time, and weekend, or damage to family and animal health from emissions from the exhaust stack and process activities.
- Impacts on the quality of the living environment e.g. potential for light pollution at night due to site and plant lighting.
- Economic and material wellbeing impacts e.g. increased employment for the wider community.
- Cultural impacts e.g. potential damage to local historic buildings from vibration.
- Impacts on family and community e.g. concern over social disruption arising from the possible establishment of a construction workers camp in the neighbourhood.
- Legal, political, and equity impacts e.g. perception of unfairness in the distribution of project social benefits and costs, with costs falling locally but benefits accruing to the wider community.

For each of the potential effects, the SIA has identified the likelihood of a social effect eventuating and has outlined the responses available both from Holcim and from

wider community resources. These responses include matters such as ensuring that the plant site complies with noise standards and air emission standards, through to the availability of support services based in Oamaru.

In most cases, local people's concerns or expectations of impacts/effects have been addressed through:

- the commissioned technical studies and assessments;
- recommendations made to and accepted by Holcim; and
- in changes already made to the project plans.

In some cases, the fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Similarly, other concerns cannot be addressed until the project components take physical form and the plant begins to function as an integrated operation.

The conclusions reached in the SIA in relation to effects range from those that can be avoided or mitigated, through to those which will have adverse effects on persons close to the plant site and which cannot be remedied. Those that cannot be remedied essentially relate to the obvious presence of the plant to those who live nearby and a permanent reduction in the quality of their living environments for various periods of time even with mitigation and control measures in place, and proven compliance with required Council standards. However, Holcim believes this needs to be considered in terms of the nature of activities contemplated by the identification of the land as a Cement Policy Area within the Waitaki District Plan.

### 5.3.10 Cultural

Potential concerns for Te Runanga o Moeraki (Appendix 11<sup>9</sup>) at the plant site centre on discharges and the potential for contaminants to enter the Waiareka Creek or groundwater. The stormwater treatment and containment system proposed would ensure that discharge was minimal and treated in a way that would not adversely affect receiving water. Storage and handling of fuel and other hazardous chemicals would be managed to avoid the risk of accidental spillage to surface water or to land. Likewise the discharges to air would be controlled to minimise any impacts on the mauri of the air.

### 5.3.11 Archaeology/Rock Art

The Rock Art and Archaeological Report (Appendix 13) considers these two interrelated aspects:

#### 5.3.11.1 Archaeology

There is the potential for the archaeology of the site to be impacted if any unrecorded archaeological sites present were damaged or destroyed during earthmoving activities. There is a potential for this to occur during the initial topsoil stripping stage and in the establishment of the cement plant (e.g. foundations, excavating stormwater basins, etc). The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

#### 5.3.11.2 Rock Art

Rock art, on Holcim owned land in the vicinity of the plant site, is fragile and is vulnerable to both direct and immediate damage from development and from subtle long term impacts. The two categories of threats to rock art sites are natural

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<sup>9</sup> Information identified as outstanding in the Cultural Impact Assessment was provided to the Runanga in January 2007. A peer review of this information, acknowledging that the outstanding information has now been provided, is attached to Appendix 11.

deterioration and human interference, although the two are linked. Natural deterioration can relate to factors such as moisture, physical weathering, biological weathering, or the microclimate.

Specific threats from the proposal to rock art could include:

- Emissions - specifically emissions lowering the pH of atmospheric water in a way that could cause 'acid rain' to damage the rock art. Based on URS emission analysis it is concluded that the potential for emission effects on rock art would be insignificant.
- Dust - this could collect on the rock surface and obscure the art, build up and provide conditions for lichen or plants to grow over the art, or act as an abrasive if wind speed and particle size were conducive. Any dust from the plant site would be unlikely to impact on rock art due to the distance from the plant site, the small particle size and the low concentrations.
- Vibration - through ground-borne vibration (e.g. from trucks). Vibration from these sources has been measured and vibration associated with the plant site would not appear likely to exceed 2mm/s peak particle velocity at the rock art sites (which is the most stringent level for the protection of buildings, ruins or monuments).
- Microclimate - particularly in relation to changes in relative humidity. Relative humidity is predicted to only have very localised changes, with no significant change in the vicinity of the known rock art. Weathering of the rock art is anticipated to be dominated by natural rainfall effects, with only minor changes to ambient relative humidity.
- Hydrology - the potential for changes in groundwater to alter the balance of moisture within the limestone. Development of the plant site would not impact on groundwater levels associated with the rock art, as groundwater adjacent to the rock art would be unaffected by the works on the plant site.

### 5.3.12 Historic Values

The Historic Archaeological Values Report (Appendix 12) considers the historic values within the site and surrounding area, and analyses how these may be affected by the proposal.

The Weston site has a long association with runholding and farming in North Otago, as James Hassell's Whitstone homestead on the Oamaru Run was situated in the Cave Valley from 1860. Early historical sites near to the plant site area include the formation of the Ngapara Branch Railway that passes immediately adjacent to the plant site, and the stone culvert in this section of the line.

These sites are of interest in a heritage landscape context, as they help with interpretation of the use of the North Otago hill country in the nineteenth and early twentieth centuries. The proposal will lead to visual changes to the heritage landscape, in particular the Hassell's homestead site.

The cultural plantings associated with Hassell's homestead and two Memorial Oaks are situated just outside the proposed works area. These would not be directly affected by any works on the plant site. The works on the plant site would affect the Ngapara Branch Railway formation in the plant site area and back to Oamaru, including the stone culvert. The reinstatement of the railway along the historical alignment would however continue the association of this corridor with railway activity.

### Summary of Effects at the Weston Plant Site

- The air emissions from the cement processing are not predicted to cause adverse effects on the environment with particulate concentrations predicted to increase in the immediate vicinity of the site, but not result in any significant increase in ambient concentrations at any occupied residential dwellings, in Weston or Oamaru.
- The remainder of the plant discharges to air would be well within their relevant assessment criteria, which have taken into account the potential for effects on human health, crops, gardens, pasture, etc. Therefore their effects are considered to be no more than minor.
- At times a water vapour plume may be visible. A small percentage of the time a tall plume may be visible. Visibility of a water vapour plume is largely dependant on temperature and relative humidity.
- There is little potential for adverse effects from emissions from the plant to cause acid deposition that would affect limestone buildings/structures or rock art in the area.
- The stormwater management concept is based on the principle of maximising the amount of stormwater that can be captured and used around the site for truck washing, process water make up, and the irrigation of landscaped areas. The water storage and adsorption basins would ensure that in other than extreme rainfall events, stormwater is disposed of to ground by infiltration. The resultant water discharge would not adversely affect groundwater resources, with no adverse pH or metal contamination effects.
- Wastewater would be treated through a Membrane Bioreactor giving highly treated discharge able to be reused where possible within the site. The majority of treated wastewater would be reused on site, and in the rare occasions this did not occur, it would be disposed of through subsurface irrigation of landscaped areas.
- Potable water is proposed to be obtained through a borefield on the site abstracting water from the underlying Waiareka Volcanic Aquifer. This borefield would not cause any quantifiable depletion of Waiareka Creek, or cause adverse effects on nearby bores/wells, or the nearby groundwater take restriction zones.
- Hazardous substances would be managed to ensure no risk of discharge to the surrounding environment.
- In the Waiareka Creek there are no sensitive or particularly susceptible fauna remaining. This means that the consequence of any stormwater discharges during extreme rainfall events would be minimal as only the most tolerant species are present. However, the strategy proposed by Holcim is to avoid the discharge of untreated hard surface run-off. The infiltration basins would present an opportunity on site to establish indigenous wetland features, promoting function as well as local indigenous biodiversity gains.
- Vegetation that would be removed from the plant site is pasture/crops and provides no specific habitat for indigenous fauna. The emissions of sulphur dioxide and nitrogen dioxide are predicted not to have adverse effects on vegetation in the vicinity of the cement plant because the predicted emissions are below the short and long term published guideline critical level and load for plant damage. The specific meteorological and soil conditions of the receiving environment further reduce any risk.

- The proposal would have moderate effects on the plant site landscape due to a change in land use brought about by the manufacturing plant operations, as well as the introduction of a number of large-scale structures into the existing rural landscape. Identification of the site as a Cement Policy Area within the Waitaki District Plan is an important consideration in terms of reasonable expectations for future change to the plant/quarry site landscape. The proximity of the plant to the Whitstone escarpment would impact upon the escarpment.
- It is anticipated that a white steam plume would, at times, occur above the stack. The plume size and shape would vary with the meteorological conditions - air temperature, relative humidity, wind speed and wind direction.
- Visual effects would range from high in the close-intermediate viewing range to negligible in the remote viewing range, as distance reduces the visual impact of the structures. The significance of effect on landscape character would be moderate-high. The contrast of the large-scale industrial plant structures with the rural Oamaru landscape is the main source of adverse visual effects and associated loss of visual amenity values.
- The two proposed site accesses can be located to provide sufficient sight distance in all directions, to ensure road safety is maintained on Weston-Ngapara Road. Based on traffic flows, basic right turn design accesses are proposed at both entrances as being appropriate to the local conditions.
- Queue distances and internal site accesses have been designed to ensure all vehicles can manoeuvre on the site without affecting the road network. There is sufficient area on the site to provide car parking to meet the needs of all users of the site.
- Noise attenuation would be provided to ensure that a noise limit of 40dBA L<sub>10</sub> would be met at all existing neighbouring residential units during all night time hours. Some activities at the site which would only occur during the daytime period (as defined by the District Plan) would operate to a maximum noise level of 55dBA L<sub>10</sub>. The cement plant noise levels would be substantially below the noise limits at all locations in Weston itself and would generally not be audible in Weston.
- A range of social/community consequences has been expressed by local people. In many cases concerns or expectations of impacts/effects have been addressed in the commissioned technical studies and assessments, in recommendations made to and accepted by Holcim, and in changes already made to the project proposals. In some cases, fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Resolution of others cannot occur until the project components take physical form and the plant, quarries, pits, and transportation begin to function as an integrated operation.
- Issues of interest to Runanga particularly relate to the quality of water and the stormwater, wastewater and site management controls are intended to protect the mauri of the waterways. The Runanga have drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air.
- Rock Art would not be adversely affected by changes to emissions, vibration, dust, microclimate or hydrology due to the plant site and associated manufacturing processes.
- The cultural plantings associated with Hassell's homestead and two Memorial Oaks are situated just outside the proposed works area. Any works on the plant site would not directly affect these.

Assessment of Actual or Potential Effects of the Proposal on the Environment

- The works on the plant site would affect the Ngapara Branch Railway formation in the plant site area and back to Oamaru, including the stone culvert. The reinstatement of the railway along the historical alignment would continue the association of this corridor with railway activity.
- The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## 5.4 Weston Quarries (Limestone/Siltstone/Tuff)

### 5.4.1 Slope Stability

Slope stability (Golder Associates Slope Stability Report, Appendix 17) has been considered in relation to disturbance of natural slopes, temporary faces during quarrying and final faces after quarrying is completed. Quarry walls would be cut to the final angle as part of the quarrying process.

#### 5.4.1.1 Natural Instability of the Escarpment

The quarrying operations have been planned so as not to disturb the prominent limestone escarpment bounding the northern and western extents of the Weston limestone quarry.

Rockfall from the escarpment may continue to occur. As no excavation or disturbance of the escarpment is proposed, no change in the risk of rockfall as a result of the proposed quarrying operations is expected.

None of the historic landslide features noted are assessed to be affected by the proposed limestone quarry directly. Similarly, as long as the quarry crest does not encroach onto the escarpment itself, quarrying is not expected to contribute to any further instability on the natural slopes below the escarpment. Vibrations from the proposed quarrying plan are expected to be negligible and are not predicted to have any detrimental effect on the stability of the escarpment or the natural slopes below. The set back distance between the quarry slope crest and the escarpment is intended to further mitigate the risk of any disturbance to the escarpment.

Limestone extraction and associated dewatering of the quarry may result in a reduction in groundwater pressures within the escarpment ridge. This would be expected to have an overall beneficial effect on global stability on the escarpment outer slopes.

#### 5.4.1.2 Limestone Quarry - Cut slope stability

Observations of the Ototara Limestone in the adjacent Parkside Holdings quarry indicate that very steep slope faces can be achieved with an apparent very low risk of failure.

The crest of the proposed quarry slopes would be set back from the crest of the escarpment to mitigate the risk of the quarry affecting escarpment stability. In the absence of specific information, a conservative 25m setback has been adopted for the quarry modelling carried out to date. Further investigation (likely to require geological mapping, discontinuity surveys and orientated cored drilling), is expected to support allowing a significantly lesser setback distance to be recommended along most of the escarpment. Locally however, this set back distance may need to be increased if adversely orientated joint combinations (possibly leading to localised wedge instability) are encountered.

Working faces would typically be flatter than final slopes to allow ripping and dozing operations, which are a key requirement for preparing the raw material for the cement process.

The siltstone is described as a weak to moderately strong calcareous siltstone. Cut slope angles in this material are not critical to quarry economics due to the relatively small volumes required, and a very conservative slope of 1V:2H (27°) has been adopted and no stability issues are anticipated at this angle.

#### 5.4.1.3 Limestone Quarry - Overburden stability

Overburden stripped from the limestone will comprise loess soil, with lesser amounts of limestone colluvium and topsoil. Slope angles within the overburden stockpile of 1V:2H should provide appropriate safety factors for stockpile heights of up to 10m. There is space for adopting shallower angles if greater heights of stockpile are required.

Loess is highly erodible when remoulded, and as such waste stacks will need to be contoured to discourage runoff concentration. Initial topsoil separation and use as re-vegetated cover to the loess for the life of the quarry would be undertaken if required.

#### 5.4.1.4 Tuff Quarry - Cut slope stability

It is expected that within the tuff quarry up to 10m of loess, limestone colluvium and slope debris would be encountered in places. This material overlies extremely to very weak weathered tuff. The most critical quarry slope would be the south-eastern quarry wall due to the expected height of up to 45m in places. A cut slope of 1 V:2 H has been used (27°), notwithstanding that the slopes are considered temporary as the quarry would be partially backfilled with overburden.

#### 5.4.1.5 Tuff Quarry - Overburden stability

Development of the tuff quarry would require stripping of overburden comprising loess, colluvium and slope debris. The upper 1 to 10m of the cut slopes would be formed in colluvium and slope debris from the escarpment above. This material would need to be locally battered back to a shallower angle. An overburden slope of 1 V:3 H (maximum 30m high) has been assumed for preliminary design purposes and it is intended that all overburden would be disposed of in-pit.

#### 5.4.1.6 Effects of tuff quarrying on natural slope stability

Any excavation into the slopes below the escarpment has the potential to reduce the global stability of the whole escarpment slope. Previous studies recommended that no excavation should occur within a plane projected at 30° from the crest of the escarpment. The tuff quarry currently proposed is located within this constraint.

Stability analyses have indicated that the presence of the tuff quarry does not significantly increase the likelihood of slope failure beyond that of the existing (unmodified) slope. The quarry crest has been positioned such that the toe of the debris lobe from a small landslide is not significantly affected by the proposed quarry wall. Additional investigations would be carried out in this area at design stage to fine tune the position of the quarry crest and prevent disturbance of the debris lobe of this feature.

### 5.4.2 Air Quality

The greatest potential for effect on air quality (URS Air Report, Appendix 14) from the operations of the main raw materials quarry are associated with dust emissions. The activities having the greatest potential to cause effects include:

- limestone ripping;
- topsoil and overburden removal;
- vehicle movements on haul roads;
- limestone, siltstone, and tuff conveyance to the plant site; and
- the limestone crusher.

Sensitivity to dust is particularly high where it impacts on where people live and dust is most likely to arise when conditions are dry and windy. The nearest residences in the area are in excess of 500m from the proposed quarry area, and on the opposite side of the Whitstone escarpment. The URS Air Report (Appendix 14) identifies this degree of separation as a significant factor in the mitigation of the potential effects arising in relation to dust. The effect of dust emissions from the activities associated with the establishment of the limestone and siltstone quarry are assessed to be no more than minor providing the appropriate dust mitigation measures are undertaken (see section 6).

There is potential for short term dust effects especially during dry and windy conditions. However, provided that mitigation measures are implemented (including the watering techniques and re-planting of cut/fill areas), the effects from operation

will not be dissimilar to that which would occur from rural activities in the surrounding area and therefore would be no more than minor.

Given the location on top of the limestone escarpment, there is also the potential for this dust to be visible. This potential would be reduced through the use of standard mitigation measures such as:

- Not removing topsoil during high wind speed conditions.
- Planting stockpiles as soon as possible.
- Imposing speed limits on construction machinery.

There would be emissions from operating vehicles and machinery, but these emissions would be negligible.

There is the potential for dust to be generated by the activity in the tuff quarry, and because of its proximity to Holcim's eastern land boundary, appropriate care will need to be taken during some establishment activities. Again, it is noted that the nearest residence will again be around 500m from the quarry boundary, therefore, providing appropriate dust mitigation measures such as watering are implemented, it is considered that the effect on ambient air quality from the activities associated with the establishment of the tuff pit will be no more than minor.

### 5.4.3 Water Management

#### 5.4.3.1 Water Management Strategy

The water management strategy for the Weston quarries (Appendix 15) covers both wastewater and quarry water. The components of water management relate to management of domestic sewage from site workers, water supply for site workers, dust control and management of quarry runoff. Quarry management of stormwater runoff includes undisturbed (clean water) and disturbed (quarry water) areas. The management of wastewater is a minor aspect of water management for the Weston quarries due to the small work force.

Quarry water management is the most significant aspect of water management at the Weston quarries. The management strategy for the Weston quarries is to divert all clean water that is unaffected by quarrying around the working areas. Runoff from all disturbed areas would be collected and receive primary treatment in one of two sediment ponds prior to discharge to an unnamed tributary of the Waiareka Creek.

The water management strategy, where possible, incorporates the water reuse principles also adopted for the plant site at Weston, however the nature of the operation limits the potential for water reuse in comparison. Quarry water collected for treatment would be used for dust control where possible, although it is expected the sediment ponds may be dry during extended dry periods and at these times water would be obtained from the North Otago Irrigation Company. Wastewater volumes are not sufficient to justify treating wastewater to the high levels required for reuse as per the plant site.

#### 5.4.3.2 Quarry Water Management

##### Runoff

Runoff from the limestone/siltstone and tuff quarries would be drained to sediment ponds before discharging into an unnamed tributary of the Waiareka Creek. Clean water runoff from the undisturbed catchment around the quarries would be diverted around and away from the quarries. The drains would discharge the diverted clean water into an unnamed tributary of the Waiareka Creek in a similar manner to what would occur naturally.

Ultimate closure of the Weston quarries would involve the formation of natural drainage patterns and removal of sediment ponds. Rehabilitation of the Weston quarry pits includes backfilling designed to ensure natural drainage of the pit base precludes formation of a pit lake.

### Staged Approach

The water management strategy for the project site has been separated into a construction stage and three quarrying stages; four stages in total:

#### Stage 1: Construction.

A prescriptive approach to control of water and mitigation of construction and quarrying related effects is proposed for construction. As a general rule, the approach described in the Auckland Regional Council's TP90, or more likely a suitable site specific derivation of them, would be applied. These earthworks management guidelines would be implemented with a focus on control of run-off water and potential sediment sources, and the use of temporary prescriptive measures such as diversions, silt fencing, operator practices, small sediment structures, etc.

The proposed construction sequence is to build the access road first, followed by haul roads, the clean water and some quarry water diversion drains, and the main sediment pond embankment. These would be completed prior to commencing overburden stripping. Even then, there would be some complexities in final scheduling and connections between streams, diversion drains, culverts, etc.

A Construction Management Plan would provide further details of the water management and control procedures.

#### Stage 2: Start-Up Quarrying.

Quarry water management is focused on draining runoff from the quarries and discharging the runoff to the sediment ponds. The clean water drainage systems would divert undisturbed catchment runoff away from the quarries and their associated quarry water drainage systems. Clean water drains would discharge directly to an unnamed tributary of the Waiareka Creek. Runoff from the limestone-siltstone quarry would flow to Sediment Pond A via a quarry water drain (refer Appendix 2). The initial Quarry Plan provides for gravity drainage from the limestone-siltstone quarry. However, in the event a variation from the quarry plan is required and gravity drainage is not possible, a pit sump could be excavated, where a contingency pump could discharge to a higher elevation quarry water drain that could discharge into Sediment Pond A via gravity.

Runoff within the tuff quarry would drain to the pit sump, where it would be pumped to a quarry water drain located along the northern side of the access road. During these early stages of quarry development the area of disturbed catchment that would contribute runoff to the pit sump is relatively small with the majority of the future footprint, which is undisturbed, being diverted away from the pit sump via a clean water diversion drain. Runoff from the access road, as well as water pumped up from the pit sump and workshop and amenity area, would flow to Sediment Pond B located to the west of the tuff quarry, via a quarry water drain that follows the access road.

#### Stage 3: Active Quarrying.

The third stage represents the progression of the tuff and limestone-siltstone quarries. By this time the tuff face would have advanced further to the west resulting in a larger disturbed pit area and a smaller undisturbed area being diverted into the clean water diversion drain. Runoff from within the tuff quarry would continue to drain to a pit sump and then be pumped up to the access road quarry water drain to be conveyed to Sediment Pond B. The limestone-siltstone quarry would be well established by this stage with a larger disturbed area, although the full extent of the final footprint would continue to drain to Sediment Pond A.

#### Stage 4: Final Quarrying.

The fourth stage represents a final footprint of the tuff and limestone-siltstone quarries. The tuff face would have advanced to its full extent to the west and by this time established a natural drainage pattern to the western edge of the pit where it would enter the quarry water drain and be conveyed to Sediment Pond B.

**Model Output and Predictions**

The following table outlines the outcomes from the water model in relation to the Weston quarries and the predictions for resulting water flows:

<b>Limestone/ Siltstone quarry</b>	Runoff from the walls and floor of the limestone-siltstone pit would drain to Sediment Pond A via gravity. Modelling indicates that 95% of the time the flow would be less than 1,439m <sup>3</sup> /d and 62m <sup>3</sup> /d for 50% of the time.
<b>Tuff Quarry</b>	<p>The operational area available on the floor of the tuff quarry is limited and as such the sump for Stages 2 and 3 would be configured as a relatively small pumping sump that could spill over across the pit floor to accommodate inflows from significant storm events. On this basis the size of the sump and the associated pump can potentially be adapted, within limits defined by operational space requirement, to permit an acceptable frequency of overflow across the pit floor. The location of the pit sump would change over time as the quarry floor moves as the tuff winning face advances. The runoff from the tuff quarry could be collected and gravity drained to Sediment Pond B during Stage 4.</p> <p>Modelling indicates that 95% of the time the flow would be less than 1,279m<sup>3</sup>/d. A 20L/s pump capacity would only result in operations in the pit being restricted by the pit floor being at least partially covered by overflow from the sump between 3% and 5% of the time. However, a smaller or larger pump capacity could be accommodated depending on the acceptable frequency of quarrying operations being interrupted. The sediment pond has been sized on the basis that the pit sump is pumped at 100L/s to the sediment pond to provide a conservative design to ensure that all flows entering the sediment pond are discharged via the decant for at least 95% of the time. The sediment pond would spill excess quarry water directly to the unnamed tributary of Waiareka Creek for the remaining 5% of the time or less.</p>
<b>Tuff quarry road and workshop</b>	Runoff from the tuff quarry road and workshop is to be collected and diverted via the quarry water drainage system to Sediment Pond B. The model indicate that 95% of the time the flow would be less than 112m <sup>3</sup> /day.
<b>Sediment ponds</b>	<p>The sediment ponds have been conceptually designed to provide sufficient sedimentation prior to discharge and that discharge would be via a decant structure for at least 95% of the time.</p> <p>Major storm events would result in occasional discharge (less than 5% of the time) via the spillways of both sediment ponds to the unnamed tributary of Waiareka Creek. The conceptual design of the two sediment ponds suggests a pond with a permanent water body of 2,500m<sup>3</sup>, with an additional 2,200m<sup>3</sup> of storage for routing of larger rainfall events, would be sufficient. When the stored volume in the pond reached a particular level water would be discharged at the specified rate.</p> <p>The model predicts that Sediment Pond A would discharge for 97.6% of the time and Sediment Pond B would discharge for 99.2% of the time via the decant with the spillways only operating the remainder of the time (2.4% and 0.8% respectively)</p> <p>The median residence time in the sediment ponds A and B are 1.4 days and 5.8 days respectively. The residence time in sediment ponds A and B is greater than 0.5 and 1.4 days respectively for 95% of the time. The overflow rates within the ponds (based on a 2,500m<sup>2</sup> surface area for both ponds) are less than 0.2 and 0.6m/day for 95% of the time respectively.</p> <p>The laboratory results suggest that greater than 90% removal of suspended solids should be achieved for 95% of the time and greater than 70% removal for the remaining 5% of the time when large rainfall events occur.</p>

<b>Clean Water Diversion Drains</b>	<p>The Weston quarries quarry water management system has three clean water diversion drains identified for Stages 2 and 3 and two clean water diversion drains for Stage 4.</p> <p>The clean water diversion drains have been designed to convey a 10% AEP event of critical duration. Clean water diversion drains have been conceptually designed to provide an indication of the required capacity and size at the lowest gradient along the drain alignment. The diversion drain sizes are:</p> <ul style="list-style-type: none"> <li>• The northern tuff clean water diversion drain has been estimated to require a 0.5m bottom width, and 2.5m top width at 0.5m. This provides for a conservative design flow of approximately 1m<sup>3</sup>/s.</li> <li>• The southern tuff clean water diversion drain above the confluence with the northern diversion drain has been also estimated to require a 0.5m bottom width, and 2.5m top width at 0.5m depth. This provides for a conservative design of approximately 1m<sup>3</sup>/s design flow.</li> <li>• The southern tuff clean water diversion drain below the confluence with the northern tuff diversion drain has been estimated to require a 2m bottom width, and 4m top width at 0.5m depth. This provides for a 1.7m<sup>3</sup>/s design flow to be conservative.</li> <li>• The limestone-siltstone clean water diversion drain has been estimated to require a 1m bottom width, and 2m top width at 0.5m depth. This provides for approximately 1.3m<sup>3</sup>/s design flow to be conservative.</li> </ul>
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**Table 5.9: Model outputs (Weston Quarries)**

Receiving Waters

The water balance model predicts the receiving waterway flows, as well as the discharges from the two sediment ponds.

The model predicts the flow in the unnamed tributary adjacent to Sediment Pond A is greater than 1,000m<sup>3</sup>/d (approximately 12L/s on average) for around 13.8% of the time, which reflects the dry climate conditions. The results suggest that following rainfall events the discharge from Sediment Pond A would contribute approximately 33% on average to the total flow in the unnamed tributary.

The model predicts the flow in the unnamed tributary adjacent to Sediment Pond B is greater than 1,000m<sup>3</sup>/d (approximately 12L/s on average) for around 41.5% of the time, which reflects the larger catchment of the tributary at the location of the pond. The results suggest the discharge from Sediment Pond A and B would contribute approximately 64% downstream of the discharge from Sediment Pond B.

The model predicts the flow in the unnamed tributary, adjacent to its confluence with the Waiareka Creek, is greater than 10,000m<sup>3</sup>/d (approximately 116L/s on average) for around 84.8% of the time, which again reflects the larger catchment of Waiareka Creek and the baseflow provided by the North Otago Irrigation Company water input. The results suggest that the unnamed tributary contributes approximately 3% of the total flow in the Waiareka Creek at its confluence. The sediment pond discharges therefore would contribute less than 2% of the Waiareka Creek flow.

Surface Water Chemistry Modelling

The chemistry of the discharges and receiving surface waters have been modelled and compared to the United States Environment Protection Agency (USEPA) criteria to assess their potential eco-toxicity.

The discharges from the limestone/siltstone treatment pond and the tuff treatment pond are expected to have less than minor effects on the chemistry of the surface waters, given:

#### Assessment of Actual or Potential Effects of the Proposal on the Environment

- The pH of both limestone/siltstone and tuff pond discharges are likely to be slightly elevated in the range 7.8 to 9.1.
- The pH of the Waiareka Creek downstream of the convergence of the unnamed tributary is predicted to be similar to upstream values.
- The concentration of trace metals in the limestone/siltstone discharge are likely to be below USEPA acute criteria.
- The concentration of trace metals in the tuff discharge are likely to be below USEPA acute criteria.
- The concentration of all trace metals in Waiareka Creek downstream of the convergence of the unnamed tributary are predicted to be below USEPA chronic criteria.
- The chemistry of the tuff pond discharge is dominated by groundwater inflow.

A routine monitoring program would be developed for the site to assess any effects resulting from operations (see Section 6).

#### 5.4.3.3 Wastewater Management Facilities

At the Weston quarries site, the wastewater would be treated and disposed to ground onsite. The textile packed bed reactor (TPBR) treatment system proposed is considered the most appropriate option for the site since it provides the best performance, is biologically stable and responds to sudden changes in organic loads. The TPBR, consistently removes nitrogen from the wastewater, suspended solids and oxidizes the organic carbon. TPBR treats the wastewater aerobically, and as a consequence very little (if any) odour would be noticed around the treatment plant.

After treatment, the treated wastewater would be disposed of to land, adjacent to the workshop facility. Due the level of treatment anticipated, the environmental effects of the discharge are anticipated to be less than minor.

#### 5.4.3.4 Water Supply

Water for the Weston quarries would be sourced from the sediment pond when available and from the North Otago Irrigation Company, along with potable water requirements, in those periods when the sediment pond is dry. There would be no effects from water take on any surface or groundwater resources at this site.

#### 5.4.4 Hazardous Substances

A range of substances, classified as Hazardous Substances, would be stored and used on the Weston Quarries site. These are listed in Section 3.2.13. In some cases (such as diesel) the quantities proposed fall within the levels permitted by the Waitaki District Plan, while others exceed these levels.

In all cases and with all substances, Holcim would ensure that the necessary primary and secondary containment systems are employed. This would involve a range of measures appropriate to the specific substances and would be designed to ensure that there is no risk of hazardous substances gaining uncontrolled entry to the surrounding environment. There would also be relevant segregation of chemical storage.

All primary and secondary containment systems will be custom designed and built to control the substances, as they are at other Holcim sites. This design and control will be coordinated with the control mechanisms under other legislation e.g. the Hazardous Substances and New Organisms Act (HSNO).

Specialist training would be given to all employees using chemicals and handlers of hazardous substances would be appropriately certified under the HSNO regulations. Holcim would use a software package called ChemAlert to list all chemicals used at each site, their quantities, and storage locations. Material safety data sheets would be available for all chemicals at their dispensing points and also in a central location.

Spill kits, fire extinguishers, and other safety equipment would be suitably located around hazardous substance areas with appropriate signage. There would also be a trained emergency response team in case of accidents and fires.

#### 5.4.5 Aquatic Ecology

For the Weston quarries, Kingett Mitchell Limited (refer Appendix 15) have assessed discharges related to potential stormwater from worked material and this has been further considered by Boffa Miskell Limited ecologists (Appendix 9). It is predicted that there would be little risk related to water contaminants.

It is proposed that the water is collected into primary treatment stormwater ponds (settlement ponds) prior to release into Troublesome Gully (effectively a vegetated swale). For ecological reasons it is also proposed (as enhancement, not mitigation) that discharge from that system is into a series of small gully wetlands formed by small earth bunds in Troublesome Gully in a cascade, prior to final discharge to a re-created wetland in the lower terrace (currently an ephemeral rain course), and from there to the Waiareka Creek.

Stormwater from the tuff quarry would initially be pumped to the same treatment system prior to the wetland being created. This would simply achieve, by appropriate sediment retention and organic filtering (swale/wetland), a good quality discharge to the Waiareka. With both strategies in place, the potential adverse effect can be managed to a level that is less than minor. The current values and condition of the potential receiving environment are such that the failure of these precautions in extreme events would have no serious adverse ecological effects.

At the Weston quarries the possible stormwater contaminants from quarry areas are nickel, chromium, zinc and pH changes related to limestone dust ( $\text{CaCO}_3$ ). The risk of release of these contaminants in harmful quantities is dependent on the quality of stormwater management at the quarry sites, however the proposed system has both the size and length of treatment, augmented with the use of natural systems, to ensure that contamination of the Waiareka Creek is highly improbable.

Other than periodic surface flow paths, no stream system would be intercepted or require diversion.

#### 5.4.6 Terrestrial Ecology

Vegetation would be removed at the Weston quarries site as a result of quarrying, roads, stormwater treatment and works associated with the construction and operation of the quarries. Almost all of this vegetation is pasture and crops, with no specific habitat for indigenous fauna.

One area with native species that would be affected by quarrying is at the north-eastern end of the escarpment in the rock outcrops above Troublesome Gully. Here there are two approximately 8m tall broadleaf trees and one mahoe, as well as scattered shrubs of *Coprosma propinqua*. This vegetation is typical of that found further west and south on the escarpment. Native invertebrates, lizards and birds may also use this area, but again it is typical of the habitat found along much of the escarpment.

This area is not considered ecologically significant but would be removed and therefore does trigger the restricted discretionary rule in the Waitaki District Plan of “no clearance of indigenous vegetation associated with limestone outcrops”. However, Boffa Miskell Limited ecologists (refer Appendix 9) consider that removal of this vegetation would have no significant adverse ecological effect as all of the species present are represented in greater abundance and in a less modified situation on the main escarpment, and this small patch provides no noticeable functional or habitat role.

#### 5.4.7 Landscape/Visual Amenity

The Landscape Report prepared by Boffa Miskell Limited (Appendix 8) analyses the direct effects of the Weston quarries on the landscape, and the visual effects from a range of distances and viewpoints.

##### 5.4.7.1 Direct Effects on the Landscape

The proposed tuff quarry is positioned at the foot of the northern end of the Whitstone escarpment, within existing fields on the edge of an area of high quality soils. In this location, towards the base of the Waiareka lower tributary stream valley, the pit is created from the lower portions of the escarpment slope. Vegetation would be removed from within the quarry area. The main effect of tuff excavation upon the immediate landscape would be the modification to the existing landform in the progressive development of the open cast pit. The temporary effects of extraction are in this way reduced through progressive backfilling in preparation for long-term rehabilitation.

The internal access road and its moderate impact upon the landscape would be mitigated through long-term rehabilitation of the site. It is anticipated that landscape effects from tuff excavation would be mitigated over time through appropriate rehabilitation.

The workshop, vehicle parking and office would be present for the duration of quarrying operations. This facility would be modelled on the form of existing farm buildings and therefore not result in significant adverse landscape effects, nor be inconsistent with agricultural intensification of the general area.

Limestone is to be progressively excavated, in a north-eastward direction, from an area of approximately 73ha behind of the Whitstone escarpment. The extent of excavations would cover much of the elevated top of the escarpment. A buffer strip would be retained along the inside of the escarpment crest to ensure the retention of the rock outcrops along the scarp face. However, a small portion (approximately 140m in length) of the escarpment crest immediately west of Troublesome Gully would be removed in order to access siltstone deposits. Overburden material would be made available for the early rehabilitation of the modified escarpment crest in this area, which would require careful re-contouring. The provision of a set back of the quarry from the escarpment crest would leave the remainder of the escarpment crest and its steep rocky face largely intact. Minimal areas of rock outcrops and associated scrub vegetation that extend beyond the proposed margin would potentially be removed in excavations. The back wall of the escarpment face would be excavated and benched, with an inter bench angle of 75%, which would enable its future planting. Generally, the proposed limestone quarry would be physically contained by the surrounding landscape.

The majority of the proposed quarry site is currently cultivated farmland. Excavation would result in a major change in land use and the modification of the existing landform, which is inherent in all quarrying activities, would be significant at the proposed scale of operations at Weston. Progressive rehabilitation is largely prevented by the simultaneous extraction of siltstone from within the main pit. There is no prospect of the limestone landform to the east of the escarpment being restored to its original state and the change to the existing landscape would therefore be permanent. The minimisation of residual landscape effects is largely dependent on the nature and effectiveness of the long-term rehabilitation proposals for the site following an estimated 30 years of operation. A major advantage of this site is that the excavated quarry pit would be almost entirely concealed within the existing landscape, avoiding direct impacts upon the main face of the south-western escarpment.

The operational quarry would involve various machinery, that would operate generally in the base of the quarry along with the screening/crusher plant. The construction of the tunnel through the escarpment linking the crusher unit with the plant site below would involve the removal of material from within the escarpment. The tunnel would

be approximately 200m long and the landscape effects would be very localised, compared to the alternative of overland haulage.

Water management strategies for both the limestone quarry and the tuff quarry would result in the need for small earth dams. These would be constructed beside the Waiareka tributary creek within Troublesome Gully and to the west of Coal Pit Road. Their construction and operation would be at an agricultural scale and would not result in an adverse effect on the landscape.

The Weston quarries would have moderate-high effects on the landscape, as they would result in a complete change in the existing agricultural land use, landform and land cover. Direct impacts upon the escarpment face and crest and associated scrub vegetation would however be avoided. Furthermore, the containment of the affected landform behind the escarpment face reduces the potential for landscape effects associated with this significant landscape feature. On both the limestone and tuff sites, the prospect of positive rehabilitation measures, with the objective of returning the land into productive agricultural use, would further help to offset any long-term effects.

#### 5.4.7.2 Visual Effects - Tuff Quarry

##### General

The area of the proposed tuff quarry is visually enclosed from the south and east by the surrounding limestone landforms. Excavations at the toe of the northern escarpment face, along the south of the quarry, would potentially be the most visible part of the proposal. Overburden stockpiles may protrude above the existing ground for an estimated period of 13 years. The overburden, where applicable, will be vegetated to reduce its visual impact. This would be backfilled into the excavated pit once steady state is reached and the remaining operations of the main pit would otherwise take place below ground level.

##### Immediate Range

Close views of the proposed tuff quarry are limited to the agricultural flats to the east of Coal Pit Road at the foot of the escarpment's north face. Views within 1-3km of the quarry in this area would be partly screened by existing shelterbelt vegetation and woodlots. The woodlots are associated with farmsteads adjacent to the north-west boundary of the quarry. The initial cut from the eastern end of the escarpment toe, which is not currently screened from the north, would therefore be the main source of potential visual impacts upon the outlook of a primarily farming audience. However, screening the northern boundary of the quarry, with appropriate planting on screen bunds, would mitigate this moderate adverse effect. The progressive excavation of tuff westwards between years 20-30 would remain largely concealed from these northern viewpoints by existing vegetation.

##### Middle Range

Enfield village, approximately 2km to the immediate west, is largely screened from the proposed tuff quarry by the intervening hillside. Other views of the proposed quarry from this direction are also limited by the existing vegetation to the north-west of the site, in combination with riparian vegetation associated with the Waiareka Stream in the foreground. The eastbound approach from the Weston-Ngapara Road beyond Enfield, although only 2km away would only be affected by the final stages of progressive extraction westward beyond year 20. Once again, additional screening along the western boundary of the tuff quarry would reduce the potential for views into the quarry from this direction. The relative elevation of the site above Coal Pit Road already restricts road user and residents' close range views into the site.

##### Long Range

Elevated, expansive views from the Burnside area approximately 5km to the northwest of the existing escarpment, look towards the northwest face of the escarpment. Along with Teaneraki Cliff, the escarpment remains a prominent feature in the background of

these middle range views. However, it is only from such relatively remote and elevated locations that partial views into the base of the tuff quarry may be possible during the final stages of extraction (viewed over the top of intervening vegetation). Screen planting along the immediate western boundary of the tuff quarry would largely mitigate views of the quarry from these locations. This would also help protect the visual integrity of the escarpment landform sequence.

The excavation of the back slope of the proposed tuff quarry may be able to be glimpsed through the Waiareka Valley in the vicinity of Windsor (7.5km to the northwest from the Weston-Ngapara Road). Again though, the screen planting along the western boundary would assist in restricting views into the quarry from this direction.

#### Remote Range

The proposed tuff quarry would not be discernible in remote views beyond a 10km range.

#### 5.4.7.3 Visual Effects - Limestone Quarry

##### General

The elevated rolling agricultural landscape to the east of the escarpment crest, from which both limestone and siltstone deposits are to be extracted, is physically and visually separated from the escarpment face. The easterly incline of this dip slope away from the high point of the escarpment crest excludes views into the limestone quarry from locations to the west. The proposed initial overburden and extracted limestone stockpiles have been located so as to prevent even temporary views of quarrying activities above the escarpment from the west. Potential views into the quarry from the east are largely controlled by the intervening topography. The early removal of siltstone from the northeast end of the escarpment crest would potentially be visible above the workings of the tuff quarry when viewed from nearby areas to the north of the escarpment. Stockpiling of overburden on existing ground above Troublesome Gully within the quarry footprint would cease when steady state was reached after approximately 20 years. At this time the overburden would be rehabilitated back into the quarry. The excavated faces of the main pit would however remain exposed during most of the operational life of the quarry.

##### Immediate Range

There are limited potential views into the proposed limestone quarry area from Airedale Road 2km to its east. Views into the quarry from most areas to the east are screened by the elevated landforms in-between the road and the escarpment top. Residents of Airedale Road, which include Rosedale Farm, would generally not have direct views into the quarry, due to the intervening topography and the eastward orientation of their buildings. Farm workers might, however, be exposed to more immediate views into the back face of the quarry from adjacent fields. From Airedale Road, east of Troublesome Gully, the northern end of the escarpment is currently visible through the small valley which separates the Whitstone escarpment from Teaneraki Cliff. There would be direct views into the main quarry pit from limited locations along this stretch of Airedale Road. At this point there are very few rural properties and the quarry would be viewed obliquely from the road. Both the early extraction of the western back wall of the quarry (immediately behind the escarpment crest) and the removal of the northeast 'nose' of the escarpment beside Troublesome Gully, would be clearly visible at this range. In particular, the initial cut of fresh limestone from the back wall would contrast with the greens and browns of the rolling agricultural landscape. For many passing motorists the experience of the quarry is likely to be reduced by views of existing limestone quarrying activities at Parkside, 2km further south. The weathering and planting of the back face of the quarry would significantly reduce the longer term impact of the exposed limestone face. The precise appearance would depend on the material characteristics of the exposed limestone. However, it is probable that the landform modifications in the northern part of the main pit would have a medium visual effect.

Airedale Road is well used by local traffic and it is important that the existing skyline of the escarpment is not breached in westward views across what is a dominantly horizontal agricultural landscape. The profile of the main overburden stockpile, which when at its maximum size, may just be discerned from Airedale Road, has been designed to marry in with the existing landform.

#### Middle Range

The removal of the north-eastern nose of the escarpment crest would also be visible in views from north of the quarry. From the unsealed Teaneraki Road, approximately 2.5km directly north of Troublesome Gully, modifications to the escarpment crest would be most visible towards the final stages of quarrying. Until this point, changes in the escarpment would be relatively indistinct when seen against the agricultural land immediately above Troublesome Gully. However, extraction up to the east boundary of the quarry, in the latter years of the quarry's life, would effectively remove a portion of land above Troublesome Gully. This would result in views into the quarry. However, this affects a relatively limited area. At a similar distance on the junction of Teaneraki Road with Coal Pit Road to the west, a backdrop to the northern escarpment would be maintained throughout the life of the quarry and modifications to the escarpment would be much less apparent.

The similarly remote Turfus Camp Road, 3km to the northeast of the proposed quarry, enables views across the limestone plateau into the back wall of the quarry. Existing shelterbelts currently provide some screening, but the visibility of the quarry would increase after two years as the back wall was excavated.

#### Long Range

Viewed from the east the back face of the proposed quarry would be visible in panoramic views from elevated locations on rural roads up to 6km away. This would apply to areas of Ardgowan and Rosebery - located to the southeast and northeast of the existing escarpment - at elevations of approximately 100m and 200 masl respectively. Within these areas there is a limited viewing audience of rural residents. The extent of visual impact from the limestone extraction would depend on the intervening landforms and vegetation, but is generally predicted to be low. However, the visual prominence of newly exposed limestone surfaces is likely to contribute to the increased visibility of the back wall of the quarry.

Inevitably the excavated limestone face would contrast with the adjacent rolling agricultural landscape. Therefore, it is proposed that the upper back face of the quarry is treated to reduce its potential visual contrast from these viewpoints.

#### Remote Range

There are no remote views of the proposed limestone quarry to the east.

#### 5.4.7.4 Landscape Character

The Whitstone escarpment, along with Teaneraki Cliff, have been identified as prominent features within the Waiareka Valley landscape. The proximity of the quarry proposals to these landforms would inevitably have effects on the wider landscape. The associated landuse, landform and landcover changes would also influence the existing landscape character of the wider area, which historically has been dominated by farming. However, as has been noted earlier, the site of the proposed quarry at Weston is already zoned as a Cement Policy Area within the Waitaki District Plan and identified for the specific purpose of extraction of limestone and tuff.

Agricultural intensification within the Waiareka Valley and recent rural residential subdivision in the vicinity of Weston are evidence of the changing landscape. Quarrying is an established activity within the locality. Nonetheless, the proposed scale of quarrying would alter the landscape character of the Whitstone escarpment area.

#### 5.4.7.5 Visual Amenity

Although quarrying is recognised as an existing activity within the local landscape, the scale of proposed limestone extraction at Weston is significantly greater than existing activities. However, the visibility of the limestone quarry would be largely restricted by existing landform and as such, only small parts of the quarry would be visible from other than aerial views.

#### 5.4.8 Traffic

Although the limestone, tuff and siltstone would be transported to the cement plant via a belt conveyor (meaning there would be no effects on the external road network), some traffic would be required to enter and exit the quarry site by road, particularly employees, contractors and service personnel, fuel tankers, and day-to-day deliveries to/from the cement plant site (refer Traffic Design Group Transport Report, Appendix 7). The presence of the escarpment limits possible routes for this traffic, and it is therefore proposed to form a new access road which joins onto Coal Pit Road and for these vehicles to use both Coal Pit Road and Weston-Ngapara Road.

At present, there is a farm access track which links to Coal Pit Road around 0.6km to the north of Weston-Ngapara Road. As the extraction of the weathered tuff would result in the removal of large sections of this track, and visibility to the right for emerging traffic would not meet the required distance set out in the District Plan, it is proposed to close this access and to form a new access some 15m to the south. This would ensure adequate visibility for traffic safety.

Coal Pit Road joins Weston-Ngapara Road around 2km to the northwest of the plant site. To the northwest of the intersection, Weston-Ngapara Road has minimal gradient but approaches the intersection on a horizontal curve. The overall effect is that the required sight distance in this direction would be easily met. To the southeast, sight distances are restricted by an earth bank on the northeast side of the intersection, which limits visibility to around 150m. However, this distance is relevant only for vehicles emerging from Coal Pit Road to turn northwest (towards Ngapara), whereas the majority of vehicles associated with the Weston quarries would be associated with origins and destinations to the southeast, including the deliveries to/from the cement plant, all contractors and the majority of employees. Holcim recognise that the sight distances to the east are limited in this location and this reduced visibility has the potential to lead to adverse road safety effects at the intersection. On this basis, Holcim would seek to improve the intersection to an appropriate standard, with the agreement of the Council (e.g. undertake earthworks to the adjacent bank).

An assessment has been made of the Approach Sight Distance of the intersection for a vehicle travelling northwest on Weston-Ngapara Road, to ensure that there is appropriate visibility should a vehicle be stopped on Weston-Ngapara Road when turning right into Coal Pit Road. This shows that a distance in excess of 200m is achieved.

On this basis, it is considered that the proposed traffic access arrangements to the quarry are suitable in maintaining the safe and efficient operation of the local roading network.

#### 5.4.9 Noise

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). As explained in section 5.3.8, the basis for the assessment of the noise level predictions is the set of noise rules for the Rural General zone, contained within the Waitaki District Plan. As these noise levels have been developed by the District Council for the area and are applied consistently across all activities within the rural zone, they can be considered to represent an acceptable level of noise within the rural environment. In addition to the District Plan noise limits, the Marshall Day Acoustics report also considers a range of other noise criteria.

The area of the limestone/siltstone quarry is relatively remote from neighbouring residential units and activity would occur during the daytime only. This distance alone would provide sufficient attenuation to ensure noise levels from the quarry did not exceed the 55dBA  $L_{10}$  daytime noise level at the residential units to the east<sup>10</sup>.

There are several different noise sources associated with the limestone quarry, however there would not be any blasting required and the method of using ripping by bulldozers is a relatively quiet technique. Measured at a distance of 10m, the source noise levels representative of the quarry equipment are expected to range between 82dBA  $L_{10}$  (medium loader) and 95dBA  $L_{10}$  (large loader), with equipment such as excavators, trucks and the crusher falling within this range. For all of these noise sources, except the crusher and large loader/excavator, at a distance of 500m, the noise level would be within 55dBA  $L_{10}$ .

There would be a cumulative effect of multiple noise sources operating at the same time. However, when considering this, noise should be assessed over a typical period such as an hour. The varying distances to sources (such as trucks moving from place to place over time) and the varying/discontinuous operation of equipment such as loaders means that assessing each source alone as operating continuously is a conservative approach, accounting also for the potential for cumulative effects.

The significant distance from the limestone quarry to residential units to the north and east means that all noise sources would be at or below a level of 55dBA  $L_{10}$  at these residential units. For the residential units to the west, the limestone escarpment would provide acoustic screening of quarry noise and this screening would increase as the quarry floor level was lowered. Even with just the initial screening from the escarpment, this would reduce noise levels from all equipment such that all sources including the large loaders and crusher would comply with the 55dBA  $L_{10}$  daytime noise limit.

The tuff quarry is on the lower slope of the escarpment around the corner from the cement plant site. The nearest residential unit<sup>11</sup> (on a different site) is around 450m to the north. Again, there would not be any blasting required and the method of using ripping is a relatively quiet technique.

Generally smaller and quieter equipment to that used in the main limestone quarry would be used for the tuff quarry. Marshall Day Acoustics have assessed that the bulldozer/ripper, loader and trucks would comply with the 55dBA  $L_{10}$  daytime noise limit at the nearest residential unit with no mitigation required. If for any reason larger equipment from the main limestone quarry were to be used in the tuff quarry, it would require noise screening from that nearest residential unit. This could be achieved by operating behind overburden stockpiles for example. If screening cannot be provided, only the smaller quarry equipment designated for the tuff quarry would be used in this location.

The site workshop and office facilities are proposed to be set back from Coal Pit Road. To ensure that noise from these buildings does not affect nearby residential units, all openings/doors to the workshop would face away from the nearest residential unit.

The maximum expected noise level of 55dBA  $L_{10}$  would not be continuous and would only be during daytime hours. This is a level of noise which would not interfere with most normal daytime domestic activities and already exists at some locations in the area, particularly near the busier roads. As such, it is considered that the District Plan daytime noise levels provide appropriate protection for residential amenity and that by meeting this limit the effect of noise from the quarries would be no more than minor.

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<sup>10</sup> Appendix 2, these residential units are identified by references 4712, 5857, 5868, 5888 on the aerial photograph contained in Appendix 2a.

<sup>11</sup> Appendix 2, reference 5847.

#### 5.4.10 Community/Social

The Social Impact Assessment (SIA) (see Appendix 10) has considered site related social impacts for each site and addresses the perceived social consequences for local people to potential local environmental changes. In each neighbourhood, people put different emphases on these various perceived effects depending upon their location and individual perspective.

A considerable number of the potential effects are expressed as fears, annoyances, and uncertainty or unease (which can be referred to as anticipated or planning effects). There has also been anticipation of benefits. While the concerns or anticipated impacts may not eventuate, some fears and concerns could eventuate into actual long-term adverse effects, which may or may not be able to be mitigated.

The issues raised in relation to the Weston quarries are varied and are set out in detail in the SIA. Many are the same as those expressed in relation to the plant site, however some are more specific to the quarries operation. These include:

- Impacts on health and social and psychological wellbeing. This includes fears and anxieties as well as actual effects arising from the proposal e.g. fears over increased physical threat or potential for accidents, especially involving local children, due to additional traffic on local roads.
- Impacts on the quality of the living environment e.g. potential for intrusive noise/s emanating from the quarry operations and establishment activities would undermine the quiet rural atmosphere.
- Economic and material wellbeing impacts e.g. expanded district economy from wages and company's local purchase of goods and services.
- Impacts on family and community e.g. gain in community members and social capital from project workers taking up permanent residence in the area.

For each of the potential effects, the SIA has identified the likelihood of a social effect eventuating and has outlined the responses available both from Holcim and from wider community resources. These responses include matters such as ensuring that the Weston quarries comply with noise standards, and the availability of support services based in Oamaru.

In most cases, local people's concerns or expectations of impacts/effects have been addressed through:

- the commissioned technical studies and assessments;
- recommendations made to and accepted by Holcim; and
- in changes already made to the project plans.

In some cases, the fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Similarly, other concerns cannot be addressed until the project components take physical form and the quarries begin to function as an integrated operation.

The conclusions reached in the SIA in relation to effects range from those that can be avoided or mitigated, through to those which would have adverse effects on persons close to the quarries. Those adverse effects essentially relate to the obvious presence of the quarries to those who live nearby and a permanent reduction in the quality of their living environments for various periods of time even with mitigation and control measures in place, and proven compliance with required Council standards. However, Holcim believes that this needs to be considered in terms of the nature of activities contemplated by the identification of the land as a Cement Policy Area.

#### 5.4.11 Cultural

Potential concerns for Te Runanga o Moeraki at the Weston quarries (Cultural Impact Assessment, Appendix 11) also centre on discharges and the potential for contaminants to enter the Waiareka Creek. The quarry water treatment and discharge

system proposed would ensure that discharge was treated in a way that would not adversely affect the Waiareka tributary and the Waiareka Creek itself. Storage and handling of fuel and other hazardous chemicals would be managed to avoid the risk of accidental spillage to surface water or to land. Likewise the discharges to air would be controlled to minimise any impacts on the mauri of the air.

Quarrying would alter the cultural landscape and the Runanga has drawn Holcim's attention particularly to the need to control quarrying activities within landscapes of cultural significance or highly visible landscapes, require management plans, and have particular control over earth disturbance.

#### 5.4.12 Archaeology/Rock Art

Refer to the Rock Art and Archaeology Report, Appendix 13.

##### 5.4.12.1 Archaeology

There is the potential for the archaeology of the site to be impacted if any unrecorded archaeological sites present were damaged or destroyed during earthmoving activities. There is a potential for this to occur during the initial topsoil stripping stage and during extraction. The necessary Archaeological Authorities would be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

##### 5.4.12.2 Rock Art

Rock art, in the vicinity of the Weston quarries, is fragile and is vulnerable to both direct and immediate damage from development and from subtle long-term impacts. The Weston quarries involve activities (quarrying, haul road, stormwater drainage) close to the rock art sites in the Troublesome Gully area.

The two categories of threats to rock art sites are natural deterioration and human interference, although the two are linked. Natural deterioration can relate to factors such as moisture, physical weathering, biological weathering, or the microclimate. Specific threats from the proposal to rock art could include:

- **Dust** - this could collect on the rock surface and obscure the art, build up and provide conditions for lichen or plants to grow over the art, or act as an abrasive if wind speed and particle size were conducive. Dust from the quarries operation would be unlikely to impact on rock art due to controls placed over operations in the vicinity of the rock art e.g. cloth screens during construction, and watering the haul road.
- **Vibration** - through ground-borne vibration from trucks, quarrying and crushing. Vibration from these sources has been assessed and it would not appear likely to exceed 2mm/s peak particle velocity at the rock art sites (which is the most stringent level for the protection of buildings, ruins or monuments), particularly with a buffer zone from the haul road.
- **Microclimate** - particularly in relation to changes in humidity. Relative humidity is predicted to only have very localised changes, with no significant change in the vicinity of the known rock art. Weathering of the rock art is anticipated to be dominated by natural rainfall effects, with only minor changes to ambient relative humidity.
- **Hydrology** - the potential for changes in groundwater to alter the balance of moisture within the limestone. Development of the quarries should not impact on groundwater levels associated with the rock art, as groundwater adjacent to the rock art would be generally unaffected by the quarrying activity.
- **Subsidence/destabilisation** - caused by either natural or anthropogenic events. Quarrying is not expected to contribute to any further instability on the natural slopes or the areas of rock art.

#### 5.4.13 Historic Values

The Weston site has a long association with runholding and farming in North Otago (Appendix 12), as James Hassell's Whitstone homestead on the Oamaru Run was situated in the Cave Valley from 1860. Early farming-related sites in the area being considered by Holcim include several rough stone walls and a stone platform. There is a lookout rock with legible dates from the very early twentieth century.

These sites are of interest in a heritage landscape context, as they help with interpretation of the use of the North Otago hill country in the nineteenth and early twentieth centuries. Therefore all practical efforts would be made to avoid damage to them.

The historic site that would be affected by the Weston quarries development is a short length of the rough stone wall on the northern escarpment. The sites that would not be affected are the stone platform in Troublesome Gully, the carved-name rock and the majority of the length of rough stone wall.

#### 5.4.14 Palaeontology

Holcim (through construction and quarry engineering staff) would record and advise of the discovery of any significant fossils, in accordance with relevant protocols to be detailed in the Annual Work and Rehabilitation Management Plan to be prepared for the Weston quarries. The objective is to ensure, where possible, the identification of any significant fossils unearthed during excavation.

#### Summary of Effects at the Weston Limestone/Siltstone/Tuff Quarries

- Slope stability both during quarrying and after rehabilitation has been considered and would be maintained through use of appropriate angles. Natural instability of the escarpment would not be increased by the quarrying activity.
- The main potential air contaminant from quarrying activity is dust associated with quarrying activities. The level of the effects of quarrying activities depends on the separation distance of sensitive locations from the activity, and the nature of the activities that are being carried out, along with use of effective dust management mitigation measures. Provided the appropriate management and mitigation measures and the necessary care is taken, especially during dry and windy conditions, it is considered that the effects of quarrying activities would be no more than minor.
- Water management would ensure that clean water is diverted around the quarried areas while quarry water is captured and treated through sediment ponds. The sediment ponds would capture all water 95% of the time prior to discharge into a tributary of the Waiareka Creek.
- The pH of discharge water would be slightly elevated in the range 7.8 to 9.1, while the concentration of all trace metals in the receiving water downstream of the pond discharge points and in the Waiareka Creek are likely to be below USEPA chronic criteria.
- Wastewater would be treated by way of a textile packed bed reactor adjacent to the workshop facility, ensuring high levels of treatment prior to discharge to ground.
- Water for dust control could be sourced from the sediment pond when available and from the North Otago Irrigation Company, along with potable water requirements, when the sediment pond is dry.

- There is little risk to aquatic ecology related to water contaminants from the Weston quarries. For ecological reasons it is also proposed that discharge from that system is into a series of small gully wetlands formed by small earth bunds in Troublesome Gully in a cascade, prior to final discharge to a re-created wetland in the lower terrace (currently an ephemeral rain course) and from there to the Waiareka Creek.
- Vegetation that would be removed at Weston as a result of quarrying is almost all vegetation pasture and crops, with no specific habitat for indigenous fauna. One area with native species to be removed is at the north-eastern end of the escarpment in the rock outcrops above Troublesome Gully. However, this vegetation is not significant and its removal would have no significant adverse ecological effect as all of the species present are represented in greater abundance and in less modified situation on the main escarpment, and the small patch provides no functional or habitat role.
- From a landscape perspective, a major advantage of this site is that the main quarry pit would be largely concealed within the existing landscape avoiding direct impacts upon the main face of the south-western escarpment. The proposal would have moderate-high effects on the Weston landscape, as there would be a complete change in the existing agricultural land use, landform and land cover within both the limestone and tuff quarry sites. Direct impacts upon the escarpment face and crest and associated scrub vegetation would however be avoided. The containment of the affected landform behind the escarpment face reduces the potential for landscape effects associated with this significant landscape feature.
- Visual effects are particularly related to the tuff quarry, which would be more visible from an intermediate distance. Glimpses of the limestone quarry may be had from limited locations. The significance of effect on landscape character would be moderate-high and it is important that the visibility of the limestone quarry would be restricted with only small parts of the quarry being visible from anywhere other than aerial views.
- A new entrance to the quarries would be established from Coal Pit Road, with sufficient sight distances to ensure road safety is maintained. As limestone, tuff and siltstone would be transported to the cement plant via a belt conveyor there would be no effects on the external road network from transport of raw materials.
- The distance from the limestone/siltstone quarry to residential units to the north and east means that all noise sources would be within the 55dBA  $L_{10}$  noise level at these residential units. For the residential units to the west the limestone escarpment would provide acoustic screening of quarry noise.
- The tuff quarry is proposed to be closer to a residential unit and so generally smaller and quieter equipment to that used in the main limestone quarry would be used for the tuff quarry. The bulldozer/ripper, loader and trucks would comply with the 55dBA  $L_{10}$  daytime noise limit at the nearest residential unit with no mitigation required. If larger equipment from the main limestone quarry is used in the tuff quarry it would require noise screening (such as working behind earth bunds) from that nearest residential unit.
- A range of social/community consequences has been expressed by local people. In many cases concerns or expectations of impacts/effects have been addressed in the commissioned technical studies and assessments, in recommendations made to and accepted by Holcim, and in changes already made to the project proposals. In some cases, fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Resolution of others cannot occur until the project components take physical form and the plant, quarries, pits, and transportation begin to function as an integrated operation.

Assessment of Actual or Potential Effects of the Proposal on the Environment

- Issues of concern to Runanga particularly relate to the quality of water and the stormwater, wastewater and site management controls are intended to protect the mauri of the waterways. The Runanga have drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air.
- Rock Art would not be adversely affected by changes to vibration, dust, microclimate, hydrology or stability from the operation of the Weston quarries.
- The historic site that would be affected by the Weston quarries development is a short length of the rough stone wall on the northern escarpment. Other historic sites in the vicinity (the stone platform in Troublesome Gully, the carved-name rock and the majority of the length of rough stone wall) would not be affected.
- The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.
- Holcim would record and advise of the discovery of any significant fossils, in accordance with relevant protocols to be detailed in the Annual Work and Rehabilitation Management Plan to be prepared for the Weston quarries.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## 5.5 Ngapara (Coal)

### 5.5.1 Slope Stability

Stability analyses (Slope Stability Report, Appendix 17) have been carried out to provide a preliminary slope profile for the temporary side-slopes of the pit. These slopes are considered temporary, as the pit would be at least partially backfilled upon completion of extraction.

#### 5.5.1.1 Cut slope stability

The proposed slope profile of 39° with benches, for the temporary cut slopes, is considered to be suitable for preliminary design, subject to the following additional considerations:

- adequate management of groundwater drainage;
- appropriate relief of any high groundwater pressures observed or suspected within the coal seam;
- management of any lower strength layers of exposed material; and
- management of any adverse geological characteristics (such as discontinuities) that become apparent during quarrying.

The Slope Stability Report provides recommendations to address these matters during quarrying operations.

#### 5.5.1.2 Overburden stability – Ex-pit ELF

The fine sand which comprises much of the overburden is likely to be susceptible to liquefaction during an earthquake event if it is placed loosely and allowed to become saturated. There are three avenues available to manage the risk of liquefaction, the first two of which, at least, are expected to be required:

- dewatering of the material in-situ prior to excavation such that it is not saturated when excavated, and
- provision of adequate drainage in waste stacks and ELF to prevent saturation from occurring after placement, and
- densification of the material such as dozer compaction in layers.

Laboratory compaction tests indicate that the silty sand requires comparatively little compactive effort to bring about a significant improvement in dry density (and therefore strength). Significant strength gain is expected in a short period of time due to compaction by placement plant and self-weight.

An 18° (1V to 3H) slope profile has been adopted for preliminary design subject to the following additional considerations:

- stripping of the ELF footprints prior to placement of overburden;
- provision of under-drainage to manage groundwater levels;
- provision of temporary impermeable capping or hydraulically isolated cells during ELF construction, if required, and a compacted low permeability siltstone layer immediately below the surface of the final landform during rehabilitation to reduce infiltration post closure;
- contouring of each ELF to discourage water penetration and encourage runoff;
- diversion of surface water away from ELF by suitable cut-off drains; and
- segregation of different overburden material types within the ELF and higher levels of compaction where necessary for stability.

#### 5.5.1.3 Overburden stability – In-pit backfill

Once an initial quarry pit has been established and sufficient space created, overburden would be replaced back into the pit behind the active extraction operation.

This would continue until extraction was complete, after which the pit would be partially backfilled and all remaining slopes re-contoured to 1V to 3H (18°) or less.

A slope of 1V in 2H (27°) has been adopted for temporary slopes within the quarry pit. These factors of safety are lower than those used for the long term ELF stability due to the temporary nature of the slopes within the pit.

The profile is considered to be suitable for preliminary design subject to the following:

- adequate management of groundwater levels;
- stripping of any saturated or softened material from the pit floor on which the backfill was placed immediately prior to backfill placement; and
- benching of pit floor slopes away from the toe of the slope, where required.

#### 5.5.1.4 Effects of extraction on natural slope stability

Several landslides at varying scales are evident on the steeper ground well to the north of the proposed pit. No evidence has been seen of existing instability adjacent to the pit, or in the vicinity of either of the ex-pit ELF. At this stage no significant adverse effects on natural slope stability due to the proposed extraction sequence are anticipated.

### 5.5.2 Air Quality

The main potential for detrimental effect on air quality (Air Report, Appendix 14) during the operation of the Ngapara site would be from dust. The main potential for particulate emissions are most likely to occur from:

- topsoil and overburden removal;
- coal extraction and processing; and
- coal load out.

Given the location of the pit area in the midst of land owned by Holcim, the available meteorological data, and the fact that the nearest residence would be a minimum of 300m from the eastern extremity of the southern engineered landform (ELF), it is not considered that there would be any significant effects associated with this work, provided that appropriate dust mitigation measures are implemented.

Although there is potential for short-term dust effects especially during dry and windy conditions, with the implementation of those mitigation measures discussed further in Section 6, it is considered that the effects from the operation of the Ngapara site would not be dissimilar to that which would occur from rural activities in the surrounding area.

### 5.5.3 Water Management

#### 5.5.3.1 Water Management Strategy

The water management strategy for Ngapara (Appendix 15) consists of three components relating to management of wastewater from site workers, water supply for site workers and dust control, and management of runoff from undisturbed (clean water) and disturbed (quarry water) areas.

The management of wastewater is a minor aspect of water management for Ngapara due to the small work force. Water supply would be sourced from the North Otago Irrigation Company.

Quarry water management is the most significant aspect of water management at Ngapara. The water management strategy is to divert all clean water that is unaffected by extraction around the working areas. Water associated with all other disturbed areas would be collected and receive primary treatment in a sediment pond. At least 95% of time, the discharge from the sediment pond would be treated by a water treatment plant prior to discharge to Bobbing Creek.

The Ngapara water management strategy would, where possible, incorporate similar water reuse principles adopted for other project sites. However, the nature of the operation limits the potential of water reuse in comparison to the plant site at Weston. Quarry water collected for treatment would be used for dust control where possible, although it is expected the sediment pond may be dry during extended dry periods. Wastewater volumes are not anticipated to be sufficient to justify treating wastewater to the high levels required for reuse as per the plant site.

#### 5.5.3.2 Quarry Water Management

The geochemistry of the Ngapara site overburden has been evaluated and would have implications for overall water management due to its potential impact on runoff chemistry from disturbed areas. The acid rock drainage potential at the Ngapara site varies with geology.

Runoff from undisturbed catchments (clean water) would be diverted away from the pit highwalls and ELF, discharging into an unnamed tributary of Bobbing Creek, or an unnamed tributary of Waiareka Creek.

Runoff from the disturbed catchments, including the Ngapara pit, in-pit fill, the soil stockpile and both ELF would be diverted either by pumping or through gravity drainage to the main sediment pond. The sediment pond would be designed to contain quarry water and discharge via a decant to a water treatment plant for at least 95% of the time, with the spillway discharging directly to Bobbing Creek less than 5% of the time. The water treatment plant would be designed to remove suspended solids (including coal fines) in order to provide a high quality discharge. The water treatment plant would also be capable of correcting pH to deal with any low pH resulting from overburden extraction or contact with the coal floor in the open pit. The water treatment plant would discharge the treated water into Bobbing Creek at the same location as the spillway from the sediment pond.

Runoff from parts of the in-pit backfill and parts of the northern ELF could not be conveyed to the sediment pond and would be managed separately through sediment ponds and wetlands.

At the end of pit life, natural drainage patterns would be reconfigured and the natural catchments reinstated as far as possible. Rehabilitation of the Ngapara pit includes backfilling designed to ensure natural drainage of the pit base precluding development of a pit lake.

#### Dewatering and water table decline

The need to dewater portions of pit floor by way of pit slope and toe drains would cause a localised decline in the water table, radiating outwards from the pit. The water table decline is asymmetric with the radius to the zero effect mark on the east at 1,200m and on the west at 835m. No bores or wells listed as operational are located within this area of effect.

#### Staged approach

The water management strategy for this site has been separated into a construction stage, 2 quarrying stages and a rehabilitated site stage:

#### Stage 1: Construction.

A prescriptive approach to control of water and mitigation of construction and quarrying related effects is proposed for construction. As a general rule, the approach described the Auckland Regional Councils TP90, or more likely, a suitable site-specific derivation of them, would be used. These earthworks management guidelines would be implemented with a focus on control of run-off water and potential sediment sources, and the use of temporary prescriptive measures such as diversions, silt fencing, operator practices, small sediment structures, etc.

The proposed construction sequence is to build the access road first followed by haul roads, the clean water and some quarry water diversion drains, and the main sediment

pond embankment. These would be complete prior to commencing overburden stripping.

A Construction Management Plan would provide further details of the water management and control procedures.

Stage 2: Active Quarrying.

Quarry water management at this stage would be focused on controlling runoff from the ELF, diverting clean water runoff away from the pit footprint, dewatering the Ngapara pit and minimising clean water runoff from entering drains discharging to the main sediment pond.

Stage 3: Completion of Quarrying

At this stage the pit would have reached its maximum extent and a significant portion of the waste rock derived from overburden stripping would have been stored in-pit. The elevation of the in-pit fill would exceed the elevation of the southern pit boundary. Quarry water drains would be in place around the top of the northern high wall and around the southern edge of the in-pit fill.

Stage 4: Rehabilitated site

The waste rock in the base of the pit would be contoured to permit a permanent naturalised drainage channel to be constructed discharging quarry water out through the haul road pit entry point and then via existing quarry water drains to the main sediment pond. Runoff from the ELF would continue to be directed into the main sediment pond.

This stage represents the final contours and layout for closure but does not represent the water management system at closure. The water management system at closure would require filling of the two clean water sumps and associated low areas to prevent ponding of water above the southern ELF. The filling of these low areas would allow the development of natural drainage patterns and removal of the requirement for pumping the clean water into the clean water diversion drain.

The treatment plant would be removed once the vegetated rehabilitated surfaces stabilise and drainage water is reflective of an undisturbed catchment. The sediment pond would either be removed or left as a water supply pond for farming purposes.

Model Output and Predictions

The following table outlines the outcomes from the water model in relation to the Ngapara pit and the predictions for water flows:

<b>Ngapara Pit sump and pump</b>	<p>The operational area available on the floor of the Ngapara pit would be limited and as such the sump would be configured as a relatively small pumping sump that could spill over across the pit floor to accommodate inflows from significant storm events. The location of the pit sump would change over time as the pit floor moves and the coal winning face advances.</p> <p>The sediment pond has been sized on the basis that the pit sump is pumped at 100L/s to the sediment pond to provide a conservative design. The treatment plant capacity has been set at 20L/s to ensure that all flows entering the sediment pond were treated by the treatment plant for at least 95% of the time. The sediment pond would spill excess quarry water into a receiving wetland before going to Bobbing Creek for the remaining 5% of the time or less, and is not predicted to adversely impact on downstream water quality as the receiving environment will have considerable dilution during these high flow events.</p>
<b>Overburden Storage Areas (ELF)</b>	<p>Runoff from the northern ELF is to be collected and diverted via the quarry water drainage system to the main sediment pond. The modelling indicates that 95% of the time the flow would be less than 159m<sup>3</sup>/day (1.84L/s).</p> <p>Runoff from the southern ELF is to be collected and diverted via the quarry water drainage system to the main sediment pond. The modelling indicates that 95% of the time the flow would be less than 325m<sup>3</sup>/day (3.76L/s).</p>
<b>Main sediment pond</b>	<p>Major storm events would result in occasional direct discharges via the sediment pond spillway to Bobbing Creek, whereas the largest component of the water flow from disturbed areas of the site would be pumped from the sediment pond to the treatment plant.</p> <p>In terms of potential direct discharges to Bobbing Creek, the worst case scenario modelled is represented by direct discharge of quarry water to Bobbing Creek about 2.1% of the time, which corresponds to 97.9% of the water collecting in the main sediment pond being pumped to the treatment plant. This corresponds to the treatment plant treating 90.8% of the average annual stormwater volume.</p> <p>The median water residence time in the pond is 6.8 days and 95% of the water entering the pond remains there for a period of more than 3.1 days. The minimum calculated water residence time is 0.4 days.</p>
<b>Clean Water Diversion Drains</b>	<p>The clean water diversion drains have been designed to convey a 10% AEP event of critical duration. The critical duration of each clean water diversion drain has been estimated based on overland flow path length, drain length and drain gradients. A conservative approach has been adopted to ensure that the diversion drain dimensions are all adequate for an approximate 1.3m<sup>3</sup>/s flow rate.</p>

**Table 5.10: Model Outputs (Ngapara)**

### 5.5.3.3 Ngapara Water Treatment Plant

The purpose of the water treatment plant (WTP) is to treat coal and sediment contaminated quarry water from exposed coal faces, coal stockpiles, engineered landforms and load out areas. The plant could also provide for the correction of pH, by adding lime, in the event that periods of low pH are experienced.

To achieve the required degree of suspended solids removal, laboratory test work undertaken indicates the quarry water would require treatment with a chemical coagulant to improve flocculation of suspended coal particles. An evaluation of different chemical coagulants identified alum (aluminium sulfate), as a product suitable for this application. Alum is one of the most common chemicals used to enhance the sedimentation of suspended and colloidal particles in municipal and industrial water treatment plants.

Alum is used beneficially in similar applications throughout New Zealand. The expected dose rate for alum would be several orders of magnitude lower than that typically required for municipal wastewater treatment.

Alum would consume some alkalinity when it was used to treat Ngapara quarry water. While rainwater is typically low in natural alkalinity it is expected the quarry water would have sufficient alkalinity from contact with the coal. It is expected the treated quarry water would have a near neutral pH value.

Alum is well documented as being non-toxic when used as a coagulant for the removal of suspended colloidal material. Optimization of alum dosing would minimize the use of alum to only that required for effective flocculation of the treated quarry water and no adverse environmental effects are expected as the result of the use of alum at Ngapara.

Following treatment through the WTP, it is anticipated the treated quarry water would have a total suspended solids concentration less than  $30\text{g/m}^3$ , although this would be higher during the commissioning period.

During WTP commissioning it is likely the treatment plant would be less efficient. The commissioning period is expected to last one month following installation of the WTP. Whilst a significant amount of non-complying water could be pumped back to the sediment pond during lower flow conditions, discharges of some non-conforming water may inevitably occur in this period.

#### Receiving waters

Treated quarry water from the Ngapara site, which is located close to the confluence of the Bobbing and Waiareka Creeks, would be discharged into Bobbing Creek about 1km upstream from the confluence.

A combination of natural climate patterns and abstraction of water from Waiareka Creek, upstream from its confluence with Bobbing Creek, results in Waiareka Creek being characterised by ephemeral flow at the confluence. Bobbing Creek flows are also ephemeral, both at the quarry water discharge area and downstream at the confluence. As a consequence, the worst-case scenario applicable to the discharge of treated quarry water is that the entire flow in the receiving catchment is derived from the quarry.

#### Surface water chemistry modelling

The chemistry of the discharge and receiving surface waters have been modelled and compared to USEPA criteria to assess their potential eco-toxicity.

The discharge from the Ngapara WTP treatment is expected to have less than minor effects on the chemistry of the surface waters. The assessment undertaken by Kingett Mitchell Limited enables the following conclusions to be made:

- The concentration of trace metals in the WTP discharge are likely to be below USEPA acute criteria.
- The pH of WTP pond discharge would be approximately neutral.
- The chemistry of the WTP discharge is predicted to be dominated by groundwater inflow.
- The pH of the receiving waters downstream of the WTP discharge is predicted to be similar to upstream values, and within the USEPA guideline range of 6.5 to 9.
- The concentration of all trace metals in Bobbing Creek, downstream of the WTP discharge, are likely to be below USEPA chronic criteria.
- The concentration of all trace metals in Waiareka Creek downstream of the convergence of the Bobbing Creek are predicted to be below USEPA chronic criteria.

A routine monitoring program would be developed for the site to assess any effects resulting from operations (see Section 6).

#### 5.5.3.4 Wastewater Management Facilities

The low volume of the wastewater requiring treatment limits the options available, and a textile packed bed reactor (TPBR) treatment system is proposed. This system provides the best treatment performance, is biologically stable, and responds to sudden changes in organic loads. The TPBR, consistently removes nitrogen from the wastewater, suspended solids and oxidizes the organic carbon. TPBR treats the wastewater aerobically, and as a consequence very little (if any) odour would be noticed around the treatment plant.

The treated wastewater would be disposed of to land, adjacent to the workshop facility. Due to the level of treatment anticipated and the low hydraulic loading the environmental effects of the discharge are anticipated to be minor.

#### 5.5.3.5 Water Supply

Water for dust control would be sourced from the sediment pond when available, and from the North Otago Irrigation Company, along with potable water requirements, when the sediment pond was dry. There would be no effects from water take on any surface or groundwater resources at this site.

### 5.5.4 Hazardous Substances

A range of substances, classified as Hazardous Substances, would be stored and used on the Ngapara site. These are listed in Section 3.2.13. In some cases the quantities proposed fall within the levels permitted by the Waitaki District Plan, while others exceed these levels.

In all cases and with all substances, Holcim would ensure that the necessary primary and secondary containment systems are employed. This would involve a range of measures appropriate to the specific substances and would be designed to ensure that there is no risk of hazardous substances gaining uncontrolled entry to the surrounding environment. There would also be relevant segregation of chemical storage.

All primary and secondary containment systems would be custom designed and built to control the substances, as they are at other Holcim sites. This design and control would be coordinated with the control mechanisms under other legislation e.g. the Hazardous Substances and New Organisms Act (HSNO).

Specialist training would be given to all employees using chemicals and handlers of hazardous substances would be appropriately certified under the HSNO regulations. Holcim would use a software package called ChemAlert to list all chemicals used at each site, their quantities, and storage locations. Material safety data sheets would be available for all chemicals at their dispensing points and also in a central location.

Spill kits, fire extinguishers, and other safety equipment would be suitably located around hazardous substance areas with appropriate signage. There would also be a trained emergency response team in case of accidents and fires.

### 5.5.5 Aquatic Ecology

At Ngapara the likely contaminants and substances that could cause pH changes are coal products, sulphurous compounds, zinc, lead and an acidic pH change, and these have been considered in the Ecology report (Appendix 9).

The risk of release of these contaminants (and sediments including coal fines) in harmful quantities to the main stem of the Waiareka system is dependent on the quality of stormwater management. At Ngapara the issue is considered minor due to operations size and the array of clean water diversions and treatments proposed. The Kingett Mitchell Limited Water Report (Appendix 15) details the proposed treatment system including catching clean water, sediment ponds, the treatment plant and various discharges.

All of the discharged water would pass through the sediment pond. 97.5 % of that water would also receive secondary treatment via the chemical treatment plant. Of

note is that 2.5% of the water may not receive secondary treatment and instead would be released directly from the sediment pond into Bobbing Creek tributary. This water may have raised turbidity, but such quantities are unlikely to have more than minor adverse effects on a system already tolerant of high contaminant loadings. Some form of secondary treatment of that water is desirable, though not necessary as mitigation, and thus it is recommended that the tributary below the sediment pond be enhanced to create a filter/assimilation wetland.

The wetlands would need edge protection from stock and would need to be given appropriate management to maintain healthy wetland vegetation and thus improve their polishing ability. The works required to improve the Bobbing Creek wetland would ensure effective stormwater treatment, and also increase indigenous biodiversity and representativeness in the Ngapara area.

Following the site treatment, stormwater would pass through Bobbing Creek wetlands and ephemeral sections or an ephemeral section of the upper Waiareka Creek, before it reaches the Queens Flat area. Both lower systems offer substantial further entrapment potential.

The proposed activities would intercept and cause significant change to the main Bobbing Creek tributary gully. Currently none of the gullies at Ngapara (including this one), contain permanent aquatic habitat or aquatic conservation values. Thus diversion work or assimilation of hill gully flow paths would have no adverse effect on aquatic ecosystems of the area.

#### 5.5.6 Terrestrial Ecology

At Ngapara, the pit areas and access routes do not cause the loss of any indigenous or significant vegetation or terrestrial habitat or community. The south-western gully, although largely exotic and highly modified, would not be adversely affected through development. The gully may receive quarry pit stormwater or other unplanned surface flows, but contamination by sediments or other products is unlikely and would have no adverse effect on the largely sediment inundated exotic wetland vegetation.

The Waitaki District Plan is specifically concerned with earthworks and clearance of indigenous vegetation in close proximity of streams and wetlands. The main gully (a tributary of Bobbing Creek) would lose part of its upper ephemeral section and the greater portion of its lower-middle section to quarrying works and overburden accommodation. Furthermore, the lower section would likely be replaced by stormwater treatment facilities. The proposed works would involve the clearance of the exotic riparian and wetland trees and the two small *Carex secta* wetland areas, as well as possible infilling of the gully bottom. Despite these features being the only indigenous vegetation areas in the gully they are common species, in poor condition, currently threatened by stock and assessed to offer no essential function or conservation role. Boffa Miskell Limited ecologists (Appendix 9) predict their loss would cause no significant adverse ecological effect.

The Bobbing Creek raupo wetland, locally the most valuable wetland area, is not directly affected by the proposal.

#### 5.5.7 Landscape/Visual Amenity

##### 5.5.7.1 Direct Effects on the Landscape

At Ngapara coal would be extracted by earthmoving in successive northward strips from an initial open cast pit. Large volumes of overburden would be stockpiled into the permanent ELF and smaller volumes of overburden would also be utilised in the formation of haul roads, laydown areas and water management structures. Subsequent overburden would be available for backfilling within excavated areas as part of a progressive rehabilitation programme enabling rehabilitation to commence at the earliest opportunity.

Although the extraction of coal would invariably result in landform modifications, this impact would be partly offset by the natural depression in the existing landform. The

permanent ELF have likewise been carefully sited and contoured to marry in with the existing undulating landform. Dependant upon the final volumes of overburden available for backfilling, it is possible that the site could be rehabilitated with minimal residual effects upon the immediate and surrounding landscape. The removal of existing gorse scrub from this extensively managed rough grazing site would not result in significant landscape impacts.

The associated stormwater management proposals would involve the diversion of existing ephemeral watercourses within the site and the construction of a permanent water treatment pond. These proposed modifications to site drainage and landform would be absorbed into the existing undulating terrain of the site interior.

An 8m wide haul road would sever an existing stand of woody scrub vegetation on the hill above Weston-Ngapara Road before winding northwards up through the site interior to the southern boundary of the coal pit. The footprint of the haul road would also include substantial embankment cuts in places. However, the scrub vegetation to be removed has been assessed in the terrestrial ecology report (Appendix 9) to be of low value. This road would also access a workshop facility and office building located to the south of the pit, neither of which are expected to impact substantially upon the existing landscape, which already accommodates existing small-scale gravel extraction operations nearby.

There would be a substantial change in the existing agricultural land use, landform and land cover at this site, including the introduction of new landforms. However, in restoring the landscape back to productive use consistent with the surrounding landscape, the residual effects upon the Ngapara landscape are assessed to be low-moderate.

#### 5.5.7.2 Visual Effects

##### General

The proposed coal pit is nestled within the generally undulating Downlands above Ngapara village. The complexity of the local landscape generally prevents long-range views into the site. Although the site is approximately 1km from Ngapara, the steep incline of the terrain to the immediate north-east of the village prevents views of it. Beyond the settlement, the landscape is typically remote and sparsely populated. The permanent engineered landform features are an additional source of visual impacts upon local isolated viewpoints.

##### Immediate Range

The most immediate views of the proposed coal site would be obtained from elevated viewpoints located along sections of Georgetown-Ngapara Road to the north and north-west of the pit. The coal pit would be directly overlooked from sections of this road. The progress of excavations would be immediately visible to motorists travelling along the road throughout the pit's life. As extraction progressed northwards, the visible extent of operations would increase through the simultaneous advance of the extraction face and retreat of the existing landform in the foreground of views. At the same time, the back wall of the pit would be backfilled using in-pit overburden (with associated increase in elevation). This would become closer and more apparent when viewed from the road. In terms of visual impacts upon viewers, it is also considered significant that the existing long-range views across the remote rural landscape from the Ngapara-Georgetown Road in the direction of Oamaru are not compromised. The progressive rehabilitation of the resulting landforms, through grading and seeding the modified slopes, should reduce the significance of visual impacts from this relatively remote roadside location to being of medium significance.

From isolated viewpoints below the site on Bobbing Creek Road and Paterson Road to the east, and from the main Weston-Ngapara Road to the south, it would be possible to see the ELF protruding above the existing terrain. The new landforms are proposed to be entirely consistent with the profiles of the existing backdrop of hills and once rehabilitated would take on a similar appearance.

### Middle Range

From approximately 2km to the south-west of the site, the pit would be visible from the opposite side of the Waiareka valley. Farm residences, which are accessed by the gravel Paradise Gully Road, currently have views across the valley towards the site. Their outlook significantly includes the existing gravel quarry just north of Weston-Ngapara Road. Although these residents would be exposed to direct views of the coal pit operations, the impact of these middle range views would be seen in the context of that existing quarry. During the establishment stages of coal quarrying the visible extent of the coal pit would be only slight in views from Paradise Gully Road. By approximately year 15, extensive rehabilitation of the site would have occurred, including stabilisation and seeding of the elevated landforms, anticipating these features becoming visually integrated within the existing terrain.

#### 5.5.7.3 Landscape Character

The proposed Ngapara pit is predominantly within the Ngapara-Oamaru Downlands, whilst also being close to the boundaries of a different adjacent Landscape Character Area (Island Cliff). The Ngapara-Oamaru Downlands exhibit the characteristic undulating topography that would contain the proposed pit area and associated landform modifications. Ultimately, the existing rural productive landscape character is to be maintained through the long-term rehabilitation proposal and the avoidance of permanent adverse effects upon significant landscape features or characteristics. Accordingly, the significance of effect on landscape character would be low.

#### 5.5.7.4 Visual Amenity

Proposed coal extraction activities at Ngapara is similar to existing quarrying operations within the vicinity. The visual containment of the site is a key factor in limiting any potential loss of visual amenity values.

#### 5.5.8 Traffic

It is proposed that the coal pit would be served by an access road (Appendix 7) which links directly onto the northern side of Weston-Ngapara Road at a point around 0.8km to the east of Paradise Gully Road (approximately mid-way between Bobbing Creek Road and Paradise Gully Road). The section of Weston-Ngapara Road onto which access is proposed is both flat and straight over a distance of around 0.7km. The site access can be sited to ensure that the appropriate sight distances are achieved.

The topography of the land to the northeast of the proposed access rises steeply. This may affect the gradient of the access road, and careful design prior to construction would seek to ensure that road safety issues are not introduced through descending vehicles losing control and hence failing to 'give-way' when entering onto Weston-Ngapara Road.

#### 5.5.9 Noise

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). As explained in section 5.3.8, the basis for the assessment of the noise level predictions is the set of noise rules for the Rural General zone, as contained within the Waitaki District Plan. As these noise levels have been developed by the District Council for the area and are applied consistently across all activities within the rural zone, they can be considered to represent an acceptable level of noise within the rural environment. In addition to the District Plan noise limits, the Marshall Day Acoustics report also considers a range of other noise criteria.

The nearest residential units<sup>12</sup> to the coal pit site are at least 500m from the coal pit itself and only one residential unit is within 500m of the closest ELF, at a distance of around 250m.

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<sup>12</sup> Appendix 4, references 195, 5647, 5640.

Noise sources operating within the coal pit, such as the two excavators, would be screened by the terrain from nearby residential units. With around 500m distance and terrain screening it is predicted that all coal pit noise sources would be within a level of 55dBA L<sub>10</sub> at the nearest residential units.

The two ELF are proposed to be located further than 500m from the two nearest residential units<sup>13</sup> next to Ngapara township, so trucks and bulldozers working in these areas are also expected to meet a level of 55dBA L<sub>10</sub>. For the nearer residential unit<sup>14</sup> on Bobbing Creek Road, there is a hill immediately behind the house, which would provide screening from the northern ELF. The bottom of the southern ELF would also be screened from that residential unit by a ridge. Noise from works in these areas would be within a level of 55dBA L<sub>10</sub>.

However, the top half of the southern ELF would rise above the ridge and be visible from the nearest residential unit<sup>15</sup>. The trucks and bulldozer constructing the top of this southern ELF would not be screened by landform and are predicted to generate approximately 60dBA L<sub>10</sub> at the residential unit. A daytime noise limit of 60dBA L<sub>10</sub> is common in other Districts for business type zones. Marshall Day Acoustics do not consider this an unreasonable level of daytime noise for this activity, particularly given that the construction of the top half of the southern ELF would be for a finite duration (in the order of 2-3 years). If the development of the ELF was considered as construction activity, the noise levels would be significantly below the standard construction noise limits. Furthermore, the southern ELF is to be constructed on land owned by the occupant of the nearest residential unit. Therefore, this ELF would only be built with the agreement of the occupant of that residential unit.

The maximum expected noise level of 55dBA L<sub>10</sub> would not be continuous and would only be during daytime hours. This is a level of noise which would not interfere with most normal daytime domestic activities and already exists at some locations in the area, particularly near the busier roads. As such, it is considered that the District Plan daytime noise levels provide appropriate protection for residential amenity and that by meeting this limit the effect of noise from the pit would be no more than minor.

#### 5.5.10 Community/Social

The Social Impact Assessment (SIA) (see Appendix 10) has considered site related social impacts for each site and addresses the perceived social consequences for local people to potential local environmental changes. In each neighbourhood, people put different emphases on these various perceived effects depending upon their location and individual perspective.

A considerable number of the potential effects are expressed as fears, annoyances, and uncertainty or unease (which can be referred to as anticipated or planning effects). There has also been anticipation of benefits. While the concerns or anticipated impacts may not eventuate, some fears and concerns could eventuate into actual long-term adverse effects, which may or may not be able to be mitigated.

The issues raised in relation to the Ngapara site are varied and are set out in detail in the SIA. Many are the same as those expressed in relation to the plant site, however some are more specific to the pit operation. These include:

- Impacts on health and social and psychological wellbeing. This includes fears and anxieties as well as actual effects arising from the proposal e.g. fear over damage to human and animal health from coal dust emanating from pit activities.
- Impacts on the quality of the living environment e.g. perceptions of unattractive alteration to the rural/pastoral landscape.

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<sup>13</sup> Appendix 4, references 5647, 5640.

<sup>14</sup> Appendix 4, reference 195.

<sup>15</sup> Appendix 4, reference 195.

#### Assessment of Actual or Potential Effects of the Proposal on the Environment

- Economic and material wellbeing impacts e.g. potential for increased work and difficulties in moving stock on Bobbing Creek Road, due to increased traffic.
- Impacts on family and community e.g. the perception that pit development is incompatible with existing local community life-styles.
- Legal, political, and equity impacts e.g. concerns that local people would be at a disadvantage in negotiations with Holcim due to differences in resources available and likely company influence.

For each of the potential effects, the SIA has identified the likelihood of a social effect eventuating and has outlined the responses available both from Holcim and from wider community resources. These responses include matters such as ensuring that the Ngapara site complies with noise standards, controls dust emissions, avoids the use of Bobbing Creek Road, and the company continues to communicate about the project.

In most cases, local people's concerns or expectations of impacts/effects have been addressed through:

- the commissioned technical studies and assessments,
- recommendations made to and accepted by Holcim, and
- in changes already made to the project plans.

In some cases, the fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Similarly, other concerns cannot be addressed until the project components take physical form and the pit begins to function as an integrated operation.

The conclusions reached in the SIA in relation to effects range from those that can be avoided or mitigated, through to those which would have adverse effects on persons close to the Ngapara site. A small number of immediate neighbours will suffer permanent reduction in the quality of their living environments for various periods of time even with mitigation and control measures in place, and proven compliance with required Council standards.

##### **5.5.11 Cultural**

Potential concerns for Te Runanga o Moeraki (Appendix 11) at the Ngapara site again centre on discharges and the potential for contaminants to enter Bobbing Creek and the Waiareka Creek. The pit water treatment and discharge system proposed would ensure that discharge was treated in a way that would not adversely affect Bobbing Creek and the Waiareka Creek itself. Storage and handling of fuel and other hazardous chemicals would be managed to avoid the risk of accidental spillage to surface water or to land. Likewise the discharges to air would be controlled to minimise any impacts on the mauri of the air.

Quarrying would alter the cultural landscape and the Runanga has drawn Holcim's attention particularly to the need to control quarrying activities within landscapes of cultural significance or highly visible landscapes, require management plans, and have particular control over earth disturbance.

##### **5.5.12 Archaeology**

The main impact on the archaeology (Appendix 13) of the Ngapara site relates to the potential for any unrecorded archaeological sites present to be damaged or destroyed during earthmoving activities. There is a potential for this to occur during the initial topsoil stripping stage, both in the preparation of the extraction site and in the creation of the ELF. The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

### 5.5.13 Historic Values

The majority of the identified historic sites (Appendix 12) within the vicinity of the Holcim proposal area at Ngapara are situated on the west side of Coal Pit Road, away from the proposed coal pit area. This includes the recorded location of an archaeological site.

The historical Ngapara Coal Mine was opened in 1878, but any surviving surface evidence is likely to date to its last few years of operation in the 1950s and 1960s. The row of houses on the west side of the road are known to have been associated with the mine at various times, one of them belonging to the Nimmos (who owned the mine). The available evidence suggests that these houses, along with the surviving but derelict timber house on the east side of the road, were built in or after about 1900. The shed and possible house site on the eastern side of Coal Pit Road is of an unknown age, although the shed itself is unlikely to be pre-1900.

All of these sites have some value in interpreting the history of Ngapara. However, they are all on the west side of Coal Pit Road, or outside of the area of proposed quarrying operations. They should therefore not be affected by the development proposal.

Within the actual site of the proposed quarry and overburden dump there are no known historic sites. The proposal would therefore not affect any known historic or archaeological sites or features.

#### Summary of Effects at the Ngapara Site

- Slope stability has been considered both within the pit and for the engineered landforms, ensuring suitable slopes would be provided. No significant adverse effects on natural slope stability due to the proposed quarrying sequence are anticipated.
- The main potential air contaminant is dust associated with extraction activity. The level of the effects from extraction activities depends on the separation distance of sensitive locations from the activity, and the nature of the activities that are being carried out. A range of effective dust management mitigation measures are proposed to be implemented, especially during dry and windy conditions. On that basis it is considered that, in conjunction with the rural nature of the proposed site, the effects of extraction activities would be no more than minor.
- Water management would ensure that clean water is diverted around the pit and engineered landform areas while pit water is captured and treated through a water treatment plant and sediment pond. The sediment pond would capture all water, while the secondary treatment plant would treat 97.5% of the water prior to discharge into Bobbing Creek. The pH of discharge water would be approximately neutral, while the concentration of trace metals in the receiving water downstream are likely to be below USEPA chronic criteria.
- Wastewater would be treated by way of a textile packed bed reactor, located adjacent to the workshop facility, ensuring high levels of treatment prior to discharge to ground.
- Water for dust control could be sourced from the sediment pond when available and from the North Otago Irrigation Company, along with potable water requirements, when the sediment pond is dry.
- For enhancement, it is proposed that wetlands be provided below the water treatment plant discharge point and at other minor discharge locations, and that the wetlands be provided with edge protection from stock and given appropriate management to maintain healthy wetland vegetation.

- At Ngapara the pit areas and access route do not require the loss of any indigenous or significant vegetation, or terrestrial habitat or community. The Bobbing Creek raupo wetland, the most valuable wetland area in the vicinity, is not directly affected by the proposal.
- The proposal would have low-moderate effects on the Ngapara landscape, as there would be a temporary but substantial change in the existing agricultural land use, landform and land cover at this site, including the introduction of new landforms. At the same time, the intention is to effectively restore the landscape back to productive use consistent with the surrounding landscape.
- Visual effects would be limited due to the undulating Downlands surrounding the site, although the ELF would be visible from local isolated viewpoints and from Georgetown-Ngapara Road. The significance of effect on landscape character is assessed to be low with the visual containment of the site a key factor in limiting any potential loss of visual amenity values.
- The establishment of a new site access road from Weston-Ngapara Road would ensure adequate sight distances to maintain road safety.
- Noise sources operating within the coal pit would be screened by the terrain from nearby residential units and with at least 500m separation distance it is predicted that all coal pit noise would be within a level of 55dBA  $L_{10}$  at the nearest residential units.
- Generally noise from equipment working on the engineered landforms would meet a level of 55dBA  $L_{10}$  at the nearest residential units. However, work on the top half of the southern ELF may generate noise levels to approximately 60dBA  $L_{10}$  at the nearest residential unit, which is in the same ownership as the land containing the southern ELF.
- A range of social/community consequences has been expressed by local people. In many cases concerns or expectations of impacts/effects have been addressed in the commissioned technical studies and assessments, in recommendations made to and accepted by Holcim, and in changes already made to the project proposals. In some cases, fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Resolution of others similarly cannot occur until the project components take physical form and the plant, quarries, pits, and transportation begin to function as an integrated operation.
- Issues of concern to Runanga particularly relate to the quality of water, and the stormwater, wastewater and site management controls are intended to protect the mauri of the waterways. The Runanga has drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air.
- Within the actual site of the proposed pit and ELF there are no known historic sites. The proposal would therefore not affect any known historic or archaeological sites or features.
- The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## **5.6 Windsor (Sand)**

### **5.6.1 Slope Stability**

Slope stability has been considered in the Golders Associates, Slope Stability Assessment (Appendix 17).

Cut slopes of 27° (1V to 2H) were originally suggested in prior site research. While no information is available on the relative density of the sand, Golders Associates consider this slope angle to be suitable even for quite loose material. The sand is likely to be susceptible to liquefaction in an earthquake should it become saturated, but this is highly unlikely as all extraction is expected to occur above groundwater level. Given suitable surface water drainage (as proposed) it is considered that a slope angle of 27° would be appropriate (and indeed conservative) for short term stability during extraction. All final overburden slopes would be re-contoured to 18° (1V to 3H) for long term stability and ease of replanting.

The southern flank of the ridge that makes up the extraction area has been over-steepened in places due to past undercutting by the small creek which occupies the valley immediately to the south. There is evidence of several re-vegetated shallow slumps near the eastern end of Holcim's property. These features would be investigated in more detail at the design stage, however based on information currently available, there is no evidence to suggest that the planned sand extraction would have any adverse effects on these features, or on natural slope stability elsewhere adjacent to the pit.

### **5.6.2 Air Quality**

The main potential for a detrimental effect on air quality arising during the operation of the Windsor site is from dust (URS Air Report, Appendix 14).

The emissions from the sand extraction would consist of large sized particles, which would fall to the ground relatively quickly and close to the point of extraction, therefore these emissions are unlikely to result in any off-site effect. In addition, there is sufficient moisture in the sand that emissions to air during extraction are extremely unlikely.

The activity that has the greatest potential to result in discharges to air would be topsoil and overburden removal. However, this activity would only take place periodically, and would be no different in effect to permitted farming activities such as pasture renewal. In addition, the fact that the overburden would be placed within the pit during normal operations reduces the potential exposure to wind and the potential for dust generation.

Holcim would adopt best practice methods to minimise any effects from this activity, including selecting appropriate meteorological conditions to carry out these activities, and ensuring that the overburden stockpiles are planted to control particulate dispersal.

Although there is potential for short-term dust effects, especially during dry and windy conditions, provided that mitigation measures, such as those discussed further in Section 6 are implemented, it is considered that the effects from construction would not be dissimilar to that which would occur from rural activities in the surrounding area.

In addition, as the material being extracted at Windsor is silica sand, URS has undertaken an assessment of the potential health effects of crystalline silica. This was prepared in order to address potential concerns over silicosis. The assessment by URS (Appendix 14) concludes that there is no significant additional risk for people living near the Windsor sand pit to contract silicosis, given, there is no on-site processing of sand proposed, separation from dwellings, and the particles of sand are generally significantly larger than 14 microns (and so would not easily reach the lungs).

### 5.6.3 Water Management

#### 5.6.3.1 Water Management Strategy

The water management strategy for the sand pit at Windsor (Kingett Mitchell Water Report, Appendix 15) relates primarily to control of disturbed (pit water) areas. Runoff from all disturbed (and undisturbed) areas would be collected in a pit sump prior to discharge to Windsor Stream and/or to ground.

The strategy would where possible incorporate water reuse principles, however the nature of the operation limits the potential for water reuse. Pit water collected for disposal could be used for dust control if the sump is able to hold water for reasonable lengths of time.

#### Staged Approach

The water management strategy for this site has been separated into a construction stage and three quarrying stages; four stages in total:

#### Stage 1: Construction.

As for all of the project quarry/pit sites, a prescriptive approach to control of water and mitigation of construction and quarrying related effects is proposed for construction. As a general rule, the approach described the Auckland Regional Council's TP90 or, more likely, a suitable site specific derivation of them would be used. These earthworks management guidelines would be implemented with a focus on control of run-off water and potential sediment sources, and the use of temporary prescriptive measures such as diversions, silt fencing, operator practices, small sediment structures, etc.

The proposed construction sequence is to build the access/haul road and some pit water diversion drains and the pit sump. These would be complete prior to commencing overburden stripping.

A Construction Management Plan would provide further details of the water management and control procedures.

#### Stage 2: Start-Up Quarrying.

Pit water management is focused on draining runoff (if any) from the sand pit and discharging any runoff to the pit sump.

#### Stage 3: Active Quarrying.

The third stage represents a natural progression of the sand pit. The sand pit face would have advanced further to the west by this stage resulting in a larger disturbed pit area.

#### Stage 4: Final Quarrying.

The fourth stage represents a final footprint of the sand pit. The sand pit face would have advanced to its full extent to the west and would by this stage have established a natural drainage pattern.

#### Model Output and Predictions

Runoff from the walls and floor of the sand pit would drain to the pit sump at times when rainfall does not directly infiltrate through the sand. The pit sump has been estimated to have a capacity of 4,600m<sup>3</sup> with a surface area of 1,700m<sup>2</sup>. The inflow frequency curve derived from the pit water management model for the sand pit suggests runoff is only generated during significant rainfall events (less than 13% of the time). The statistics indicate that 95% of the time the flow is less than 108m<sup>3</sup>/d.

The pit water model assumes that any water held in the pit sump would infiltrate through the base and sides of the sump. Infiltration rates for clean sands are typically around 210mm/hour with a Loamy Sand being 61mm/hour. The Windsor Sand is

typically fine and therefore the infiltration rate has conservatively been assumed to be 100mm/hour.

The only predicted surface water discharge is for events greater than 2% AEP (approximately a 1 in 50 year event) with durations of approximately 24 hours.

#### Surface Water Chemistry

The chemistry of the discharge and receiving surface waters were modelled and compared to USEPA criteria to assess their potential eco-toxicity.

The predicted concentrations of metals for a 50 year, 24 hour discharge event are well below the USEPA acute criteria. The pH of the discharge is expected to be in the range 4.0 to 9.3. The median pH of the discharge is predicted to be 7.9 and is most likely to be a more realistic representation of the discharge pH, which would be buffered in the settling pond.

The water chemistry in Windsor Stream immediately down stream of the discharge has been determined from the discharge chemistry using the flows from the 50 year return event. The pH of Windsor Stream downstream of the discharge is likely to be approximately neutral, and similar to the upstream pH. The predicted metal concentrations are below the USEPA chronic criteria for metals and the discharge from the treatment pond is likely to be less than minor with respect to any effects on surface water chemistry.

A routine monitoring program would be developed for the site to assess any effects resulting from operations (see Section 6).

#### 5.6.3.2 Wastewater Management Facilities

The sand pit at Windsor would not have a permanent work force present and the options for treatment include a port-a-loo or a composting toilet. All wastewater would be captured and disposed of at an appropriate facility offsite unless compost could be buried appropriately on the site.

#### 5.6.3.3 Water Supply

When available, water for dust control would be sourced from the pit sump (if any exists) and from the North Otago Irrigation Company, along with potable water requirements, at other times. There would be no effects from water take on any surface or groundwater resources at this site.

### 5.6.4 Aquatic Ecology

Potential discharge of contaminants relative to the quarrying of sand at Windsor (Appendix 9) is highly unlikely to release any contaminants (mineral or otherwise). Given the likely absence of contaminants and general absence of surface flows, contamination of the Windsor stream (and so Waiareka Creek) is therefore highly unlikely. The proposed site stormwater management, which is a precautionary but not unusual approach, would also make contamination unlikely.

Direct watercourse modification is not required at the Windsor site.

### 5.6.5 Terrestrial Ecology

At Windsor all areas are modified exotic vegetation, and there would be no adverse effects on terrestrial ecology as a consequence of the proposed extractive activities (Appendix 9).

### 5.6.6 Landscape/Visual Amenity

#### 5.6.6.1 Direct Effects on the Landscape

Sand extraction would progressively retreat into the side of an existing ridge within agricultural land above the north bank of Windsor Stream. Consequently there is an opportunity to marry in the rehabilitation of the quarry with the existing landform

(Appendix 8). The southeast portion of the proposed pit would involve the removal of existing exotic woody weeds, mostly gorse having no significant landscape values.

The extraction of sand in a northwest direction is expected to reach steady state after approximately 7 years; after which time the pit would be progressively backfilled with new overburden. Whilst the operational sand pit would temporarily impact upon the immediate and local Windsor landscape over a projected approximately 30-year period, it is anticipated that potential long-term effects would be largely mitigated through restoring the site back into productive land use. The progressive restoration as part of ongoing extraction activities would further reduce the duration of landscape impacts in this location.

There would be a change from the existing agricultural land use, landform and land cover at this site, although these impacts would be largely off set by restoring the land back into productive use, consistent with the surrounding landscape. Boffa Miskell Limited (Appendix 8) has assessed this to result in low-moderately significant residual landscape effects.

#### 5.6.6.2 Visual Effects

##### General

The site at Windsor is contained by the valley sides of the Windsor Stream and by the gently rolling topography. There are therefore limited views of the proposed pit for a restricted viewing audience of rural farmers and mainly local traffic on unsealed rural roads. Potential views of the quarry fall within 1-2 km of the site.

##### Immediate Range

Other than the resident farmers located within the Windsor Stream Valley, the main views of the sand pit would be obtained from elevated viewpoints along the southern section of Windsor Road, looking westward up through the Windsor Stream valley. The angle and orientation of the hillside north of Windsor Stream would conceal the western portion of the proposed pit during the latter stages of extraction. Views of the initial eastern extraction would also be obscured by the hill slopes when viewed along the valley. The existing valley landscape contains shelterbelts and woodlot plantings within a mixed patchwork of farm paddocks. Whilst the sand pit would be partially visible in close range views from Windsor Road, the impact upon the viewing audience has been assessed to be of medium-low significance.

The sand pit would also be visible from gravel roads to the south and west of the site. From Post Office Gully Road, which is located on an elevated ridge to the west of Windsor Road, the upper portion of the extracted face would become visible as the excavation progressed.

The gravelled Victoria Hill Road, which descends from the west into the base of the Windsor Stream Valley to access adjacent farm residences, would afford several close range views of the proposed sand pit. Whilst most residents within this valley would be subjected to direct medium-high impact views of the sand pit, for the passing motorist travelling through the Windsor landscape, the impact of the same views would be of medium-low significance. Rehabilitation of the pit would return the re-graded hillside to productive agriculture. As such, the visual exposure of residents to quarrying activities would be completely mitigated in the long-term, with the appropriate restoration of original landform, land cover and land use.

#### 5.6.6.3 Landscape Character

The proposed Windsor pit is predominantly within the Ngapara-Oamaru Downlands, whilst also being close to the boundaries of a different adjacent Landscape Character Area (the Waiareka Valley). The Ngapara-Oamaru Downlands exhibit the characteristic undulating topography which would contain the proposed pit and associated landform modifications. Ultimately, the existing rural character would be maintained through the long-term rehabilitation proposal and the avoidance of permanent adverse effects upon significant landscape features or characteristics within either the Ngapara-

Oamaru Downlands or adjacent landscape character area. The significance of effect on landscape character would be low.

#### 5.6.6.4 Visual Amenity

Proposed sand extraction activities at Windsor is of a similar scale to existing quarrying operations within the vicinity and the visual containment of the site is a key factor in limiting any potential loss of visual amenity values.

#### 5.6.7 Traffic

There are two options for accessing the sand pit (Transport Report, Appendix 7), either by constructing an access road which follows the line of a disused railway to join Peaks Road northeast of the sand pit, or using Victoria Hill Road.

Both roads have broadly similar characteristics, being of limited width and functioning on a day-to-day basis as single-lane roads, with vehicles occupying the centre of the carriageway. However, they are lightly-trafficked and it is unlikely that one vehicle would encounter another travelling in the opposite direction. In such a case, there appears to be sufficient space available for both vehicles to pass (albeit slowly) if they are light vehicles. There may be some difficulties with two heavy vehicles passing due to the narrow widths, but an assessment of the expected frequency of heavy vehicles shows that at most one truck movement is expected every 20 minutes during the day. This suggests that the likelihood of two heavy vehicles meeting is very low. If this were to occur on rare occasions, safe passing could still be achieved, albeit with care and at slow speeds.

Neither road is sealed. It is not considered likely that the additional vehicles associated with the sand pit would require either road to be sealed, but some upgrading of the road structure may be required (depending upon its current strength) to accommodate the increased number of heavy vehicles.

An access onto Peaks Road that would comply fully with the District Plan requirements could be located at any point between the existing farm access (around 140m west of Finlays Road) and 68m west of Finlays Road. With the access in this location, all vehicles travelling to or from the sand pit would have to cross a short single lane bridge, to the immediate west of Finlays Road. This however is not considered to present any safety or operational issues due to the limited potential for two vehicles to meet and the good approach sight distances to the bridge from either direction.

From a transport perspective, the alignment of Victoria Hill Road is considered to be slightly better than Peaks Road, with fewer significant vertical (crest) curves. Sight distances where Victoria Hill Road joins onto Windsor Road are considered appropriate for the prevailing speed environment. One feature of this route however is that Victoria Hill Road joins Windsor Road towards the west of Windsor. All traffic associated with the sand pit would therefore have to pass through the settlement.

Irrespective of whether Peaks Road or Victoria Hill Road is used, further towards the east, all traffic associated with the sand pit would be required to pass through the Windsor Road/Peaks Road intersection. While visibility to the left for emerging traffic is appropriate for a 100km/h speed limit, the sight distance to the right is restricted to 150m due to a crest in Windsor Road. Traffic Design Group (Appendix 7) do not consider this would present any significant road safety issues in this particular instance due to the low frequency of vehicles emerging from Peaks Road, and the low traffic flows on Windsor Road in this direction (a peak hour volume of 14 vehicle movements, with four to five vehicle movements per hour at other times).

One important benefit of the Peaks Road route is that as Peaks Road joins Windsor Road towards the northeast of Windsor, traffic associated with the sand pit would not be required to pass through the settlement. Holcim is pursuing this option as the preferred route, through negotiations with the landowner.

### 5.6.8 Noise

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). As explained in section 5.3.8, the basis for the assessment of the noise level predictions is the set of noise rules for the Rural General zone, as contained within the Waitaki District Plan. As these noise levels have been developed by the District Council for the area and are applied consistently across all activities within the rural zone, they can be considered to represent an acceptable level of noise within the rural environment. In addition to the District Plan noise limits, the Marshall Day Acoustics report also considers a range of other noise criteria.

The sources of noise at this site would be the tracked loader and grader operating within the pit and the truck periodically accessing the site. There are three residential units<sup>16</sup> nearby ranging from 100m to 500m distant from the pit.

It is predicted that the tracked loader and grader operating at this site would meet a level of 55dBA L<sub>10</sub> at the two further residential units, but to meet this level at the nearest residential unit specially silenced equipment incorporating noise attenuation would need to be used.

### 5.6.9 Community/Social

The Social Impact Assessment (SIA) (see Appendix 10) has considered site related social impacts for each site and addresses the perceived social consequences for local people to potential local environmental changes. In each neighbourhood, people put different emphases on these various perceived effects depending upon their location and individual perspective.

A considerable number of the potential effects are expressed as fears, annoyances, and uncertainty or unease (which can be referred to as anticipated or planning effects). There has also been anticipation of benefits. While the concerns or anticipated impacts may not eventuate, some fears and concerns could eventuate into actual long-term adverse effects, which may or may not be able to be mitigated.

The issues raised in relation to the Windsor site are varied and are set out in detail in the SIA. Many are the same as those expressed in relation to the plant site, however some are more specific to the pit operations. These include:

- Impacts on health and social and psychological wellbeing. This includes fears and anxieties as well as actual effects arising from the proposal e.g. fears over increased physical danger from road runoffs or accidents due to passing encounters with sand trucks on narrow sections of Windsor Road.
- Impacts on the quality of the living environment e.g. perception of a reduction in the ruralness of the area due to the introduction of an industrial activity and associated transportation movements.
- Economic and material wellbeing impacts e.g. concerns over potential damage to homes in Windsor village due to vibration from passing heavy trucks.
- Impacts on family and community e.g. potential for social tension/community conflict due to different positions among the residents about the proposal and its effects.
- Legal, political, and equity impacts e.g. possibility for unfairness in distribution of costs between generations, especially the cost of rehabilitation.

For each of the potential effects, the SIA has identified the likelihood of a social effect eventuating and has outlined the responses available both from Holcim and from wider community resources. These responses include matters such as ensuring that

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<sup>16</sup> Appendix 5, references 5367, 5365, 5371

the Windsor site complies with noise standards, driver training, and the availability of support services based in Oamaru.

In most cases, local people's concerns or expectations of impacts/effects have been addressed through:

- the commissioned technical studies and assessments,
- recommendations made to and accepted by Holcim, and
- in changes already made to the project plans.

In some cases, the fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Others concerns cannot be addressed until the project components take physical form and the pit begins to function as an integrated operation.

The conclusions reached in the SIA in relation to effects range from those that can be avoided or mitigated, through to those which would have adverse effects on persons close to the Windsor site. A small number of immediate neighbours will suffer permanent reduction in the quality of their living environments for various periods of time even with mitigation and control measures in place, and proven compliance with required Council standards.

#### **5.6.10 Cultural**

Potential concerns for Te Runanga o Moeraki at the Windsor site (Appendix 11) again centre on discharges and the potential for contaminants to enter Windsor Stream and the Waiareka Creek. The pit water treatment and discharge system proposed would ensure that discharge was treated in a way that would not adversely affect Windsor Stream and the Waiareka Creek itself. Likewise the discharges to air would be controlled to minimise any impacts on the mauri of the air.

Excavation would alter the cultural landscape and the Runanga has drawn Holcim's attention particularly to the need to control quarrying activities within landscapes of cultural significance or highly visible landscapes, require management plans, and have particular control over earth disturbance.

#### **5.6.11 Archaeology**

The main impact on the archaeology of the site (Appendix 13) relates to the potential for any unrecorded archaeological sites present to be damaged or destroyed during earthmoving activities. There is a potential for this to occur during the initial topsoil stripping stage and during extraction. The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

#### **5.6.12 Historic Values**

The main historic feature at the Windsor site is the abandoned railway formation (Appendix 12). As it was constructed prior to 1900, it is subject to the archaeological provisions of the Historic Places Act. Holcim intends to use the formation as access to the proposed sand pit, therefore an archaeological authority would be required prior to any modifications to the formation.

The abandoned house on the Holcim property is a typical small timber cottage of the late nineteenth/early twentieth century. It is outside the area that is proposed for excavation, and would not be affected by the Holcim proposal.

### Summary of Effects at the Windsor Site

- Slope stability has also been considered within the pit ensuring suitable slopes would be provided. No significant adverse effects on natural slope stability due to the proposed extraction process are anticipated.
- The main potential air contaminant from extraction activity is dust. The level of the effects of extraction activities depends on the separation distance of sensitive locations from the activity, and the nature of the activities that are being carried out. A range of effective dust management mitigation measures are proposed to be implemented, especially during dry and windy conditions. On that basis it is considered that, in conjunction with the rural nature of the proposed site, the effects of the proposed activities would be no more than minor.
- There is no significant additional risk for people living near the Windsor sand pit to contract silicosis, given, no on-site processing of sand is proposed, separation from dwellings, and the particles of sand are generally significantly larger than 14 microns (and so would not easily reach the lungs).
- Water management would ensure that all water is captured and treated through a sump before discharging to ground in almost all events. The quality of the water discharged would not cause adverse effects on ground or surface water.
- Wastewater would be dealt with by either a composting toilet or port-a-loo.
- Water for dust control would be sourced from the pit sump (if available) and from the North Otago Irrigation Company, along with potable water requirements, at other times.
- Given the likely absence of contaminants and general absence of surface flows, contamination of the Windsor Stream (and so Waiareka Creek) is highly unlikely. The proposed site stormwater management, which is a precautionary approach, would also make contamination unlikely.
- At Windsor all areas are modified exotic vegetation, and there would be no adverse effects on terrestrial ecology.
- The proposal would have low-moderate effects on the Windsor landscape, as there would be a temporary change in the existing agricultural land use, landform and land cover at this site. These impacts would be largely offset by the progressive restoration of the land back into productive use, consistent with the surrounding landscape.
- Visual effects would be limited as there are a limited number of potential views into the site and a restricted viewing audience of rural farmers and mainly local traffic on unsealed rural roads. The significance of effect on landscape character would be of medium-low significance and the visual containment of the site is a key factor in limiting any potential loss of visual amenity values.
- The establishment of a new site access could be achieved from either Peaks Road or Victoria Hill Road. Both access options would ensure adequate sight distances to maintain road safety. While both access routes are narrow, vehicles would be able to pass safely.
- Use of Peaks Road as a site access is preferred by Holcim, as it would ensure trucks do not need to travel through most of Windsor Village.
- It is predicted that the tracked loader and grader operating at this site, with noise attenuation installed, would meet a noise level not exceeding 55dBA L<sub>10</sub> at the nearest residential units.

- A range of social/community consequences has been expressed by local people. In many cases concerns or expectations of impacts/effects have been addressed in the commissioned technical studies and assessments, in recommendations made to and accepted by Holcim, and in changes already made to the project proposals. In some cases, fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Resolution of others similarly cannot occur until the project components take physical form and the plant, quarries, pits, and transportation begin to function as an integrated operation.
- Issues of concern to Runanga particularly relate to the quality of water, and the stormwater, wastewater and site management controls are intended to protect the mauri of the waterways. The Runanga has drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air.
- The main historic feature at the Windsor site is the abandoned railway formation. As it was constructed prior to 1900, it is covered by the archaeological provisions of the Historic Places Act. Holcim intends to use the formation as access to the proposed sand pit, therefore an archaeological authority would be required prior to any modifications to the formation. The necessary Archaeological Authority will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authority would be followed.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## 5.7 Transport Interconnections

This section relates to the traffic, noise and social effects relative to the transportation interconnections between each of the project sites and between the project sites and the wider area.

### 5.7.1 Traffic

The assessment of traffic effects (Appendix 7) has used the concept of 'Level of Service' to understand the current and future conditions of the roading network. This concept is widely used and rates roads according to six levels of service reflecting such matters as free flow of traffic and level of comfort/convenience for drivers.

#### 5.7.1.1 Preferred Routes for Operational Traffic

##### Ngapara and Windsor (Coal and Sand) to the Plant Site

The location of the coal and sand pits in relation to the proposed plant site mean that Weston-Ngapara Road is the only practical route choice. The addition of the maximum<sup>17</sup> number of vehicles carrying coal and sand (equivalent to at most 9 truck movements per hour) would result in the present high Level of Service A being maintained along this route. There are therefore no capacity-related reasons why this traffic could not be accommodated on Weston-Ngapara Road.

There is no road safety record on Weston-Ngapara Road, which would suggest the coal and sand trucks could not be accommodated safely.

The operational traffic has priority at the majority of intersections between the coal and sand pits, and the cement plant site. As a result, other vehicles emerging from district roads onto Weston-Ngapara Road may experience a reduced frequency of suitable gaps in the traffic stream. However, the number of vehicles and frequencies (one vehicle movement every 2.7 minutes in the peak hour and one vehicle movement every 6.7 minutes at other times) are small, and Traffic Design Group assess the effects of this traffic to be less than minor.

##### From Timaru (Gypsum and Oil) to the Plant Site

On the basis of an assessment of road capacity, the addition of the maximum number of vehicles carrying oil would result in only a very minor increase in traffic volumes, such as to not affect the current traffic peak hour Level of Service, irrespective of the route selected. The movement of gypsum would also not affect the current peak hour Level of Service on any of the routes being considered. Traffic Design Group has assessed that the increase in traffic due to oil and gypsum movement (equivalent to one vehicle movement every 15 minutes) would result in less than minor effects on queues and delays at the intersections through which vehicles passed.

At peak times, Level of Service C-D is offered by State Highway 1 through Oamaru. While this would not be significantly affected by trucks carrying gypsum, it is likely to lead to delays and to variability in respect of truck arrival times at the plant site. As reliable journey times (and hence arrival times at the plant site and also at the stockpile near Timaru) are required, it is proposed that during the morning and evening peak times, trucks carrying gypsum and oil do not travel through Oamaru, but use the Seven Mile Road/Airedale Road route instead.

There is no road safety record on any of the routes which would suggest the oil and gypsum trucks could not be accommodated safely. However, traffic flows through Oamaru are significantly greater than at other locations and this contributes to a

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<sup>17</sup> The **average number** of vehicle loads movements represents the expected traffic when the plant is operating at maximum production. The **maximum number** of loads/movements (or peaks) represents the traffic expected when the plant is operating at maximum production and when exceptional demand circumstances have arisen, such as a customer carrying out a large-scale continuous concrete pour.

greater number of accidents on this section of State Highway 1. This again suggests that during the morning and evening peak traffic periods, the route through Oamaru should be avoided.

Consequently, while it is considered that both routes are viable, insofar as it is practical for Holcim to do so, trucks would be encouraged to use the alternative route to travelling through Oamaru during the morning and evening peak traffic periods.

#### To Local Destinations (Local Cement Deliveries) from the Plant Site

For traffic movements related the distribution of cement to locations south of the plant site, using Whiterocks Road to travel to State Highway 1 offers the most direct route. It is estimated that up to 51 vehicles could use this route per day (equivalent to at most three movements per hour), and this volume of traffic would have no effect upon the peak hour Level of Service on the road. The low frequency of vehicle movements (one every 20 minutes) would also not noticeably affect any intersections.

Vehicles travelling to other inland destinations are able to use a route via Airedale Road and State Highway 83. Up to 26 vehicles could use this route per day (equivalent to at most two movements per hour), and this volume of traffic would have no effect upon the peak hour Level of Service on any roads. The low frequency of vehicles (one movement every 30 minutes) would also not affect the safe operation of any intersections.

There is no road safety record on either of the routes which would suggest the cement delivery trucks could not be accommodated safely.

#### To and From Oamaru (Operational Requirements)

The other regular traffic associated with the operational cement plant, quarries and pits would be staff and service vehicles. Given the available options, there is considerable uncertainty regarding the routes which would be used by workers and other operational traffic, and to a large extent these would be determined by factors outside the control of Holcim.

Based upon the distribution of population, it could be expected that the majority of these trips would be associated with origins and destinations in the Oamaru area, meaning that the most direct route would be to use Weston Road/West View Drive or Saleyards Road and Weston-Ngapara Road to travel to and from the plant, quarries and pits. Both of these routes are along Collector Roads in the road hierarchy. The route via Whiterocks Road also offers potential to accommodate the operational traffic, albeit with a reduction in peak hour Level of Service from A to B. However, this route is longer than Weston Road/West View Drive and Saleyards Road both in distance and in journey time, and is likely to be perceived by drivers as more indirect. It has therefore not been considered further in assessing journeys to and from Oamaru.

During the existing morning and evening peak times on the roading network, the operational traffic associated with the plant, quarries and pits is estimated to be up to 160 vehicle movements. This would result in the Level of Service on Weston Road/West View Drive and Saleyards Road reducing to one level below that which occurs at present, but remaining within the level of stable flow.

#### 5.7.1.2 Traffic Effects from Vehicle Routes

##### General

Even when the cumulative impacts of the traffic associated with the cement plant, quarries and pits are considered, and allowing for the maximum predicted amount of traffic to be generated, the effects are assessed by Traffic Design Group to be minimal on the majority of roads, with no change to the Level of Service presently provided.

The main effects are predicted to be upon the routes which would be used by those travelling to work, that is, Weston Road/West View Drive, Saleyards Road, Main Street and Weston-Ngapara Road/Main Street (west). The present Levels of Service on these roads would reduce by one level to, at worst, Level of Service C. This is still within the

zone of stable flow, but is noted in the Austroads Guide to Traffic Engineering Practice as the level at which the general level of comfort and convenience “declines noticeably”. As it is related to employee travel, this reduced Level of Service would occur during the morning and evening peak hours on the road network only. Holcim would endeavour to encourage employees and suppliers to use routes other than Weston Road/West View Drive, and/or to use sustainable travel where possible (e.g. a company bus).

The peak hour Level of Service on Weston-Ngapara Road to the northwest of the plant site would also reduce by one level, from A to B, again due to employee travel. This is still within a zone of stable flow, and the overall volume of vehicles remains low.

Effects on Intersections

Based upon the increases in traffic predicted, it is considered that on the following intersections the effects of additional traffic volumes would be less than minor:

- Weston-Ngapara Road/Windsor Road;
- State Highway 1/Whiterocks Road;
- State Highway 83/Horse Gully Road;
- State Highway 83/Gibsons Road;
- Seven Mile Road/Gibsons Road; and
- State Highway 1/Seven Mile Road.

The increase in traffic would be somewhat greater at four intersections, and accordingly a more detailed analysis has been carried out:

<b>State Highway 1/Weston Road</b>	The effects of the additional turning traffic are assessed to be negligible with queues increasing by up to one vehicle. Level of Service A would continue to be provided on all approaches at all times, and through-traffic on State Highway 1 would not be affected.
<b>Weston Road/Saleyards Road</b>	The predicted increase in delay for traffic emerging from Saleyards Road is under two seconds per vehicle, and queue lengths to increase by up to one vehicle. The Level of Service offered would remain the same as that presently provided.
<b>Main Street/Whiterocks Road/West View Drive</b>	The greatest increase in queue length would arise in the morning peak hour, when the queue of vehicles emerging from West View Drive would increase by up to two vehicles. The greatest increase in delay however would occur in the evening peak hour, when vehicles emerging from West View Drive would be delayed by an additional second. Level of Service A would continue to be provided on all approaches at all times.
<b>Main Street/Main Street (west)</b>	The effects of the additional turning traffic are assessed to be small, with the queue of vehicles emerging from Main Street (west) in the evening peak hour increasing by slightly over two vehicles. Level of Service A would continue to be provided on the approach at all times.

**Table 5.11: Analysis of specific Intersections**

For all of these intersections, the recorded accidents do not indicate any issues that would be exacerbated by the increased traffic volumes.

In the event of a rigid start and finish time for all staff at the cement plant, quarries and pits, it is possible that vehicle movements would occur over a shorter timeframe than the one hour period used in analysis. In order to evaluate this, the intersection

models have been used to assess the effects of all vehicles travelling within a 30 minute period. Delays and queues do not increase significantly when compared to the existing traffic flows (without any traffic associated with the cement plant, quarries and pits).

Level of Service A would continue to be provided on all approaches and at all times at the State Highway 1/Weston Road intersection. At the Weston Road/Saleyards Road intersection, Level of Service C would be provided, compared to Level of Service B at present. However, queue lengths would increase by up to three vehicles in the morning peak hour, with an increase in delay in the order of 5 seconds per vehicle compared to the present situation.

At the Main Street/Whiterocks Road/West View Drive intersection, Level of Service A would continue to be provided, other than in the morning peak hour for vehicles turning right from West View Drive, where the Level of Service would change from A to B. Queue lengths would increase by up to six vehicles with increased delays per vehicle of three seconds, compared to those occurring at present.

Similarly, Level of Service B would be provided at the Main Street/Main Street (west) intersection, with queue lengths increasing by around nine vehicles and an increased delay per vehicle of around four seconds compared to that occurring at present.

A detailed evaluation of intersections of concern to Transit New Zealand is proposed to be carried out once the likely traffic flows have been resolved further, and any necessary upgrading works would be agreed with Transit New Zealand.

#### Effects on Pedestrians and Cyclists

The assessment by Traffic Design Group (Appendix 7) concludes that the movement of trucks associated with the proposed cement plant, quarries and pits would not lead to any road safety issues arising on the majority of the roading network in respect of pedestrians and cyclists.

The majority of walking trips are less than 1km in length with cycling trips being generally less than 3km in length, and the patterns of development show that there are generally few trip generators and attractors within these distances of the various project sites. It is not expected that the low frequency of vehicles generated over much of the day would lead to any noticeable change in opportunities for pedestrians to cross the road.

A more detailed analysis has however been carried out in Weston recognising that due to the compact nature of the settlement, the incidence of walking and cycling can be expected to be higher. Walking to Weston Primary School has also been specifically considered.

Along the routes which would experience the greatest increase in traffic flows (West View Drive, Main Street/Whiterocks Road and Main Street (west)) there is already provision made for pedestrians walking alongside the carriageway, either by means of a footpath, a seal extension or a wide grassed verge. This means that pedestrians are not required to walk within traffic lanes. There are few formal facilities for pedestrians wishing to cross the road, although there is a raised island at the West View Drive/Whiterocks Road intersection providing an opportunity for pedestrians to cross the road in two movements. The configuration of the Main Street/Main Street (west) intersection also means that pedestrians are able to cross traffic streams in separate movements. However, there are no formal crossing facilities for those wishing to cross Main Street in an east-west direction or West View Drive to the east of Main Street/Whiterocks Road.

Surveys by Traffic Design Group of pedestrian volumes carried out on West View Drive showed that comparatively few pedestrians crossed the road during the periods when the number of vehicles associated with the proposed cement plant, quarry and pits would be at its greatest (in the morning and evening peak hours). The volume of child pedestrians is not sufficient to justify the provision of any formal crossing facilities, but

the increased traffic volume is likely to lead to an increased level of risk for these road users. Assuming that the children were walking to school, using an alternative route via West View Drive and Main Street does not impose an increased journey distance and the island at the West View Drive/Whiterocks Road intersection creates an opportunity for them to cross the road safely. These children would then be on the same side of Main Street as the school, and would not be required to cross any roads where traffic flows would be increased due to the proposals.

Those children walking along the western side of Main Street would be required to cross this road to reach their school. As the cement plant, quarries and pits would not result in a significant increase in traffic volume to the north of the Main Street/Main Street (west) intersection, opportunities for crossing movements in this location and adjacent to the school would be unaffected. For other pedestrians crossing elsewhere on Main Street, the straight horizontal and vertical alignment of the road means that sight distances are excellent, affording pedestrians every opportunity to identify appropriate gaps in the traffic.

#### Effects on School Bus Routes

Analysis of the school bus routes locally shows that many of the roads where children are picked up and dropped off would not be used by traffic associated with the cement plant, quarries and pits. Many of the bus routes turn onto or from Weston-Ngapara Road to the northwest of the plant site, but the predicted volume of traffic to be generated on this section of the road in the peak times is 36 vehicle movements and it is therefore not considered that buses would be delayed at intersections.

Many of the school bus routes use Weston-Ngapara Road southeast of the plant site, as well as Main Street, West View Drive, Weston Road, Saleyards Road, Chelmer Street, and these are also routes likely to be used by employees at the site. However, the buses transporting children to the schools in Oamaru are travelling in the opposite direction to those that would be travelling to the plant, and they are therefore unlikely to experience any additional delay.

It is possible that there would be an increased journey time for buses departing from the Oamaru depot to start the school routes. Analysis by Traffic Design Group shows that this would be minimal, but it may require buses to leave the depot a few minutes earlier than they do at present to maintain present schedules.

#### 5.7.1.3 Constraints on the Roding Network for Trucks

An analysis has been carried out of the horizontal alignment of roads to identify any locations where (due to adverse geometries) trucks might be required to cross the centreline of the road and enter into the road space used by oncoming vehicles. The assessment indicates that there are no locations where trucks must enter onto the opposite side of the road, but there are several locations where drivers may choose to cross the centreline (see Transport Report, Appendix 7).

All of the identified constraints are highly localised and taking into account the existing traffic flows, the likelihood of two vehicles meeting at any of these locations is small. With such low volumes, even the presence of the additional trucks due to the proposed cement plant, quarries and pits would not significantly increase the frequency of two vehicles meeting. Moreover, many of the potential road safety issues noted are as a result of drivers positioning their vehicles incorrectly. Holcim has a strong emphasis upon safe working (and driving) practices intended to assist in minimising this potential.

An evaluation of recorded accidents at these above locations shows that there have been several accidents involving a single vehicle losing control as the driver negotiated curves in the road (with a contributing factor of excessive speed). There have been no accidents recorded at any of the locations where the road narrows due to a bridge.

Traffic Design Group assess that no road safety issues would be introduced or exacerbated by the movement of trucks to and from the project sites.

#### 5.7.1.4 Effects of Reinstating the Railway Line

The process of reinstating the branch railway line, and assessment of traffic effects related to this, would be carried out in accordance with the Outline Plan of Works process, which is separate from these resource consent applications.

### 5.7.2 Noise and Vibration

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). There is no single criterion that can be used to assess road traffic noise and a number of different methods have been applied.

#### 5.7.2.1 Road Traffic

The majority of traffic movements to and from all sites connected with the overall proposal would pass through the main cement plant site. For vehicle movements associated with the transport of raw materials, each movement relates to a single pass-by of a truck and trailer unit. The general traffic is expected to be primarily cars and vans, but may include occasional coaches and trucks. There would also be a number of additional vehicles travelling to the quarry/pit sites, such as staff/servicing vehicles and fuel tankers. The vast majority of these would be light vehicles.

#### Changes in noise levels resulting from additional traffic

In providing an indication of where detailed assessment of road traffic noise should be focused, Marshall Day Acoustics have considered the changes in noise levels calculated from the existing traffic flows and the predicted additional traffic resulting from the proposal. In most cases the existing traffic flows vary at different points along each of the routes/roads listed, as traffic joins and leaves at junctions. However, in terms of noise, these minor variations are generally not significant.

Marshall Day Acoustics estimate that the increases in noise levels range from 0dB (in many locations) to 4dB (at peak times on Windsor Road). Along all State Highway routes the increase in typical and peak noise levels is predicted to be negligible. For the remainder of the routes there is predicted to be generally only a minor increase in noise with typical project traffic levels.

#### Predicted noise levels at individual residential units

To perform this analysis, noise levels have been calculated at each residential unit along the proposed routes. From these levels, an extensive analysis has been conducted considering the calculated existing and future noise levels for residential units visible and within 250m of these routes. For all of the routes it is predicted that there would be a negligible increase in adverse reaction to traffic noise as a result of the proposal.

There is no significant difference in the overall noise effect between Weston Road and Whiterocks Road, however it is proposed that for all traffic over which Holcim has control (e.g. all trucks and any staff buses) Whiterocks Road is used, as it is rural rather than residential in nature and thus has a lower density of residential units with greater separation from the road and is designated as a District Arterial route. Likewise, it is proposed that northbound trucks from the site and southbound trucks to the site would be best using Seven Mile Road/Airedale Road rather than travelling through the centre of Oamaru, to avoid the higher density of residential units. While substantially fewer residential units would be affected by trucks using Seven Mile Road/Airedale Road than using Whiterocks/Weston Roads and travelling through the centre of Oamaru, due to the relatively low existing traffic volume on Seven Mile/Airedale Road the relative increase in noise level would be slightly greater (due to lower ambient noise levels). Airedale Road and Seven Mile Road are also identified by the District Council as District Arterial routes.

#### Transit New Zealand noise criteria

Transit New Zealand noise criteria can be used to examine the absolute noise levels resulting from the additional road traffic, based on existing ambient noise levels. The

predictions have been based on the distance of the nearest residential unit to each road. For all residential units further from the roads or screened from the roads, the existing traffic noise levels would be lower.

Marshall Day Acoustics' assessment identifies that, including the additional project traffic, the predicted typical noise levels range from 46dBA (Seven Mile Road) to 57dBA (West View Drive and Weston Road) and with peak project traffic the noise levels range from 47dBA (Seven Mile Road) to 58dBA (West View Drive). Transit's average noise design criteria would be achieved for all roads, indicating that the resulting noise levels could reasonably be expected by people living along each of the roads.

#### Overall noise predictions

For all routes, it has been assessed that there would not be a significant change in traffic noise compared to the existing situation and also that the resulting traffic noise levels are well within accepted limits for these types of environment. The predicted external traffic noise levels would result in internal noise levels that are within recommended limits for residential buildings. Accordingly, the noise levels should generally not interfere with normal domestic activity.

##### 5.7.2.2 Peak hour traffic and night-time traffic

Virtually all truck movements associated with the project would be distributed throughout the day and any noticeable peak periods are considered unlikely. As these trucks dominate the project traffic noise on most routes, assessment of the daily average levels provides a reliable measure of noise effects, the same as if a 'peak' hour was considered.

For employee light vehicle movements there would be traffic peaks coinciding with the beginning and end of shifts. The exact timing of shifts has not been finalised but it is anticipated that these employee traffic peaks would occur during the existing periods of higher traffic noise. Therefore, the changes in traffic noise during shift changes should be no more than the overall average changes.

The vast majority of project traffic would only occur during daytime hours. However, for cement trucks and vehicles relating to the 24-hour running of the cement plant, there would be a number of additional night-time movements. All of the routes for these vehicles have existing night-time vehicle movements and the additional traffic should not generate maximum noise levels greater than the existing traffic. Therefore, as the frequency of night-time movements would not markedly increase over the current situation, it is considered that the noise effect would be no more than minor.

##### 5.7.2.3 Vibration

Marshall Day Acoustics has recently measured vibration levels from loaded coal trucks on various different types of road and at different distances from the roads. The nearest position was less than 5m from a road.

In all cases the truck vibration was less than 0.5mm/s ppv<sup>18</sup>. These measurements are consistent with other vibration measurements conducted by Marshall Day Acoustics from road traffic. All of the measured levels would only result in possible faint perception of vibration and are significantly less than levels that could result in building damage. It is therefore considered that the effect of vibration from the proposed trucks associated with this project would be negligible.

##### 5.7.2.4 Trains

The majority of cement produced at the cement plant would be transported to the Port of Timaru and dispatched from there by ship. Holcim considered the options of both trucks (190 truck movements/day) and trains for this transport (4 train

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<sup>18</sup> ppv = peak particle velocity.

movements/day -2 return trips). Holcim has decided to proceed on the basis of using a train.

The reinstatement and use of the railway line is authorised by the existing designation, however the potential noise and vibration effects associated with the operation of the railway have nevertheless been assessed. The process of reinstating the branch railway line would be carried out in accordance with the Outline Plan of Works process, which is separate from these resource consent applications.

The majority of the train journey would be on the Main South Line. This line is already in regular use, including by trains during the night. There are typically eight to ten trains passing through Oamaru each weekday and four each day at weekends. Marshall Day Acoustics assess that the proposed four additional cement train movements on this line would have a no more than a minor noise effect.

The final part of the train journey to the cement plant site utilises a disused branch-line. The branch-line is still a designated railway even though the track has been largely removed.

Assessment of the noise exposure of residential units beside the branch-line has been undertaken and shows that the four train movements each day would give rise to an  $L_{dn}$  just above 42dBA for five residential units which are particularly close to the railway. Marshall Day Acoustics has applied the outcomes of international studies correlating people's response to noise with a measured noise level, and train noise criteria applied in Queensland, Australia to conclude that the overall noise effects from the train operation would be no more than minor.

The maximum cement train noise level at the nearest residential unit to the branch-line through Weston is predicted to be approximately 80dBA  $L_{max}$ . Given that there would be only four occurrences each day of this maximum level and they should generally occur within known timeframes, this would not be expected to cause undue disturbance to people living alongside the railway.

The timing of the four train movements each day are primarily determined by the time needed to load and unload the cement at each end. Holcim has prepared a provisional timetable which would mean that the first movement would aim to arrive at Weston not before 7:00am each day and the last movement would aim not to leave Weston after 10:00pm each day on Monday to Saturday only. The trains however would be operated by Toll and rail network constraints and maintenance could necessitate occasional operation outside these times and days.

Whilst the last train on a Saturday would depart the plant site after the daytime period defined by the District Plan (7:00pm as opposed to 10:00pm during weekdays), the likelihood for sleep disturbance to occur in the early evening on a Saturday is not considered by Marshall Day Acoustics to differ markedly when compared with the same evening period on a weekday.

The branch-line has several road crossings which when reinstated may require warning bells. An electronic bell is proposed to be used rather than mechanical bells to minimise potential disturbance from these.

Marshall Day Acoustics has measured vibration from various freight trains. For a freight train travelling at approximately 50km/h the measured ground vibration was in the order of 3mm/s ppv at a distance of 15m from the track. Through Weston the cement train would have new rolling stock travelling slowly on new continuously welded track. These factors combined would minimise the potential vibration. It is therefore considered that 3mm/s ppv is a conservative estimate of vibration in residential units near the railway in Weston. For standard buildings, which include all residential units near the railway in Weston, this vibration level is below the recognised limit for possible building damage from vibration. Whilst this vibration is within the range where it could be distinctly perceptible, it is a level considered minor with respect to road traffic by the Transfund Project Evaluation Manual. The train vibration in Weston would also be simultaneous with noise from the train and people usually

respond to train noise rather than vibration. Therefore, whilst a degree of train vibration is likely to be perceptible at residential units nearest to the railway, this would be consistent with the sight and sound of the train.

### 5.7.3 Community/Social Effects

The Social Impact Assessment (SIA) (see Appendix 10) has considered site related social impacts for each site and addresses the perceived social consequences for local people to potential local environmental changes. In each neighbourhood, people put different emphases on these various perceived effects depending upon their location and individual perspective.

A considerable number of the potential effects are expressed as fears, annoyances, and uncertainty or unease (which can be referred to as anticipated or planning effects). There has also been anticipation of benefits. While the concerns or anticipated impacts may not eventuate, some fears and concerns could eventuate into actual long-term adverse effects, which may or may not be able to be mitigated.

The issues raised in relation to the transport interconnections between the various project sites and the wider area are varied and are set out in detail in the SIA. Many are the same as those expressed and previously discussed in relation to other sites, however some are more specific to transportation issues. These include:

- Impacts on health and social and psychological wellbeing. This includes fears and anxieties as well as actual effects arising from the proposal e.g. concern over increased physical threat or potential for accidents.
- Impacts on the quality of the living environment e.g. potential for intrusive noise from project vehicles/heavy traffic.
- Legal, political, and equity impacts e.g. belief that council would not be balanced in its assessment of the rail use proposal.

For each of the potential effects, the SIA has identified the likelihood of a social effect eventuating and has outlined the responses available both from Holcim and from wider community resources. These responses include matters such as ensuring that the transportation aspects of the project meet safety standards, provision of driver training, and appropriate use of the rail corridor.

In most cases, local people's concerns or expectations of impacts/effects have been addressed through:

- the commissioned technical studies and assessments;
- recommendations made to Holcim; and
- in changes already made to the project plans.

In some cases, the fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Similarly, other concerns cannot be addressed until the project components take physical form and the project begins to function as an integrated operation.

The conclusions reached in the SIA in relation to effects range from those that can be avoided or mitigated, through to those which would have adverse effects on persons close to the roading network. A small number of households living alongside the transportation network will suffer permanent reduction in the quality of their living environments for various periods of time even with mitigation and control measures in place, and proven compliance with required Council standards. However, Holcim believes that this needs to be considered in terms of the nature of activities contemplated by the identification of the plant site and Weston quarries site as a Cement Policy Area.

### Summary of Transport Interconnection Effects

- Even when the cumulative impacts of the traffic associated with the cement plant, quarry and pits are considered, and allowing for the maximum amount of traffic to be generated, the effects are predicted to be minimal on the majority of expected transport routes with no change to the Level of Service provided.
- The main effects would be upon the routes which would be used by those travelling to work, that is, Weston Road/West View Drive, Saleyards Road, Main Street and Weston-Ngapara Road/Main Street (west). The present Levels of Service on these roads would reduce by one level to, at worst, Level of Service C. As it is related to employee travel, this Level of Service would occur during the morning and evening peak hours on the road network only. The peak hour Level of Service on Weston-Ngapara Road to the northwest of the site also would reduce by one level, from A to B, again due to employee travel, and therefore for short periods at peak times.
- Based upon the increases in traffic predicted, it is considered that the effects of additional traffic volumes at intersections would be less than minor.
- It is not considered that the movement of trucks associated with the proposed cement plant, quarry and pits would lead to any road safety issues arising on the majority of the roading network in respect of pedestrians and cyclists, or school bus routes.
- The use of the railway line is authorised by the existing designation and the process of reinstating the branch railway line would be carried out in accordance with the Outline Plan of Works process, which is separate from these resource consent applications.
- Assessment of the noise exposure of residential units beside the branch rail line shows that the four train movements each day give rise to an Ldn just above 42dBA for five residential units which are particularly close to the railway. On the basis of this analysis it is indicated that the overall noise effects from the train operation will be no more than minor. Vibration from trains may be perceptible but effects would be no more than minor.
- For all transport routes it has been demonstrated that there would not be a significant change in traffic noise compared to the existing situation and also that the resulting traffic noise levels would be well within accepted limits for the local environment. The noise levels should generally not interfere with normal domestic activity and the overall effects of road traffic noise would be no more than minor.
- A range of social/community consequences has been expressed by local people. In many cases concerns or expectations of impacts/effects have been addressed in the commissioned technical studies and assessments, in recommendations made to and accepted by Holcim, and in changes already made to the project proposals. In some cases, fears and uncertainties cannot be resolved until a formal decision has been made about the acceptability of the proposal and its effects. Resolution of others similarly cannot occur until the project components take physical form and the plant, quarries, pits, and transportation begin to function as an integrated operation.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## **5.8 Construction Effects Across all Sites**

### **5.8.1 Air Quality**

The Air Report (Appendix 14) addresses discharges to air from construction effects at the various project sites.

#### **5.8.1.1 Cement Plant Establishment**

The greatest potential for adverse effect on air quality associated with the construction of the proposed cement manufacturing plant is dust emissions from earthmoving.

The extent of effect would depend on a range of factors but can be controlled through separation distances and mitigation measures. In applying the proposed mitigation measures, such as watering techniques (see section 6), the potential effects from construction activity are considered to be no more than minor.

The design of the concrete batching plant, associated with construction, is such that the truck loading area would be enclosed and the cement and aggregates are to be mixed with water during loading. In addition, appropriate bag filters on the cement silo and bunkers for the aggregates would be installed. Therefore URS considers that there would be little potential for adverse effects from this activity.

#### **5.8.1.2 Weston Limestone/Siltstone/Tuff Quarries**

The potential for adverse effect with opening and establishing the Weston quarry would also be associated with dust emissions and are similar to those occurring during operation (see section 5.4.2). Holcim propose a range of mitigation measures to limit the potential for dust to create adverse effects (see Section 6). Furthermore, the nearest residences are in excess of 500m from the proposed limestone/siltstone quarry area, and on the opposite side of the Whitstone escarpment.

#### **5.8.1.3 Ngapara Coal Pit**

The main emissions associated with the coal pit would be dust and are similar to those occurring during operation (see section 5.5.2). Given the location of the site would be in the midst of land owned by Holcim, the available meteorological data, and the fact that the nearest residence would be a minimum of 300m from the eastern extremity of the southern ELF, it is not considered that there would be any significant effects associated with this work, provided that appropriate dust mitigation measures are implemented (see AEE Section 6).

#### **5.8.1.4 Windsor Sand Pit**

The main emissions associated with the sand pit would again be dust and are similar to those occurring during operation (see section 5.6.2). This has been assessed to not be any more significant than that which may occur from permitted farming activities such as pasture renewal on adjacent land.

### **5.8.2 Terrestrial and Aquatic Ecology**

In relation to both terrestrial and aquatic ecology (Appendix 9), the construction effects are likely to be the same or similar to the operational effects and would not cause any adverse effect on terrestrial ecology or aquatic ecosystems.

### **5.8.3 Traffic**

The anticipated vehicle movements due to the construction of the cement plant, quarry, and coal and sand pits have been evaluated (Appendix 7) in respect of the likely effects upon the existing roading and highway network, principally in order to determine whether there are any clear preferred routes (or alternatively, routes which should be avoided).

### 5.8.3.1 Cement Plant Site

The construction of the plant site would involve the movement of pre-fabricated specialist equipment and plant which may be larger and/or heavier than the standard allowable dimensions and weight. It is intended that all imported overweight and over dimension equipment be transported to Timaru by sea. That equipment would then be loaded onto specialist transporters and moved by road to the plant site. However at present, the plant is not fully engineered and so the dimensions of the overweight and over dimension equipment cannot be confirmed. Such loads would only be permitted to be moved after consideration of the likely effects by the appropriate regulatory body and the issue of a permit. Approvals for the haulage of overweight loads on the State Highway network are administered by Transit New Zealand, and on district roads by Waitaki District Council. Land Transport New Zealand administers approvals for over dimension loads.

The pattern of the roading network in the area limits the possible routes which could be used for transporting overweight and over dimension loads from Timaru to the plant site. Taking the localised constraints into consideration, a generic route for transporter vehicles would be for vehicles to travel south on State Highway 1 to travel to Oamaru, where they then turn onto district roads prior to Ribble Street and continue along district roads to reach the plant site. There are several possibilities for the routes using district roads and it is expected that the final routes would be determined in conjunction with Waitaki District Council.

In respect of other vehicles travelling from the north, particularly heavy vehicles delivering equipment to the site, there is no clear advantage in journey time for the selection of either State Highway 1 through Oamaru to Weston Road or Whiterocks Road, or the route using Seven Mile Road and Airedale Road. Similarly, there are no road safety concerns evident on any of the roads under consideration.

Generally, it is considered preferable for these journeys to be made using roads or highways which are higher in the roading hierarchy, anticipated to have a greater proportion of through traffic, and to have a significant role in supporting the local or regional economy. The assessment of preferred routes for construction traffic is very similar to that for operational traffic and concludes that the addition of the maximum number of vehicles carrying equipment would result in only a very minor increase in traffic volumes (in the order of five in the peak periods) which would not affect the current Level of Service irrespective of the route selected. As with the operational trips during peak periods, it is not anticipated that personnel traffic would cause adverse effects on the roading network.

### 5.8.3.2 Limestone and Siltstone Quarry

In common with deliveries of equipment to the sand and coal pits, and the plant site, it is anticipated that heavy vehicles would use either State Highway 1 through Oamaru to Whiterocks Road, or the route using Seven Mile Road and Airedale Road. The frequency of heavy vehicles is predicted to be in the order of one vehicle movement every hour, and it is considered that this would have less than minor effects on any roading or intersection capacities.

### 5.8.3.3 Coal and Sand Pits (Ngapara and Windsor)

The location of the coal and sand pits means that Weston-Ngapara Road is the only practical route choice. On the basis of an assessment of road capacity the addition of the maximum number of construction vehicles would result in the present Level of Service A being maintained. There are no capacity-related reasons why this traffic could not be accommodated on Weston-Ngapara Road. There is no road safety record on Weston-Ngapara Road which would suggest the construction traffic could not be accommodated safely.

#### 5.8.4 Noise

Anticipated noise levels have been predicted by Marshall Day Acoustics in the Noise Report (Appendix 6). For the quarry/pit sites the initial construction activity would involve similar machinery to operational activity. Given the nature of what would be involved, construction activity at the quarry and pit sites has generally been assessed in the same way as operational noise. One-off activities such as construction of buildings at the plant site and workshop areas have however been assessed using NZS 6803 (as described below).

Construction of the cement plant would be a one-off event and the associated noise generated by construction activity would be distinguishable from operational noise. Marshall Day Acoustics consider that the long-term noise limits from NZS 6803 are appropriate for a project such as this where the main works are anticipated to last approximately two years. This standard is widely used and sets a clear framework for routine methods for the control of construction noise. Noise from construction would continually vary throughout this time. Different construction noise limits are set for four time periods within each day, which effectively restricts the noisiest operations to between 7:30am and 6:00pm during weekdays and Saturdays. Construction noise levels approaching the 70dBA limit during these hours would be clearly audible but would not be unduly disturbing given the finite duration. There are early morning and evening shoulder periods with reduced noise limits and then a night-time limit of 45dBA. This external night-time noise limit would result in noise levels inside bedrooms within the World Health Organisation guidelines for the prevention of sleep disturbance.

Generally for the range of activities required for this site it is predicted that the NZS 6803 long-term construction noise limits would be achieved beyond 500m from construction activity during the day and beyond 1km at night. However, the majority of construction activities would be quieter than this and limits would generally be achieved at shorter distances. Also, with screening by noise bunds the distances would be further reduced.

There would be less traffic during construction than the operational traffic. Operational traffic has been shown to have a no more than minor noise effect and it is therefore concluded that construction traffic would also have no more than a minor noise effect.

Some controls would be needed to ensure NZS 6803 limits are met at the nearest occupied residential unit. It is therefore proposed that a Construction Noise Management Plan be implemented to provide this control, and may form part of a broader Construction Management Plan (see Section 6).

#### 5.8.5 Community/Social

The Social Impact Assessment (Appendix 10) has considered the potential social effects during the construction phase:

##### 5.8.5.1 Construction Workforce

According to the Department of Labour, economic growth has been particularly evident in the most labour intensive industries, such as construction, social services, and wholesale and retail trade and many of the skills required for the Holcim construction project are those that are most in demand nationally.

At the regional level, the demand for some of the key skills required for the project may have increased and there are a number of potential construction projects in Otago and Canterbury over the next 6 years or so which may also demand construction skills. Some of these possible developments may coincide with the project construction, and compete for the available labour at the time. On the other hand, some of these projects may be completed by the time Holcim is ready to begin construction thus freeing up skills and labour for the Weston development, with contractors from Canterbury and Otago looking for further work. Within the local labour market, there

are limited numbers of people working in the construction sector and Waitaki's trades people have been in high demand in recent years.

The Waitaki District, and specifically the local labour market, would be unlikely to supply much of the workforce for the construction of the project without significant disruption to the local supply of trades skills, especially if the market for skilled trades people remains tight. Some of the required labour could potentially come from within the wider (commuting distance) area, however views vary about the extent to which the project's skill needs might be met from within this area. Remaining workers would need to be recruited from elsewhere in New Zealand, particularly Dunedin and Christchurch, which could allow for long-distance commuting.

In order to estimate the potential number of incoming construction workers and the associated demand for accommodation and other services, two scenarios for skills availability have been developed. Based on these scenarios,

- between 180 and 260 workers and staff for the construction and commissioning phases of the project would be required from outside the wider commuting area (approximately 160-230 at the peak of construction); and
- between approximately 250 and 330 would come from within the daily commuting area, including the local labour market.

The arrival of a resident construction workforce would make additional and rapid demands on accommodation and services. Maximising employment benefits of the project at the same time as minimising the chances of a construction boom-bust situation occurring, can be achieved by maximising the participation in the project by workers and firms that are based within the local and daily commuting area. This can be done through a range of methods e.g. arranging contracting packages so that 'local' firms can participate in the construction as sub-contractors. Maximising the use of local labour also means a larger share of the economic benefits of the construction can flow into the local economy and households.

Where the required workers cannot be sourced from within the commuting area, long distance commuting by unaccompanied workers would reduce the acute demand for family-type housing and social services in the host communities.

#### 5.8.5.2 Workforce Accommodation

To estimate the potential size of an incoming workforce, and the potential number of long distance commute workers, the two labour supply scenarios were expanded using two worker-residence scenarios. This modelling suggests that:

- Between 60 and 130 non-local construction workers and staff might take up residence in the Oamaru area for various lengths of time (12% to 26% of the estimated labour force), with 54-155 at the peak of construction.
- The total number of long distance commuters would range between 83 and 182 (16% to 36% of the estimated labour force), with 74-162 at the peak of construction.

Based on this data, the local accommodation requirements at the peak of the project would be:

- between 27 and 57 houses or larger flats for couples and families;
- between 9 and 19 houses or flats for unaccompanied new residents (based on three persons per accommodation unit);
- between 73 and 162 motel or hotel beds for long distance commuters (or the equivalent of between 24 and 54 three-bed units).

It would appear that currently there would not be sufficient rental housing on the local market to meet these demands but that this could be increased through investors purchasing properties for rental or through use of holiday homes. These changes could however increase the demand for rental accommodation and the associated rent prices, impacting on existing or prospective local renters.

With respect to accommodation for long distance commuters, the Oamaru urban area and wider district have over 600 visitor beds available. Given the number of motel units and hotel rooms in the Oamaru area alone, and the relatively low year-round occupancy rates, it would appear Oamaru has sufficient capacity to accommodate all of the potential long distance commuters for the period of the project construction without unduly reducing the availability of accommodation for visitors. At peak holiday times, when visitor accommodation is in most demand, the construction workers may be absent from the area. On the basis that there appears to be sufficient short-term accommodation in the Oamaru area, there would be no necessity for Holcim's contractors to establish a dedicated construction workers' camp in the district.

#### 5.8.5.3 Population changes

Based on the construction labour and residence scenarios, and the total required workforce, there could be a maximum of 100 to 270 additional people living in the Oamaru urban area and possibly adjacent communities for up to 20 months as 'construction residents'. These are estimated to be made up of:

- between 80 and 172 adults (aged 25-50), of whom between 54 and 114 would be in families; and
- between 20 and 43 children.

Using the 2006 population as the base, this would mean an increase in the population of the Oamaru Urban Area of between 0.8% and 2%. Given the relatively small numbers and the potential age distribution of the anticipated construction residents, there would be little discernable or sustained effect of the new residents on the structure of the populations of the Oamaru urban area and wider Waitaki District.

The 75 to 162 long distance commuters at the peak of the construction are expected to range from 20 and 50 years in age, to be unaccompanied, and predominantly male. The total length of this part-time residence would depend on the particular aspect of the construction in which the worker is engaged, and for some, could be up to 12 months.

#### 5.8.5.4 Education

The project construction could inject between 15 and 32 school-age children into the schools of the Oamaru area as follows:

- up to 16 students into the 6 local primary schools;
- up to 5 into the intermediate school (and/or 3 full-primary schools); and
- up to 11 into the 3 secondary schools.

Several Oamaru primary schools (Pembroke and Fenwick) have increasing rolls and lack space to expand. Weston School also has seen rapid roll increase in 2005 and 2006 and is short of classroom space. The proposed zoning for Weston School and the limited rental accommodation in Weston and in the Waiareka Valley would reduce the possibility of the school coming under pressure from construction-related families located in Oamaru itself. Fitzgerald Applied Sociology assesses that between the schools in the Kakanui, Maheno and Oamaru area, the additional school children should be able to be accommodated without particular difficulty.

Since the new students would be new arrivals in the area, possibly quite itinerant, and few in number, they could, as has been shown in projects in the 1980's, experience isolation and difficulty in settling into the new environment. The resulting problems can create additional demands on classroom teachers, and require schools to make additional calls on support services. However, these support services are available in the Oamaru area, and given the small number of such children, should be able to accommodate the needs that arise.

#### 5.8.5.5 Health Services

The construction of the Weston Option project could place demands on local health services in a range of ways.

Oamaru and its hospital offer a wide range of modern health services for its residents and visitors. However, Oamaru's medical practices are limited and so while the total number of possible 'construction residents' would not be great, there could be difficulties in enrolling them in local medical practices, potentially leading to greater use the A&E department of Waitaki Hospital, or travelling out of town for medical attention.

The demand for medical services from resident construction workers and their families is difficult to predict, but might be expected to be typical of other New Zealanders. On the basis of one visit per year each, the incoming workers and their families would generate a maximum of 300 doctor visits per annum. Based on current doctor-patient ratios, this could create work for up to 0.28 additional doctors during the construction period. However, long-distance commuters would have a lower demand on medical services.

While industrial accidents may occur, it is expected that the on-site first aid station/clinic would attend to minor injuries and act as first responder for serious accidents, and thus reduce demand on health practitioners. Furthermore, it is expected that any major contractor would have sound health and safety practices and management plans, which would minimise the likelihood of accidents. Serious accidents or injuries, if they did occur, would be expected to be attended by St John initially and then travel either to Dunedin or Waitaki Hospital depending on the circumstances.

#### 5.8.5.6 Social Support Services

The extent and intensity of the social welfare and wellbeing effects of the proposed construction project would depend on a range of factors including the number of outside construction workers that are engaged, and the characteristics of such workers. Based on studies of major projects, Fitzgerald Applied Sociology predict the potential effects on local social support services of the project planning and construction could be:

- An increase in demand from the existing residents due to their uncertainties and anxieties about the impacts of the development on them and their properties.
- An increase in demand for services arising from the incoming project-related population and its needs.
- Economic difficulties for those on fixed and low incomes who are renting their homes.

It is reasonable to conclude that there would be some increase in demand on local social support services. The additional demand, however light, would fall mainly on crisis and general welfare services in Oamaru, especially those focusing on child and family wellbeing, relationships, and women's health and wellbeing. Fitzgerald Applied Sociology anticipate that the potential demand is unlikely to require services to take on additional staff.

#### 5.8.5.7 Police, Law, and Order

Oamaru Police expect that, with a concentration of unaccompanied male workers in the District during the project construction, additional law and order problems could arise which they would have to attend to. In addition, local residents may perceive such visitors as a threat, especially if there are not sufficient behavioural expectations and controls on visiting workers. Police indicate that they have sufficient resources locally to deal with such problems, especially as there would be no construction workers camp to deal with, and if necessary can apply for extra staff.

Oamaru Police also anticipate that with increased traffic on the local and main roads, especially during the construction, there would possibly be more traffic incidents and offences to deal with.

#### 5.8.5.8 Fire Services

Potential effects on the various fire services from the construction include increased potential for motor vehicle accidents and increased potential for industrial accidents. In discussion with Fitzgerald Applied Sociology, the Weston fire service noted that if there were a large number of incidents they would need to seek additional resources from the New Zealand Fire Service in Dunedin, and to recruit additional volunteers. The likelihood of additional callouts for residential fires due to the long distance commuting and locally resident construction workforces is however considered low.

#### 5.8.6 Cultural

Potential concerns for Te Runanga o Moeraki (Appendix 11) during construction are the same as those related to operation and are covered by the discussion provided for each project site. These centre on discharges and the potential for contaminants to enter waterways. The water treatment and discharge systems proposed at each would ensure that discharges are treated in a way that would not adversely affect any waterway. Likewise the discharges to air would be controlled to minimise any impacts on the mauri of the air.

Excavation would alter the cultural landscape and the Runanga has drawn Holcim's attention particularly to the need to control land disturbance activities within landscapes of cultural significance or highly visible landscapes, to prepare management plans, and to have particular control over earth disturbance. At the time of earthworks, special care would be taken to avoid disturbance of archaeological sites of significance to the Runanga.

#### 5.8.7 Archaeology

The main impact on the archaeology of the project sites (Appendix 13) relates to the potential for any unrecorded archaeological sites present to be damaged or destroyed during earthmoving activities. At all sites there is a potential for this to occur during the initial topsoil stripping stage, both in the preparation of the extraction sites and in the construction phase of the cement manufacturing site. The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

### Summary of Construction Effects across all sites

- The main air emissions anticipated with regard to activities associated with the construction of the proposed plant and quarries is dust. Construction vehicle combustion emissions are considered insignificant, given the numbers of vehicles involved.
- The extent of effects of construction activities depends on the separation distance of sensitive locations from the activity, the nature of the activities that are being carried out, and effective dust management mitigation measures. By implementing the proposed management and mitigation measures and taking the necessary care, especially during dry and windy conditions, recognising also the rural nature of the proposed sites, it is considered that the air emission effects of construction activities would be no more than minor.
- In relation to both terrestrial and aquatic ecology, the construction effects are likely to be the same or similar to the operational effects and not cause any adverse effect on terrestrial ecology or aquatic ecosystems.

- The effects of the construction traffic are expected to be similar to those which would arise during operation of the plant, quarries and pits, with the cumulative effects of the traffic being minimal on the majority of roads. The main effects would be upon the routes which would be used by construction personnel, and the present Levels of Service on these roads would reduce by one level, although the result would still be within the zone of stable flow. The effects would occur only during the morning and evening peak hours on the road network.
- Movement of large loads would be coordinated with appropriate authorities once the scale of these loads is known.
- Overall, the number of additional vehicle movements is less than is anticipated when the plant is operating at capacity, and can be accommodated on the road network with less than minor effects on intersections, pedestrians, cyclists or school bus routes. There is no road safety record on Weston-Ngapara Road which would suggest the traffic could not be accommodated safely.
- For the quarry/pit sites the initial construction activity would involve similar machinery giving rise to noise levels similar to operational activity. It is proposed that construction activity at the quarry and pit sites should generally be treated as operational noise. One-off activities such as construction of buildings at the plant site and workshop areas would however be assessed using NZS 6803 and this standard would be met.
- There would be less traffic during construction than the operational traffic. Operational traffic has been shown to have no more than a minor noise effect and it is therefore concluded that construction traffic would also have no more than a minor noise effect.
- The construction of the plant site would require many workers with a range of skills. These workers would be sourced both from local areas and from further a field. The workers moving into the area would make demands on accommodation and services (which could generally be met by existing services), while providing economic benefits to the local economy.
- New residents to the area would require education services, health services, and social support services (which could generally be met by existing services). Police services would be sufficient, or adequately able to respond, to deal with any issues arising during construction, as would fire services.
- Issues of concern to Runanga particularly relate to the quality of water and the stormwater, wastewater and site management controls are intended to protect the mauri of the waterways. The Runanga have drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air.
- The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**

## 5.9 Effects Arising from the Project as a Whole

### 5.9.1 Landscape/Visual Amenity

#### 5.9.1.1 Landscape Values

The natural values of the Whitstone escarpment are mainly exhibited in the steep and rocky north and west faces of the limestone escarpment (Appendix 8). The location of the proposed manufacturing plant in the foreground of its southern face and the tuff quarry to its immediate north would potentially affect the natural values of the escarpment. The extraction of limestone from agricultural land to the immediate east of the escarpment face would also modify the landscape.

The existing natural values of the escarpment have been modified by increasingly intensive agricultural activities. The siting and layout of both quarries and manufacturing plant at Whitstone specifically avoid direct physical impacts upon the main escarpment face. Permanent loss of natural values, in relation to this significant feature, would be minimised.

The aesthetic values associated with the Whitstone escarpment are also based on its prominence as a natural geological feature within a lowland landscape setting. The potential impact of quarrying activities upon the aesthetic values of the escarpment face is largely dependant upon the prominence of extraction operations. Due to its location, it is probable that the limestone quarry would not be perceived in the overall context of the escarpment face. However, the location of the tuff quarry at the foot of its northern face would detract from the aesthetic values of the existing landscape from within certain locations. It is expected that any temporary reduction in aesthetic values associated with the escarpment feature as a result of quarrying would be mitigated through appropriate rehabilitation.

The manufacturing plant could substantially compromise the existing aesthetic appeal of the escarpment when experienced from the wider rural agricultural landscape. Quarrying activities at Windsor and Ngapara, both reasonably contained and remote, are less likely to adversely undermine the aesthetic values of their contextual landscapes.

The significance of effects on landscape values would be of low significance at Ngapara and Windsor and moderate-high significance at Weston.

#### 5.9.1.2 Landscape and Rural Amenity Values

Rural amenity values would be influenced by the cement manufacturing operation being seen as a 'good neighbour' to the local rural community. The values of rural outlook, spaciousness and privacy would be largely maintained through the careful siting and physical containment of quarrying activities, which could be increased through appropriate mitigation at all sites (see section 6). Whilst similar mitigation measures would also be employed in relation to the design of the main manufacturing plant, it is likely that rural outlook, spaciousness and privacy values of some nearby properties would be significantly affected by the presence of the large-scale industrial plant. Nonetheless, it is important to recognise that this is a landscape subject to change. The intensification of agricultural activities within the lower valley landscape has brought about the introduction of large-scale mechanical equipment including irrigation pivots/booms that also change rural amenity values. The site is also identified specifically for cement manufacture within the District Plan.

The plant site, operating 24 hours per day, would require internal lighting to ensure safe and secure operations for the reduced staffing that would be on-site at night. Lighting of the quarry sites, where work is expected to largely occur within daylight hours, would be limited to minimal security lighting. The potential luminosity of operational lighting would be minimised through lighting design. However, there are likely to be increased direct visual effects associated with the lighting of the manufacturing plant site, which, at least in early years, is relatively exposed to public views.

The increased road traffic generated by combined quarrying and manufacturing activities, particularly in the vicinity of Weston, would undoubtedly contribute to the perception of intensifying industrial activities. At the same time, there are several existing operational quarries within the area, and an agricultural intensification which involves increased truck and other vehicular movements.

It is a concern of some local residents that the potential deposition of 'limestone dust' as part of quarrying and manufacturing operations at Weston, would adversely affect the appearance of the surrounding rural landscape. Dust pollution has been considered in more detail within the report by URS (Appendix 14) which covers the mitigation measures, which would be undertaken to ensure that excessive volumes of particulate dust are not emitted from the Weston or other associated sites.

The temporary loss of agricultural land would be largely mitigated through the future rehabilitation of the quarry sites back into productive land use. In addition, a community liaison group is intended to be established by Holcim, to both receive and coordinate responses to any project related community issues. The recreational values of the Vanished World trail, in tracing the unique geological heritage through the wider North Otago area, would be uncompromised by quarrying and manufacturing activities. There are also opportunities to provide educational links with the trail both during manufacturing operations and through the long-term rehabilitation of the Weston quarry sites that demonstrate the productive use of limestone as an important local mineral.

Whilst thirty years is a minimal lifetime for large scale quarrying operations it is a substantial period to assess 'temporary effects' upon the landscape. In order to minimise the period during which quarrying and manufacturing activities would have adverse landscape effects, the proposal incorporates long-term rehabilitation and management concepts for all sites.

The significance of effects on landscape and rural amenity values would be of low significance at Windsor and Ngapara and moderate-high significance at Weston.

#### 5.9.1.3 Cumulative Landscape Effects

The Ngapara-Oamaru Downlands landscape includes existing and historic mining and quarry activities within its relatively remote and topographically complex landscape. It is considered particularly able to absorb any potential cumulative impacts as a result of combined quarrying and other operations.

The combined activities of the manufacturing plant and the quarrying operations at Whitstone are likely to result in cumulative landscape impacts. In particular, there would be a cumulative loss in the productive agricultural land that surrounds the escarpment. However, the physical separation of the quarrying and manufacturing components reduces the potential for cumulative adverse effects. Additional quarrying could also be seen as intensification of the existing Parkside quarrying activity.

Potential cumulative effects are limited to the Weston site, where the proximity of simultaneous activities to the Whitstone escarpment would result in adverse landscape effects. However, Boffa Miskell Limited (Appendix 8) has concluded that the physical separation of the different component activities would minimise the significance of cumulative effects to being low-moderate.

#### 5.9.1.4 Cumulative Visual Effects

The Weston limestone quarry would be visible from a limited number of viewpoints to the east of the existing Whitstone escarpment, however, the manufacturing plant would not be visible from these same viewpoints. This would eliminate any potential cumulative visual effects from these combined activities. However, the presence of a water plume at times may result in cumulative effects if it is clearly visible in combination with other parts of the proposal. There are viewing areas to the northwest of the escarpment from which both the proposed manufacturing plant and the tuff quarry would be visible. Visual effects associated with the plant and the tuff

quarry could be more significant when they are seen together, as they would affect a larger extent of the same view. At these distances, however, the magnitude of such cumulative effects would be low.

The 'entrance' to the limestone quarry (through Troublesome Gully) would be seen in the context of the tuff quarry when viewed from between Coal Pit and Teaneraki Roads. From here the northeast nose of the escarpment (which would be partially removed in the early extraction of siltstone) is visible. From the majority of viewpoints from within this area, the angle of view is such that the reduction in the northeast extent of the escarpment would not be apparent, due to the backdrop provided by Troublesome Gully. Screen planting along the northern boundary of the tuff quarry would further reduce the significance of cumulative visual effects from within these views.

### 5.9.2 Social/Community Effects

The Social Impact Assessment (Appendix 10) also includes consideration of social and community effects from the project as a whole, with all the project sites and aspects of the proposal considered together.

#### 5.9.2.1 Accommodation for Operations Workers

The operation of the cement plant, quarries, and pits would require a workforce of between 110 and 125 consisting both of Holcim employees and contractors. It is expected that the project would employ up to 80-100 resident locals, and would therefore not require accommodation for these, but that around 25 incoming Holcim staff, contractors, and transfers, would add approximately 58 people to the permanent population of the greater Oamaru area.

The potential local accommodation requirement might therefore expect to be approximately:

- 3 to 6 flats for single persons;
- 10 flats or houses for couple-only families; and
- 9 houses or larger flats for families with children.

The likelihood is that the majority of the incoming operations staff and contractors would seek to purchase or build their own homes in the area. The Oamaru property market is of sufficient scale to be able to provide all the necessary long-term housing and it could be expected that these new residents would be distributed across the Oamaru area.

In the unlikely event that all or most of these incoming workers would seek to live at Weston there would not be sufficient housing available without further subdivision and new residential construction. Based on the current developer interest in subdivision at Weston, it is likely there would be sufficient sections available to meet realistic demand.

#### 5.9.2.2 Impacts on the Size and Character of the Population

Of the around 58 new permanent residents, there could be:

- approximately 44 adults aged between 25 and 50 years, of whom 38 could be in families (including couple only families); and
- approximately 14 children.

For the children, there could be approximately 2 new infants, 1 or 2 new preschoolers, 5 new primary schoolers, 2 new intermediate schoolers, and 4 or 5 new secondary schoolers moving to the Oamaru area.

While small in number, these new long-term residents would help reduce the projected long-term population decline in the District. Furthermore, the operation of the project would provide on-going, multi-generational, non-seasonal employment and servicing

opportunities to the existing residents who might otherwise leave the area, and thereby counterbalance some of the projected population reduction and aging.

Since the incoming operations management and technical staff and contractors would be expected to be professional people with a high level of education and with administrative, managerial, and leadership skills, they would also bring valuable social capital and potentially new members to local clubs and organisations. As noted earlier, the operations workforce might also include experienced Holcim employees transferring from Westport and therefore used to living in a provincial town situation.

#### 5.9.2.3 Education

Among the 14 project-related children arriving in the area, there would be approximately 7 primary and intermediate schoolers and possibly 4 high schoolers. All should be able to be accommodated in the existing schools in the Oamaru urban area, including those who reside at or near Weston. Apart from initial adjustment challenges, this number of students would be unlikely to place demand on school support services. With falling or stable rolls in the secondary schools, the new students are likely to be very welcome.

The Weston cement manufacturing plant and quarries would contribute to both secondary and primary school education in Waitaki District (and perhaps further afield) by offering a unique site for science and technology-related class visits and fieldtrips. In addition, due to their management and administration skills and experience, some of the staff brought to the district by the company could be expected to make a valuable 'social capital' contribution to their local schools.

Holcim has a proud record of supporting community organisations, including sponsoring local school groups, provision of scholarships, and offering student holiday employment.

#### 5.9.2.4 Health Services

It is estimated that the new residents would generate around 46 doctor's visits per annum. These new residents should be able to access GPs and other health services, though this would depend on the post-construction capacity of local medical practices.

Holcim currently has a health and safety programme for its staff, which includes preventative health checks, vaccinations, first aid training, and psychological support and counselling as required. Most of these services would be provided by local professionals on contract to the company. Since the majority of staff would be recruited locally, local people would benefit from access to this programme.

The cement plant would have a first aid facility and onsite trained personnel. For the on-going operation of the cement complex, St John management anticipates that most callouts would be medical, with few if any serious accident cases. For accidents on site Holcim's trained emergency response team would be the first responder. While the operation of the Weston cement plant would put more trucks on local roads, and road collisions involving trucks on open roads tend to be more traumatic, it is believed that there is low likelihood of serious Holcim-related truck accidents due to traffic volumes, road network conditions and the standard likely to be demanded of drivers by the company.

#### 5.9.2.5 Social Support Services

The operation of the cement complex is expected to have net benefits for the wider Oamaru community through improved access to long-term, steady, and non-seasonal local employment and the use of local servicing contractors and suppliers. This in turn would improve the economic circumstances, quality of life, and self support and resilience of some people, especially those who have experienced difficulty in finding work - thus reducing their need for social support services. On the other hand, some households and individuals who live within the directly affected area may find themselves negatively affected in the long term and receiving few of the project benefits.

Based on the likelihood of up to 25 Holcim staff and technical specialists taking up permanent residence in the Oamaru area at the start-up of the cement plant, there is likely to be some short-term increase in demand for local social support services as families seek to adjust to living in a new environment and community.

#### 5.9.2.6 Fire Services

Demand on the local fires services might come from:

- Motor vehicle accidents (MVA) and road spillages involving trucks;
- industrial fires involving stored fuels;
- industrial accidents at the cement plant, as well as the quarries and pits where earthmoving equipment would be used; or
- low probability, but large scale events that might impact on local communities (such as an explosive fire, toxic emission, discharge to local waterways during storms, etc.).

With respect to the potential for MVAs, the proposed operations would add to what is thought to be already increasing volumes of trucks on local roads following recent increases in dairy farm development.

The storage and stockpiling of combustible fuels at the cement plant and quarries would represent a new fire risk. The likelihood of there being a fire on the site/s, especially one that became a major incident, would depend on the fire management planning and equipment put in place.

The Weston, Oamaru and Rural fire services noted that all of the proposed sites for the Weston project lie within the area covered by the Weston Fire Service and the Windsor Rural Fire Brigade. Weston would be the first responder to a fire or industrial accident at the cement plant, quarries, and pits, and to a serious road accident in the Waiareka-Weston area. Fires at the Ngapara and Windsor pits or on surrounding land would also be attended by the Windsor brigade which has its depot at Peaks Road in the neighbourhood of the proposed sand pit. Any such rural fires would be managed by the Rural Fire Authority/Waitaki District Council.

Depending on the seriousness of any incident, the Oamaru Fire Service would be called on to back up Weston and make its rescue vehicle available. In the event of a major fire brigades from Duntroon, Kurow, Waimate and Glenavy may also be called in to assist or other equipment may come from further a field.

#### 5.9.2.7 Distribution of benefits and costs

Those who benefit from the new jobs and new business opportunities created by the establishment of the cement plant, would not necessarily be those who would be asked to carry the cost of the development in terms of any long term reduction in the quality of their living environments. For this reason Holcim propose to attempt to achieve more of a balance in the distribution of costs and effects by setting up a trust to provide funds for ongoing social and environmental development and improvement in the directly affected /cost bearing communities (see section 6).

### 5.9.3 Cultural

The Cultural Impact Assessment (Appendix 11) considers matters of concern to the Runanga from the project as a whole:

#### 5.9.3.1 Wai Maori

##### Waiareka Creek

The Waiareka Creek currently suffers poor water quality and appears to support only a limited fauna and flora. Its mauri is severely degraded. It was formerly healthy and productive, supporting a wide range of fish and invertebrate species, and would have been a valuable source of mahika kai.

Ideally, Te Runanga o Moeraki would like to see the creek returned to its former state but recognise that this is not the responsibility of Holcim. It is Holcim's responsibility, however, to ensure that it does not cause any further degradation.

Of relevance is that as a result of negotiations carried out with between the Runanga and North Otago Irrigation Scheme during the consent process for the Downlands irrigation scheme, all properties within the Waiareka valley that would benefit from the irrigation scheme must have a farm management plan in place. A major goal of the management plan is to avoid a reduction in ground and surface water quality within the catchment. Through this process, Te Runanga o Moeraki are actively working with the irrigation company to ensure the values of Waiareka Creek are enhanced.

The Runanga have expressed concern that the project could pose a risk to the creek through the discharge of stormwater and wastewater into the creek or adjacent groundwater affecting water quality, and physical alteration of the creek such as diversion of the channel. Construction of bridges or culverts across the creek, if required, or earthworks in the immediate vicinity, also have the potential to result in sediment discharge to the creek.

Holcim propose to treat the stormwater from hard surfaces at the Weston site via a settlement pond, followed by discharge via a wetland system into a grassed ephemeral stream channel and eventually into the Waiareka. With such a treatment system in place, it is considered that the effects of the stormwater discharge on the creek would be less than minor.

Stormwater run-off from the sites may also contain contaminants picked up from the quarrying activities. Potential contaminants include sulphur, silica, aluminium, iron and calcium at Weston. The risk of release of these contaminants in harmful quantities is dependent on the quality of stormwater management at the quarry sites.

The stormwater control and treatment methods proposed would ensure the best possible capture of sediments, heavy metals and any other contaminants. Guidelines and standards for stormwater treatment from such areas would be met.

Boffa Miskell Limited comment that nitrogen products may always be raised in the treated water but since both groundwater and surface water shows elevated nitrate levels already, the effects of additional contamination is low risk.

While the Runanga and Holcim accept that the quality of the water in the creek is poor, neither accept this as justification for any further degradation of the creek. All measures would be taken to ensure that contaminants, including nutrients, are removed from water before it reaches the creek. Where complete removal of contaminants is not possible, discharges would only proceed where the effects of these contaminants are minor, and further mitigation and enhancement is proposed in the form of new wetlands.

#### Fuel storage/hazardous chemicals, risk of spillage

Inappropriate storage or handling of fuel and other hazardous chemicals can lead to the risk of accidental spillage to surface water or to land, and therefore potentially to groundwater. This could result in significant adverse effects on water quality and instream biota. Management plans would be in place and followed to ensure this does not occur.

#### 5.9.3.2 Mahika kai

The effects on Waiareka Creek have been described above. No significant native vegetation or important habitats of terrestrial native species would be removed. Modelling undertaken on sulphur dioxide indicates that the emissions of sulphur dioxide and nitrogen dioxide are predicted not to have adverse effects on vegetation in the vicinity of the cement plant. Any adverse effects of emissions on native vegetation or significant habitat for native species would not be acceptable to the Runanga.

### 5.9.3.3 Cultural Landscape and Wahi Toaka

The whole catchment, particularly the area around the Weston site, is a valued cultural landscape and wahi taoka, due to the previous importance of the area to Maori. Despite the modified nature of the landscape, with pasture replacing native bush and scrubland, and the poor quality of the creek and instream biota, the area remains of value.

Quarrying of the site has the potential to affect these values through direct impact on the rock art and archaeological sites, a change to the visual landscape and the potential for further damage to native vegetation and the water quality of the creek and the associated ecosystems. Maori used visual markers in the landscape to identify their trails and peaks and hills were given names that remembered ancestors, helping to preserve stories and traditions down through the generations. Physical alteration of the landscape through quarrying could affect these values.

The Runanga have drawn Holcim's attention particularly to the need to control quarrying activities within landscapes of cultural significance or highly visible landscapes, to require management plans, and to exercise particular control over earth disturbance. All these matters have been taken into account in the design of the project.

### 5.9.3.4 Air and Atmosphere

Runanga have an interest in maintaining the mauri of the air. Excess dust can affect the health of the workforce and vegetation in the vicinity. All necessary measures would be taken to reduce dust emissions to a minimum.

#### Summary of Effects Arising from the Project as a Whole

- The Ngapara-Oamaru Downlands landscape includes existing and historic mining activities within its remote and topographically complex landscape. It is therefore considered particularly able to absorb any potential cumulative visual impacts as a result of combined operations.
- The proposal would have low-moderate cumulative effects on the wider landscape, as potential cumulative effects would be limited to the Weston site, where the proximity of simultaneous activities to the escarpment feature would result in landscape effects. However, the physical separation of the different component activities would minimise the significance of this effect.
- The increased road traffic generated by combined quarrying and manufacturing activities, particularly in the vicinity of Weston, would undoubtedly contribute to the perception of intensifying industrial activities. At the same time, there are several existing operational quarries within the area, and an apparent intensification of agricultural operations involving increased truck movements.
- The significance of effects on landscape and rural amenity values would be low at Windsor and Ngapara and moderate-high at Weston.
- Accommodation would be available for operations workers within the area and the new residents would increase the population in the immediate area.
- Support services, educational and health services would be able to cope with any impacts from additional population in the area, as would emergency services such as police and fire.
- Holcim recognise that there may not be a balance between the costs of the project on the immediate environment and the benefits from the project, and accordingly a Community Trust fund is proposed to be established.

Assessment of Actual or Potential Effects of the Proposal on the Environment

- The Runanga are concerned to maintain the integrity of the Waiareka Creek and ensure it does not suffer further degradation. The proposed stormwater, wastewater and site management controls are intended to protect the mauri of the waterway. Any effects of emissions on native vegetation or significant habitat for native species would not be acceptable to the Runanga and would be avoided. The Runanga has drawn Holcim's attention particularly to the need to consider impacts on the cultural landscape and the mauri of the air and this has been taken into account in the project design.
- The necessary Archaeological Authorities will be sought from the New Zealand Historic Places Trust, and should any archaeological deposit be revealed during earthmoving activities, the due process under the Authorities would be followed.

**See Section 6 of this Assessment of Environmental Effects for mitigation and monitoring measures.**